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Attorneys for Petitioner



BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI`I

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| In the matter of the Petition<br><br>of<br><br>1250 OCEANSIDE PARTNERS<br><br>To Amend the Land Use District Boundary of Certain Lands situate at North and South Kona, Island of Hawai`i, State of Hawai`i; consisting of approximately 1,434.755 acres from the Agricultural District to the Rural District and the Conservation District | DOCKET NO. A06-769 |

**PETITION FOR LAND USE DISTRICT BOUNDARY AMENDMENT;**

**VERIFICATION;**

**PETITIONER'S EXHIBITS 1 - 10;**

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OF THE STATE OF HAWAI`I

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**PETITION FOR LAND USE DISTRICT BOUNDARY AMENDMENT**

Petitioner, 1250 OCEANSIDE PARTNERS (hereinafter referred to as "Petitioner"), hereby petitions the Land Use Commission (hereinafter "LUC") to amend the land use district classification of certain lands situate at Honuaino 3 and 4, Hokukano 1 and 2, Kanaueue 1 and 2, Haleki`i, Ke`eke`e, `Ilikahi, Kanakau, Kalukalu, and Onouli 1, North and South Kona Districts, Island of Hawai`i, consisting of approximately 1,434.755 acres, as depicted in Petitioner's Exhibit 1 attached hereto and incorporated herein ("Petition Area"), as follows:

(1) 1,418.739 acres of land from the State land use agricultural district ("Agricultural District") to the State land use rural district ("Rural District"); and

(2) 16.016 acres of land from the Agricultural District to the State land use conservation district ("Conservation District").

## 1. AUTHORITY FOR RELIEF SOUGHT

*§15-15-50(a)(1): State clearly and concisely the authorization or relief sought; and (2) Cite by appropriate reference the statutory provision or other authority under which commission authorization or relief is sought.*[1]

This Petition is filed pursuant to §205-4, Hawai`i Revised Statutes ("HRS"), as amended, and LUC Administrative Rules §15-15-46 *et seq.*, seeking an amendment of land use district boundaries. The LUC is authorized to grant the relief sought pursuant to Chapter 205, HRS, as amended, all other statutes applicable to the LUC, and rules promulgated thereby.

## 2. IDENTIFICATION OF PETITIONER

*§15-15-50(c)(1): The exact legal name of each petitioner and the location of the principal place of business and if an applicant is a corporation, trust, or association, or other organized group, the state in which the petitioner was organized or incorporated.*

Petitioner is a Hawai`i limited partnership, with its principal place of business located at 78-6831 Ali`i Drive Suite K-15, Kailua-Kona, Hawai`i 96720. In addition to its interest as a fee simple property owner within the Petition Area, Petitioner also represents the interests of lot owners within Petitioner's development (known as and referred to herein as "Hokuli`a" or "the Project") who have authorized Petitioner to include their respective properties in this Petition. Pursuant to the Covenants, Conditions and Restrictions ("CC&Rs") for the Project, Petitioner is authorized to continue to include in the subject Petition any lots sold or resold during the pendency of these proceedings.

[1] Italicized subheadings restate the informational requirements for boundary amendment petitions that are set forth in Hawai`i Administrative Rules ("HAR"), Title 15, Chapter 15, Section 15-15-50 (hereinafter "LUC Administrative Rules").

## 3. AUTHORIZED REPRESENTATIVE

*§15-15-50(c)(2): The name, title, and address of the person to whom correspondence or communications in regard to the application are to be addressed.*

The law firm of TSUKAZAKI YEH & MOORE is authorized to represent Petitioner in this Petition and the proceedings thereon. All papers, notices, correspondence and communications in regard to this Petition shall be addressed to:

R. Ben Tsukazaki, Esq.
Michael W. Moore, Esq.
Tsukazaki Yeh & Moore
A Limited Liability Law Company
85 W. Lanikaula Street
Hilo, Hawai`i 96720
Phone: (808) 961-0055
Fax: (808) 969-1531

## 4. IDENTIFICATION OF PETITION AREA

*§15-15-50(c)(3): Description of the subject property, acreage, and tax map key number, with maps, including the tax map, that identify the area under petition. If the subject property is a portion of one or more lots, or the petition proposes incremental development of the subject property on both increments of development, the petitioner shall include a map and description of the subject property and increments in metes and bounds prepared by a registered professional surveyor.*

The Petition Area is located within the ahupua`a of Honuaino 3 and 4, Hokukano 1 and 2, Kanaueue 1 and 2, Haleki`i, Ke`eke`e, `Ilikahi, Kanakau, Kalukalu, and Onouli 1 in the North and South Kona Districts of the Island of Hawai`i, and comprises 1,434.755 acres. It is approximately 10 miles south of Kailua-Kona and less than one mile west or makai of the town of Kealakekua. Specific Tax Map Key ("TMK") numbers are identified in Petitioner's Exhibit 2 attached hereto and incorporated herein by reference. A location map of the Petition Area is

included as Petitioner's Exhibit 3. The real property tax maps concerning the Petition Area are submitted herewith collectively as Petitioner's Exhibit 4.[2]

## 5. RECLASSIFICATION SOUGHT/PRESENT USE OF PROPERTY/ASSESSMENT OF CONFORMITY WITH BOUNDARY AMENDMENT STANDARDS

*§15-15-50(c)(4): The reclassification sought and present use of property, including an assessment of conformity of the reclassification to the standards for determining the requested district boundary amendment.*

Petitioner seeks to amend the land use district classification of the Petition Area from the Agricultural District to the Rural District and the Conservation District. The proposed reclassifications conform to the standards and characteristics of the Rural and Conservation Districts, respectively.

Section 15-15-21, LUC Administrative Rules, sets forth standards for determining Rural District boundaries. These standards are as follows:

(1) Areas consisting of small farms; provided that the areas need not be included in this district if their inclusion will alter the general characteristics of the areas;

(2) Activities or uses as characterized by low-density residential lots of not less than one-half acre and a density of not more than one single-family dwelling per one-half acre in areas where "city-like" concentration of people, structures, streets, and urban level of services are absent, and where small farms are intermixed with the low-density residential lots; and

(3) It may also include parcels of land which are surrounded by, or contiguous to this district, and are not suited to low-density residential uses for small farms or agricultural uses.

Hokuli`a is a low-density community, with lots currently ranging in size from approximately 1 to 3 acres, an 18-hole golf course and related facilities and a 140-acre shoreline park (the park is not in the Petition Area, but is in the adjoining Conservation District). It will be characterized by homes that are located amidst open space corridors. The rural nature of the

[2] Petitioner has submitted with the Petition one set of full-sized tax maps (10 total) concerning the Petition Area which are collectively designated as Petitioner's Exhibit 4. Reduced copies of these tax maps are included in the Petition for convenience and are designated as Petitioner's Exhibit 4a.

Petition Area will be preserved by its low structural densities, absence of commercial uses, open spaces including cultural and agricultural preserves and the adjoining shoreline park.

During the 2005 legislative session, the Hawai`i State Legislature amended Chapter 205, HRS, to allow golf courses, golf driving ranges and golf-related facilities in the Rural District. Although the golf course and related facilities remain permitted uses in the Agricultural District under such legislation, they are now also characteristic of and consistent with the Rural District as re-characterized by the 2005 legislation.

Section 15-15-20, LUC Administrative Rules, sets forth the standards for determining Conservation District boundaries, the following of which are applicable to this Petition:

(1) It shall include lands necessary for the conservation, preservation, and enhancement of scenic, cultural, historic, or archaeological sites and sites of unique physiographic or ecologic significance;

(2) It shall include lands necessary for providing and preserving parklands, wilderness and beach reserves, for conserving natural ecosystems of indigenous or endemic plants, fish, and wildlife, including those which are threatened or endangered, and for forestry and other related activities to these uses.

Petitioner seeks to reclassify approximately 16.016 acres of land from the Agricultural District to the Conservation District, including approximately six acres on the mauka side of Pu`u Ohau, a prominent land feature located near the shoreline below the Petition Area, and approximately ten acres which were previously subdivided into five lots within Phase 2 of the Project. The 16.016 acres are adjacent to and will be added to the lands for the shoreline park currently within the Conservation District along the coast.[3] The shoreline park provides public shoreline access and hiking trails featuring historic and cultural interpretive sites. The first phase of the shoreline park is open to the public. A parking lot and temporary restrooms for public use have been constructed. In conformance with the intent of the Conservation District, inclusion of

[3] Petitioner intends to consolidate these five lots with adjoining land in the Conservation District. As such, these lots are not to be included as part of the maximum lot count.

these lands will enhance the conservation of the natural, cultural, historic and scenic resources of the area and public recreational opportunities.

## 6. PETITIONER'S PROPERTY INTEREST IN THE SUBJECT PROPERTY

*§15-15-50(c)(5): The petitioner's property interest in the subject property. The petitioner shall attach as exhibits to the petition the following: (A) A true copy of the deed, lease, option agreement, development agreement, or other document conveying to the petitioner a property interest in the subject property; (B) If the petitioner is not the owner in fee simple of the subject property, written authorization of the fee owner to file the petition; and (C) An affidavit of the petitioner or its agent attesting to its compliance with section 15-15-48.*

Petitioner holds a property interest in all properties that comprise the Petition Area, which is comprised of lands (including lots in the Project) owned by Petitioner and lots in the Project owned by others. In addition to its title ownership of properties as noted in Petitioner's Exhibit 2, Petitioner owns easement rights in each lot listed in Exhibit 2 pursuant to the terms and conditions of the CC&Rs for Hokuli`a. An excerpt from the CC&Rs that provides Petitioner with easement rights within each lot of access for infrastructural purposes, historic site preservation, and other purposes is attached as Petitioner's Exhibit 5.

A summary including a list of the properties that are included in the Petition Area, the names of the respective owner(s) of each property as of the date of the filing of the subject Petition, and a reference number relating to the conveyance documents that evidence each such owner(s) respective property interest is presented as Petitioner's Exhibit 2. A complete set of the deeds will be made available upon request. Additionally, written authorizations from such owners for Petitioner's representation of their respective interests will be filed under separate cover.

## 7. DESCRIPTION OF DEVELOPMENT PLAN

*§15-15-50(c)(6): Type of use or development being proposed, including without limitation, a description of any planned development, residential, golf course, open space, resort, commercial, or industrial use.*

Petitioner is currently engaged in the implementation of further development of the Project, in accordance with County approvals received in 1993 and thereafter, but with the development plan modifications noted below. A Final Environmental Impact Statement ("FEIS") was prepared in anticipation of actions that were proposed as part of the development at that time. The FEIS was accepted by the County of Hawai`i Planning Department in September of 1993. A copy of the FEIS is attached hereto as Petitioner's Exhibit 6.

The FEIS assessed the potential impacts of the development that was initially planned to include 1,440 lots and other components.[4] Subsequently during the mid-1990's, after reductions in the scale of the development, Hawai`i County granted various permits and approvals to Petitioner to allow the development of approximately 730 lots, a members' lodge and a 27-hole golf course and related facilities, subject to certain conditions of approval. Such conditions required Petitioner to: construct a public bypass highway from Keauhou to Captain Cook over a distance of more than five miles ("Bypass Highway"); develop and perpetually maintain a 140-acre public shoreline park, including all of the roughly three miles of shoreline in the Conservation District adjacent to the makai boundary of the Petition Area; donate acreage to expand the Kona Scenic Park, which is adjacent to the mauka boundary of the Petition Area; and establish an employee housing program.

[4] The FEIS disclosed the need to seek an urban district reclassification from the LUC for a development component that involved a subdivision of roughly 4 lots per acre. This component was removed from the master plan when the maximum lot count was reduced by approximately 50% and the minimum lot size was increased to one acre, the minimum lot size in the Agricultural District under Chapter 205, HRS.

Within the Petition Area, two areas have been subdivided to date resulting in a current total of 338 lots, ranging in size from 1 to 3 acres.[5] Petitioner has also constructed an 18-hole golf course with related improvements (golf shop, restaurant pavilion and temporary maintenance facility), internal roadways, the initial segment of the regional Bypass Highway, the first phase of the shoreline park, the construction of buffers around cultural sites in accordance with approved plans, and various utility infrastructure to serve the golf course, the lots and the shoreline park. Individual lot owners have also completed three residences; an additional residence is now under construction, and many more are in the planning and permitting stage. Petitioner is continuing with the construction of approved infrastructure and other work necessary to complete the development of the Project and to fulfill Petitioner's existing obligations, including those noted above.

Pursuant to an agreement with Hawai`i County, the State of Hawai`i, and other interested parties, Petitioner has further amended its development plan by removing the members' lodge and reducing the maximum number of lots to 665. Petitioner's Exhibit 7 depicts the current development plan for the Petition Area.

Petitioner has also agreed to cause up to 168 units of affordable housing to be constructed in Kona (consistent with Hawai`i County's current 20 percent affordable housing requirement); to conduct a baseline water quality study along an 11-mile stretch of shoreline, including areas both north and south of Hokuli`a; and to form a new foundation designed to serve the broader Kona community (which has since been done).

[5] The first phase of lot development consisted of a subdivision creating 261 lots in 1999. The second phase, approved in June 2001, consisted of a subdivision creating an additional 98 lots. Due to subsequent consolidation and resubdivision of these lots (including applications currently pending before the County), the current lot count is 253 lots in Phase 1 and 85 in Phase 2.

The present development plan calls for a development of lesser scale and substantially less intensity than the one contemplated in the FEIS. The major differences consist of a significant reduction from the originally proposed 1,440 lots to a maximum of 665 lots, limiting the golf course facility to a maximum of 18 holes, and the exclusion of the members' lodge from the present development plan. A table comparing the development plan that the FEIS was based on and the present development plan is attached as Petitioner's Exhibit 8.[6]

The development plan includes an agricultural component that prescribes the establishment of agricultural activities on and around homesites. Under a Rural District reclassification, the agricultural component would be re-evaluated and modified.

Overall, the development plan seeks to achieve a rural character and preserve the unique site characteristics of the area by maintaining low-density neighborhoods integrated with generous open space areas. Design standards will maintain visual integrity with the surrounding

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[6] With respect to compliance with HRS Chapter 343, Section 343-5(g) provides that "[a] statement that is accepted with respect to a particular action shall satisfy the requirements of this chapter, and no other statement for the proposed action shall be required." The FEIS was accepted for the Hokuli`a development in 1993. When the scale of a proposed action has been substantially increased subsequent to the acceptance of an environmental impact statement, a supplemental statement may be required. Chapter 200, HAR, which sets forth the Environmental Impact Statement Rules, provides specific grounds upon which a supplemental statement would be warranted:

> Section 11-200-27 Determination of Applicability
>
> The accepting authority or approving agency in coordination with the original accepting authority shall be responsible for determining whether a supplemental statement is required. This determination will be submitted to the office for publication in the periodic bulletin. Proposing agencies or applicants shall prepare for public review supplemental statements whenever the proposed action for which a statement was accepted has been modified to the extent that new or different environmental impacts are anticipated. A supplemental statement shall be warranted when the scope of an action has been substantially increased, when the intensity of environmental impacts will be increased, when the mitigating measures originally planned are not to be implemented, or where new circumstances or evidence have brought to light different or likely increased environmental impacts not previously dealt with. (Emphasis added)

Because the present Project is smaller in scale, less intensive in impacts, and less dense than that contemplated in the accepted FEIS, and because originally planned mitigation measures have been implemented and different or increased environmental impacts are not indicated in new circumstances or information, it does not appear that a SEIS is warranted.

area. Archaeological and cultural preservation sites will be buffered appropriately and incorporated into the open spaces planned throughout the development.

## 8. DENSITY & PROJECTED MARKET

*§15-15-50(c)(7): A statement of projected number of lots, lot size, number of units, densities, selling price, intended market, and development timetables.*

Two phases of the Project have been subdivided into a current total of 338 one to three acre lots. Petitioner currently expects future lot sizes to be in the same range. However, the total number of lots to be developed within the Petition Area will not exceed 665. Assuming that maximum is reached, the Petition Area would have a gross density of 2.1 acres per dwelling unit at full build-out.

A Market Study prepared by KPMG Peat Marwick in 1993[7] projected sales averaging 46 lots per year. Lot sales from late 1999 through 2003[8] exceeded that forecast. Sales prices were also somewhat above anticipated prices, even when adjusted for inflation. Thus, based on the current sales data, the key projections in the market study appear to have been slightly conservative.

Specific sales data for the Project indicate that 247 lots were sold between 1999 and 2003 (50 of which were sold to an affiliate of Petitioner). The average sale prices ranged from $946,312 in 1999 to $1,063,911 in 2003. Resale data indicate that 60 lots were resold between 2003 and the present at average prices ranging from $768,125 in 2003 to $1,378,175 in 2006. In light of the above, the key projections of the market study are still valid for Hokuli`a, and there seems to be a clear demand for the Hokuli`a product. It is notable that 37 of the existing buyers are from the Island of Hawai`i.

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[7] A copy of the Market Study is appended to the 1993 FEIS, Vol. II, Sec. IV.1.

[8] Developer sales have been suspended since September 2003 but are scheduled to resume in November 2006.

The Market Study anticipated that buyers of Hokuli`a lots will most likely be middle-aged, employed people who intend to build second homes or vacation retreats. The Project, including homes to be built by lot owners, is expected to be constructed over an approximate thirty-year period.

## 9. FINANCIAL CONDITION AND FINANCING

*§15-15-50(c)(8): A statement describing the financial condition together with a current balance sheet and income statement, and a clear description of the manner in which the petitioner proposes to finance the proposed use or development. A petitioner, which is a state or county department or agency, shall be waived from this requirement.*

Petitioner's financial condition is sound and stable. Petitioner's current balance sheet and income statement are attached hereto as Petitioner's Exhibit 9. The existing subdivisions and facilities at Hokuli`a have been developed in part using the proceeds of conventional financing, the outstanding balance of which is now approximately $188 million. The value of various outstanding completion bonds is approximately $123 million. The estimated cost for completing the development of the Project, including planning and consulting costs, construction and infrastructure costs, other miscellaneous costs, and projected financing costs (but not including the cost to lot owners of building homes) is approximately $500 million. Petitioner intends to continue to finance the development of Hokuli`a through a combination of lots sale revenue and conventional financing.

## 10. DESCRIPTION OF THE PROPERTY AND SURROUNDING AREA

*§15-15-50(c)(9): Description of the subject property and surrounding areas including the use of property over the past two years, the present use, the soil classification, the agricultural lands of importance to the State of Hawai`i classification (ALISH), the productivity rating, the flood and drainage conditions, and the topography of the subject property.*

The Petition Area comprises approximately 1,434.755 acres of land. It is partially developed with 338 existing lots, the 18-hole golf course and associated improvements, roadways and ancillary infrastructure, including potable and nonpotable water systems, sewer lines and electrical and other utilities. The developed area comprises approximately 800 acres, within which three residences have been constructed, and one additional residence is under construction. A three mile segment of the Bypass Highway has been constructed by Petitioner, extending from Keauhou south through the northeast corner of the Petitioner Area to about Haleki`i Street.

Approximately 600 acres within the Petition Area are undeveloped and will be subdivided so that the Project does not include more than a total of 665 lots.

The Petition Area and surrounding areas have relatively little soil cover, although pockets of soil are found throughout the site, generally following the patterns of lava flows and drainageways. The soils within the Petition Area consist of seven soil types, as classified by the United States Department of Agriculture Soil Conservation Service Soil Survey, as follows: KDD (Kainaliu very stony silty clay loam), WHC (Waiaha extremely stony silt loam), rKED (a`a lava), rLW (pahoehoe lava), rPYD (Punalu`u extremely rocky peat), rCL (cinder land), and KEC (Kainaliu extremely stony silty clay loam). The University of Hawai`i's Land Study Bureau's ("LSB") Detailed Land Classification Report for the Island of Hawai`i has designated the lands within the Project site as predominantly Class C, D, and E. A small portion covering approximately eight acres in the mauka corner of the Petition Area is rated as B lands by the LSB. From an agronomic perspective, the Project site soils are generally moderately to poorly suited for agricultural use. There are no lands rated "Prime" or "Unique" by the ALISH system within the Petition Area. Limited portions of the Petition Area are identified as "Other

Important" lands. This classification indicates that portions of the site can be used for agricultural purposes but generally require infrastructure support and other necessary agronomic improvements.

Four drainageways touch or cross the Petition Area. The Flood Insurance Rate Map shows one drainageway designated as Flood Zone A running along the northern property line. Three drainageways are near the southern boundary and are designated as Zone A, AE and X areas. Portions of the coastline are also designated with the AE and VE zones, but they are outside of the Petition Area. Annual rainfall for the area averages approximately 35 inches, with the summer months receiving the majority of the rainfall as is characteristic of the Kona coast.

The Petition Area is situated at the 1,240 foot elevation along the mauka boundary and descends towards the shoreline and Conservation District boundary to an elevation ranging between 16 feet to 120 feet above mean sea level. The general slope of the property is approximately 13 per cent, with some steeper portions exceeding 20 per cent in areas generally associated with gullies and rock outcroppings.

## 11. ASSESSMENT OF IMPACTS UPON RESOURCES

*§15-15-50(c)(10): An assessment of the impacts of the proposed use or development upon the environment, agriculture, recreational, cultural, historic, scenic, flora and fauna, groundwater, or other resources of the area.*

Based on the historical uses of land within the Petition Area, the valued natural, historical, and cultural resources upon or relating to such land, and the assessment of actual and projected impacts upon such resources, as more specifically addressed below, the proposed reclassification of the Petition Area into the Rural and Conservation Districts will not significantly affect the environment in an adverse manner.

**(1) Agricultural**

The Petition Area has historically been intermittently utilized for seasonal cattle ranching over the past 100 years. Use of the Petition Area for such ranching activities was ultimately discontinued as it was determined to be infeasible by the previous owners of the property. Prior to its use as a cattle ranch, there are historical references to limited agricultural use in the mauka portions of the property, including cultivation of sugar cane, coffee and citrus.

Because the property as a whole is only marginally suited for intensive agricultural use, the Project is not expected to significantly impact agricultural uses in the Petition Area and its vicinity.

**(2) Recreational**

The development has and will enhance recreational resources in the area. The Petition Area is bordered by the Conservation District along the shoreline, and Petitioner is continuing to develop and maintain the shoreline park within 140 acres of this Conservation District area. The shoreline park is open for public and resident access to the shoreline and will be linked with a system of public access trails (such as the "Stepping Stone Trail") that traverse the Petition Area. Infrastructure for the park includes shoreline parking and restroom facilities.

The golf course has also introduced a new recreational resource. Although the golf course is generally restricted to members, public play opportunities are regularly provided through a charity and community-related public play program. Approximately $2 million of charitable contributions has thus far been raised through fund-raising tournaments at Hokuli`a.

Petitioner has also agreed to dedicate approximately five acres to the County for an addition to the Kona Scenic Park, which is situated at the mauka boundary of the Petition Area, and to construct two pavilions, public restrooms and additional parking for the park.

**(3) Cultural/Historic**

The Petition Area includes ancient Hawaiian archaeological sites, including burials, heiau, habitation sites, walls, agricultural sites and other remnants of ancient Hawaiian habitation. The ancient Hawaiian village of Hokukano is makai of the Petition Area on State land and has many intact archaeological features. Remnants of the Kona Field System, an area or belt along mauka Kona used by the Hawaiians for agricultural subsistence cultivation, are located within the Petition Area. The common agricultural crops cultivated prehistorically and during the early historic period include: within the coastal zone (0 to 500 feet elevation) coconuts, sweet potatoes and *wauke* (paper mulberry), and within the upper elevations (500 to 1000 feet) crops probably consisting mainly of breadfruit, with *wauke* and sweet potatoes planted between the breadfruit. Pu`u Ohau, a volcanic cinder cone near the shoreline, is the site of ancient Hawaiian burials. The shoreline area below the Petition Area is a resource for fishing and other ocean related activities.

The development of Hokuli`a has enhanced the preservation of and public access to these cultural and historic resources. During the decades before Petitioner acquired the Hokuli`a lands, little or no public access to historic and cultural resources was permitted by the previous owners. Portions of the makai area of the property had been chain-dragged during the early 1900's. Chain-dragging involved dragging a heavy steel bar between two bulldozers to break down and clear vegetation, without regard to the damage to historic or cultural sites.

Following fieldwork in 1991 and 1992, an archaeological inventory survey ("AIS") was prepared for Petitioner and submitted to the State Historic Preservation Division ("SHPD") of the Department of Land & Natural Resources ("DLNR") for approval. The AIS was revised in response to comments received from SHPD and was accepted by SHPD in

December 1996. The AIS has been supplemented by information obtained by additional survey work (referred to as "block reports") conducted within the area covered by the AIS and submitted to SHPD for approval. The information in the block reports confirms and is consistent with the historical and archaeological resources of the Petition Area as described in the 1993 FEIS.

In 1999, SHPD approved an Integrated Archaeological Mitigation Plan ("IAMP") for the Project area. The IAMP and Interim Protection Plans approved by SHPD set forth procedures (i) to identify historic sites for possible data recovery or preservation and (ii) to protect burial and other important archaeological sites from damage or destruction, pending final determination of the appropriate treatment. Based on the AIS, the block reports, and the IAMP, proposed burial treatment plans and a list of recommended preservation sites have been submitted to SHPD, and approval is pending. Once approved, the list of preservation sites will form the basis for the Preservation Plan and an Interpretive Plan incorporated therein. The Preservation Plan is anticipated to be submitted to SHPD for approval in April, 2007.

The result of archaeological survey work and cultural analyses conducted to date has shed light on the importance and extensive nature of Hawaiian settlement, cultivation practices and existing cultural resources associated with the Kona Field System. Data recovery in the Kona Field System historically has generally been limited to relatively small and noncontiguous parcels of property. The systematic survey and analyses resulting from Petitioner's development and the related preservation, maintenance and care of significant archaeological and cultural sites enhances the general knowledge of the field system and contributes to a better understanding upon which to base the preservation and maintenance of the historic and cultural resources within and around the Petition Area.

Among the historic sites and cultural resources identified in the AIS were remnants of a historic trail, referred to as the "Stepping Stone Trail," which runs north-south through the makai portion of the Petition Area.[9] Petitioner has entered into an agreement with DLNR and others, pursuant to which (i) Petitioner will execute a quitclaim deed conveying its interest in the trail to the State of Hawai`i; (ii) DLNR will designate the trail as a preservation site on terms permitting only pedestrian use (other than roadway, cart path and underground crossings related to the Project); (iii) Petitioner will restore and reconstruct the southern section of the trail; (iv) Petitioner will establish a protective buffer zone on both sides of the trail; and (v) Petitioner will establish and maintain in perpetuity two interpretive sites alongside the trail.

The Petitioner has also agreed to take additional steps for the protection of historic and cultural resources. These steps include the creation of a non-profit "Park and Cultural Sites Entity" ("PCSE"). The PCSE will be responsible for the maintenance of the shoreline park and the preserved cultural and historical sites therein, as well as all other cultural and historic sites to be preserved in perpetuity throughout the Project. The PCSE will also be responsible for the preservation of the Stepping Stone Trail, the Old Government Road and the Old Cart Road. The PCSE will develop educational materials and programs designed to encourage understanding and appreciation of these resources and will develop standards for the proper maintenance and care of the resources. The PCSE will establish an advisory board whose purpose will be to provide advice and guidance to the PCSE regarding the preservation, operation and maintenance of the shoreline park and cultural and historic sites within Hokuli`a. The advisory board will have approximately 20 members and will be comprised of representatives designated by Petitioner, Hokuli`a lot owners, Protect Keopuka Ohana, other

[9] The Stepping Stone Trail, as well as sections of a trail referred to as the "Old Cart Road," and a trail referred to as the "Old Government Road," are excluded from the Petition Area and district reclassification for the area comprising these trails is not being requested under this Petition.

descendants of the lands at Hokuli`a, Hawai`i County, kuleana owners and other appropriate groups. The PCSE will also take possession of and store all native Hawaiian artifacts and relics discovered by Petitioner or its agents on the Hokuli`a site or in connection with the Project. Funding for the PCSE will be in part by way of a ¼% transfer fee upon all future sales and resales of lots and homes within the Project.

In addition, Petitioner is establishing two Cultural Practice and Preservation Areas ("Cultural Preserves"), comprising a total of approximately 12 acres, where lineal and cultural descendants may engage in traditional cultural practices.

**(4) Visual Resources**

The development is not expected to significantly impact visual resources in the area. Views of portions of the Petition Area are presently available from portions of the existing residential neighborhoods that are directly mauka of the Petition Area, primarily the Kona Scenic Subdivision. The Petition Area is also visible to those approaching the property along the coast. Additional views of the coastline will be available from the Bypass Highway upon its completion. Any potential visual impacts will be mitigated through appropriate landscaping buffers, architectural design standards and the low-density nature of the Project. The shoreline park in the Conservation District makai of the Petition Area and the golf course will provide a significant measure of open space throughout and around the Petition Area.

**(5) Flora and Fauna**

No significant impact on floral or faunal resources is anticipated. No threatened, endangered or candidate species as listed by the U.S. Fish and Wildlife Service appear to be present within the Petition Area, nor are there unique or valuable wildlife habitats. No existing or proposed federally designated critical habitat is present within the Petition Area.

Four major vegetation types were identified within the Petition Area. The first consists of prosopis trees with a mixed grass understory extending from the coastline to nearly the 700-foot elevation. The second vegetation type is a mixture of *koa haole* and prosopis scrub generally located midway between the mauka and makai property boundaries. The third vegetation type consists of *kukui* scrub extending from the 850-foot elevation to about 1,100-foot elevation. The fourth vegetation type consists of lantana scrub with some mango, avocado, guava, papaya, and large monkey pod trees extending generally from the 1,100-foot elevation to the mauka property boundary.

Existing fauna typically consists of introduced species that are transient in nature, including mongoose, cardinal, barred dove, spotted dove, myna bird, golden plover and house sparrow. Feral dogs, cats, pigs and rodents are also known to the area. No endemic species were found on the property. Endemic birds, such as the short-eared owl or *Pueo* and Hawaiian Hawk, or *I`o*, may forage in this region, but none were found on or near the Petition Area.

**(6) Groundwater and Coastal Water Resources**

There are no perennial streams, wetlands or special aquatic sites within the Petition Area. The golf course and other aspects of the Project have been designed and are being operated under the regulatory oversight of the County of Hawai`i and the State Department of Health ("DOH") to minimize any potential impacts of the development on the existing biological and water chemistry conditions in the groundwater and coastal water resources. Preventative measures include subterranean lining of portions of the golf course, the recycling of irrigation water and the adoption of best management practices regarding the use and storage of fertilizers, herbicides and pesticides. In connection with Hawaii County's approval of the golf course, Petitioner established a water quality monitoring program which provides for periodic sampling

of the near shore ocean waters adjacent to the Project, as well as periodic benthic surveys of marine life in those waters. Petitioner has also agreed to conduct a new baseline water quality study along an 11-mile stretch of shoreline, including areas both north and south of the Petition Area.

Following runoff incidents which resulted from heavy storms in September and November 2000, Petitioner, with oversight by the DOH, revisited and significantly enhanced its erosion control measures and expended more than $5 million to implement them and establish best management practices to minimize the possibility of future runoff events.

## 12. AVAILABILITY OF PUBLIC SERVICES AND FACILITIES

*§15-15-50(c)(11): Availability or adequacy of public services and facilities such as schools, parks, wastewater systems, solid waste disposal, drainage, water, transportation systems, public utilities, and police and fire protection, and to what extent any public agency would be impacted by the proposed development or reclassification.*

The public schools closest to the Petition Area are Konawaena Elementary School, Middle School and High School, which are all in Kealakekua. Schools are not expected to be significantly impacted by the proposed reclassification and the subject development due to the nature of the projected market (primarily second home and vacation retreat buyers) and the relatively high anticipated age of buyers who will actually reside full-time within Hokuli`a.

The development has had and will continue to have a positive effect on the availability of recreational opportunities in West Hawai`i through the implementation of the public shoreline park within the Conservation District area which provides public access to the shoreline and cultural resources within the shoreline area, a trail system within the Petition Area, the golf course and related amenities, and the future expansion and improvement of the County's Kona Scenic Park.

Wastewater will be disposed by way of a private wastewater treatment plant ("WWTP") for which permits have been issued. Construction of the first increment of the WWTP is approximately 75 per cent complete. Solid waste disposal facilities are available at the County Napo`opo`o and Keauhou Transfer Stations.

Four drainageways touch or cross the Petition Area. The Flood Insurance Rate Map (FIRM) shows Flood Zone A running along the northern property line and Flood Zones A, AE and X traversing the site midway into the southern half of the property and along the southern property line. Although these four minor flood zones, associated with drainageways, impact the Petition Area, the development plan will ensure that habitable structures are, either, placed outside these zones or that the improvements necessary to accommodate development within these zones are constructed. Portions of the coastline are also designated with the AE and VE zones; however, these are within the Conservation District area along the coast and not within the Petition Area.

The Project has potable water commitments from the County under a water source agreement for 499 units. Additional water sources will be needed to address the maximum daily demand of full development. Facilities charges for Phases 1 and 2 and other golf course-related improvements have already been paid to the County Department of Water Supply ("DWS"). Petitioner is presently coordinating its efforts with DWS relating to a future potable water well that will satisfy the remaining potable water needs for the balance of the Project.

Irrigation water for agricultural and golf course uses is provided by a non-potable water system separate from the potable water supply. Separate wells, storage facilities and distribution lines have been and will continue to be developed for these purposes.

Vehicular access to the Petition Area is by way of Haleki`i Street from Mamalahoa Highway, and by the north-south regional Bypass Highway being constructed by Petitioner pursuant to an agreement with the County. The new Bypass Highway right-of-way will eventually accommodate four lanes of traffic. Petitioner is required to construct the initial two lanes, and the County is responsible for construction of the additional lanes as needed. The Bypass Highway will divert a portion of the regional through traffic from Mamalahoa Highway to relieve current congestion at peak times in mauka Kona and will provide needed infrastructure to serve not only the residents of the Project, but the wider region of North and South Kona.

In addition to the construction of the Bypass Highway, Petitioner is required to provide certain roadway and intersection improvements. The improvements include the channelization and signalization of the Mamalahoa Highway/Haleki`i Street intersection, which has already been completed; construction of the extension of Haleki`i Street through most of the Petition Area, in order to facilitate public access to the shoreline, which is substantially complete; the provision of roadway stub-outs to provide future connections between the subject property and the adjacent properties to the north and south; and the provision of landscape buffers along highway sections within 500 feet of existing dwellings to reduce the impacts of noise and light on the residents therein.

Electrical, telephone and cable television services are available for the development from existing and planned public utility company facilities. The provision of utility services to Phase 1 lots is in progress.

The Petition Area is situated within the service areas of the Captain Cook Police and Fire Departments located in Captain Cook, less than three miles away. These facilities are anticipated to be adequate to serve the Petition Area and existing area requirements.

## 13. ADJACENT USES/LAND USE DISTRICTS

*§15-15-50(c) (12): Location of the proposed use or development in relation to adjacent land use districts and any centers of trading and employment.*

The lands abutting the Petition Area to the north and the south are within the Agricultural District. The lands makai or along the western boundary of the Petition Area are within the Conservation District. The lands mauka or east of the Petition Area are within the Agricultural and Urban Districts. Centers of trading and employment include the mauka towns of Kealakekua, Captain Cook, Kainaliu, and Honalo, which offer support services adequate for most of the Project's residents' general commercial needs. Kailua-Kona, the major center of trading and employment for the West Hawai`i region, is located approximately 10 miles to the north. In addition, numerous resorts and resort areas are located along the North Kona and South Kohala coasts.

## 14. ASSESSMENT OF ECONOMIC IMPACTS

*§15-15-50(c)(13): Economic impacts of the proposed reclassification, use, or development including, without limitation, the provision of any impact on employment opportunities, and the potential impact to agricultural production in the vicinity of the subject property, and in the county and State.*

Prior to a discontinuation in the construction of the Project in 2003, Petitioner's annual construction costs reached a high of approximately $50 million, thus contributing significantly to the local and State economies. In addition, prior to that discontinuance, approximately $10 million was in Petitioner's annual payroll, and $2 million annually was paid in real property taxes. The Project is anticipated to continue to increase the availability and variety of job opportunities in the area, resulting in higher employment and improvement of the quality of life for local residents

The development will sustain construction employment over a thirty-year buildout period for the construction of new facilities and residences. Direct employment of construction workers will stimulate additional employment on the island and elsewhere in the State. Employment which will be supported directly by the construction of the facilities includes onsite laborers, operatives and craftsmen, as well as professional, managerial, sales and clerical workers whose usual place of employment may be elsewhere on the island or in the State. Based upon data from the Department of Business, Economic Development & Tourism, it is estimated that 1.79 other full time jobs are created for every full time job in the construction industry.

Employment in the operation and support of those facilities will provide permanent full time jobs for area residents. Prior to the discontinuation of operations in 2003, Petitioner employed approximately 180 full-time employees. Since the resumption of operations earlier this year, approximately 110 full-time employees are being employed by Petitioner.

As with the effects of construction jobs, effects from operational employment will be direct and indirect or induced. Direct operational employment opportunities have been created at the golf course, golf shop, support and maintenance facilities, and administrative operations. Facility operations will also indirectly generate employment elsewhere on the island and elsewhere in the State.

The Project is not anticipated to have a significant impact upon agricultural production in the vicinity of the subject property, which has historically not been agriculturally productive. In general, the soil conditions of the area are marginally suited for agricultural purposes

## 15. LOW INCOME HOUSING

*§15-15-50(c)(14): If a residential development is proposed, a description of the manner in which the petitioner addresses the housing needs of low income, low-moderate income, and gap groups.*

Petitioner has committed to construct or cause to be constructed a minimum of 100 units of affordable housing within the Kona area by 2011. In addition, within five years of receipt of final subdivision approval for additional homesites within the Petition Area, Petitioner has agreed to construct or cause to be constructed additional affordable housing units within the Kona area, such that the number of affordable housing units which Petitioner has constructed or caused to be constructed would equal 20% of the total number of housing units which Petitioner has developed or caused to be developed, consistent with current County affordable housing policy. Under this commitment, if Petitioner develops a total of 665 lots, Petitioner will construct or cause to be constructed a total of 168 affordable units.

## 16. ASSESSMENT OF NEED

*§15-15-50(c)(15): An assessment of need for the reclassification based upon the relationship between the use or development proposed for the area and consideration of other similarly designated land in the area.*

Studies performed in the planning process indicate that the Project is compatible with and will enhance the existing natural environment. Market studies, based on an analysis of regional and demographic trends, visitor trends, and an overview of similar projects indicate that Hokuli`a will be uniquely situated on the island of Hawai`i. The Project continues to expand employment opportunities and to provide recreational and public facilities that are presently lacking in this area.

Reclassification of the Petition Area to the Rural and Conservation Districts will be consistent with the surrounding residential, agricultural and conservation uses. Surrounding areas include agricultural (orchards and grazing), urban-residential and conservation uses, including the Kona Scenic Subdivision and the town of Kealakekua which are mauka of the Petition Area and within the Urban District; Agricultural Districts to the north and south; and the

Conservation District along the coastline. The low density and open space character of the development are compatible with and complement the existing uses that surround the Petition Area.

## 17. ASSESSMENT OF CONFORMITY WITH STATE PLANS

*§15-15-50(c)(16): An assessment of conformity of the reclassification to applicable goals, objectives, and policies of the Hawai`i state plan, chapter 226, HRS, and applicable priority guidelines and functional plan policies.*

The proposed reclassification is consistent with applicable goals, objectives and policies of the Hawai`i State Plan. The State Plan lists three "Overall Themes" relating to 1) individual and family self-sufficiency; 2) social and economic mobility; and 3) community or social well-being (Section 226-3(1-3)). These themes are viewed as "basic functions of society" and goals toward which government must strive. To guarantee the elements of choice and mobility embodied in the three themes, three goals were formulated (Section 226-4(1-3)):

(1) A strong, viable economy, characterized by stability, diversity and growth that enables fulfillment of the needs and expectations of Hawai`i's present and future generations.

(2) A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems and uniqueness that enhances the mental and physical well-being of the people.

(3) Physical, social and economic well-being, for individuals and families in Hawai`i, that nourishes a sense of community responsibility, of caring and of participation in community life.

Hokuli`a will provide direct and indirect short and long term employment opportunities for the present and future residents of North and South Kona and West Hawai`i. The Project will generate increased State and County tax revenues and will contribute to the stability, diversity and growth of local and regional economies. Archaeological, historic and natural site features

will be protected within the Petition Area. Key elements of the Project relative to the goals, objectives and polices of the State Plan are that the Project will provide additional employment, recreational and cultural opportunities for existing and future residents of North and South Kona and West Hawai`i; that it will provide these opportunities in a planned setting wherein design, operation and maintenance and environmental protection provisions can be effectively, efficiently and economically controlled, and that it will provide these opportunities close to existing and planned developments such that travel times are minimized and yet will be sufficiently separated from planned or existing residential developments such that the activities within the Project will not be a nuisance to nearby communities or related activities. By providing recreational, educational and cultural opportunities within a planned setting, the Project will enhance the sense of community responsibility and participation.[10]

## 18. ASSESSMENT OF CONFORMITY WITH CZMA

*§15-15-50(c)(17): An assessment of the conformity of the reclassification to objectives and policies of the coastal zone management program, chapter 205A, HRS.*

A portion of the Petition Area is within the Special Management Area ("SMA"). The proposed reclassification conforms to the objectives and policies of the coastal zone management program, HRS Chapter 205A, discussed as follows.[11]

### (1) Recreational Resources

The development of Hokuli`a provides the public with previously unavailable vehicular and pedestrian access to the shoreline and cultural and historic coastal resources by

[10] A comprehensive analysis of the conformity of the development with the State Plan and its applicable priority guidelines and functional plan policies is set forth in the 1993 FEIS, Vol. I, Secs. 5.1.2. and 5.1.3.

[11] It is of note that several SMA permits have been approved by the Hawai`i County Planning Commission in relation to the development. SMA Permit Nos. 345, 356, 401, 402, 403 and 404 were approved between 1993 and 2000. The permits allowed the development of the golf course, clubhouse, driving range, golf maintenance facility, golf member facilities, shoreline park, bypass highway, member's lodge and a wastewater treatment facility. The member's lodge has since been excluded from the development plan.

way of a designated roadway and parking facilities, as well as the recreational resources of the trail system and the shoreline park in conjunction with resource management plans for the protection of shoreline resources as well as culturally significant sites.

**(2) Historic Resources**

Historic resources are being and will continue to be protected and preserved under the various mitigation and preservation plans approved by the SHPD. Where appropriate, selected sites will be restored and incorporated as part of an overall interpretive program integrated with a pedestrian trail network. Where recommended, signage will be provided explaining the significance of a site and its relationship to the history of the area.

**(3) Scenic and Open Space Resources**

The development will continue to protect, maintain or improve the quality of coastal, scenic and open space resources. The golf course, infrastructure and related facilities have been and will be designed to take advantage of the natural contours of the land and minimize adverse effects on the environment. The golf course, open space and landscaped areas, coupled with the low density of the Project, ensure that the area's open space and scenic resources are maintained. Facilities will retain a low profile to maintain coastal views from mauka areas, and views along the coast will not be obstructed.

**(4) Coastal Ecosystems**

To assure that groundwater and near shore marine water quality is maintained, standard engineering and design precautions and adherence to State, County and Federal standards are being followed in the design of the drainage system, including compliance with State NPDES permitting requirements. Petitioner has implemented extensive erosion control measures to minimize storm runoff into the near shore waters. Petitioner has also established a

water quality monitoring program which provides for periodic sampling of the near shore waters adjacent to the Project as well as periodic benthic surveys of marine life in these waters, and will conduct a new baseline water quality study along 11 miles of the coast adjacent to the Petition Area.

**(5) Economic Uses**

The development is significantly removed from and will not adversely impact existing coastal dependent developments such as harbors or ports and visitor industry facilities.

**(6) Coastal Hazard**

All inhabitable structures within the development are located significantly inland so as to be outside areas of potential tsunami, high storm or wave action. Public access to the shoreline areas will be managed so as to control access during times of high wave action or tsunami danger. No significant development or habitable structures will be located in any of the flood hazard zones or drainage ways. The development will comply with the requirements of the Federal Flood Insurance Program. Petitioner is also required to install a tsunami warning system.

**(7) Managing Development/Public Participation**

Management of development and public participation will be facilitated through the review process of this petition and any further required permitting prior to any additional development.

**(8) Beach Protection**

As noted, all inhabitable structures will be located well inland of the shoreline. No private erosion-protection structures will be constructed seaward of the shoreline.

**(9) Marine Resources**

Although not part of the Petition Area, the shoreline park will be managed to ensure that the use and development of marine and coastal resources are ecologically and environmentally sound. The water quality monitoring, surveys of marine life and baseline water quality study which Petitioner will perform will promote the understanding of ocean processes, marine life, and other marine resources and improve understanding of how development activities relate to and impact upon ocean and coastal resources.

## 19. ASSESSMENT OF CONFORMITY WITH COUNTY PLANS

*§15-15-50(c)(18): An assessment of conformity of the reclassification to the applicable county general plans, development or community plans, zoning designations and policies, and proposed amendments required.*

The General Plan of the County of Hawai`i, amended in 2005, is the policy document for the long range comprehensive development of the island. The General Plan addresses twelve elements or subject areas which are relevant to the long term planning of development on a regional basis.[12] The General Plan includes a Land Use Pattern Allocation Guide ("LUPAG") Map of the island. The land use pattern is a broad, flexible design intended to guide the direction and quality of future developments in a coordinated and rational manner. The LUPAG map indicates the general locations of various land uses in relation to each other. The Petition Area is designated on the LUPAG map as Orchard, Extensive Agriculture and Open.[13] The General Plan specifically references Hokuli`a as a planned development for a residential and golf course

[12] The twelve elements include the following: Economic, Energy, Environmental Quality, Flooding and Other Natural Hazards, Historic Sites, Natural Beauty, Natural Resources and Shoreline, Housing, Public Facilities, Public Utilities, Recreation, Transportation and Land Use.

[13] The Orchard designation includes "[t]hose agricultural lands which though rocky in character and content support productive macadamia nuts, papaya, citrus and other similar agricultural products." The Extensive Agriculture designation covers lands that are not Important Agricultural Land and includes "[l]ands that are not capable of producing sustained, high agricultural yields without the intensive application of modern farming methods and technologies due to certain physical constraints such as soil composition, slope, machine tillability and climate." The Open designation includes "[p]arks and other recreational areas, historic sites, and open shoreline areas."

community. Hokuli`a is consistent with the goals, policies and standards set forth in the General Plan.[14] The Petition Area is being served with existing infrastructure and will be served in the future with planned infrastructure and is in balance with the natural, cultural and social environment of the County.

The County zoning designation for the Petition Area is Agricultural-1 acre (A-1a), which allows a minimum lot size of one acre. The Agricultural zone provides for agricultural and very low density agriculturally-based residential use, encompassing rural areas of good to marginal agricultural and grazing land, forest land, game habitats, and areas where urbanization is not found to be appropriate. Permitted uses within this zoning district include single-family dwellings, farm dwellings, agricultural parks, crop production, parks and other similar open area recreational facilities, and golf courses and related golf course uses (with a Use Permit). The Hokuli`a development is consistent with the purpose and applicability of this zoning designation.

## 20. HAWAIIAN CUSTOMARY AND TRADITIONAL RIGHTS

*§15-15-50(c)(20): A statement addressing Hawaiian customary and traditional rights under Article XII, section 7 of the Hawai`i State Constitution.*

Traditional and customary native Hawaiian rights within or in proximity to the Petition Area include a right of pedestrian access over the Stepping Stone Trail and other recognized trails traversing the property, worshipping at burial sites within the property, and subsistence and cultural activities, including fishing and ocean resource gathering, along the shoreline. The preservation and protection of these resources is being effected through archaeological and burial preservation plans, the establishment of the shoreline park which will provide public access to the shoreline area and traditional and cultural resources within the area, the establishment of two

[14] A detailed discussion of the conformity of Hokuli`a with the General Plan's goals, policies and standards in set forth in the 1993 FEIS, Section 5.2.

Cultural Preserves within the Petition Area that total approximately 12 acres where lineal and cultural descendants may engage in traditional and cultural practices, and the establishment of three Agricultural Preserves to facilitate traditional and customary native Hawaiian agricultural practices.

Petitioner is also forming the PCSE for the purpose of preservation, operation and maintenance of the shoreline park and specified cultural and historical sites within the Petition Area. Petitioner, in coordination with DLNR and the certified lineal and cultural descendants of Hokuli`a, will continue to implement measures to protect, and to provide access to, burial sites, including (i) providing information to lineal and cultural descendants on burial sites within the Petition Area; (ii) implementation of both short-term and long-term protection measures for burial sites; and (iii) providing access for lineal and cultural descendants to such burial sites.

Petitioner is also preserving and protecting the Old Government Road and the Stepping Stone Trail. Petitioner will restore portions of the Stepping Stone Trail to create a continuous trail segment varying in width from three to five feet, and will create a five-foot buffer on each side of the trail centerline. Petitioner will maintain and preserve the Old Government Road and the Stepping Stone Trail in coordination with DLNR.

Petitioner will also establish and maintain two interpretive areas connecting the existing remnant trail sections to the shoreline park, which interpretive areas will then be available for public access from the shoreline park, and will install warning signs on the golf course advising of the trail and its significance.

Petitioner will also work with DLNR to maintain and preserve what is referred to as the "Old Cart Road" situated primarily within the shoreline park in the Conservation District as a

public pedestrian access trail, and will grant an easement between the Old Cart Road and the Old Government Road for pedestrian trail access purposes in the vicinity of Pu`u Ohau.

Another significant protective measure concerns the burial site of Kamaeo`kalani, near the summit of Pu`u Ohau, which is a significant historic and cultural site. This site is located within the Conservation District and outside the Petition Area. In order to provide an additional buffer around this site, Petitioner has agreed to abandon the development of five previously subdivided lots presently within the Agricultural District along the current Conservation District boundary. The area included in such lots is part of the area for which the instant Petition seeks reclassification to the Conservation District. Petitioner will also construct a gated wall or other buffer to restrict access to, and to protect and preserve, the burial site of Kamaeo`kalani and other cultural resources within the buffered area.

These mitigation measures will ensure that traditional and customary native Hawaiian rights, customs and practices will be preserved and protected in a feasible manner.

## 21. WRITTEN COMMENTS

*§15-15-5(c)(21): Any written comments received by the petitioner from governmental, non-governmental agencies, organizations, or individuals in regards to the proposed reclassification.*

Petitioner has not received any written comments from governmental or non-governmental agencies, organizations or individuals concerning the proposed reclassification. Any written comments received in the future shall be submitted for inclusion into the record of this docket.

## 22. NOTIFICATION OF PETITION FILING

A copy of the *Notification of Petition Filing* to be sent pursuant to §15-15-50(d), LUC Administrative Rules, is attached hereto as Petitioner's Exhibit 10.

WHEREFORE, Petitioner respectfully requests that the Land Use Commission approve this Petition and issue an Order Amending the Land Use District Boundary in order to reclassify the Petition Area from the Agricultural District to the Rural District and the Conservation District.

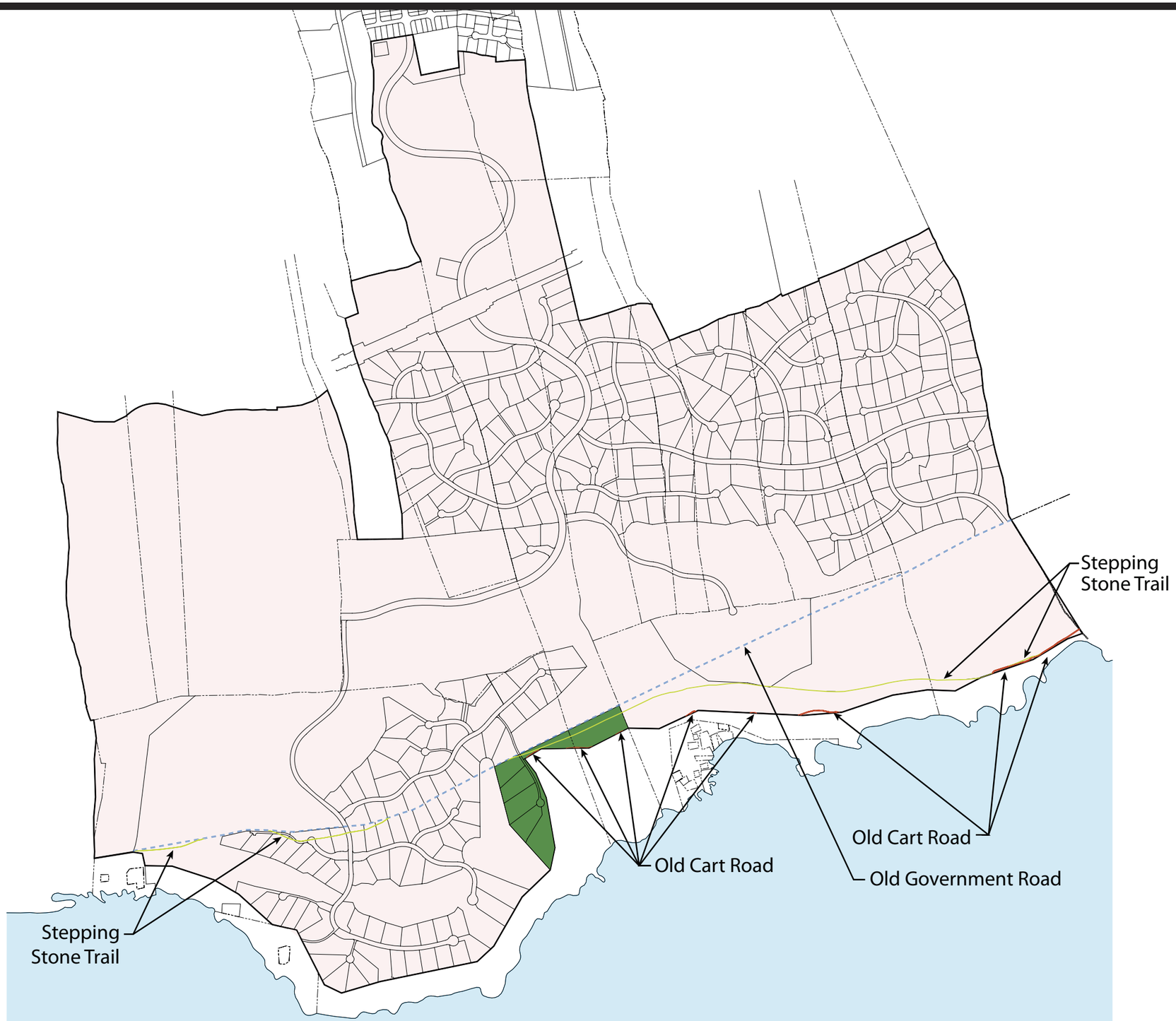
DATED: Kailua-Kona, Hawai`i, October 11, 2006.

1250 OCEANSIDE PARTNERS

By: Red Hill 1250, Inc.
Its: General Partner

By: _____
JOHN DE FRIES
Its: Vice President

# PETITIONER'S
# EXHIBIT 1




**LEGEND**

Agricultural to Rural (1,418.739 Acres)

Agricultural to Conservation (16,016 Acres)

Total Petition Area = 1,434.755 Acres

Exclusions:

Old Cart Road–Portion within the Agricultural District (Site Number 17189)

Stepping Stone Trail (Site Number 21664)

Old Government Road (Site Number 10290)

Note: 1. The majority of the Old Cart Road lie in the Conservation District, makai of the Petition Area. Only the portions of the Old Cart Road that encroach into the Petition Area are shown on the map.

2. Portions of the Stepping Stone Trail lie within the alignment of the Old Government Road.

BeltCollins

NORTH

0 400 800 1200

SCALE IN FEET

**PETITIONER'S EXHIBIT 1**
**PETITION AREA**

HŌKŪLIA

1250 Oceanside Partners
October 11, 2006

# PETITIONER'S
# EXHIBIT 2

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 1 | 7-9-12-04 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 2 | 7-9-12-06 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 3 | 7-9-12-11 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 4 | 7-9-12-29 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 5 | 7-9-12-34 (portion) | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 6 | 8-1-04-03 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 7 | 8-1-04-56 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 8 | 8-1-04-59 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 9 | 8-1-04-60 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 10 | 8-1-04-61 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 11 | 8-1-04-62 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 12 | 8-1-04-64 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 13 | 8-1-04-65 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 14 | 8-1-04-68 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 15 | 8-1-04-70 (portion) | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 16 | 8-1-04-71 | | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 17 | 8-1-26-01 | Lot B | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 18 | 8-1-26-02 | 1-002 | William P. Batiste and Virginia F. Batiste, Trustees of the W. and V. Batiste Trust dated 1/23/01 | 2004-176056 |
| 19 | 8-1-26-03 | 1-003 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 20 | 8-1-26-04 | 1-004 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 21 | 8-1-26-05 | 1-005 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 22 | 8-1-26-06 | 1-006 | Andrew Meislin, Trustee of the Andrew Meislin Trust dated January 3, 2006 and Clyde Lawrence Webb | 2006-089940 |
| 23 | 8-1-26-07 | 1-007 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 24 | 8-1-26-08 | 1-008 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 25 | 8-1-26-09 | 1-009 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 26 | 8-1-26-10 | 1-010 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 27 | 8-1-26-11 | 1-011 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 28 | 8-1-26-12 | 1-012 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 29 | 8-1-26-13 | 1-013 | Aloha Aina Development, LLC, a Hawaii limited liability company | 2006-116356 |
| 30 | 8-1-26-14 | 1-014 | Hokuli`a 14, LLC, a Hawaii limited liability company | 2006-049169 |
| 31 | 8-1-26-15 | 1-015 | Pace Investments Limited Partnership, a Hawaii limited partnership | 2006-044056 |
| 32 | 8-1-26-16 | 1-016 | Charles P. Virden and Lynnsey Virden, Trustees of the Virden Family Trust dated September 2, 1998 | 2006-040051 |
| 33 | 8-1-26-17 | 1-017 | EWM Investments LLC, a Nevada limited liability company | 2001-187507 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 34 | 8-1-26-18 | 1-018 | Norma Foster Maddy, Trustee of the Norma Foster Maddy 1997 Revocable Trust dated January 13, 1997 | 2000-112198 |
| 35 | 8-1-26-19 | 1-019 | Norma Foster Maddy, Trustee of the Norma Foster Maddy 1997 Revocable Trust dated January 13, 1997 | 99-206737 |
| 36 | 8-1-26-20 | 1-020 | Phillip Harris III and Donna Lee Harris | 2004-137703 |
| 37 | 8-1-26-21 | 1-021 | Lyle H. Anderson | 2000-046664 |
| 38 | 8-1-26-22 | 1-022 | George D. Marshall and Sharon C. Marshall | 99-201008 |
| 39 | 8-1-26-23 | 1-023 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 40 | 8-1-26-24 | 1-024 | Stephen C. Dinsmore and Deborah W. Dinsmore, Trustees of the Stephen C. Dinsmore and Deborah W. Dinsmore Trust dated November 18, 1982 | 2005-061714 |
| 41 | 8-1-26-25 | 1-025 | Lyle H. Anderson | 2000-047353 |
| 42 | 8-1-26-26 | 1-026 | Lyle H. Anderson | 2000-046667 |
| 43 | 8-1-26-27 | 1-027 | Tatsuya Omura | 99-201009 |
| 44 | 8-1-26-28 | 1-028 | Michael J. Roberts | 2006-076421 |
| 45 | 8-1-26-29 | 1-029 | Maurmark, LLC, a California limited liability company | 2001-091417 |
| 46 | 8-1-26-30 | 1-030 | John R. Kennedy | 2006-143258 |
| 47 | 8-1-26-31 | 1-031 | Stuart H. Mendel and Jennie Ann Freiman | 2005-107016 |
| 48 | 8-1-26-32 | 1-032 | William W. Adams, Trustee of the Adams Family Trust under Declaration of Trust dated December 10, 1991 | 2003-166559 |
| 49 | 8-1-26-33 | 1-033 | Yutaka Takeda and Tomoko Takeda | 2000-011972 |
| 50 | 8-1-26-34 | 1-034 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 51 | 8-1-26-35 | 1-036 | ENNIS, LLC, a Washington limited liability company | 2000-028218 |
| 52 | 8-1-26-36 | 1-037 | Hokulia 37, LLC, a Delaware limited liability company | 2006-052506 |
| 53 | 8-1-26-37 | 1-038 | Larry S. Gutsch and Jaqua L. Gutsch, Co-Trustees for the Gutsch Family Trust dated December 28, 1995 | 2000-041869 |
| 54 | 8-1-26-38 | 1-039 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 55 | 8-1-26-39 | 1-040 | Norma Foster Maddy, Trustee of the Norma Foster Maddy 1997 Revocable Trust dated January 13, 1997 | 99-206743 |
| 56 | 8-1-26-40 | 1-041 | The Conklin Family Limited Partnership, an Arizona limited partnership | 2000-014832 |
| 57 | 8-1-26-41 | 1-042 | The Conklin Family Limited Partnership, an Arizona limited partnership | 2000-014835 |
| 58 | 8-1-26-42 | 1-043 | Anthony K. Hedley | 2000-076116 |
| 59 | 8-1-26-43 | 1-051 | Andrew Meislin, Trustee of the Andrew Meislin Trust dated January 3, 2006 | 2006-117077 |
| 60 | 8-1-26-44 | 1-052 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 61 | 8-1-26-45 | 1-053 | Suffolk Investment, LLC, a Hawaii limited liability company | 2004-067983 |
| 62 | 8-1-26-46 | 1-054 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 63 | 8-1-26-47 | 1-055 | Christopher John Williams and Kristine Claire Williams | 2000-034277 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 64 | 8-1-26-48 | 1-056 | Douglas Mayer Rhymes and Susan Lee Rhymes | 2000-010162 |
| 65 | 8-1-26-49 | 1-057 | Richard R. Goodmanson and Janet A. Goodmanson | 2000-040867 |
| 66 | 8-1-26-50 | 1-058 | William O'Grady and Patrice O'Grady | 2000-036790 |
| 67 | 8-1-26-51 | 1-059 | Chartana Fifty-Nine LLC, a New Mexico limited liability company/Robert L. Helstrom and Yvonne E. Helstrom, Trustees of the Bob and Yvonne | 2005-058515/2001-157959 |
| 68 | 8-1-26-52 | 1-060 | Clark Realty Corporation, a Hawaii corporation | 2006-110403 |
| 69 | 8-1-26-53 | 1-061 | Wan Koo Huh and Yong Soo Huh | 2003-045999 |
| 70 | 8-1-26-54 | 1-062 | Robert K. Greenwell | 2005-0184426 |
| 71 | 8-1-26-55 | 1-063 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 72 | 8-1-26-56 | 1-064 | Canyon River Investments L.P., a Delaware limited partnership | 2000-021065 |
| 73 | 8-1-26-57 | Lot R-1 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 74 | 8-1-27-01 | 1-001 | Richard S. Belas and Judith E. Soltz | 2001-173455 |
| 75 | 8-1-27-02 | Lot A | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 76 | 8-1-27-03 | 1-035 | Up-Front Agency, Co., Ltd., a Japan corporation | 2001-013888 |
| 77 | 8-1-27-04 | 1-044 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 78 | 8-1-27-05 | 1-045 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 79 | 8-1-27-06 | 1-046 | Hokulia Investors, LLC, a Delaware limited liability company | 2001-086341 |
| 80 | 8-1-27-07 | 1-047 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 81 | 8-1-27-08 | 1-048 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 82 | 8-1-27-09 | 1-049 | Sharon Watt Ney, Trustee of the Watt-Ney Family Trust dated June 6, 1989 | 2003-007490 |
| 83 | 8-1-27-10 | 1-050 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 84 | 8-1-27-11 | 1-065 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 85 | 8-1-27-12 | 1-066 | Linda Ralphs, Trustee of the Linda Ralphs Trust dated June 26, 1991 | 2002-161993 |
| 86 | 8-1-27-13 | 1-067 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 87 | 8-1-27-14 | 1-068 | James R. Parrish and Lisa R. Parrish, Co-Trustees of the Parrish Living Trust dated August 9, 1995 | 99-202308 |
| 88 | 8-1-27-15 | 1-069 | Dennis R. Cook | 2001-029230 |
| 89 | 8-1-27-16 | 1-070 | Wood Hawaiian Properties, LLC, a Hawaii limited liability company | 2001-140549 |
| 90 | 8-1-27-17 | 1-071 | Malie Investment Partners, LLC, a Nevada limited liability company | 2001-071948 |
| 91 | 8-1-27-18 | 1-072 | Robert C. Luton | 2001-124865 |
| 92 | 8-1-27-19 | 1-073 | Lyle H. Anderson | 2000-046670 |
| 93 | 8-1-27-20 | 1-092 | Lawrence Wayne Shaw and Lisa Jo Shaw, Co-Trustees under the Shaw Family Trust dated March 7, 1997 | 2003-187374 |
| 94 | 8-1-27-21 | 1-093 | Tokuo Fujita and Masako Fujita | 99-201011 |
| 95 | 8-1-27-22 | 1-094 | Takuo Horikoshi | 2000-121553 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 96 | 8-1-27-23 | 1-095 | KDM Chartana LLC, a Michigan limited liability company and PHM Chartana LLC, a Michigan limited liability company | 2003-180225 |
| 97 | 8-1-27-24 | 1-096 | HKH 96, LLC, a New Mexico limited liability company | 2001-011756 |
| 98 | 8-1-27-25 | 1-097 | James Wilfred Higgins, Trustee under Memorandum of Trust dated July 3, 2002 and Mary Helen Higgins, Trustee under Memorandum of Trust dated July 3, 2002 | 2005-216650 |
| 99 | 8-1-27-26 | 1-098 | Hackahokulia, LLC, a Connecticut limited liability company | 2001-055423 |
| 100 | 8-1-27-27 | 1-099 | Hidetaka Tembata and Saori Tembata | 99-203990 |
| 101 | 8-1-27-28 | 1-100 | Clark Realty Corporation, a Hawaii corporation | 2006-159970 |
| 102 | 8-1-27-29 | 1-101 | James L. Gremp and Karen E. Gremp, and Alan C. Steinbeck | 2004-086607 |
| 103 | 8-1-27-30 | 1-102 | Jack A. Dempsey, Trustee of the Boxer I Trust dated 11/08/2000 | 2006-055880 |
| 104 | 8-1-27-31 | 1-103 | Forelinks, LLC, a Hawaii limited liability company | 2001-137745 |
| 105 | 8-1-27-32 | 1-104 | Mark Douglas Davis and Susan Perry Davis, Trustees of the 2000 Davis Family Trust UDT dated May 2, 2000 | 2000-085742 |
| 106 | 8-1-27-33 | 1-105 | Thomas W. Crosswhite and Barbara J. Crosswhite | 2005-246237 |
| 107 | 8-1-27-34 | 1-106 | Tiki Three, LLC, a Hawaii limited liability company | 2005-160764 |
| 108 | 8-1-27-35 | 1-107 | Carol Ann Farrow | 2004-238916 |
| 109 | 8-1-27-36 | 1-108 | Carol Ann Farrow | 2004-238915 |
| 110 | 8-1-27-37 | 1-109 | Greenspring Development Company, L.L.C., an Arizona limited liability company | 2001-037814 |
| 111 | 8-1-27-38 | 1-110 | 2030 Investors, LLC, an Oregon limited liability company | 99-202311 |
| 112 | 8-1-27-39 | 1-111 | Jack A. Dempsey | 99-204374 |
| 113 | 8-1-27-40 | 1-112 | Yoshitake Kitao | 99-201013 |
| 114 | 8-1-27-41 | 1-113 | Tatsuya Omura | 99-201014 |
| 115 | 8-1-27-42 | 1-114 | Platinum Investment Kona, Inc., a Hawaii corporation | 2003-132697 |
| 116 | 8-1-27-43 | 1-261 | Mark Geist and Maureen Prisby, Trustees for the Mark Geist and Maureen Prisby Family Trust | 2000-023139 |
| 117 | 8-1-27-44 | 1-262 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 118 | 8-1-28-01 | 1-074 | Douglas D. Troxel | 99-203943 |
| 119 | 8-1-28-02 | 1-075 | Douglas D. Troxel | 99-203946 |
| 120 | 8-1-28-03 | 1-076 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 121 | 8-1-28-04 | 1-077 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 122 | 8-1-28-05 | 1-078 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 123 | 8-1-28-06 | 1-079 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 124 | 8-1-28-07 | 1-080 | Jennie Ann Freiman, Trustee of the Jennie Ann Frieman MD Profit Sharing Plan | 2005-135332 |
| 125 | 8-1-28-08 | 1-081 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 126 | 8-1-28-09 | 1-082 | Hideyuki Tanigami and Judy Bogard-Tanigami, Co-Trustees of the Tanigami Family Trust dated September 1, 1999 | 2001-006955 |
| 127 | 8-1-28-10 | 1-083 | Lyle H. Anderson | 2000-046673 |
| 128 | 8-1-28-11 | 1-084 | Peter Riepenhausen and Waltraud Riepenhausen, Trustees of the Riepenhausen Family Trust dated June 24, 1988 | 2003-046968 |
| 129 | 8-1-28-12 | 1-085 | Lyle H. Anderson | 2000-046679 |
| 130 | 8-1-28-13 | 1-086 | Robert S. Kildow and Barbara Tabbert Kildow | 2000-184054 |
| 131 | 8-1-28-14 | 1-087 | Roger Arnold Buckles and Cindy Kiyono Buckles, Trustees of the Roger and Cindy Buckles Revocable Family Trust dated October 29, 1991 | 2000-039740 |
| 132 | 8-1-28-15 | 1-088 | Donally King | 2000-087831 |
| 133 | 8-1-28-16 | 1-089 | Maryl Group, Inc., a Hawaii corporation | 2001-024181 |
| 134 | 8-1-28-17 | 1-090 | 2030 Investors, LLC, an Oregon limited liability company | 99-203119 |
| 135 | 8-1-28-18 | 1-091 | 2030 Investors, LLC, an Oregon limited liability company | 99-203116 |
| 136 | 8-1-28-19 | 1-115 | H. Irving Grousbeck, Trustee under that certain unrecorded H. Irving Grousbeck Revocable Trust dated December 18, 1985 | 2005-098149 |
| 137 | 8-1-28-20 | 1-092 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 138 | 8-1-28-21 | 1-117 | C. James Jensen and Jeri L. Jensen | 2000-020914 |
| 139 | 8-1-28-22 | 1-118 | U.S. Trust Company of Delaware, N.A., Administrative Trustee of the Berghorst 1998 Dynastic Trust | 2006-044557 |
| 140 | 8-1-28-23 | 1-119 | F. Terry Eger and Carol E. Eger, Trustees U/T/A DTD October 17, 1991 | 99-201016 |
| 141 | 8-1-28-24 | 1-120 | Edward J. O'Sullivan and Barbara O'Sullivan | 99-201017 |
| 142 | 8-1-28-25 | 1-121 | Julie Blankenship Mundt and The First National Bank and Trust Company of Tulsa, a national banking association, Co-Trustees of the Julie Blankenship Mundt Trust dated May 9, 1986 | 2006-065490 |
| 143 | 8-1-28-26 | 1-122 | James Simpson and Carol Olerich Simpson | 2000-078376 |
| 144 | 8-1-28-27 | 1-123 | James Simpson and Carol Olerich Simpson | 2000-078377 |
| 145 | 8-1-28-28 | 1-124 | Kathleen M. Lopez, Trustee of the Kathleen M. Lopez Trust under Trust Agreement dated January 3, 2002 | 2003-049405 |
| 146 | 8-1-28-29 | 1-125 | Kent P. Buckles and Suzanne R. Buckles | 2005-148027 |
| 147 | 8-1-28-30 | 1-126 | David R. Metcalf and Kim H. Metcalf, Trustees of The Metcalf Family Trust dated June 11, 1993 | 2006-098554 |
| 148 | 8-1-28-31 | 1-127 | Ronald Ervin Nelson | 2001-194344 |
| 149 | 8-1-28-32 | 1-128 | Richard Tincher and Leslie Tincher, Co-Trustees of The Tincher Living Trust Agreement dated October 28, 1993 | 2000-152710 |
| 150 | 8-1-28-33 | 1-129 | Hokukano Ranch, Inc., a Hawaii corporation | 2004-124096 |
| 151 | 8-1-28-34 | 1-130 | Sally A. Nordstrom, Trustee for the Nordstrom Family Living Trust dated March 14, 1986 | 99-201020 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 152 | 8-1-28-35 | 1-131 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 153 | 8-1-28-36 | 1-132 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 154 | 8-1-28-37 | 1-133 | Thomas A. Tucker and Rachel R. Tucker, Trustees of the Tucker Living Trust dated October 4, 1995 | 2003-068374 |
| 155 | 8-1-28-38 | 1-134 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 156 | 8-1-28-39 | 1-135 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 157 | 8-1-28-40 | 1-136 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 158 | 8-1-28-41 | 1-137 | Red Hill 1250, Inc., a Washington corporation | 2002-169591 |
| 159 | 8-1-28-42 | 1-138 | Ackerman Ranch, Inc., a Hawaii corporation | 2006-068202 |
| 160 | 8-1-28-43 | 1-139 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 161 | 8-1-28-44 | 1-237 | Red Hill 1250, Inc., a Washington corporation | 2002-169594 |
| 162 | 8-1-28-45 | 1-238 | Richard Schleicher and Joan Morgan | 2002-080144 |
| 163 | 8-1-28-46 | 1-239 | AZ Sun Holdings, Inc., an Arizona corporation | 2001-030730 |
| 164 | 8-1-28-47 | 1-240 | JWH, L.L.C., an Arizona limited liability company | 2001-121554 |
| 165 | 8-1-29-01 | 1-140 | UCC Ueshima Coffee Co., Ltd., a Japan corporation | 2001-035586 |
| 166 | 8-1-29-02 | 1-141 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 167 | 8-1-29-03 | 1-142 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 168 | 8-1-29-04 | 1-143 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 169 | 8-1-29-05 | 1-144 | Red Hill 1250, Inc., a Washington corporation | 2002-169592 |
| 170 | 8-1-29-06 | 1-145 | Lou E. Lambert, Trustee of the Revocable Living Trust of Lou E. Lambert dated March 3, 1994 | 2005-208850 |
| 171 | 8-1-29-07 | 1-146 | Hale S. Irwin and Sally J. Irwin | 2003-166767 |
| 172 | 8-1-29-08 | 1-147 | Aloha Aina Development, LLC, a Hawaii limited liability company | 2005-011874 |
| 173 | 8-1-29-09 | 1-148 | Donald C. Zepp and Barbara J. Zepp, Co-Trustees for the Donald C. and Barbara J. Zepp Family Trust dated June 10, 1975, as amended in its entirety on May 24, 1990 | 2001-054545 |
| 174 | 8-1-29-10 | 1-149 | Hama Corp., a Nevada corporation | 2006-087257 |
| 175 | 8-1-29-11 | 1-150 | Donald F. House and Joyce D. House, Co-Trustees of the HF Trust dated March 2, 1987 | 2006-049159 |
| 176 | 8-1-29-12 | 1-151 | Kevin Sean Donnelly and Laura Elise Donnelly, Trustees for The Donnelly Family Revocable Living Trust dated November 6, 1997 | 2000-152713 |
| 177 | 8-1-29-13 | 1-152 | Stanley G. Freimuth and Cynthia S. Freimuth, Trustees of the Freimuth Family Living Trust dated May 7, 2002 | 2003-105132 |
| 178 | 8-1-29-14 | 1-153 | William P. Batiste and Virginia F. Batiste, Co-Trustees of the W. and V. Batiste Trust dated January 23, 2003 | 2001-042267 |
| 179 | 8-1-29-15 | 1-154 | Patrick T. Fujieki, CPA, as Successor Trustee of the Paul Mitchell Trust dated August 19, 1983, as amended | 2000-010369 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 180 | 8-1-29-16 | 1-155 | Herbert M. Gould, III, Trustee for the Gould Hawaii Property Trust | 99-203978 |
| 181 | 8-1-29-17 | 1-156 | Kona Manana, L.L.C., an Arizona limited liability company | 2001-021313 |
| 182 | 8-1-29-18 | 1-157 | Donald F. House and Joyce D. House, Co-Trustees of the HF Trust dated March 2, 1987 | 2001-013226 |
| 183 | 8-1-29-19 | 1-158 | Sandra Lee House | 2005-169828 |
| 184 | 8-1-29-20 | 1-161 | Hayao Nakayama | 2006-074304 |
| 185 | 8-1-29-21 | 1-162 | Ronald James Hogg and Carole Celia Hogg | 2001-007790 |
| 186 | 8-1-29-22 | 1-170 | Stephen D. Ewing and Mary Kim Ewing | 2001-048955 |
| 187 | 8-1-29-23 | 1-171 | Kimo D. Cummings and Virginia Cha | 2005-029759 |
| 188 | 8-1-29-24 | 1-172 | Junichi Nonogawa | 2001-092956 |
| 189 | 8-1-29-25 | 1-173 | William W. Adams, Trustee of the Adams Family Trust dated December 10, 1991, as amended and restated March 6, 1995 | 2002-140355 |
| 190 | 8-1-29-26 | 1-174 | Eisuke Kawamoto | 2000-145155 |
| 191 | 8-1-29-27 | 1-175 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 192 | 8-1-29-28 | 1-176 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 193 | 8-1-29-29 | 1-177 | T Group Capital, LLC, a Delaware limited liability company/Golden Point - H.I.E., LLC, a Nevada limited liability company | 2006-054770/2002-140014 |
| 194 | 8-1-29-30 | 1-178 | T Group Capital, LLC, a Delaware limited liability company/Dean R. Gilpin, Juana P. Gilpin, William E. Allen and Terri M. Allen | 2006-021495/2002-140346 |
| 195 | 8-1-29-31 | 1-179 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 196 | 8-1-29-32 | 1-180 | Puaa Development, LLC, a Hawaii limited liability company | 2004-096996 |
| 197 | 8-1-29-33 | 1-181 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 198 | 8-1-29-34 | 1-182 | Joseph M. Hirko and Kathleen A. Hirko, Trustees of the Hirko Family Trust U/T/A dated August 21, 2000 | 2000-143126 |
| 199 | 8-1-29-35 | 1-183 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 200 | 8-1-29-36 | 1-184 | Sankyo Sekiyu Limited Investment, a Japan corporation | 99-201025 |
| 201 | 8-1-29-37 | 1-185 | Chiyo Kano Springer, Trustee of the Revocable Living Trust dated February 22, 1995, as amendede | 99-201026 |
| 202 | 8-1-29-38 | 1-186 | Chip-Bud L.L.C., an Arizona limited liability company | 2000-067500 |
| 203 | 8-1-29-39 | 1-187 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 204 | 8-1-29-40 | 1-188 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 205 | 8-1-29-41 | 1-189 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 206 | 8-1-29-42 | 1-190 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 207 | 8-1-29-43 | 1-191 | Keith Michael Katcher and Nickie Marie Branco-Katcher, Trustees of the 2000 Branco-Katcher Family Trust U/D/T November 29, 2000 | 2003-103726 |
| 208 | 8-1-29-44 | 1-192 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 209 | 8-1-29-45 | 1-193 | Yoshiko Mizumaki, Trustee under that certain Yoshiko Mizumaki Declaration of Trust dated October 21, 2004 | 2004-257748 |
| 210 | 8-1-29-46 | 1-194 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 211 | 8-1-29-47 | 1-195 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 212 | 8-1-29-48 | 1-196 | T Group Capital, LLC, a Delaware limited liability company/Robert K. Greenwell and William H. Wilton | 2005-198000/2001-104446 |
| 213 | 8-1-29-49 | 1-197 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 214 | 8-1-29-50 | 1-198 | T Group Capital, LLC, a Delaware limited liability company/D K and Diane Sather, Trustees under the Duane and Diane Sather Living Trust dated | 2005-053607/ 2005-053608/ 2001-103486 |
| 215 | 8-1-29-51 | 1-199 | Clarence L. Werner, Trustee of the Clarence L. Werner Revocable Trust dated July 31, 1992 | 2005-074328 |
| 216 | 8-1-29-52 | 1-200 | Duane D. Sparks and Mary D. Sparks | 2002-181013 |
| 217 | 8-1-29-53 | 1-201 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 218 | 8-1-29-54 | 1-202 | T Group Capital, LLC, a Delaware limited liability company/Dean R. Gilpin, Juana P. Gilpin, Sung Hung Chung and Nancy Chung | 2006-021492/ 2006-021493/ 2001-103490 |
| 219 | 8-1-29-55 | 1-203 | Lyle H. Anderson | 2000-046680 |
| 220 | 8-1-29-56 | 1-204 | Holua Kai, LLC, a Hawaii limited liability company | 2006-014021 |
| 221 | 8-1-29-57 | 1-205 | John P. Morbeck and Sally R. Morbeck | 2001-088257 |
| 222 | 8-1-29-58 | 1-206 | T Group Capital, LLC, a Delaware limited liability company/Greg G. Ogin and Cherrie K. Ogin | 2005-177562/ 2005-177563/ 2001-103492 |
| 223 | 8-1-29-59 | 1-207 | T Group Capital, LLC, a Delaware limited liability company | 2001-103494 |
| 224 | 8-1-29-60 | 1-208 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 225 | 8-1-29-61 | 1-209 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 226 | 8-1-29-62 | 1-210 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 227 | 8-1-29-63 | 1-211 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 228 | 8-1-30-01 | 1-159 | Herbert M. Gould III, Trustee of the Gould Hawaii Property Trust dated November 20, 1999 | 2006-075157 |
| 229 | 8-1-30-02 | 1-160 | Sunil Kappagoda and Judit Fabian | 2003-024039 |
| 230 | 8-1-30-03 | 1-163 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 231 | 8-1-30-04 | 1-164 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 232 | 8-1-30-05 | 1-165 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 233 | 8-1-30-06 | 1-166 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 234 | 8-1-30-07 | 1-167 | Jeffrey N. Newton and Carolyn E. Newton, Trustees for the Newton Family Trust | 99-204375 |
| 235 | 8-1-30-08 | 1-168 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 236 | 8-1-30-09 | 1-169 | Paul E. Bonham and Dani L. Knapp-Bonham, Trustees under The Bonham Revocable Living Trust dated September 11, 1992 | 2006-101986 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 237 | 8-1-30-10 | 1-212 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 238 | 8-1-30-11 | 1-213 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 239 | 8-1-30-12 | 1-214 | Gregg L. Engles and Cynthia K. Engles | 2001-007779 |
| 240 | 8-1-30-13 | 1-215 | Red Hill 1250, Inc., a Washington corporation | 2002-169593 |
| 241 | 8-1-30-14 | 1-216 | Richard O. White and Toni S. White, Trustees of the White Family Declaration of Living Trust dated June 25, 1999 | 2002-143942 |
| 242 | 8-1-30-15 | 1-217 | Malie Investment Partners, LLC, a Nevada limited liability company | 2001-071951 |
| 243 | 8-1-30-16 | 1-218 | Chartana Four LLC, a New Mexico limited liability company | 2001-133116 |
| 244 | 8-1-30-17 | 1-219 | Lyle H. Anderson | 2000-046683 |
| 245 | 8-1-30-18 | 1-220 | Big Island Partners LLP, a Colorado limited liability partnership | 2006-027333 |
| 246 | 8-1-30-19 | 1-221 | West Coast Hawaii Partners, a Delaware general partnership | 2002-138231 |
| 247 | 8-1-30-20 | 1-222 | David R. Metcalf and Kim H. Metcalf, Trustees of The Metcalf Family Living Trust dated June 11, 1993 | 2004-261992 |
| 248 | 8-1-30-21 | 1-223 | Forever Success Ltd., a Cayman Island corporation | 2000-037939 |
| 249 | 8-1-30-22 | 1-224 | PS Kona, LLC, an Arizona limited liability company | 2006-119780 |
| 250 | 8-1-30-23 | 1-225 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 251 | 8-1-30-24 | 1-226 | Jonathan H. Salewski and Carol A. Salewski | 2001-062232 |
| 252 | 8-1-30-25 | 1-227 | Pinnaprop Holdings Inc., a Canada corporation | 99-201029 |
| 253 | 8-1-30-26 | 1-228 | Kona Lot 228, L.L.C., a Washington limited liability company | 2000-039114 |
| 254 | 8-1-30-27 | 1-229 | Angelo R. Mozilo and Phyllis G. Mozilo, Trustees for the Mozilo Living Trust dated May 12, 1988 | 2000-009373 |
| 255 | 8-1-30-28 | 1-230 | Frederick R. Charley | 2001-022114 |
| 256 | 8-1-30-29 | 1-231 | Thermar, Inc., a Nevada corporation | 99-202317 |
| 257 | 8-1-30-30 | 1-232 | Charles Grant Shoemaker, Trustee of the Shoemaker Family Trust dated November 22, 1989 | 2000-114247 |
| 258 | 8-1-30-31 | 1-233 | Jean Tichenor, Trustee of The Jean Tichenor Family Trust dated February 24, 1998 | 2001-015463 |
| 259 | 8-1-30-32 | 1-234 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 260 | 8-1-30-33 | 1-235 | T Group Capital, LLC, a Delaware limited liability company | 2001-103496 |
| 261 | 8-1-30-34 | 1-236 | West Coast Hawaii Partners, a Delaware general partnership | 2002-138232 |
| 262 | 8-1-30-35 | 1-241 | Mara Gateway Associates Limited Partnership, a Washington limited partnership | 2001-161675 |
| 263 | 8-1-30-36 | 1-242 | Wei Qiang LLC, a Hawaii limited liability company | 2001-071954 |
| 264 | 8-1-30-37 | 1-243 | Puaa Development, LLC, a Hawaii limited liability company | 2004-096997 |
| 265 | 8-1-30-38 | 1-244 | Asahi Kohsan Corporation, a Japan corporation | 99-201031 |
| 266 | 8-1-30-39 | 1-245 | Richard Ben Komen and Joan Rae Komen | 2004-086529 |
| 267 | 8-1-30-40 | 1-246 | Dean Gilpin and Putman D. Clark | 2006-113222 |

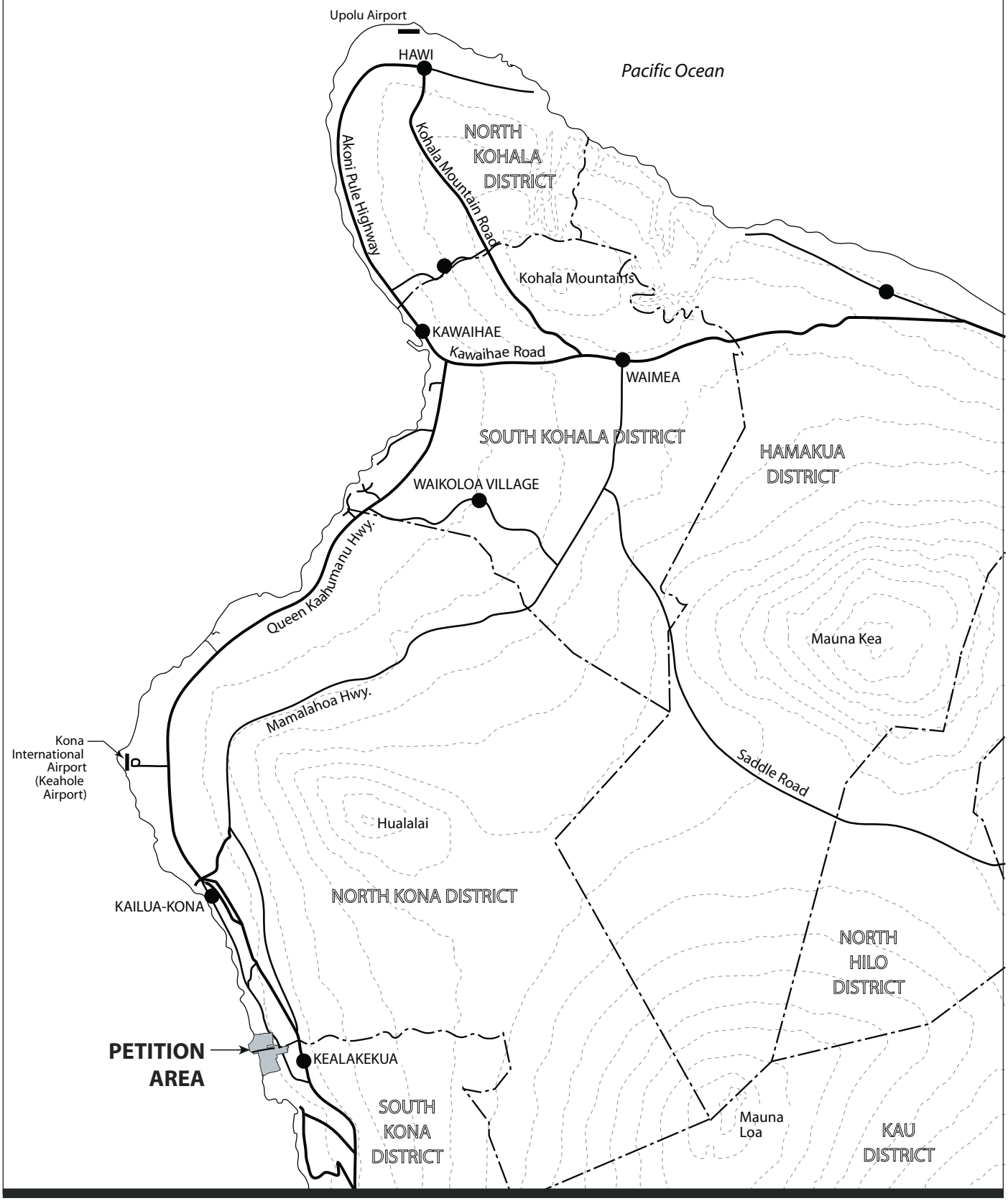
| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 268 | 8-1-30-41 | 1-247 | Frank P. L. Minard and Lynne S. Minard | 2001-029099 |
| 269 | 8-1-30-42 | 1-248 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 270 | 8-1-30-43 | 1-249 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 271 | 8-1-30-44 | 1-250 | William W. Adams, Trustee of the Adams Family Trust under Declaration of Trust dated December 10, 1991 | 2004-077736 |
| 272 | 8-1-30-45 | 1-251 | William W. Adams, Trustee of the Adams Family Trust under Declaration of Trust dated December 10, 1991 | 2004-077736 |
| 273 | 8-1-30-46 | 1-252 | William W. Adams, Trustee of the Adams Family Trust under Declaration of Trust dated December 10, 1991 | 2004-077736 |
| 274 | 8-1-30-47 | 1-253 | 1250 Oceanside Partners, a Hawaii limited partnership | 2006-119776 |
| 275 | 8-1-30-48 | 1-254 | Thomas R. Pitts | 2005-177521 |
| 276 | 8-1-30-49 | 1-255 | George F. Peper and Elizabeth W. Peper | 2000-153620 |
| 277 | 8-1-30-50 | 1-256 | Christopher Webster | 2003-120190 |
| 278 | 8-1-30-51 | 1-257 | Christopher Rowland Webster, Jr. and Patricia Gibney Webster, Co-Trustees of the Webster Family Trust U/T/A dated February 22, 2002 | 2002-042974 |
| 279 | 8-1-30-52 | 1-258 | Wood Hawaiian Properties, LLC, a Hawaii limited liability company | 2002-172386 |
| 280 | 8-1-30-53 | 1-259A | Wood Hawaiian Properties, LLC, a Hawaii limited liability company | 2002-079170 |
| 281 | 8-1-32-01 | 2-001 | West Coast Hawaii Partners, a Delaware general partnership | 2005-073993 |
| 282 | 8-1-32-02 | 2-002 | West Coast Hawaii Partners, a Delaware general partnership | 2005-073994 |
| 283 | 8-1-32-03 | 2-003 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 284 | 8-1-32-04 | 2-004 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 285 | 8-1-32-05 | 2-005 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 286 | 8-1-32-06 | 2-006 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 287 | 8-1-32-07 | 2-007 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 288 | 8-1-32-08 | 2-008 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 289 | 8-1-32-09 | 2-009 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 290 | 8-1-32-10 | 2-010 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 291 | 8-1-32-11 | 2-011 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 292 | 8-1-32-12 | 2-012 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 293 | 8-1-32-13 | 2-013 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 294 | 8-1-32-14 | 2-034 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 295 | 8-1-32-15 | 2-035 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 296 | 8-1-32-16 | 2-036 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 297 | 8-1-32-17 | 2-037 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 298 | 8-1-32-18 | 2-038 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 299 | 8-1-32-19 | 2-039 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 300 | 8-1-32-20 | 2-040 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 301 | 8-1-32-21 | 2-041 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 302 | 8-1-32-22 | 2-042 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 303 | 8-1-32-23 | 2-043 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 304 | 8-1-32-24 | 2-044 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 305 | 8-1-32-25 | 2-045 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 306 | 8-1-32-26 | 2-046 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 307 | 8-1-32-27 | 2-047 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 308 | 8-1-32-28 | 2-048 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 309 | 8-1-32-29 | 2-049 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 310 | 8-1-32-30 | 2-050 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 311 | 8-1-32-31 | 2-051 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 312 | 8-1-32-32 | 2-052 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 313 | 8-1-32-33 | 2-053 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 314 | 8-1-32-34 | 2-054 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 315 | 8-1-32-35 | 2-055 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 316 | 8-1-32-36 | 2-056 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 317 | 8-1-32-37 | 2-057 | Lyle H. Anderson | 2002-010608 |
| 318 | 8-1-32-38 | 2-058 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 319 | 8-1-32-39 | 2-059 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 320 | 8-1-32-40 | 2-060 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 321 | 8-1-32-41 | 2-061 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 322 | 8-1-32-42 | 2-062 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 323 | 8-1-32-43 | 2-066 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 324 | 8-1-32-44 | 2-067 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 325 | 8-1-32-45 | 2-068 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 326 | 8-1-32-46 | 2-069 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 327 | 8-1-32-47 | 2-070 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 328 | 8-1-32-48 | 2-071 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 329 | 8-1-32-49 | 2-072 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 330 | 8-1-32-50 | 2-073 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 331 | 8-1-32-51 | 2-074 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 332 | 8-1-32-52 | 2-075 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 333 | 8-1-32-53 | 2-076 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 334 | 8-1-32-54 | Lots R-1 thru R-11 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 335 | 8-1-33-01 | 2-014 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 336 | 8-1-33-02 | 2-015 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 337 | 8-1-33-03 | 2-016 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 338 | 8-1-33-04 | 2-017 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 339 | 8-1-33-05 | 2-018 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 340 | 8-1-33-06 | 2-019 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 341 | 8-1-33-07 | 2-020 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 342 | 8-1-33-08 | 2-021 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 343 | 8-1-33-09 | 2-022 | West Coast Hawaii Partners, a Delaware general partnership | 2005-073995 |
| 344 | 8-1-33-10 | 2-023 | West Coast Hawaii Partners, a Delaware general partnership | 2005-073996 |
| 345 | 8-1-33-11 | 2-024 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 346 | 8-1-33-12 | 2-025 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 347 | 8-1-33-13 | 2-026 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 348 | 8-1-33-14 | 2-027 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 349 | 8-1-33-15 | 2-028 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 350 | 8-1-33-16 | 2-029 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 351 | 8-1-33-17 | 2-030 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 352 | 8-1-33-18 | 2-031 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 353 | 8-1-33-19 | 2-032 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 354 | 8-1-33-20 | 2-033 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 355 | 8-1-34-01 | 2-063 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 356 | 8-1-34-02 | 2-064 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 357 | 8-1-34-03 | 2-065 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 358 | 8-1-34-04 | 2-077 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 359 | 8-1-34-05 | 2-078 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 360 | 8-1-34-06 | 2-079 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 361 | 8-1-34-07 | 2-080 | Lyle H. Anderson | 2002-010608 |
| 362 | 8-1-34-08 | 2-081 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 363 | 8-1-34-09 | 2-082 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 364 | 8-1-34-10 | 2-083 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 365 | 8-1-34-11 | 2-084 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 366 | 8-1-34-12 | 2-085 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 367 | 8-1-34-13 | 2-086 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 368 | 8-1-34-14 | 2-087 | Lyle H. Anderson | 2002-010608 |
| 369 | 8-1-34-15 | 2-088 | Lyle H. Anderson | 2002-010608 |
| 370 | 8-1-34-16 | 2-089 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 371 | 8-1-34-17 | 2-090 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 372 | 8-1-34-18 | 2-091 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 373 | 8-1-34-19 | 2-092 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 374 | 8-1-34-20 | 2-093 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |

| Ref # | TMK: | Lot # (Parcel - Lot) | Lot / Entity Owner | Deed/Conveyance/ Instrument No. |
|---|---|---|---|---|
| 375 | 8-1-34-21 | 2-094 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 376 | 8-1-34-22 | 2-095 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 377 | 8-1-34-23 | 2-096 | 1250 Oceanside Partners, a Hawaii limited partnership | 96-074328 |
| 378 | 8-1-34-24 | 2-097 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |
| 379 | 8-1-34-25 | 2-098 | Front Nine, LLC, a Delaware limited liability company | 2002-010558 |

# PETITIONER'S
# EXHIBIT 3






Belt Collins

NORTH

0 3.5 7

SCALE IN MILES

**PETITIONER'S EXHIBIT 3**
**LOCATION MAP**

HŌKŪLIA

1250 Oceanside Partners
October 6, 2006

# PETITIONER'S
# EXHIBIT 4

**Full size versions of Tax Maps provided in the original Petition.**

# PETITIONER'S
# EXHIBIT 4a

INSET "A"
POR. KAINALIU BEACH

Norman L. Greenwell
L.C.Aw. 3361-BB:2
5.00 Acs.
Leilani Kahaliiole Thompson
L.C.Aw. 5002:1
0.70 Ac.
TRUE NORTH
1" = 200'

13 Henry A. Greenwell
L.C.Aw. 3659
James J. Ackerman & wf. Grace - T/C
22.664 Acs.
Plat 06
Plat 07
GRANT 1651
GRANT 1463
GRANT 1453
GRANT 1587
GRANT 1745
GRANT 1176
GRANT 1177
GRANT 1175
GRANT 787
Excl. 2
0.80 Ac.
3.48 Ac.
28.56 Ac.
193.77 Ac.
181.41 Ac.
91.5 Ac.
21.611 Ac.
4.01 Ac. L.C.Aw. 8157-0
7.81 Ac.
2.76 Ac.(pt.)
5.002 Ac
(0.216 Ac.)
(0.184 Ac.)
(0.387 Ac.)
Ackerman Ranch Inc.
L.C.Aw. 9428-B
L.C.Aw. 9428
L.C.Aw. 9413
L.C.Aw. 9414
9.2 Ac.
L.C.Aw. 8157-D
L.C.Aw. 9428-C
L.C.Aw. 9428-F:1
L.C.Aw. 7277-C
L.C.Aw. 7277-D
L.C.Aw. 7731
L.C.Aw. 7739:1
L.C.Aw. 9414
L.C.Aw. 8157-P:1
L.C.Aw. 9428-E:1
L.C.Aw. 9428-C
L.C.Aw. 9415:1
L.C.Aw. 7991
L.C.Aw. 6150-C
L.C.Aw. 5564-I
L.C.Aw. 6150:1
L.C.Aw. 5564:2
L.C.Aw. 10588
L.C.Aw. 9411
L.C.Aw. 10588
L.C.Aw. 5561-BB:1
L.C.Aw. 5561-C
L.C.Aw. 6150-C
(Ac.)
(pt.)
ROAD EASEMENT "A" (50 ft.)
ACCESS EASEMENT 9963
PLAT 11
PLAT 10
PLAT 1
UNIT I 1501
UNIT II 1501
UNIT I 1499
Ld. Ct. App. 1603
1st.
2nd
977
866
992
Gr. 210
Gr. 146
Gr. 173
1ST
2ND
3RD
4TH
1ST 2ND
SOUTH KONA DISTRICT
NORTH KONA BDRY.
SOUTH KONA
ZONE 6 SEC. 1
E 1ST 2ND

23 (Summit Land & Cattle Co
Tamura Children's Trust-T/C)1/2
(Robert D. Jackson Jr. & wf.
Edith M. T/E - 1/8,
Thomas B. Wilson & wf
Edith E. - T/E - 1/8,
Buhle R. Darrow & hsb.
Kenneth F. - T/E - 1/8,
Eric E. Doorly - 1/4
Wallace K. Murata & wf.
Claire J.
Florence P.G. Jang - J/T - 1/4

12 Ackerman Ranch Inc.
(Wilmot B. Boone & wf. Elsie G.) 1a.

Dropped Parcels: 2, 10, 1, 15 thru 23.

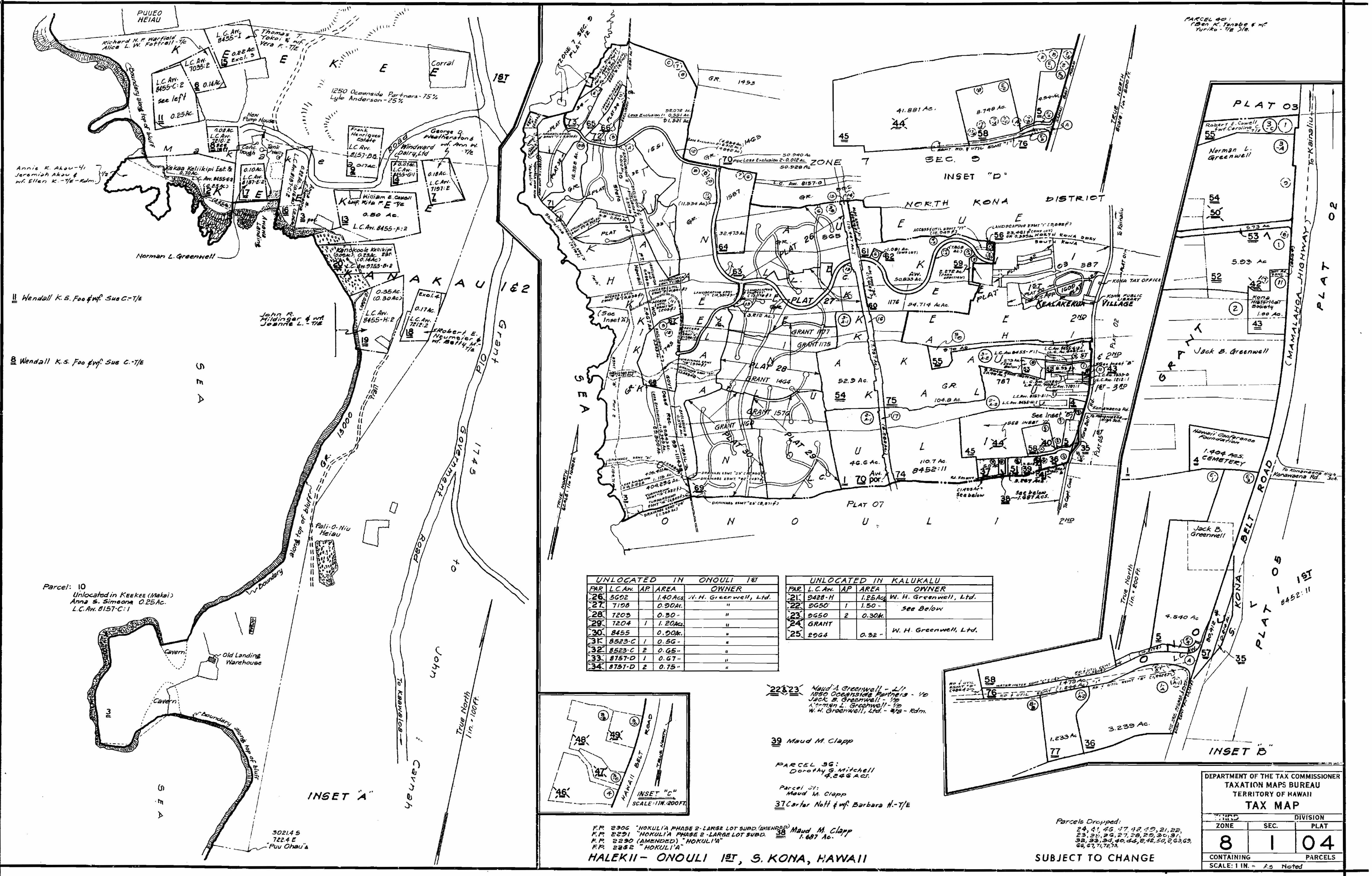
POR. HONUAINO 3RD KANAUELUE 1ST 2ND N. KONA, HAW.

ADVANCE SHEET
SUBJECT TO CHANGE

| THIRD | | DIVISION |
|---|---|---|
| ZONE | SEC. | PLAT |
| 7 | 9 | 12 |
| CONTAINING | | PARCELS |
| SCALE: 1in.= 500 ft. | | |

Dwg. No.: 2739
Source: Tax Map Bureau - Field Survey
By: F.N.B., R.K.B. & E.K.V. June 1986

PETITIONER'S EXHIBIT 4a PRINTED



| UNLOCATED IN ONOULI 1ST | | | | |
|---|---|---|---|---|
| PAR. | L.C. Aw. | AP. | AREA | OWNER |
| 26 | 5692 | | 1.40 Acs. | W. H. Greenwell, Ltd. |
| 27 | 7198 | | 0.90 Ac. | " |
| 28 | 7203 | | 0.30 " | " |
| 29 | 7204 | 1 | 1.20 Acs. | " |
| 30 | 8455 | | 0.90 Ac. | " |
| 31 | 8523-C | 1 | 0.56 " | " |
| 32 | 8523-C | 2 | 0.65 " | " |
| 33 | 8757-D | 1 | 0.67 " | " |
| 34 | 8757-D | 2 | 0.75 " | " |

| UNLOCATED IN KALUKALU | | | | |
|---|---|---|---|---|
| PAR. | L.C. Aw. | AP. | AREA | OWNER |
| 21 | 9428-H | | 1.25 Acs. | W. H. Greenwell, Ltd. |
| 22 | 9650 | 1 | 1.50 " | See Below |
| 23 | 9650 | 2 | 0.30 Ac. | |
| 24 | GRANT | | | W. H. Greenwell, Ltd. |
| 25 | 2964 | | 0.32 " | |

22 & 23 Maud A. Greenwell - L/I
1250 Oceanside Partners - 1/6
Jack B. Greenwell - 1/9
Norman L. Greenwell - 1/9
W. H. Greenwell, Ltd. - 4/9 - Rdm.

39 Maud M. Clapp

PARCEL 36:
Dorothy G. Mitchell
4.246 Acs.

Parcel 51:
Maud M. Clapp

37 Carter Nott & wf. Barbara H. - T/E

F.P. 2306 "HOKULI'A PHASE 2 - LARGE LOT SUBD. (AMENDED)"
F.P. 2291 "HOKULI'A PHASE 2 - LARGE LOT SUBD.
F.P. 2290 (AMENDED) "HOKULI'A"
F.P. 2282 "HOKULI'A"

38 Maud M. Clapp
1.687 Ac.

# HALEKII - ONOULI 1ST, S. KONA, HAWAII

Parcels Dropped:
24, 41, 46, 47, 48, 49, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 40, 44, 8, 42, 50, 2, 63, 69, 66, 67, 71, 72, 73,

SUBJECT TO CHANGE

DEPARTMENT OF THE TAX COMMISSIONER
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP

| THIRD | | DIVISION |
|---|---|---|
| ZONE | SEC. | PLAT |
| 8 | 1 | 04 |
| CONTAINING | | PARCELS |
| SCALE: 1 IN. = As Noted | | |

DWG. NO. 2784 Revised Jan. 1952 By: S.I.
SOURCE: TMB & Field Survey CSF - 11257
BY: R.K.B. June '30

2/12/02

8 – 1 – 26 3RD. DIST.

SOURCE F.P. 2263 DATE MARCH 16, 2000 BY RU/HS DWG NO.

ZONE 7 SECTION 9

TRUE NORTH Scale: 1in = 100 ft.

PLAT 04 PLAT 27 PLAT 04

"HOKULI'A, PHASE 1", F.P. 2263, HOKUKANO 2nd, KANAUEUE 1st & 2nd, & HALEKII, NORTH & SOUTH KONA, HAWAII (FORMERLY POR. 8-1-04)

FOR PROPERTY ASSESSMENT PURPOSES – SUBJECT TO CHANGE

Owners, lessees, & vendees name recorded of this tax map print may not be current. Please refer to computer and history sheets for current owners.

DEPARTMENT OF FINANCE
PROPERTY ASSESSMENT DIVISION
MAPPING BRANCH
STATE OF HAWAII
TAX MAP

COUNTY OF HAWAII

| ZONE | SECTION | PLAT |
|---|---|---|
| 8 | 1 | 26 |

SCALE: 1 IN. = 100 FT.

PRINTED:

2/12/02

3 - 1 - 27 3RD. DIST.

PLAT 26

PLAT 04

PLAT 04

PLAT 28

1175

1176

1177

387

137

2ND

TRUE NORTH
Scale: 1in = 100 ft.

"HOKULI'A, PHASE 1", F.P. 2263, HALEKII, KEEKEE 1st & 2nd, & ILIKAHI, SOUTH KONA, HAWAII (FORMERLY POR. 8-1-04)

FOR PROPERTY ASSESSMENT PURPOSES - SUBJECT TO CHANGE

Owners, lessees, & vendees name recorded of this tax map print may not be current. Please refer to computer and history sheets for current owners.

DEPARTMENT OF FINANCE
PROPERTY ASSESSMENT DIVISION
MAPPING BRANCH
STATE OF HAWAII
TAX MAP

| COUNTY OF HAWAII | | |
|---|---|---|
| ZONE | SECTION | PLAT |
| 8 | 1 | 27 |

SCALE: 1 IN. = 100 FT.

PRINTED: _____

SOURCE F.P. 2263 BY RU/HS DATE MARCH 20, 2000 DWG NO.

TRUE NORTH
Scale: 1in = 100 ft.

PLAT 04

PLAT 27

2ND

1ST & 2ND

1ST, 2ND & 3RD

PLAT 30

PLAT 29

787

"HOKULI'A, PHASE 1", F.P. 2263, KEEKEE 2nd, ILIKAHI, KANAKAU 1st & 2nd, & KALUKALU 1st, 2nd & 3rd, SOUTH KONA, HAWAII (FORMERLY POR. 8-1-04)

FOR PROPERTY ASSESSMENT PURPOSES – SUBJECT TO CHANGE

Owners, lessees, & vendees name recorded of this tax map print may not be current. Please refer to computer and history sheets for current owners.

DEPARTMENT OF FINANCE
PROPERTY ASSESSMENT DIVISION
MAPPING BRANCH
STATE OF HAWAII
TAX MAP

COUNTY OF HAWAII

| ZONE | SECTION | PLAT |
|---|---|---|
| 8 | 1 | 28 |

SCALE: 1 IN. = 100 FT.

PRINTED: _____

SOURCE F.P. 2263 BY RU/HS DATE MARCH 22, 2000 DWG NO. _____

PLAT 04

TRUE NORTH
Scale: 1in = 100 ft.

GR. 787

1464 1576 1160

(0.952 Ac.) (0.666 Ac.) (0.330 Ac.) (0.745 Ac.) (0.794 Ac.) (2.374 Ac.) (2.872 Ac.)

B452:11

GR. GR. GR. GR.

L.C.

AW.

PLAT 28 PLAT 30 PLAT 07

NOTE: TOTAL AREA FOR ROADWAY LOTS R-1 THRU R-29 ACCOUNTED FOR IN TMK: 8-1-26: 57

Owners, lessees, & vendees name recorded of this tax map print may not be current. Please refer to computer and history sheets for current owners.

"HOKULI'A, PHASE 1", F.P. 2263, KANAKAU 1st & 2nd, KALUKALU 1st, 2nd & 3rd, & ONOULI 1st, SOUTH KONA, HAWAII (FORMERLY POR. 8-1-04)

FOR PROPERTY ASSESSMENT PURPOSES - SUBJECT TO CHANGE

DEPARTMENT OF FINANCE
PROPERTY ASSESSMENT DIVISION
MAPPING BRANCH
STATE OF HAWAII
TAX MAP

COUNTY OF HAWAII

| ZONE | SECTION | PLAT |
|---|---|---|
| 8 | 1 | 29 |

SCALE: 1 IN. = 100 FT.

PRINTED: _____

SOURCE F.P. 2263 BY RU/HS DATE MARCH 23, 2000 DWG NO. _____

1/23/03

8 – 1 – 30 3RD. DIST.

PLAT 29

TRUE NORTH
Scale: 1in = 100 ft.

PLAT 28

PLAT 04

PLAT 07

(1.307 Ac.)

(6.629 Ac.)

(1.815 Ac.)

(0.357 Ac.)

(1.139 Ac.)

(2.320 Ac.)

(0.776 Ac.)

8452:11

1576

1160

GR.

L.C.

AW.

NOTE: TOTAL AREA FOR ROADWAY LOTS R-1 THRU R-29 ACCOUNTED FOR IN TMK: 8-1-26: 57

Dropped Parcels: 54,

Owners, lessees, & vendees name recorded on this tax map print may not be current. Please refer to computer and history sheets for current owners.

DEPARTMENT OF FINANCE
PROPERTY ASSESSMENT DIVISION
MAPPING BRANCH
STATE OF HAWAII
TAX MAP

COUNTY OF HAWAII

| ZONE | SECTION | PLAT |
|---|---|---|
| 8 | 1 | 30 |

SCALE: 1 IN. = 100 FT.

PRINTED: _____

"HOKULI'A, PHASE 1", F.P. 2263, KALUKALU 1st, 2nd & 3rd, & ONOULI 1st, SOUTH KONA, HAWAII (FORMERLY POR. 8-1-04)

FOR PROPERTY ASSESSMENT PURPOSES – SUBJECT TO CHANGE

DWG NO. _____ DATE MARCH 27, 2000 BY RU/HS SOURCE F.P. 2263

NOV. 21, 2001

SOURCE F.P. 2293, F.P. 2307

BY RU/HS

DATE JUNE 14, 2001

DWG NO.

PLAT 34

PLAT 04

PLAT 04

PLAT 04

PLAT 33

2ND

TRUE NORTH
Scale: 1in = 100 ft.

GR.

(1.916 Ac.)

(2.421 Ac.)

(35.228 ft)

(12.399 Ac.)

(5.585 Ac.)

EXCLUSION "3-A" (10 FT. WIDE) 0.372 Ac.

1651

"HOKULI'A, PHASE 2" (AMENDED), F.P. 2307
"HOKULI'A, PHASE 2", F.P. 2293, HOKUKANO 2ND, NORTH KONA, HAWAII (FORMERLY POR. 8-1-04)

FOR PROPERTY ASSESSMENT PURPOSES - SUBJECT TO CHANGE

Owners, lessees, & vendees name recorded of this tax map print may not be current. Please refer to computer and history sheets for current owners.

DEPARTMENT OF FINANCE
PROPERTY ASSESSMENT DIVISION
MAPPING BRANCH
STATE OF HAWAII
TAX MAP

| COUNTY OF HAWAII | | |
|---|---|---|
| ZONE | SECTION | PLAT |
| 8 | 1 | 32 |

SCALE: 1 IN. = 100 FT.

PRINTED: ----------

8 – 1 – 33 3RD. DIST.

NOV. 23, 2001

SOURCE F.P. 2293, F.P. 2307

BY RU/HS

DATE JUNE 26, 2001

DWG NO.

PLAT 04

PLAT 32

HUKA

KUKA

KANAUEUE 1ST

KANAUEUE 2ND

HALEKII

1587

1651

387

GR.

1.111 Ac.

1.614 Ac.

1.121 Ac.

1.676 Ac.

1.417 Ac.

1.481 Ac.

1.783 Ac.

2.197 Ac.

1.681 Ac.

3.243 Ac.

1.830 Ac.

2.549 Ac.

1.666 Ac.

1.229 Ac.

1.101 Ac.

1.074 Ac.

1.490 Ac.

1.195 Ac.

1.343 Ac.

2.551 Ac.

(31,466 ſ.)

EXCLUSION "3-C-1" (10 FT WIDE) 0.069 Ac.

EXCLUSION "3-C-2" (10 FT WIDE) 0.005 Ac.

ACCESS CONC. "A" (10 FT WIDE)

ARCHEOLOGICAL CONC. "A" (0.026 ac.)

ARCHEOLOGICAL CONC. "B" (0.019 ac.)

ARCHEOLOGICAL CONC. "C" (0.016 ac.)

ARCHEOLOGICAL CONC. "D" (0.016 ac.)

Gross Area = 0.647 Ac.
Less Portion Exclusion 3-C-2 = 0.005 Ac.
(Net Area = 0.642 Ac.)

KONA NORTH SOUTH

DISTRICT KONA DISTRICT

L. C. Aw.

TRUE NORTH
Scale: 1in = 100 ft.

"HOKULI'A, PHASE 2" (AMENDED), F.P. 2306
"HOKULI'A, PHASE 2", F.P. 2293, HOKUKANO 2ND, KANAUEUE 1ST & 2ND, & HALEKII, NORTH AND SOUTH KONA, HAWAII (FORMERLY POR. 8-1-04)

FOR PROPERTY ASSESSMENT PURPOSES – SUBJECT TO CHANGE

Owners, lessees, & vendees name recorded of this tax map print may not be current. Please refer to computer and history sheets for current owners.

DEPARTMENT OF FINANCE
PROPERTY ASSESSMENT DIVISION
MAPPING BRANCH
STATE OF HAWAII
TAX MAP

COUNTY OF HAWAII

| ZONE | SECTION | PLAT |
|---|---|---|
| 8 | 1 | 33 |

SCALE: 1 IN. = 100 FT.

PRINTED: ----------

NOV 27, 2001

SOURCE F.P. 2293, F.P. 2307

BY RU/HS

DATE JUNE 29, 2001

DWG NO.

SEA

PLAT 12

SECTION 9,

ZONE 7,

"HOKUKANO VILLAGE"

PLAT 04

1651 04

TRUE NORTH
Scale: 1in = 100 ft.

1ST

2ND

PLAT 04

PLAT 32

GR.

(1.916 Ac.)

(26,786 ft²)

(10,382 ft²)

(14,661 ft²)

(36,617 ft²)

"HOKULI'A, PHASE 2" (AMENDED), F.P. 2307
"HOKULI'A, PHASE 2", F.P. 2293, HOKUKANO 1ST & 2ND, NORTH KONA, HAWAII (FORMERLY POR. 8-1-04)

FOR PROPERTY ASSESSMENT PURPOSES - SUBJECT TO CHANGE

Owners, lessees, & vendees name recorded of this tax map print may not be current. Please refer to computer and history sheets for current owners.

DEPARTMENT OF FINANCE
PROPERTY ASSESSMENT DIVISION
MAPPING BRANCH
STATE OF HAWAII
TAX MAP

| COUNTY OF HAWAII | | |
|---|---|---|
| ZONE | SECTION | PLAT |
| 8 | 1 | 34 |

SCALE: 1 IN. = 100 FT.

PRINTED: ----------

# PETITIONER'S
# EXHIBIT 5

R-1004

STATE OF HAWAII
BUREAU OF CONVEYANCES
RECORDED

DEC 20, 1999 03:29 PM

Doc No(s) 99-200357

/s/CARL T. WATANABE
ACTING
REGISTRAR OF CONVEYANCES

LAND COURT SYSTEM | REGULAR SYSTEM

Return by Mail ☐ Pickup ☒ To:

CARLSMITH BALL
1001 Bishop Street, Suite 2200
Honolulu, Hawaii 96813

Attention: Eric A. James, Esq.
Telephone: 523-2500

TITLE OF DOCUMENT:

DECLARATION OF COVENANTS, CONDITIONS, AND RESTRICTIONS FOR HOKULI'A

PARTIES TO DOCUMENT:

DECLARANT: 1250 OCEANSIDE PARTNERS, a Hawaii limited partnership
Keauhou Shopping Center
Suite K-15
78-6831 Ali'i Drive
Kailua-Kona, HI 96740

TAX MAP KEY(S): Hawaii 8-1-004-003 (Por.) (This document consists of 119 pages.)

1345592.1.051730-10

PETITIONER'S EXHIBIT 5

The owner of any golf course within or adjacent to any portion of Hokuli'a, its agents, employees, successors, and assigns shall have a perpetual, exclusive easement of access over Hokuli'a for the purpose of retrieving golf balls from bodies of water within the Common Areas lying reasonably within range of golf balls hit from its golf course.

Every Lot and the Common Area and the Village Common Area of any Village Association adjacent to such golf course are burdened with an easement for golf car paths, sewer, and other utility adjacent to the golf course, or in such other areas as may be reasonably determined by Declarant, so long as such relocation does not materially interfere with an Owner's improvement or use of his/her Lot. Declarant may assign any or all of such easement rights to the Association and/or the owner of the golf course located within the Hokuli'a, its successors, and assigns.

11.8. Easement to Inspect and Right to Correct.

Declarant reserves for itself and others it may designate the right to inspect, monitor, test, redesign, and correct any structure, improvement, or condition which may exist on any portion of the property within Hokuli'a, including Lots, and a perpetual, nonexclusive easement of access throughout Hokuli'a to the extent reasonably necessary to exercise such right. Except in an emergency, entry onto a Lot shall be only after reasonable notice to the Owner and no entry into a Dwelling shall be permitted without the Owner's consent.

11.9. Easement for Public Access to Shoreline Park.

Each Owner acknowledges that as a condition of the development of the Property, the public must be granted access to the Shoreline Park. Such access shall be in accordance with the rules and guidelines established in the Shoreline Park Management and Public Access Plan ("Public Access Plan") as required under SMA Permit No. 345. Therefore, Declarant reserves for the public the right to use designated portions of Hokuli'a for access to, and use of, the Shoreline Park.

11.10. Easement for Agricultural Uses.

Each Owner and occupant acknowledges that portions of Hokuli'a (including road rights-of-way and other Common Areas, and Association Easement), may be utilized for Agricultural Use. An easement is hereby reserved over Common Area and Lots (whether developed or undeveloped) within Hokuli'a for the benefit of the Declarant, its authorized agents, successors, and assigns, and the Association, and its authorized agents, successors, and assigns, for Agricultural Use and related activities conducted by Declarant, the Association, and their respective agents, successors, and assigns. Such easement shall include, but not be limited to, the transmission, discharge, or emissions of surface water runoff, noise, vibration, smoke, soot, dust, exhaust, noxious vapors, odors, and other substances which are created as a result of activities incidental to one or more of the following: (a) cultivation of flowers, trees, plants, vegetables, fruits, foliage, forage, and other Agricultural Products; and (b) buildings and uses, including but not limited to, storage facilities, roadways, and maintenance facilities that are normally considered necessary and appropriate for the uses described in (a). Each Owner and

occupant further acknowledges that the Association and Declarant, shall not be held liable for any nuisance, personal injury, illness, or any other loss or damage which is caused by the presence and operation of Agricultural Uses within Hokuli'a.

11.11. Easement for Historical Sites.

Declarant reserves for itself and the Association a nonexclusive, perpetual easement over the Common Areas and Lots to (a) travel to and from the Historical Sites, and (b) inspect, evaluate, perform data recovery, maintain and preserve the Historical Sites identified on the Property from time to time. Such easement shall affect only such portions of the Common Area and Lots as Declarant or the Association, as the case may be, deems reasonably necessary for such purposes. Declarant further reserves for itself and the Association the right to grant nonexclusive easements over the Common Areas and Lots to (a) travel to and from such Historical Sites, (b) inspect, evaluate, perform data recovery, maintain and preserve such Historical Sites, and/or (c) perform traditional, cultural and/or religious practices at such Historical Sites, to any Person who is or may be entitled under Hawaii law to exercise any such rights. Such easements shall affect only such portions of the Common Areas and Lots as Declarant or the Association, as the case may be, deems reasonably necessary for such purposes and may be subject to such reasonable terms, conditions and restrictions that Declarant or the Association may impose consistent with Hawaii law. Some Historical Sites have been identified, however, others may exist that have yet to be discovered. The Historical Sites that have yet to be discovered may be located on Lots or in lava tubes or caves beneath Lots. The Declarant reserves for itself and the Association the right to grant additional easements or modify existing easements under this Section for additional Historical Sites that are discovered and to comply with Hawaii law, or the requirements of any governmental or quasi governmental entity that has jurisdiction over matters involving such Historical Sites.

Due to the sensitive nature of this type of easement, the potential exists for conflict between Persons using easements pursuant to this Section and Owners. In order to avoid or eliminate any potential conflicts that may arise, an environment of mutual respect between Persons using the easements and Owners must prevail. Owners should exercise caution to avoid disruption of Historical Sites and should take no action to prevent or hinder access to Historical Sites. Persons utilizing easements pursuant to this Section should do so in a careful, considerate and conscientious manner and take reasonable steps to avoid disturbing Owners. Neither the Association nor Declarant shall have any liability for any damages, increased construction costs, or delays caused by the existence of, or the discovery of, a Historical Site or the designation or use of an easement related to such Historical Site.

11.12. Easement for Maintenance of Lots.

Declarant reserves for itself and the Association, an easement of ingress and egress over such portions of Lots necessary for the purpose of removing, replacing, installing, and maintaining trees, plants, and other vegetation on such Lots. Declarant and the Association shall have the right to exercise this easement over the entire area of a Lot, including the Building Envelope until the Owner of such Lot completes construction of a Dwelling on the Lot. Except as otherwise provided by the Governing Documents, after an Owner has completed construction

of a Dwelling on his/her Lot the right to exercise this easement shall be limited to the area of the Lot that is outside the Building Envelope. The Declarant and the Association shall have the right, but not the obligation, to undertake any, or all, of the activities described in this Section.

The activities undertaken pursuant to this Section may include, but not be limited to, grading of Lots and the removal, replacement, installation, and maintenance of trees, plants and other vegetation. Subject to the restrictions contained in this Section the Declarant and the Association may conduct such activities on all or a portion of such Lots including, but not limited to, the portion of a Lot that is designated as the Building Envelope. The cost of conducting activities under this Section shall be a Common Expense. No tree, plant, or other vegetation installed pursuant to this Section, including but not limited to, trees, plants, and other vegetation, shall be modified, pruned, cut, or removed without the approval of the Declarant.

11.13. Easement for Drainage.

The Property is burdened with a perpetual and nonexclusive easement over, through, and across the Property as necessary to accommodate drainage from or across property adjacent to Lots in its currently existing and natural pattern and flow, or as the pattern or flow may be altered by any of Declarant's landscaping activities undertaken pursuant to Section 11.12. Declarant reserves the right to designate additional drainage easements over, through, and across the Property including, but not limited to, portions of Lots. Each Owner assumes all liability for damage to persons or property caused by interference with the flow of drainage from, over, through, or across such Owner's Lot in connection with Owner's activities on all or any part of such Lot, and agrees to indemnify, defend, and hold harmless Declarant and the Association from and against any liability, claim, demand, action, or suit arising out of, or in connection with, any such interference with drainage.

11.14. Easement for Public Access to Kuleana Parcels.

Each Owner acknowledges that as a condition of the development of the Property, the public must be granted access to the Kuleana Parcels referenced in the Public Access Plan. Such access shall be in accordance with the rules and guidelines established in the Public Access Plan as required under SMA Permit No. 345. Therefore, Declarant reserves for the public the right to use designated portions of Hokuli'a for access to, and use of, the Kuleana Parcels.

11.15. Easement for Helicopter Landing Area.

Each Owner and occupant acknowledges that a helicopter landing area may be constructed on a portion of the Common Area for use by Declarant, the Association, and the Members, for, among other things, transportation to and from the Property. The use of the helicopter landing area shall be subject to such reasonable Restrictions and Rules that may imposed by the Board of Directors in its discretion. The helicopter landing area shall not be utilized for the temporary or permanent storage of helicopters or any other aircraft. An easement is hereby reserved over Hokuli'a for the benefit of the Declarant, its authorized agents, successors, and assigns, the Association, and Members to the extent necessary to fly helicopters to and from the helicopter landing area and for the transmission, discharge, or emissions of noise,

vibration, air currents, light, smoke, soot, dust, exhaust, noxious vapors, odors, and other substances which are created as a result of activities incidental to the operation of the helicopter landing area. Each Owner and occupant further acknowledges that the Association, Declarant, and Members, shall not be held liable for any nuisance, personal injury, illness, or any other loss or damage which is caused by the presence and operation of the helicopter landing area.

11.16. Association Easement.

Declarant reserves for itself, so long as Declarant owns any property described in Exhibit "A" or "B" of this Declaration, and grants to the Association and its successors, assigns, and designees, the nonexclusive right and easement to the portion of each Lot that is designated as Association Easement for the purposes of installing, maintaining and repairing utilities, widening roads, installing structures and Improvements, installing and maintaining landscaping, conducting Agricultural Uses, and any other reasonable purpose as may be determined in the discretion of the Declarant or the Association as the case may be. No Improvement, structure, landscaping, plants, trees, or other vegetation that is installed or maintained in the Association Easement shall exceed the height of eight feet.

No Owner may remove, damage, or destroy any Improvement, structure, landscaping, plants, trees, or Agricultural Products that are within the Association Easement unless given express, written consent by the Board of Directors. No Owner may construct any Improvement or install landscaping on any portion of a Lot other than the Building Envelope. Any Owner that constructs any Improvement or installs any landscaping on a portion of his/her Lot that is designated as Association Easement shall be required, upon notice from the Board, to remove such Improvement or landscaping at his/her expense and restore the Association Easement to substantially the same condition as it existed prior to the construction or installation of such Improvement or landscaping. In the event an Owner fails to take such action as required by the Board, the Association shall have the right to remove such landscaping or Improvement and restore the Association Easement. The costs for such action may be levied against such Owner's Lot as a Specific Assessment.

11.17. Easement for Maintenance of Natural Area.

Declarant reserves for itself, so long as Declarant owns any property described in Exhibit "A" or "B" of this Declaration, and grants to the Association its successors, assigns, and designees, the nonexclusive right and easement, but not the obligation, to enter upon the portion of each Lot designated as the Natural Area, for the purpose of maintaining landscaping, plants, trees and any other vegetation existing on the Natural Area. Except as otherwise provided by the Declaration this easement shall not include the right to enter the Building Envelope or any Dwelling on a Lot.

# PETITIONER'S
# EXHIBIT 6

Volume I of II

# Villages at Hokukano
# Final Environmental Impact Statement
# County of Hawaii

September 1993

Volume I of II

# Villages at Hokukano
# Final Environmental Impact Statement
# County of Hawaii

September 1993

IEE

BRIAN J. J. CHOY
Director

**STATE OF HAWAII**

OFFICE OF ENVIRONMENTAL QUALITY CONTROL

220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185

## *Dear Participant:*

*Attached for your information is a Final Environmental Impact Statement which was prepared pursuant to the EIS law (Hawaii Revised Statutes, Chapter 343) and the EIS rules (Administrative Rules, Title 11, Chapter 200).*

*TITLE OF PROJECT:* Villages at Hokukano

*LOCATION:* *ISLAND* Hawaii *DISTRICT* North & South Kona

*TAX MAP KEY NUMBERS:* 8-1-4:03 por; 7-9-12:03 por, 04 por, 05 por, 11; 7-9-6:01

*AGENCY ACTION:* _____ *APPLICANT ACTION:* XX

*ACCEPTING AUTHORITY:* County of Hawaii Planning Department
*ADDRESS:* 25 Aupuni Street, Suite 109
Hilo, Hawaii 96720

*CONTACT:* Ms. Virginia H. Goldstein, Director *PHONE:* 961-3333

*PROPOSING AGENCY OR APPLICANT:* Oceanside 1250
*ADDRESS:* 74-5620A Palani Road, Suite 200
Kailua-Kona, Hawaii 96740

*CONTACT:* Mr. Richard "Dick" Frye, Project Manager *PHONE:* 326-2966

*CONSULTANT:* PBR HAWAII
*ADDRESS:* 101 Aupuni Street, Suite 310
Hilo, Hawaii 96720

*CONTACT:* Mr. James Leonard, Managing Director *PHONE:* 961-3333

*If you no longer need this EIS, please return it to OEQC (please <u>do not</u> recycle document). Thank you for your participation in the Environmental Impact Statement process!*

Volume I of II

# Villages at Hokukano
# Final Environmental Impact Statement
# County of Hawaii

This document is submitted
pursuant to Chapter 343,
Hawaii Revised Statutes

Prepared for:
Oceanside 1250

Prepared by:
PBR HAWAII

Submitted by:

Wm. Frank Brandt, President
PBR HAWAII

September 9, 1993

## Table of Contents

## List of Figures

## List of Tables

# 1.0 Introduction and Summary

# 1.0 INTRODUCTION AND SUMMARY

## 1.1 INTRODUCTION

### 1.1.1 Applicant and Project Summary

| | |
|---|---|
| Applicant: | 1250 Oceanside Partners, dba Oceanside 1250, a Hawaii Based Partnership |
| Developer: | 1250 Oceanside Partners, dba Oceanside 1250 |
| Subject Area: | ± 1540 acres |
| Location: | Kealakekua, Hawaii (Island of Hawaii) |
| Tax Map Key: | 8-1-04: 03 portion; 7-9-12: 03 portion; 04 portion; 05 portion; and 11; 7-9-06: 01 |
| State Land Use District: | Agricultural (± 1400 acres)<br>Conservation (± 140 acres) |
| County General Plan: | Extensive Agriculture<br>Orchards<br>Open Space |
| County Zoning: | A-5a (Agriculture - 5 acre minimum)<br>U (Unplanned) |
| Existing Use: | Pastureland - Cattle Grazing |
| Proposed Uses: | 27-hole golf course, practice range, clubhouse, members' lodge of up to 100 units, approximately 1,440 predominantly single family residential and residential/agricultural lots (resulting in a total maximum number of 1,540 units), shoreline access with parking, and hiking trails |

### 1.1.2 Proposed Government Action

This Environmental Impact Statement (EIS) has been prepared to meet the requirements of various governmental applications required for the project development. Regulatory approvals required for the first phase of development include: applications for a Use Permit, Special Management Area (SMA) Use Permit, Change of Zone and Subdivision. The second phase will be initiated by a General Plan Amendment for a State Land Use Boundary Amendment to allow low and medium density urban uses, followed by petitions for Change of Zone, SMA Use Permit and Subdivision approvals. Although the proposed action involves no changes to the existing Conservation District designation, plans for shoreline access, a hiking trails network, and a public parking area (depending upon its final location) will require a Conservation District Use Application.

### 1.1.3 Purpose and Content of this Document

This document has been prepared in accordance with the provisions of the Hawaii Revised Statutes (HRS) Chapter 343, Title 11, Department of Health, Chapter 200, Environmental Impact Rules, Section 11-200-6 through 11-200-13. Section 11-200-6(b) establishes certain classes of action that subject an applicant to an EIS requirement. These include:

- Any amendment to existing County General Plans;
- Any use within the State Conservation District; and
- The use of State or County lands.

Accordingly, the proposed group of actions below, which are part of the total undertaking, will trigger the requirement of an EIS.

- An amendment to the County General Plan from Extensive Agriculture and Orchards to medium and low density urban use on a ± 763 acre portion of the project site;
- Development of shoreline access and hiking trails and associated improvements within the Conservation District; and

- Restoration and improvement of the King's Trail (Ala Loa or Ala Aupuni), possibly a State owned historic trail, constituting use of State lands.

This EIS contains a description of the proposed action to the extent possible at this stage of planning; an analysis of the impacts of that action upon the physical, natural, and social economic environment; recommendations for mitigation of any potential adverse impacts resulting from the proposed action; and comments from public agencies, elected officials, private business persons, and the general public, and the applicant's responses to those comments. In addition to fulfilling the requirements of Chapter 343, HRS, this EIS is also presented as a supportive informational document to accompany the applicant's General Plan Amendment application, State Land Use Boundary Amendment petition, Change of Zone application, and SMA Use Permit application, as well as a Conservation District Use Application.

## 1.2 PROJECT SUMMARY

Oceanside 1250 proposes to develop a residential community on approximately 1,540 acres near the village of Kealakekua on the Kona coast of the Island of Hawaii. The Villages at Hokukano is a master planned residential and recreational community which, at buildout, is planned to include approximately 1,440 predominantly single family residential units, a 27-hole golf course, a private members' lodge of up to 100 units, and supporting infrastructure. The plan provides for an overall project density of approximately 1,540 units, or one unit per acre. About 140 acres along the shoreline within the State Conservation District are intended to serve as a passive oceanfront park that would remain natural in character and incorporate shoreline access and hiking trails providing access to prehistoric, historic, and cultural interpretive sites. Shoreline access parking would also be provided.

The proposed project is planned to proceed in two phases. The first phase will include the creation of about 367 residential/agricultural lots of one to three acres in size, a 27-hole golf course with golf clubhouse, related facilities, and infrastructure improvements. The second phase of development will include residential development of up to 1,073 predominantly single family residential units that will be executed in several subphases, and a private members' lodge of up to 100 units.

## 1.3 SUMMARY OF IMPACTS AND PROPOSED MITIGATION MEASURES

In general, the proposed project is expected to have minimal, if any, negative impacts to the environment. For areas of environmental concern, where necessary, appropriate mitigation measures have been planned as part of the proposed project, such as the integration of appropriate design considerations, implementation of management plans, and use of appropriate plantings in landscape plans. For those areas of particular concern, the following summarizes the associated mitigation measures that are either recommended or planned to ensure that potential adverse impacts are minimized.

### 1.3.1 Soil Erosion and Sedimentation

Potential Impacts

The erosion of soils from wind or stormwater runoff caused by disturbances to the vegetation and soil layer during project related construction, if unabated, can impact surrounding areas and the nearshore environment as a result of sedimentation.

Mitigation Measures

To protect nearshore waters from the impacts of erosion and sedimentation during construction, in addition to meeting the State's National Pollution Discharge Elimination System (NPDES) permitting requirements, an erosion and sedimentation plan will be prepared and approved by the Department of Public Works as part of the permitting procedure for grading work. Mitigation measures that could be employed include limiting exposed areas and dust control measures, such as frequently sprinkling and prompt seeding of exposed finished areas, as part of the onsite construction phasing. The retention basins that will form part of the eventual drainage system for the project could be established early on. Because the majority of rainfall occurs during the months from May to September, additional mitigation measures could result from scheduling grading in the drier periods.

### 1.3.2 Agricultural Potential

Potential Impacts

In general, the soil conditions on the project site are marginally suited for agricultural purposes. The soils are rated predominantly Class C, D, and E by the Land Study Bureau's Detailed Land Classification Report for the Island of Hawaii. Similarly, no area of the project site has been rated "Prime" or "Unique" by the Agricultural Lands of Importance to the State of Hawaii (ALISH) system. However, limited portions are identified as "Other Important" lands by this system, and a small portion of approximately eight acres in the mauka corner is rated as "B" lands by the Land Study Bureau. Additionally, the upper portion of the project is proposed to remain as part of the State Agricultural District and zoned Agriculture (A-1a) under the County Zoning Code. Historically, the subject property has been used for cattle grazing for the past 100 years.

Mitigation Measures

Although the subject lands are, in general, marginally suited for agricultural use, mitigation measures appear warranted in order to offset the potential loss of those areas that may show potential for agricultural use. In addressing this issue, the developer plans to implement a program for integrating appropriate agricultural activities on portions of the larger one to three acre agriculturally zoned lots in a manner that would not only benefit the adjacent residential uses by providing a desirable landscape and open space element within the development areas, but would also allow for an efficient management operation for select crops and/or orchard uses through proper planning and by providing the necessary capital, infrastructure and site preparation needed to support agricultural activity in this area. In total, the developer plans to add approximately 75 acres of land that is not in agriculture at this time to productive agricultural use.

### 1.3.3 Air Quality

Potential Impacts

Based on an Air Quality Study prepared by B.D. Neal & Associates, the impacts to air quality from the forecasted project related traffic are projected to be minimal. In the short term, fugitive dust from construction activities could impact air quality in the immediate area. Over the long term, impacts due to air quality are possible due to indirect impacts associated with the development's

electric power requirements. However, based upon the estimated emission rates involved and the relative changes in demand, the attendant impacts are expected to be small. Pesticides used to maintain the landscaped areas and golf course grasses, if not properly applied, could also impact areas downwind as a result of airborne drift.

Mitigation Measures

Due to the minimal air quality impacts from projected project related traffic, no measures are recommended to mitigate these emissions other than the roadway improvements recommended by the traffic consultant. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with State regulations. Fugitive dust emissions can be controlled to a large extent by watering active work areas, keeping adjacent paved roads clean, covering open bodied trucks, and the use of wind screens. Other dust control measures could include limiting the area disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas as early as practical in the construction schedule will also reduce dust emissions. Exhaust emission impacts can be mitigated by moving construction equipment and workers to and from the project site during off peak traffic hours.

Although pesticides used on the golf course, if properly applied, should not pose a problem to downwind areas, measures that would provide an added level of protection include:

- Use of shrouded spray equipment fitted with computerized flow controllers;
- Maintaining a buffer distance of at least 100 feet between target spray areas and populated locations; and
- Planting of vegetation screens along populated areas of the golf course perimeter to provide added measures of protection.

### 1.3.4 Nearshore Marine Environment

Potential Impacts

Potential threats to the nearshore marine environment could result from erosion and sedimentation of stormwater or wind borne soil or dust as a result of the proposed development. These impacts and the proposed mitigation measures related to these are covered above under Section 1.3.1 pertaining to soils. Additionally, there is a potential threat that those chemicals applied as part of the landscape and golf course maintenance, if persistently and/or improperly applied, could potentially leach into the groundwater and eventually migrate to the area of the coastal waters.

Mitigation Measures

Several measures are being proposed by the developer as part of the golf course planning, design, and operation to mitigate, to the furthest extent practical, the potential for nutrients or chemicals associated with the golf course maintenance from impacting groundwater or coastal waters fronting the proposed project. These measures include:

- Incorporating a "Reduced Turf" golf course design, which reduces fairway areas and requirements for water, fertilizers, and chemicals;

- Engineering the golf course with a bowl-shaped fairway construction and with a subsurface drainage system designed to collect stormwater runoff or excess irrigation water and conducting this to the irrigation pond for reuse on the course;

- Implementing an Integrated Golf Course Management Program (Appendix I-7) aimed at minimizing the use of chemicals for golf course maintenance and ensuring safe handling and storage of all chemicals;

- Adopting Hawaii proven biorational pest control methods when appropriate; and

- Implementing a Water Quality Monitoring and Mitigation Program (Appendix I-4) to ensure monitoring of soil and coastal water conditions for chemicals used in golf course landscaping and, if indicated, implementing appropriate mitigation measures.

### 1.3.5 Roadway Traffic

Potential Impacts

Access to the project is currently provided off of Haleki'i Street, an 80-foot wide right-of-way that links the site with Mamalahoa Highway. At the Mamalahoa intersection, Haleki'i Street has a channelized "T" intersection, with separate left and right turn lanes. Access from this roadway will be extended into the project site to the vicinity of the proposed golf course and clubhouse. Future traffic will be affected by the proposed construction of the Mamalahoa Highway bypass that would traverse the mauka portion of the project site. The proposed alignment is to begin north of Honalo and terminate at Napo'opo'o Road intersection by tying back into the existing highway. The proposed bypass has been planned to remove much of the through traffic from Mamalahoa Highway, thus relieving the current congestion that occurs during peak times within the villages of Honalo, Kainaliu, and Kealakekua. With the construction of the proposed project, the applicant expects to participate with the State and other landowners with the planning, design, and construction of the highway bypass. In this regard, the Hokukano project could serve as a catalyst for the construction of the bypass, allowing this to be built sooner than might otherwise be possible and at a lower cost to the State.

A detailed traffic impact study addressing project related traffic impacts and intersection roadway improvement requirements was prepared by Parsons Brinckerhoff Quade & Douglas, Inc. (PBQD). The traffic study forecasts that with the proposed project, the bypass road will reduce volumes along Mamalahoa Highway, thereby improving operating conditions at the existing Haleki'i Street/Mamalahoa Highway intersection. The study further projects that if forecasted conditions are realized, improving the bypass road to a four lane road is recommended by the year 2005, and signalization of the bypass road/Haleki'i Street intersection may be warranted pending the phasing of the development to facilitate left hand movements. All approaches to the bypass road/Haleki'i Street intersection are recommended to have separate through and turn lanes. In that traffic conditions are projected to improve as a result of the roadway improvements, further mitigation measures beyond those proposed by the traffic consultant do not appear warranted.

### 1.3.6 Archaeological Resources

Potential Impacts

Direct impacts to archaeological features located within the project boundaries would primarily be a loss of those features not recommended for preservation. However, the proposed facilities have been carefully sited to avoid significant archaeological sites and features. For those sites to be preserved, possible impacts could include increased human activity around and exposure to the site because of the increased public access to the project area. Many of these indirect impacts can be mitigated to a great degree by access control related to the proposed trail system, which would provide access to the more durable and appropriate sites, as part of the overall historical/ archaeological interpretive program.

Mitigation Measures

To mitigate potential impacts to historical/archaeological resources of the project area, the recommendations of the consulting archaeologist, which are subject to the approval of the Department of Land and Natural Resources, Historic Sites Preservation Division (DLNR-HSPD), would be followed by the developer. With regard to possible burials identified within the project area, if they are not preserved "as is", it is required that the procedures of Section 43 of Chapter 6e (Historic Preservation, HRS) be followed. Buildings, roads, infrastructure, along with the proposed golf course, have been planned to avoid all sites noted for preservation, including provisions for appropriate buffer zones. It is the developer's intent to incorporate these features into the proposed project through historic parks and interpretive programs linked with an extensive pedestrian trail system. Those sites that are located within the Conservation District would be preserved.

## 1.4 SUMMARY OF ALTERNATIVES CONSIDERED

The alternatives that have been considered are the "no project" alternative, the alternative of developing a smaller project, a higher density alternative, alternate use and alternative combinations of the amenities to be provided and/or different configurations of the proposed project. None of the development alternatives, however, were found to be capable of fulfilling the project objectives. All alternatives that have been considered were found to be either not cost effective or

would present greater potential environmental impacts than the proposed project. The alternatives that have been considered and the reasons for their rejection are fully described within Section 3.

## 1.5 SUMMARY OF UNRESOLVED ISSUES

The applicant has actively sought input over the past few years from area residents, business persons, community leaders, and others to identify and address their concerns as they relate to the proposed development. In most cases, these concerns have been fully addressed and are covered within this EIS. Some issues, however, require further study and will be resolved as part of the regulatory approval process. These are discussed in detail within Section 6.4, and include:

- The precise alignment, intersection improvements, and timing for the Mamalahoa Highway bypass road, in which the applicant has proposed to participate;

- Procedures by which the applicant will address the affordable housing requirements as part of the State and County land use approval process;

- The source of future potable water requirements beyond the first 499 water units already owned by the developer, which may be provided through further development agreements with the County and with other landowners in the area;

- Specific measures for archaeological site preservation and buffer treatments, which will be determined as part of the regulatory approval process in conjunction with the recommendations of the DLNR-HSPD, Hawaii Island Burial Council and County Planning Department; and

- The status of certain trails which, due to their historic use and reference as public roads, may be subject to State ownership, the status and treatment of which would be determined as part of further study and discussions with pertinent State agencies.

## 1.6 SUMMARY OF COMPATIBILITY WITH LAND USE PLANS AND POLICIES

As covered in detail within Section 5, the proposed project is generally consistent with the policies and objectives of State and County land use plans, including the Hawaii State Plan, State Functional Plans, State Land Use Commission rules, the Coastal Zone Management Act, and the

Hawaii County General Plan. Land use approvals required to implement the project include: a State Land Use Boundary Amendment petition, an amendment to the Hawaii County General Plan, Change of Zone and SMA Use Permit applications, Use Permit for the proposed golf course, and possibly a Conservation District Use Application for access and maintenance improvements within the State Conservation District. Each of the abovementioned approvals would require evidence of consistency with appropriate State and County land use policies and objectives. Upon acceptance of the Final EIS and approval of the requested land use changes, the proposed project would be consistent with all State and County plans and policies.

## 1.7 NECESSARY APPROVALS AND PERMITS

This EIS has been prepared to address the potential environmental impacts of the proposed project and to serve as an informational document in support of various land use applications. Table 1 identifies the required County and State approvals pertaining to the proposed project.

## 1.8 PREPARERS AND CONTRIBUTORS TO THIS EIS

Table 2 lists the principle preparers and contributors to this EIS, the organizations with which they are associated, and their areas of expertise.

# Table 1
# Project Approvals Required

| Approvals Needed | Approving Agency |
|---|---|
| **County of Hawaii** | |
| • Environmental Impact Statement | Planning Department |
| • General Plan Amendment | County Council |
| • Special Management Area (SMA) Use Permit | Planning Commission/ County Council |
| • Use Permit (Golf Course) | Planning Commission |
| • Change of Zone | Planning Department/County Council |
| • Plan Approval | Planning Department |
| • Subdivision Approval | Planning Department |
| • Building Permit | Department of Public Works |
| • Grubbing, Grading, Excavation and Stockpiling Permit | Department of Public Works |
| • Outdoor Lighting Permit | Department of Public Works |
| • Conformance with County Flood Control Ordinance | Departments of Public Works and Planning |
| • Sign Permit | Department of Public Works |
| • Water System Expansion Program | Department of Water Supply |
| **State of Hawaii** | |
| • Land Use District Boundary Amendment | State Land Use Commission |
| • Conservation District Use Permit | Department and Board of Land & Natural Resources |
| • Drinking Water System Approval | Department of Health |
| • Wastewater System Approval | Department of Health |
| • National Pollution Discharge Elimination System (NPDES) | Department of Health |
| • Well Development Permit | Department of Land & Natural Resources Commission on Water Resource Management |
| **Federal Permits** | |
| • None Required | |

Table 2

# EIS - List of Preparers/Contributers

| Name | Firm | Area of Expertise |
|---|---|---|
| Richard T. Frye | Oceanside 1250 | Project Management |
| Frank Brandt, ASLA<br>James Leonard, AICP<br>Guy Tsutsui<br>Toshiko Matsushita | PBR HAWAII<br>Hilo & Honolulu | Master Planning, EIS & Graphics Preparation, Regulatory Applications, Project Coordination |
| Gage Davis, AIA, AICP, ASLA<br>Bob Stuit | Gage Davis Associates<br>Kailua-Kona | Land Planning, Architecture, Site Design |
| Benjamin Kudo, Esq. | Dwyer Imanaka Schraff & Kudo<br>Honolulu | Legal Counsel |
| Gordon Leslie | Gordon Leslie<br>Napo'opo'o | Historical Consultant |
| Ann Bouslog, Ph.D.<br>Malcolm Tom<br>Jeff Pietsch<br>Rebecca Soh | KPMG Peat Marwick<br>Honolulu | Market Research, Economic/Fiscal Impact Assessment |
| Richard Brock, Ph.D. | Environmental Assessment Co.<br>Honoulu | Marine Biology, Coastal Water Monitoring |
| Russell Figueiroa, RLS<br>Roy Tsutsui, P.E. | R.M. Towill Corporation<br>Kailua-Kona & Honolulu | Civil Engineer (Sewer/Drainage) |
| Hallett Hammatt, Ph.D.<br>Doug Borthwick | Cultural Surveys Hawaii<br>Honolulu | Archeaological Inventory Survey |
| Robert Miyasaki, P.E. | Parsons Brinckerhoff Quade & Douglas<br>Honolulu | Traffic Engineering |
| Ronald Ho, P.E.<br>Gary Funasaki, P.E. | Ronald N.S. Ho & Associates<br>Honolulu | Electrical Engineering |

**Table 2**
**EIS - List of Preparers**
**Continued**

| Name | Firm | Area of Expertise |
|---|---|---|
| Wm. Lee Berndt, Ph.D. | Wm. Lee Berndt, Ph.D.<br>Florida | Golf Course Integrated Pest Management Program |
| Donald Okahara, P.E.<br>Nancy Burns. P.E. | Okahara & Associates<br>Kailua-Kona & Hilo | Civil Engineering<br>(Roads, Water) |
| Jon Stubbart<br>Steve Bowles | Waimea Water Services<br>Kamuela | Water Resource Availability,<br>Water Quality Monitoring |
| Barry Neal | B.D. Neal & Associates<br>Captain Cook | Air Quality<br>Assessment |
| Ronald A. Darby, P.E.<br>W. Brendt Ferren | Darby & Associates<br>Kailua | Noise Impact<br>Assessment |
| Evangeline J. Funk, Ph.D. | Botanical Consultants<br>Honolulu | Botanical<br>Assessment |
| Phillip L. Bruner | Phillip L. Bruner<br>Laie | Avifauna and Feral<br>Mammals Assessment |
| James Lipe, ASGCA | Jack Nicklaus Golf Services<br>Florida | Golf Course<br>Architecture |

# 2.0 Description of the Proposed Project

# 2.0 DESCRIPTION OF THE PROPOSED PROJECT

## 2.1 REGIONAL SETTING

The approximately 1,540 acre project site is bisected by the North and South Kona district boundaries at Hokukano. The majority of the site is owned in fee by Oceanside 1250, and roughly one-sixth of the total area is leased from Ackerman Ranch, Inc. The site is situated approximately ten miles south of Kailua-Kona (Figure 1) and is about 2,800 feet makai of Mamalahoa Highway. The parcel is over two miles wide and the north and south property boundaries extend approximately one mile mauka from the coastline. The middle portion of the property extends approximately two miles mauka from the coastline to an elevation of 1,240 feet. Surrounding uses include agriculture (orchards and grazing) and residential uses, including the Kona Scenic Subdivision, located directly mauka of the property. The town of Kealakekua is located mauka of the project site along Mamalahoa Highway, where access to the project site is gained from Haleki'i Street (Figure 2).

The property, which includes Tax Map Key (TMK) parcels 8-1-04: 03 portion; 7-9-12: 03 portion, 4 portion, 05 portion, 11; and 7-9-06: 01, is owned in fee or leased by Oceanside 1250 (Figure 3).

## 2.2 PROJECT BACKGROUND

The proposed Villages at Hokukano project is a result of several years of planning. Over the past two years, the owners and their representatives have been meeting with neighbors, community leaders, organizations, agency representatives, businesses, and concerned individuals in order to fully understand public and agency concerns, and to address these to the furthest extent practical in the planning of the proposed project. Several studies, which are included with this EIS, were conducted on the site archaeology, environmental and market conditions, economic and fiscal impacts, and engineering requirements. The plan was adjusted, tested, and refined to what is presented in this EIS. A considerable amount of study, planning, and care went into the preparation of the plan for this area, which reflects the thoughts and concerns of many individuals who took the time to explore the site and to determine what is appropriate for this unique property.

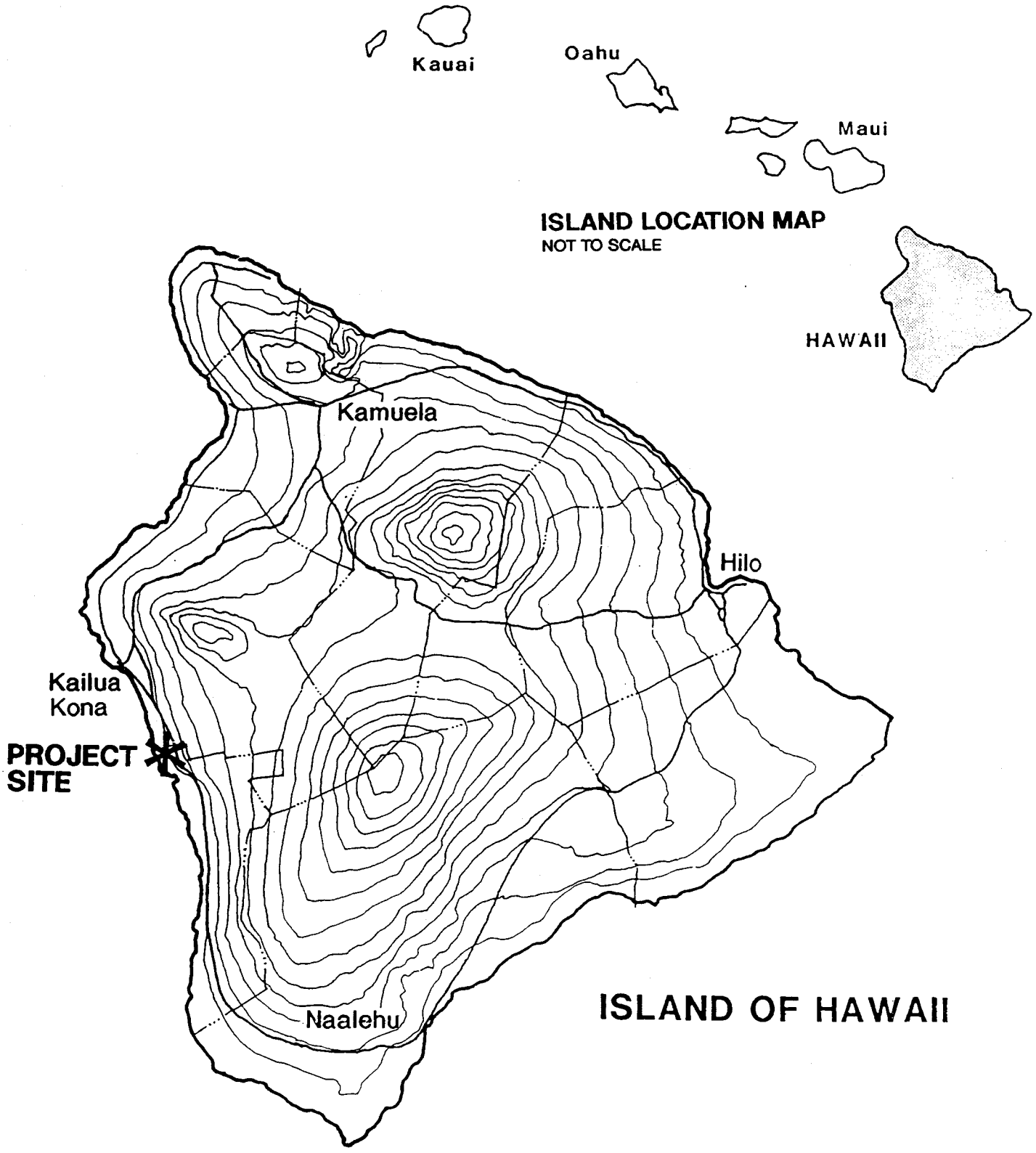



FIGURE 1
**LOCATION MAP**
**FINAL ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**

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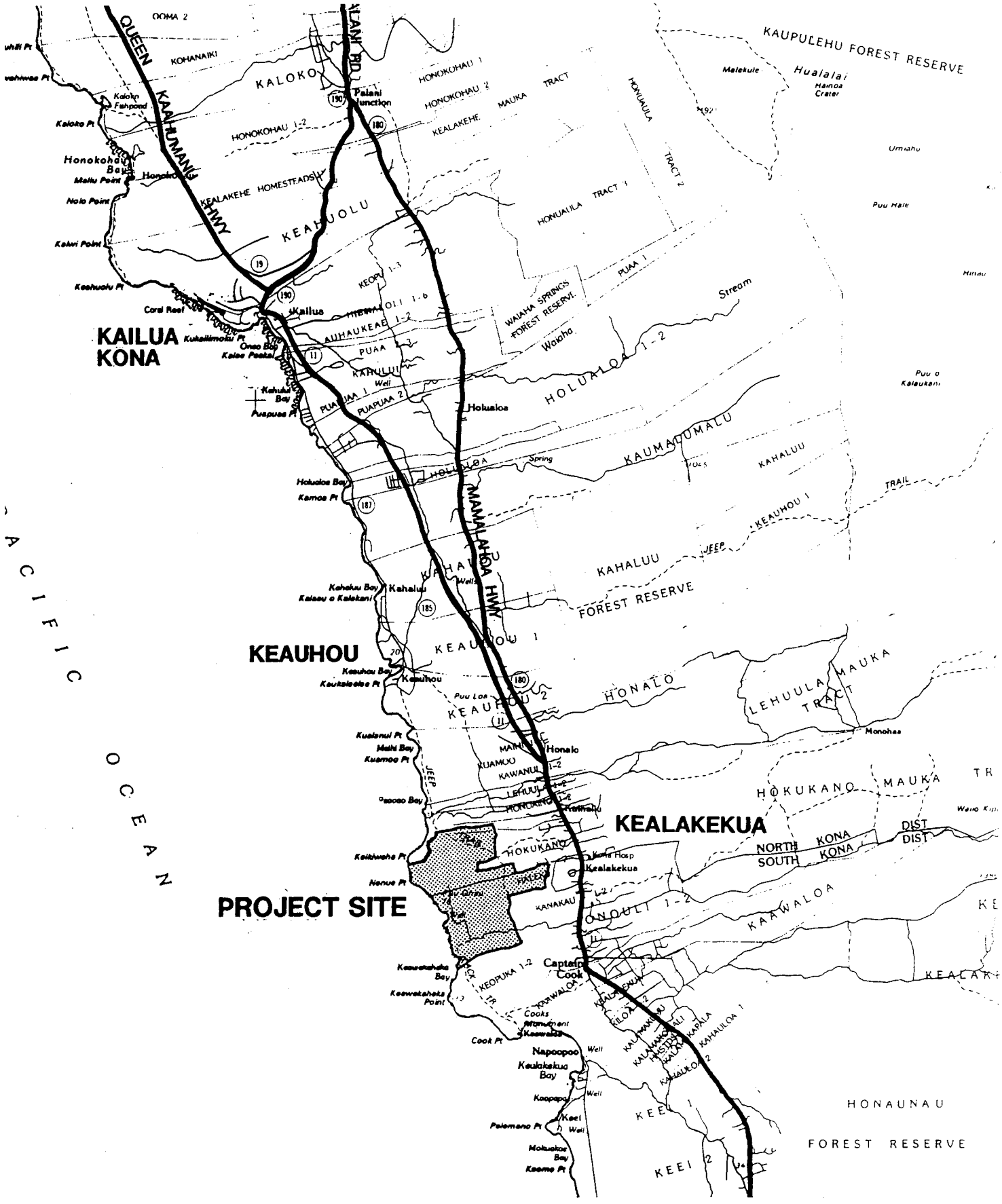


source: USGS, 1980

FIGURE 2
**REGIONAL CONTEXT MAP**
**FINAL ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**

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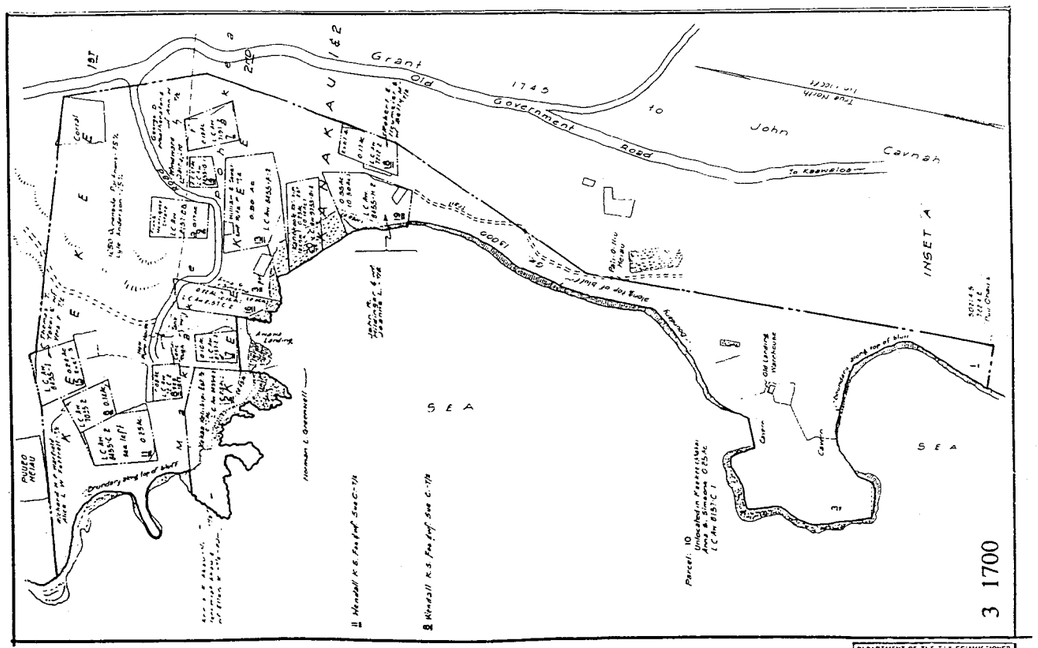
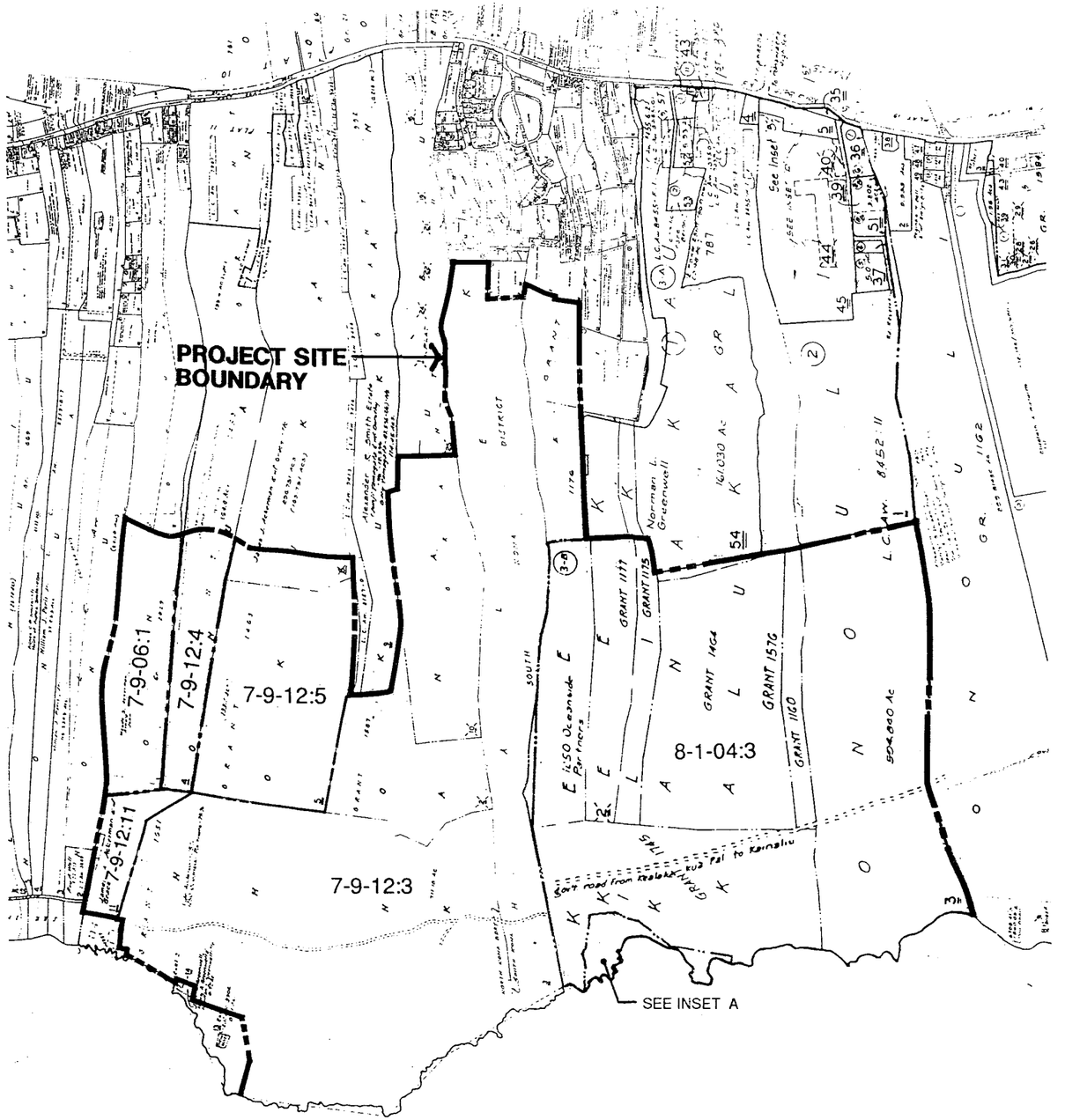



**INSET A PARCELS**




SOURCE: TAX MAP BUREAU; PUBLISHED 1992

FIGURE 3
**TAX MAP KEY**
**FINAL ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**

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## 2.3 PROJECT OBJECTIVES

The applicant and developer, Oceanside 1250, is a Hawaii based partnership located in Kailua-Kona. Mr. Lyle Anderson, President of Red Hill 1250, Inc., and General Partner from Oceanside 1250, has earned a reputation for his environmentally sensitive approach and long term commitment to each project he has undertaken, as evidenced by such award winning projects as Desert Mountain and Desert Highlands in Scottsdale, Arizona, and Las Campanas in Santa Fe, New Mexico. The applicant's overall objective is to develop a high quality residential/recreational community that will maintain the rural character and natural beauty of the area. As an experienced specialist in creating similar communities in other areas, the developer has long recognized the benefits of designing a project that is sensitive to the natural land features and unique historical heritage of each area. Based on preliminary studies, the developer believes that these objectives can be obtained for the subject property in an economically viable manner.

## 2.4 NEED FOR THE PROPOSED PROJECT

The subject property possesses the locational and physical attributes, including ocean and mountain views, proximity to the coast, appropriate slope characteristics and a relatively dry and mild climate, which are ideally suited for the proposed use. The studies performed in the planning process indicate that the proposed project is compatible with and will enhance the existing natural environment.

The market studies prepared specifically for the project indicate, based on an analysis of regional and demographic trends, visitor trends, and an overview of similar residential communities, that the proposed Hokukano project would be unlike any other project currently in existence in Hawaii. Although West Hawaii has several existing agricultural and residential lot subdivisions, the combination of a secluded, spacious residential community that offers extensive recreational facilities without hotel or resort facilities has not yet been offered. Hokukano has an added benefit over existing agricultural communities due to its access to the coastline, its sloping topography, lush vegetation, and calm winds.

Hokukano is expected to attract many potential resort lot owners who appreciate the privacy available in a non-resort development. The Hokukano project would allow residents the greater sense of community and seclusion typically associated with a residential community.

Retaining the property in its present pasture land use poses potential impacts to the marine ecosystem from erosion and cattle inflicted damage. Leaving the property undeveloped would result in the loss of an opportunity to expand employment alternatives and recreational and public facilities that are presently lacking in this area. The project would be phased to respond to market demand, and has been master planned to ensure that there is an orderly and timely development that is planned and coordinated with the provisions of public services and facilities in the region.

## 2.5 PROJECT DESCRIPTION

Preliminary Development Plan

The Villages at Hokukano is a master planned low density community focused on a 27-hole golf course. The preliminary development plan, as shown in Figure 4, includes the 27-hole golf course, golf clubhouse and related facilities, a members' lodge of up to 100 units, historic park area, open space elements, and a maximum of approximately 1,440 predominantly single family lots, yielding a total project density of no more than one unit per acre. The residential components include approximately 367 one to three acre lots in the upper portion with provisions to encourage agriculture. In the mid portion of the project, 350 to 400 approximately half acre lots are planned in the area above the golf course. At the lower elevations, predominately single family residential neighborhoods ranging in density from three to five units per acre are integrated with the golf course. The State Conservation District, which extends about 300 feet inland and includes approximately 140 acres along the coast, is planned as a natural in character, open-space recreational element. Together with portions of the golf corridor, the Conservation District provides a significant buffer between the coast and planned residential areas.

The golf course has been primarily planned in areas of relatively mild slopes in order to integrate with existing land forms and minimize the need for extensive grading. Overall, the development plan seeks to achieve a rural character and preserve the unique site characteristics of the area by maintaining low density neighborhoods integrated with generous open space areas. Additionally, design standards and controls will be implemented, aimed at maintaining cohesion throughout the project while maintaining visual integrity with the surrounding area.

The development plan includes an historic park area, along with an extensive trail system providing access for the public and residents to other historic and prehistoric archaeological sites within the project area, such as the King's Trail (Ala Loa or Ala Aupuni), Kuakini Wall, heiaus, platforms,


**LAND USE SUMMARY**

| Parcel | Area | Yield | Use | Gross Density |
|---|---|---|---|---|
| A | 118.0 | 60 | Residential/Agriculture | .5 du/ac |
| C | 47.3 | 95 | Residential | 2.0 du/ac |
| D | 226.0 | 154 | Residential/Agriculture | .5 du/ac |
| E | 45.5 | 140 | Residential | 3.0 du/ac |
| F | 8.5 | 35 | Residential | 4.0 du/ac |
| G | 12.0 | 50 | Residential | 4.0 du/ac |
| H | 20.0 | 40 | Residential | 2.0 du/ac |
| I | 123.5 | 65 | Residential/Agriculture | .5 du/ac |
| J | 170.0 | 88 | Residential/Agriculture | .5 du/ac |
| K | 46.0 | 100 | Residential | 2.1 du/ac |
| L | 15.0 | 50 | Residential | 3.1 du/ac |
| N | 66.0 | 139 | Residential | 2.1 du/ac |
| O | 35.0 | 140 | Residential | 4.0 du/ac |
| P | 17.0 | 68 | Residential | 4.0 du/ac |
| Q | 42.5 | 200 | Residential | 4.7 du/ac |
| R | 7.5 | 16 | Residential | 2.1 du/ac |
| **Subtotal** | **1000.0 Acres** | **1440 Units** | | |
| S | 4.0 | -- | Golf Clubhouse | -- |
| T | 14.0 | 100 | Lodge | -- |
| V | 2.0 | -- | Historic Park | -- |
| W | 140.0 | -- | Conservation District | -- |
| X | 349.0 | -- | Golf Course | -- |
| Y | 17.0 | -- | By-Pass | -- |
| Z | 14.0 | -- | Roads | -- |
| **Subtotal** | **540.0 Acres** | **100 Units** | | |
| **TOTAL** | **1540 Acres** | **1540 Units** | | |

FIGURE 4
**PRELIMINARY DEVELOPMENT PLAN**
FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

Planning/Design Team
Gage Davis Associates
PBR HAWAII

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enclosures and other sites as part of an interpretive program. The project includes provisions for public and resident access to the shoreline, such as shoreline parking, and the necessary internal and external infrastructure to serve the project, including a potable water transmission and distribution system; non-potable water transmission and distribution system (for golf course and landscape irrigation purposes); wastewater collection, transmission, treatment and disposal system; and internal roadway system.

As shown on the TMK Map exhibit, within the area of the State Conservation District are approximately fourteen land court award parcels. The current or alternate access to these privately owned parcels would be maintained throughout the construction period and retained as part of the internal roadway improvements.

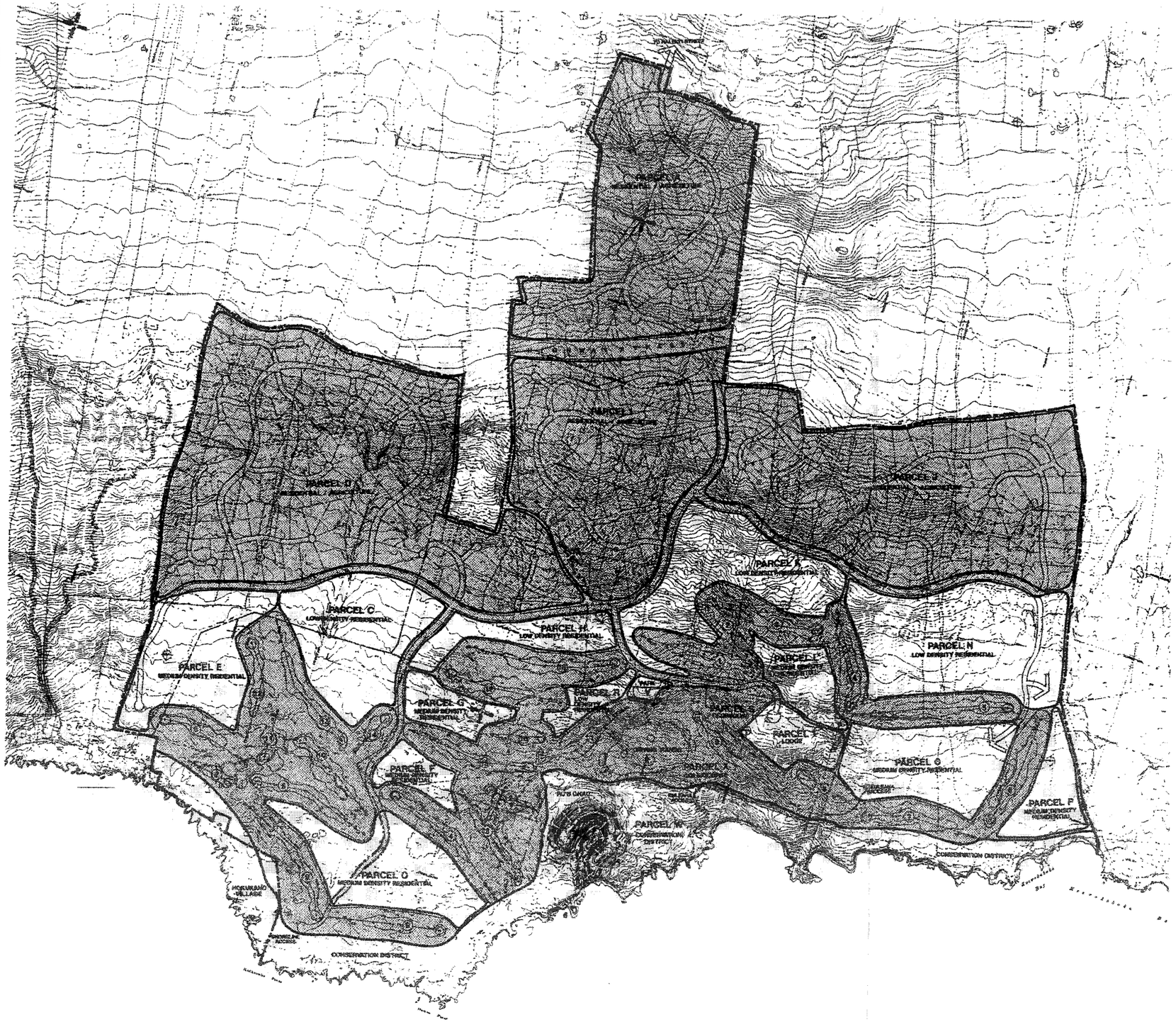
Also, with the construction of the proposed project, the applicant proposes to participate with the State and other land owners in the planning, design, and construction of the highway bypass, allowing this element to be built sooner than might otherwise be possible and at a lower cost to the State.

Development Schedule and Phasing

The project would be developed over an approximately 30 year period. The first phase, which is currently planned to begin in 1995, would include the 27-hole golf course, golf clubhouse and related facilities, and approximately 367 lots of one to three acres in size. The members' lodge and related facilities, and the approximately 1,073 predominantly single family units would be developed in subsequent phases, as market forces dictate (Figure 5). Development of the primary internal roads, facilities, and major infrastructure is anticipated to be completed within the first five years of development.

Residential/Agricultural Lots

The first phase of development includes approximately 367 one to three acre lots totalling approximately 637 acres in the upper elevations of the property. The developer, in an effort to support agricultural activity within those portions where the zoning will remain within the Agriculture District and larger lot sizes permit, has proposed a program by which the necessary site improvements and infrastructure needed to support agricultural uses could be implemented as part of the Phase I development. The program would allow for commercially viable agricultural




## LAND USE SUMMARY

| Parcel | Area | Yield | Use | Gross Density |
|---|---|---|---|---|
| A | 118.0 | 60 | Residential/Agriculture | .5 du/ac |
| C | 47.3 | 95 | Residential | 2.0 du/ac |
| D | 226.0 | 154 | Residential/Agriculture | .5 du/ac |
| E | 45.5 | 140 | Residential | 3.0 du/ac |
| F | 8.5 | 35 | Residential | 4.0 du/ac |
| G | 12.0 | 50 | Residential | 4.0 du/ac |
| H | 20.0 | 40 | Residential | 2.0 du/ac |
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| N | 66.0 | 139 | Residential | 2.1 du/ac |
| O | 35.0 | 140 | Residential | 4.0 du/ac |
| P | 17.0 | 68 | Residential | 4.0 du/ac |
| Q | 42.5 | 200 | Residential | 4.7 du/ac |
| R | 7.5 | 16 | Residential | 2.1 du/ac |
| **Subtotal** | **1000.0 Acres** | **1440 Units** | | |
| S | 4.0 | -- | Golf Clubhouse | -- |
| T | 14.0 | 100 | Lodge | -- |
| V | 2.0 | -- | Historic Park | -- |
| W | 140.0 | -- | Conservation District | -- |
| X | 349.0 | -- | Golf Course | -- |
| Y | 17.0 | -- | By-Pass | -- |
| Z | 14.0 | -- | Roads | -- |
| **Subtotal** | **540.0 Acres** | **100 Units** | | |
| **TOTAL** | **1540 Acres** | **1540 Units** | | |

**LEGEND**

PHASE I

FIGURE 5
**PHASING PLAN**
FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

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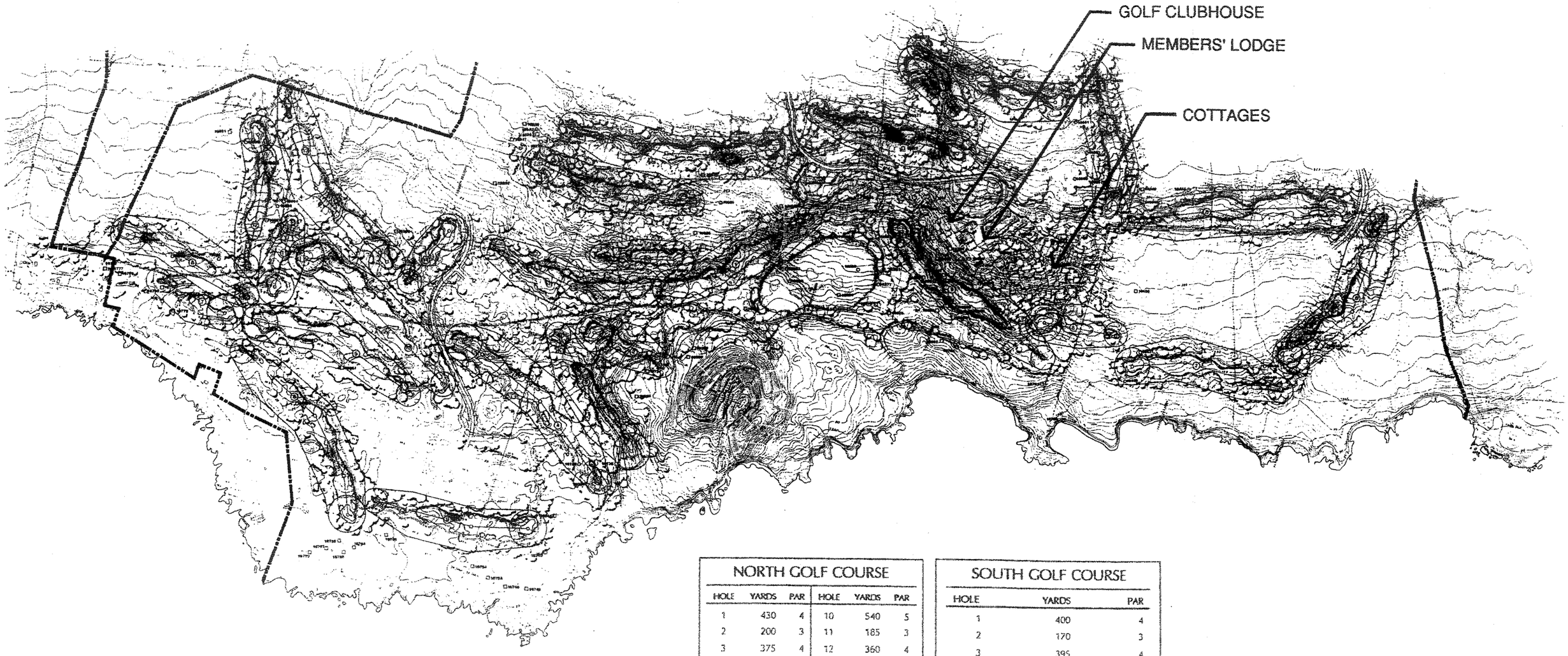
activities that are compatible with the residential uses to be integrated in the areas of the project most suited to agricultural use. At the same time, the select agricultural orchards and crops could provide a significant landscape and open space element within the Villages at Hokukano community. Conversely, the resources from the associated residential development would provide the needed capital to support the agricultural use on an ongoing basis. Thus the proposed program offers advantages to the owner/resident and grower alike. In this way, it is felt that commercially viable agricultural activity, on a modest scale, could be supported as part of the large lot development.

Residential Lots

The subsequent phases of residential development will total approximately 1,073 predominately single family lots. The residential lots would be comprised of approximately 350 to 400 half acre lots in the area overlooking the golf course, and the remainder within neighborhoods ranging in densities of three to five units per acre integrated among the 27-hole golf course and associated open space areas. In some instances, where topographic conditions dictate, a cluster of planned unit developments may be appropriate. In general, the individual residential neighborhoods are intended to be single family in nature with densities up to approximately five units per acre. Although individual neighborhoods would be planned with street and landscape features intended to impart individual character and identity, design standards and controls would be implemented to maintain a visual cohesion throughout the residential community.

Golf Course and Clubhouse

The proposed golf club at Hokukano will be a 27-hole, Jack Nicklaus designed golf course with related facilities, including a golf clubhouse, practice range, maintenance center, and other golf service functions (Figure 6). The golf course and these related facilities are proposed to be sited on approximately 346 acres. The proposed clubhouse would include a reception and check-in area, pro shop, grill, and bar on the upper entrance level. On the lower level are planned women's and men's locker rooms and facilities for cart storage, maintenance, and staging. The clubhouse floor area, as proposed, would comprise approximately 21,000 square feet. The golf course has been carefully sited to help blend with existing land forms, protect significant historical and cultural sites, and integrate existing vegetation into the layout. Turf areas within the fairways would be reduced from typical golf course areas to lessen the amount of irrigation required, while still providing for a pleasant golf experience. Irrigation water would be collected from holes subject to




## NORTH GOLF COURSE

| HOLE | YARDS | PAR | HOLE | YARDS | PAR |
|---|---|---|---|---|---|
| 1 | 430 | 4 | 10 | 540 | 5 |
| 2 | 200 | 3 | 11 | 185 | 3 |
| 3 | 375 | 4 | 12 | 360 | 4 |
| 4 | 530 | 5 | 13 | 570 | 5 |
| 5 | 470 | 4 | 14 | 170 | 3 |
| 6 | 370 | 4 | 15 | 430 | 4 |
| 7 | 205 | 3 | 16 | 200 | 3 |
| 8 | 550 | 5 | 17 | 435 | 4 |
| 9 | 420 | 4 | 18 | 570 | 5 |
| OUT | 3550 | 36 | IN | 3460 | 35 |
| | | | Total | 7010 | 72 |

## SOUTH GOLF COURSE

| HOLE | YARDS | PAR |
|---|---|---|
| 1 | 400 | 4 |
| 2 | 170 | 3 |
| 3 | 395 | 4 |
| 4 | 380 | 4 |
| 5 | 555 | 5 |
| 6 | 470 | 4 |
| 7 | 415 | 4 |
| 8 | 200 | 3 |
| 9 | 520 | 5 |
| TOTAL | 3505 | 36 |

FIGURE 6
**ILLUSTRATIVE**
**GOLF COURSE SITE PLAN**
FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

Planning/Design Team
Gage Davis Associates
Jack Nicklaus Golf Services

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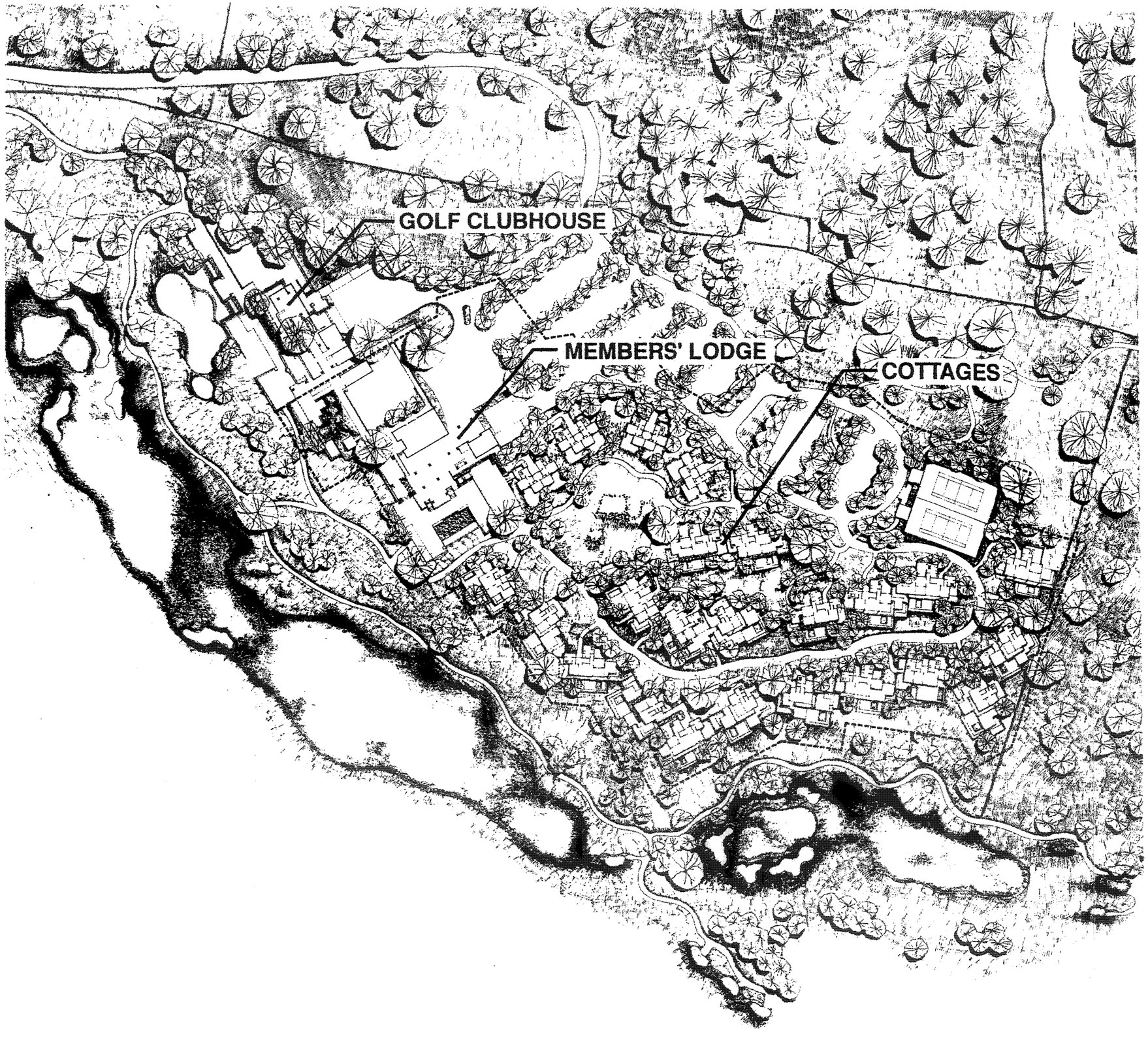
PBR HAWAII

potential runoff by a subsurface drainage system that recycles the collected water to irrigation ponds for reuse on the course. A well has been established onsite that will provide brackish water sufficient to meet the project's irrigation demands. In addition, project consultants are studying alternative types of turf that are viable in this unique climate and might provide further water savings.

Members' Lodge

The site for the lodge is an approximately 10 to 20 acre parcel adjacent to the golf clubhouse (Figure 7). The lodge is anticipated to accommodate up to 100 units in the main pavilion and within detached suite and bungalow buildings carefully sited within the parcel (Figure 8). In addition to the lodge units, the main pavilion will accommodate hospitality, reception, dining and pool related activities, as well as administrative and service functions. This pavilion will be designed to complement the style used in the golf clubhouse and each would share a common garden area set between the golf clubhouse and main lodge pavilion. A small tennis center, including two courts, pro shop, and shelter are also proposed for the site. The lodge is envisioned as a hospitality center for member and guest activities and is not intended to offer public accommodations. Other events related to organized member activities may take place at the lodge hospitality center. These might include dinner parties and private weddings, as well as social gatherings associated with members' golf and recreational activities.




Architect:Gage Davis Associates

FIGURE 7
**ILLUSTRATIVE SITE PLAN**
**GOLF CLUBHOUSE, LODGE & COTTAGES**

FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

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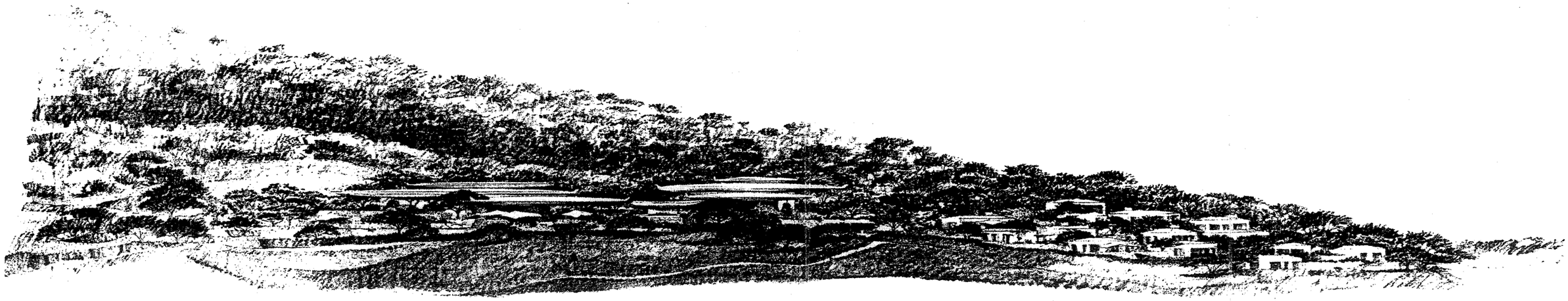

CLUBHOUSE MEMBERS' LODGE LODGE COTTAGES

FIGURE 8
**ILLUSTRATIVE ELEVATIONS GOLF CLUBHOUSE, LODGE & COTTAGES**

FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

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Architect:Gage Davis Associates

# 3.0 Alternatives Considered

# 3.0 ALTERNATIVES CONSIDERED

## 3.1 INTRODUCTION

The proposed Villages at Hokukano project has been planned to provide a high quality, low density residential community with golf and recreational amenities, which is in keeping with the rural character of the area. It is designed in a manner that seeks to maintain the unique characteristics of the site. This would be accomplished by maintaining low density neighborhoods integrated with generous open space areas and by implementing a design standard aimed at maintaining a visual cohesion and integrity with the surrounding area. Additionally, the project has been planned with a sensitivity to the site conditions and surrounding environment, seeking to minimize potential impacts to the greatest extent practical through implementation of various measures, as discussed previously within Section 2. While the actual development of the property will be phased to respond to the market demand, the entire 1,540 acres has been master planned to ensure that there is an orderly and timely development that is planned and coordinated with the provisions of public services and facilities in the region. In compliance with the provision of Title 11, Department of Health, Chapter 200, Environmental Impact Statement Rules, Section 11-200-17(f), the "known feasible" alternatives to the proposed project are discussed in this section. Those alternatives that could "feasibly" obtain the objectives of the project are described and evaluated. An exploration and evaluation of the environmental impacts of all reasonable alternative actions, particularly those that might enhance environmental quality or would avoid or reduce some or all of the adverse environmental impacts, costs, and risks, is included in order not to prematurely preclude options that might enhance environmental quality or have less detrimental effects.

The alternatives have been evaluated relative to their capability of meeting the proposed project objectives, as stated in Section 2.3. In addition to the preferred alternative (the proposed project), the alternatives of no action, alternate configurations of the site, and alternative uses of the property were evaluated.

## 3.2 DESCRIPTION OF ALTERNATIVES

### 3.2.1 "No Action" Alternative

The "No Action" alternative would retain the property in its present, pasture land use, continuing the potential impacts to the marine ecosystem from erosion and cattle inflicted damage. This alternative would not allow the property owners, the State or the County governments to generate any significant income from the project lands. To receive any reasonable benefits, the developer would likely sell the property to another private buyer, who probably would seek land use changes that would enable a higher use of the land. Leaving the property undeveloped would result in the loss of an opportunity to expand employment alternatives and recreational and public facilities that are presently lacking in this area.

### 3.2.2 Alternative Configurations of the Proposed Project

The analysis of alternative configurations and sizes of the project elements took into consideration several factors. These included the number and types of individual components that could be efficiently and economically located within the project boundaries, the opportunities and constraints of the site, and community and governmental agency input and concerns regarding the proposed project. Following the evaluation of all of the various factors, the preferred alternative (proposed project) was selected as the alternative that could best meet the objectives of the project because it provides the greatest flexibility in phasing and construction, the type of amenities and services best suited for the proposed development, the necessary financial return in order to provide the necessary improvements to the public infrastructure, and it allows the County's goals and objectives regarding the development of the project area to be met in the most expeditious manner.

During the conceptual master planning, a number of alternative concepts and variations were evaluated. The following alternatives are representative of those considered in response to achieving a development program to include a members' lodge and related amenities, an 18 to 36 hole golf course, and residential lots on the 1,540 acre parcel, and to do so in a manner that retains the character of the area and is accomplished with little or no negative impacts to the existing environmental conditions.

### 3.2.3 "Scaled Down" Alternative

One alternative would contemplate similar land uses and would not require the extensive regulatory processing, such as a State Land Use Boundary Amendment, General Plan Amendment or Change of Zone. Current A-5 and Unplanned zoning will allow approximately 300 lots, a golf course (with Use Permit) and related facilities under the current entitlements. A project of such low density, however, would not generate the revenues required to provide the public benefits, as envisioned for the proposed project, including regional roadway improvements, the agricultural development plan, shoreline management plans and interpretive development, and educational programs related to sites of historical and cultural importance.

### 3.2.4 "High Density" Alternative

Another alternative envisioned the integration of an affordable housing component as part of the overall residential development. This alternative required additional market units in order to make the project financially viable. The resulting development density from this alternative was found not to be in keeping with the rural character of the surrounding area, nor would it have allowed for as sensitive a design that preserves the unique characteristics of the site. It was felt that, overall, the potential impacts to public services and facilities, as well as to the environment, were amplified with the higher density alternative.

### 3.2.5 Intensive Agricultural Alternative

As noted, the property has been used in ranching for the past 100 years. There are periods during the drier seasons when the productivity of the land for grazing purposes diminishes greatly. Prior to its use as a cattle ranch, there are historical references to limited agricultural use on the portions of the property, including sugar cane, coffee, and citrus. The property as a whole is only marginally suited for intensive agricultural use, which would not be feasible without significant capital input and site and infrastructure improvements. Without the necessary capital and improvements that accompany the proposed development, intensive agricultural use on the property by itself does not appear to be a viable alternative from an economic perspective.

## 3.3 COMPARATIVE EVALUATION

In general, the alternatives evaluated do not provide the degree of satisfaction to meet the project objectives, they have greater adverse impacts, higher on or offsite infrastructural costs, and less expansion capabilities. Furthermore, these alternatives are incompatible land uses for the area, as well as being economically unfeasible, and/or would not allow the County's overall goals and objectives regarding the project area to be met. Alternative uses of the property, including the "no action" alternative, were also rejected because they do not meet the objectives of the proposed project. The proposed project satisfies the owners' objectives and provides the best opportunity to assist in supporting West Hawaii's forecasted residential, recreational, educational, and public facility needs over the period of development. Although each alternative evaluated may have some merit and be worthy of consideration, none have the degree of positive merits nor meet the proposed project's stated objectives.

# 4.0 Description of Environmental Setting, Anticipated Impacts and Recommended Mitigation Measures

# 4.0 DESCRIPTION OF ENVIRONMENTAL SETTING, ANTICIPATED IMPACTS AND RECOMMENDED MITIGATION MEASURES

## 4.1 PHYSICAL ENVIRONMENT

### 4.1.1 Geography and Climate

Existing Conditions

Located on the western slopes of Mauna Loa, the site's environmental conditions are similar to other areas along the leeward coast. Due to the wind shadow effect caused by Mauna Loa, winds in this region are often light and variable, dominated by local land-sea breezes. However, Kona storms in the winter season can bring very strong winds from the south or southwest for brief periods. Average daily temperatures range from a minimum of sixty-one degrees fahrenheit to a maximum of seventy-nine degrees fahrenheit. The annual rainfall averages approximately thirty-five inches, with the summer months receiving the majority of rainfall, which is a unique characteristic of the Kona coast. For all other parts of the Hawaiian Islands, the winter months receive the highest average rainfall.

Lower portions of the project site are comprised of large areas of rolling terrain with exposed pahoehoe lava flows and some top soil in the flatter areas and between ridges. Pu'u Ohau, a natural cinder cone, is a prominent landmark in the central portion of the property near the coast. It rises to an elevation of about 230 feet at its highest point. Vegetation, comprised of keawe, koa haole, grasses, and brush, extends from the coastal area up to the 800 foot elevation (MSL). Above 800 feet to the upper boundary at the 1,240 foot elevation, large kukui and monkey pod trees are found, with typical guinea grass and buffel grass understory. Along the rocky coastline are found occasional pockets of sand in the area north of Pu'u Ohau, with steep and occasionally undermined cliffs along the shore, south of the pu'u. The general slope of the property is approximately thirteen percent, with some steeper portions exceeding 20 percent in areas generally associated with gullies and rock outcroppings (Figure 9).

Potential Impacts and Mitigation Measures

As noted, one of the objectives of the proposed golf course layout is to respond to the natural conditions with as little alteration to the existing site conditions as practical. Within residential

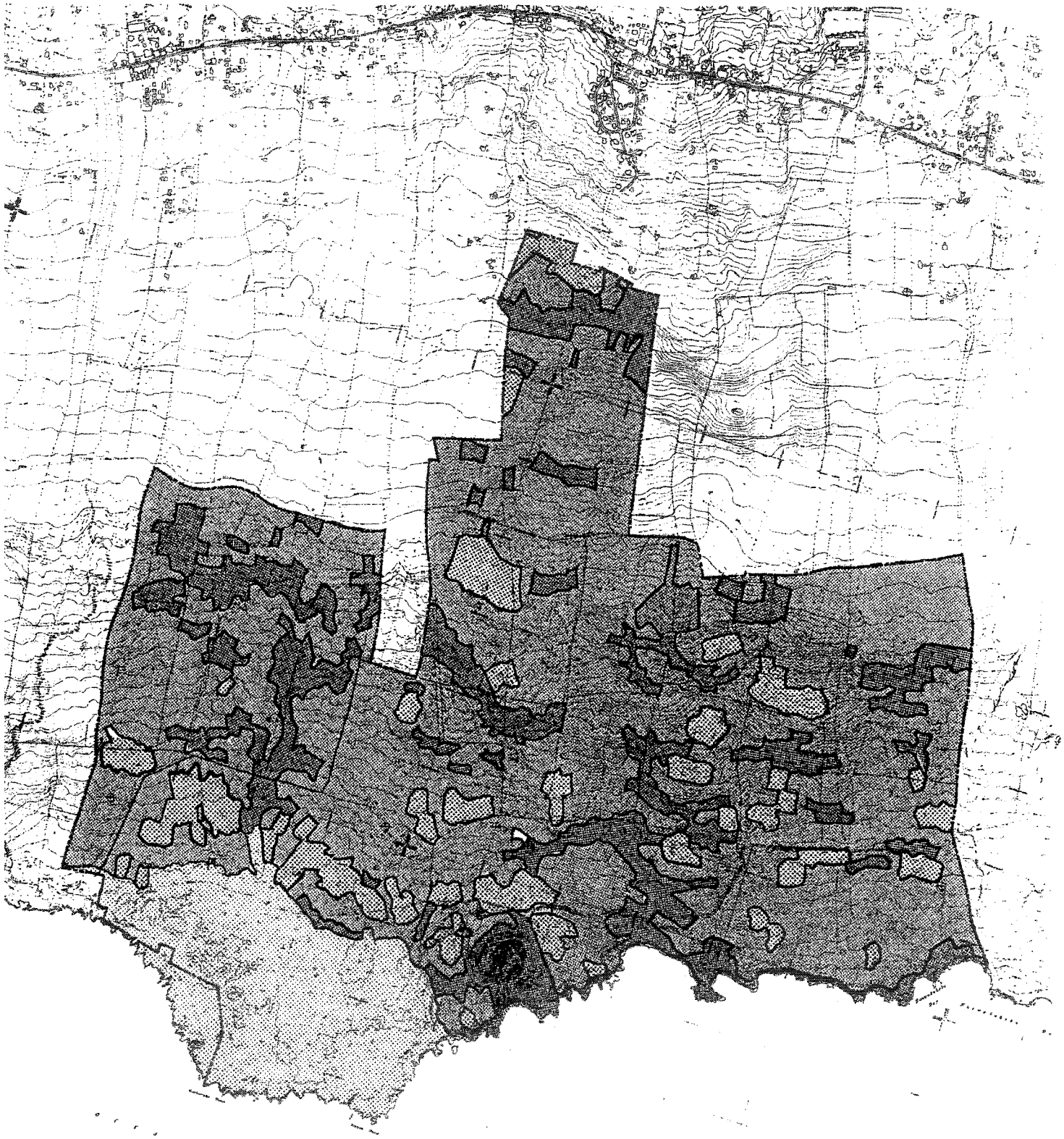


FIGURE 9
**SLOPES**

FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

neighborhoods, building envelopes will limit the residential development to those areas most suited for construction with little topographic alteration. The land form of Pu'u Ohau, being situated largely within the State Conservation District and outside the proposed area of development, would remain unaffected by the proposed project. The proposed lodge and clubhouse, as well, will be designed in relation to the natural features of the land. As such, it is expected that the project will be constructed without major adverse impacts to the natural land forms. Likewise, the proposed project will have no effect on climatic conditions and, therefore, no mitigation measures are warranted.

### 4.1.2 Geology, Topography, Soils, and Agricultural Potential

Existing Conditions

The project site is a coastal property situated on the lower slopes of Mauna Loa. Typical of West Hawaii coastal land, the project site and surrounding areas have relatively little soil cover, although pockets of soil are found throughout the site, generally following the patterns of lava flows and drainageways. A number of rock outcroppings occur on the project site. All of the surrounding area, including the project site, is of volcanic origin.

The soils found on the subject property consist of six soil types, as classified by the United States Department of Agriculture Soil Conservation Service Soil Survey (Figure 10). The descriptions of soil characteristics on the subject property are as follows:

KDD Kainaliu very stony silty clay loam, 12 to 20 percent slopes. This soil generally follows the long narrow patterns of lava flows, but can be isolated and surrounded by more recent flows. On the subject property, these soils may be marginally suitable for macadamia nuts, coffee, and pasture with proper irrigation.

WHC Waiaha extremely stony silt loam, 6 to 12 percent slopes. The surface layer is very dark brown comprised of extremely stony silt loam approximately 4 inches thick and slightly acid. Subsoil is dark brown, very stony silt loam, neutral to mildly alkaline and approximately 14 inches thick located above pahoehoe lava bedrock. Permeability is moderately rapid, runoff is slow, and the erosion hazard slight.


FIGURE 10
**SOIL SURVEY**
**FINAL ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**

SOURCE: USDA - Soil Conservation Services & Univ. of Hawaii; Soil Survey - Island of Hawaii, State of Hawaii; Dec. 1973

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rKED Kaimu extremely stony peat, 6 to 20 percent slopes. This soil is generally found at low elevations. The surface layer is very dark brown extremely stony peat approximately 3 inches thick and underlain by a'a lava. Permeability is rapid, runoff is slow, and the erosion hazard slight. This soil is not suitable for cultivation, however, some small areas can be used for pasture, macadamia nuts, papaya, and citrus fruits.

rLW This soil type is also known as pahoehoe lava, a "miscellaneous land type". Although this lava often has a billowy, glassy surface, it can also be rough and broken. There is no soil covering and is typically bare of vegetation except for mosses and lichens. Annual rainfall and elevations vary widely.

rPYD Punalu'u extremely rocky peat, 6 to 20 percent slopes. This soil type characteristically has rock outcrops occupying approximately 40 to 50 percent of the surface. The soil layer on the surface is approximately 4 inches thick and underlain by pahoehoe lava bedrock. The peat portions of the soil are rapidly permeable while the pahoehoe lava is very slowly permeable if not fractured. Runoff is slow and the erosion hazard is slight.

rCL Cinder land. This soil type is located primarily at Red Hill and is considered as a "miscellaneous land type" consisting of bedded cinders, pumice, and ash. The particles have jagged edges and glassy appearance and show little or no soil development. Although some grass can be supported, it is not good pastureland because of its loose consistency and poor trafficability.

KEC Kainaliu extremely stony silty clay loam, 12 to 20 percent slopes. This soil is generally found at low elevations on Mauna Loa and Hualalai. The surface layer is very dark brown with extremely stony silty clay loam about 10 inches thick. The subsoil is approximately 16 inches thick and underlain by fragmental a'a lava.

Other soil classification systems used in Hawaii are the University of Hawaii's Land Study Bureau System and the Department of Agriculture's ALISH system.

The Land Study Bureau's Detailed Land Classification Report for the Island of Hawaii has designated the lands within the project site as predominantly Class C, D, and E. A small portion covering approximately eight acres in the extreme mauka corner is rated as B lands by the Land Study Bureau (Figure 11). From an agronomic perspective, these soils are generally moderately to


FIGURE 11
**DETAILED LAND CLASSIFICATION**
**FINAL ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**

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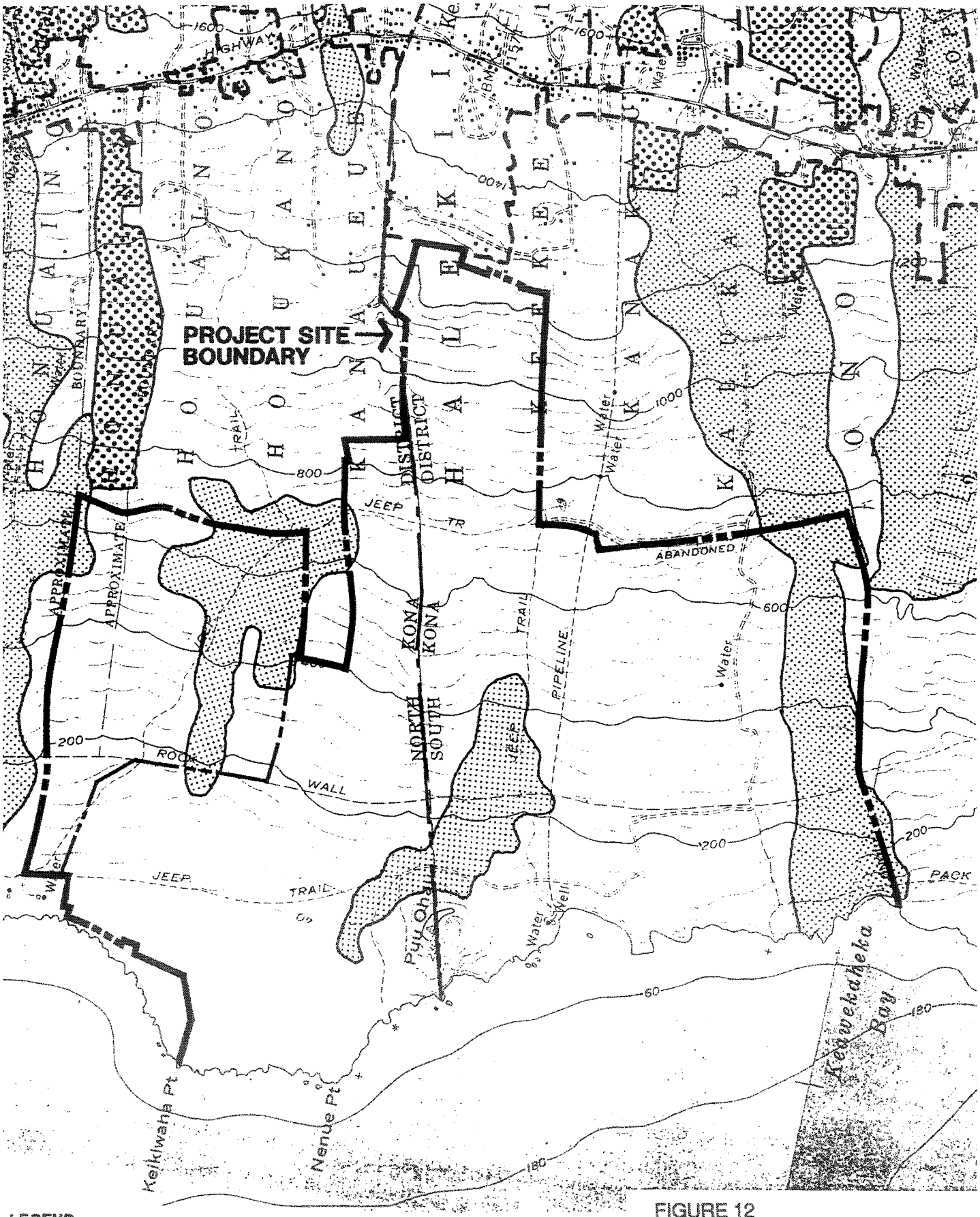
URCE: Land Study Bureau, Univ. of Hawaii;
Detailed Land Classification - Island of Hawaii; Nov. 1965

poorly suited for agricultural use. Similarly, no area of the project site has been rated "Prime" or "Unique" by the ALISH system (Figure 12). However, limited portions of the project area are identified as "Other Important" lands. This classification indicates that portions of the site can be used for agricultural purposes but generally require infrastructure support and other necessary agronomic improvements.

Potential Impacts

Soil depths exceed twenty inches in some portions of the project area. From initial calculations, it is anticipated that sufficient soil exists on the site to supply the soil base for the proposed golf course (turf areas) development. About six to eight inches of soil is required for residential and golf landscaping. Of the approximately 350 acres for the proposed golf course area, approximately 150 acres will be improved as turf areas and a portion will remain as a natural buffer at the edges of the golf course and between some residential areas and the golf course. The Pu'u Ohau cinder cone, the area along the coast within the State Conservation District, specified archaeological sites, and other open space and natural buffers are to remain largely unaffected by the proposed development. Clearing and grubbing activities during construction will temporarily disturb the soil retention values of the existing vegetation and expose soils to erosional forces. Some wind erosion of soils could occur without a proper watering and regrassing program. Heavy rainfall could also cause some erosion of soils within disturbed areas of land. Should imported soils be required, these soils may pose a potential siltation or runoff problem if they are stockpiled without adequate precaution. They also may impact air quality in the form of dust generated during off loading from trucks or if not properly stockpiled.

With regard to agricultural uses, the project will impact the limited agricultural activity (cattle grazing) existing on the property. Given the relatively poor quality of the soil, light rainfall and scrub nature of much of the vegetation over the project site, the loss of these lands for cattle grazing is not considered to be a significant adverse impact from an agricultural perspective. The proposed project will eliminate the agricultural potential of those lands identified as "Other Important" lands of agricultural importance to the State of Hawaii. The value of these lands for agricultural use, however, needs to be evaluated in relation to potentially viable agricultural uses within these areas. Historically, the land has been used for cattle and, to a small degree, sheep grazing. There is also record of limited attempts at orchard and sugar cane cultivation. Any potential agriculture uses, however, would be restricted by the limited usable areas (e.g., areas




**LEGEND**

- UNIQUE AGRICULTURAL LAND
- OTHER IMPORTANT AGRICULTURAL LAND
- EXISTING URBAN DEVELOPMENT

rce: S.O.H., Dept. of Agriculture; AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII; Jan. 1977.

FIGURE 12
**ALISH**

FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

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with sufficient soil area and topography) and the need for supporting infrastructure, primarily irrigation and roads. Given the marginal soil conditions and lack of even rainfall, the potential for agricultural use is questionable without extensive irrigation, land clearing, and site improvements.

Mitigation Measures

During construction, measures will need to be provided to protect nearshore waters from the impacts of sedimentation. In addition to meeting the State's NPDES permitting requirements, an erosion and sedimentation plan will need to be prepared and approved by the Department of Public Works as part of the permitting procedure for the grading work. Mitigation measures which could be employed include limiting exposed areas, dust control measures (frequent sprinkling), and prompt seeding of exposed finished areas. As part of the construction phasing, retention basins could be established, which will form part of the eventual drainage system for the project. Because the majority of the rainfall occurs during the months from May to September, additional mitigation could result from scheduling grading, as much as practical, to the drier periods.

Generally, soil conditions on the property are marginally suited for agricultural uses, but by providing the necessary site preparation, access, and infrastructure improvements as part of project development, limited agricultural uses can be supported on an ongoing basis. The developer has proposed an agricultural program that would integrate appropriate agricultural activities on portions of the agricultural lots in a manner that would not only benefit adjacent residential uses but would allow for the efficient management and operations of select crop and/or orchard uses. As proposed, the agricultural program would place approximately 75 acres into commercially productive agricultural use. A brief description of the proposed agricultural program follows.

Agricultural Program Concept

As part of the first phase of development within the Villages at Hokukano, approximately 367 home lots, covering about 678 acres, will be developed in the upper elevations of the property. These lots would be generally one to three acres in size and are intended to be offered under the County Agriculture (A-1a) zoning designation. As a method to facilitate agricultural uses on these lots, the program would identify certain lands in and around these homesites that could be used for select agricultural activity, as shown in Figure 13. A typical section showing an integration of the agricultural use with the residential/agricultural lots is shown in Figure 14.

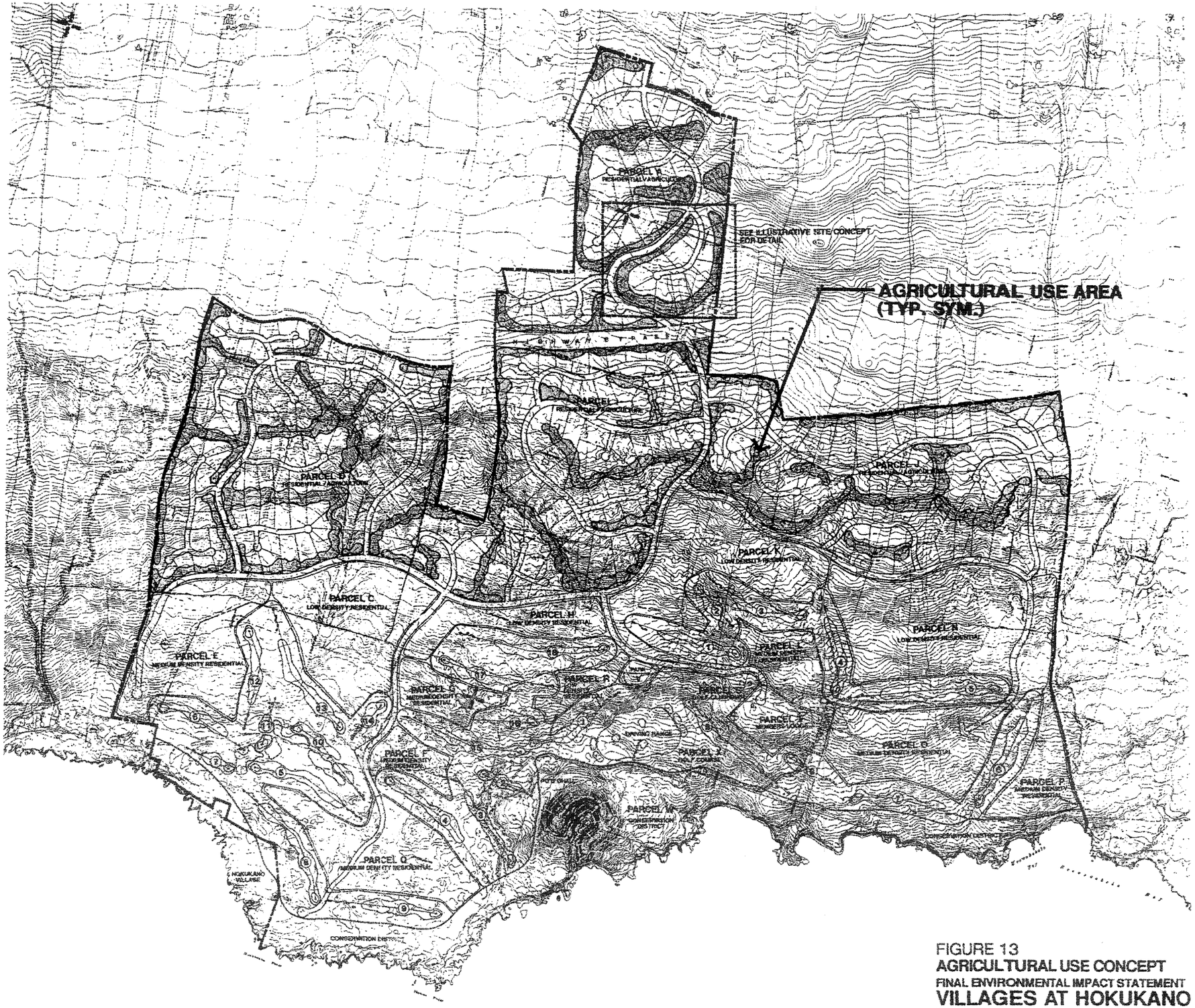


FIGURE 13
**AGRICULTURAL USE CONCEPT**
FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

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Architect:Gage Davis Associates

**Local Road**
Landscape material should compliment existing site character, incorporate existing terrain features, and where appropriate, allow additional site walls to create unique residential treatments.

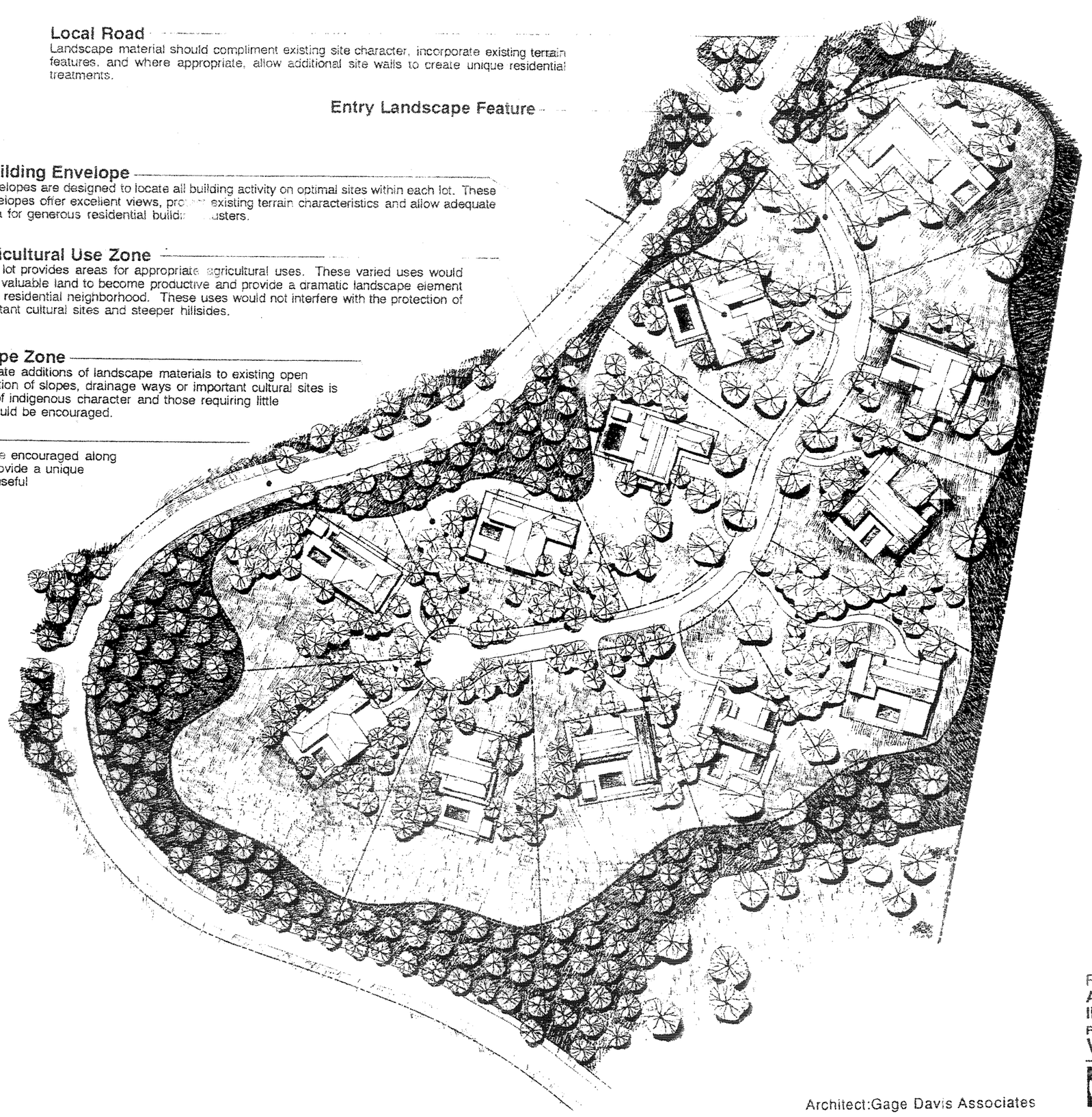
**Entry Landscape Feature**

**Building Envelope**
Envelopes are designed to locate all building activity on optimal sites within each lot. These envelopes offer excellent views, pro[illegible] existing terrain characteristics and allow adequate area for generous residential buildi[illegible]usters.

**Agricultural Use Zone**
Each lot provides areas for appropriate agricultural uses. These varied uses would allow valuable land to become productive and provide a dramatic landscape element to the residential neighborhood. These uses would not interfere with the protection of important cultural sites and steeper hillsides.

**Common Landscape Zone**
This zone allows appropriate additions of landscape materials to existing open spaces. Significant alteration of slopes, drainage ways or important cultural sites is not permitted. Materials of indigenous character and those requiring little supplemental irrigation would be encouraged.

**Collector Road**
Agricultural uses should be encouraged along major roads and would provide a unique streetscape as well as a useful landscape buffer edge.



Architect:Gage Davis Associates

FIGURE 14
**AGRICULTURE/LOT PARCEL ILLUSTRATIVE SITE CONCEPT**
FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

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Currently, the lands on the site consist generally of open kiawe scrub and mixed grasslands, and are used for marginal pasture use. There are agriculture operations nearby consisting of plumeria, papaya, macadamia, and coffee orchards. These traditional orchard crops could also be introduced into plans at Hokukano if they are determined to be appropriate to site conditions. At the same time, other products, such as organic herbs and vegetables, valuable grasses, and other flower and orchard products are being studied to determine if these offer satisfactory alternatives or complimentary products. Due to the relative proximity of residential growth, activities such as animal husbandry, game, and livestock propagation or truck farming are seen as inappropriate agricultural activities for this area. A preliminary list of potential crops is as follows:

- Acerola Cherry
- Artichoke
- Atemoya
- Avocado
- Breadfruit
- Cashew (20-30")
- Carob
- Citrus
- Cocoa
- Coffee
- Fig
- Grapes
- Guava
- Jobiticaba
- Lychee
- Macadamia
- Malabar Chestnut
- Mango (<60")
- Mangosteen
- Natal Plum (DT)
- Papaya (40-60")
- Peach Palm
- Pineapple
- Pummelo
- Rambutan

- Sapote (DT)
- Starfruit
- Surinam Cherry

In general, the slope of this portion of the property is about ten percent. Some areas, however, have steeper slopes exceeding, in some cases, twenty percent. Agricultural portions would generally not include steeper areas in order to minimize grading requirements and to protect the existing slopes and site character. Some grading activity, however, would be necessary to create deeper planting beds and to provide access for maintenance purposes. In those areas where soils are over shallow bedrock, the subsurface layers may need to be modified to provide plantable areas and suitable soil conditions.

A good quality brackish water source has been developed onsite and thus adequate water can be provided for agricultural uses, possibly through an on ground irrigation system. In general, the suitability of brackish water for crop irrigation not only depends on the quality of the water but also on the adequacy of the drainage, method of irrigation, physical properties of the soil, salt tolerance of chosen crops, and management and operation of the irrigation and drainage systems. All crops initially selected for the agricultural program are expected to be supportable within the quality parameters of the available brackish water.

One of the goals of the program would be to provide a financial structure that will benefit the growers, as well as the community and the lot owners, within the agricultural area at Hokukano. The financial structure would help to minimize the start up costs for participating growers outside of their own direct early production and maintenance costs. Strictly speaking, the land would remain as the lot owners' property and an easement or leasing arrangement would be created to allow other persons to engage in agricultural operations on designated parcels. Provisions for management of these parcels would likely be the responsibility of the homeowners' association.

Market conditions would be examined to ensure there is a demand for good exotic fruit producers and products from Hawaii. Some could be provided by contacting local marketing "cooperatives" or the farm bureau and utilizing their expertise and resources. Fruit pricing and available labor would be carefully studied to help select crops best suited for this area.

Thus, the agricultural program envisioned for the Villages at Hokukano is intended to offer local farmers and growers opportunities for agricultural experimentation and employment and expand

the local agricultural land inventory. It would also, due to its modest scale, provide an effective marketing and distribution network between producer and consumer, helping to provide opportunities for economically competitive and sustainable agriculture. At the same time, the agricultural areas could provide a well maintained landscape and open space element within the large lot subdivision. In sum, the program offers advantages to owners/residents, growers, and farmers alike, while demonstrating an appropriate blending of residential and agricultural uses.

### 4.1.3 Groundwater and Hydrology

Existing Conditions

Domestic water supply along the Kona coast is derived from two sources: direct rainfall catchment and the basal groundwater lens. At the higher elevations above 1,500 feet, the rainfall is normally adequate to furnish a limited catchment supply, however, groundwater provides the only reliable water supply. There are no perennial streams in the project area.

A complete assessment of the existing hydrological conditions in the area of the project site was conducted by Waimea Water Services and is contained within Appendix II-5. Initial hydrological studies (Bowles, 1992) projected that the groundwater recharge for the study area (bounded by the ocean, the 5,000 foot elevation, and lines drawn parallel to the district boundary, one mile to the south and 2.75 miles to the north) may total approximately 60 MGD (million gallons per day). This recharge percolates downward into the high level water, mauka of the project area, into the basal lens at sea level, and then to the sea. Fresh groundwater floats on the underlying salt water at a ratio of about 1 to 40, so that for every one foot of fresh water head (water level of the lens above sea level) there is approximately 40 feet of fresh water below the sea level. The equation is modified by tidal and recharge fluctuations, which produce a thick brackish or transition zone between the fresh water and salt water. The head increases upward away from the shore (inland) at rates normally from one to two feet per mile.

Since 1990, discoveries of high level groundwater have been made in the area mauka of Mamalahoa Highway. High level groundwater has been found in several wells scattered from Kalaoa in North Kona to Kealakekua Bay in South Kona with water levels in excess of the 350 foot elevation verified by pumping wells at Keei and above Higashihara Park at Honalo. At the observation well mauka of Kona Hospital, a water level of over 490 feet has been reported. A well is presently under construction at Kona Hospital.

Based on the initial estimated recharge, the seaward flow of groundwater through the property was calculated to be approximately 11 mgd per mile of shoreline. Recent discoveries made at the onsite exploration well at the 810 foot elevation, however, indicate that this groundwater flow may have been overestimated. Based on estimates from the water level at the exploration well (3.8 feet) and on preliminary water quality data which shows total chlorides of about 340 mg/l, the groundwater flow through the property to the sea is estimated to be in the range of 4 to 6 MGD . The estimated groundwater flow and quality, however, appears to be more than adequate to support the irrigation water needs of the project.

Drilling of the exploration well has suggested the existence of a major hydrogeologic boundary between the Hokukano exploration well at an elevation of 810 feet and the Department of Water Supply (DWS) production well at 1,780 foot elevation near Kona Hospital. Based on the water quality and water level data, it appears that the majority of the groundwater recharge is diverted away from the subject property. The high water level differential between the two wells in a distance of 1.5 miles indicates a geologic structure(s) of relatively low permeability.

Recent offshore bottom surveys along the Kona coast (J.G. Moore, et. al, 1989) have indicated that massive submarine landslides are in evidence along the Kona coast. With the completion of the Hokukano well and the DWS Kealakekua well in 1992, it now appears that not only does onshore faulting exist, more than likely these faults in some way impede or divert the groundwater flow.

There is also a possibility that the high level groundwater, which is present at the wells mauka of Mamalahoa Highway, extends makai of the highway at the upper elevations of the project. On the project lands, the best site for a potable well would be at an elevation of 1,200 feet or approximately 1.75 miles from the shore. At this location, the basal water level should stand at an elevation in excess of 4 feet above sea level. A more precise determination, however, can only be made following completion of the Kealakekua Well and other wells planned in the area.

Potential Impacts

As indicated from Table 3, the average daily water demand for the full development is projected to be 643,000 GPD (gallons per day) of potable water and 1,773,000 GPD of irrigation water. In

Table 3
Estimated Average Daily Water Demands at Buildout

| Potable Water | Units (Average) | Total | |
|---|---|---|---|
| 1440 Housing Units | 400 GPD* | 576,000 GPD | |
| 1 Golf Club House | 20,000 GPD | 20,000 GPD | |
| 1 Golf Maintenance Building | 2,000 GPD | 2,000 GPD | |
| 1 Sewage Treatment Building | 5,000 GPD | 5,000 GPD | |
| 100 Lodge Units | 400 GPD* | 40,000 GPD | |
| | | **Subtotal** | **643,000 GPD** |
| Irrigation Water | | | |
| 150 acres - Golf Course Use | 6,000 GPAD** | 900,000 GPD | |
| 20 acres - Common Landscape | 4,000 GPAD | 80,000 GPD | |
| 75 acres - Agricultural | 2,000 GPAD*** | 150,000 GPD | |
| | | **Subtotal** | **1,130,000 GPD** |
| | **TOTAL WATER DEMAND (DAILY)** | | **1,773,000 GPD** |
| Treated Effluent (70% Estimated Recovery) | | 450,000 GPD | |
| Total Irrigation Water Demand | | 1,130,000 GPD | |
| Irrigation Water Demand if Effluent Used | | 680,000 GPD | |

---

gpm: gallons per minute
gpd: gallons per day
gpad: gallons per acre daily
* County Design Standard
** 30% higher during growing in
*** Assuming drip irrigation crops

Source: Evaluation of Water Resources for Hokukano Project prepared by Waimea Water Services (12/92)

that the project is planned to use treated effluent as a supplemental source of irrigation water for the proposed golf course providing an estimated 450,000 GPD, the total irrigation water requirements from groundwater sources is estimated to be approximately 680,000 GPD. The maximum daily potable water demand is estimated to be 964,500 GPD, which is based on the average daily demand multiplied by 1.5. This figure would also be used to determine the installed pumping capacity for potable wells.

Onsite golf course irrigation wells are expected to produce water with chlorides ranging from 250 to 1,000 mg/l. Water quality will be effected primarily by the elevation of well sites. The water quality from the exploration well located at the 810 foot elevation produced about 340 mg/l chloride water. As noted, wastewater treatment plant effluent is also planned as a source of irrigation water for the proposed project as the salinity of the effluent is generally low enough to be used for irrigation. As proposed, the treated effluent would be from a treatment plant located onsite or from a regional development wastewater plan, whereby processed effluent would be transmitted back to the project site for use. Potential impacts to the groundwater hydrology of the project area could result from increased withdrawal of water resources or through the introduction of potential contaminants in the form of treated effluent used for irrigation and/or fertilizer or biocides used on the golf course and landscaped areas leaching to the groundwater supply.

Impacts to the groundwater resources are not anticipated as the proposed irrigation well at the 810 foot elevation is the only permitted or planned well in the general area, makai of Mamalahoa Highway, as recorded with the State Water Commission or County. The adequacy of the ground water resources to meet the brackish water requirements has been established through an Evaluation of Water Resources, prepared by Waimea Water Services (Appendix II-5). Use of the onsite brackish water source would not impact the availability of potable water resources in the area as there is a considerable distance (approximately 1.5 miles) and geological separation, as noted above, between the onsite brackish well and existing and planned County potable well sources located mauka of Mamalahoa Highway.

The potable water requirements for the proposed project are to be provided through the County Water System. The developer has water commitments from the County under the Kealakekua Water Source Agreement equivalent to 499 units, which is sufficient to meet the requirements of the initial phase of development. The developer has secured additional well site options from the adjoining property owners should additional well sites be required. Those sources developed with

the County as stand alone wells would be turned over to the County for operation and would use the DWS transmission lines to transmit water to the project site. Should additional well sources be required either onsite or in the general area, the location and sizing of wells would be regulated through State well permitting procedures to insure that the proposed well development does not adversely impact existing or planned regional water sources.

Significant impact to the groundwater resources due to the use of treated effluent for golf course irrigation and/or the use of fertilizers and biocides are similarly not expected, as described in section 4.2.3 below.

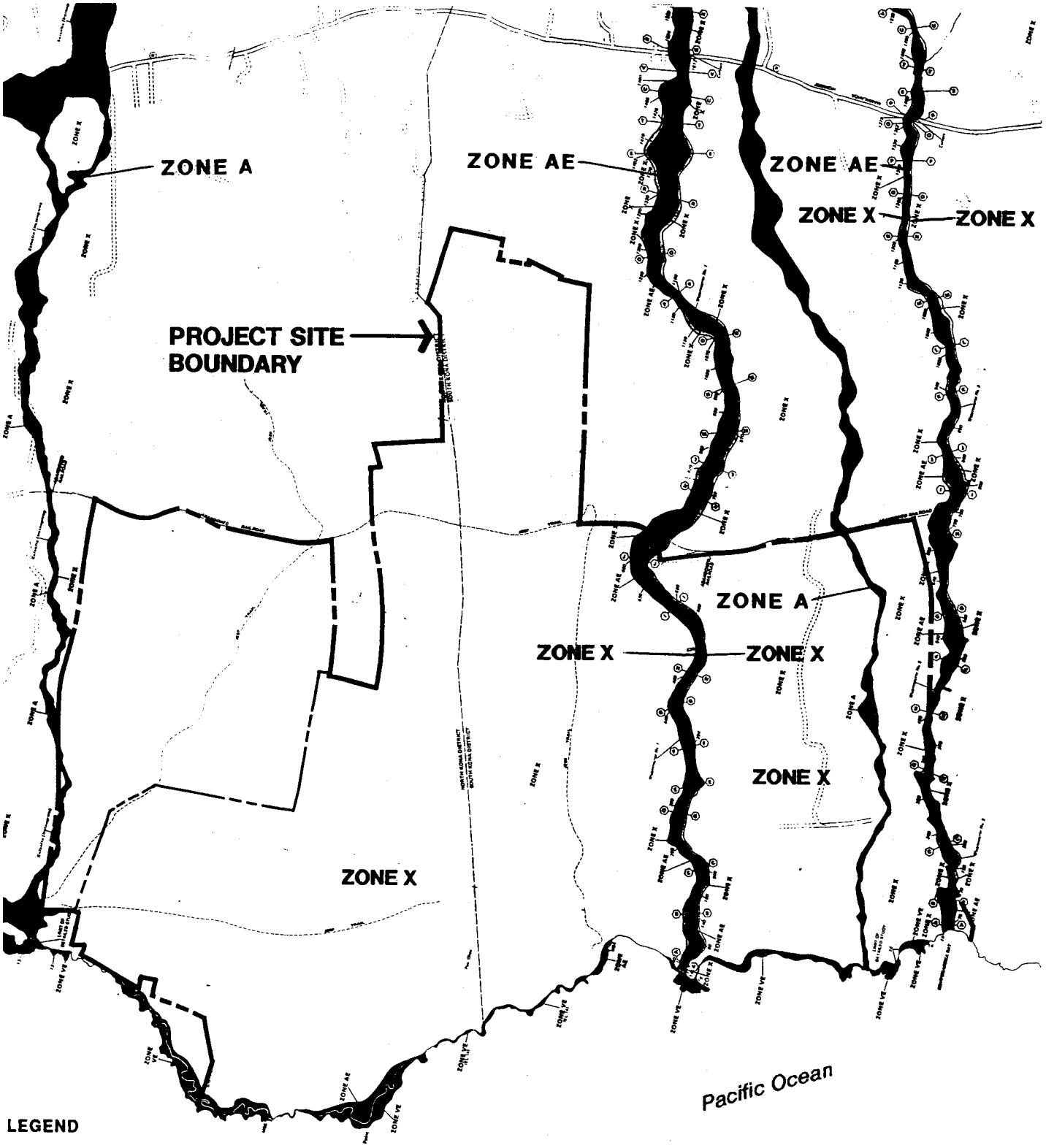
Mitigation Measures

Development of the onsite brackish water system and increased usage of potable water from the County water system is not expected to have any adverse impact on the potable or groundwater resources of the area due to the predicted usage requirements versus the projected quantity available in the basal water resource. Any future well development will need to meet the State DLNR well permitting requirements. In compliance with DLNR, Division of Water Resource Management permitting requirements, brackish water sources developed onsite will require ongoing monitoring and should significant changes to water quality parameters occur, appropriate mitigation measure, including altering or reduction of pumpage rates, would be required.

### 4.1.4 Drainage and Stormwater Runoff

Existing Conditions

Four drainageways touch or cross the project site. The Flood Insurance Rate Map (Figure 15) shows Flood Zone A running along the northern property line and another Zone A traversing the project site near the southern property line. Flood Zone AE traverses the site midway into the southern half of the property and another Zone AE runs along the southern property line. Zone A is defined as areas within the 100 year flood plain where no base flood elevation has been determined and Zone AE is the same, except that the base flood elevation has been determined to be at a specific elevation. Portions of the coastline are also designated with the AE and VE Zones, however, the proposed development would occur significantly inland of these coastal areas so as not to be impacted.




**LEGEND**

| | |
|---|---|
| **ZONE A** | 100 YEAR FLOOD PLAIN<br>BASE FLOOD ELEVATION UNDETERMINED |
| **ZONE AE** | 100 YEAR FLOOD AREA<br>BASE FLOOD ELEVATION DETERMINED |
| **ZONE X** | AREAS OF 500 YEAR FLOOD; 100 YEAR FLOOD WITH AVERAGE DEPTHS OF LESS THAN I FOOT OR WITH DRAINAGE AREAS LESS THAN 1 MILE; AND AREAS PROTECTED BY LEVEES FROM 100 YEAR FLOOD. (ASSOCIATED WITH FLOODWAYS.) |
| **ZONE X** | AREAS DETERMINED TO BE OUTSIDE 500 YEAR FLOOD PLAIN. |

'ce: Federal Emergency Management Agency;
FLOOD INSURANCE RATE MAP-HAWAII COUNTY, HAWAII;
revised Sept. 16, 1988.

FIGURE 15
**FLOOD INSURANCE RATE MAP**
**FINAL ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**

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Potential Impacts

The two drainageways situated within the interior of the site traverse the proposed residential development and golf course and discharge into the ocean. In compliance with County of Hawaii flood zone regulations, plans will ensure that habitable structures are placed outside flood zones or that necessary improvements are made to accommodate development. The most significant impact on existing drainage characteristics will result from the creation of impervious surfaces, primarily parking areas and roadways.

The onsite drainage system will consist primarily of golf course retention/infiltration basins and drywells to dispose of runoff generated from roads. Siltation basins will be constructed, as required, to control runoff water quality, and may be incorporated into the golf course. Runoff generated from rainfall on the golf course may be retained and used to supplement the treated effluent and brackish water used to irrigate the golf course. The golf course runoff will be collected by bowl shaped fairways combined with a drainage tile system that will direct the runoff into the irrigation holding ponds for reuse on the golf course. Roadway and parking area runoff will generally be disposed of through injection wells designed according to Department of Health standards and regulations.

The proposed development and drainage improvements are not expected to impact storm flows within the existing drainageway, as surface runoff will be limited to preconstruction volumes and no offsite drainage improvements are anticipated.

Mitigation Measures

The proposed project is not expected to result in significant adverse impacts to drainage and storm water runoff. To assure that groundwater and nearshore marine water quality is maintained, stormwater runoff generated onsite as a result of the proposed project will be disposed of onsite. As noted above, onsite surface water runoff will be allowed to percolate into the soils of the project site and, if required, sand filters would be used to assist in removing any contaminants that may be present in the surface water runoff. Given the lack of expected adverse impacts, additional mitigation measures are not warranted. The drainage structures and system will be designed, constructed, and operated in compliance with applicable State and County rules and regulations.

### 4.1.5 Natural Hazards

Existing Conditions

Those natural hazards which could have the greatest potential impact upon the physical character of the subject property, aside from storms and strong winds, are volcanic eruptions and earthquakes. Tsunamis are not considered to be a potential threat because the proposed development is planned inland of the coastal area and not within the coastal hazard zones, designated as the "VE" zone by the FEMA Flood Insurance Rate Map.

The proposed project is located on the western slope of Mauna Loa volcano, which rises to a height of 13,679 feet above sea level. The project site is located about 22 miles west of Mokuaweoweo Crater, the volcano's summit, on a prehistoric lava flow, which is estimated to be more than 4,000 years old. According to the United States Geological Survey, Mauna Loa has erupted thirty-two times since 1832. Seven of those eruptions have occurred in the southwest rift zone, that area of the volcano with the greatest potential exposure to the South Kona area. Of those seven eruptions, the closest to the project site occurred in 1950 when a lava flow from the southwest rift zone reached the sea about eight miles south of Kealakekua Bay.

Hazards associated with eruptions can be categorized in four types: lava flows, tephra falls, pyroclastic surges, and volcanic gasses. Volcanic hazard zones have been established for the entire Island of Hawaii, including the South Kona region (Mulleneaux, et.al., 1987). The area surrounding the project site is designated as lava flow Hazard Zone 3 (with Zone 1 being the highest and Zone 9 being the lowest risk), and is characterized by lava coverage of about 5 percent in the past 40 years, and 20 percent during historic times.

Tephra consists of volcanic ash and coarser fragments produced by lava fountaining or explosive eruptions. The project area is located in Tephra Hazard Zone 2. Hazard zones for volcanic gases are the same as for tephra. The project site is located in Volcanic Gas Hazard Zone 2. No threat from pyroclastic surges, which are clouds of ash, rock fragments, and gas that move at high speeds outward from a source vent, has been identified for the project area. Pyroclastic surges are presently associated only adjacent to Kilauea Caldera, although they could conceivably be initiated at other places where groundwater or sea water interact with magma.

The Island of Hawaii experiences thousands of earthquakes every year, usually associated with volcanic activity or the movement of magma at shallow depths. Earthquakes endanger people and property by shaking structures and generating ground fractures, settling, and landslides. Sudden subsidence along the shoreline associated with an earthquake can also generate a tsunami. The two most severe earthquakes during historical times occurred in 1868 and 1975. The magnitudes of both quakes exceeded 7 on the open-ended Richter scale and resulted in local major damage in the Ka'u and Kilauea areas respectively. Both events generated a tsunami, with the 1975 quake creating a tsunami that sank boats in Keauhou Bay.

The most likely threat to the North and South Kona regions would come from a large earthquake (magnitude of 6 or greater) occurring at Mauna Loa or Kilauea. The Kealakekua Fault line is about 1.5 miles from the project site at its closest point along the shore, at which point it extends off shore. In 1951, an earthquake occurred about one mile offshore of the project area caused by movement on the fault. In 1983, a landslide at Kealakekua Bay occurred shortly after a magnitude 6.6 earthquake occurred at a depth of seven miles, approximately midway between Kilauea and Mauna Loa. The most recent large earthquake on Kilauea's south flank occurred in June 1989, with a magnitude of 6.1. This quake, however, caused much less damage than the aforementioned 1975 event.

Potential Impacts

Natural hazards, such as lava flows and earthquakes, could have a direct impact on the proposed project. Based on information developed by the United States Geological Survey (USGS) and published in its Professional Paper 1350 (1987), the likelihood of volcanic eruption at Mauna Loa is remote; one to three percent of the land surface in Lava Flow Zone 3 has been covered by lava during historic times. An eruption at Mauna Loa could also result in thin layers of tephra impacting the project site. Volcanic gases from an eruption might also impact the project site. However, both of these latter occurrences would depend in great part on the size of the eruption, associated fountaining of lava, and wind direction.

Buildings, including residential structures, as well as roadways, sewer, and water lines could be damaged by an earthquake of sufficient magnitude. Landslides triggered by earthquakes are a possibility in the project area, although they would likely occur on the face of the coastal ridge north of Pu'u Ohau rather than on the proposed development area, which would be significantly inland (minimum of 300 feet) from the coast.

Mitigation Measures

The impact of lava flows upon the project site can only be mitigated with the intention of protecting life. The protection of property from lava inundation has proven to be relatively ineffective on a regional scale. Therefore, mitigation of lava flow hazards is limited to the provision of adequate evacuation routes and a civil defense warning system designed to provide area residents with as much advance notice of a threatening lava flow as possible.

Mitigation of hazards associated with earthquakes include adherence to County building codes and standards in order to minimize potential damage to structures. All buildings and structures within the proposed project would be designed and constructed in compliance with applicable building codes and standards.

4.1.6 Air Quality

Existing Conditions

Existing air quality in the vicinity of the project is mostly affected by emissions from natural, agricultural, and/or vehicular sources. The dominant factor for the past several years has been the volcanic haze (vog) from Kilauea volcano which eventually drifts into the Kona and Kohala areas more than fifty miles away. Other natural sources of air pollution that may affect the air quality of the site include the ocean, plants, and wind blown dust. Mamalahoa Highway, located mauka of the project site, is a major arterial roadway. Prevailing onshore winds during the daytime tend to carry emissions from motor vehicles traversing this roadway away from the project site.

Very little air quality monitoring data from the State Department of Health is available for the Kona area. Based on what little data is available, it appears likely that both State and National ambient air quality standards are currently being met despite the persistent vog.

Potential Impacts

Based on an Air Quality Study prepared for this project by B.D. Neal & Associates (Appendix I-5), it was concluded that proper implementation of the project would not exceed State or Federal air quality standards, although there are certain minor impacts that may be realized. Short term impacts from fugitive dust will likely occur during project construction phases. To a lesser extent,

exhaust emissions from stationary and mobile construction equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction.

After construction, depending on the volume of traffic generated and the capacity of area roadways, long term impacts on air quality could potentially occur indirectly as a result of emissions emanating from vehicular traffic coming to and from the development. Access to the project will be accomplished primarily via Mamalahoa Highway, a proposed new bypass road, and the extension of Haleki'i Street. To assess the impact of emissions from these vehicles, an air quality modeling study was undertaken to estimate current maximum ambient concentrations of carbon monoxide along roadways leading to and from the project area and to predict future levels of air pollution both with and without the proposed project. Based on the modeling results, present carbon monoxide concentrations were estimated to be well within both State and National ambient air quality standards. Future scenarios studied included the years 2005 and 2010 both with and without the project. The results of these studies indicated that project traffic through these stages of development would have only a slight negative impact at intersections along the bypass road and would result in improved air quality near the intersection of Haleki'i Street and Mamalahoa Highway. With or without the project, all locations in the area would comply with the National standards. Although there is the potential exceeding the more stringent State standards for carbon monoxide at some point in the future near the bypass/Kuakini Highway intersection, the proposed project would contribute little to the problem. Because the State standards are set at such stringent levels, it is likely that they are currently exceeded at many locations in the State that have even moderate traffic volumes.

Depending on the demand levels, long term impacts on air quality are also possible due to indirect emissions associated with the development's electrical power and solid waste disposal requirements. Quantitative estimates of these potential impacts were not made, but based on the estimated emission rates involved and the relative changes in demands, the attendant impacts are expected to be small. The promotion of energy conservation and recycling programs within the proposed development could serve to reduce any impacts.

Pesticides will be used to maintain golf course grasses. If applied during low wind conditions using proper application techniques, contamination of nearby, downwind areas by airborne drift should not be a problem.

Mitigation Measures

Due to the minimal air quality impacts from projected project related traffic, no measures are recommended to mitigate these emissions other than the roadway improvements recommended by the traffic consultant.

State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with State regulations. Fugitive dust emissions can be controlled to a large extent by watering active work areas, keeping adjacent paved roads clean, covering open bodied trucks, and use of wind screens. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas as early as practical in the construction schedule will also reduce dust emissions. Exhaust emission impacts from construction related equipment can be mitigated to some extent by moving construction equipment and workers to and from the project site during off peak traffic hours.

Although pesticides used on the golf course, if properly applied, should not pose a problem to downwind areas, measures which would provide an added level of protection include:

- Use of shrouded spray equipment fitted with computerized flow controllers;
- Maintaining a buffer distance of at least 100 feet between target spray areas and populated locations; and
- Planting of vegetation screens along populated areas of the golf course perimeter to provide added measures of protection.

4.1.7 Noise Quality

Existing Conditions

The proposed project site is currently exposed to low noise levels of less than 39 dBA, typical of quiet rural and remote pasture areas. The dominant noise sources include wind, birds, and surf.

The only nearby noise sensitive area is the Kona Scenic Subdivision, which currently experiences a background noise level of approximately 41 dBA, typical of quiet residential neighborhoods.

Potential Impacts

According to a Noise Impact Assessment prepared for the Villages at Hokukano by Darby & Associates (Appendix I-6), traffic noise increases along Haleki'i Street due to project generated traffic should offer minimal impact to noise sensitive locations along Haleki'i Street. Traffic noise levels along Mamalahoa Highway, due to the development of the project, are predicted to decrease and, thus, offer no noise impact to noise sensitive locations along Mamalahoa Highway. The traffic noise level decrease along Mamalahoa Highway is attributed to the following:

- The proposed State bypass road will divert traffic from Mamalahoa Highway to the bypass road, thus decreasing the traffic volume on Mamalahoa Highway; and

- The project's proposed lengthening of Haleki'i Street to intersect with the bypass road will divert some local Haleki'i traffic currently using Mamalahoa Highway to the bypass road, thus again decreasing the traffic volume on Mamalahoa Highway.

The dominant noise source during project construction will probably be earth moving equipment, such as bulldozers and diesel powered trucks. Any noise impact from such activity on the existing Kona Scenic Subdivision residential area should, however, be relatively short term. Blasting, if required, could also have noise impacts. However, with the appropriate blast design techniques, the noise from blasting can be controlled within acceptable limits at the closest noise sensitive areas.

According to the Noise Impact Assessment, some of the proposed residential areas closest to the proposed State bypass road may be exposed to future hourly Leq (equivalent continuous noise level) noise levels of greater than the FHWA recommended limit of 67 dBA if less than 50 feet from the bypass road. If residential setbacks from the bypass road of 50 feet or more cannot be achieved, other noise mitigation measures should be implemented to conform with FHWA traffic noise exposure guidelines.

Noise associated with the operation of the proposed golf clubhouse may impact the closest proposed homes if not properly mitigated. Additionally, equipment associated with the grounds

maintenance of the proposed 27-hole golf course may impact nearby homes within the project, however, such activities generally take place during the daytime and are usually of short duration. Therefore, they should not be considered objectionable.

Due to the distance from Keahole Airport, noise from airport activities should not impact the proposed development. Occasional high altitude flyovers of such aircraft as single engine planes and helicopters may be audible at times. However, flyovers should be infrequent and, therefore, their impacts to the proposed development should be minimal.

Mitigation Measures

Given the relatively low noise conditions present on the property, projected noise levels are expected to increase onsite during the short term grading and construction phases. Long term impacts to noise quality in the area would come from increased traffic, golf course maintenance equipment, public address equipment, and the sounds of people talking. It is expected, however, that the noise from these sources would be less than the noise generated by construction activity. However, construction noise would occur generally for short periods during daytime periods and would not be significant, provided appropriate noise control measures are incorporated with the operation of construction equipment. Proposed residential areas should be planned with appropriate buffer areas from the proposed highway bypass that may transect the property in order to mitigate traffic generated noise impacts from this source. Once golf course construction is complete, vehicular noise would generally be distributed evenly throughout the day and limited to daylight and early evening hours with respect to golf course operations. Since long term impacts to noise quality in the area are expected to be minimal and far removed from existing developed areas, mitigation measures beyond the planning and construction phases do not appear warranted.

### 4.1.8 Visual Attributes

Existing Conditions

The existing site characteristics are shown in Figures 16 through 19. The lower portions include large areas of rolling terrain with exposed pahoehoe lava flows and some top soil in the flatter areas between ridges. Vegetation, comprised of keawe, koa haole, grasses, and brush, extends from the coastal area up to the 800 foot elevation (MSL). Above 800 feet to the upper boundary at the

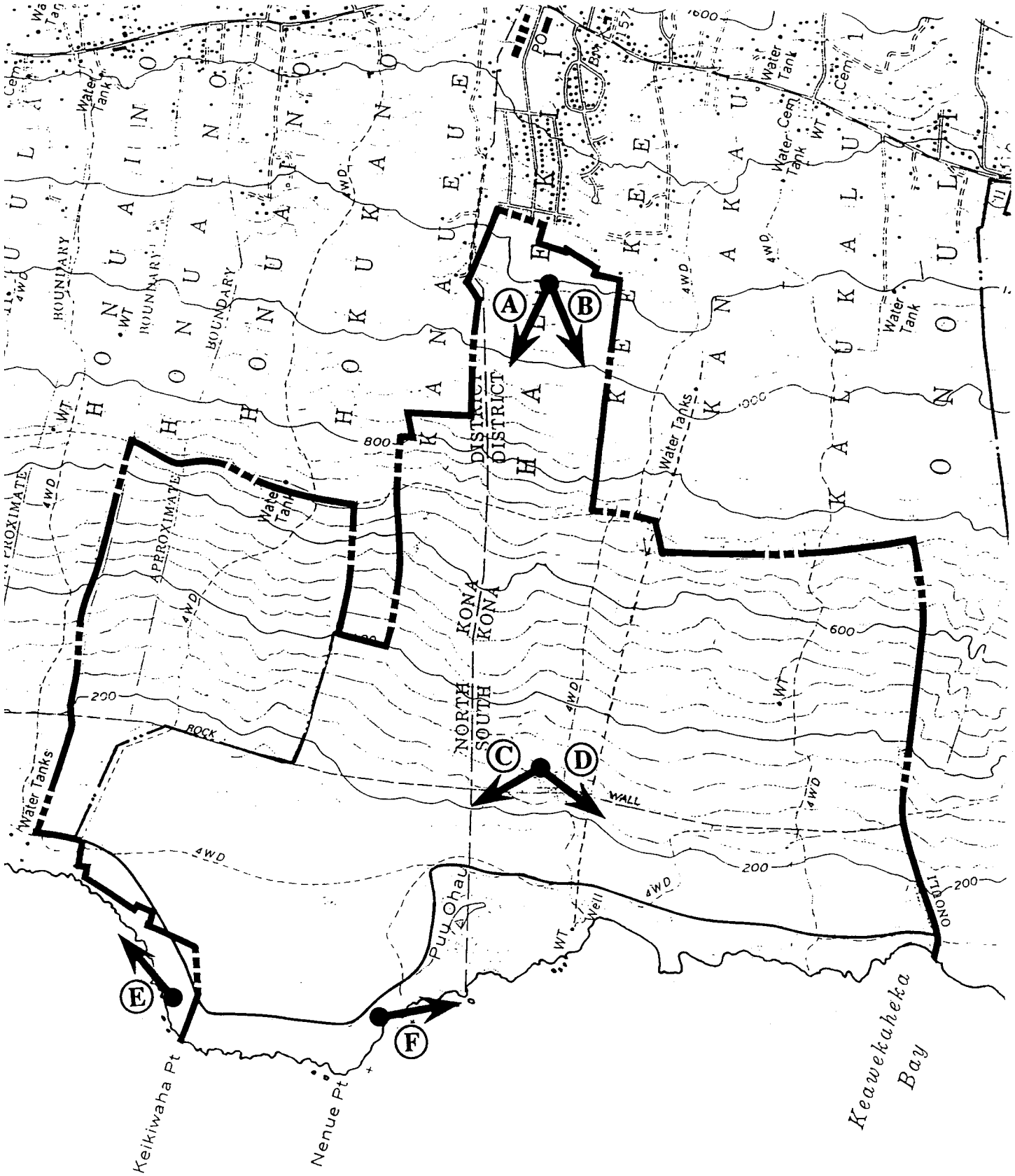


FIGURE 16
**VISUAL KEY MAP**

**FINAL ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**

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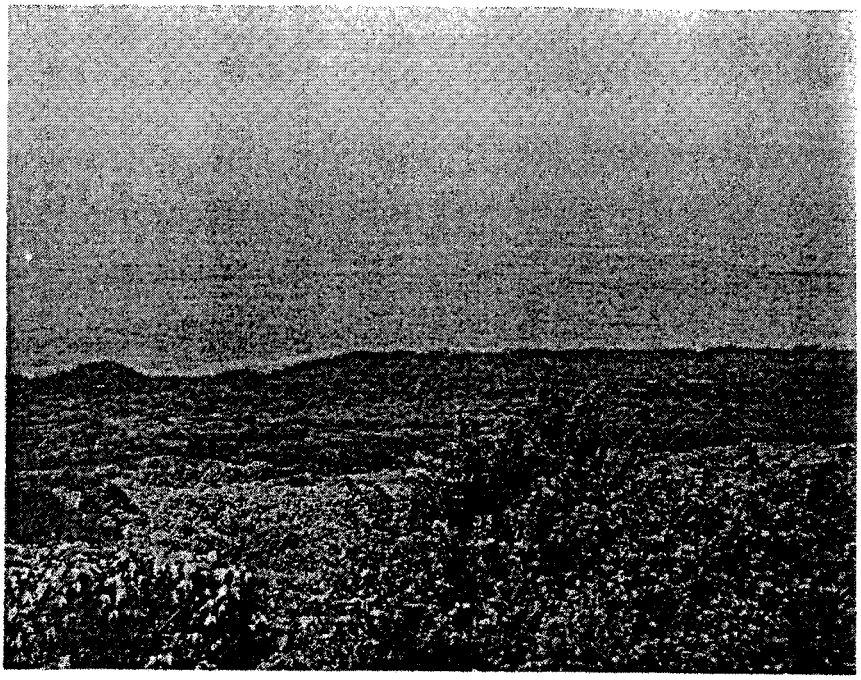
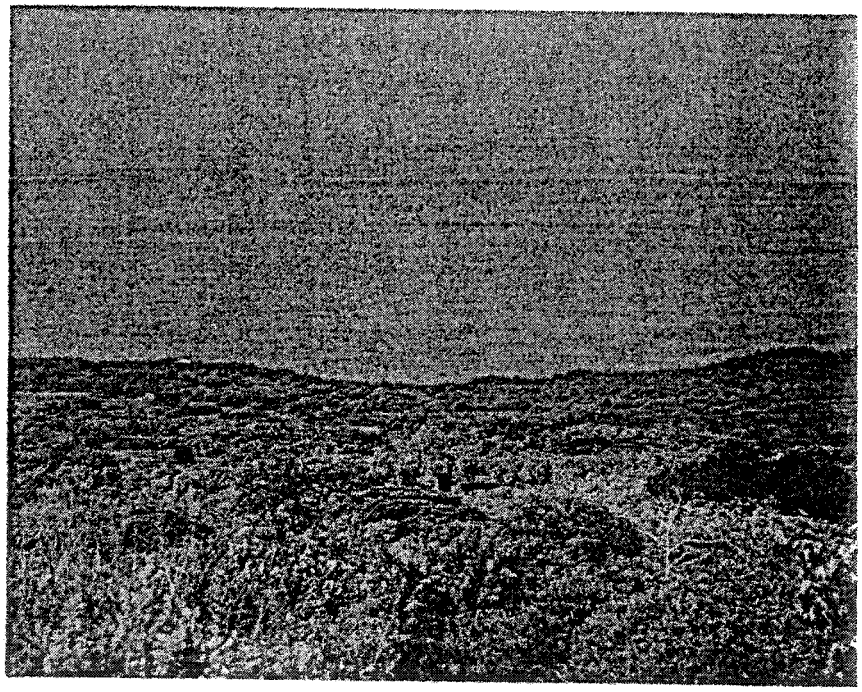


(A) Looking from the top of the property towards Pu'u Ohau (Red Hill).



(B) View to the Southwest from the top of the property.

FIGURE 17
SITE PHOTOS A & B
FINAL ENVIRONMENTAL IMPACT STATEMENT
VILLAGES AT HOKUKANO

NO SCALE

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Ⓒ View Northwest from the middle of the property at Kuakini wall.

Ⓓ View South from the middle of the property at Kuakini wall.

FIGURE 18
SITE PHOTOS C & D
FINAL ENVIRONMENTAL IMPACT STATEMENT
VILLAGES AT HOKUKANO

NO SCALE

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(E) View North along the coast near the "Hokukano Village" site.

(F) View South along the coast at "Coconut beach".

FIGURE 19
SITE PHOTOS E & F
FINAL ENVIRONMENTAL IMPACT STATEMENT
VILLAGES AT HOKUKANO

NO SCALE

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1,240 foot elevation, large kukui and monkey pod trees are found, with typical guinea grass and buffel grass understory. Pu'u Ohau, a prominent land feature located midway near the coast, rises to an elevation of approximately 230 feet. Along the shore is found a rocky coastline with occasional pockets of sand found in the area north of Pu'u Ohau, with steep and occasionally undermined cliffs along the shore, south of the Pu'u. Views of the project site are presently available from limited portions of Mamalahoa Highway, primarily from the southeast beyond the town of Kealakekua, and from portions of the existing residential neighborhoods that are directly mauka of the project site, primarily the Kona Scenic Subdivision. The project site is also visible to those accessing the property along the coast.

Potential Impacts

In the short term, the visual character of the area will be affected by the presence and operation of construction equipment. The heavy construction involved with site preparation and infrastructure development will extend for about two years. The housing construction will be phased over a period of 30 years or more, beginning in 1995.

Construction activities will create some adverse effects on the views of the project site. Construction of the access road and highway improvements, portions of the golf course, residential structures and support facilities may be visible from limited portions of Mamalahoa Highway. Vegetation clearing and grading involved with construction will be visible from surrounding properties, as will the construction of buildings and the installation of utilities. Because the development will be phased, future users of the site will also be exposed to views of construction activities. Some of the construction activities may also be visible from coast and offshore ocean locations.

The most important near term changes in the views of the project will be the construction of the access road, the golf course fairways, golf clubhouse, lodge, and associated buildings. Many of these features will be visible from the proposed bypass road. Cleared vegetation, bared soils in graded areas, and stored construction equipment will be evident during much of the construction period. Buildings and exposed soil and rock surfaces will be visible until the landscape plantings have been established.

Long term visual effects will result from the proposed project when it is completed. Replacing the barren landscape in many areas will be a low density residential development planned around a golf

course and open areas. Because of topographic conditions and existing vegetation, few structures will be visible from most locations along the coast.

Mitigation Measures

Although the potential impact from the proposed project would have a negligible impact on existing views to the shore or mauka from the shoreline, the development will alter the existing natural character of the property. Several measures have been proposed by the developer to enhance the visual characteristics of the proposed project. These include:

- Use of landscaping and architectural style designed to blend the buildings with the visual character of the site;

- Building of the golf course and lodge will be low profile in nature and designed to fit with the existing topography with little alteration to the natural terrain;

- Implementing architectural standards and design guides as part of the CC&R's for the residential neighborhoods in order to maintain a visual cohesion throughout the community and to present a more pleasing visual harmony with the existing natural conditions;

- Maintaining the coastal area (State Conservation District) primarily as a natural open space;

- Providing for a generally low density planned development integrated with generous open space elements in order to achieve a low density rural character that is consistent with the surrounding area;

- Controlling residential development by designating building envelopes within each lot and controlling the landscape improvements that can occur within the lots; and

- Providing opportunities for selected agricultural activities (primarily orchard and ornamental crops) to occur on portions of the larger one to three acre lots.

Additionally, the proposed golf clubhouse and lodge buildings have been planned to fit with the existing land forms and are of a low profile, so as not to impact views to the shore from surrounding areas or from the proposed highway bypass as it traverses the project site. Taken as a whole and combined with sensitive site planning, these measures can ensure that the resulting development presents a minimal impact to the existing visual character of the property.

## 4.2 NATURAL ENVIRONMENT

### 4.2.1 Terrestrial Flora

Existing Conditions

A botanical survey report of the entire 1,540 acre project site was prepared by Evangeline Funk, Ph.D., in November, 1991 (Appendix I-1). The survey described the composition of the vegetation cover and mapped the vegetation types. It also determined that there were no proposed or listed threatened or endangered plant species. At least 98 percent of the area's vegetation was examined. Within the property, four major vegetation types were identified. From the seacoast up to nearly the 700 foot elevation, the prosopis tree with a mixed grass understory is common. Within the central part of the property, koa haole is the second most common vegetation, with a prosopis scrub. Within this area were found three wiliwili trees and the only native plant species, consisting of a colony of Euphorb and 'Akoko (Chamaesyce celastroides), in an area mauka of Pu'u Ohau at the 470 foot elevation. Within this colony was also found a single Maiapilo or Hawaiian Caper (Capparis sandwichiana DC), which thrives in dry, hot locations and has been used as a landscape plant in other sites on the Kona coast. From the 850 foot elevation to about the 1,100 foot elevation, kukui scrub is common. Above this elevation to the mauka boundary are typically found the lantana scrub. Within this area are also found several fruit trees, including mango, avocado, guava, and papaya. In the upper elevations, especially in the southern portion, are found large monkey pod trees, which were planted to provide shade for the cattle.

Potential Impacts

Impacts to the existing flora would result from preparation of the project site for the development of the golf course, golf clubhouse, lodge, residential units, and supporting infrastructure. Grading, cut and fill work, and similar construction activities will impact existing plant cover.

It is anticipated that portions of the site would be left intact where feasible, especially within the Conservation District along the shoreline, in natural buffer areas around the golf course, and in open space areas throughout the residential neighborhoods. Potential impacts to the vegetation of the site will be significant in that much of the existing vegetation will be lost. However, as noted below, the potential adverse impacts will be largely mitigated. Of some concern is the small community of native plants, including the single Capparis. Although none of the plants are considered threatened or endangered, the plants should be preserved if possible, as continued development of the Kona coast will diminish their populations and range in the future.

Mitigation Measures

To offset the loss of existing vegetation, the use of native plant material for landscaping in and around the golf course will be considered, wherever practicable. The native species, such as the Euphorbs, Wiliwili trees, and the single Capparis, would be preserved or propagated and used in the landscaping plan to the furthest extent practical. Many of the Prosopis trees could also be saved and moved to places where they will provide quick shade.

### 4.2.2 Terrestrial Fauna

Existing Conditions

According to the Survey of Avifauna and Feral Mammals at Hokukano by Philip L. Bruner dated October 16, 1991 (Appendix I-2), the existing fauna typically consists of introduced species that are transient in nature. These include the mongoose, cardinal, barred dove, spotted dove, myna bird, golden plover, and house sparrow. Feral dogs, cats, pigs, and rodents are also known to the area. No endemic species were found on the property. Additionally, no unique wildlife habitat was found on this property. The limited number of migratory shorebirds recorded on the site was attributed to the lack of suitable habitat. Endemic birds, such as the short-eared owl or Pueo and Hawaiian Hawk or I'o may forage in this region, however, none were found on or near the project site.

Potential Impacts

The proposed development will cause the disruption of wildlife use of the site. During construction, most birds and mammals will probably migrate to undisturbed areas within the site or

along the coast. Once the project is completed, the more formal open landscape and water features of the golf course portion will contribute to increased habitat diversity necessary for the fauna which are present or frequent the area. In some instances, the greater diversity in plant materials and water features may actually increase the available habitat for several species, primarily the Golden Plover and Ruddy Turnstone. No threatened or endangered wildlife species will be affected by the project, as none occur on the property.

The controlled use of fertilizers and pesticides in golf course maintenance is seen as presenting little or no hazard to birds frequenting the grassed areas or ponds associated with the golf course (Murdoch and Green, 1991). Fertilizers are relatively non-toxic unless ingested in large amounts, and all herbicides and fungicides used in golf course maintenance in Hawaii are of low to moderate toxicity. The only chemicals used in Hawaiian golf course maintenance which are highly toxic to birds are the organic phosphate insecticides, especially chloropyrifos. However, chloropyrifos is strongly absorbed on to the thatch layer of turf and moves little from the site of application.

Because of the absorption of organic phosphate insecticides on organic layers in turf and their rapid breakdown, there is little chance of their movement from grassed areas into the retention ponds associated with the proposed golf course. Label instructions strictly prohibit their direct applications to streams and ponds. In addition, other insecticides with reduced toxicity can be substituted for chloropyrifos with little loss of effectiveness.

Mitigation Measures

No significant impact is expected to occur to any wildlife species on the property; however, several measures are recommended to minimize effects on wildlife during project development.

- Revegetation of cleared areas: Extensive ornamental and native landscape vegetation species can be planted as buffers and perimeter areas. These landscaped areas will again serve as habitat areas for some faunal species.

- Pesticide controls: Use of pesticides should be controlled on the site with special care to avoid any impacts on wildlife. Only those pesticides which are approved for golf courses should be applied. Application should be supervised by the golf course superintendent. (Measures related to limiting the application and managing the use of pesticides is covered in detail in the following section.)

### 4.2.3 Nearshore Marine Environment

Existing Conditions

A Quantitative Assessment of the Marine Communities and Water Quality by Richard E. Brock, Ph.D., was completed in April 1992 (Appendix I-3). In general, the marine communities resident to the waters fronting the Villages at Hokukano are diverse and the fish communities do not show the declines in abundance that have been encountered in many other Hawaiian coastal settings in recent years. No unusual marine species or communities were noted in the study area.

No threatened or endangered species were encountered within the study area, however, several humpback whales were noted well offshore of the site during the March 1992 field effort. Despite not seeing green turtles (a threatened species), it is expected that turtles must, at a minimum, pass through the waters fronting the project site.

In the study area, 24 sites were established to quantitatively assess water quality characteristics. One of the sampled sites was a brackish water pool, the remaining stations sampled marine waters. Based on this analysis, the waters fronting the project site were found to be typical of well-flushed, underdeveloped West Hawaii coastal settings.

Potential Impacts

An analysis of potential impact to marine communities with the development of the Villages at Hokukano suggests that sedimentation during the construction phase of the project may pose potential for negative impacts. However, given the porous nature of the substratum and relatively low rainfall characteristics of the project site, if prudent construction techniques are used (i.e., removing vegetation only as immediately needed, use of temporary settlement basins, etc.), the potential impact to the marine communities due to sedimentation can be largely mitigated during the construction phase.

Long term water quality studies by Brock and Norris, 1988, carried out along the West Hawaii coast at Waikoloa, monitored the changes to the groundwater chemistry for dissolved nutrients, pesticides and herbicides. These changes involved increases in the concentration of inorganic nutrients. Pesticides and/or herbicides were not detected in water, sediments or organisms. Additionally, the changes in the inorganic nutrients all fell within the range of concentrations

encountered at other localities on the West Hawaii coast that have no surrounding development (i.e., completely natural systems). Further, the studies were unable to detect any quantifiable change in the aquatic biota resident to the Waikoloa area. This apparent insensitivity of the aquatic biota to these changes is probably related to: 1) the presence of numerous herbivores controlling algal growth; 2) high dilution and advection rates of incoming high nutrient groundwater; and 3) a probable preadaption of these organisms to waters with highly variable nutrient concentrations. These data suggest that if a similar elevation of nutrient levels were to occur following the proposed development, there should be a similar lack of response by the marine communities to this input. Despite considerable efforts during the quantitative assessment, no anchialine ponds, which are common along the West Hawaii coast, were located on the project site. There is a strong likelihood, however, that anchialine species are present within isolated wells or caves near the shore.

Upon development of the proposed project, it is planned that the public will have increased access to the ocean shoreline by way of a public access road to be provided by the developer leading to a greater pressure on marine resources. This increased pressure could lead to a decrease in the abundance of fish and desirable invertebrates such as lobster and squid. Additionally, some people are inclined to litter and leave wastes behind, befouling the shoreline area and marine environment.

Mitigation Measures

Several measures are being considered by the developer as part of the golf course planning, design, and operation to mitigate, to the furthest extent practical, the potential for nutrients or chemicals associated with the golf course maintenance from impacting groundwater or coastal waters fronting the proposed project. These measures include:

- Implementing an Integrated Golf Course Management Program (Appendix I-7) aimed at minimizing the use of chemicals for golf course maintenance and ensuring safe handling and storage of all chemicals;

- Adopting Hawaii proven biorational pest control methods when appropriate;

- Engineering the golf course with a bowl-shaped fairway construction and with a subsurface drainage system designed to collect stormwater runoff or excess irrigation and conducting this to irrigation ponds for reuse on the course;

- Incorporating a "Reduced Turf" golf course design, which reduces fairway areas and requirements for water, fertilizers and chemicals; and

- Implementing a Water Quality Monitoring and Mitigation Program (Appendix I-4) to ensure ongoing monitoring of soil and coastal water conditions for chemicals used in golf course and landscaping and, if indicated, implementing appropriate mitigation measures.

The Integrated Golf Course Management Program (IGCMP) mentioned above is a comprehensive program intended to coordinate the "best management practices" related to the major aspects of golf course management. Best management practices (BMP) are specific modern measures within the construction and management fields intended to encourage a greater sensitivity to the environment. Relating to golf course development, that focus is intended to produce high quality turfgrass, which is essential to the maintenance of a premium golf course while reducing any negative threats to the environment, especially with reference to water quality. Briefly, the IGCMP covers the following areas of golf course construction and operations:

- Golf course construction
  - General design approach
  - Clearing and grading
  - Construction time frame
  - Erosion and sedimentation control
  - Construction noise

- Golf course turfgrass management
  - Turfgrass management areas
  - Management and personnel
    - Upper level management
    - Golf course superintendent
    - Supporting staff
  - Limitations to culturing turfgrass
  - Major turfgrass management tools
    - Integrated pest management
    - Turfgrass pesticides

        - Biological controls
        - Turfgrass fertilizers
        - Turfgrass irrigation
    - Golf course maintenance facility

- Environmental monitoring
    - Water quality monitoring

In part, the plan contemplates selection of disease resistant turf grasses and the use of certain soil types in suitable quantities to properly absorb nutrients and water. It also involves timing the application of fertilizer and pesticides to prevent rainfall and irrigation water from leaching chemicals to the underlying bedrock formation and groundwater.

Chemicals that may be used for golf course maintenance are not expected to have any adverse impact on groundwater resources given the depth of the underlying brackish aquifer and the natural filtering properties of the soils characteristic of the site. However, the application procedures of the IGCMP will augment the overall precautionary measures contemplated in the plan. One of the goals of the golf course maintenance and management program is to limit the application of chemicals to the minimum required to maintain a healthy landscaped environment. In this way, the potential for over application and leaching of chemicals through the soil column is reduced or, perhaps, virtually eliminated.

The developer proposes the use of lined drainage channels consisting of a tile system designed to collect excess runoff and infiltration. Generally, fairways would be topographically shaped to collect rainfall and irrigation runoff into the tile system and transferred to retention ponds for reuse as irrigation water. This type of water management system will also incorporate a golf course design concept known as "Reduced Turf" to attain a two-fold objective: reduction of water consumption and reduction of chemical applications. Reduced Turf design is often used in desert climates where water is at a premium. It strives to reduce the amount of fairway acreage by retaining the natural land form and vegetation in the area between the tee boxes and the fairways. By design, the overall irrigation area and the amount of fertilizer and pesticide application necessary to maintain the turf is reduced.

In order to ensure that the groundwater quality is monitored for pesticides, fertilizers, and other potential contaminants as part of the IGCMP, the applicant proposes to establish a comprehensive

water quality monitoring program and mitigation plan. In this plan, groundwater will be sampled on a regular basis for potential contaminants. The goal of the plan will be to ensure that primary and secondary lines of control have been successful in protecting water quality. A secondary goal will be to mitigate any problems the monitoring has detected. The success of the monitoring will depend in part on:

- Establishing a water sampling plan according to the requirements of the Department of Health and established protocol;

- Implementing a routine sampling plan designed specifically for the site using modern, accepted technologies, including wells, lysimeters, and other appropriate devices;

- Utilizing appropriate analytical techniques with established protocol by qualified laboratory personnel;

- Establishing a reliable, valid background index of water quality, including the documentation of concentrations of dissolved solids, chlorides, nitrate, phosphorus, and other compounds, as mandated by the Department of Health;

- Accurately comparing background indices with collected data in a timely fashion; and

- Reporting valid results and conclusions or recommendations in an expedient manner.

In the monitoring plan, drainage water samples from an underground collection system and/or lysimeters will be analyzed for contaminants according to established protocol. Lysimeter wells will be located strategically in association with fairways and greens at the upper and lower elevations of the golf course. Analysis of this water will give the first indication of quality change because contaminants should be most concentrated in drainage water. The next analysis point would be water from the groundwater, while the final monitoring points would be coastal water.

In order to be successful, a most important aspect of monitoring will be to establish a valid, reliable background index of water quality for all water sources. That index is what all subsequent analysis will be compared to. It will be equally important to obtain representative samples and conduct analyses according to an established, reliable protocol.

The primary purpose of mitigation would be to prevent the sustained contamination of ground or marine waters by changing management practices. The proposed development will adhere to a water quality monitoring and mitigation plan (Appendix I-4) which delineates the procedures for monitoring, reporting, and implementation of appropriate mitigation measures should significant changes to baseline conditions be detected. By using monitoring in this fashion, a change in water quality attributable to management activities can be readily identified and mitigated.

## 4.3 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

An investigation of archaeological and historic features was conducted on the project site by Cultural Surveys Hawaii (CSH), during the period from August 20, 1991, to January 17, 1992. The survey was conducted to identify and evaluate historic and archaeological resources on properties known as the Villages of Hokukano, and was designed to meet the requirements of the DLNR State Historic Preservation Development Review Process. The quality of significance was evaluated utilizing criteria considerations established by both the Hawaii and National Registers of Historic Places.

Section 7 of Chapter 6E, HRS, established a State historic preservation program to preserve, restore and maintain historic properties in Hawaii in a spirit of stewardship and trusteeship for future generations. The DLNR-HSPD keeps an inventory of known sites in the State of Hawaii, and has the responsibility to serve as the technical and administrative point of contact for all historic preservation issues within the State. For this survey, the developer has submitted all of the inventory forms and the survey report to the DLNR-HSPD for their review and approval. In doing so, the DLNR-HSPD may request additional information to be added to the forms or report and may recommend future action to the developer regarding the treatment of potential historic resources.

### 4.3.1 Historical Background of the Project Area

The Hokukano project area has gone through a number of different phases of occupation and land use. Prehistorically, settlement was focused mainly along the coast in village like clusters. There are no precise population estimates for the prehistoric period in the Kona region. The population for the shoreline area between Keauhou and Ka'awaloa in 1825 was estimated at approximately 3,400 people. A missionary census in 1836 recorded approximately 1,000 people (including children) living between Honalo and Hokukano. The majority of the village clusters within the

project area are situated in areas where access to the ocean is easily obtained. There are permanent habitation sites mauka of the coastal region but they are scattered and situated mainly along the edges of the lava flow that bisects the project area. The majority of the upland areas of the project area, prehistorically, appear to have been utilized for agriculture, as evidenced by the remnants of the Kona Field System. Common agricultural crops cultivated prehistorically and during the early historic period include: within the coastal zone (0 to 500 feet MSL) coconuts, sweet potatoes, and wauke (paper mulberry); and within the upper elevations of the project area (500 to 1000 feet MSL) crops probably consisted mainly of breadfruit, with wauke and sweet potato planted in between the breadfruit.

During the early historic period the project area still had a substantial population situated along the coast with agricultural practices continuing in the upland areas of the project. In the mid-1800's habitation was still situated mainly along the coastal region. A school was opened in the village at Nawawa Bay where, according to Fornander, in 1866 the student population consisted of 71 regular students and 76 students altogether. Rev. Paris also mentions a church at Nawawa, in 1844, that had 44 church members. The Land Commission Award (LCA) Testimony and Register information reflects the coastal habitation and upland agriculture. The general pattern of kuleana (LCA) awards was multiple parcels with a house lot at the coast and one or more parcels inland for subsistence crops. In 1854 a survey description map for Grant 1651 indicated 16 houses in Hokukano Village.

At the end of the 19th century the population within the project area began to decline as families began to move upland along the Mamalahoa highway corridor. The economy of the area was shifting from a subsistence based economy to a market based and export economy. This accounted for the shift of families from the coastal region to the upland area along the new highway corridor. The decline in population was also a reflection of the numerous epidemics that were sweeping through the native populations at this time. This decline continued into the early 20th century, at which point the project area was completely abandoned as a habitation area.

Dr. G. Trousseau and Henry Weeks were two well known foreigners who lived within the project area during the end of the 1800's. Dr. G. Trousseau was a Frenchman from a very prestigious family in France. He came to the islands in the 1870's and was appointed to the Board of Health and as the king's personal physician by King Lunalilo. Trousseau engaged in other ventures including sheep ranching in Keauhou, sugar cane in Hamakua, and ostriches on Oahu. The foundation and well of the Trousseau house is still present along the northern coast just outside of

the project area at Hokukano village. After the house was abandoned it was utilized as a "honey house" for a beekeeping operation associated with ranching concerns (Greenwell). Henry Weeks was employed to haul wood for the Greenwell store. He lived in and worked out of Hokukano Village like Dr. Trousseau.

In conjunction with the decline of the population of the project area there was an increase in cattle ranching in the later half of the 1800's. Other ventures that were attempted within the project area or just mauka of the project area include sheep ranching, beekeeping, sugar cane, and coffee. Additional crops that may have been cultivated within the project area include oranges and pineapple. Cattle ranching has been the main focus of the project area for approximately the last 100 years.

### 4.3.2 Existing Conditions and Methodology

In order to research the historic and archaeological background of the project area, contacts were made with locally knowledgeable persons and resource organizations, such as the Kona Historical Society, historic maps and archives, and public and university libraries. Additionally, site records were reviewed and useful information was obtained from Land Commission Award documents.

For the archaeological study, CSH staff reviewed archaeological survey and site records on file from DLNR-HSPD. CSH also examined aerial photographs, and relevant archaeological publications and reports. This research revealed that approximately 200 acres of the project area were previously investigated by Paul H. Rosendahl, Inc., during an investigation of Pu'u Ehu Estates (Kaschko 1984). Upon review of that document by the DLNR-HSPD, it was determined that because "Hokukano Flats", a section of the Pu'u Ehu Estates project area, had been subjected to an inventory level survey, there was no need for further investigation of that particular area during the present study. However, sites outside of the "Hokukano Flats" area which had been previously described were resurveyed and are described in detail in the present survey (Dr. Ross Cordy, personal communication 1991).

For the archaeological field survey, CSH staff completed a 100 percent pedestrian survey of the project site to determine whether historic properties were present and, if so, to establish their nature and locations. The field archaeologist examined the project area using parallel pedestrian transects spaced at no more than 30 meters apart. Utilizing the pedestrian survey, all archaeological sites were located, described, and mapped. Field documentation included photographs and drawings to

scale of the majority of the sites. In accordance with DLNR-HSPD, all sites were assigned State site numbers, and interpretive evaluations including the archaeological significance and recommended treatment of each site was documented and is shown in Table 1 in Appendix III-1.

An important aspect of the survey was to provide functional interpretations and to apply an initial assessment of significance. The functional interpretations were established on the basis of structural characteristics and in some cases associated artifacts, in conjunction with external correlations with other archaeological studies and interpretations in the general region. Additionally, limited subsurface testing was performed to provide important information regarding the likely function of the sites and chronological information. All collected artifacts and midden underwent laboratory analysis to assess age with dating results. Artifacts collected from the site were placed for temporary curation until a location is chosen for permanent curation by the landowner in agreement with the DLNR-HSPD.

The initial significance evaluations were based on criteria established by both the Hawaii and the National Register. To be significant, an historic property shall possess integrity of location, design, setting, materials, workmanship, feeling, and association, and shall meet one or more of the following criterion:

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

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

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

d) Have yielded, or be likely to yield, information important for research on prehistory or history;

e) Have an important traditional cultural contribution or value to the native Hawaiian people or to other ethnic groups of the State.

Once appropriate procedures have been followed to identify and gather sufficient inventory information to make an initial assessment regarding a properties significance, the report was

prepared and submitted to DLNR-HSPD for their "consensus determination", and at this writing, remains under review. The complete report of the archaeological study, which includes general background information, archival research, analysis, site descriptions, and significance evaluations, and selected site maps is included as Appendix III-1.

### 4.3.3 Archaeological and Historic Findings

During the inventory survey, 807 structural and nonstructural features were identified within the project area and were subsequently organized into 473 sites. The matrix evaluation of the resources surveyed for the Villages at Hokukano is shown in Table 1 of Appendix III-1. From this analysis, 179 sites were recommended for preservation, and of those 179, 17 were recommended for selective preservation. By way of preservation within the project area, the following general recommendations were presented by the consulting archaeologist:

- Preservation of all burial sites. Those sites listed as probable burials should be favored for preservation if burials are found during testing.

- Preservation of all heiaus and sites listed as probable heiaus.

- Preservation of all major lava tube sites, including all tubes containing burials.

- Preservation of selected examples of multi-component habitation sites mauka of the Conservation Area.

- Selective preservation, i.e., preservation of portions of the Great Wall of Kuakini, the distinguishable portions of the King's Trail, the railway bed, and the ahupua'a boundary walls.

- Recommended treatment of sites may change as a result of further study through data recovery. For example, burials may be uncovered during excavations. In this case, preservation would be the favored alternative. Information on functional associations may also be generated in data recovery, which could change the presently recommended treatment.

- Preservation treatment should be in accordance with a Preservation Plan submitted to the DLNR-HSPD and Hawaii County for review and approval. The plans should have two components: short term preservation and long term preservation.

Two hundred eighty-nine sites are recommended for data recovery. Limited subsurface testing was conducted at nine probable and possible burial sites, one agricultural mound complex and within two of the lava tube systems.

Evidence of features associated with the Kona Field System was also present, primarily the rectangular walled fields formed by Kua'iwi walls (walls tending in the mauka/makai direction), which are intersected at various points by walls cross-cutting the slopes. What is presently referred to as the Kona Field System was observed on the early voyages of Captain James Cook and Captain George Vancouver, and has been described as agricultural fields which parallel long and low mounded walls running upslope intersected in places by shorter cross-slope field walls following natural contours. The grid pattern of fields are typically very narrow and greatly elongated rectangles oriented on an axis that is both northeast-southwest and sea-mountain. Evidence indicates that land productivity greatly increases further inland, and suggests that substantial agricultural endeavor took place at higher elevations.

Other features associated with the walled fields consist of intermittent mound concentrations, terraces, and modified outcrops. The survey report notes that although the Kona Field System extended above the 900 foot elevation beyond the mauka boundary of the project area, various historic and modern land modifications, including "chain dragging", bulldozing and stone clearing associated with ranching activities, sugar cane cultivation, and urban activity have apparently destroyed much of the evidence of the field system in this area.

Fourteen sites in the project area are interpreted to be possible heiau or shrine structures, considered as such based on size, presence of formally structured surface areas, elevated surfaces (suggesting altars), and internal features. One major heiau located in the project area is of particular importance. Based on Reverend William Ellis' accounts in Polynesian Resources Hawaii, this heiau is locally known as Ukanipo, and is described by Ellis as follows:

> "On top of a high mountain, in the neighborhood, stood the remains of an old heiau, dedicated to Ukanipo, a shark, to which, we were informed, all the people

along the coast, for a considerable distance, used to repair, at stated times, with abundant offerings." (Ellis 1825: 129-130)

Also of note is the presence of several lava tubes that functioned primarily as burial sites, although some functioned as habitation sites and for refuge during times of war. Almost half of the lava tubes contained some external and/or internal modifications, in particular, refuge related features consisting of surface pavements and walls to conceal the entrance or limit accessibility. In a few, several petroglyph figures are also present, including numerous human forms, a dog, centipede, and possibly a turtle. Remnants of Hokukano Village, a prehistoric Hawaiian fishing village, are located along the coast (within the Conservation District), but outside the project boundaries, on State property.

### 4.3.4 Potential Impacts

Direct impacts to archaeological features located within the project boundaries would primarily be a loss of the features due to excavation and construction, however, the proposed project facilities have been carefully sited to avoid significant archaeological sites and features.

The initial inventory assessment proposes that the appropriate treatment for 179 significant historic sites is preservation, and that 289 sites are recommended for data recovery. The preparation of acceptable detailed treatment (mitigation) plans must be submitted and approved by DLNR-HSPD and the Division's Island Burial Councils must also approve proposed burial treatments. The proposed treatments will be addressed in the preparation of an historic preservation plan which includes buffers and both interim and long term protection measures. It is considered that once the Division agrees in writing with the plan, that the project would result in a "no adverse effect" to the significant historic sites.

### 4.3.5 Mitigation Measures

Mitigation of significant historic sites generally takes one of two forms: 1) preservation, or 2) data recovery. Preservation is accomplished either through site protection as is or through the development of an interpretation program. Those sites that are recommended for selected preservation include the Kuakini Wall, distinguishable portions of the King's Trail, the railroad bed, and the ahupua'a boundary walls. With regard to the King's Trail, in conformance with the recommendations of the consulting archaeologist, the developer plans to preserve the trail in place,

with slight modifications, as necessary. In those areas where there is no evidence of the trail, the developer proposes to reestablish it in the general area where it was once located based on existing map information, historical references, and compatibility with proposed land use. At points where the recreated trail intersects the project roads, appropriate signage and alternate pavement treatment can be used to provide continuity through the project site. It is noted that although "King's Trail" is the common name used for this trail, it is perhaps more properly referred to as as either Ala Loa (Long Trail) or Ala Aupuni (Government Road).

In data recovery, sites have a reasonable amount of their significant information recovered through documentation. Many of the indirect impacts to the significant sites to be preserved can be mitigated to a great degree by access control related to the proposed trail system, which would provide access to the more durable and appropriate sites, as part of an overall interpretive program.

To mitigate potential impacts to the historical/archaeological resources of the project area, the recommendations of the consulting archaeologist which are subject to the approval of the DLNR-HSPD will be followed by the developer. With regard to the possible burials identified within the project area, if they are not preserved "as is", it is required that the procedures of Section 43 of Chapter 6e (Historic Preservation, HRS) be followed. Buildings, roads, infrastructure, and the proposed golf course have been planned to avoid all sites noted for preservation, including appropriate buffer zones. The specific treatment for trails and other features that are designated for preservation would be determined as part of the regulatory approval process, in conjunction with the recommendations of the DLNR-HSPD, Hawaii Island Burial Council, the State Na Ala Hele Trails Advisory Group, and other resource groups. The Mitigation Program for archaeological sites, including plans for site preservation, will require approval by the County Planning Department, in consultation with the DLNR-HSPD prior to issuance of a grading permit for any portion of the proposed development. The developer and consulting archaeologist have been and will continue to work together with local historians, resource persons, and community groups in gaining a full appreciation of the historical and archaeological resources of the project area. It is the developer's intent to incorporate these features into the proposed project through historic parks and interpretive programs, linked with an extensive pedestrian trail system. A further description of the trail system is contained in Section 4.7.4, in reference to proposed provisions for shoreline access.

## 4.4 SOCIO-ECONOMIC FACTORS

This section presents baseline data on population and housing, the social and economic conditions, and employment patterns in the North and South Kona districts. Information on local residents' values and lifestyles is also presented in this section.

### 4.4.1 Existing Conditions

Population

The project area is considered rural in character, with an estimated 1990 population of 7,658 people in South Kona with an average of 22.8 persons per square mile. Approximately 2,595 people live in Captain Cook, 2,373 people live in Honaunau-Napo'opo'o, and about 1,453 live in the community of Kealakekua, with 208 of the people living in that portion of Kealakekua lying in the North Kona district.

Population growth in the district has slowed since the 1970-80 growth rate of 4 percent, to 2.9 percent during the decade from 1980-90 (DBED Statistical Report, May 1991). The moderate growth which has occurred in the district has been attributed to some extent to the urban and resort growth in North Kona (HCGP, 1989, p. 50). Kealakekua's population between 1980 and 1990, on the other hand, maintained an annual growth rate of 4 percent resulting in a 1990 population of 1,453. That portion of Kealakekua within the South Kona district constitutes approximately 16 percent of its total district population, and the portion of Kealakekua within the North Kona district comprises .9 percent of the total district population (extrapolated from 1990 Census of Population and Housing, Summary Population and Housing Characteristics, Hawaii 1990).

Demographic characteristics of the South Kona District (County of Hawaii Data Book, December 1991) show that the median age of residents (34.6 years) and the average number of people per household (2.94) was close to countywide figures (34.3 years and 2.86 people per household) in 1990. A larger portion of South Kona district residents are Hawaiian (24 percent compared to 19 percent in the county), as well as a Asian or Pacific Islander (approximately 65 percent in South Kona district compared to 57 percent in the county). Forty-six percent of the county population is white, as compared with 39 percent in the South Kona District.

## Housing

The total stock of housing on the Island of Hawaii has greatly increased in the past two decades, from almost 19,000 in 1970 to almost 50,000 in 1990. Despite this marked growth in housing, there still exists a housing shortage in West Hawaii. The tightness of the present housing market is demonstrated by a rental vacancy rate of only 3.4 percent in the project area in 1990. The inadequate supply is due to high land costs, the presence of many resort and high-priced market units, and pent-up demand for affordable housing. High prices and a lack of available units help to explain why there appears to be widespread overcrowding and house sharing in West Hawaii. In 1985 there were 1,971 dwelling units in the South Kona District, with 1,846 being single family units, 30 duplex, 80 apartment/condo units, and 15 other units. In 1980, 53 percent of occupancy was in fee, and 47 percent was in rental (HCGP, 1989, p. 50).

The demand for housing has been influenced by several factors. Among them is the trend of decreasing household sizes at National, State, and County levels. These changes are being driven by the aging population, the change in lifestyle, and a variety of other socio-economic reasons. Other factors affecting housing in the North and South Kona districts include economic cycles, inflation, and financing. Of particular importance in the project area is the second home and vacation market.

## Employment

In 1990, the civilian labor force of South Kona amounted to 4,263 persons, of which 4,129 were employed. The unemployment rate averaged 3.1 percent according to 1991 data from the State Department of Labor and Industrial Relations. However, the more recent downturn of the economy has resulted in a significant reduction of construction, tourism, and agricultural activities. According to a conversation with the State Department of Labor & Industrial Relations, the summer 1992 unemployment rate for the Island of Hawaii was estimated at 7.3 percent, as compared to an islandwide average of 3.8 percent in 1990.

## Property Taxes

Both market forces within the study area and government decisions applied Countywide can raise property taxes. Future taxes cannot be predicted with certainty, because they depend on decisions of elected officials as well as market forces. A residential development could conceivably affect the

assessment of nearby properties, either by providing amenities to some immediately adjacent properties or by making the area more valuable to potential buyers, leading to higher market prices.

Socio-Economic Issues and Concerns

Since acquiring the property in 1985, the developer has actively sought the input of community groups and individuals, in part, to assess the perceived social impacts of the project. For example, the developer has met with community leaders, organizations, and neighbors to discuss the project. Several hundred individuals have toured the project site and attended four widely advertised public informational meetings. This process of public involvement and interaction has identified major issues and concerns related to the proposed project. Many of these have been previously discussed in the various technical studies and this EIS, but have been summarized below in the context of social impact. These issues and concerns can be grouped into five general categories as follows:

(1) General Social Concerns

- Rural Character/Lifestyle

  Many residents reside in the area because they value the rural character of the region and want to be sure that new development will not jeopardize this lifestyle. The proposed project and planned densities are intended to maintain a low density, open space character that would blend with the rural character of the surrounding area. Design guidelines for residences are also intended to achieve a compatibility and blending with the character of the surrounding area. Consequently, persons moving into the project will also desire a rural lifestyle and the amenities offered by the project.

- Social Interaction

  Because the proposed project will involve the construction of expensive housing, concerns were expressed that the development would represent more of an exclusive residential enclave and the positive aspects of the development would be enjoyed only by new residents. This distinction between upper and lower incomes is a characteristic of a dynamic economy, yet the opportunity to interact between income groups also exists. Opportunities for greater community interaction can be reinforced by encouraging local employment through job training programs, by improved opportunities for public use of

the ocean park and trail systems, and mutual support of community activities. Participation in schools, churches, businesses, and other interrelated activities will encourage interaction, as well.

- Visual

Although there is no direct socio-economic impact associated with visual alterations to the property, some expressed concern that the property will simply look better if it remains undeveloped. Generally, the property is only seen from the ocean. Once developed, the low density character and enforced design guidelines can even provide a positive visual impact to the project. The natural buffer area along the coast (coastal park) will also provide a pleasant view from the ocean or shore.

- Cultural and Religious Practices

An issue voiced by those in the Hawaiian community is the protection of native Hawaiian rights for the exercise of traditional cultural practices on the property (gathering rights and access to religious sites). Such cultural practices have historically been restricted on the property due to cattle and ranching operations. By improving access to the shoreline and to culturally significant archaeological sites, such practices can be supported and enhanced. The proposed development does not appear to impinge upon such practices that presently occur on the property.

(2) Infrastructure

- Public Infrastructure

One of the most frequently voiced concerns centered on the existing traffic conditions along Mamalahoa Highway. Many individuals expressed support for the proposed bypass road, but also expressed concern regarding the timing of construction in relationship to the proposed development. The potential impacts to residents who might be affected by the proposed alignment was also a concern.

In addressing these concerns, the developer has held public meetings and met with organizations, businesses, agency representatives, and concerned individuals in planning

the proposed bypass road alignment in a manner which does not impact existing residences in the area and is of mutual benefit to all concerned. The developer proposes a construction schedule that would provide access to the project before new homes are occupied.

Additional questions centered on how the project would impact the availability of water and utility services to the area residents. Many questioned whether the project would negatively impact the limited power and water service to area residents. The infrastructure improvements (roads, water, and power) in general will be phased to provide facility improvements in sequence with project related demands. The proposed improvements to regional water and power systems are expected to have additional benefits to the community in upgrading the existing system in relation to area demands.

- Community Services

The issue of additional demands on community facilities and services (schools, parks, hospitals, etc.) as a result of the project, was also expressed. The economic and fiscal analysis has shown that the benefit to the community in additional tax revenues, as a result of the project, far outstrip the projected government expenditures on both the State and County level. Also, the project development buildout is projected to occur over a greater than 30 year period, allowing sufficient time to plan facility improvements in a manner that meets the projected needs of the area. The project is also expected to have a positive impact on recreational facilities in providing additional recreational opportunities in the area (hiking, fishing, swimming, snorkeling, etc.).

- Housing

Some commented that the proposed project, in providing a residential development aimed at the upper end of the market, would do little to address the need for affordable housing for local residents. The availability of housing would be improved directly in two ways. First, over the life of the project, the number of available housing units in the community will increase by approximately 1,550 units, thereby decreasing the demand on the existing housing supply. Secondly, any required affordable units (subsidized by the sale of market units) will be provided to persons who economically qualify in accordance with applicable State and County affordable housing programs. As described in the market

study, there is a significant demand for housing units in all price ranges in West Hawaii. If market units are not developed by the private sector, the price of existing homes would rise as the demand outstrips the supply.

(3) Archaeological Resources

- Cultural Heritage/Significance

Those knowledgeable of the property point to the cultural and historical significance of this area, as evidenced by the number and type of archaeological and historical features on the site. Several expressed concern as to how these features would be preserved and the integrity of related sites would be protected. To ensure that the proposed plan does not significantly impact the cultural heritage and significance of the property, an extensive archaeological inventory was prepared. This inventory was used in the design process to integrate sites into the plan without the destruction of significant sites, and to ensure even the preservation of many sites (nearly 70 percent of those inventoried) that were not considered as significant. Consequently, most sites will be preserved by the project. Input from local resource persons and historians has also been and will continue to be sought in obtaining a more complete understanding of the historical and cultural significance of the area.

(4) Public Shoreline Access

Because the land has been in ranching for the past 100 years or more, access to the shoreline through the property has been limited. The developer's proposed improvements to shoreline access, including an extensive trail system, were largely supported, though concerns were expressed that improved public access to the shoreline not be to the detriment of the quality and character of the shoreline area. Several expressed the need for a managed system of public access. The developer has proposed a management program for the coastal area, coordinated with the State DLNR, to ensure that increased use and accessibility does not adversely affect the area's resources and natural character.

(5) Environmental Impacts

Several residents spoke of the importance of protecting the environment and questioned whether there would be potential impacts to coastal waters from construction activities or from chemicals used on the golf course, agricultural areas, or home landscaping. There is a perception that golf courses, in particular, serve as potential sources of pollution via chemical runoff or seepage to the coastal waters. Although long term studies conducted of resort and golf course developments in Hawaii do not support this premise, there is a concern that protective measures are needed to avoid the potential threat to the ocean environment. In addressing these concerns, the developer has proposed an integrated system of design and management controls aimed at minimizing the potential environmental threats and protecting coastal water quality. A program of water quality monitoring and mitigation is also planned to ensure that potential impacts would be readily detected and, once identified, appropriate corrective measures taken.

4.4.2 Probable Impacts

Population

Preliminary population projections by the County of Hawaii Planning Department show that population in the South Kona district will increase by about 3,000 persons by the year 2010 to a total of over 10,600, representing an increase of about 40 percent. This annualizes to approximately 20 percent per year, which is less than the percent changes for each previous decade (47.7 percent for 1970-80 and 29.5 percent for 1980-90) (DBED County and District Trends in Hawaii, 1990). Because of the many influences inherent in real estate purchases, it is difficult to predict what the racial mix of the projected population will be, and what influence the proposed project will have on that mix. The Market Assessment for the Villages at Hokukano (Appendix IV-1) indicated that the majority of lot buyers at Hokukano (40 percent) are expected to be from the U.S. mainland, of which three-quarters could be from the U.S. West Coast. Hawaii residents are expected to represent about 30 percent of the lot purchasers at Hokukano, and foreign purchasers are estimated to represent 30 percent of the buyer market.

Population impacts, both direct and indirect, were developed by KPMG Peat Marwick as part of their Economic and Fiscal Impact Report (Appendix IV-2). The onsite population impacts of the proposed project can be considered to be the result of three sources:

- Daily Visitors

  - Daytime visitors (including local players) would be those using the golf course or other recreational facilities, non-golfing guests of the members, users of shoreline access facilities, and visitors and residents who dine at the clubhouse restaurant. The average daily visitor population is projected to reach 40 persons in 1997 and increase to 140 persons in 2029.

- Resident Population

  - The total daily resident population will be about 1,670 persons by the year 2029 when completion of 1,440 residential units are assumed to be sold. The resident population is anticipated to be small in 1997, less than 50 residents, but increasing in later years as home construction progresses.

- Employees

  - Direct operational and construction employees would add to the onsite population on a daily basis although most are expected to commute from the general North and South Kona areas. The total number of onsite employees directly involved in facilities construction or operations is estimated to average 330 full time equivalent workers per year, beginning at 190 employees in 1997 and reaching its peak in 2008.

Therefore, the total project population will consist of approximately 2,110 daily residents and visitors (54 percent full time residents, 26 percent part time residents, 15 percent employees and 7 percent guests and visitors). One hundred-eighty onsite operational employees are expected at stabilization. As noted, the above population and employment projections are based on data provided by KPMG Peat Marwick as part of an Economic and Fiscal Impact Study contained within Appendix IV-2.

Housing

Development of the Villages at Hokukano could impact West Hawaii's housing situation in several ways. Temporary housing may be needed to house workers brought in to the island during project

construction. Operational employment at the community could trigger new housing demand to accommodate in-migrant employees and their dependents which could be expected to seek permanent housing in the area. Direct operational employees will generate a need for about 70 additional homes, 47 of which will be needed to meet the demand for new in-migrant households. However, construction employment is temporary and usually does not generate the long term housing demand associated with operational employment. In-migrating construction workers could be expected to seek short to medium term rental units in the general market. Temporary housing for in-migrant construction employees will need to accommodate, on the average, between 140 and 150 workers and their dependents, with up to 180 workers and their dependents during heavier construction periods. That translates to a need for 30 rental units to house the in-migrant population associated with construction activities. At the peak construction employment levels, as many as 140 rental units may be required.

As pointed out in the employment section, most construction and operational employment is expected to be filled by the resident population commuting from North and South Kona. Additional temporary and permanent housing demand generated by the project should not be significant. Conditions of the development approval, however, will require monitoring of this demand and supply of housing stock as the project progresses to ensure future housing needs are met.

The project will be expected to provide provisions for affordable housing meeting the State and County affordable housing requirements. In providing additional housing which can add to the County's primary housing market and affordable housing, the overall impact to regional housing conditions as a result of the proposed project is generally positive and, therefore, additional mitigation measures are not warranted.

Employment

Initial projections show that the proposed development will sustain construction employment over an extensive period for the construction of new facilities and homes. Employment in the operation and support of those facilities will provide permanent full time jobs for area residents. Employment effects may also be classified as being direct, indirect, or induced.

- Direct construction employment

- Employment supported directly by the construction of the facilities includes onsite laborers, operatives and craftsmen, as well as the professional, managerial, sales and clerical workers whose usual place of employment may be elsewhere on the island or in the State. Direct construction employment will be sustained over the more than 30 year project buildout period. Beginning with the initial infrastructure and golf course development, it will phase into the construction of custom built homes.

The total number of direct construction employment was calculated by multiplying the projected number of full time equivalent (FTE) positions generated per year and the projected buildout period of 30 years, its product equaling the number of "person years". The heaviest employment period will be over the earlier stages of the project where major portions of infrastructure, lot development, golf course, clubhouse, lodge, and housing construction will be underway. However, home construction, lot development, and remaining infrastructure development will continue throughout the entire buildout period. The total number directly involved in the various facets of facilities construction is estimated at 4,860 person years over the buildout period. This number equates to an average of 140 FTE direct construction workers per year.

- Indirect and induced construction employment

  - Direct employment of construction workers will stimulate additional employment on the island and elsewhere in the State. Based upon data from Department of Business, Economic Development & Tourism, it is estimated that 1.79 other full time jobs are created for every full time job in the construction industry. Based on this multiplier, 8,700 person years involving indirect and induced jobs supported by direct construction employment will be generated. This equates to an average of about 30 FTE jobs per year on the Big Island and 80 FTE jobs per year elsewhere in the State from direct and induced construction related jobs.

The above numbers indicate that on average, a total of 250 FTE positions annually could be generated from construction activities.

- Direct operational employment

- Direct operational employment would occur at the golf course, clubhouse, members' lodge, and related facilities and through support and maintenance of the residential component of the project that would involve jobs to service over 1,670 residents of the project. It is anticipated that approximately 330 FTE positions will be generated through the golf course/clubhouse operations and facilities administration.

- Indirect and induced operational employment

  - Facility operations at the Villages at Hokukano would also indirectly generate employment elsewhere in the State and County. Based upon employment multipliers from DBED, approximately 110 indirect and induced employment positions can be expected from direct operational employment.

Overall, a total of 330 FTE operational employment positions will be possible at stabilization, adding positively to the local economy with job opportunities for those who live in the area.

Property Taxes

The project is expected to have little impact on residential land values in the surrounding communities of North and South Kona. Property assessments are generally estimated on the basis of properties sold in the same neighborhood and not on the value of homes within adjacent developments, especially if the amenities are not shared. Assessors generally do not assume that the value of new properties automatically carries over to existing ones, nor do they compute the value of residential property on the basis of other properties in the area. Instead, value is estimated on the basis of sales of properties similar in type (e.g., residential), location and amenities.

Recent studies of the value impacts of golf course development and upscale single family residential areas support the finding that value impacts of the project will be limited. Golf and exclusive residential projects were found to have little effect on existing residential areas (Locations, Inc., 1988 and 1989, and Community Resources, Inc., 1988 and 1989b). The two approaches reach similar findings from different analytical starting points. The Locations, Inc., studies dealt with areas such as TMK zones. These studies used quantitative data only. The Community Resources, Inc., studies dealt with both communities and smaller areas and combined quantitative data with expert assessments.

## 4.5 FISCAL IMPACTS

The proposed project is expected to generate significant positive fiscal benefits for the County and State of Hawaii. These fiscal impacts have been evaluated by comparing tax revenues and operating expenditures that are normally borne by the State and County governments. Increased County government revenues would be primarily in the form of real property taxes generated by the improved property. Revenues to the State government would be composed primarily of excise taxes, personal income taxes generated by new employees, and sales tax. New visitors and residents attracted by the project would necessitate expenditures of State and County public resources. In-migrant residents would incur public costs in terms of public safety, maintenance of highways, recreational facilities, health services, education, public welfare, and other government functions. Net revenues, however, are expected to increase at both the State and County levels overall.

### 4.5.1 Government Revenues

New real property tax revenues to the County government are expected to reach $9.8 million as compared to the current property tax of $10,000. About 77 percent of the new County property tax revenue would be from improved single family lots. Additional non-real property tax collections related to fuel, utility, motor vehicle, and other sources attributable to visitor and in-migrant residents could generate another $260,000 per year.

The State will also realize new tax revenues from visitors, residents, and employees. Approximately $2 million might be attributable to general excise taxes on direct and indirect visitor spending and on transient accommodations tax on single family rentals and the members' lodge. A major portion will come from high income in-migrant residents who will be moving to the community and paying State income taxes as well as general excise, employment, and specific taxes. Personal income from direct employment in construction and operations could approach $10.53 million. It is estimated that about $1.16 million would be derived through construction and $1.95 million through operational sources. Overall, an additional $13.64 million in new State revenues are projected.

### 4.5.2 Revenue/Expenditure Analysis

Based on past Hawaii County expenditures for visitor and resident populations, the new service population would require $1.2 million in total expenditures. This means that new County revenues will far exceed new County expenditures, providing about $8.6 million in net additional revenues. The ratio of new County revenues to new expenditures is 8.2 to 1.

The State's per capita government expenditure is estimated at $3,900 per resident and $1,220 per visitor. Applying these factors to the new service population of visitors, community residents, and in-migrant employees, total expenditures of over $4.9 million are expected. Again, State revenues collected are projected to be far greater than that expended to provide for the new service population, yielding net additional revenues of $8.7 million. The ratio of new State revenues to new expenditures is 2.8 to 1. Future tax revenues that will be collected by the County and the State are expected to offset the costs of providing public services for the proposed community. As such, no additional mitigation measures are considered necessary with respect to government expenditures.

## 4.6 INFRASTRUCTURE AND PUBLIC FACILITIES

### 4.6.1 Traffic Circulation

Existing Roadway Conditions

Access to the project site is currently provided from Haleki'i Street, an 80 foot right-of-way that links the site with Mamalahoa Highway. In the vicinity of the proposed project, Mamalahoa Highway is a two lane arterial roadway that is generally aligned in the north-south direction, providing regional access between the areas of Kailua-Kona and Ka'u. The lanes are generally ten feet wide with unpaved shoulders. The posted speed limit for the area is 30 miles per hour (mph).

Haleki'i Street is a two-lane local roadway serving the post office, commercial businesses, and the Kona Scenic Subdivision. Haleki'i Street is generally aligned in the east-west direction. Haleki'i Street is approximately 34 feet wide with two foot gutters and sidewalks on both sides. Parking is permitted on both sides of the street. On its mauka end, Haleki'i Street intersects with Mamalahoa Highway, forming the stop controlled stem of the "T" intersection. Dedicated left and right turn

lanes, as well as an acceleration lane, are provided. The posted speed limit on Haleki'i is 25 miles per hour.

Existing Traffic Conditions

A Traffic Impact Study was prepared by Parsons Brinckerhoff Quade & Douglas (PBQD) (Appendix II-1) in which existing and future roadway conditions along Mamalahoa Highway in the vicinity of the project were evaluated to determine the traffic impacts of the proposed development. The description of existing conditions is based on peak hour traffic turning movement counts and field observations taken along Mamalahoa Highway at its intersection with Haleki'i Street. The counts, taken on June 25, 1992, were adjusted to reflect traffic volumes during the school year for the morning peak hour.

Intersection capacities usually control overall roadway capacities. Traffic conditions were, therefore, evaluated at the Mamalahoa Highway/Haleki'i Street intersection using the methodologies for unsignalized intersections. Segments of Mamalahoa Highway, north and south of the Haleki'i Street intersection, were also analyzed.

Roadway and intersection operations are typically expressed as a qualitative measure known as Level of Service (LOS). These levels of service are expressed as letter designations from A to F, with LOS A representing the best operating conditions and LOS F the worst. The unsignalized intersection capacity analyses revealed that the left turn movement from Haleki'i Street onto Mamalahoa Highway operates at LOS E during both the morning and evening peak hours. The right turn movement operates at LOS A during the morning peak hours and LOS B during the evening peak hours. The left turn movement from Mamalahoa Highway to Haleki'i Street operates at LOS A during both the morning and evening peak hours. Roadway capacity analyses on segments north and south of Haleki'i Street reveal that Mamalahoa Highway presently operates at LOS E during both the morning and evening peak hours on segments north and south of Haleki'i Street.

Traffic signal warrants were also evaluated at the Mamalahoa Highway/Haleki'i Street intersection, following criteria outlined in the Manual on Uniform Control Devices (MUTCD). These nationally accepted traffic signal warrants have been established to aid in identifying locations that justify traffic signalization. A review of traffic signal warrants at the Mamalahoa Highway/Haleki'i Street intersection for existing 1992 conditions indicated that existing traffic volumes marginally meet the

peak hour volume traffic signal warrant during the evening peak hour at the Mamalahoa Highway/Haleki'i Street intersection.

The Hawaii County General Plan shows a north-south highway alignment which crosses the project site in the upper portion at approximately the 800 foot elevation (Figure 20). The alignment has been studied by the State Department of Transportation (DOT) for a proposed highway. This highway is to be designed to accommodate four lanes of traffic within a minimum 150 foot right-of-way. The proposed basic design criteria recommendations include a design speed of 60 miles per hour, partial access control, and a principal rural arterial highway classification. The exact location of the proposed State highway alignment has not been finalized.

Future Traffic Without the Project

The Traffic Impact Assessment conducted by PBQD indicates that, without the proposed project or roadway improvements, Mamalahoa Highway would reach capacity conditions by the year 2005. Future traffic conditions, however, will be affected by the proposed Mamalahoa Highway bypass that would traverse the mauka portion of the site. As shown in Figure 20, the proposed alignment would begin north of Honalo and terminate at about the Napo'opo'o Road intersection by tying back into the existing highway. The proposed bypass has been planned to divert a portion of the through traffic from Mamalahoa Highway to relieve the current congestion at peak times in the villages, at Konawaena School, and at the Kona Hospital. When the bypass is completed, most of the project traffic is anticipated to use this alternative with the exception of those needing to frequent area businesses along Mamalahoa Highway.

Future Traffic With the Proposed Development Plan

The Traffic Impact Study forecasts that, with the proposed project, the proposed bypass road will reduce volumes along Mamalahoa Highway, therefore improving operating conditions at the existing Haleki'i Street/Mamalahoa Highway intersection. The Traffic Impact Study further projects that if forecasted conditions are realized, improving the bypass road to a four lane road is recommended by the year 2005, and signalization of the Haleki'i bypass highway intersection may be warranted pending the phasing of the development to facilitate left turn movements. All approaches to the bypass road/Haleki'i Street intersection are recommended to have separate through and turn lanes.

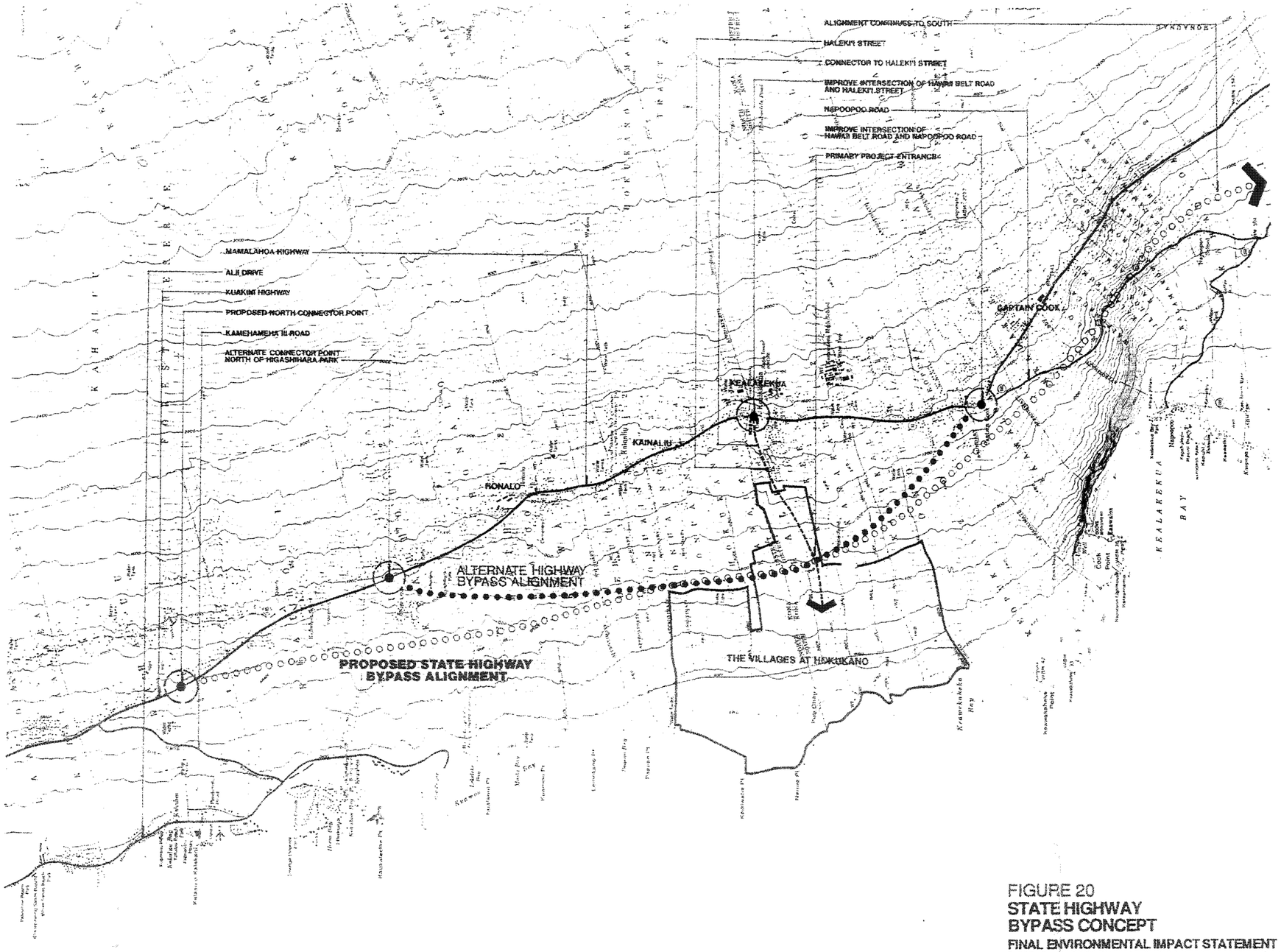


FIGURE 20
**STATE HIGHWAY BYPASS CONCEPT**
FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANO**

0 2200 4400 FEET 6/93 PBR HAWAII

With the construction of the proposed project, the applicant expects to participate with the State and other landowners in the planning, design, and construction of the highway bypass.

Analysis of Impacts

Traffic conditions with the proposed development were analyzed for the years 2005 and 2010. As there are no long range traffic volume forecasts beyond the year 2010, assumptions were also made regarding traffic volume increases in the year 2034, when the proposed development is expected to reach buildout.

The analysis of traffic conditions in the year 2005, when Phase I of the proposed development is expected to be completed, assumes that the bypass road will be fully constructed as a two lane facility, and access to the project site would be provided through the cross intersection of the bypass road and Haleki'i Street. It is also assumed that this intersection will have separate through and turn lanes on each approach. This analysis indicates that Mamalahoa Highway, north of Haleki'i street, would operate at LOS C during both morning and evening peak hours. South of Haleki'i Street, Mamalahoa Highway would operate at LOS D during morning peak hours and LOS C during evening peak hours. At the bypass road/Haleki'i Street intersection, unsignalized intersection analyses reveal that eastbound left turn movement from Haleki'i Street onto the bypass road southbound would operate at LOS E during the morning peak hour and LOS F during the evening peak hour. All other movements at the intersection would operate at LOS B or better during both the morning and evening peak hours.

Using MUTCD criteria, traffic volume analysis at the bypass road/Haleki'i Street intersections indicates that the project peak hour traffic volumes will marginally meet the peak hour volume traffic signal warrant during the morning peak hour and would meet the warrant during evening peak hours. However, signalization of this intersection would result in an under capacity operation during both morning and evening peak hours. The roadway capacity analysis performed for a two lane segment of the bypass road south of Kuakini Highway reveals that the bypass road would operate at LOS E during both morning and evening peak hours for the year 2005. However, both the bypass road/Kuakini and bypass road/Mamalahoa Highway intersections would operate under capacity with the project traffic as signalized intersections.

The proposed development will include additional single family residential dwellings by the year 2010; therefore, analysis was also conducted for the year 2010 to assess traffic impacts, again

assuming that the bypass road remains a two lane facility. Roadway capacity analysis conducted reveals that, both north and south of Haleki'i Street, Mamalahoa Highway would operate at LOS D during the morning and evening peak hours. At the unsignalized Mamalahoa Highway/Haleki'i Street intersection, left turn movement from Haleki'i Street would operate at LOS D during the morning peak hour and LOS C during the evening peak hour. Unsignalized intersection capacity analysis performed at the bypass road/Haleki'i Street intersection reveals that the eastbound left turn movement from Haleki'i Street onto the bypass road would operate at LOS F during both the morning and evening peak hours. Westbound left turn movement from Haleki'i Street would operate at LOS F during both morning and evening peak hours, as well. However, if signalized, this intersection would operate under capacity during both morning and evening peak hours.

Signalized intersection capacity analysis reveals that the bypass road/Kuakini Highway intersection would operate near capacity during the morning peak hour and under capacity during the evening peak hour, while the bypass road/Mamalahoa Highway intersection would operate under capacity during both the morning and evening peak hours. The bypass road north and south of Kuakini Highway would operate at LOS E during both the morning and evening peak hours.

As mentioned earlier, long range traffic volume forecasts are not available beyond the year 2032, when expected project buildout would occur. However, it can generally be assumed that as the North and South Kona areas reach development buildout, overall increases in regional traffic will taper off with relatively low annual growth. Assuming this occurs, the additional external trips generated by later phases of development at the Villages at Hokukano, can be accommodated by the reserve capacity of a four lane bypass road.

Mitigation Measures

The project will be developed in phases to provide facility improvements that are commensurate with increased traffic generated by project development, thereby reducing the potential for adverse impacts to traffic conditions in the project vicinity. Furthermore, the applicant intends to participate in construction of the new highway bypass to divert a portion of the through traffic from Mamalahoa Highway, relieving current congestion at peak times in the village, at Konawaena School, and Kona Hospital. This bypass would increase capacity and reduce congestion through the Mamalahoa Highway corridor by providing an alternative route between Kamehameha III Road/Kuakini Highway and the City of Refuge Road. The completion of the bypass road would also improve operations at the Mamalahoa Highway/Haleki'i Street intersection. Additional traffic

generated by the buildout of the Villages at Hokukano between the years of 2010 and 2034 is expected to be accommodated by the reserve capacity of the proposed four lane bypass road.

The project roadways will be designed according to County of Hawaii subdivision standards and will meet County dedicable roadway criteria to the extent possible. The roadways will be laid out to facilitate grading, utility, and lot design. Particular care will be exercised in the roadway layout in order to preserve significant archaeological and historical features and to minimize potential impacts to natural topographic conditions.

The main collector roads will be constructed within 60 foot right-of-ways. While meeting County standards for paving and right-of-way width, the developer will explore with the County roadway features designed to maintain the rural character of the area and aesthetic theme of the development. The minor streets will also be designed using County of Hawaii paving design criteria and will generally be constructed within 50 foot right-of-ways.

### 4.6.2 Water Source

Existing Conditions

The nearest County water line in the vicinity of the project site is an 8" line in Haleki'i Street, which is adjacent to and east of the proposed development. This 8" line is fed by another 8" line along Mamalahoa Highway. The closest existing storage tank is the .25 million gallon Haleki'i Tank located mauka of Mamalahoa Highway. The availability of potable water to the project site is presently limited due to a lack of County infrastructure, however, the DWS is currently developing additional wells in the area. An exploratory well constructed mauka of Mamalahoa Highway in the vicinity of Kona Hospital verified the presence of high water levels (exceeding 490 feet) at this location, indicating a sizeable groundwater resource.

Potential Impacts

The project has water commitments from the County under the Kealakekua Water Source Agreement, equivalent to 499 units. These commitments are sufficient to meet the initial phase of development. Additional water sources will be needed to address the maximum daily demand of the full development. Based on previous agreements by other developers with the DWS, those sources would be developed together with the County of Hawaii as stand alone wells. The wells

would be turned over to the County for operation and would use DOW transmission lines to transmit the water to the project site. The developer has secured additional well site options from adjoining property owners as potential well sites, should additional sources be required to meet the full project demand for potable water beyond those shown.

Mitigation Measures

The DWS applies a maximum daily water demand factor of 600 GPD per unit for residential domestic consumption. Using this guideline and actual water consumption rates of other golf related facilities (clubhouse, lodge, etc.), it is estimated that the project will require approximately 964,500 GPD of potable water. In addition to domestic consumption, the water system must be sized to accommodate fire flow ranging from 500 GPD to 2,000 GPD, depending on the use and construction type.

It is anticipated that one or more potable water reservoirs will be required to serve the development. It is the developer's intention to design the water system to be dedicable to the DWS, if practical. The location of an adequate and reliable water source, along with the general transmission, storage, and distribution system requirements, will need to be identified at the time of rezoning and subdivision approvals. In order to ensure that the water system will be acceptable to the County, the storage tanks and water lines must be sized to meet domestic consumption guidelines and fire flow requirements.

Irrigation water for agricultural and golf course uses is planned to be developed and distributed in a separate system from the potable water supply. Separate wells, storage facilities, and distribution lines will be required to supply the irrigation water. Overall water supply considerations are addressed in the Groundwater and Hydrology section of this EIS (Section 4.1.3).

### 4.6.3 Wastewater Treatment and Disposal

Existing Conditions

At the present time, the project site is not serviced by a municipal wastewater treatment system. Because the property is vacant and was historically used only for grazing, no private sewage disposal system exists, such as cesspools or septic tanks. Homes in the vicinity of the project site are serviced by cesspools, as the nearest existing sewage treatment plant is the Heeia plant in

Keauhou which does not provide service to the Captain Cook or Kealakekua areas. There are no known plans to extend this plant to provide service in these areas.

Potential Impacts

A preliminary engineering study prepared by R.M. Towill Corp. (Appendix II-4) indicates that the proposed Villages at Hokukano project will generate an average of 532,800 GPD of wastewater, with a maximum flow of 1,918,080 GPD upon buildout. The composition of this wastewater is expected to be within normal range for residential and some commercial (golf clubhouse and lodge) sources.

The developer is currently examining two alternatives for the treatment of wastewater. The first is to develop an onsite wastewater management system that would consist of a collection and treatment plant with disposal of effluent from golf course irrigation. The collection system would include gravity sewer lines ranging in size from eight to twenty-one inches, three pump stations, and a force main ranging from six to ten inches. The treatment plant would consist of a sequencing batch reactor (SBR) facility and a tertiary treatment, which should achieve Class A reclaimed effluent for use as irrigation water in accordance with DOH guidelines. The SBR is the preferred system of choice because of its ability to be installed in increments; thus, it can be flexibly constructed in concurrence with the various phases of the project's development.

It is estimated that 100 percent of the Class A reclaimed water can be utilized to irrigate the golf course. The difference between the estimated sewage generation rate and the effluent necessary for golf course irrigation can be made up by using fresh, brackish, or non-potable water. Effluent holding ponds would be impervious and periodically monitored for leakage into the subsurface.

The second alternative that the developer is currently investigating involves a collection system onsite with treatment offsite at the existing Heeia Wastewater Treatment Plant (HWWTP). The collection system would be similar to that contained within the first alternative, however, this alternative would require offsite sewage system improvements, which would consist of approximately 24,000 linear feet of pipe, five additional pump stations, for a total of eight, and a force main. The HWWTP has a capacity of 7.2 MGD, and is currently treating 0.4 MGD. The additional effluent to be generated by the proposed development at buildout does not appear to substantially diminish the capacity of the HWWTP, especially when taking into consideration that the project is designed in increments such that buildout will not occur until 2034.

The feasibility of this alternative is dependent upon availability of the transmission line alignment and excess capacity in the future at the HWWTP. Other factors to be taken into consideration with this alternative include: obtaining agreements with Kamehameha Development Corp. (HWWTP); financial obligations, such as land acquisition costs, facilities charges and cost sharing assessments; and the availability of easements that would provide access to the transmission system and the force main. It is possible that construction of the bypass road, as discussed in the previous section, could reduce the amount of service roads necessary to provide access to the sewer transmission lines. Construction of the wastewater treatment facility is not anticipated to result in any adverse impacts to the environment, provided the facility is properly operated with appropriate safeguards and emergency generating capacity in the case of power outages.

Mitigation Measures

If the first alternative is chosen, the design, construction, and operation of the wastewater treatment plant will conform with all applicable State and County health and sanitation standards. The system, to include all gravity sewer lines, pump stations, force main, and the sequencing batch reactor (SBR) facility, would all be carefully sited to minimize visual and acoustic impacts. Furthermore, the placement of these will be closely coordinated with the consulting archaeologist to avoid disturbing any archaeological sites.

Design of the wastewater treatment plant could incorporate emergency response methods to deal with possible equipment failure, such as emergency standby generators. The combination of qualified operators, programmed preventative maintenance, and planned onsite availability of critical spare parts will also minimize the potential for adverse impacts due to equipment failure. Preventative maintenance by skilled wastewater treatment plant operators is recognized as essential to avoid equipment failure and, as such, will be an integral part of the system's upkeep and management. The wastewater treatment plant would not have an ocean outfall system to bypass sewage to the ocean, as the developer recognizes that this is an inappropriate emergency method.

Should the second alternative be implemented, the collection system and transmission lines will comply with all State and County health standards, and offsite improvements will be carefully examined to ensure that the issues of property ownership, existing land usage and development, archaeological sites, and easement availability are all addressed.

### 4.6.4 Solid Waste Disposal

Existing Conditions

Solid waste from the communities surrounding the project area is collected by the County from both the Napo'opo'o and Keauhou Transfer Stations, and transported by truck to the County landfill at Kealakehe, just north of Kailua-Kona. As this landfill is near capacity, a new landfill at Puuanahulu is anticipated to open in September of 1993. As an interim measure to extend the life expectancy of the Kealakehe landfill, the County Wastewater/Solid Waste Division is backhauling waste from the Kohala District to the Hilo landfill.

Probable Impacts

Applying the refuse generation rate of six pounds per capita per day used in the West Hawaii Sanitary Landfill EIS, 1992, the buildout population of the project would generate approximately six to seven tons per day. Based on the incremental development of the project and the scheduled opening of the new landfill, sufficient waste disposal capacity should be available to accommodate the project. The proposed site is also anticipated to accommodate a greenwaste composting facility and other solid waste recycling and reuse facilities.

Once the golf course construction has been completed, it is anticipated that a minimum of solid waste, primarily associated with the restaurant, snack bar, and office operations, would be generated. These, in addition to the residentially generated waste, would be collected and disposed of by a private contractor.

Mitigation Measures

Green waste from the golf course operation is planned to be composted or otherwise disposed onsite, thus reducing the volume of solid waste to be landfilled. A solid waste disposal plan will contemplate onsite use and disposal of lawn and landscape trimmings. It is noted that the new West Hawaii landfill will also accommodate a green waste composting facility with the capacity to include other solid waste recycling and reuse facilities onsite, as appropriate. The developer will also investigate the possibility of establishing a recycling program, perhaps in concert with the surrounding community, in an effort to reduce solid waste volumes.

### 4.6.5 Power and Communication

Existing Conditions

Electrical and telephone service is provided by Hawaii Electric Light Company (HELCO) and Hawaiian Telephone Company (HTCO). A 69 KV transmission line is located along Mamalahoa Highway and links the Captain Cook substation to the electrical generating facility near Keahole Airport. Both HTCO and HELCO anticipate that normal power and communication services can be provided to the project site from existing and planned facilities.

Probable Impacts

HELCO anticipates that a substation will be required to serve the project. Substation installation will require that existing 69 KV lines along Mamalahoa Highway must be extended to a 62,500 square foot lot substation site, which could be located along Mamalahoa Highway. The onsite electrical and communication systems will be underground facilities with the exception of the 69 KV electric lines from Mamalahoa Highway to the proposed substation site.

At the current projected buildout rate, Villages at Hokukano would take over 38 years before reaching its maximum electrical load forecast of 13 MW. The gradually increasing demand should be offset by the incremental development of power supply, given the limited number of homes that will be built each year. An incremental load forecast was prepared on the assumption that one-fourth of the total homes built each year will be on large acreage lots and that the remaining homes will be on lots of less than one acre. It also assumes that the golf course and lodge will be fully operational. The projection, found in the Preliminary Electrical and Communication System Analysis prepared in November, 1992, by Ronald N. S. Ho & Associates, Inc. (Appendix II-2), shows that maximum demand would be approximately 5 MW by the year 2008, increase to 8.3 MW by the year 2020, and begin leveling off to 11.5 MW by the year 2032. By this time, about 200 lots would remain unbuilt, based on the buildout schedule provided by KPMG Peat Marwick.

By the year 2011, HELCO plans to deliver a total generating capacity of 350 MW and anticipates a demand of 305 MW, including the proposed project, providing a 13 percent surplus in generating capacity over peak demand, thereby assuring an adequate amount of electrical supply to meet the project's needs. Recent information provided by HELCO shows current generating capacity at 181 MW and a present peak demand of 151 MW. By 1999, HELCO plans to have the proposed 56

MW combustion turbine at the Keahole generating station at full capacity, expects to have the 25 MW geothermal plant on line and an initial phase of 20 MW operating at the West Hawaii combustion turbine station. These capacity additions, offset by the planned retirements of older stations, will raise net generating capacity to 244 MW. The forecasted peak demand of 203 MW will provide a seventeen percent surplus in generating capacity over demand in 1999.

The offsite improvements necessary to serve the development should not have any adverse impacts, as these are maintained on an ongoing basis by the respective utility companies, and should cause them no undue hardship. Some impacts to ambient air quality are anticipated, however, according to a study conducted by B. D. Neal & Associates (Appendix I-5), the attendant impacts are expected to be negligible.

Mitigation Measures

The Electrical and Communication System Analysis indicates that onsite facilities for the utility systems should have minimal impact on the environment. Noise, aesthetic considerations, safety hazards, and loading impacts will be within normally applied guidelines. Energy efficient and conservation measures to reduce the maximum electrical demand will be considered for implementation into the project where feasible. These will include power factor corrections, the use of energy efficient pumps, and scheduling certain types of loads to run during off peak hours whenever practical. Further efforts to minimize energy consumption may include implementation of select items from the "Hawaiian Design Strategies for Energy Efficient Architecture" published by the Energy Division of the State of Hawaii Department of Business, Economic Development and Tourism. Energy conservation measures that should be considered and evaluated based on the potential for live cycle costs savings include:

a) Siting buildings to minimize the heat loads and to effectively utilize natural breezes for indoor and outdoor living and recreational spaces.

b) Use of high-efficiency light sources and ballasts for indoor and outdoor lighting purposes.

c) Use of high-efficiency refrigerators, washers and dryers, and ranges.

d) Use of high-efficiency air conditioners.

e) Use of heat pump, waste heating recovery, and solar water heating systems.

f) Use of occupant sensing or time switch type light and air conditioner controls.

## 4.7 PUBLIC SERVICES

### 4.7.1 Police and Fire Protection

Existing Conditions

The project area police and fire services are provided by facilities located in Captain Cook, less than three miles from the project area. At present, these facilities are adequate to serve existing area requirements. The police station is a substation of the main facility located just north of Kailua-Kona at Kealakehe. The fire station is staffed by 18 personnel divided into three shifts providing 24 hour coverage. Equipment consists of a 1,500 gallons per minute (GPM) pumper carrying 1,000 gallons of water, a mini-pumper 4X4 carrying 300 gallons of water, and an ambulance.

Probable Impacts

Although the proposed project may result in increased criminal activity associated with growth, as well as an increase in requests for police services, it is expected that these will be relatively insignificant and not cause an increase in County police manpower requirements. The project is expected to employ its own security service, which will be increased as the project is developed. As the resident population increases in the project area, the need for additional County police personnel will require evaluation in the context of a County Police Department needs assessment.

The development of the project and related facilities could lead to an increased demand for fire protection service and facilities. However, given the location of the existing fire station and the fact that all new facilities would be constructed in accordance with the County Fire Code, it is expected that any increased demand can be accommodated by existing fire protection services and facilities.

Mitigation Measures

The lack of expected adverse impacts on the present County and private police and fire protection services indicates that mitigation measures are not warranted. As noted above, the property will be policed by a security force that will be increased as development proceeds to sufficiently meet the needs of the project area. Per the County Building Code, all facilities would be designed to meet all applicable code requirements, thereby providing adequate fire protection and access for fire and emergency equipment.

### 4.7.2 Schools

Existing Conditions

The South Kona district is served by the Konawaena Elementary School and High School, both in Kealakekua. A new elementary school is also being planned for the general area, although the location is not known at this time.

Probable Impacts

The number of school children associated with the project is expected to be low due to the second home and retirement home emphasis of the project, and the relatively high anticipated age of permanent residents. The State Department of Education (DOE) has made its own assessment of potential school age children generated by the project. Based on an assumption of an average of 1,440 single and multi-family residential units to be built on the project site, the State DOE estimates that 298 students would be added to the local school system. This would include approximately 155 students in kindergarten through grade five, 58 in grades six through eight, and 85 in grades nine through twelve. This estimate is based on historic student enrollment rates of similar developments within the State. Although this appears to present a significant impact to the educational resources of the area, the project at buildout is expected to occur over a 30 year period, allowing sufficient time for the State DOE to accommodate any increase in school population as a result of the proposed project.

Mitigation Measures

A portion of the State tax revenues generated by this project will be allocated to education, which should defray additional operating expenses (KPMG Peat Marwick, 1993). The actual number of residential units built and the number of children attending school will be determined at a later stage in the project planning. The developer has discussed with the State DOE their plans for public school facilities in the area and will continue to coordinate with the State DOE in order to assure that adequate public school services are provided to project residents.

### 4.7.3 Medical Facilities

Existing Conditions

The State operated Kona Hospital in Kealakekua is located about one half mile mauka of the project site. Although the hospital is licensed for 54 acute care beds, only about 40 are normally available for acute care because of staffing and other limitations. However, according to the West Hawaii Regional Health Center Task Force Report of October, 1989, the State Department of Health is committed to renovate the Kona Hospital "without delay" at the cost of $6 million.

A twenty-four hour emergency ambulance service is located in Captain Cook in conjunction with the Captain Cook Fire Station. Current response time to the project site is estimated to be approximately five to ten minutes.

Probable Impacts

The proposed project could add to the demand on emergency health care services due to the added population, however, existing conditions indicate that the health care facilities in West Hawaii require upgrading with or without the proposed project. Residents and visitors to the proposed project would be able to seek emergency care at Kona Hospital, and as noted previously, an emergency ambulance service is available to the project area.

Mitigation Measures

As indicated within Section 4.5 and Appendix IV-2, the tax revenues generated by the project should more than cover the cost of additional emergency health care and hospital services attributable to the proposed development (KPMG Peat Marwick).

### 4.7.4 Recreational Facilities

The project site is approximately seven miles from Kealakekua Bay Historic Park, formerly known as Napo'opo'o Beach Park, which is operated by the State. Recreational activities at this park include snorkeling, swimming, hiking, and sightseeing. Facilities at the park include a picnic area, pavilion, and restrooms. Also in the general region are Ho'okena and Miloli'i County Beach Parks which provide picnic, camping, swimming, and snorkeling areas. Additionally, the 180 acre Pu'uhonua O' Honaunau National Park, within which lies the historic "City of Refuge", is located approximately nine miles south of the project site.

Probable Impacts

In that the proposed development plan provides for recreational amenities such as the 27-hole golf course, coastal and internal hiking trails, ocean and neighborhood related amenities, and the anticipated emphasis toward second and retirement homes, the impact to local recreational facilities is expected to be minimal. The project would, however, provide opportunities for public access to golf and public use of onsite amenities, thereby adding to the range of recreational activities for residents of the area.

Mitigation Measures

Overall, the project is expected to have a positive effect on the availability of recreational opportunities in West Hawaii through the provision of improved public access to the shoreline area and availability of project related recreational activities to the public. The developer has proposed to manage the shoreline area as a passive coastal park available for public use, as described below.

Shoreline Use Concept

The shoreline use concept, as shown within Figure 21, would connect the shoreline area with other portions of the development through an extensive trail system extending over several miles in length. The trail system would not only provide access to the shoreline area, but would also provide access to other historic and archaeological sites, such as the King's Trail, Kuakini Wall, heiaus, platforms, enclosures, and other sites.

For the King's Trail, the developer intends to restore this in place where the trail exists, and in areas where the trail cannot be found, the intent is to rebuild the trail in the general area it was once located, with some routing movements to achieve compatibility with the proposed development uses. In all, there would be several miles of looping trails for the enjoyment of the general public, as well as residents of the project. Also, portions of the Ala Kahakai ("Trail by the Sea"), which is being studied for inclusion in the National Trail System, could be included as part of this trail system where it traverses the property.

The primary focus of the trail system would be in the area between Pu'u Ohau and the northern property boundary. The shoreline conditions in this area provide the best opportunities to access the ocean. There are open areas where it would be suitable for children to play, families to picnic and other areas suitable for individuals to hike or explore archaeological sites as part of an archaeological and historical interpretive program. The areas south of Pu'u Ohau consist of palis ranging from twenty to eighty feet in height with vertical or concave cliffs, providing very unsafe conditions along the top. This coastal portion would be generally unsafe for family activities, however, there is a primitive trail along the southern portion of the shoreline that would be made available to the public, although this would remain unimproved with signage indicating that the trail may prove hazardous.

The developer proposes to build the shoreline trail, the archaeological and interpretive trails, and the ocean park in phases over a ten to fifteen year period, although the specific details of the phasing plan would need to be developed and refined as part of the regulatory approval process. Initial improvements would include road access leading to shoreline access and parking areas, which would be open with the golf course club opening. Once improvements are made, these areas are planned to be managed and maintained as a responsibility of a community homeowners'

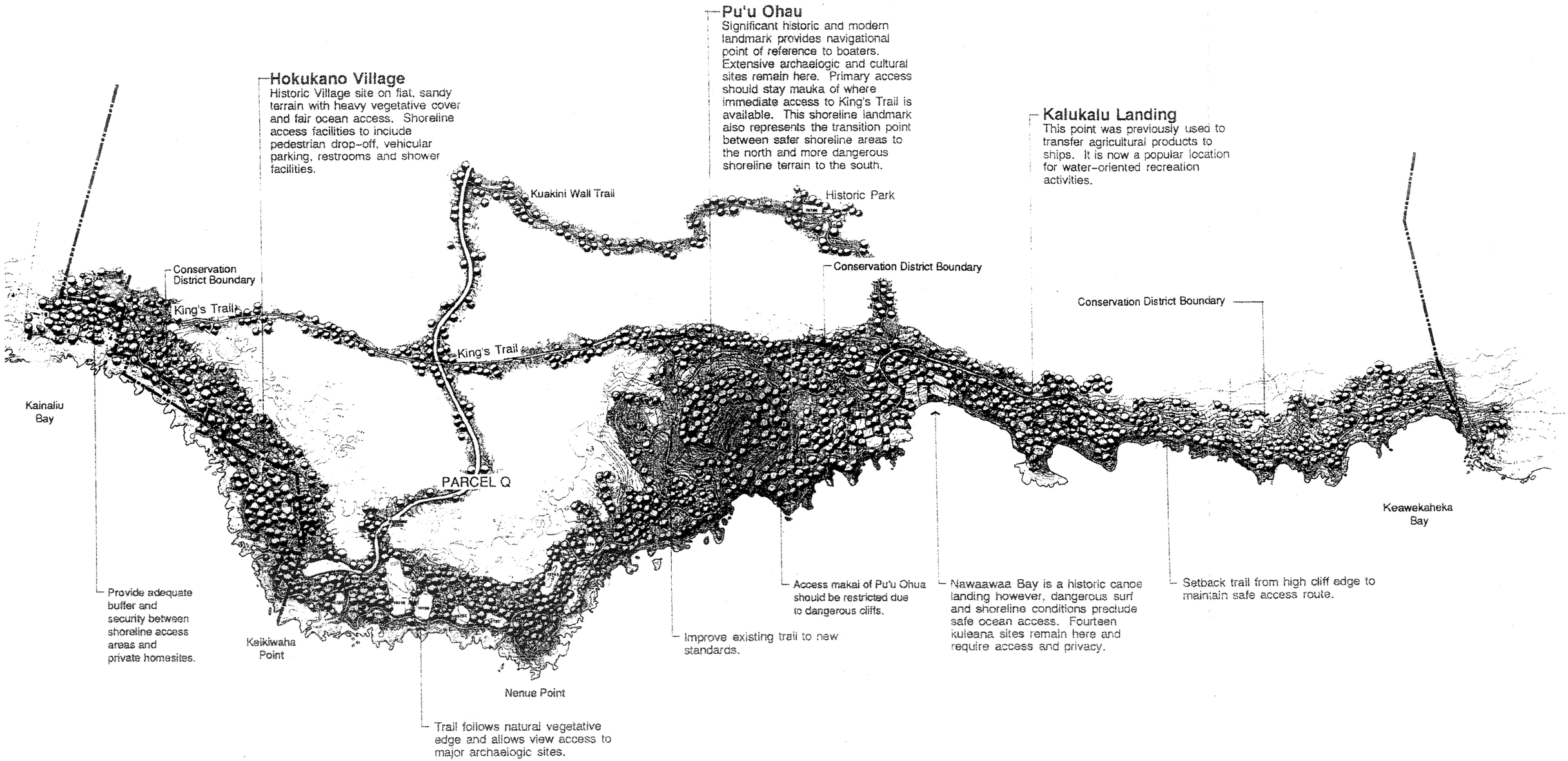


FIGURE 21
SHORELINE USE CONCEPT
FINAL ENVIRONMENTAL IMPACT STATEMENT
VILLAGES AT HOKUKANO

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Architect:Gage Davis Associates

association or other non-profit entity, established by the developer. Again, in preparing a management plan for this area, the management criteria for this area will need to be developed in consultation with appropriate government agencies, citizen experts, and consulting professionals. Included within the Conservation District is a prehistoric fishing village known as Hokukano Village in a portion along the northern part of the shoreline that is owned by the State. The developer proposes to request a Conservation Easement that would allow this area to be included within the park system under the same management plan as the rest of the shoreline and Conservation park area. In sum, the overall shoreline use concept is aimed at providing a managed park system that will enhance the value of this area as a recreational educational resource available to the residents of the proposed development, as well as the general public.

# 5.0 Relationship of the Proposed Action to Land Use Plans, Policies, and Controls for the Affected Area

# 5.0 RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS FOR THE AFFECTED AREA

The applicable governmental land use plans, policies and controls affecting the proposed project include Chapter 205, HRS, Land Use Commission Rules (Chapter 15-15 Hawaii Administrative Rules), the Hawaii State Plan and State Functional Plans for Agriculture, Conservation Lands, Employment, Energy, Health, Historic Preservation, Housing, Human Resources, Recreation, Tourism, Transportation and Water Resources Development; Hawaii Coastal Zone Management Program, Hawaii County Special Management Area (SMA), Hawaii County General Plan and Hawaii County Zoning. Additionally, the West Hawaii Regional Plan and Kona Regional Plan are applicable to the proposed project. The project's relationship to these plans, policies and controls is described in the sections that follow. Following receipt of all necessary permits and approvals, the proposed project would be consistent with the above noted plans and land use controls.

## 5.1 STATE LAND USE PLANS, POLICIES AND CONTROLS FOR THE AFFECTED AREA

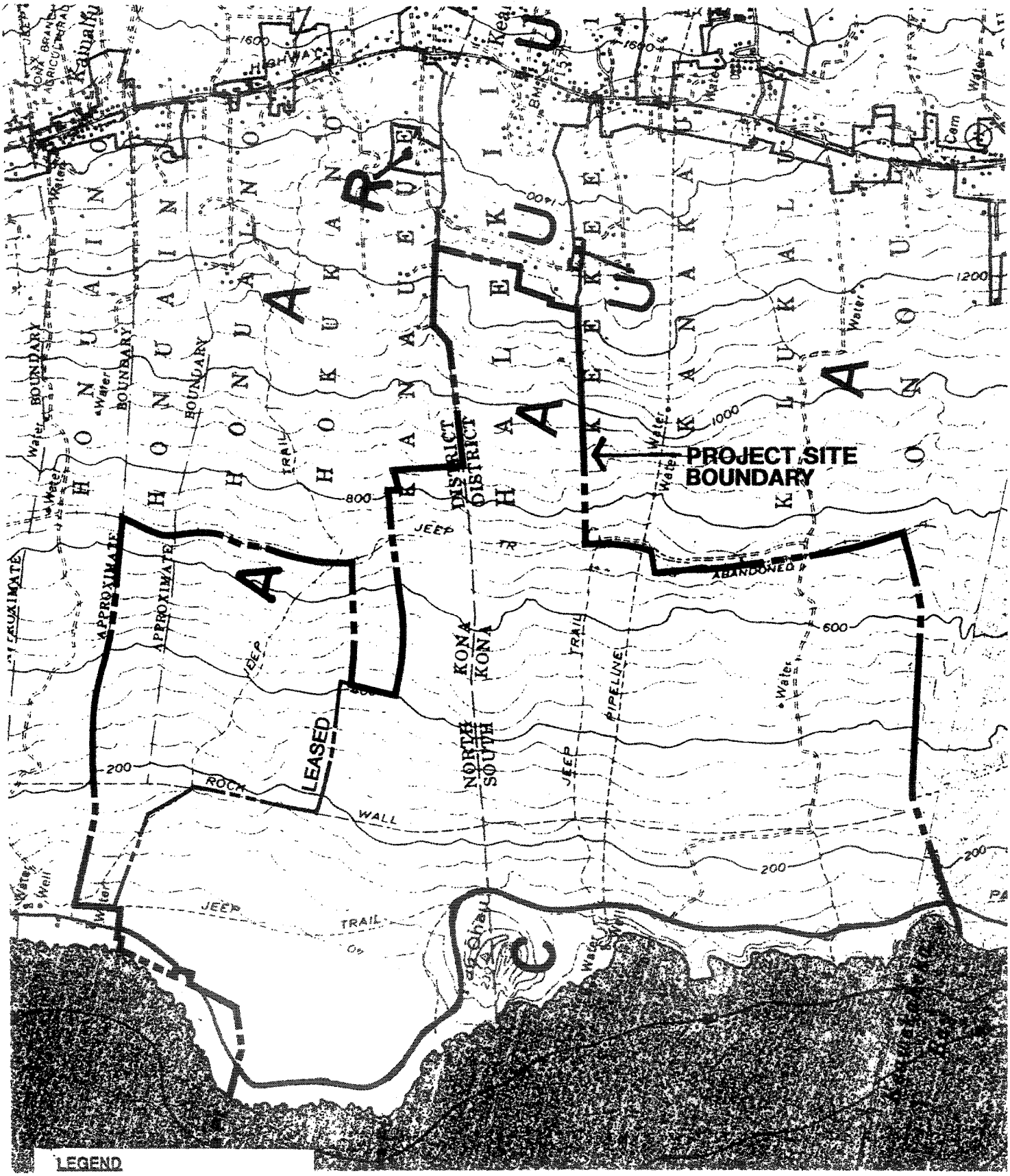
### 5.1.1 CHAPTER 205, HRS, Land Use Commission Rules

As shown in Figure 22, approximately 1,400 acres of the project lands are designated Agriculture by the State Land Use Commission (SLUC). For the project to move forward, a land use district boundary amendment petition will be submitted to the State Land Use Commission, to redesignate approximately 863 acres of the Agricultural District lands for Low and Medium Density Urban uses. This will allow development of the proposed members' lodge and a predominantly single family residential development in neighborhoods ranging in density from 2 to 4.7 units per acre.

#### 5.1.1.1 Section 205-17, HRS

Section 205-17, HRS, sets forth the following decision making criteria for reclassification of District boundaries by the SLUC:

(1) The extent to which the proposed reclassification conforms to the applicable goals, objectives and policies of the Hawaii State Plan and related to the applicable priority guidelines of the Hawaii State Plan and the adopted functional plans;




LEGEND

- U STATE URBAN DISTRICT
- R STATE RURAL DISTRICT
- A STATE AGRICULTURE DISTRICT
- C STATE CONSERVATION DISTRICT

source: S.O.H., Dept. of Planning & Urban Development, State Land Use Commission; STATE LAND USE DISTRICT MAPS, COUNTY OF HAWAII; printed Feb. 1992.

FIGURE 22
**SLU DESIGNATIONS**
FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKANC**

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(2) The extent to which the proposed reclassification conforms to the applicable district standards; and

(3) The impact of the proposed reclassification on the following areas of State concern:

(a) Preservation or maintenance of important natural systems or habitats;

(b) Maintenance of valued cultural, historical or natural resources;

(c) Maintenance of other natural resources relevant to Hawaii's economy, including but not limited to, agricultural resources;

(d) Commitment of State funds and resources;

(e) Provision for employment opportunities and economic development;

(f) Provision for housing opportunities for all income groups and gap groups.

The subject matter of these criteria are addressed below and also in Section 4 regarding probable impacts on the environment. Based on these discussions, the project meets the criteria contained in Section 205-17, HRS.

5.1.1.2 Section 205-2, HRS, Land Use Commission Rules

The SLUC District Regulations require that the application for a boundary amendment show that it is "reasonable, not violative of Section 205-2 and consistent with the Interim Statewide Land Use Guideline Policies." The consistency of the proposed district designation with Section 205-2, HRS, and with the State Interim Land Use Guideline Policies are discussed below.

The proposed amendment to the State Land Use district boundaries is consistent with the basic standards for determining boundaries that are set forth in Section 205-2, HRS. Relevant standards from this section include the following:

Conservation District

Conservation shall include areas necessary for:

(1) Protecting watersheds and water resources;

(2) Preserving scenic and historic areas; and

(3) Providing park lands, wilderness and beach reserves; conserving endemic plants, fish and wildlife; preventing floods and soil erosion; forestry; open space areas whose existing openness, natural condition or present state of use, if retained, would enhance the present or potential value of abutting or surrounding communities, or would maintain or enhance the conservation of natural or scenic resources; areas of value for recreational purposes; other related activities; and other permitted uses not detrimental to a multiple use conservation concept.

Response: The proposed use of the Conservation lands will incorporate shoreline access and hiking trails featuring historic and cultural interpretive sites. Shoreline access parking for public use will also be provided. Trail improvements will generally replicate and improve the existing trail system with as little impact to existing natural conditions as practical. A management plan for the use of the shoreline area will also be developed in conjunction with a future Conservation District Use Application to the Board of Land and Natural Resources. In conformance with the intent of the Conservation District, the proposed use would maintain and enhance the conservation of the natural and scenic resources of this area, and would increase its value for public recreational purposes.

Agricultural District

"Agriculture districts shall include activities or uses characterized by the

(1) Cultivation of crops, orchards, forage and forestry;

(2) Farming activities or uses related to animal husbandry, aquaculture, game and fish propagation;

(3) Aquaculture, which means the production of aquatic plant and animal life for food and fiber within ponds or other bodies of water;

(4) Wind generated energy production for public, private and commercial use;

(5) Services and uses accessory to the above activities including but not limited to living quarters or dwellings, mills, storage facilities, processing facilities and roadside stands for the sale of products grown on the premises;

(6) Wind machines and wind farms;

(7) Agricultural parks;

(8) Open area recreational facilities including golf courses and golf driving ranges, provided that they are not located within agricultural district lands with soil classified by the land study bureau's detailed land classification as overall (master) productivity rating class A or B; and

(9) These districts may include areas which are not used for, or which are not suited to, agricultural and ancillary activities by reason of topography, soils, and other related characteristics.

Response: The Agricultural District land that is proposed for Urban designation is generally unsuited for the cultivation of crops, orchards, forage or forestry. The land is classified D230 and E289 under the Land Study Bureau Detailed Land Classification System and is characterized as rocky and unsuitable for mechanical cultivation. The land is suitable for seasonal grazing purposes but this use is limited due to the lack of improved irrigation facilities and precipitation. Similarly, the land is not suitable for wind generated energy uses due to the general lack of sustainable winds required for the production of electrical energy. The land may be suitable for agricultural parks, however, there does not appear to be a lack of better suited agricultural land in the North and South Kona districts. The land is not particularly well suited to aquaculture activities given the lack of basic infrastructural services and the availability of those services at Keahole Point in North Kona. With the exception of

seasonal grazing, the topography and physiography of the land does not lend itself to agricultural activities. A portion of the land proposed for the Urban designation is classified by the State Department of Agriculture ALISH classification as "Other Important Agricultural Lands". However, this classification is based primarily on the U.S. Department of Agriculture Soil Conservation Service soil classifications for this area and does not take into consideration important site related factors that are essential to productive agricultural practice, including the availability of supporting infrastructure, compatibility with surrounding uses, size, location and configuration of the area, drainage considerations, proximity to support services or market related questions. As described previously in Section 4.1.2, the proposed development would include an agricultural program to provide opportunities for agricultural activities on the property, especially within those areas that are to remain within the Agricultural district. Although the subject lands are only marginally suited for agricultural use, through careful planning and by introducing the needed site preparation, infrastructure and capital, the proposed development can provide for sustainable agricultural uses on lands that would otherwise remain largely unproductive.

### 5.1.2 Hawaii State Plan (Revised 1989)

The Hawaii State Plan (Chapter 226, HRS, as amended and approved June 8, 1989), establishes a set of goals, objectives and policies that are to serve as long-range guidelines for the growth and development of the State. The Plan is divided into three parts: Part I (Overall Theme, Goals, Objectives and Policies); Part II (Planning, Coordination and Implementation); and Part III (Priority Guidelines). Part II elements of the State Plan pertain primarily to the administrative structure and implementation process of the Plan. As such, comments regarding the applicability of this part to the proposed project are not appropriate. The following sections of the Hawaii State Plan are directly applicable to the proposed project:

#### 5.1.2.1 Part I: Overall Theme, Goals, Objectives and Policies

The Hawaii State Plan lists three "Overall Themes" relating to: (1) individual and family self-sufficiency; (2) social and economic mobility; and (3) community or social well-being [Section 226-3 (1-3)]. These themes are viewed as "basic functions of society" and goals toward which

government must strive. To guarantee the elements of choice and mobility embodied in the three themes, three goals were formulated [Section 226-4 (1-3)]:

(1) A strong, viable economy, characterized by stability, diversity and growth that enables fulfillment of the needs and expectations of Hawaii's present and future generations.

(2) A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems and uniqueness, that enhances the mental and physical well-being of the people.

(3) Physical, social and economic well-being, for individuals and families in Hawaii, that nourishes a sense of community responsibility, of caring and of participation in community life.

Response: The proposed project would contribute to the attainment of the three goals. The project would provide direct and indirect short and long term employment opportunities for the present and future residents of North and South Kona and West Hawaii; the proposed project would generate increased State and County tax revenues; the project would contribute to the stability, diversity and growth of local and regional economies; and the archaeological, historic and natural site features would be protected. Key elements of the proposed project relative to the above noted goals are that the proposed project would provide additional employment, recreational and cultural opportunities for existing and future residents of North and South Kona and West Hawaii; that it would provide these opportunities in a planned setting wherein design, operation and maintenance and environmental protection provisions can be effectively, efficiently and economically controlled; that it would provide these opportunities close to existing and planned developments such that travel times are minimized and yet would be sufficiently separated from planned or existing residential developments such that the activities within the proposed project are not a nuisance to nearby residential communities or other related activities. By providing recreational, educational and cultural opportunities within a planned setting, the proposed project would enhance the sense of community responsibility and participation.

Specific objectives, policies and priority directions of the State Plan most relevant to the proposed project are discussed below. Those objectives and policies that are not listed below are those not applicable to the proposed project.

**226-5: Objectives and Policies for Population**

Objective: (a) To guide population growth to be consistent with the achievement of the physical, economic and social objectives of the State.

Policies: (b)(1) Manage population growth Statewide in a manner that provides increased opportunities for Hawaii's people to pursue their physical, social and economic aspirations while recognizing the unique needs of each County.

(b)(2) Encourage an increase in economic activities and employment opportunities on the Neighbor Islands consistent with community needs and desires.

(b)(3) Promote increased opportunities for Hawaii's people to pursue their socio-economic aspirations throughout the State.

(b)(7) Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area.

Response: Rapidly increasing population levels in the West Hawaii area are presently a concern to both State and County planners because of the present lack of affordable housing, limited public facilities and services and increased demands on those facilities and services. The proposed project will have an effect on these factors, but that effect would be less than that which would occur should the project area remain undeveloped. That is, the proposed project will provide the economic means by which other elements of the overall County General Plan can be implemented. Without an income generating product, implementation of the County General Plan elements relating to housing, infrastructure, development and other employment opportunities becomes questionable. The Villages at Hokukano project is expected to provide long term economic and employment opportunities for businesses servicing and providing equipment and supplies for the golf club,

members' lodge and residential units. The development of the project and residential neighborhoods is also expected to contribute to the overall growth of the North and South Kona area in a manner that is consistent with the communities's desire and need as demonstrated in the goals and policies of the County General Plan. As previously indicated in this EIS, marketing studies indicate a definite market for both the project and related facilities, including the residential and agricultural lots, thereby indicating resultant positive primary and secondary employment and economic opportunities for socioeconomic growth and development of the area. Additionally, the planned development can be coordinated with pertinent State and County agencies such that the proposed project would contribute to the enhancement of existing infrastructure in a manner to meet the growing needs of the surrounding area.

**226-6: Objectives and Policies for the Economy - General**

Objective: (a)(1) To increase and diversify employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawaii's people.

(a)(2) A steadily growing and diversified economic base that is not overly dependent on a few industries.

Policies: (b)(2) Promote Hawaii as an attractive market for environmentally and socially sound investment activities that benefit Hawaii's people.

(b)(4) Expand existing markets and penetrate new markets for Hawaii's products and services.

(b)(6) Strive to achieve a level of construction activity responsive to, and consistent with, State growth objectives.

(b)(9) Foster greater cooperation and coordination between the public and private sectors in developing Hawaii's employment and economic growth opportunities.

(b)(10) Stimulate the development and expansion of economic activities which will benefit areas with substantial or expected employment problems.

(b)(11) Maintain acceptable working conditions and standards for Hawaii's workers.

(b)(13) Encourage businesses that have favorable financial multiplier effects within Hawaii's economy.

(b)(14) Promote and protect intangible resources in Hawaii such as scenic beauty and the aloha spirit, which are vital to a healthy economy.

(b)(16) Foster a business climate in Hawaii - including attitudes, tax and regulatory policies and financial assistance programs - that is conducive to the expansion of existing enterprises and the creation and attraction of new business and industry.

Response: As a master planned residential community with associated recreational amenities, the project would add an environmentally and socially sound investment amenity to the marketing and promotion of Hawaii. Further, the project would expand an existing market and penetrate a new market for Hawaii's products and services. The proposed project would provide continued construction activity in the West Hawaii area that would closely follow construction of other West Hawaii projects, thereby ensuring local construction workers continued employment, as well as provide employment opportunities for other types of construction trades. Given the present land use designations for the project site, the proposed project is consistent with State growth objectives. The proposed project would provide increased employment, income and job opportunities for Big Island residents, thereby leading to improved living standards for those residents. The development of the proposed project would also increase the opportunities to enhance the working conditions of the businesses that would service the project, increase the opportunities for businesses having favorable financial multiplier effects and provide a climate conducive to the expansion of existing businesses and the creation of new business.

## 226-10: Objectives and Policies for the Economy - Potential Growth Activities

Objective: (a) Planning for the State's economy with regard to potential growth activities shall be directed towards achievement of the objectives of development and expansion of potential growth activities that serve to increase and diversify Hawaii's economic base.

Policies: (b)(1) Facilitate investment and employment in economic activities that have the potential for growth such as diversified agriculture, aquaculture, apparel and textile manufacturing, film and television production and energy and marine-related industries.

(b)(2) Expand Hawaii's capacity to attract and service international programs and activities that generate employment for Hawaii's people.

(b)(3) Enhance and promote Hawaii's role as a center for international relations, trade, finance, services, technology, education, culture, and the arts.

(b)(5) Promote Hawaii's geographic, environmental, social, and technological advantages to attract new economic activities into the State.

(b)(6) Provide public incentives and encourage private initiative to attract new industries that best support Hawaii's social, economic, physical, and environmental objectives.

Response: The proposed project would assist in the achievement of the above State objective and policies by providing facilities that directly promote the growth of diversified agriculture; encourages existing business to expand and provide the impetus for the creation of new businesses related to golf and real estate activities centered around the project; assist in enhancing and promoting Hawaii's role as a center for international and domestic relations, trade, finance, services and technology, and promote the State's geographic, environmental, social and technological advantages, especially given the project's location relative to the internationally known recreational facilities and sport fishing grounds off West Hawaii; and

granting of the requested permits and future zoning requests would represent the extent of public incentives required to encourage the private interests to construct homes and utilize planned facilities, thereby supporting the State's social, economic, physical and environmental objectives.

## 226-11: Objectives and Policies for the Physical Environment - Land Based, Shoreline and Marine Resources

Objectives: (a) Planning for the State's physical environment with regard to land-based, shoreline and marine resources shall be directed towards the achievement of the following objectives:

(a)(1) Prudent use of Hawaii's land-based, shoreline, and marine resources.

(a)(2) Effective protection of Hawaii's unique and fragile environmental resources.

Policies: (b)(1) Exercise an overall conservation ethic in the use of Hawaii's resources.

(b)(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.

(b)(3) Take into account the physical attributes of areas when planning and designing activities and facilities.

(b)(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.

(b)(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.

(b)(7) Provide public incentives that encourage private actions to protect significant natural resources from degradation or unnecessary depletion.

(b)(8) Pursue compatible relationships among activities, facilities, and natural resources.

(b)(9) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational and scientific purposes.

Response: The demonstrated policy of Oceanside 1250, developers of the proposed Villages at Hokukano, is to exercise a strong overall conservation ethic in the planning of all its projects. This has been demonstrated in the care and planning that has occurred with regard to the natural and historical/cultural resources found within the project boundaries and with previous projects. This same ethic would be continued with the development of the proposed project to ensure compatibility between the project-associated activities, and the natural resources and ecological systems that would be affected by the proposed project. As indicated previously in this EIS, the planning and design of the project has taken into account the physical attributes of the property and surrounding areas. Further, it is the intention of the developer to manage the natural resources and environs of the project area such that beneficial and multiple uses are encouraged as to not cause damage to those resources. Granting of the requested permit and land use actions provides an additional public incentive for encouraging private actions to protect significant natural resources from degradation or unnecessary depletion. This, together with a desire to provide a desirable and marketable residential product, will encourage the developer to pursue compatible relationships among the activities, facilities and natural resources of the area. The proposed project would also promote increased accessibility and prudent use of inland and shoreline areas for public recreational and educational purposes. Plans for the proposed Villages at Hokukano project are being developed and prepared in conjunction with extensive environmental studies of the site as well as extensive public input. This EIS documents the process by which these environmental considerations have been integrated into the planning process. Although no threatened or endangered species of plants, animals or potentially threatened or candidate species were encountered through these studies, any native species would be respected through appropriate site planning considerations. Similarly, significant archaeological/historical features within the project boundaries would be preserved and protected in compliance with applicable Federal, State and County rules and regulations and implementation of a community, developer, State, and County prepared and approved mitigation plan.

## 226-12 Objectives and Policies for the Physical Environment - Scenic, Natural Beauty and Historic Resources

Objective: (a) Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multi-cultural/historical resources.

Policies: (b)(1) Promote the preservation and restoration of significant natural and historic resources.

(b)(2) Provide incentives to maintain and enhance historic, cultural and scenic amenities.

(b)(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.

(b)(4) Protect those special areas, structures, and elements that are an integral and functional part of Hawaii's ethnic and cultural heritage.

(b)(5) Encourage the design of developments and activities that complement the natural beauty of the islands.

Response: The proposed Villages at Hokukano project was conceived based on the unique attributes of the site and has thus been planned and designed to maintain and/or enhance the natural features of the site. As discussed previously, significant historical, cultural and archaeological sites will be protected; building pads have been planned and sited to maintain the primary vistas to the mountains and ocean as well as to avoid significant archaeological sites. The low density, golf course and landscaped character of the project site, as well as the integration of significant open space elements, would provide a means for the development to accommodate and be complemented by the surrounding land and ocean environment.

**226-13 Objectives and Policies for the Physical Environment - Land, Air and Water Quality**

Objectives: (a) Planning for the State's physical environment with regard to land, air and water quality shall be directed towards achievement of the following objectives:

(a)(1) Maintenance and pursuit of improved quality in Hawaii's land, air and water resources.

(a)(2) Greater awareness and appreciation of Hawaii's environmental resources.

Policies: (b)(1) Foster educational activities that promote a better understanding of Hawaii's environmental resources.

(b)(2) Promote the proper management of Hawaii's land and water resources.

(b)(3) Promote effective measures to achieve desired quality in Hawaii's surface, ground and coastal waters.

(b)(8) Foster recognition of the importance and value of land, air and water resources to Hawaii's people, their cultures and visitors.

Response: An important element of the proposed project is the construction of an historic park interpretive program and trail system to convey the rich history of the area, thereby providing an educational experience regarding the importance of the area's land and water resources. The proposed project has been designed and would be constructed in such a manner that the land and water resources of the area can be managed in an environmentally compatible and beneficial manner and foster the recognition of the importance and value of the area's land, air, and water resources to Hawaii's people, their cultures, and visitors.

**226-19 Objectives and Policies for Socio-Cultural Advancement - Housing**

Objectives: (a) Planning for the State's socio-cultural advancement with regard to housing shall be directed towards achievement of the following objectives:

(a)(2) The orderly development of residential areas sensitive to community needs and other land uses.

Policies: (b)(1) Effectively accommodate the housing needs of Hawaii's people.

(b)(5) Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services and other concerns of existing communities and surrounding areas.

(b)(7) Foster a variety of lifestyles traditional to Hawaii through the design and maintenance of neighborhoods that reflect the cultures and values of the community.

Response: The proposed development has been planned and designed to lend itself towards fostering a sense of community and cohesiveness. This planning, as noted previously, has actively involved the surrounding Kealakekua community. It is the intent of the proposed development to create a character that reflects the values that are traditional to Hawaii in general and specifically to the region through an appreciation and respect for the beauty of the land. Development of another large-scale resort hotel in the area would add undue burdens on the public facilities and services of the area and not be in keeping with the lower density or rural character desired by existing communities. Through the development of the proposed project, and meeting the requirements for affordable housing that would accompany land use approvals, the project will also provide a range of housing options for Hawaii residents.

**226-23 Objectives and Policies for Socio-Cultural Advancement - Leisure**

Objective: (a) Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.

Policies: (b)(1) Foster and preserve Hawaii's multi-cultural heritage through supportive cultural, artistic, recreational, and humanities - oriented programs and activities.

(b)(2) Provide a wide range of activities and facilities to fulfill the cultural, artistic and recreational needs of all diverse and special groups effectively and efficiently.

(b)(3) Enhance the enjoyment of recreational experiences through safety and security measures, educational opportunities and improved facility design and maintenance.

(b)(4) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.

(b)(5) Ensure opportunities for everyone to use and enjoy Hawaii's recreational resources.

(b)(10) Assure adequate access to significant natural and cultural resources in public ownership.

Response: The project would provide a new array of recreational opportunities that would be integrated into the community. The project includes provisions for open spaces, public shoreline access, public access to the project facilities, educational displays and facilities and continued access to significant historical and cultural sites. In addition, opportunities for community activities would be available. As such, a wide range of recreational facilities and opportunities would be made available to the residents of North and South Kona regions, as well as residents of the overall West Hawaii area.

5.1.2.2 Part II: Planning, Coordinating and Implementation

As indicated previously, this part of the Hawaii State Plan pertains to the administrative structure and implementation process of the Plan. As such, comments are not deemed appropriate.

5.1.2.3 Part III: Priority Guidelines

The purpose of this part of the Plan is to establish overall priority guidelines to address areas of Statewide concern. The Plan notes (Section 226-102) that the State shall strive to improve the quality of life for Hawaii's present and future population through the pursuit of desirable courses of action in five major areas of Statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice and quality education. The priority guidelines applicable to the proposed project are discussed below:

**226-103 Economic Priority Guidelines**

(a) Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawaii's people and achieve a stable and diversified economy:

(a)(1) Seek a variety of means to increase the availability of investment capital for new and expanding enterprises.

(a)(8) Provide public incentives and encourage private initiative to develop and attract industries which promise long term growth potentials and which have the following characteristics:

(a)(8)(A) An industry that can take advantage of Hawaii's unique location and available physical and human resources.

(a)(8)(B) A clean industry that would have minimal adverse impacts on Hawaii's environment.

(a)(8)(D) An industry that would provide reasonable income and steady employment.

(a)(10) Enhance the quality of Hawaii's labor force and develop and maintain career opportunities for Hawaii's people through the following actions:

(b) Priority guidelines to promote the economic health and quality of the visitor industry:

(b)(1) Promote visitor satisfaction by fostering an environment which enhances the Aloha Spirit and minimizes inconveniences to Hawaii's residents and visitors.

(b)(2) Encourage the development and maintenance of well-designed, adequately serviced hotels and resort destination areas which are sensitive to neighboring communities and activities and which provide for adequate shoreline setbacks and beach access.

(b)(3) Support appropriate capital improvements to enhance the quality of existing resort destination areas and provide incentives to encourage investment in upgrading, repair and maintenance of visitor facilities.

(b)(4) Encourage visitor industry practices and activities which respect, preserve and enhance Hawaii's significant natural, scenic, historic and cultural resources.

(b)(7) Maintain and encourage a more favorable resort investment climate consistent with the objectives of this chapter.

(f) Priority guidelines for energy use and development:

(f)(3) Provide incentives to encourage the use of energy conserving technology in residential, industrial and other buildings.

Response: The proposed Villages at Hokukano project would assist in meeting the above stated guidelines by allowing private investment in a facility that would assist in expanding existing businesses as well as provide the impetus for new businesses to be created to serve an expanded real estate market; assist in the development of an industry that can take advantage of Hawaii's location and available physical and human resources; encourage expansion of a clean industry that would have minimal adverse impacts on Hawaii's environment; assist an industry that provides a reasonable income and steady employment; and provide the market for and stimulus needed to increase vocational training in an area where growth is desired and

feasible. With regard to promoting the economic health, the proposed project would provide an ideal resident oriented area while allowing the development of the businesses that would serve the project and residents of the project; and allow the expenditure of private capital to upgrade and improve the quality of facilities in an area where they are now lacking. The proposed project would also aid in the attainment of the energy related guidelines through the energy conservation measures that would be taken during the design, construction and operation of lodge and golf club facilities and encouraged in the design and construction of individual homes.

## 226-104 Population Growth and Land Resources Priority Guidelines

(a) Priority guidelines to effect desired Statewide growth and distribution:

(a)(1) Encourage planning and resource management to insure population growth rates throughout the State that are consistent with available and planned resource capacities and reflect the needs and desires of Hawaii's people.

(a)(2) Manage a growth rate for Hawaii's economy that will parallel future employment needs for Hawaii's people.

(a)(4) Encourage major State and federal investments and services to promote economic development and private investment to the neighbor islands, as appropriate.

(b) Priority guidelines for regional growth distribution and land resource utilization:

(b)(6) Seek participation from the private sector for the cost of building infrastructure and utilities and maintaining open spaces.

(b)(12) Utilize Hawaii's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands and other limited resources for future generations.

(b)(13) Protect and enhance Hawaii's shoreline, open spaces and scenic resources.

Response: The project would comply with and assist in the achievement of the above stated population growth and land resources priority guidelines and objectives. The proposed project would provide the means by which Oceanside 1250 would make available investment capital for the members' lodge, golf course, clubhouse and house lots, and meet County and State affordable housing conditions. As such, growth would continue to be focused in an existing urban area. Further, the project would maintain the open space character of the area; would be designed to protect and enhance the shoreline and coastal resources of the area; and provide additional recreational opportunities to the public. The proposed development would provide employment opportunities paralleling future employment needs; encourage private investment on a neighbor island; and profitably use suitable lands for urban uses. Infrastructural components required by and for the project would be provided by the developer at no cost to the State or County.

### 5.1.3 State Functional Plans

The Hawaii State Plan directs the appropriate State agencies to prepare functional plans for their respective program areas. There are twelve State Functional Plans that serve as the primary implementing vehicle for the goals, objectives and policies of the Hawaii State Plan. The following sections of the listed State Functional Plans are directly applicable to the proposed project:

#### 5.1.3.1 State Agriculture Functional Plan (1985)

The project site has relatively little soil cover, although pockets of soil are found throughout the site. The majority of the land is designated as Class C, D, and E, with only a small portion designated as Class B. From an agronomic perspective, these soils are generally moderately to poorly suited for agricultural use. The entire project site is designated Orchards, Open Space and Extensive Agriculture by the County General Plan. No area of the project site has been rated as "Prime" or "Unique" by the ALISH system. Consequently, the majority of the implementing actions of the State Agriculture Functional Plan do not apply either directly or indirectly to the

proposed project. Those that do apply are related to non-cultivation activities such as grazing, for which there is no present or forecast shortage of lands in West Hawaii.

5.1.3.2 State Conservation Lands Functional Plan (1984)

There are several implementing actions in the State Conservation Lands Functional Plan that are relevant to the proposed project. This functional plan addresses more than officially designated Conservation District lands in that it establishes a conservation ethic that the State should strive to attain and maintain.

**Management of Natural Resources**

Objective: A. Effective protection and prudent use of Hawaii's unique, fragile and significant environmental and natural resources.

Policies: A(1) Exercise an overall conservation ethic in the use of Hawaii's resources by protecting, preserving and conserving the critical and significant natural resources of the State of Hawaii and controlling use of hazardous areas.

A(1)(c) Review the various rules and regulations and permit systems applicable to Conservation District lands for possible simplification and/or consolidation for effective and efficient management controls and compliance with the Coastal Zone Management program.

A(1)(d) Provide for effective enforcement of rules and regulations and permit system applicable to the Conservation District.

A(1)(d) Review applications for use of Conservation lands to control impacts on natural and cultural resources.

Response: In compliance with the Coastal Zone Management Program regulations, a Special Management Area permit will be requested from the County Planning Department. The proposed project does not plan any use of the State Land Use Conservation District land other than the provision of access trails and interpretive improvements associated with important archaeological sites. This EIS will allow extensive

review by governmental agencies and the general public with regard to the potential impacts on natural and cultural resources and the controls (mitigating measures) proposed to minimize potential adverse impacts. Additionally, any improvements within the State Conservation District will require approval from the Board of Land & Natural Resources through the Conservation District Use application processing, allowing further scrutiny of the potential impacts and proposed mitigating measures from proposed uses of this area.

**Protection of Endangered Species**

Objective: B. Protection of rare or endangered species and habitats native to Hawaii.

Policies: B(1) Protect and preserve habitats of rare and endangered wildlife.

B(2) Protect and preserve unique native plant species.

Response: As noted previously, based on the studies conducted specifically for the project, there are no threatened or endangered species of plants or animals found within the project boundaries. However, to preserve examples of the native and introduced vegetation onsite, the landscaped areas will include the use of appropriate species that are presently found onsite. The native species such as the Euphorbs, Wiliwili trees and Capparis are planned to be preserved or propagated and used in the landscaping plan to the furthest extent practical.

**Management of Open Space, Watersheds and Natural Areas**

Objective: C. Effective protection and management of Hawaii's open space, watersheds and natural areas.

Policies: C(3) Protect and manage the lands with historic or natural resources value.

C(3)(a) Establish criteria and evaluate and prioritize areas of private lands with historic or natural resources value for possible acquisition by public or private agencies.

C(3)(b) Acquire and maintain historic sites for park and other purposes.

C(4) Provide opportunities and facilities to meet public needs for a wide range of recreational and educational activities within Conservation lands.

C(4)(a) Where possible, make available areas of unique biota or geology for public appreciation and enjoyment.

C(4)(c) Maintain scenic and natural open space areas as part of a Statewide system of parks.

Response: To determine the extent and nature of historic and cultural resources within the project boundaries, an archaeological survey of the project site was conducted. The survey was performed in compliance with guidelines established by the State Department of Land and Natural Resources, Historic Sites Section and guidelines developed by the Advisory Council on Historic Preservation. Within the petition area, 471 sites and complexes were identified. Of this total, 180 of these were recommended for preservation, 18 sites are recommended for selected preservation, and 268 sites are recommended for data recovery. The developer intends to incorporate as many of these features as possible into the proposed project through historic parks and interpretive programs, linked with an extensive pedestrian trail system. As part of this effort, the Kuakini Wall will be protected and the King's Trail (Ala Loa or Ala Aupuni) will be restored in areas where it is currently dilapidated. Similarly, as noted previously, the natural resources of the area, especially the shoreline area, will be preserved, maintained and managed as a passive ocean park area for the enjoyment of residents and visitors.

### 5.1.3.3 State Education Functional Plan (1989)

The State Education Functional Plan reflects the Department of Education's strategies to address the policies and priority guidelines of the Hawaii State Plan and the goals of the Board of Education and the concerns of the Education Functional Plan Advisory Committee. As such, it serves as a mechanism for implementing the Hawaii State Plan as it relates to the directions of the Board of Education and the programs of the Department. All of the actions are to be undertaken by the Department of Education and hence, they are not applicable to the proposed project.

5.1.3.4 State Higher Education Functional Plan (1984)

There are no objectives, policies or implementing actions in this functional plan that are directly applicable to the proposed project.

5.1.3.5 State Employment Functional Plan (1989)

The State Employment Functional Plan, the preparation of which was coordinated by the Department of Labor and Industrial Relations, lists four major issue areas under which specific objectives have been defined. These issue areas and objectives are as follows:

**Issue I: Education and Preparation Services for Employment**

Objectives: I.A Improve the qualifications of entry level workers and their transition to employment.

I.B Develop and deliver education, training and related services to ensure and maintain a quality and competitive workforce.

**Issue II: Job Placement**

Objective: II.A Improve labor exchange.

**Issue III: Quality of Work Life**

Objective: III.A Improve the quality of life for workers and families.

**Issue IV. Employment Planning Information and Coordination**

Objective: IV.A Improve planning of economic development, employment and training activities.

Under each of the above listed objectives are defined policies to implement the objectives. The implementation actions are primarily the responsibility of the Department of Labor and Industrial Relations (DLIR) with assistance from other agencies and groups.

Response: The proposed project is generally in concert with the objectives of the State Employment Functional Plan in that new jobs will be created and/or others, such as in construction, will be continued for a period of time. By providing additional employment opportunities in several areas the proposed project would be one more element of the North and South Kona and West Hawaii environment assisting in the improvement of the quality of life for workers and families. As noted in Section 4.4, the proposed project, at completion of build-out, is expected to generate about 330 jobs, including onsite and offsite positions.

5.1.3.6 State Energy Functional Plan (1984)

The State Energy Functional Plan's most relevant objective is that of the promotion of energy efficient design. This relates to both overall land use planning and to specific building design and equipment selection decisions. While specific building designs have not been completed, the proposed project will adhere to energy conservation standards whenever possible. Elements of energy conservation that may be incorporated into the project include the use of passive design principals, which reduce the need for air conditioning and lighting, use of solar energy for water heating and heat recovery for air conditioning purposes, and the use of energy conservation lighting systems.

5.1.3.7 State Health Functional Plan (1989)

The State Health Functional Plan identifies four major priority issue areas on which the plan focuses. These are (1) preventive health; (2) access to health care; (3) environmental protection; and (4) internal administrative issues. Of these four, the environmental protection issue is the most relevant to the proposed project.

Objective: Environmental programs to protect and enhance the environment. Continued development of new environmental protection and health services programs to protect, monitor and enhance the quality of life in Hawaii.

Policy: Air, land and water quality programs. The Department of Health (DOH) will develop and implement new programs to prevent degradation and enhance the quality of Hawaii's air, land and water.

The objective and policy of the DOH will be implemented through programs that will include development and implementation of a comprehensive air toxic control program; development and implementation of a comprehensive solid and hazardous waste management program; development and implementation of a comprehensive recreational water quality monitoring strategy; development and implementation of a non-point source pollution program to protect recreational and other surface waters; development and implementation of an indoor air pollution control program; and development and implementation of a groundwater protection program including groundwater monitoring, safe drinking water and underground injection control. These actions, in concert with existing duties and responsibilities of the DOH, form the primary environmental protection elements of the department.

Response: The proposed project will be in compliance with applicable DOH rules and regulations as well as those established by Hawaii County. A complete marine survey, including water quality analysis, of the area that may be impacted by the proposed project has been performed and forms the basis of a part of this EIS (see Section 4.2.3). In addition, applicable DOH permit/approval requirements will be complied with. The proposed project will comply with all necessary requirements related to the DOH permitting procedures.

5.1.3.8 State Historic Preservation Functional Plan (1984)

The objectives, policies and implementing actions of the State Historic Preservation Plan are directed toward State agencies, primarily the DLNR-HSPD. The archaeological resources at the project site will be surveyed and evaluated by DLNR-HSPD. The developer, with approval from the County Planning Department and the DLNR-HSPD, will implement the mitigation measures recommended by the consulting archaeologist for any sites that requires additional investigation and/or protection. All proposed improvements have been sited to avoid significant archaeological sites. The more durable and appropriate sites would be included as part of an historic interpretive program. The applicant plans to maintain and preserve the significant archaeological sites and

features found within the project boundaries for the education and enjoyment of the residents and visitors to the project area.

### 5.1.3.9 State Housing Functional Plan (1989)

The State Housing Functional Plan, prepared by the State Housing Finance and Development Corporation, addresses six major areas of concern: (1) increasing home ownership; (2) expanding rental housing opportunities; (3) expanding rental housing opportunities for the elderly and other special need groups; (4) preserving housing stock; (5) designating and acquiring land that is suitable for residential development; and (6) establishing and maintaining a housing information system. The plan assumes the use of existing programs at both the State and County levels to attain the goals of the Hawaii State Plan. The majority of the objectives, policies and implementing actions of the State Housing Functional Plan apply to the government sector. With regard to the provision of employee housing, Oceanside 1250 is continuing to discuss with the County and State methods of satisfying its affordable housing requirements for the entire planned development. In addition to meeting the provisions for affordable housing, in providing up to 1,440 homes, which would be suitable as primary residences, the proposed project will add significantly to the County's housing supply, lessening the market demands on lower priced homes. These homes would be priced for the intended market, safe, sanitary, liveable, and located in a suitable environment that accommodates the needs and desires of families and individuals who would reside in these homes.

### 5.1.3.10 State Human Services Functional Plan (1989)

The State Human Services Functional Plan identifies elderly care, children and family support, self-sufficiency and service delivery improvements as priority issues. The objectives, policies and implementing actions of the plan are directed toward State and County agencies for accomplishment. In general, the proposed project is in concert with the basic philosophy of the Human Services Functional Plan in that it will assist, through the provision of employment opportunities, families in achieving economic and social self-sufficiency.

5.1.3.11 State Recreation Functional Plan (1984)

The objectives, policies and implementing actions of the State Recreation Functional Plan are oriented toward improving public recreation opportunities both now and in the future. The following objectives and policies of the plan are relevant to the proposed project.

**Land Use Planning**

Objective: A. Achieve a pattern of land and water resources usage which is compatible with community values, physical resources, recreation potential and recreation uses which support comprehensive public land use policies.

Policies: A(2) Ensure that intended uses for a site respect community values and are compatible with the area's physical resources and recreation potential.

A(3) Emphasize the scenic and open space qualities of physical resources and recreation areas.

Response: The proposed project is favored in part by nearby communities over much larger facilities that could be planned for the project site. The general feeling of the communities that would be most affected by the project is that, as planned and discussed in this EIS, the project is the correct scale for the area. The proposed project is not only compatible with the area's physical resources but enhances the area's recreation potential and will assist in the realization of that potential. Further, the proposed project emphasizes the scenic and open space qualities of the physical resources and recreation characteristics of the area.

**Conservation and Resource Management**

Objective: B. Establish a system of maintaining natural and cultural resources for present and future generations, and of managing recreation and other uses in accordance with sound conservation principles.

Policy: B(1) Exercise an overall conservation ethic in the use of Hawaii's resources.

Response: Throughout the development of the plans for the project area, Oceanside 1250 has sought the community's input, especially with regard to the cultural and shoreline scenic resources, which would enhance the physical, cultural and recreational characteristics of the area. The programs that will be developed and implemented will be designed to preserve the valuable shoreline and cultural resources of the project site and area for the use and enjoyment of visitors and residents. The proposed project will continue to follow the conservation ethic that has been established, as demonstrated through the involvement of the communities with regard to the maintenance of the coastal and cultural resources of the project site and area.

**Recreational Facilities and Programs**

Objective: C. Provide a comprehensive range of opportunities which fulfill the needs of all recreation groups effectively and efficiently.

Policy: C(1) Maintain an adequate supply of recreation facilities and programs which fulfill the needs of all recreation groups.

Response: The proposed project will assist in implementing the above stated objective and policy by providing a facility that will allow groups to pursue and enjoy their recreational needs. The provision of the project and associated facilities will be accomplished by private investment, thereby allowing public funds to be available for other recreation oriented programs.

Objective: D. Assure the provision of adequate public access to lands and waters with public recreation value.

Policies: D(2) Promote the securing of public access to resources with recreational value.

D(3) Ensure that the community feels safe and comfortable in accessing to public recreation lands.

Response: The proposed project includes provisions for public access to the shoreline and to those lands that have public recreation value. Further, the proposed project, acting

in concert with previously established public recreational facilities in the West Hawaii area, will ensure that facilities for both residents and visitors are enhanced.

#### 5.1.3.12 State Transportation Functional Plan (1984)

The overall objective of the State Transportation Functional Plan is to provide for the efficient, safe and convenient movement of people and goods. The developer will continue to work with the State Department of Transportation, as well as with the County and community, in its planning for the proposed highway bypass road. As noted in Section 4.6, which specifically addresses those elements that are applicable to the State Transportation Functional Plan, the applicant intends to participate in construction of a new highway bypass to divert a portion of the through traffic from Mamalahoa Highway to relieve current congestion at peak times in the village, at Konawaena School and Kona Hospital. This bypass would increase capacity and reduce congestion through the Mamalahoa Highway corridor by providing an alternative route between Kamehameha III Road/Kuakini Highway and the City of Refuge Road. The completion of the highway bypass would also improve operations at the Mamalahoa Highway/Haleki'i Street intersection.

#### 5.1.3.13 State Water Resources Development Functional Plan (1984)

This functional plan primarily affects governmental operations. The purpose of the plan is to set forth specific water-related objectives, policies, programs and projects to guide State and County governments in implementing the broader objectives, policies and priority guidelines of the Hawaii State Plan. In essence, the plan presents guidelines for the regulation of the development and use of water to assure adequate supplies in the future; development of water resources to meet municipal, agriculture and industrial requirements and the reduction of flood damage; and preservation of water-related ecological, recreational and aesthetic values and the quality of water resources. With regard to the development and use of water to assure adequate supplies in the future, the proposed project includes provisions to develop potable and non-potable supplies in compliance with appropriate State Department of Health and Land and Natural Resources, Water Resources Development Commission rules and regulations. Non-potable sources would be used for golf course and landscaped area irrigation. Within this context, the proposed project is in concert with the State Water Resources Development Functional Plan.

5.1.4 Coastal Zone Management Act (Chapter 205-A, HRS)

The objectives of the Hawaii Coastal Zone Management (CZM) Program, as set forth in Chapter 205A, HRS, include the protection and maintenance of valuable coastal resources. The proposed project conforms to applicable CZM program objectives as indicated below.

5.1.4.1 Recreational Resources

Objective: Provide coastal recreational opportunities accessible to the public.

Policies: 1.b. Provide adequate, accessible and diverse recreational opportunities in the coastal zone management area by:

i. Protecting coastal resources uniquely suited for recreation activities that cannot be provided in other areas;

iii. Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

iv. Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

vii. Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, artificial reefs for surfing and fishing; and

viii. Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, County planning commissions and crediting such dedication against the requirements of 46-6.

Response: At present, access to the shoreline in the project area is limited due to the lack of appropriate access, roadways, and parking. Development of the site for the proposed uses will provide the public with vehicular and pedestrian access to coastal resources by way of a designated roadway and trail system. Provisions in the access plan will protect the shoreline resources, as well as historically

significant sites. Public parking facilities and use of existing pedestrian paths along the shoreline area, will further enhance public access to the area.

5.1.4.2 Historic Resources

Objective: Protect, preserve, and where desirable, restore those natural and man made historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies: 2.a. Identify and analyze significant archaeological resources;

2.b. Maximize information retention through preservation of remains and artifacts or salvage operations; and

2.c. Support State goals for protection, restoration, interpretation and display of historic resources.

Response: A full archaeological inventory survey of the 1,540 acre property was conducted by CSH. As a result of the Archaeological Inventory Survey, historic sites have been identified. As applicable, their documentation, protection, and restoration are incorporated as part of the plans for the proposed development. In accordance with the recommendations of the consulting archaeologist and other community resource persons, important sites will be preserved. Where appropriate, selected sites will be restored and incorporated as part of an overall interpretive program integrated with a pedestrian trail network. Where recommended, signage will be provided explaining the significance of the site and its relationship to the history of the area. Additionally, a historic park will be established within the project and incorporated as part of the interpretive program providing information on the native Hawaiian and modern history of this area.

5.1.4.3 Scenic and Open Space Resources

Objective: Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies: 3.b. Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline.

3.c. Preserve, maintain, and where desirable, improve and restore shoreline open space and scenic resources.

Response: The proposed development will protect, maintain, or improve the quality of coastal, scenic, and open space resources. The Villages at Hokukano development is not planned to encroach upon shoreline or conservation areas. In addition, the golf course, infrastructure and related facilities will be designed to take advantage of the natural contours of the land and minimize adverse effects on the environment. The golf course, open space and landscaped areas, coupled with the low density of the project, will ensure that the area's open space and scenic resources are maintained. With regard to maintaining scenic views, the proposed facilities would retain a low profile to maintain coastal views from mauka areas. Planned facilities are located such that views along the coast would not be obstructed. Coastal open space itself and landscaping will be incorporated into the project design to ensure the smooth visual integration of the project and makai views. All building facility designs will conform to County zoning and building regulations.

5.1.4.4 Coastal Ecosystems

Objective: Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

Policies: 4.a. Improve the technical basis for natural resource management;

4.b. Preserve valuable coastal ecosystems of significant biological or economic importance.

Response: To assure that groundwater and nearshore marine water quality is maintained, standard engineering and design precautions and adherence to State, County and Federal standards will be followed in the design of the drainage system, including meeting State NPDES permitting requirements. Construction specifications will

provide plans and describe techniques to mitigate soil erosion and control sediment in accordance with County requirements. Design techniques will minimize required grading and the potential for soil erosion by the establishment of onsite retention basins. Retention basins or water features will be incorporated to ensure that surface water is allowed to remain on the property long enough to reduce its velocity thereby controlling erosion. Water held by the retention basins may also be reused for golf course irrigation purposes. Surface water runoff to existing drainageways will be limited to pre-construction volumes. As noted, other mitigation measures have been incorporated as part of the golf course planning, design, and operation to mitigate, to the furthest extent practical, the potential for nutrients or chemicals associated with the golf course maintenance from impacting groundwater or coastal waters. These measures include:

- Incorporating a "Reduced Turf" golf course design, which reduces turf areas and subsequent requirements for water, fertilizers, and chemicals;

- Engineering the golf course with a bowl-shaped fairway construction and with a drainage system designed to collect stormwater runoff or irrigation water passing through the soil layer and conducting this to the irrigation pond for reuse on the course;

- Implementing an Integrated Golf Course Management Program (IGCMP) aimed at minimizing the use of chemicals for golf course maintenance and ensuring safe handling and storage of all chemicals;

- Adopting proven biorational pest control methods when appropriate; and

- Implementing a Water Quality Monitoring and Mitigation Program to ensure ongoing monitoring of soil and coastal waters for chemicals used in golf course maintenance and, if indicated, implementing appropriate mitigation measures.

Collectively, these measures represent the state of the art in environmentally sensitive golf course design and management and are proposed as part of the development to ensure protection of the coastal ecosystems. Additionally, as a basis for the proposed Water Quality Monitoring and Mitigation Program, a

Quantitative Assessment of the Marine Communities and Water Quality was conducted for the coastal waters fronting the project site, thus providing a strong technical basis for the ongoing monitoring of the coastal marine environment.

5.1.4.5 Economic Uses

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies: 5.b. Insure that coastal dependent development such as harbors and ports, visitor industry facilities and energy generating facilities are located, designed and constructed to minimize adverse social, visual and environmental impacts in the coastal zone management area.

5.c. Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long term growth at such areas, and permit coastal dependent development outside presently designated areas when:

ii. Adverse environmental effects are minimized.

Response: The proposed development is significantly removed so as not to impact the surrounding communities, however, it is appropriately located so as to make efficient use of existing infrastructure and public facilities. Additionally, the project site has the desired scenic and climatic environment to support a residential/recreational development as proposed. As noted previously, careful planning and design for the proposed project will minimize any potential adverse social, visual and environmental impacts.

5.1.4.6 Coastal Hazards

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion and subsidence.

Policies: 6.b. Control development in areas subject to storm wave, tsunami, flood, erosion and subsidence.

6.c. Ensure that developments comply with the requirements of the Federal Flood Insurance Program.

Response: All habitable structures within the proposed development are located significantly inland so as to be outside areas of potential tsunami, high storm or wave action. Public access to the shoreline areas needs to be managed so as to control access during times of high wave action or tsunami danger. No significant development or habitable structures will be located in any of the flood hazard zones or drainageways. Additionally, The governmental agency and public review of this EIS along with the various permits required for the proposed project ensure that adequate governmental controls on the project are being applied. The proposed project will be designed and constructed in compliance with all applicable Federal, State and County environmental protection, design and building standards and regulations, including the Federal Flood Insurance Program.

5.1.4.7 Managing Development

Objective: Improve the development review process, communication and public participation in the management of coastal resources and hazards.

Policies: 7.a. Effectively utilize and implement existing law to the maximum extent possible in managing present and future coastal zone development.

7.b. Facilitate timely processing of application for development permits and resolve overlapping or conflicting permit requirements.

7.c. Communicate the potential short and long term impacts of proposed significant coastal developments early in their life-cycle and in terms understandable to the general public to facilitate public participation in the planning and review process.

Response: This EIS has been prepared in compliance with existing State and County environmental rules (Chapter 343, HRS, and Chapter 200, Department of Health,

Environmental Impact Rules). It will be used as the environmental documentation required to apply for the required permits. Further, Oceanside 1250 has been meeting with appropriate State and County agency personnel as well as affected and interested community groups and individuals to communicate the plans for the project and to solicit their comments for incorporation into the planning process and this EIS. Public review of the EIS also assures adequate public and governmental agency review of the project.

## 5.2 HAWAII COUNTY PLANS AND CONTROLS

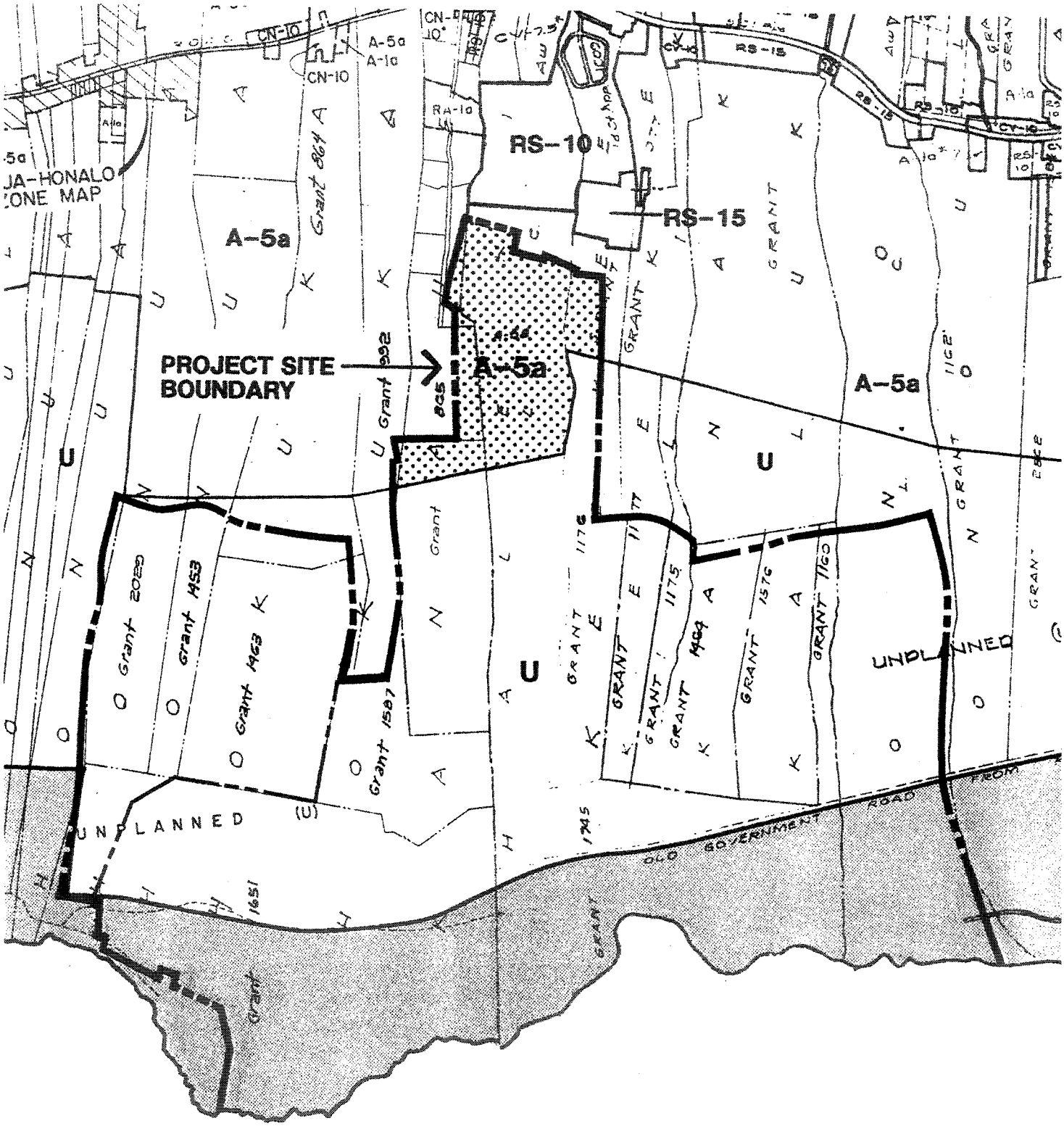
### 5.2.1 Hawaii County Special Management Area

Approximately 415 acres falls within the "Special Management Area" (SMA) as defined by the Hawaii County Planning Commission under the provisions of Chapter 205A, HRS, and the County's Rule 9, Special Management Area (Figure 23). As such, an SMA permit application was filed with the Hawaii County Planning Commission for the proposed project. That permit application will be supported in part by this EIS. In essence, County objectives and policies regarding the Special Management Area mirror the State objectives and policies as discussed in the preceding section (5.1.4). County SMA guidelines relevant to the proposed project are as follows:

**Guidelines A.1, 2, 3,4 and 5**

These guidelines seek to minimize alterations to any body of water; impose restrictions on public access to tidal and submerged lands and beaches; interfere with or detract from the line-of-sight toward the sea; and minimize adverse effects on water quality and wildlife habitats.

Response: Although the proposed project would not affect the offshore area, the project is intended to expand and enhance the recreational opportunities available to the residents of the area as well as visitors to the lodge. The visual character of the proposed project is expected to be positive and assist in maintaining the open space character of the site. Views inland from the shoreline and views seaward from the highway are not expected to be adversely affected.




LEGEND

- SPECIAL MANAGEMENT AREA
- UNPLANNED ZONE
- A-5a ZONE

FIGURE 23
**EXISTING COUNTY ZONING/SMA**

FINAL ENVIRONMENTAL IMPACT STATEMENT
**VILLAGES AT HOKUKAN**

0 425 850 1700

source: County of Hawaii; NORTH KONA ZONE MAP, SECT. 7.02, effective May 24, 1967 (last revision Jun 25, 1991); SOUTH KONA ZONE MAP, SECT. 7.03, effective MAY 24, 1967 (last revision May 22, 1991).

**Guidelines B.1, 2 and 3**

These guidelines seek to minimize potential adverse environmental impacts; assure that projects are consistent with State objectives and policies; and assure that projects are consistent with the County General Plan.

Response: The proposed project is not expected to result in any adverse impacts that cannot be mitigated. The project is consistent with applicable provisions of the State's coastal zone management objectives and policies as indicated in the preceding section and the project will be subject to County regulatory approvals, including a General Plan Amendment Petition, to ensure consistency with the Hawaii County General Plan.

**Guidelines C.1, 2, 3, 4, 5 and 6**

These guidelines seek to assure adequate public access to publicly owned beaches, recreation areas and natural reserves; reserve public recreation areas and wildlife preserves; and provide liquid and solid waste treatment, disposition and management that will minimize adverse effects on Special Management Area resources.

Response: As indicated previously, the proposed project includes provisions for public access to the shoreline; would provide additional recreational opportunities for the residents and visitors to the project area; and includes provisions to restore and preserve the archaeological/historical resources of the project area. Liquid and solid wastes will be treated, disposed of and managed in compliance with applicable Federal, State and County rules and regulations. Liquid wastes will be treated and disposed of in the wastewater treatment and disposal system to be developed as part of the project. Solid wastes would be collected and disposed of at approved County sanitary landfill sites.

5.2.2 Hawaii County General Plan

The Hawaii County General Plan is the policy document for the long-range comprehensive development of the Island of Hawaii and provides direction for balanced growth of the County. The Plan contains goals, policies and standards concerning thirteen functional areas as well as a series of land use maps referred to as General Plan Land Use Pattern Allocation Guide (LUPAG)

Maps. The present LUPAG Map designations for the property are a mixture of Orchard, Open Space and Extensive Agricultural (Figure 24). As part of the anticipated regulatory applications, a petition will be submitted to the County seeking Medium Density Urban (MDU), Low Density Urban (LDU), and Open Area (OA) designations for approximately 763 acres of the project area, which would allow for the proposed low and medium density residential developments, recreational amenities, and associated commercial uses, such as the members' lodge and golf clubhouse. The area of the anticipated General Plan and State Land Use Petition areas is shown in Figure 25.

The relevant goals, policies and standards of the functional areas are discussed below.

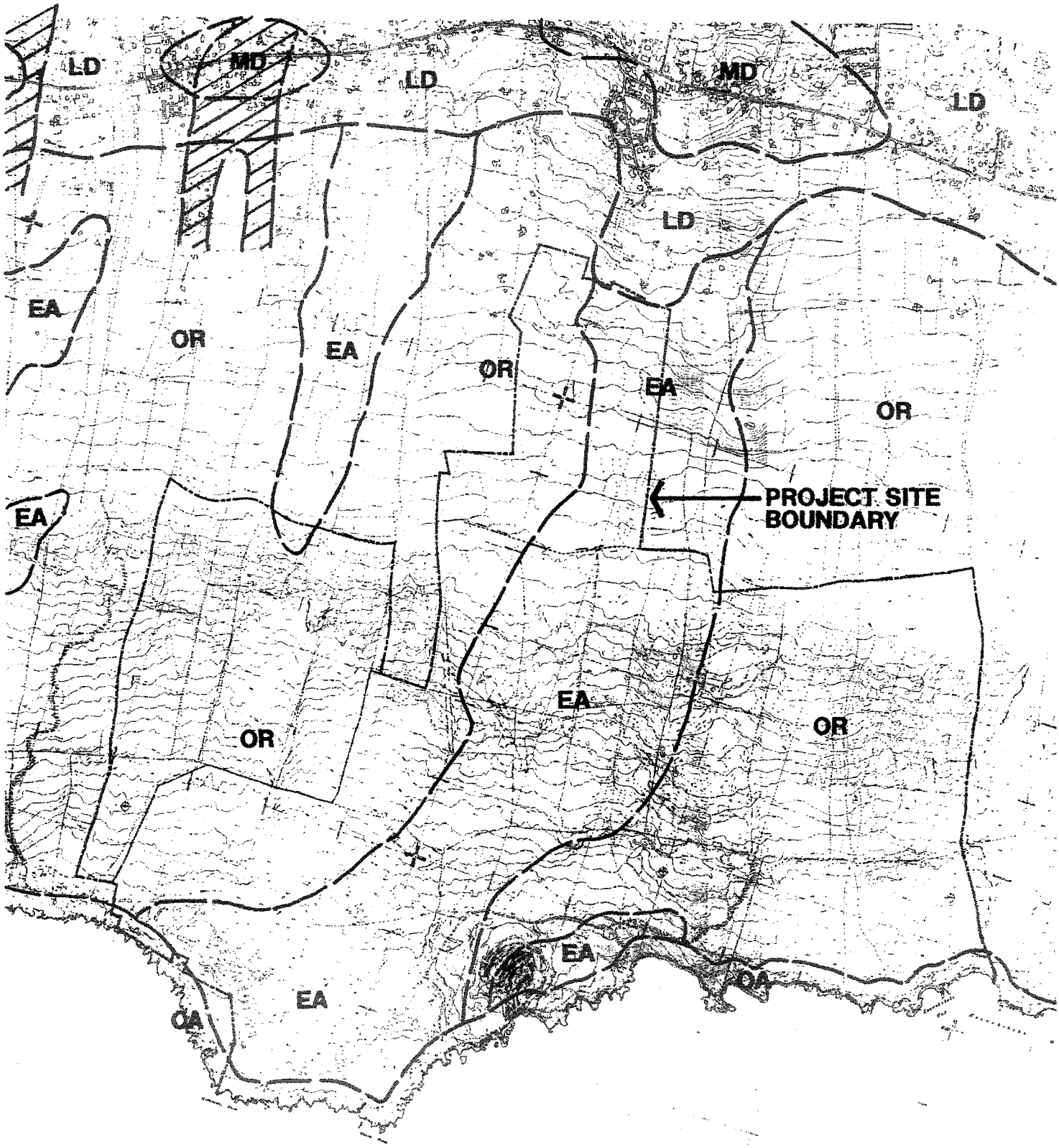
5.2.2.1 Economic

Goals:

- Provide residents with opportunities to improve their quality of life.
- Economic development and improvement shall be in balance with the physical and social environments of the Island of Hawaii .
- The County of Hawaii shall strive for diversity and stability in its economic system.
- The County shall provide an economic environment which allows new, expanded, or improved economic opportunities that are compatible with the County's natural and social environment.

Policies:

- The County of Hawaii shall assist in the expansion of the agricultural industry, especially diversified agriculture, through the protection of important agricultural lands, capital improvements, and other programs, and continued cooperation with appropriate State and Federal agencies.
- The County of Hawaii shall strive for an economic climate which provides its residents an opportunity for choice of occupation.




LEGEND

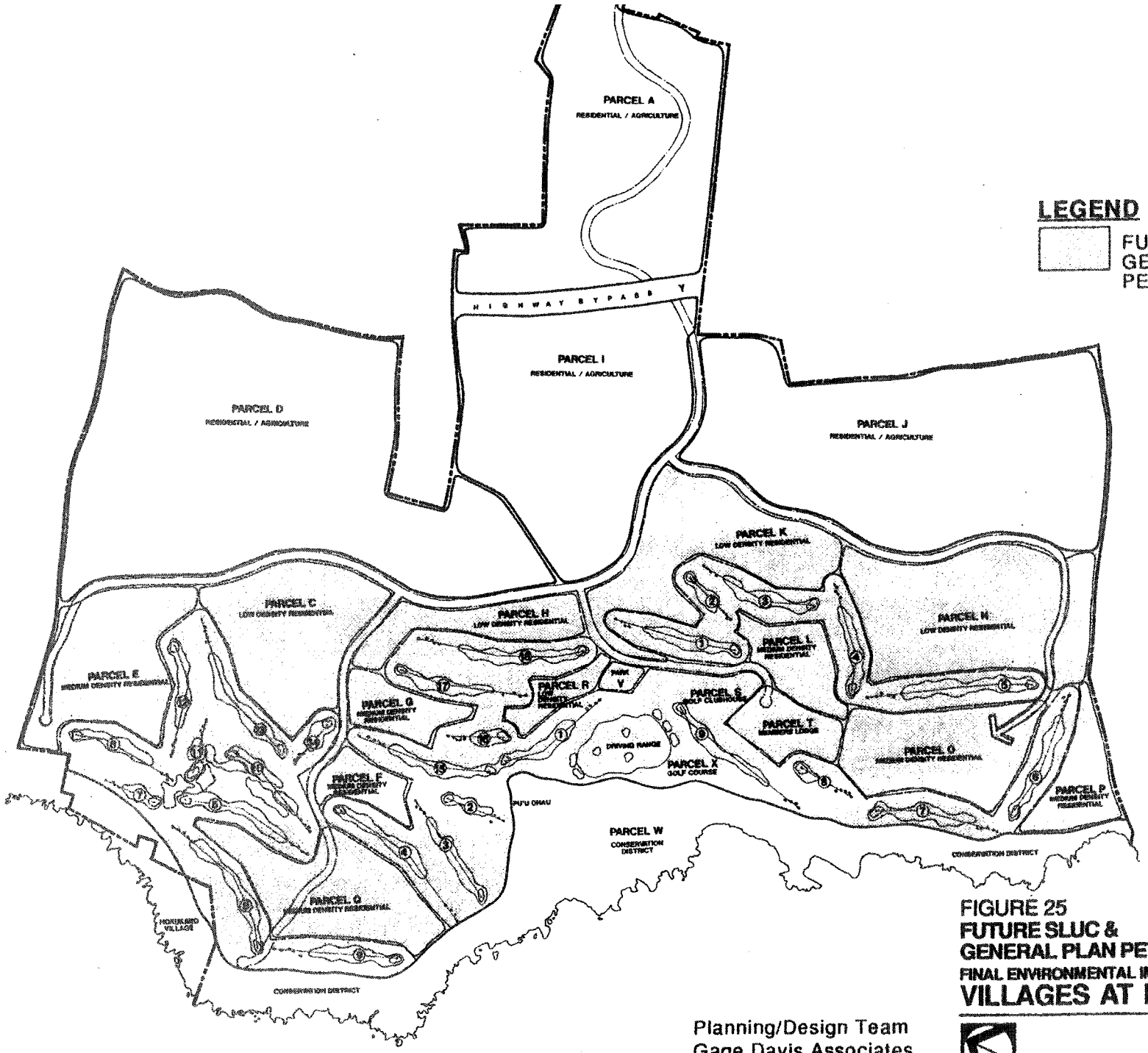
| | |
|---|---|
| MDU | MEDIUM DENSITY URBAN |
| LDU | LOW DENSITY URBAN |
| OR | ORCHARDS |
| EA | EXTENSIVE AGRICULTURE |
| OA | OPEN AREA |
| | FLOOD PLAIN |
| | GENERAL PLAN BOUNDARY |

source: Planning Dept., County of Hawaii;
County of Hawaii General Plan; adopted Nov. 1989.

FIGURE 24
COUNTY GENERAL PLAN
FINAL ENVIRONMENTAL IMPACT STATEMEN
VILLAGES AT HOKUKAN

0 425 850 1700
FEET

6/93




**LEGEND**

FUTURE SLUC & GENERAL PLAN PETITION AREA

FIGURE 25
**FUTURE SLUC & GENERAL PLAN PETITION AREA**
**FINAL ENVIRONMENTAL IMPACT STATEMENT**
# VILLAGES AT HOKUKANO

Planning/Design Team
Gage Davis Associates
PBR HAWAII

NO SCALE

6/93

- The County of Hawaii shall encourage the development of a visitor industry which is consistent with the social, physical and economic goals of the residents of the County.

- The County shall require a study of the significant social and physical impact of large developments prior to approval.

- The County of Hawaii shall strive for diversification of its economy by strengthening existing industries and attracting new endeavors.

- The County shall encourage the expansion of the fishing industry, various forms of aquaculture, and other fresh and ocean water based activities.

Standards:

- The Island of Hawaii should be developed into a unique scientific and cultural model. The island should become a model of living where economic gains are in balance with social and physical amenities. Development should be reviewed on the basis of total impact on the residents of the County, not only in terms of immediate short run economic benefits.

- New industries which provide favorable benefit-cost relationships to the people of the County should be encouraged. Benefit-cost relationships as used here include more than fiscal considerations.

Response: The proposed project will increase the availability and variety of job opportunities for local residents, resulting in higher employment and improvement of the quality of life for local residents. By working with the community to identify pertinent issues, using sensible planning principles, and developing needed support facilities and infrastructure in an orderly fashion, the proposed project will minimize any potential adverse effects on the physical and social environment of the area and help expand the variety and quality of services available to the community. The proposed development will provide continued employment for those in the construction and real estate industry and other jobs needed for the operation and maintenance of the such related facilities as the golf clubhouse, infrastructure, restaurants, and golf course. Also, consistent with the County General Plan's economic policy of encouraging ocean based activities, ocean recreational activities

such as ocean fishing will be provided to project residents and to the public. The economic and fiscal studies conducted for the preparation of this EIS have indicated that the proposed project will have a positive effect on the local economy by providing direct and indirect employment opportunities and bringing increased State and County tax revenues. Additionally, because the proposed project is generally residential, rather than tied to the visitor industry, it will be less susceptible to the cyclical trends of the economy and thus will provide for greater economic stability to the region and Island's economy.

5.2.2.2 Energy

Goals:

- Strive towards energy self-sufficiency for Hawaii County.
- Establish the Big Island as a demonstration community for the development and use of natural energy resources.

Policies:

- The County shall strive to educate the public on new energy technologies and foster attitudes and activities conducive to energy conservation.
- The County shall strive to assure a sufficient supply of energy to support present and future demands.
- The County shall provide incentives which will encourage the use of new energy sources and promote energy conservation.

Standard:

- New power plants shall incorporate devices which minimize pollution.

Response: To the extent possible, the engineering design of the lodge and associated facilities will utilize appropriate technologies to ensure efficient use of energy. Opportunities to conserve energy in the areas of water heating, lighting, air conditioning, refrigeration and others, as appropriate, will be encouraged in all residential development, including passive design techniques aimed at reducing mechanical air conditioning and lighting requirements.

5.2.2.3 Environmental Quality

Goal:

- Maintain and, if feasible, improve the existing environmental quality of the island.

Policies:

- The County of Hawaii shall take positive action to further maintain the quality of the environment for residents both in the present and in the future.

- Encourage the concept of recycling agricultural and municipal waste material.

Standards:

- Pollution shall be prevented, abated, and controlled at levels which will protect and preserve the public health and well-being, through the enforcement of appropriate Federal, State and County standards.

- Environmental quality controls are to be incorporated either as standards in appropriate ordinances or as conditions of approval.

- Federal and State environmental regulations shall be adhered to.

Response: The applicant will endeavor to maintain or improve environmental quality, will comply with all Federal, State, and County environmental rules and regulations, and will mitigate potential adverse impacts to the greatest extent practical. Applicable pollution control measures will be employed. Additionally, in concurrence with a Marine Water Quality Monitoring Plan prepared for the project, coastal marine waters will continue to be monitored on an ongoing basis to detect any significant impacts to water quality. In the area of recycling, treatment plant effluents will be used to irrigate the golf course rather than being discharged to groundwaters or coastal marine waters. It is also very likely that landscape and golf course cuttings will be composted onsite, thus reducing the stream of solid waste.

5.2.2.4 Flood Control and Drainage

Goals:

- Protect human life.

- Prevent damage to man-made improvements.

- Control pollution.

- Prevent damage from inundation.

- Reduce surface water and sediment runoff.

Policies:

- The County shall promote participation in the Soil and Water Conservation Districts' conservation programs for developments on agricultural and conservation lands.

- All development-generated runoff shall be disposed of in a manner acceptable to the Department of Public Works.

- It is the responsibility of both the government and the private sector to maintain and improve existing drainage systems and to construct new drainage facilities.

Standards:

- "Storm Drainage Standards," County of Hawaii, October, 1970, and as revised.

- Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawaii County Code.

- Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).

- Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control," of the Hawaii County Code.

Response: The proposed development areas described within this application occur significantly inland so as not to be subject to potential threat from strong wave action or tsunami. Although two minor flood zones, associated with drainageways, do impact the project site, the development plan will insure that habitable structures are placed outside these zones or that necessary improvements are made to accommodate development. Standard engineering and design precautions and

adherence to State and County design standards will be followed in the design of the drainage system. Additionally, construction specifications, in accordance with County requirements, will provide plans and describe techniques to mitigate the potential for erosion and to control sedimentation. To further ensure that erosion control is maintained, a marine water quality monitoring program, as previously noted, has been implemented along the shoreline area to identify impacts, should they occur.

5.2.2.5 Historic Sites

Goals:

- Protect and enhance the sites, buildings and objects of significant historical and cultural importance to Hawaii.

- Access to significant historic sites, buildings and objects of public interest should be made available.

Policies:

- Agencies and organizations, either public or private, pursuing knowledge about historic sites should keep the public apprised of projects.

- The County of Hawaii shall require both public and private developers of land to provide a historical survey prior to the clearing or development of land when there are indications that the land under consideration has historical significance.

- Public access to significant historic sites and objects shall be acquired.

- The County of Hawaii shall encourage the restoration of significant sites on private lands.

- Signs explaining historic sites, buildings and objects shall be in keeping with the character of the area or the cultural aspects of the feature.

Standards:

The evaluation of the importance of specific historic sites is necessary for future action. The following standards establish a framework for evaluating sites.

- Importance in the life or activities of a major historic person.
- Associated with a major group or organization in the history of the island or community.
- Associated with a major historic event (cultural, economic, military, social, or political).
- Associated with a major recurring event in the history of the community (such as annual celebrations).
- Associated with a past or continuing institution which has contributed substantially to the life of the community.
- Unique example of a particular style or period.
- One of the few of its age remaining.
- Original materials and/or workmanship which can be valued in themselves.
- Sites with a preponderance of original materials in context and complexes rather than single isolated sites unless they are of great significance.
- Sites of traditional and cultural significance.

Response: A full archaeological inventory survey of the property was conducted by CSH. Historic sites have been identified, and their documentation, protection, and restoration, where appropriate, are incorporated as part of the plans for the proposed development. In accordance with the recommendations of the consulting archaeologist and other community resource persons, important sites will be preserved and, where appropriate, restored and incorporated as part of an overall interpretive program integrated with a pedestrian trail network. Public access to important historic sites will be provided, as appropriate. Where recommended, signage will be provided explaining the significance of the site and its relationship

to the history of the area. Additionally, an historic park will be established within the project site and incorporated as part of an interpretive program providing information on the native Hawaiian and modern history of this area.

5.2.2.6 Natural Beauty

Goals:

- Protect, preserve and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.
- Protect scenic vistas and view planes from becoming obstructed.
- Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

Policies:

- Increase public pedestrian access opportunities to scenic places and vistas.
- Access easement to public or private lands which have natural or scenic value shall be provided or acquired for the public.
- Standard criteria for natural and scenic beauty shall be developed as part of design plans.
- The County shall consider structural setback from major thoroughfares and highways and shall establish development and design guidelines to protect important view planes.

Standards:

The following standards provide guidelines for designating sites and vistas of extraordinary natural beauty which shall be protected.

- Distinctive and identifiable landforms distinguished as landmarks, e.g., Mauna Kea, Waipio Valley.
- Coastline areas of striking contrast, e.g., Laupahoehoe Point.

- Vistas of distinctive features.

- Natural or native vegetation which makes a particular area attractive.

- Areas which are harmoniously developed and enhanced by man so as to appear natural.

Response: The project proposes to maintain, as well as emphasize, the rural character of the area through the integration of a low density development with generous open space elements. Throughout the project, these homes will be subject to architectural standards calling for softly contrasting colors and shapes to enhance its visual integrity with the surrounding area. Public access to the shore with provision for public parking will be provided within the property allowing greater access to scenic views within the development site. The public access would be provided through a public shoreline trail system integrated with the archaeological interpretive program. Views to the shore and to Pu'u Ohau from surrounding residential areas and views to the mountains from the shore will not be obstructed.

5.2.2.7 Natural Resources and Shoreline

Goals:

- Protect and conserve the natural resources of the County of Hawaii from undue exploitation, encroachment and damage.

- Provide opportunities for the public to fulfill recreational, economic, and educational needs without despoiling or endangering natural resources.

- Protect and promote the prudent use of Hawaii's unique, fragile and significant environmental and natural resources.

- Protect rare or endangered species and habitats native to Hawaii.

- Protect and effectively manage Hawaii's open space, watersheds and natural areas.

- Ensure that alterations to existing land forms and vegetation, except crops, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.

Policies:

- The County of Hawaii should require users of natural resources to conduct their activities in a manner that avoids or minimizes adverse effects on the environment.

- The shoreline of the Island of Hawaii shall be maintained for recreational, educational, and/or scientific uses in a manner that is protective of resources and is of the maximum benefit to the general public.

- The shoreline shall be protected from the encroachment of man-made improvements and structures.

- Encourage the use of native plants for screening and landscaping.

Standards:

The following shall be considered for the protection and conservation of natural resources.

- Areas necessary for the protection and propagation of specified endangered native wildlife, and conservation for natural ecosystems of endemic plants, fish and wildlife.

- Lands necessary for the preservation of forests, park lands, wilderness and beach areas.

- Lands with a general slope of 20% or more which provide open space amenities or possess unusual scenic qualities.

- Lands necessary for the protection of watersheds, water sources and water supplies.

- Lands with topographic, locational, soils, climate or other environmental factors that may not be normally adaptable or required for urban, rural, agricultural or public use.

- The Coastal Zone and Special Management Area as defined by statute and in accordance with the adopted objectives and guidelines.

Response: The development of the Villages at Hokukano will maintain or improve the quality of coastal, scenic, and open space resources. The proposed project does not impact the shoreline or conservation areas, other than providing for improved shoreline access. A botanical survey of the property identified no endangered or threatened species on site. Native plants species found on site, such as euphorbs, wiliwili, and capparis would be incorporated in the landscaping plan to the extent practical. In addition, many of the prosopis trees found on site would also be saved and moved to places where they can provide quick shade.

5.2.2.8 Housing

Goals:

- Attain safe, sanitary, and livable housing for the residents of the County of Hawaii.

- Attain a diversity of socio-economic housing mix throughout the different parts of the County.

- Maintain a housing supply which allows for a variety of choice.

- Develop better places to live in Hawaii County by creating viable communities with decent housing and suitable living environments for our people.

- Improve and maintain the quality and affordability of the existing housing stock.

- Seek sufficient production of new affordable rental and fee-simple housing in the County in a variety of sizes to satisfactorily accommodate the needs and desires of families or individuals.

- Ensure that housing is available to all persons, regardless of age, sex, marital status, ethnic background and income.

- The cornerstone of the County's housing programs and activities shall continue to be the encouragement and expansion of appropriate home ownership opportunities for our residents.

Policies:

- The County shall encourage a volume of construction and rehabilitation of housing sufficient to meet growth needs and correct existing deficiencies.

- The County shall protect residential property values from depreciating influences.

Standards:

Housing standards shall consist of and comply with:

- Housing Code
- Building Code
- Electrical Code
- Plumbing Code
- Zoning Code
- Subdivision Code
- Standards of the single family and multiple residential land use element.

Response: The proposed project will provide as many as 1,440 additional residential units, which can add to the County's primary housing market. The project would also be expected to provide provisions for affordable housing, meeting State and County

affordable housing requirements. As a result, the project will have an overall positive impact to regional housing conditions, especially with regard to meeting the goals of the County General Plan.

5.2.2.9 Public Facilities

Public facilities are separated into four groups in the General Plan: education, protective services, health and sanitation, and government operations. The goals, policies and standards provided pertain to provision of facilities by government agencies and, in the area of health and sanitation, by government and private entities. The following pertain to health and sanitation.

Goal:

- Encourage the provision of public facilities that effectively service community needs and seek ways of improving public service through better and more functional facilities which are in keeping with the environmental and aesthetic concerns of the community.

Policy:

- The County should encourage the development of new or improvement of existing health care facilities to serve the needs of Hamakua, North and South Kohala, and North and South Kona.

Standards:

- Sanitary landfill sites for refuse disposal shall be established in accordance with the needs of communities and shall be landscaped. Appropriately designed and cost effective transfer station sites shall be located in areas of convenience and easy access to the public.

Response: The proposed development will serve to increase tax revenues to the State and County and thereby support the goal of expanded protection, health services and sanitation installations servicing the community. Protection services may be supplemented with private security, thereby reducing the potential demand for these services. Water service for this development will be provided through the County water system where water commitments are sufficient to satisfy the project potable water requirements. The developer's contribution through water development assessments will help to upgrade the existing system's infrastructure to the benefit of the surrounding community. Additionally, the developer's contribution to roadway improvements, including the Mamalahoa Highway Bypass and the

Mamalahoa Highway/Haleki'i Street intersection will help to improve current traffic conditions in the immediate area and surrounding villages.

5.2.2.10 Public Utilities

Goals:

- Ensure that adequate, efficient and dependable public utility services will be available to users.
- Maximize efficiency and economy in the provision of public utility services.
- To have public utility facilities which are designed to fit into their surroundings or concealed from public view.

Policies:

- Public utility facilities shall be designed so as to complement adjacent land uses and shall be operated so as to minimize pollution or disturbance.
- Provide utilities and service facilities which minimize total cost to the public and effectively service the needs of the community.
- Utility facilities shall be designed to minimize conflict with the natural environment and natural resources.

The Public Facilities functional group is subdivided into five subgroups: water, telephone, electricity, gas and sewer. Specific policies and standards within those areas are as follows.

**Water**

Policies:

- All water systems shall be built to Department of Water Supply standards.
- Improve and replace inadequate systems.
- Water sources shall be adequately protected to prevent depletion and contamination from natural and man-made occurrences or events.

- The fire prevention systems shall be coordinated with water distribution systems in order to ensure water supplies for fire protection purposes.

Standard:

- Water systems shall meet the requirements of the Department of Water Supply and the Subdivision Control Code.

**Telephone**

Policy:

- The County shall encourage underground lines where they are economically and technically feasible.

Standard:

- In the development and placement of telephone facilities, such as lines, poles and substations, the design of the facilities shall consider the existing environment, and scenic view and vistas shall be considered and preserved where possible.

**Electricity**

Policies:

- Power distribution shall be placed underground when and where feasible. The County shall encourage developers of new urban areas to place utilities underground.

- Route selection for high voltage transmission lines should include consideration for setbacks from major thoroughfares and residential areas.

- Safety standards for power systems shall conform to safety standards as established by appropriate regulatory authority.

Standards:

- There shall be a minimization of obstruction of scenic views and vistas by electrical facilities.

- Facilities such as substations shall be aesthetically pleasing.

## Gas

Policy:

- Gas storage facilities shall be located so as to minimize danger to commercial and residential areas.

Standard:

- The County's ordinances shall reflect appropriate safety standards for gas facilities.

## Sewer

Policies:

- The "Sewerage Study for All Urban and Urbanizing Areas of the County of Hawaii, State of Hawaii," December 1970 and the "Water Quality Management Plan for the County of Hawaii," December 1980, shall be used as guides for the general planning of sewerage disposal systems.

- Private systems shall be installed by land developers for major resort and other developments along shorelines and sensitive higher inland areas, except where connection to nearby treatment facilities is feasible and compatible with the County's long-range plans, and in conformance with State and County requirements.

- Schemes for wastewater reclamation and reuse for irrigation shall be utilized where feasible and needed.

Standards:

- Incorporate sewage works standards proposed in the "Sewerage Study for All Urban and Urbanizing Areas of the County of Hawaii" and the "Water Quality Management Plan for the County of Hawaii."

- Sewerage systems shall be designed for the particular area, depending on topography, geology, density of population, costs, and other considerations of the specific area.

Response: Infrastructure systems will be constructed to support the proposed development, including roadways, wastewater, potable water, drainage, communications and electrical systems. Use of underground utilities will enhance the physical

appearance of the project while also improving the system safety and reliability. The facilities will conform to current standards as to efficiency and quality.

5.2.2.11 Recreation

Goals:

- Provide a wide variety of recreational opportunities for the residents and visitors of the County.
- Maintain the natural beauty of recreation areas.
- Provide a diversity of environments for active and passive pursuits.

Policies:

- Recreational facilities in the County shall reflect the natural, historic, and cultural character of the area.
- The use of land adjoining recreation areas shall be compatible with community values, physical resources and recreational potential.
- Public access to the shoreline shall be provided in accordance with an adopted program of the County of Hawaii.

Response: The proposed project will provide increased recreational opportunities, which include an 27-hole golf course and ocean related activities to be available to the public. In addition, the public shall be provided improved access to the shore and to significant scenic and historical sites located within the State Conservation District lands through the provision of public parking and a pedestrian access trail system. Several scientific surveys and studies of the environment at Hokukano have been made to accurately identify the existing natural resources of the site. Based on these studies, development plans have been prepared to minimize potential impacts to the site's natural resources and important archaeological sites and, to the greatest extent practical to protect and conserve them.

5.2.2.12 Transportation

Goal:
- Provide a transportation system whereby people and goods can move efficiently, safely, comfortably and economically.

Policy:
- The improvement of transportation service shall be encouraged.

Standard:
- Transportation systems shall meet the requirements of the State DOT and the County of Hawaii.

Response: Traffic impacts related to the overall Hokukano development have been thoroughly analyzed and described in the traffic analysis performed specifically for the proposed project by Parsons Brinckerhoff Quade & Douglas. (See Appendices, Section II-1). The results of this analysis indicate that the future traffic conditions will be positively affected by the proposed construction of the Mamalahoa Highway bypass that would traverse the mauka portion of the project site. The proposed bypass divert much of the through traffic from Mamalahoa Highway, thereby relieving the current congestion that occurs during the peak hours in the villages of Kealakekua, Kainaliu and Honalo, and improving operating conditions at the existing Haleki'i Street/Mamalahoa Highway intersection. The applicant expects to participate with the State and other land owners in the construction of the highway bypass. In this manner, the proposed project could serve as the catalyst for construction of the bypass, allowing the highway to be built more efficiently and sooner than might otherwise be possible. The necessary intersection improvements, in accordance with the State DOT requirements will be provided at the existing Mamalahoa Highway/Haleki'i Street intersection and at future intersections with the highway bypass, if warranted.

5.2.2.13 Land Use

Goals:
- Designate and allocate land uses in appropriate proportions and mix and in keeping with the social, cultural, and physical environments of the County.
- Protect and encourage the intensive utilization of the County's important agricultural lands.

- Protect and preserve forest, water, natural and scientific reserves and open areas.

Policies:

- Zone urban and rural types of uses in areas with ease of access to community services and employment centers and with adequate public utilities and facilities.

- Promote and encourage the rehabilitation and use of urban and rural areas which are serviced by basic community facilities and utilities.

- Allocate appropriate requested zoning in accordance with the existing or projected needs of neighborhood, community, region and County.

- The County shall encourage the development and maintenance of communities meeting the needs of its residents in balance with the physical and social environment.

Standard:

- The designated land uses will be delineated on the General Plan Land Use Pattern Allocation Guide Map.

Eight types of land uses are addressed individually. Relevant goals, policies and standards are summarized and discussed below.

**Agriculture**

Goal:

- Identify, protect and maintain important agricultural lands on the Island of Hawaii .

Policies:

- Zoning shall protect and maintain important agricultural lands from urban encroachment. New approaches to preserve important agricultural land shall be implemented by the County.

- Agriculture land shall be used as one form of open space or as green belt.

- Rural-style residential-agricultural developments, such as new small-scale rural communities or extensions of existing rural communities, shall be encouraged in appropriate locations.

## Commercial Development

Goals:

- Provide for commercial developments that maximize convenience to users.

- Provide commercial developments that complement the overall pattern of transportation and land usage within the island's regions, communities and neighborhoods.

Policies:

- In an effort to assist existing commercial developments, urban renewal rehabilitation, and/or redevelopment programs shall be undertaken in cooperation with communities, businesses and government agencies. The key to the success of these kinds of programs is active and sustained participation from communities and businesses.

- Commercial facilities shall be developed in areas adequately served by necessary services, such as water, utilities, sewers, and transportation systems. Should such services not be available, the development of more intensive uses should be in concert with a localized program of public and private capital improvements to meet the expected increased needs.

- Distribution of commercial areas shall be such as to best meet the demands of neighborhood, community and regional needs.

- Existing strip development shall be converted to more appropriate uses when and where it is feasible.

- The development of commercial facilities should be designed to fit into the locale with minimal intrusion while providing the desired services. Appropriate infrastructure and design concerns shall be incorporated into the review of such developments.

- Applicable ordinances shall be reviewed and amended as necessary to include considerations for urban design, aesthetic quality and the protection of amenities in adjacent areas through landscaping, open space and buffer areas.

Standards:

There are three types of shopping centers:

- Neighborhood centers

  Provide: Convenience goods, e.g., foods, drugs, and personal services
  Major Shops: Supermarket and/or drug store
  Number of Shops: 5 to 15
  Acreage: 5 to 10 acres
  Approximate Market: 3,000 people

- Community Centers

  Provide: Convenience goods, plus "soft line" items, such as clothing, and "hard line" items, such as hardware and small appliances
  Major Shops: Variety or junior department store
  Number of Shops: 20 to 40
  Acreage: 10 to 30 acres
  Approximate Market: 15,000 people

- Regional Centers

  Provide: Full range of merchandise and services
  Major Shops: Full size department store
  Number of shops: 40
  Approximate market: 50,000 people

- Commercial development shall be located in areas adequately served by transportation, utilities and other amenities. Commercial developments shall

provide for adequate internal circulation amongst commercial facilities in the area.

- Off street parking and loading facilities shall be provided.

- Commercial development shall maintain or improve the quality of the present environment through the consideration of visual, access, landscaping and other design elements in their development.

- Preference shall be given to commercial lands with a reasonably level topography.

### Industrial

Industrial development is not a part of the present proposal.

### Multiple Residential

Goals:

- To provide for multiple residential developments that maximize convenience for its occupants.

- To provide for suitable living environments which accommodate the physical, social and economic needs of the island residents.

Policies:

- Appropriately zoned lands shall be allocated as the demand for multiple residential dwellings increases. These areas shall be allocated with respect to places of employment, shopping facilities, education, recreational, and cultural facilities, and public facilities and utilities.

- The County shall incorporate reasonable flexibility in the design of residential sites, buildings and related facilities to achieve a diversity of socio-economic housing mix and innovative means of meeting the market requirements.

- The rehabilitation and/or utilization of multiple residential areas shall be encouraged.

- To assure the use of multiple residential zoned areas and to curb speculation and resale of undeveloped lots only, the County may impose incremental and conditional zoning which shall be based on performance requirements.

- Applicable codes and ordinances shall be reviewed and amended as necessary to include consideration for urban design, and aesthetic quality through landscaping, open space, and buffer areas.

Standards:

- Areas shall be located in such a manner that traffic generated by high density development will not be required to travel through areas of lesser density en route to principal community facilities.

- Areas shall be protected from incompatible uses by transition zones.

- Provide adequate access to arterial streets, shopping facilities, schools, employment centers, and other services.

- Development shall not be permitted in natural hazard areas unless proper onsite improvements are provided.

- Development shall be located in areas where public utilities can be economically provided at a level adequate to meet the demand for the concentrated service.

- Recreational areas and/or facilities shall be considered in multiple residential development.

**Single Family Residential**

Goals:

- To maximize choices of single family residential lots and/or housing for residents of the County.

- To ensure compatible uses within and adjacent to single family residential zoned uses.

Policies:

- Rural-style residential-agricultural developments, such as new small scale rural communities or extensions of existing rural communities, shall be encouraged in appropriate locations.

- The County shall incorporate reasonable flexibility in codes and ordinances to achieve a diversity of socio-economic housing mix and to permit aesthetic balance between single family residential structures and open spaces.

Standards:

- There shall be a transitional area between single family residential areas and incompatible uses.

- Major traffic routes shall not be located through single family residential areas.

- Areas shall have basic improvements and amenities necessary for immediate use.

- Areas shall be limited to low density and medium density residential uses.

**Resort**

Resort development is not a part of the present proposal.

**Open Space**

Goal:

- Provide and protect open space for the social, environmental, and economic well-being of the County of Hawaii and its residents.

Policy:

- Open space in the County of Hawaii shall reflect and be in keeping with the goals, policies, and standards set forth in the other elements of the General Plan.

**Public Lands**

Goal:

- Utilize publicly owned lands in the best public interest and to the extent possible, to the maximum benefit for the greatest number of people.

Policy:

- Encourage uses of public lands which will satisfy specific public needs, such as housing, recreation, open space and education.

Response: The scale and design of the proposed development is in keeping with the social, cultural and physical environment. Most of the land will be in the form of open space, either golf course natural open space areas, landscaped areas, or small scale agriculture. The rural style residential agricultural lots will be a significant feature of the project, providing benefits in the areas of agriculture, single family residences and an open space buffer. As described previously, the applicant plans to provide opportunities for commercial agricultural activities within the agriculturally zoned areas by providing the access, infrastructure and site preparation necessary to support agricultural activities in an ongoing and sustainable manner. Public access to the shoreline and the State Conservation District will be maintained and improved. Parking will be provided along with passive and educational types of recreation activities.

Section 5 of the General Plan provides "Courses of Action" for the districts of the Island. Those relevant to the proposed development include the following:

### Economic

- The County shall assist the further development of agriculture by protecting important agricultural land for urbanization, by providing necessary resources, such as water, and through other assistance.

### Flood Control and Drainage

- Drainage recommendations proposed by the South Kona Flood Hazard Analysis for the Kealakekua, Napo'opo'o and Honaunau areas shall be implemented. These consist of diversions and catchments to collect and transport water and reduce peak flows from upper watershed areas through the urban area. The practice of proper soil conservation measures and the improvement of existing drainage features complement these proposals.

- Establish and maintain appropriate vegetative cover in high rainfall, sediment and debris producing areas.

## Housing

- Since the lands in this district are sloped, the County shall encourage the use of innovative types of housing developments, such as cluster and planned unit developments, which take advantage of topographic conditions.

- Aid and encourage the development of a wide variety of housing for this area to attain a diversity of socio-economic housing mix.

Public Facilities

This area is provided for by government agencies.

## Public Utilities

- Pursue groundwater source investigation, exploration and development in areas that would provide for anticipated growth and that would provide for efficient and economic system operation

## Recreation

- Expand and/or develop recreational facilities in existing and urbanizing communities.

- Encourage the development of the coastal area for public recreational use.

## Transportation

- Improve present Kona-Ka'u road.

## Land Use

(a) Agriculture

- Assist in the provision of water in agricultural areas.

(e) Single Family Residential

- The County shall encourage the concentration of residential structures to avoid strip residential development.

- Due to the geologic and topographic conditions, the County shall encourage the use of more innovative types of housing developments, such as zones of mix and cluster and planned unit developments.

Response: The proposed project includes planned provisions that would encourage and support intensive agricultural activity in areas that otherwise would remain in intermittent grazing use. Proper soil conservation measures and improvements to existing drainage areas, where necessary, are proposed as a component of the planned development. Although the area is subject to relatively low rainfall and erosion, appropriate precautions for protecting disturbed areas, such as watering and prompt revegetation, are also proposed. The use of cluster and planned unit developments that take advantage of topographic conditions are being considered as part of the planning and design of the planned residential areas. The project would also be expected to provide provisions for affordable housing, meeting State and County affordable housing requirements. These provisions, in conjunction with the proposed residential developments, would add significantly to the variety of housing available for this area. Additionally, the project has explored the water resources that are available onsite and has worked with the County Department of Water Supply to provide for the anticipated water demands for both potable and irrigation uses. In concert with recreation related goals of the County General Plan, the project will increase the recreational opportunities available to the public by providing for a passive ocean park with provisions for public shoreline access, and parking, hiking trails and an interpretive program related to the archaeological resources of the area. Lastly, the developer's participation in providing for the planned highway bypass road will contribute in a meaningful way towards meeting the General Plan "Course of Action" of improving the Kona to Ka'u Road.

### 5.2.3 West Hawaii Regional Plan

The West Hawaii Regional Plan (Office of State Planning, 1989), was prepared because of the State's interest in formulating and implementing a plan for West Hawaii that would (1) coordinate State activities in the region in order to respond more effectively to emerging needs and critical problems, (2) address areas of State concern, (3) coordinate the capital improvements program within a regional planning framework and (4) provide guidance in the State land use decision-making process. The plan addresses critical topical issues which require State attention in order to most effectively meet the region's present and emerging needs. The West Hawaii Regional Plan is meant to complement the County General Plan and Community Development Plans. The plan's focus, however, is in planning for the proposed resort developments in the North Kona and North and South Kohala Districts of the Big Island. In that the proposed project does not include a resort component, the recommendations of the plan are not directly applicable to the proposed action.

### 5.2.4 Hawaii County Zoning

The present County zoning designation of the subject property is A-5a and Unplanned. The developer has applied for a Change of Zone from Hawaii County to allow for the first phase of a low density residential/agricultural development. In the second phase of development, another Change of Zone application will be submitted to the County Planning Department to allow for the single family residential and lodge uses following State Land Use and County General Plan approvals.

## 5.3 CHAPTER 343 (HRS)

Section 343-5(a) of Chapter 343, HRS, states that except as otherwise provided, an environmental assessment shall be required for eight (8) different types of actions that utilize State lands and/or monies, propose actions in Conservation District Lands, require an applicant initiated amendment to the County General Plan. Accordingly, the following actions, which are to be accomplished in both Phase I and Phase II of the proposed development, will trigger the requirement of an environmental impact statement, pursuant to Chapter 343.

- An amendment to the County General Plan from Extensive Agriculture and Orchards to Medium and Low Density Urban on a ± 763 acre portion of the project site;

- The development of shoreline access and hiking trails possibly within the Conservation District; and

- The restoration and improvement of the King's Trail (Ala Loa or Ala Aupuni), a State owned historic trail constituting use of State lands.

# 6.0 Contextual Issues

# 6.0 CONTEXTUAL ISSUES

## 6.1 RELATIONSHIP BETWEEN SHORT TERM ISSUES AND MAINTENANCE OF LONG TERM PRODUCTIVITY

As discussed in the previous sections of this document, the subject property is largely vacant with portions being used for grazing purposes. No other short term uses of the property that may have potential negative long term consequences have been identified. Potential long term impacts from the current use, primarily as a result of the exposed areas from grazing activities, continued erosion of soils and the impacts to the marine ecosystem from non-point runoff, including cattle wastes, are unknown and unquantifiable without the benefit of long term environmental studies. As discussed in Section 3, the alternatives to the proposed project would include retaining the project area in its current use. This would present a less than optimum use of the land. The proposed facilities, including the members' lodge, golf course and residential units, would result in a significant social and economic benefit to the community in the form of increased job opportunities and increased tax revenues. Direct full and part time employment opportunities and temporary construction employment will be generated by the project and these in turn will impart multiple benefits to the island and regional economy. The public revenues from excise, personal and real property taxes are expected to far exceed and offset any expenses associated with the expansion of public services or public facilities needed to meet both the project development and indirect population growth.

With regard to the long term impacts to the environment from the proposed development, the subject property possesses the locational and physical attributes, including ocean and mountain views, proximity to the coast, appropriate slope characteristics and a relatively dry and mild climate, which are ideally suited for the proposed use. The studies performed for this EIS have also indicated that the proposed project is compatible with and will enhance the existing natural environment.

The proposed residential/recreational community, as planned, will be of the same high quality as other projects undertaken by the developer, such as the Desert Highland and Desert Mountain projects in Scottsdale, Arizona, both of which are noted for their sensitivity to the environment and quality of design. Other long term benefits include the productive use of the property in a manner in which the low density rural character of the region would be maintained through careful site planning and integration of significant open space elements. The open space of the coastal area,

comprising the area within the State Conservation District and vistas to the ocean and mountains, would be retained for the long term benefit of residents and visitors to the area. Increased recreational and economic opportunities for all socio-economic levels would also be provided, along with increased community services and facilities.

## 6.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The development of the proposed project and resultant construction of the 27-hole golf course, golf clubhouse, members' lodge, residential units and supporting facilities would result in the irreversible and irretrievable commitment of certain natural and fiscal resources. Major resource commitments include the land on which the proposed project is located and the money, construction materials, manpower and energy required for the project's completion. The impacts represented by the commitment of these resources, however, should be weighed against the positive socio-economic benefits that could be derived from the project versus the consequences of either taking no action or pursuing another less beneficial use of the property.

## 6.3 OFFSETTING CONSIDERATIONS OF GOVERNMENTAL POLICIES

There are inherent conflicts in the goals and objectives of the land use plans, policies and controls, and the proposed project's relationship to various policies must be reconciled against those plan elements which most appropriately apply. As indicated in Section 5, the proposed project would be consistent with the applicable Hawaii County General Plan goals, policies and standards following adoption of the proposed General Plan Amendment and rezoning required for the proposed project. As also indicated in Section 5, the proposed project is consistent with the applicable Hawaii State Plan and various functional plans, as well as the objectives and policies of the Hawaii Coastal Zone Management Program (Chapter 205A, HRS). Significant adverse effects are not expected to result from the proposed project. There may be some minor impacts, but these are thought to be offset by the benefits accruing from the project. State and County plans have encouraged quality residential developments on the Island of Hawaii, especially when these have been planned in concert with community goals, as expressed within the County General Plan.

Regional infrastructure required to support the project are present or planned. Additions that may be required would largely be provided by the developer or funded through increased tax revenues that the project would generate. The project development is consistent with governmental policies calling for increased access to the shoreline and increased recreational facilities and opportunities.

The analysis of direct, indirect and induced County revenues versus County expenditures generated by the proposed project, as shown in Section 4, indicates that the benefit cost ratio would be favorable and range from 10.4 to 8.2, and State revenue to expenditure ratio would range from 8.9 to 2.8. The State might expect to net approximately $8.69 million, and the County may expect to net approximately $8.67 million in additional annual revenues at the project completion (in 1992 dollars). While the above analysis does not quantify the environmental costs, the adverse environmental impacts of the proposed project are relatively minor, while the potential positive environmental and social impacts appear to be significant. The current sedimentation and erosion of soils would be arrested through the landscaping and maintenance of open space areas, and the coastal area monitored on a continual basis. Public access to the shoreline would be improved and managed in a manner that would protect the historical and archaeological sites in this area and overuse of the coastal resources. Historical and archaeological sites would be protected and incorporated into the development plan, thereby adding to the cultural resources of the County and State and needed employment, economic and housing opportunities would be provided. Generally, as discussed in Section 5, the plan is consistent with relevant government plans and policies. It would fulfill the goals of the Hawaii County General Plan, which call for economic growth that maintains the desired physical environment that meets the needs of Hawaii's people.

## 6.4 UNRESOLVED ISSUES

During the past years, the project developers and their representatives have conducted numerous meetings and site tours with groups and individuals, met with agency representatives both on and offsite, and conducted several public informational meetings in order to identify and address to the extent practical the issues and concerns pertaining to the proposed development. All the issues raised have been addressed in this EIS, although some may be considered as unresolved at present. These issues are listed below, along with a brief discussion as to the process for their eventual resolution. In most cases, these issues relate to the development of further plan details that are unavailable at this time but are planned as part of the planning and regulatory approval process. The developer will continue to work with residents of the area, organizations and pertinent County and State agencies to resolve these issues.

### Issue #1: Alignment and Timing of the Highway Bypass

The State has proposed a bypass road to relieve traffic congestion within the towns of Kealakekua, Honalo and Kainaliu, however, this item is far down on the State DOT's priority list, indicating

that it will likely be some time before the proposed bypass would receive significant attention. The developer has proposed a privately funded alternative, which, although shorter in length, would accomplish much the same objectives as the State's proposal. As proposed, the highway bypass road would be designed and built by the developer with the review, inspection and approval of the State DOT. In addition, there would be a contribution agreement required of future developments in the area to fund their fair share of the proposed bypass, thereby returning a portion of the cost advanced by the initial developers. Several meetings have taken place with property and business owners, agency representatives and developers regarding the proposed bypass concept. Although a precise alignment, intersection configuration and timing for construction have not been determined at this time, the initial proposal put forth by Oceanside 1250 has received a favorable response by the State DOT, other developers, and surrounding landowners. The proposal offers the prospect of constructing the much needed bypass in a shorter time and at no expense to the State. The developer will continue to work with the State DOT, developers and landowners in the area, the business community, as well as other interested citizens to implement their proposal of construction of the highway segment. The specific alignment and design details will follow receipt of the requisite regulatory approvals related to the Villages at Hokukano, and further engineering design.

Issue #2: Affordable Housing

The proposed residential community does not include an onsite affordable housing component. The developer fully intends to comply with the affordable housing requirements that are in place at the time of land use approvals. Both the County and the State are reassessing the affordable housing requirements, which are conditioned as part of land use approvals. The developer has investigated options for integrating the affordable housing as part of the proposed development using the State's current guidelines, however, in order to make the project financially viable, the resulting density would not have allowed for a sensitive treatment of the land, nor would it have allowed the developer to retain the rural character, which would be in keeping with the area. It is felt that affordable housing would best be located in another location where it would better fit with the urban fabric and be in proximity to the necessary supporting public services and facilities.

Issue #3: Potable Water

Oceanside 1250 has completed a test well onsite that has shown to be a suitable source of brackish water for meeting the landscaping and golf course irrigation requirements for the proposed project.

(No brackish water will be used in combination with treated effluent to meet the irrigation needs of the project). The well has shown to be of sufficient quality and quantity to meet the project requirements for brackish water. The developer also has commitments from the County for 499 units of potable water from the County water system, which is sufficient to meet the requirements of the first phase of development (367 lots and golf club use). Additionally, the owner has secured agreements to develop other sources of water in the area. From initial indications from the County and State's exploratory wells in the area, there appears to be an ample source of high level water for potable uses, especially in the areas above the 1,200 foot elevation. The developer plans to secure additional water development agreements from the County for the subsequent phases of development, or develop additional well sources in the area through previous water development agreements. The specific sources that would meet these future requirements are unknown at this time; it would be premature, however, for the developer to acquire any further water commitments from the County or to develop additional water sources prior to receipt of initial land use approvals.

Issue #4: Site Preservation Measures

A complete archaeological survey was conducted by Cultural Surveys Hawaii for the 1,540 acre parcel (Appendices III-1 and III-2). Based on the field reconnaissance, limited data recovery and subsurface testing, initial significance determinations and treatment recommendations were provided. The survey report was submitted in February 1993 to the DLNR-HSPD for review and approval. Although the property has been thoroughly surveyed for the presence of archaeological or historical features and sites have been identified and evaluated as to their potential historic or cultural significance, the specific measures for site preservation and appropriate buffer treatment will be determined at a later point in the approval process through discussions with the DLNR-HSPD, the Hawaii Island Burial Council and the County of Hawaii Planning Department. The applicant will continue to work closely with local historians and cultural specialists, as well as representatives from DLNR-HSPD in gaining a full appreciation of the archaeological features that are present on the site and in preparing a comprehensive plan for site protection, preservation and interpretive development.

Issue #5: Historic Trails and Roads

An initial investigation of historic trails in the project area has shown reference with historic grant documents to a "public road" that traverses the site in the north/south directions. In some

instances, map references to this public road appear to generally align with the existing trails and portions of the "King's Trail". Although the King's Trail is only evident in select portions and the public road is never referred to as the King's Trail, it is not known at this time whether the King's Trail and the aforementioned public road are one and the same or whether the earlier reference to this trail as a pubic road would place this portion under the State's ownership. A final determination on this matter can only follow further archival research and discussions with the State. As with the other historic trails and sites that may be present on the property, the measures for protection and treatment will be determined as part of the regulatory approval process.

# 7.0 Parties Consulted and Those Who Participated in the Preparation of the EIS

# 7.0 PARTIES CONSULTED AND THOSE WHO PARTICIPATED IN THE PREPARATION OF THE EIS

## 7.1 CONSULTED PARTIES IN PREPARATION OF THE DRAFT EIS

The notice of the availability of the EIS Preparation Notice and Environmental Assessment for the Villages at Hokukano was published in the OEQC Bulletin by the Office of Environmental Quality Control on April 8 and 23, 1993. In addition to holding a series of community informational meetings in Kona, Kealakekua and Napo'opo'o, representatives of the applicant have personally met with a wide variety of public agencies, community organizations, elected officials and private citizens. The agencies, organizations and individuals consulted about the project are listed below. Those who commented on the Environmental Assessment in writing are listed on Table 4. Copies of their correspondence and responses thereto are reproduced at the end of this section.

### 7.1.1 Agencies Consulted

- County of Hawaii Department of Planning
- County of Hawaii Department of Public Works
- County of Hawaii Department of Water Supply
- Office of State Planning
- State of Hawaii Department of Education
- State of Hawaii Department of Land & Natural Resources
- State Historic Preservation Division, Department of Land & Natural Resources
- State of Hawaii Department of Transportation
- State Land Use Commission
- U.S. Department of Agriculture, Soil Conservation Service

### 7.1.2 Business & Community Groups Consulted

- AFL-CIO Local 368
- Agriculture Development & Coordination Committee

- American Lung Association
- Amy Greenwell Botanical Gardens
- Big Island Traffic Safety Council
- Carpenter's Union - Local 745
- Conservation Council
- County Mauka Rotary Club
- Discovery Charters
- Exchange Club of Kona
- Greater Kona Community Council Office
- Hawaiian Civic Club
- Hawaii Island Environmental Council
- Hawaii Leeward Planning Conference
- Japanese Civic Associations
- Junior Golf
- Kainaliu Business and Professional Association
- Ka Lahui Hawaii
- Keauhou Visitor Center
- King Kam Divers
- Kiwanis
- Kona Board of Realtors
- Kona Coast Divers
- Kona Conservation Group
- Kona Farmers Coop
- Kona Historical Society
- Kona Kai Farms
- Kona Lions Club

- Kona Outdoor Circle
- Kona Regional Senior Center
- Kona Surf Resort
- Kona Traffic Safety Committee
- Kona Traffic Safety Council
- Konawaena Elementary School
- Konawaena High School
- Lions
- Mauka Rotary Club
- Protect Kahoolawe Ohana
- Public Access Shoreline Hawaii
- RC & D Forestry
- Rotary Club
- Sierra Club - Moku Loa Group (East Hawaii)
- Sierra Club - West Hawaii Group
- West Hawaii Committee

### 7.1.3 Citizens

- Deborah Chang
- Lois Tyler

## 7.2 CONSULTED PARTIES IN PREPARATION OF THE FINAL EIS

The Draft EIS for the Villages at Hokukano was distributed to all required agencies and organizations indicated within the Draft EIS Distribution List, Guidebook for the Hawaii State Environmental Review Process, prepared by the Office of Environmental Quality Control. Additionally, copies of the Draft EIS were also submitted to many community groups, organizations and individuals who expressed interest in participating in the Draft EIS review process. Those who received a Draft EIS are listed in Table 5.

## Table 4
## Comments Received on the Environmental Assessment/ Environmental Impact Statement Preparation Notice

| Name/Organization | Date |
|---|---|
| Deborah Chang | 5/7/93 |
| Office of Environmental Quality Control | 3/23/93* |
| Lois Tyler | No date |

*No substantive comment nor response

# Table 5
# Draft EIS Distribution List

Federal Agencies

- United States Environmental Protection Agency, Regional Division
- United States Army Directorate of Facilities Engineer
- Department of the Navy, Naval Base, Pearl Harbor
- Soil Conservation Service
- United States Army Corps of Engineers
- United States Coast Guard
- United States Fish & Wildlife Service
- United States Geological Survey

State Agencies

- Office of Environmental Quality Control
- Department of Agriculture
- Department of Accounting & General Services
- Department of Defense
- Department of Health
- Department of Land & Natural Resources
- Department of Land & Natural Resources Historic Preservation Office
- Department of Land & Natural Resources Forestry & Wildlife
- Na Ala Hele
- Department of Business, Economic Development and Tourism
- Department of Business, Economic Development and Tourism, Library
- Department of Business, Economic Development and Tourism, Energy Office
- Housing Finance & Development Corporation
- Department of Transportation
- State Archives
- Office of State Planning
- Department of Human Services

County Agencies

- Planning Department
- Department of Parks & Recreation
- Department of Public Works
- Department of Research & Development
- Department of Water Supply

University of Hawaii

- Environmental Center
- Water Resources Research Center
- University Sea Grant Extension

News Media

- Honolulu Star Bulletin
- Honolulu Advertiser
- Sun Press
- Hawaii Tribune Herald
- West Hawaii Today

Libraries

- University of Hawaii, Hamilton Library
- University of Hawaii at Hilo Campus Library
- Legislative Reference Bureau
- State Main Library
- Kaimuki Regional Library
- Kaneohe Regional Library
- Pearl City Regional Library
- Hilo Regional Library
- Kahalui Regional Library
- Kauai Regional Library
- Holualoa Library
- Kailua-Kona Library
- Kealakekua Library

Non-Governmental Agencies, Community Organizations & Individuals

- American Lung Association
- Hawaiian Electric Company
- Office of Hawaii Affairs
- Agriculture Development & Coordination Committee
- Big Island Traffic Safety Council
- Carpenter's Union Local 745
- Conservation Council
- County Mauka Rotary Club
- Exchange Club of Kona
- Hawaii Island Environmental Council
- Hawaii Leeward Planning Conference
- Kainaliu Business & Professional Association
- Kona Board of Realtors
- Kona Farmer's Coop
- Kona Historical Society
- Kona Traffic Safety Committee
- Sierra Club Moku Loa Group
- Sierra Club West Hawaii Group
- West Hawaii Committee
- Deborah Chang
- Lois Tyler
- The Ocean Recreational Council of Hawaii (TORCH)
- Schutte Fleming Wright, Attorneys at Law
- Michael Matsukawa, Esq.
- Councilman Keola Childs
- Napo'opo'o Village Council
- Ka Lahui Hawaii Moku o Hawaii
- Kona Conservation Group

The notice of the availability of the Draft EIS for the Villages at Hokukano was published in the OEQC Bulletin by the Office of Environmental Quality Control on June 23, July 8, and July 23, 1993. The agencies, organizations and individuals who participated in the Draft EIS review by written correspondence are listed in Table 6. Additionally, copies of their correspondence and responses thereto are reproduced at the end of this section.

## Table 6
## Comments Received on the Draft EIS

| Name/Organization | Date |
|---|---|
| Department of the Interior | 8/25/93* |
| Department of Transportation | 8/16/93 |
| Ka Lahui Hawai'i Moku o Hawai'i | 8/13/93 |
| Wilmot B. Boone, M.D. | 8/12/93 |
| Napo'opo'o Village Council, Inc. | 8/12/93 |
| Charles Young | 8/12/93 |
| Office of State Planning | 8/10/93 |
| Department of Health | 8/10/93 |
| Jerry Rothstein | 8/7/93 |
| Kona Conservation Group | 8/7/93 |
| Valerie Rounsfull | 8/7/93 |
| Ka Ohana O Ka Lae | 8/6/93 |
| Department of Budget & Finance, HFDC | 8/6/93 |
| University of Hawaii Environmental Center | 8/6/93 |
| Deborah Chang | 8/6/93 |
| Maryna Allan | 8/6/93 |
| County of Hawaii Planning Department | 8/5/93 |
| Department of Land & Natural Resources | 8/5/93 |
| Office of Environmental Quality Control | 8/4/93* |
| Board of Agriculture | 8/2/93 |
| Shanti Devi | 8/1/93 |
| Na Ala Hele | 7/30/93 |
| Department of the Navy | 7/29/93* |
| Department of Business, Economic Development & Tourism | 7/28/93 |
| State Land Use Commission | 7/19/93 |
| Department of Accounting & General Services | 7/13/93* |
| United States Department of Agriculture | 7/7/93 |
| Department of Business, Economic Development & Tourism (Energy Division) | 6/30/93 |
| Rebecca Layton | No date |

*No substantive comment

5-7-93

Aloha Virginia Goldstein:

Please send me a copy of the Draft EIS for the Hokukano Villages Project when it is ready: Deborah Chang P.O. Box 3226 Lihue, Hi. 96766-6226,

In the EIS I am requesting a full description of proposed "improvements" and changes to all historic trails and a maps showing proposed trail networks, Also I would appreciate an explanation/justification for use of the term, "King's Trail." Eg., is that the correct name for the trail involved? Mahalo, Deborah L. Chang

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

June 8, 1993

Ms. Deborah L. Chang
P.O.Box 3226
Lihue, Kauai 96766-6226

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT VILLAGES AT HOKUKANO**

Dear Ms. Chang:

Thank you for your letter of May 7, 1993 to Virginia Goldstein in which you request a copy of the Draft Environmental Impact Statement (DEIS) and request that a full description of the proposed improvements and changes to all historic trails, including a map showing the proposed network, be included in the DEIS. A general description of the proposed trail network is included with the discussion on historical and archaeological resources in Section 4.3 of the DEIS and a map exhibit of the proposed trail network is included within the discussion on the shoreline trail system in Section 4.7.4. With regard to the existing trails, the following description from the Archaeological Inventory Survey prepared by Cultural Surveys Hawaii is provided:

> "One major trail is located within the project. It is known as the King's Trail and is still discernable along the northern half of the project area. The trail runs from the northern boundary at approximately 20 feet a.m.s.l. to the mauka side of Pu'u Ohau. The trail then turns mauka and runs roughly parallel with the "Great Wall of Kuakini" until the southern project boundary where it continues into the ahupua'a of Keopuka. The portion of the trail mauka of Pu'u Ohau to the south boundary was not observable on the ground; however, its location was obtained on historic maps. The portion of the trail that is distinguishable on the ground follows the general route of the Greenwell Road (reportedly built by the Greenwell Family), which at one time connected Keauhou Bay to the north and Kealakekua Bay settlement at Kaawaloa to the South."

As part of the proposed improvements for the King's Trail, in those portions where the trail exists, Oceanside 1250 proposes to preserve the trail in place, with slight modifications, as necessary. In those areas where there is no evidence of the trail, the developer proposes to reestablish the trail in the general area where it was once located based upon existing map information, historical references, and compatibility with the proposed land use plan.

With regard to other trail improvements, the developer has proposed a trail network linking sites of archaeological and historic significance as part of the interpretive program. The trail network would also provide access to the shoreline area. The proposed trail network and site improvements are conceptual at this point. The details of the trail improvements would be prepared as part of

further archaeological work, in conjunction with the regulatory approval process. Recommendations for site preservation and interpretive development will be developed by the consulting archaeologist in conjunction with the recommendations of the Department of Land & Natural Resources Historic Preservation Program (DLNR-HPP), the State Na Ala Hele Trails Advisory Group, and other pertinent agencies, historical organizations, resource professionals and interested community members. The mitigation program for archaeological sites, which will include plans for site preservation, will require approval by the County Planning Department in consultation with the DLNR-HPP prior to issuance of grading permits for any portion of the proposed project.

With reference to the use of the term "King's Trail" or "Cart Trail", as it is sometimes referred, this name has been used commonly by all those who have been involved with the project, including the archaeologist, as noted above. There is, however, a Hawaiian name for the trail, which we believe is correct, that being Ala la loa. There are other map references that refer to a "Public Road" or "Old Government Road" in the same general alignment as the King's Trail. This is assumed to be the same as the Greenwell Road referred to above. Should you know of other references, we would appreciate any information you might be able to provide us.

Again, I thank you for your inquiries. Should you have any further questions, please do not hesitate to contact either myself (961-3333) or Mr. Richard Frye, Project Manager at Oceanside 1250 (326-2966).

Sincerely,

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein
R. Frye
B. Kudo
L. Tanimoto
G. Leslie
D. Hulse

JOHN WAIHEE
GOVERNOR

BRIAN J. J. CHOY
Director

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185

March 23, 1993

Ms. Virginia Goldstein, Planning Director
County of Hawaii Planning Department
25 Aupuni Street, Room 109
Hilo, Hawaii 96720-4252

Attention: Mr. Daryn Arai

Dear Ms. Goldstein:

SUBJECT: EIS PREPARATION NOTICE (EISPN) FOR THE VILLAGES AT HOKUKANO, NORTH & SOUTH KONA, HAWAII

We have completed our review of the subject document and have a few comments to offer.

When submitting the Draft EIS for this project, please describe the impacts and mitigation measures in regard to the risks of earthquake and volcanic eruptions in the area, if any.

Please consider printing the Draft EIS on both sides of the paper to cut down on paper and postage costs.

If you have any questions, please call Margaret Wilson at 586-4185. Thank you.

Sincerely,

Brian J.J. Choy
Director

c: Scott A. Shiigi, PBR Hawaii
Richard Frye, Oceanside 1250

Virginia Goldstein
County of Hawaii Planning Department
25 Aupuni Street, Room 109
Hilo, Hawaii 96720

SUBJECT: EISPN: Oceanside 1250, Villages at Hokukano

Dear Mr. Frye:

Thank you for giving me this opportunity to contribute to the EIS process by accepting my concerns about the proposed project. I believe that the following concerns should be disclosed and thoroughly discussed in the draft EIS, and the cumulative effects projected for five, ten, and twenty years.

1. Effect of the project on Kealakekua Bay:
A. What effect will chemicals carried by currents have on the Kealakekua Bay Marine Reserve's unique sealife?
B. What effect will the silt from construction activity have on the shoreline at the project site, which is considered to be a significant diving area?
C. Since at least SOME of the chemicals to be used on the 27-hole private golf course and 1,440 homesites will get into the ocean and flow around nearby Keawekaheka Point and into Kealakekua Bay, a full disclosure and discussion is needed regarding:

(1) the estimated and possible damage to coral and other marine life in Kealakekua Bay. (Cite Doty Report.)
(2) the effect on the tourist economy, since glass bottom boats, swimmers, and snorkelers use this bay.
(3) the effect on the resident school of spinner dolphins. Reputable scientists should be consulted.
(4) the impact of degradation of the bay on the status and designations of the bay as a marine life conservation area; Hawaii state's second underwater park; the nation's ninth best swimming area, according to a national survey reported in USA Today recently; and the home of endangered species such as the Hawksbill turtle.

2. Transportation/circulation: (Section 3.11 in EISPN)
A. Figure 6 shows the highway bypass as it is planned within the project site, but it does not show how it connects outside the project to the north or to the south. These must be shown so that the community, especially residents near this proposed bypass, will be able to assess its impact on them.

3. Historical/archaeological and cultural sites:
A. The Kona Field System must be disclosed and its significance thoroughly discussed.(See studies by Marion Kelly and others.)

E. Hawaiian groups such as the Burial Council, Ka Lanui, and others should be consulted for their expertise in evaluating cultural sites. A golf course designer's idea of preservation of sites by designing golf course features around them may not agree with Hawaiians' ideas of preservation as including the maintenance of the INTEGRITY of the sites. The question that arises is whether a development of this type is even compatible with historic preservation.

4. Economic and social impacts:

A. What are the benefits of this project to the community? How many people will benefit? Will Hawaiians, for example, benefit from this development? How? How many? In what way(s)?

B. What will be the cumulative effect of the approval of this project? Will this smooth the way for approval for similar projects planned for Kona: at Opihihale, at Kealakekua Bay, above the Kealakekua Ranch Center, and one near the Kona Hospital?

C. What will be the cumulative effect of having a private golf club and high-priced homes in this relatively rural community? If these five projects are approved, what is the optimum number of private golf course-high priced home enclaves for Kona? What studies are there that may guide planners?

D. How much of an impact will this development have on residents' shoreline activities, which are so much a part of daily living, especially for the Hawaiians? What are the provisions for access to and along the shoreline for residents?

E. What effect will this development have on population growth in Kona in five years? ten? twenty?

F. What are all the public costs anticipated by the new residents and golfers of this project?

G. What will be the effect of this project on residents' property taxes?

H. How stable is the fiscal backing for this project, considering the recent failure of the Riviera resort in Ka'u?

I. The Hawaiian sovereignty movement and the environmental movement agree on the idea of living in harmony with the land that our lives depend on. Ecotourism is being encouraged more and more. An artificially manicured golf course with very high-priced homes and an exclusive golf club house seem to be a contradiction to both of these movements.

5. Fauna: The EISPN states in Section 3.9 that "the greater diversity in plant materials and water features may actually increase the available habitat for several species, primarily the Golden Plover and Ruddy Turnstone." Might not the effects of chemicals as well as increased human activity

reduce their numbers or eliminate them altogether rather than increase them? What is the basis for this assertion?

5. Geologic:

A. A discussion is needed on the tsunami zone, flood plain, lava tubes, and caves in the area and their consideration for minimum effect to the proposed project. The Civil Defense Director should certainly have input in this discussion.

B. The Kealakekua Fault:

Where is the Kealakekua Fault Line in relation to this project? Input is needed from experts if the proximity warrants such consideration. What are the probable and possible effects on different factors such as injection wells and sewage treatment facilities?

7. Water:

What are the water needs of this development? Where is the water to come from? What is the capacity of the present water sources and anticipated needs for this project? At a time when residents are already being told periodically not to water their plants and to conserve water in various ways, they see the golf courses being watered lavishly. Will this project require more sacrifice on the part of residents?

8. Sewers and waste:

What provisions are being made for the waste from this project? At what public costs? What is the public cost for "connecting to the STP at Keauhou" as suggested in the EISPN? What measures will be taken to INSURE that the shoreline, and especially Kealakekua Bay, will not be adversely affected by any waste from this project? Is the developer willing to agree to the terms of the Valdez Principles that the polluter will pay?

The concerns raised above are submitted with the hope that they will assist in the preparation of the draft EIS.

Sincerely,

LOIS TYLER
Resident, taxpayer

cc: Richard Frye, Project Manager, Oceanside 1250
✓James Leonard, PBR Hawaii, Inc.
Brian Choy, Director, OEQC

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

June 8, 1993

Ms. Lois Tyler
P.O. Box 1001
Captain Cook, HI 96704

**SUBJECT: COMMENTS TO ENVIRONMENTAL IMPACT STATEMENT NOTICE OF PREPARATION (EISPN) VILLAGES AT HOKUKANO**

Dear Ms. Tyler:

Thank you for your letter regarding the Environmental Impact Statement Preparation Notice (EISPN) for the Villages at Hokukano expressing your concerns about the project. For the most part, your questions have been addressed within the various sections of the Draft Environmental Impact Statement (DEIS), but to answer your specific questions, I'll address them individually as they are listed in your letter.

1) The effects on Kealakekua Bay:

   a) The effects of chemicals carried by currents on the sea life at Kealakekua Bay.

   b) The effects of silt runoff from construction activities to the shoreline area fronting the project site.

   c) (1-4) Discussion of the potential impacts on coral, marine life, commercial and public uses in the bay and potential impacts on the Bay's status as a marine life conservation area.

Response: A discussion of the potential impacts to the marine environment as a result of the proposed development is found in Section 4.2.3 of the DEIS. In general, we do not expect the proposed project to negatively impact the coastal waters fronting the project site, and therefore, no negative impacts to marine life or use of any other waters, including Kealakekua Bay, either directly or indirectly, are anticipated. We have heard from a few people who expressed concern that chemicals used in the maintenance of the golf course might leach down through the soil and eventually find their way to the coastal waters, impacting the marine ecosystem. There have been several studies performed on coastal golf courses in Hawaii from which there has been no indication that the golf courses have had an adverse impact to ground or nearshore water quality.

Richard E. Brock, Ph.D., the marine biologist who performed the marine water quality studies for the waters fronting the Villages at Hokukano, has been monitoring the anchialine (brackish and tidal) ponds and coastal waters fronting the Waikoloa Resort for the past eight years. The scientific monitoring program taking place at Waikoloa under the

auspices of the University of Hawaii at Manoa has shown that although nutrient levels do fluctuate, they remain well within the levels found in other natural conditions along undeveloped portions of the West Hawaii coast. The program also found no discernible impact to the marine biota in either the ponds or the coastal waters fronting the Waikoloa Resort. From Dr. Brock's analysis of coastal waters fronting the Villages at Hokukano, his assessment is that there is little or no potential threat to the marine community as a result of the proposed development. However, to ensure that any potential threat to the marine environment is minimized to the greatest extent practical, Oceanside 1250 has proposed the following measures as part of the design of the golf course:

- Engineering the golf course with a bowl-shaped fairway construction and with a subsurface drainage system designed to collect stormwater runoff or irrigation water passing through the soil layer and conducting this to the irrigation pond for reuse on the course;

- Incorporating a "Reduced Turf" golf course design, which reduces fairway areas and requirements for water, fertilizers and chemicals;

- Implementing an Integrated Golf Course Management Program aimed at minimizing the use of chemicals for golf course maintenance and ensuring safe handling and storage of all chemicals;

- Adopting Hawaii proven bio-rational pest control methods when appropriate; and

- Implementing a Water Quality Monitoring and Mitigation Program to ensure monitoring of soil and coastal water conditions for chemicals used in golf course landscaping and, if indicated, implementing appropriate mitigation measures.

Taken collectively, these represent the state of the art in environmentally sensitive golf course design and management. Part of this effort, as indicated, includes an ongoing monitoring program, not only of the irrigation water as it passes through the soil layer, but also of the ground and coastal waters. Should any significant change to water chemistry be detected at any of these points, corrective measures can be taken prior to there being any adverse impact to the marine environment. Correspondingly then, since negative impacts to the marine waters fronting the project are not anticipated, those areas further removed from the project site, such as Kealakekua Bay, would likewise be unaffected.

2) Transportation/Circulation:

a) The DEIS should show the highway bypass alignment, including where it connects to Mamalahoa Highway to the north and south of the project.

Response: A full discussion of the planned bypass road, including a map showing the proposed alignment and connection points to Mamalahoa Highway, is included within Section 4.6.1 of the DEIS. I have also included this exhibit for your reference. In summary, the developer has proposed a shorter alignment than that which was originally proposed by the State. In the 1970's, the State Department of Transportation proposed a highway bypass for a portion of Mamalahoa Highway that would have departed the

highway just south of the Kamehameha III intersection and continued south to a point well beyond Honaunau. The developer's proposed alignment would be similar to the State's except the northernmost intersection would be moved southward along Mamalahoa Highway to the area between Pu'uloa Subdivision and Higashihara Park. The developer's proposed alignment would run between Higashihara Park and Pu'uloa Subdivision, reach the State's alignment at the 800 foot elevation and then follow the State's alignment through the Villages at Hokukano land where it would begin to curve in a mauka direction to intersect Mamalahoa Highway near the current intersection with Napo'opo'o Road. As part of the construction of the proposed highway bypass, intersection improvements would be made at Napo'opo'o Road in order to eliminate the dangerous curve and intersection conditions that presently exist.

As proposed, the developer, together with other major landowners, would combine efforts and funds toward the construction of the shorter version of the proposed bypass highway. The highway would be designed and built by the developers with the approval, inspection and some participation by the Department of Transportation (DOT). Additionally, there would be a contribution agreement that would require future developments in the area to pay their fair portion of the proposed bypass, thereby returning a portion of the cost to the initial developers.

It is felt that, through private sector efforts, including those of Oceanside 1250, the highway bypass can be built in a relatively short period compared to the length of time it would take if done by the State DOT, considering its position on the priority list and the State's more complicated processing requirements.

Although the proposed alignment and improvements are conceptual at this time, in reviewing this proposal with the DOT, other developers, landowners, business owners, and interested citizens and organizations, the developer has received a favorable response. It is felt that this proposal offers the potential of providing a less expensive highway, built in a shorter time and providing much needed relief to traffic conditions along this portion of Mamalahoa Highway.

3) Historical, Archaeological and Cultural Sites:

a) Disclosure of the Kona Field System.

b) Hawaiian groups, such as the Hawaii Island Burial Council, Ka Lahui, and others should be consulted in the evaluation of cultural sites in that the golf course designer's ideas for site preservation may not agree with that of the Hawaiians.

Response: First, allow me to clarify that the golf course designer does not determine which sites are preserved or the eventual treatment for these sites. These requirements are determined by others then the designer works to make the golf course compatible with these constraints. Over the past few years, the developer has gone to great lengths to seek input from the Hawaiian community on the significance of the archaeological and historic sites that are on the property. At this point, what has been completed has been an Archaeological Inventory Survey, prepared by Cultural Surveys Hawaii. This report provides a background history on the property and settlement patterns, and describes the features that were found through the survey, including the remnants of the Kona Field

System, and further provides preliminary recommendations as to the level of importance and treatments for each site. This report has been submitted to the Department of Land & Natural Resources Historic Preservation Program (DLNR-HPP) for review and approval. Following DLNR approval, plans for site preservation will be prepared as part of further archaeological work, which will occur in conjunction with the regulatory approval process. Recommendations for site preservation and interpretive development will then be developed by the consulting archaeologist in conjunction with DLNR-HPP, the State Na Ala Hele Trails Advisory Group and other pertinent agencies, historical organizations and resource professionals. The Archaeological Mitigation Program for archaeological sites will include plans for site preservation and will require approval by the County Planning Department in consultation with DLNR-HPP prior to issuance of grading permits for any portion of the project. The routing and design of the proposed golf course will be adjusted accordingly to accommodate those sites that are to be preserved and where necessary, provide adequate buffer areas. In this manner, the golf course development can be extremely sensitive to the goals of archaeological site preservation.

4) Economic and Social Impacts:

a) What are the benefits of the project to the community?

b) What will the cumulative effect of this project in combination with other proposed projects in the area be?

c) What will the cumulative effect of having a private golf club and high-priced homes in this relatively rural community be?

d) How much impact will this development have on shoreline activities, especially that of Hawaiians, and what are the provisions for access to and along the shoreline for residents?

e) What effect will this development have on population growth in Kona over the next five to twenty years?

f) What are the public costs as a result of the residents and golfers who will utilize this project?

g) What will the effect of this project on residents' property taxes be?

h) How stable is the fiscal backing for this project?

i) Is an artificially manicured golf course with high-priced homes, an exclusive golf clubhouse a contradiction to the goals of living in harmony with the land or moving toward the direction of more ecotourism, as expressed by the environmental and Hawaiian sovereignty movements?

Response: Based upon the Economic and Fiscal Impact Report prepared for this project, the economic impacts to the community are expected to be positive. It is estimated that the new property tax revenues to the County from the proposed project are expected to reach approximately $10 million, as compared to the current property tax of $10,000 and

approximately $13.6 million in new State revenues. These revenues would far exceed the projected State and County expenditures in providing public services to project residents and guests, such that the ratio of new tax revenues to new expenditures would be 8.2 to 1 for the County, and approximately 2.8 to 1 on the State level. The additional benefits to the community would include contributions to the area's infrastructure improvements, such as the County's water system and roads; provisions for public access to the shoreline that were previously unavailable; the enhancement of archaeological resources on the property that will be accessible to the public through an extensive trail system combined with a historical and archaeological interpretive program; the provision of jobs that are expected to be filled in large part by local residents; and the development of the highway bypass road.

Regarding potential impacts to the regional population, projections by the Department of Planning & Economic Development indicate that, between the years 1980 and 1990, the populations for North and South Kona increased by 62.1% and 29.5%, respectively. Preliminary projections by the County of Hawaii show that population in the South Kona district is expected to increase by about 40% by the year 2010, from 7,658 in 1990 to over 10,600. In North Kona, the population is projected to increase approximately 136%, from 22,284 in 1990 to 52,620 by the year 2010.

The population impacts are reflective of those attracted to the State by the Villages at Hokukano project, as well as those employees who move to Hawaii to fill job positions. According to projections by KPMG Peat Marwick, the in-migrant population to the County as a result of the project is estimated to be 1,530 persons at buildout. This is expected to be comprised of a relatively small portion of the projected growth of each district. Regarding the cumulative effect this may have with other developments, several other projects have been proposed in the general area, all of which are at various stages of planning and regulatory approval. It would be somewhat misleading to assume that all projects will be approved and built as planned. In order to address the potential impacts to public services, utilities and infrastructure, State and County planning for area-wide infrastructure and public service requirements are typically coordinated with projected developments, as these projects are reviewed by the respective agencies at various stages of the regulatory process.

Regarding the concern about the project's fitting with the rural character of the area, this concern has been expressed by many and has been a primary objective in the planning of this project. We take this to mean that if the project were viewed either from the ocean or from the mauka area, it would appear low in density and generally single family in nature. Accordingly, the project is proposed as a low density development with generous open space elements and an overall density of no greater than one unit per acre. Design guidelines and controls on homes and buildings are also planned so as to maintain a soft contrast between the buildings and surrounding areas. Additionally, with the development of the proposed highway bypass, the rerouting of non-village traffic will help return some of the rural feel to the village areas themselves.

With regard to the potential impact to taxes of surrounding areas, based on our discussions with tax assessors and officials with the County Real Property Tax Office, because the amenities of the proposed project would be available to those who own lots and not to the surrounding properties, the assessed valuation of surrounding properties should not be materially affected. For instance, the homes within the Kona Scenic Subdivision, which are directly mauka of the project site, would be assessed based on the value of homes

within that subdivision, and not the value of the homes within the project site. The value of these homes, not having direct access to the amenities of the project, should not be affected.

Regarding the financial stability of the backers of this project, the project is backed by Japan Airlines, which has experienced a steady growth over the past few years and is the 15th largest Japanese owned company in Hawaii based on revenues. This contrasts with other Japanese firms that may have invested in Hawaii properties and whose values were based on unrealized projected land values, and which are now experiencing financial problems as a result of the tightening of credit and devaluation of land prices. Although the project has yet to seek construction financing, the developer believes that they shall be able to do so when it becomes necessary. Financing is generally obtained after approvals are in place, prior to construction and sales. The developer has recently obtained financing for another project similar to this one in Santa Fe, New Mexico during a period that has been one of the most difficult times to obtain financing in modern history.

The ideal of living in harmony with the land is an admirable one, although it may mean different things to different people. The developers of the Villages at Hokukano strongly believe in an environmentally sensitive approach to all development. The general partner for Oceanside 1250, Mr. Lyle Anderson, has a proven track record of award winning projects in Arizona and New Mexico, which are noted for their environmental sensitive approach to development. These include projects such as Desert Highlands and Desert Mountain in Scottsdale, Arizona. This project will likely include higher priced homes and a golf course, but that does not mean that it cannot be environmentally friendly; on the contrary, it can afford the developer greater flexibility to fit the project to the site and implement effective environmental management and monitoring programs that may not be possible with a more affordable oriented residential subdivision. In an effort to further the sensitivity and awareness of the unique characteristics of this property to potential residents, the developer plans to impart information about the rich history of the property and its relationship to the surrounding area. The developer also plans to maintain the coastal area (the area inside the State Conservation District), comprising approximately 140 acres along the coast, as a natural ocean park and recreation area for both the protection of the shoreline and community and property owner enjoyment. This is envisioned to remain essentially a natural environment, with selective cleaning and trimming to accommodate public access, hiking, etc. and enjoyment of the shoreline area. The developer proposes a trail system not only within the Conservation District, but also in some of the mauka lands to provide managed access to other historic and prehistoric archaeological sites, such as the King's Trail, the Kuakini Wall, heiaus, platforms, enclosures, and the like. These types of measures could be seen as being very much in line with the ecotourism approach to development. However, ecotourism is a term that generally relates to resort developments, as opposed to a residential community, which is proposed for this property.

5) Fauna:

a) Might the effects of chemicals, as well as increased human activity, reduce the number of available species, such as the golden plover and ruddy turnstone, or eliminate them all together, rather than increase them? What is the basis of the assertion within the EISPN that the greater diversity in plant material and water features may increase the available habitat for these species?

Response: The statement in the EISPN regarding the increase to the habitat for species such as the golden plover and ruddy turnstone was based on an assessment of biological resources from the consulting biologist, Evangeline Funk, Ph.D. As discussed within Section 4.2.1 of the DEIS, the use of fertilizers and pesticides on the golf course is expected to present little or no hazard to birds frequenting the grass areas or ponds associated with the golf course (Murdoch & Green, 1991). Fertilizers are relatively non-toxic unless ingested in large amounts and the use of flowable fertilizers can prevent the potential of birds ingesting fertilizer granules applied to the turfgrass. Herbicides and fungicides pose little danger to life forms other than weeds and fungi, respectively.

As mentioned, there are several measures proposed by the developer aimed at minimizing the use of insecticides used on the golf course and encouraging the use of alternative measures for pest control. According to the golf course agronomist, William Lee Berndt, Ph.D., the environmental conditions at Hokukano are such that insect infestation should be relatively rare, allowing the use of insecticides on the golf course to be kept to a minimum. Also, the Integrated Pest Management component of the Integrated Golf Course Management Program, mentioned previously, is specifically designed to achieve pest control in an ecologically sound manner and to reduce reliance on pesticides. This is achieved through a program of monitoring for pests and treating infested areas on an as-needed, controlled manner, as opposed to a scheduled and broad basis. Alternate treatment strategies, such as biological pest control measures, are also considered. In this manner, the potential threat to birds frequenting the golf course due to chemical applications is minimized, to the furthest extent practical.

6) Geologic Considerations:

a) A discussion is needed on the tsunami zone, flood plane, lava tubes and caves in the area and their consideration in the planning of the proposed project. The Civil Defense Director should have input in this discussion.

b) Where is the Kealakekua Fault Line in relationship to this project? Input is needed from experts if the proximity warrants such consideration.

c) What are the potential effects on different factors, such as injection wells and sewage treatment facilities?

Response: A discussion of the tsunami zones, flood planes, lava tubes and other geological considerations is contained within the DEIS and these factors have been considered in the planning of the proposed project. The Villages at Hokukano development will be set back from the shoreline and will therefore be outside the zone of potential tsunami inundation, as delineated on the Federal Emergency Management Agency Flood Insurance Rate Maps. The developer has also met with the National Tsunami Director regarding the proposed project. The Hawaii County Civil Defense Agency, as a reviewing agency, will be involved in the review of the project as plans are developed throughout the EIS and regulatory process. The Kealakekua Fault is situated approximately 1.5 miles from the project site, where it extends offshore. Because the residential development is planned considerably inland, the threat from earthquake generated tidal waves, such as those that occurred in 1975 and 1989, does not pose a significant danger. With regard to

potential impacts to injection wells and the planned sewage system, these will be designed according to State and County standards. According to the civil engineer, the seismic activity needed to cause significant damage to these elements would have to be of such magnitude as to cause severe damage to other infrastructure and buildings, both onsite and in the surrounding area. Section 4.1.5 of the DEIS discusses the various natural hazards and their potential impacts to the proposed project.

7) Water:

a) What are the water needs of the development? Where is the water to come from? What is the capacity of the present water sources and anticipated needs for this project? Will this project require addition sacrifice on the part of area residents because of competing demands for water?

Response: The irrigation water to be used for the golf course would come from a brackish water source onsite, combined with treated effluent from the wastewater treatment plant. Development of a brackish well onsite should have no impact on potable water resources in the area. The County water sources are generally located mauka of Mamalahoa Highway, where significant high level potable water resources have been discovered. In the area of Kona Hospital, a County test well has verified the presence of a substantial water resource, with the water level occurring at an elevation of over 490 feet above sea level. Based on the hydrological calculations provided by the project's hydrological consultant, there are indications of considerable potable water resources in the area. Any potential shortage of potable water would appear to be more a problem of a lack of infrastructure (wells, tanks, pumps and transmission lines) than a lack of water resources.

The average daily water demand for the full development is projected to be approximately 643,000 gallons of potable water, and 1,777,000 gallons of irrigation water. The developer has commitments from the Department of Water Supply sufficient to meet the first phase of development and expects to work with the County to develop additional resources in the area to meet the full project requirements. The developer's contribution to water development in this area will not only meet the project requirements, but will also assist the County in developing the much needed infrastructure to meet other public requirements in the region.

8) Sewers and Waste:

a) What provisions are being made for waste from this project and at what public cost?

b) What is the public cost for connecting to the Sewage Treatment Plant (STP) at Keauhou, as suggested in the EISPN?

c) What measures will be taken to ensure that the shoreline, and especially Kealakekua Bay, will not be adversely affected by any waste from this project?

d) Is the developer willing to agree to the terms of the Valdez Principle, that the polluter will pay?

Response: The wastewater to be generated by the project would be handled by one of two means: either through a wastewater treatment plant built onsite or through a transmission line to the recently completed wastewater treatment plant at Keauhou. In either instance, the treated effluent is intended to be reused as an irrigation source on the golf course. Treated effluent used for irrigation purposes would need to meet the Department of Health's (DOH) standards for reclaimed water and the developer would be required to establish a DOH approved irrigation plan and groundwater monitoring system. The facilities would be constructed at the developer's cost, at no cost to the County or State. If a wastewater treatment plant is built onsite, it would be built with provisions for emergency standby generation to ensure that the plant operates, even in the case of a power outage. In terms of ensuring that there will be no impact to Kealakekua Bay, the coastal monitoring program mentioned previously will ensure that there are no impacts to the waters fronting the project, which in turn ensure that there are no direct or indirect impacts elsewhere. We are not familiar with the terms of the Valdez Principle.

In closing, let me say that you've raised some excellent questions that are certainly helpful in the EIS process. By addressing your questions, hopefully we have answered some questions that others might have. Thank you for your efforts.

Should you have any further questions, please do not hesitate to contact either myself (961-3333) or Mr. Richard Frye, Project Manager of Oceanside 1250 (326-2966).

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein
R. Frye
B. Kudo
L. Tanimoto
D. Hulse

United States Department of the Interior

GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
677 Ala Moana Blvd., Suite 415
Honolulu, Hawaii 96813

TAKE PRIDE IN AMERICA

August 25, 1993

Ms. Virginia Goldstein
Planning Director
County of Hawaii Planning Department
25 Aupuni Street, Suite 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Subject: Villages at Hokukano, Draft Environmental Impact Statement (DEIS), North and South Kona, Hawaii

We are in receipt of the subject DEIS. We regret that due to prior commitments, we were unable to review the subject DEIS by the August 7th deadline.

We are returning the DEIS to your office for your future use.

Sincerely,

William Meyer
District Chief

Enclosure

cc: State of Hawaii
Office of Environmental Quality Control
220 South King Street
Fourth Floor
Honolulu, Hawaii 96813

Mr. Richard Frye, Project Manager
Oceanside 1250
74-5620A Palani Road, Suite 200
Kailua-Kona, HI 96740

Mr. James Leonard, Managing Director
PBR Hawaii
101 Aupuni Street, Suite 310
Hilo, Hawaii 96720

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. William Meyer, District Chief
United States Department of the Interior
Geological Survey
Water Resources Division
677 Ala Moana Boulevard, Suite 415
Honolulu, Hawaii 96813

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Meyer:

Thank you for your letter of August 25, 1993 concerning the subject project. We appreciate your review of the Draft Environmental Impact Statement (EIS).

Should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R.T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter, and this response, will be appended to the Final EIS.

Sincerely,

James M. Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

JOHN WAIHEE
GOVERNOR

REX D. JOHNSON
DIRECTOR

DEPUTY DIRECTORS
JOYCE T. OMINE
AL PANG
KANANI HOLT
CALVIN M. TSUDA

IN REPLY REFER TO:
STP 8.5403

**STATE OF HAWAII**
**DEPARTMENT OF TRANSPORTATION**
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

August 16, 1993

Ms. Virginia Goldstein, Director
Planning Department
County of Hawaii
25 Aupuni Street, Suite 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Subject: Draft Environmental Impact Statement
Villages at Hokukano; TMK: 8-1-4:03 por;
7-9-12:03, 04 por, 05 por, 11; 7-9-6:01;
North & South Kona

We have the following comments on the proposed Villages at Hokukano development:

1. A revised traffic study reflective of the following should be submitted for our review:

   a. It is uncertain that the Bypass Road would be in place to accommodate the various phases of this project. The evaluation and recommendations should therefore be expanded to reflect the traffic conditions and improvements necessary if the Bypass Road were not built.

   b. The forecast should be revised to reflect other major developments in the area and also upstream in Kailua-Kona. In light of the developmental projects planned in West Hawaii, the growth factor of 3% is overly conservative. The Hawaii long-range highway plan did not reflect many of these planned projects.

   c. The location of the connector road between Mamalahoa Highway and the proposed Bypass Road has not yet been determined. Since we desire to restrict access to the Bypass Road, Halekii Street may be the only connector provided in this vicinity. Halekii Street should be reevaluated accordingly, with appropriate recommendations for Halekii Street and its intersections with Mamalahoa Highway and the Bypass Road. (i.e., Traffic projections for Halekii Street would have to be adjusted.)

In this regard, the construction of double left-turn lanes at the Halekii Street/Bypass Road intersection should be considered. Sufficient right-of-way should be reserved for this purpose.

d. A project of this magnitude will have regional impacts. The report should address this and recommend appropriate roadway mitigation measures.

2. Sufficient right-of-way should be reserved through the development for the proposed Bypass Road, and dedicated to the State at the appropriate time.

3. The proposed development relies solely on the existing Mamalahoa Highway and the proposed Hawaii Belt Road to accommodate the north/south traffic. The developer should coordinate with adjacent developers and owners to design an internal roadway system with stub end roads that would eventually connect with adjacent properties. A map of the overall system of proposed roadways should be provided.

4. The traffic study states that the DOT is reviewing its 1980 study of the Bypass Road and that planning funds have been appropriate for an update of the report. This statement is incorrect and misleading as we have yet to begin our review of the 1980 study and available funds are not sufficient to update the study.

5. The needs of bicyclists and pedestrians should be addressed.

6. The developer should be responsible for all required on site and access improvements, including the improvements to Halekii Street and its intersections with Mamalahoa Highway and the Bypass Road. Additionally, the developer should be required to participate in the funding and construction of other local and regional transportation improvements.

7. No direct surface water runoff will be allowed onto our state highway. Specific measures should be provided to control runoff during construction and after buildout.

8. All plans for construction work within our State highway rights-of-way must be submitted for our review and approval. Specific mitigative measures should be provided for the heavy truck traffic that will be generated during the construction of the golf course and development of the project.

We appreciate the opportunity to provide comments.

Sincerely,

for Rex D. Johnson
Director of Transportation

c: OEQC
Mr. Richard Frye - Oceanside 1250
Mr. James Leonard - PBR Hawaii

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Rex D. Johnson, Director of Transportation
State of Hawaii Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Johnson:

Thank you for your comments of August 16, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

1) Revisions to the traffic study

a) "It is uncertain that the bypass road would be in place to accommodate the various phases of this project. The evaluation and recommendations should therefore be expanded to reflect the traffic conditions and improvements necessary if the bypass road were not built."

Response: Based on the input from the project traffic engineer, Parsons Brinckerhoff Quade & Douglas (PBQD), their analysis reveals that the existing two-lane Mamalahoa Highway currently experiences near or at capacity conditions requiring two additional lanes of capacity through the corridor. Widening Mamalahoa Highway to a four-lane roadway does not appear to be a feasible alternative due to existing residential and commercial development along the highway and the limited available right-of-way. For this reason, the only reasonable alternative appears to be the construction of the bypass road. If the bypass road could not be built, then alternatively a portion of it could be built to at least serve the proposed development. A second alternative is to build an extension of Ali'i Drive from its current southern terminus to the proposed project's northern boundary.

b) "The forecast should be revised to reflect other major developments in the area and also upstream in Kailua-Kona. In light of the development projects planned in West Hawaii, the growth factor of 3% is overly conservative. The Hawaii Long Range Highway Plan did not reflect many of these planned projects."

Response: By "major developments in the area and also upstream in Kailua-Kona", we assume that you are referring to developments such as the Villages of Lai Opua, Queen Liliuokalani Trust Expansion, and University Lands. These projects affect the regional distribution of traffic but will not necessarily result in higher traffic volumes travelling along Mamalahoa Highway towards South Kona. Furthermore, using a higher background growth rate would result in less net project related impacts. If anything, the need for the bypass road would be accelerated.

c) "The location of the connector road between Mamalahoa Highway and the proposed bypass road has not yet been determined. Since we desire to restrict access to the bypass road, Haleki'i Street may be the only connector provided in this vicinity. Haleki'i Street should be reevaluated accordingly, with appropriate recommendations for Haleki'i Street and its intersection with Mamalahoa Highway and the bypass road. In this regard, the construction of double left-turn lanes at the Haleki'i Street/bypass road intersection should be considered. Sufficient right-of-way should be reserved for this purpose."

Response: The analysis of the Haleki'i Street/Mamalahoa Highway intersection conducted by PBQD does account for the redistribution of traffic from Mamalahoa Highway to the bypass road and is therefore appropriate. Based on the forecast traffic volumes at the Haleki'i Street/bypass road intersection presented in the January 1993 Traffic Impact Study for the Villages at Hokukano, the construction of dual left-turn lanes does not appear to be warranted. The distribution of traffic on the bypass road is dependant on the number and location of the connector roads provided. Evaluation of the need for dual left-turn lanes at Haleki'i Street would be appropriate when SDOT has identified the number or location of the connector roads.

d) "A project of this magnitude will have regional impacts. The report should address this and recommend appropriate roadway mitigation measures."

Response: The developer has been working with the SDOT to coordinate the development of the proposed bypass road in meeting the regional demand for additional highway capacity. Regional impacts by the proposed project will be slowly introduced over a relatively long period of time. Full development of the project and its ultimate impacts will occur beyond normal traffic planning horizons (greater than 20 years).

2) "Sufficient right-of-way should be reserved through the development for the proposed bypass road, and dedicated to the State at the appropriate time."

Response: A sufficient right-of-way within the project site will be reserved for the proposed bypass road and dedicated to the State at the appropriate time.

3) "The proposed development relies solely on the existing Mamalahoa Highway and the proposed Hawaii Belt Road to accommodate the north/south traffic. The developer should coordinate with adjacent developers and owners to design an internal roadway system with stub end roads that would eventually connect with adjacent properties. A map of the overall system of proposed roadways should be provided."

Response: The proposed development plan provides for connections to the northern and southern boundaries from the primary lateral roadway. The lateral roadway is aligned and sized to connect with an extension of Ali'i Drive, if desired and appropriate. The developer will continue to coordinate the development plans with the SDOT as they are refined to ensure that such plans are in concert with the State plans for regional roadway improvements. It should also be noted that the County of Hawaii has the authority through the subdivision approval process to require developers to provide stub-out roadways that could be connected into a comprehensive circulation system.

4) "The traffic study states that the DOT is reviewing its 1980 study of the bypass road and that planning funds have been appropriated for an update of the report. This statement is incorrect and misleading as we have yet to begin our review of the 1980 study and available funds are not sufficient to update the study."

Response: The statement regarding the bypass road contained within the traffic study was based on information received from SDOT over a year ago. It is our current understanding based on more recent discussions and your comment letter that sufficient funds to conduct an updated planning study have not been appropriated and additional funds are currently being requested.

5) "The needs of bicyclists and pedestrians should be addressed."

Response: Provisions for bicyclists and pedestrians along the bypass road, which are consistent with the SDOT requirements for highways of this type, will be provided.

6) "The developer should be responsible for all required onsite and access improvements, including the improvements to Haleki'i Street and its intersections with Mamalahoa Highway and the bypass road. Additionally, the developer should be required to participate in the funding and construction of other local and regional transportation improvements."

Response: The developer anticipates being responsible for all required onsite and access improvements and would participate in the funding of construction and other local and regional transportation improvements unless otherwise agreed upon with the SDOT.

7) "No direct surface water runoff will be allowed onto our State highway. Specific measures should be provided to control runoff during construction and after buildout."

Response: Consistent with SDOT policy, the project drainage system will be planned such that no direct surface water runoff will impact the State highway, both during and after construction of the proposed development.

8) "All plans for construction work within our State highway rights-of-way must be submitted for our review and approval. Specific mitigative measures should be provided for the heavy truck traffic that will be generated during the construction of the golf course and development of the project."

Response: All plans for construction within the State highway rights-of-way will be submitted for review and approval. Mitigation measures will be implemented to avoid heavy

truck traffic during the construction of the proposed development, especially during times of peak traffic volumes.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James M. Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

District of North Kona
Post Office Box 4551
Kailua-Kona, Hawai'i 96745

# KA LAHUI HAWAI'I

Moku o Hawai'i

District of South Kona
Post Office Box 891
Honaunau, Hawai'i 967

August 13, 1993

Virginia Goldstein, Director
Planning Department
County of Hawai'i
25 Aupuni Street
Hilo, Hawai'i 96720

RE: Villages at Hokukano
Draft Environmental Impact Statement

Dear Ms. Goldstein:

Thank you for this opportunity to respond to Oceanside 1250's Draft EIS regarding the construction of a resort and residential project at Hokukano.

## INTRODUCTION

Ka Lahui Hawai'i is a native initiative created in 1987 to establish self-governance and self-determination for the native people of Hawai'i. In its Constitution, Ka Lahui declares that native Hawaiians are the traditional occupants and guardians of the land, water, sea, minerals and all other natural resources of Hawai'i and that native Hawaiians have inhabited and occupied the Hawaiian archipelago and exercised traditional, religious and access rights since time immemorial to sustain and maintain the native culture and primordial interests of these islands. In its pursuit of building a nation upon established traditions, Ka Lahui's Constitution protects native Hawaiians' customary and traditional rights to access, cultivate, propogate and harvest anywhere in the Hawaiian archipelago for personal, subsistence, religious and cultural purposes.

Ka Lahui's Constitution was created by native Hawaiians who believe that the culture of ancient Hawai'i was developed upon the fundamental law that everything in the universe has life and that all life forms have integral connections to one another, man to man, man to nature, man to the spirit world. To disturb the complex interrelationship and interdependence of these life forms meant to bring severe imbalance to the entire life system and disorder to the physical, environmental and spiritual worlds.

The following comments about the subject Draft EIS are based upon Ka Lahui's obligation to protect and preserve the hamony and balance that comes when the integral connections between man, nature and the spirit world are flowing freely and abundantly for all people of Hawai'i, especially native Hawaiians.

**COMMENTS**

Overall, Oceanside 1250's Draft EIS is incomplete and vague. Some of its conclusions, particularly in the historical and archaeological section, are questionable. The methods of study and analysis of data, especially the historical and archaeological sites, seriously lack sensitivity to and respect for Hawai'i's history and its spirit. Such a void naturally casts serious doubt upon the developer's proposed treatment of the 473 historical sites located in the area and upon the developer's desire and capability to protect and preserve the integral connections between man, nature and the spirit world that bring harmony and balance for the entire community, especially to those who already have a long history of contributions to that harmony and balance. The EIS is also void of any discussion regarding native Hawaiian rights to access the area for traditional gathering purposes.

The preparers of the EIS have chosen to limit their research, analysis and recommendations to technical Western methodologies and mindsets. They have identified, evaluated and recommended treatment of several historical/archaeological sites without fully describing the criteria upon which their interpretations and recommendations are based. In this chosen process, the EIS seriously and sadly fails to acknowledge and address the significant resources the area in and around Hokukano holds for native Hawaiians which are spiritual and emotional in nature as well as the integral connections to areas surrounding the proposed project site. Shamefully few of the historical and archaeological sites are recommended for preservation. These evaluations and recommendations made by a majority of individuals foreign in their behavior and spirits to the host culture cannot possibly understand and appreciate the spiritual and emotional content of a burial site, a cave, a wall, a mound, a foot trail, a lava tube, a shelter, an enclosure, a terrace. So evident is the disconnection, the ignorance and the disregard of the preparers that they can only refer to each site by number, not by name and meaning to native Hawaiians.

The Draft itself admits that it lacks sufficient data to make many assessments and recommendations. Admissions such as "Our observations are tentative and hopefully further research can clarify this issue." clearly indicate that this EIS is an incomplete document. But even the need for further research has not prevented the preparers from proceeding to recommend the fate of 473 archaeological sites and the traditional spirit of the area. Such recommendation demonstrates enormous arrogance.

In sum, the EIS is seriously and fundamentally void of an acknowledgement of and respect for the full history and sacred aura of the area in and around Hokukano. Furthermore, full disclosure and explanation of its findings and recommended treatments of historical sites and features are absent. The report also admits that it does not have sufficient data to make assessments and recommendations. At least from the historical and archaeological standpoint, there are two major conclusions drawn by the EIS: 1) that the cultural value of the entire area is not worthy of preservation and protection, and 2) that the desecration of the sacred grounds in and around Hokukano will be minimal when compared to the financial profits to be gained by the proposed development. The total of these deficiencies, uncertainties, selective disclosures and discussions, omissions, unfinished work and conclusions therefore render the EIS unacceptable.

**RECOMMENDATIONS**

At the very least, the EIS must expand and complete its historical and archaeological analysis to include acknowledgment and description of all aspects of ancient life in and around Hokukano before and after 1776 as well as the significance of all historical and archaeological sites on the project site in light of the foregoing acknowledgement and description of ancient life in the area. The revised Draft EIS should also address impacts on native Hawaiian gathering rights and religious practices in a manner which guarantees that practitioners will be able to exercise these rights without obstructions from modern amenities. Following the publication of an expanded Draft EIS, the public should again, as always, be solicited for comments and recommendations.

Additionally, the Big Island Burial Council must be allowed to inspect the project site, identify and evaluate historical and archaeological sites on the premises, make its own recommendations about the treatment of these historical and archaeological sites and present its assessment of the full impact the Villages at Hokukano will have upon native Hawaiians.

**CONCLUSIONS**

Until and unless a revised Draft EIS is completed, public opinion about the expanded EIS is obtained and acted upon and the Big Island Burial Council is permitted to inspect, evaluate and assess the project site, the project should not be allowed to proceed. In fact, any decisions by the County Planning Department based solely upon the subject Draft would be grossly incompetent.

The citizens of Ka Lahui Hawai'i and their ancestors have historically been victims of and witnesses to the irresponsible, self-serving activities of a comparatively small group of power starved, insensitive, imbalanced individuals and organizations. Native Hawaiians can no longer trust the oral and written statements of developers and their consultants for we have lost too much in the past trusting that our friends would stay true to their words. Ka Lahui Hawai'i is committed to protecting and preserving our homeland and the traditions we carry in our na'au. We therefore stand opposed to the Villages at Hokukano project not only because of legislative directives which compel our action but because our souls and our lives are inherently and inextricably bound to the 'aina of Hokukano and all that is in it. Without this 'aina, all native Hawaiians become even more seriously separated, lost and disempowered.

Thank you for this opportunity to submit this response and we look forward to the opportunity to examine and comment on the next EIS.

Aloha, a hui hou,

Anuhea Reimann-Siegerl
Po'o, North Kona District

Maile P. David
Land Committee Chair,
North Kona District

/ar-g
cc: Mililani Trask
Clara Kakalia
Clarence Kauahi

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Ms. Anuhea Reimann-Giegeri
Ms. Maile P. David
Ka Lahui Hawaii
Moku o Hawaii
District of North Kona
Post Office Box 4551
Kailua-Kona, Hawaii 96745

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. Reimann-Giegeri & Ms. David:

Thank you for your comments of August 13, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano, and the concerns of Ka Lahui Hawaii regarding the treatment of archaeological sites and protection of customary and traditional native Hawaiian rites.

As recommended in your letter, the historical record of the property will be expanded within the Final EIS. The procedures and criteria used by the consulting archaeologist for evaluating the various archaeological sites on the property will also be expanded upon within the Final EIS. While following these procedures, the resulting report may not convey the "spiritual and emotional" importance of these sites to all people, it should be noted that these procedures are based on the guidelines put forth by the Department of Land and Natural Resources, Historic Site Preservation Division (DLNR-HSPD), which the consulting archaeologist and developer are required to follow in preparation of the Archaeological Inventory Survey report.

The developer, Oceanside 1250, and consulting archaeologists have been and will continue to work together with local historians, resource persons, and community groups in gaining a full understanding and appreciation of the historical and archaeological resources within the project area. We acknowledge the presence of numerous archaeological/cultural sites on the property and will continue our efforts to preserve a majority of the sites.

Regarding the input from the Hawaii Island Burial Council, there are currently no plans to disturb, alter, or relocate any of the known burials onsite, and therefore, a presentation to the Council has not been made at this time. The developer will ask the Council to visit the site and to provide their thoughts and recommendations regarding the treatment of burial sites. Should there be any plans in the future which would impact known burials onsite, these would be submitted to the Council for their review and recommendation.

Regarding the protection of native gathering rights and religious practices, such cultural practices were previously restricted on the property to protect cattle and ranching operations. By improving access to the shore and to those sites of historical and cultural significance, it is believed that the project can have a positive impact in this respect. The outcome of the current litigation regarding another island project may give additional clarification to this important issue.

We hope the recent field trip helped to clarify the nature and goals of this project, and we look forward to your continued input. Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

WILMOT B. BOONE, M.D.
P.O. Box 666
Kealakekua, HI. 96750

12 August 1993

Mrs. Virginia Goldstein, Managing Director
25 Aupuni Street, Hilo, Hawaii 96720

RE: Hokukano Villages Draft EIS: Interpretation and commentary

FROM: Boone, Wilmot B. MD, Member, Napoopoo Village Council

Plans for Hokukano Villages are presented with a draft EIS which is both incomplete and erroneous. No characterization of the terrain or offshore waters are presented. No appropriate effort has been made to assess area resident interests. Shoreline and ocean factors are significantly overlooked. Impingment on the neighborhood and infrastructure is glossed over.

(1) This area shoreline is riddled with lavatubes, draining from above. Divers constantly note cold "Spring" waters in the area. Tidal flows flow up these lava tubes and volcanic strata, bringing in saltwater to salinize the freshwater meniscus, therafter return to the ocean bearing runoff contaminated with all human effluent, including cesspools, highway and industrial seepage, variegated chemicals including agricultural weedkillers, insecticides, fertilizers, seepage of which will ultimately reach the saline meniscus and follow the tidal outflow, draining ultimately directly to the ocean, and affect those currents to Kealakekua Bay.

During periods of heavy rainfall this is particularly deleterious. I have personally witnessed such discolored water outflow from lavatube. It is evidenced by increasingly deleterious effect on ocean fauna and flora. It is recognized by scientists and by those who regularly use these waters during past decades in diminshed coral blooms, increased dead corals, and reduced(quite noticeably) fish and other fauna.

(2) There is absoltely no reason for the proliferation of golf courses on this Island, nor of hotels and wealthy residential complexes, which will impinge on infrastructure demands, will become costly to the tax payer, and realize, at the best, small profit to the community.

(3) Jobs created by such developments are few and attract newcomers looking for work, requiring community support and housing.

(4) A high percentage of visitors who come to enjoy watersports and to fish and enjoy a truly Hawaiian environment will be deprived of much of the scenic values derived from our coastline.

(5) Archeological sites and the Kona Field Systemm can only be degraded, despite a limited effort at minimal preservation for few sites.

(6) No adequate way of monitoring ocean pollution is presented and as yet no such sophisticated mechanisms are effectual until damage has occurred, and then, perpetuated.

(signed)

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Wilmot B. Boone, M.D.
P.O. Box 666
Kealakekua, HI 96750

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Dr. Boone:

Thank you for your comments of August 12, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

1) Impacts to the Coastal Environment

The seaward flow of groundwater occurs constantly along the Kona coast of the Island of Hawaii. Because of the porous nature of the lava coastline, there is a substantial intrusion and mixing of seawater with the groundwater flowing seaward near the shoreline. Lava tubes may serve as a more direct path for groundwater reaching the ocean, though we understand no evidence has been found of running water within those lava tubes known to be onsite.

The premise in your letter seems to be that materials from human activities are entering the ocean via lava tubes and these materials ultimately have an impact on aquatic organisms. As stated within the Draft EIS and detailed within the Quantitative Assessment of Marine Communities and Water Quality (Appendix I-3), and the Water Quality and Marine Life Monitoring Study and Mitigation Plan (Appendix I-4), this has not been evidenced for the waters fronting the project site or for other developed areas of West Hawaii. The reports note that at Waikoloa, long term studies have not found any products from pesticides, herbicides or fungicides used at Waikoloa in the waters fronting the resort. Also, ongoing monitoring of the aquatic biota has found no change in any of the species. This suggests that there should not be a contamination problem of the coastal

groundwaters with the proposed development, especially in light of the numerous design and management controls proposed for the Hokukano golf course development.

Also, your letter states that scientists and those who regularly have used these waters during the past decades have recognized diminished coral blooms, increased dead corals and reduced fish or fauna. The study on marine communities and water quality notes that the coral community fronting the project site is subject to occasional storm surf. Because Hawaiian corals are primarily slow growing, storm waves do not have to occur with much frequency to have a very noticeable impact. The fact that storm surf is the major structuring element in Hawaiian corals has been well documented in scientific literature. The study of marine communities and water quality noted that impacts from both the January 1980 storm and Hurricane Iwa (November 1982) were still evident at the time of sampling. These storm events, as well as Hurricane Iniki, which occurred in September of 1992, have had a large impact on corals along this section of the West Hawaii coast.

With regard to the decrease in fish, this is probably related to greater use of the area in recent years, more than anything else. This relationship in the decline in fish with the increase in public use has been documented for other areas of the Kona coast. As stated in Section 4.2.3 of the Draft EIS, there is a concern that increased public use of the shoreline area as a result of improved public shoreline access may have a similar adverse impact on certain faunal species.

2) Impacts to Public Infrastructure and Services

Rather than "impinging on infrastructure demands" being costly to the taxpayer and bringing little profit to the community, as your letter suggests, the proposed project will have a positive impact on public services and infrastructure, primarily because tax revenues that would be generated as a result of this project are projected to far exceed the tax expenditures for such services and infrastructure on both the County and State level. Additionally, regional infrastructure systems, such as roads (in particular, participation in the Mamalahoa bypass highway), water and power would benefit from the developer's contribution to regional improvements. Other direct benefits to the community include an expanded economic base, provision of jobs and housing, expanded recreational opportunities and improved shoreline access.

3) Job Opportunities

It is expected that the majority of operational jobs created through the project will be filled by those in the community looking for work closer to home. The golf course, its ancillary facilities, and other project needs could support up to 180 direct positions at buildout. In general, golf courses on an acreage basis generate up to five times more jobs than agricultural industries. As noted in your letter, the jobs created by the development will attract those looking for work who require community support and housing. Based on the projections within the Economic and Fiscal Impact Assessment prepared by KPMG Peat Marwick, it is estimated that approximately 47 new homes will be needed to meet the demand for new in-migrant households. This demand, however, is expected to be exceeded in meeting the State and County provisions for affordable housing.

4) Impacts to the Scenic Value of the Coastline

The potential impacts to the open space character of this coastal area is noted within Section 4.1.8 of the Draft EIS. The project has been planned in a manner to avoid these impacts by maintaining a natural buffer area along the shoreline of approximately 300 feet, further enhanced by 300 feet or more of developed open space (the golf course), by maintaining a relatively low density residential development integrated with significant open space elements, and by implementing design controls to maintain a soft contrast between the buildings and the surrounding areas. Additionally, the project has been planned such that mauka views from the shoreline would not be obstructed by planned facilities.

5) Archeological Sites

Every effort has been made to preserve as many archaeological sites as possible. To ensure that the integrity of the heiau is maintained, an open space area has been incorporated in the conceptual plan to buffer the heiau from developed areas. Data recovery of sites identified by the project archaeologist does not mean that they will necessarily be destroyed, as most will remain untouched. We concur that the cultural sites in this area are extensive and, in some cases, interrelated and that significant sites should not be destroyed. Certainly the data recovery and study of archaeology afforded by the project will benefit historians in their quest to put together the area's historical picture.

The historical perspective of the proposed development as it relates to the historical uses of the subject properties and immediately surrounding areas is provided in Appendix III-1 and III-2 of the Draft EIS.

In accordance with State recommendations, maintenance of historic sites will consist primarily of control of encroaching vegetation, which will be provided by the homeowners' association. It is anticipated that the maintenance program will continue indefinitely. To ensure that the treatment and maintenance of archaeological/cultural sites is in accordance with State requirements, the applicant will continue to work with the Department of Land and Natural Resources. Their review of the archaeological report is currently underway.

6) Marine Water Monitoring

The monitoring program proposed for the Villages at Hokukano project includes monitoring of soils, groundwater, nearshore, and marine waters. In this manner, any presence of chemicals used for the golf course maintenance would be detected as close to the source of application as practical, and such monitoring offers the best opportunity for detection and remediation. The monitoring procedures described within the Water Quality and Marine Life Monitoring Study and Mitigation Plan (Appendix I-4) mirrors those presented by the West Hawaii Coastal Monitoring Task Force. The developer will adhere to these guidelines, which were prepared by personnel from the University of Hawaii, Natural Marine Fisheries Service, U.S. Fish and Wildlife Services, U.S. Army Corps of Engineers, Department of Health, Department of Land & Natural Resources, and the County of Hawaii Planning Department, and are considered to be the most comprehensive that have been developed to date.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

Napo'opo'o Village Council, Inc.
82-6035 Manini Beach Road
Captain Cook, Hawaii 96704

August 12, 1993

Planning Director Virginia Goldstein
County of Hawaii
25 Aupuni Street, Suite 109
Hilo, Hawaii 96720

Subject: Comments to Draft E.I.S., Villages at Hokukano, June 1993.

It would be much appreciated if you could please accept these comments to the Draft E.I.S. on the Villages at Hokukano.

1. Air Quality

A. Natural emission: the D.E.I.S. mention nothing of the vog which continuously plagues West Hawaii since the past 10 years. Many residents, especially retired people and youths, have acquired respiratory problems exclusively from vog emission. By focusing on retired people to own homes on the project, could also impact West Hawaii's only overcrowded hospital. This issue should be addressed in the D.E.I.S.

2. Protection of Class 3A waters and Kealakekua Bay

A. In Volume II study, it states that Kealakekua Bay is "about 3.7 km to the south of the southern boundary of the project site" (p.I-3-32). That would convert to only to about 2.3 miles away from Kealakekua Bay. This should have been stated in the D.E.I.S. It is required that the D.E.I.S. be written as a self contained document which should not require the reviewer to extract information out of the supporting document. The D.E.I.S. does not include possible currents, that may contain run-offs from the project, which could enter into Kealakekua Bay. It would be feasible to include possible probable impacts on Kealakekua Bay, for the fact that the Southern part of the project (high density 42.5 acres with 200 units) is closest to Kealakekua Bay. The Bay is a Marine Life Conservation District (MLCD), and is also registered as a National Historical Landmark. Where are the Feds? According to the newspaper article published in West Hawaii Today on August 6, 1993, Congresswoman Patsy Mink is quoted in her letter to the County Administration, "the class AA pristine waters of Kealakekua are to precious, too fragile, to sequester to pick. She said no one with any sensitivity to the history, ecology or mana'o of this special place would imperil its uncommon virtues for the sake of 18 holes of golf". In regards to such lamentation from a respectable person, Kealakekua Bay should be considered in a REVISED DRAFT E.I.S. for a project

that is larger than 15 acres, and only 1.5 miles away from Kealakekua Bay. Possible negative impacts on Kealakekua Bay would be:

- Run-off from the development, carried by currents into Kealakekua Bay

- Impact on endangered marine species that are covered by Marine Mammal Protection Act of 1972. (Consult Sierra Club)

B. Note: according to the D.E.I.S. The study conducted to determine whales was on March 22, 1993, on one particular day. There is a need for further study. March is also the closing period of the whale migration. As a ninth generation descendant resident of Kealakekua Bay, I find more and more sightings of whales inside and outside of Kealakekua as the years go by. There could be a possibility whales frequent this particular spot for a reason.

3. The Proposed Highway Bypass

A. Is there an alternative alignment bypass? Many residents are concerned about possible traffic impact on them. For example, landowners whose property must be purchased, exactly where is the south end connection, who will be affected?

B. Will the bypass be a "speed through" traffic, or will it have commercial businesses planned along the new bypass? What about other possible development? This should be included in the D.E.I.S.

4. The Cost - Benefit Ratio

A. The D.E.I.S. mentions the home buyers will mostly comprise of second home buyers and retirees, therefore requiring to obtain services all year round. This would require more than 20 - 30% of the residents to be new comers, and immigrants to the State. This development seems to cost more to the taxpayers of Hawaii than it will benefit us.

B. The average family's income in Hawaii could not possibly afford such prices on the homes listed in the project for Agriculture purposes.

5. Protection of Archaeology Sites

A. How does native hawaiian groups such as O.H.A.-Office of Hawaiian Affairs, Ka Lahui (particularly North and South Kona Districts), and the Big Island Burial Council feel about the sites in the area?

B. Is the golf course and residential homes recommended to be integrated with ancient Hawaiian burial sites? Can the

integrity of these heiaus-religious temples be kept? Isn't it contradicting to preserve these sites with respect, and at the same time provide a playground for the very rich only?

C. Who are the relatives of the deceased buried there? What is the actual name of "King's Trail"? What kind of historic significance does Hokukano and the surrounding area have? Specifically, what are the impacts? How ancient is the ancient Hawaiian village? Lapakahi State Park is the only ancient Hawaiian Village preserved on this Island.

D. How long will the maintenance last, who will maintain it, and what kind of maintenance is needed for these sites during and after the project stages?

E. What is the involvement of Bishop Museum, or State Archaeologist office. All these agencies mentioned in this section should comment on the D.E.I.S.

6. Agriculture

A. The anticipated buyers of these ag lots are Hawaii - 40%, Mainland - 40%, Japan and other foreign countries - 20%" How realistic are these figures?

B. The developer states that the area is "only marginally suited for agricultural purposes" (p.5), yet claims to create residential/agricultural lots in the same area. How serious is this project?

C. Run-offs from the ag lots are not shown. D.E.I.S. is vague and unclear in stating run-offs of the entire project (eg. golf course, ag lots, construction, residential). All of this combined and confined in one area could have a greater impact than the hotels in Waikoloa. The study conducted in Waikoloa showed a long range effect of run-off impacts. It would be too late if the project finishes, then to realize its not feasible for our environment. Kona Lagoon (total vacant occupancy) is a perfect example of poor resource management.

D. Is 2-4-D legal in the United States? Does County's Public Roads Maintenance use it? Is it true, that just the fumes from 2-4-D toxic enough to burn our skin.

7. Sewage

A. Is Heeia STP in close range? The low volume usage at the present time would change, especially when Bishop Estates or other proposed developments occur.

B. If a sewage plant is built on site, what respers to the already existing residents and businesses in Kealakekua?

7. Need for the Project

A. There are 13 golf courses on this island, 32 are planned. If there really is need for more golf courses in Japan, there is a major uproar of people opposing such development. Also, the Hawaii Times Aug 8, 1993, summarized Congresswoman Patsy Mink's letter by stating that a golf course is not economically feasible.

B. The D.E.I.S. claims that this project will help to alleviate the housing shortage that is the average family's lower, lower middle, middle class citizens' income in west mauii. Are the residents here ready for a higher cost of living.

9. Unresolved Issues

A. All of the unresolved issues should be more clearly stated and fully addressed in REVISED DRAFT D.E.I.S. All alternatives must be FULLY DISCLOSED so reviewers have a solid basis in critiquing whether all issues have been FULLY EXPLORED.

10. Consulted Parties

A. Comment on p.178: Ten Federal, State, and County offices are listed as having been consulted: NONE RESPONDED. This non-involvement, for whatever reasons, minimizes the effectiveness of the E.I.S. process. The questions and comments they should have provided would have contributed to a better document and helped reviewers by identifying pertinent issues.

In my letter, only major concerns were pointed out. If there is any discrepancies, errors, or assumptions, please notify me.

Sincerely,

Shane Palacat-Nelsen

Shane Palacat-Nelsen
President

cc: PBR Hawaii
Oceanside 1250
EPGC

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Shane Palacat-Nelsen, President
Napo'opo'o Village Council, Inc.
62-6026 Manini Beach Road
Captain Cook, Hawaii 96704

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. Palacat-Nelsen:

Thank you for your comments of August 12, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

1) Air Quality

Air quality implications associated with volcanic eruptions are described in the Air Quality Study, Appendix I-5, pages 2, 11 and 12. As indicated in the report, current levels of sulfur dioxide generally associated with volcanic emissions do not exceed State air quality standards. After project build-out, State and Federal air quality standards will not be exceeded and should not impact older residents of the project. Additionally, those home buyers who would be attracted to this project are likely to be privately insured rather than using public health services.

2) Protection of Class AA Waters and Kealakekua Bay

Kealakekua Bay is located between 1.3 and 2.3 miles from the nearest boundary of the proposed project as depicted in Figure 2 of the Draft EIS. As indicated in Appendix I, Sections 3, 4, and 7, an elaborate system of onsite drainage improvements and retention basins will ensure that project related chemicals used within the project boundaries will not enter coastal waters. In addition, the ocean currents and natural dilution associated with over one mile of ocean water establish a significant barrier between the project and Kealakekua Bay.

Non-point pollution from runoff generated by residential land uses will be mitigated by strict adherence to design guidelines for residential landscaping and management of runoff through onsite drainage improvements and retention basins. Additionally, during construction, potential non-point pollution from runoff will be mitigated through adherence to State National Pollution Discharge and Elimination System Regulations (NPDES) and implementation of erosion and sedimentation control measures, as required by the County for grading permit approval.

To ensure that the proposed project does not impact marine waters fronting the property, the applicant will implement a water quality monitoring program in adherence to the guidelines set forth by the West Hawaii Coastal Monitoring Task Force and conditions set forth by the State Department of Health for golf course developments. In that impacts to the marine waters fronting the proposed project are not anticipated, conversely, the waters of Kealakekua Bay will not be impacted. We concur that at certain times of the year whales do frequent the waters fronting Kealakekua Bay.

3) Proposed Highway Bypass

A) Individuals within the community, especially those in the area of the proposed bypass road, have been consulted either through community meetings or through personal discussions or correspondence. The proposed alignment has been planned to minimize the potential impacts to existing residents to the fullest extent practical. The proposed bypass road alignment is shown within Figure 20 of the Draft EIS. However, this alignment is only preliminary and subject to further design considerations based on community input and government review.

B) The bypass is envisioned as a limited access highway without commercial development. Furthermore, the applicant will not support the development of commercial land uses along the highway if proposed by adjoining land owners in the future.

4) Cost Benefit Ratio

A) Tax Revenues and Expenditures: Even with the large percentage of in-migrant residents to the County and State of Hawaii, the cost/benefit ratio of the Hokukano development is projected to be overwhelmingly positive. For the County of Hawaii, new County revenues generated from the project could be eight to ten times the new expenditures the County could incur because of the project. For the State, new State revenues generated from the Villages at Hokukano development could be three to eight times that of the new State operating expenditures.

B) Census data indicates a 1989 median income for the County of Hawaii to be $33,186. Adjusting for inflation, this equates to an estimated median income of $42,325 in 1993 dollars. Because of the large lot sizes, views and amenities offered at the Villages at Hokukano, the market base lot prices would most likely appeal to Big Island residents in the upper income categories, as well as to Oahu, U.S. Mainland, and foreign purchasers. Development of the Villages at Hokukano project could potentially alleviate the island's housing shortage by allowing these high income residents and visitors who currently own homes on the Big Island to make a "trade up" purchase at Hokukano and subsequently "free up" the less expensive homes which they currently occupy. Additionally, the project would add to the region's housing supply in meeting any affordable housing requirements, as imposed by the State and County as conditions of the requisite land use approvals.

5) Protection of Archaeological Sites

A) In a letter regarding the proposed development, Ka Lahui expressed concern regarding impacts to the exercise of traditional religious and access rights of native Hawaiians. They also recommended that the EIS contain a more complete description of the evaluation and criteria for archaeological sites, along with a description of all aspects of Hawaiian life in and around the project site before and after 1776. A copy of the letter from Ka Lahui will be enclosed within the Final EIS. As no alteration of known burial sites onsite are currently planned, the Hawaii Island Burial Council has not been formally consulted. However, should any impact, alteration or relocation of burial sites be considered, such measures will be reviewed with the Council, which serves as an advisory body to the Department of Land & Natural Resources, Historic Site Preservation Division (DLNR-HSPD). Approval of an archaeological site preservation plan from the DLNR-HSPD will be required prior to any land alteration or grading activity on the proposed development.

B) In conducting the initial archaeological survey, the consulting archaeologist, Cultural Surveys of Hawaii, attempted to consolidate related features into site complexes, such that if a few features within a complex were deemed significant, then the whole complex was deemed significant and recommended for preservation due to its overall association. In this manner, it is felt that the integrity of sites and site complexes can and will be preserved with appropriate buffer areas according to the recommended procedures and guidelines approved by the DLNR-HSPD.

C) In accordance with the procedures and guidelines set forth by the DLNR-HSPD, public notice will solicit information about known descendants of those burials on the property should any alteration or reinterment be proposed for such sites. As no alteration or relocation of known burial sites is planned at this time, such efforts have not been initiated. However, those individuals within the community with known descendants buried on the property have been consulted.

Other names used in reference to the King's Trail include Ala Loa and Ala Aupuni. Although test samples from the area at the Hokukano Village site have not been taken, test sampling from other areas on the property indicate that early habitation may have occurred in the period ranging from 1250 to 1430 A.D. It is likely that such habitations occurred during this same period at the Hokukano Village site, as this would be consistent with other known habitations along the Kona coast.

D) In accordance with State recommendations, maintenance of historic sites will consist primarily of control of encroaching vegetation, which will be provided by the homeowners' association. It is anticipated that the maintenance program will continue indefinitely.

E) To ensure that the treatment and maintenance of archaeological/cultural sites is in accordance with State requirements, the applicant will continue to work with the Department of Land and Natural Resources. Their review of the archaeological report is currently underway. The Bishop Museum is not a reviewing agency for such reports.

6) Agriculture

A) The estimated mix of potential buyers is felt to be realistic based upon available market research (Market Assessment, Appendix IV-1 of the Draft EIS).

B) The developer proposes to underwrite the costs of providing the necessary onsite improvements to adequately prepare the site for agricultural activity. This would include such elements as land preparation and irrigation installation. While some of these lands are considered marginally suited for agriculture, the land preparation plan would be designed to mitigate these factors and renew the lands into productive acreage. As envisioned, and depending upon which crops are selected, the program may not be self sustaining for several years after planting and, until then, the developer and subsequently the homeowners' association would contribute to the ongoing uncovered costs. Our studies indicate that these orchard crops can generate revenues in excess of the operating costs so that positive cash flow can be realized from these agricultural activities after a few years.

C) Potential impacts from runoff generated by residential and recreational land uses will be mitigated by design guidelines for residential landscaping, management of runoff through onsite drainage improvements and retention basins, and by strict adherence to State and County rules and regulations. As noted, potential construction related impacts from runoff will be mitigated through adherence to State NPDES regulations and implementation of erosion and sedimentation control measures, as required by the County for grading permit approval. The Water Quality and Marine Life Monitoring and Mitigation Program (Appendix I-4) mentioned previously will also be implemented to further ensure the protection of coastal waters.

D) The County does not use 2,4-D for public road maintenance, however, products which include 2,4-D are legally available for use in the United States and many other countries when applied according to label directions. According to the project's agronomy consultant, it is doubtful if the fumes from lawful chemical formulations of 2,4-D are toxic enough to burn skin. The developer will use only lawful chemicals which will only be applied by properly trained personnel under the direction of legally certified supervisors.

7) Sewage

A) The Heeia Sewage Treatment Plant (STP) is privately owned by Kamehameha Investment Company. If the use of this facility is the preferred alternative, costs associated with connecting to the plant, sewage treatment, and disposal options will be negotiated between the applicants and the STP owners at the appropriate time in the development process. Presently, the Heeia STP has a capacity of 1.8 MGD and can be further expanded to an ultimate size of 3.6 MGD. Present usage is approximately 0.5 to 0.6 MGD.

B) Should a STP be developed onsite, no impacts relative to existing residents and businesses in Kealakekua will occur.

8) Need for the Project

A) Although the financial feasibility of a stand alone golf course may be questionable, the Villages at Hokukano golf course is planned primarily as an amenity to the master planned, residential community. The market feasibility of the project has been clearly established through the market assessment (Appendix IV-1).

B) Based on 1989 U.S. Census information, the distribution of families within the County of Hawaii by income is shown in the following table.

| Income Range | Number of Families |
|---|---|
| Less than $14,999 | 5,609 Families |
| $15,000 to $24,999 | 5,375 Families |
| $25,000 to $34,999 | 5,174 Families |
| $35,000 to $49,999 | 6,072 Families |
| $50,000 to $74,999 | 5,405 Families |
| $75,000 to $99,999 | 1,736 Families |
| $100,000 to $149,999 | 857 Families |
| $150,000 and Up | 426 Families |

As noted previously, census data also indicates the 1989 median income to be $33,186. Adjusting for inflation, this equates to an estimated median income of $42,325 in 1993 dollars. Also, as stated, because of the site characteristics, views and amenities offered at the Villages at Hokukano, the lot prices would likely appeal to residents in the upper income categories.

9) Unresolved Issues

According to Chapter 343, HRS, the purpose of the EIS law is to "establish a system of environmental review which will ensure that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations." It is not to resolve all issues, but to provide decision makers with the knowledge necessary to make informed decisions. Alternatives considered are described in Section 3 of the Draft EIS. Selection of the appropriate alternative is more appropriate during the entitlement review process.

10) Consulted Parties

We assume that the various governmental agencies referenced in your comment withheld comments on the Preparation Notice since they awaited more detailed information, as is required within the Draft EIS.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

County of Hawaii Planning Department
25 Aupuni Street, Suite 109
Hilo, Hawaii 96720
Attn: Ms Virginia Goldstein, Planning Director

August 12,1993

Dear Ms. Goldstein:

I appreciate this opportunity to comment on the draft EIS recently submitted by PBR Hawaii on behalf of the developer Oceanside 1250 regarding their proposed project, the Villages at Hokukano.

The Hawaii County General Plan calls for the entire project area to be zoned conservation, agriculture, or unplanned. Any amendment to the general plan of this proportion sets a bad precident for south Kona. As a resident of south Kona I see this development as an erosion of the rural character of south Kona and as an inroad for similar devlopments.

The developer has gone to great lengths to discover the cultural and historical significance of the project area and has taken unusual steps in attempting to mitigate the publics' concern about the social and enviromental impacts. However, the EIS is not comprehensive and is vague in certain key areas.

1) The EIS does not address the use of agricultural chemicals with respect to the proposed agricultural uses other than the golf course or their potential harming effects to the groundwater or nearby Kealakekua bay. What happens if contamination occurs?

2) The historical information is limited to only recent events and recent ownership. The archeological sites are of great significance to the families who lived and practiced their culture in the ahupuaa within the project area. It has been well established that the project area was extensively used for agricluture before the arrival of Cook and heavily populated by native Hawaiians. Have those families been allowed to provide input with respect to the significance of the sites? After all it's their sites and they do have rights to the continued use of those sites.

3) There appears to be no allowance for low or even moderate income housing.

4) What are the guaranteed direct benefits to the resident community? Are all the jobs created going to the local residents? If the increase in county revenues is realized, how much will go to benefit those immediately impacted by this development.

5) If the by pass road were to be constructed what are the forseeable impacts and pressures for further development along that roadway. The EIS may wish to examine this in consultation with the land owners.

It is difficult to accept that while the developer emphasizes the rural and agriculture aspects of the project that the target market has any interest in agricultural pursuits. In reality the projects' appeal is to the high income bracket, offering exclusive and somewhat segregated living quarters where recreational pursuits are the main draw. What has always appealed to our south Kona residents are the natural recreational pursuits available in our district. Developments such as the one proposed are artificial and thus can only detract from the character of the district and may even lead to the destruction of the natural systems which support our lifestyle. The EIS is vague as to exactly what kind of agriculture may take place in the project area, its' economic viablity or its' impact on the enviroment. The one to five acre farmer in south Kona is usually a MIFF, multiple income family farmer. The farm can rarely support the family thus they work at other jobs to supplement their income. It is hardly likely that a farm within the project area will be profitable and thus it may not provide any incentive for the owner to farm at all. What then?

With all due respect to the developer whose reputation for being culturally sensitive seems well established and well deserved I keep asking myself " what's in it for me" (the community). I am reminded that the purpose and ultimate goal of the development is profit. I am very concerned that there is a perceived partnership between the County and the developer in the pursuit of profit which comes out in the justification for the project as being increased county revenues. I apologize for making arguments based on idealogies but I believe it is important that the developer understand that the concerns of the citizenry are not necessarily reflected through our county agencies. I would like to suggest that the the developer work more closely with the community (pro and con) and together they make a proposal to the county. Developments as sensitive as this one should proceed from the ground up, instead some in the community feel its being forced down their throat. I know first hand how hard the community representative has been working to gain support for the project however there appear to be several additional hurdles.

In its' present form the DEIS for the proposed Villages at Hokukano does not address all the concerns with respect to the cultural,social or eviromental impacts.

Once again I appreciate the opportunity to give comment on the proposed development at Hokukano. It is my sincere hope that the developer will consider more closely its' proposed project with respect to the needs and concerns of the immediate community.

Mahalo,

Charles Young

Charles Young
P.O. Box 505
Honaunau,Hi 96726

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Charles Young
P.O. Box 505
Honaunau, Hawaii 96726

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Young:

Thank you for your comments of August 12, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

County of Hawaii General Plan

The General Plan for the County of Hawaii designates the subject property as Extensive Agriculture, Orchard, and Open Space, rather than Conservation, Agriculture, or Unplanned as stated in your correspondence. In addition, the proposed development plan requires that a General Plan Amendment be approved for only a portion of the property (approximately 763 acres of the 1,540 total acres). The remainder could retain the existing General Plan classifications.

Regarding the concern about the project's fitting with the rural character of the area, this has been a primary objective in the planning of this project. Accordingly, the project is proposed as a low density development with generous open space elements, such as the golf course, natural and landscaped buffer areas, as well as shoreline and historic park areas. Design guidelines and controls on homes and buildings are also planned so as to maintain a soft contrast between the buildings and surrounding areas. The overall gross density of the project of approximately one unit per acre would retain an overall density much lower than other existing residential developments in the area. Additionally, with the development of the proposed highway bypass, the rerouting of non-village traffic would help return some of the rural feel to the village areas themselves.

Use of Agricultural Chemicals

The use of pesticides in the proposed agricultural program would be controlled by all applicable regulations governing the use of such products. The utmost care would be used in the storage, loading, mixing and application of these products. It is intended that these products be used within

a fully integrated pest management program and that the use of such products would be monitored by an onsite water monitoring program. In addition, all applications would be made by personnel trained in the use of these products. The developer realizes the importance of the region's marine resources and therefore finds water pollution to be unacceptable and those practices that may endanger this resource would not be tolerated. As explained in the water monitoring and mitigation plan, if any problem should be discovered, the proper agencies would be notified and corrective actions would be implemented. Inasmuch as the area receives relatively little rainfall, the application of irrigation water and agricultural chemicals is easily controlled. In light of the proposed management and monitoring controls, no harmful effects to the groundwater or Kealakekua Bay (located approximately 1.3 miles from the project boundary) are anticipated.

Historical Information

The historical perspective of the proposed development as it relates to the historical uses of the subject properties and immediately surrounding areas is provided in Volume II, Section III of the Draft EIS. Section 4.3 of Volume I will be expanded to include a more complete description of the historical uses of the property. The applicant has actively sought input from the Hawaiian community and from those with historical ties to the property in order to gain a fuller appreciation and understanding of the unique history of the area.

Affordable Housing

As noted in the Draft EIS, the proposed project, in meeting State and County requirements regarding affordable housing, is expected to have a direct positive impact on a broad spectrum of the housing market.

Community Benefits

Guaranteed direct benefits to the resident community will result from expansion of the community's economic base, as well as new jobs, housing, infrastructure improvements (i.e. highway bypass, water system, power substation), expanded recreational opportunities (i.e. hiking, fishing, diving), and improved shoreline access. It is expected that many of those jobs created will be filled by qualified local residents who presently commute to work and are looking for employment opportunities closer to home. Increased County revenues will be allocated by the County Council and Administration as they determine appropriate to meet regional needs and to address those areas immediately impacted by the development.

Potential Development Along the Bypass Highway

No commercial development is planned by this project along the proposed Mamalahoa Highway bypass corridor. In addition, this highway would be a limited access roadway, as determined by the State Department of Transportation. Consequently, future land use along the bypass will be determined by State and County land use agencies and not the applicant. However, the applicant will not support the development of commercial land uses along the highway if proposed by adjoining landowners in the future.

General Comments

While we agree that the project is primarily aimed toward the higher end of the housing market, it would be misleading to say that recreational pursuits are the "main draw" of the project. The project is responding to an existing need for housing as people come to the region for its fine climate and location qualities. Also, we do not agree that the proposed project is any more "artificial" than any other manmade structure or development in the region. On the contrary, the main elements of the project have been carefully planned to fit well with the natural terrain and cause as little disruption to the natural environment as practical. Overall, the project has been planned to maintain a low density, single family character with generous open space elements, in keeping with the relatively low density, rural character of the area. In that the developer proposes to implement design guidelines intended to blend the structures with the surrounding environment, it is felt that the development would add to rather than detract from the character of the district.

Regarding the viability of the proposed agricultural program, the proposed agricultural concept is not a traditional agribusiness venture and thus the viability parameters used for large scale farming may not apply to this proposal. Site and infrastructure preparation are expected to be completed by the developer in order to minimize typical "up-front" costs for growers, thereby providing stronger incentives for grower participation. While there is a significant amount of capital required for site preparation, our studies show orchard crops can eventually provide a positive cash flow. In addition, ongoing costs not supported by the grower program would likely be the responsibility of the developer and subsequently the homeowners' association.

It is true that the developer hopes to make a profit from the proposed development project. It is also true that without a profit, the community benefits and tax revenues generated by the project would not occur. Pointing to the positive cost benefit ratio of the proposed project, however, is not intended to imply any partnership between the County and the developer. This information is included simply to show that the new tax revenues from the project would far exceed the projected governmental expenditures. It is assumed that those from the surrounding community and the County as a whole would benefit as a result of this, not the developer or the County government.

Your comment that the developer should work more closely with the community in planning the project is well taken. In fact, the developer has gone to great lengths to involve all interested parties in the project by soliciting their comments and suggestions as early as possible in the process. Throughout the development of the land use plan the developer has involved several hundred people from the community in field trips to the property. Additionally, four advertised public meetings have been conducted by the developer and the project consultants. In this respect, the entire population of West Hawaii has been invited to participate in the process of creating this land use plan. This process of community involvement is described in Section 7.0 of the Draft EIS and will be further elaborated within the Final EIS.

We appreciate your thoughtful comments to the Draft EIS. Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

# OFFICE OF STATE PLANNING

Office of the Governor

MAILING ADDRESS: P.O. BOX 3540, HONOLULU, HAWAII 96811-3540
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FAX: Director's Office 587-2848
Planning Division 587-2824


Ref No. C-179

August 10, 1993

The Honorable Virginia Goldstein
Planning Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Subject: Villages at Hokukano, Draft Environmental Impact Statement

We have reviewed the subject draft environmental impact statement relative to the Coastal Zone Management (CZM) Program and have the following comments.

It is a policy of the CZM Program to promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems. We are concerned about the possible water quality impacts associated with the construction phase of the project. Disturbance of the vegetation and top soil during vegetation clearing and grading activities may result in sediment entering the nearshore waters through storm water runoff. We suggest that appropriate sediment and erosion control best management practices be established prior to commencement of any construction related grading or clearing.

In addition, we are concerned about the possibility of increased nonpoint pollution to the nearshore waters resulting from the large scale residential use proposed. Guidelines for landscaping, pesticide and herbicide use, and household cleaner disposal should be considered to reduce the potential for nonpoint source pollution from the residential areas.

It is a CZM objective to protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems. Increases in public access to the shoreline may increase the use of the nearshore area. We understand that the nearshore area adjacent to the project site is a pristine resource. Although we encourage public access to and along the shoreline, we are concerned that increased use may adversely affect the area's resources. The need for special management of the nearshore area should be investigated.

Thank you for the opportunity to comment. If there are any questions, please contact Valerie McMillan of our CZM Program.

Sincerely,

Harold S. Masumoto
Director

cc: Mr. Brian J.J. Choy
Mr. Richard Frye
Mr. James Leonard

VWM/mc
VWM#1

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Harold Masumoto, Director
Office of State Planning
P.O. Box 3540,
Honolulu, Hawaii

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Masumoto:

Thank you for your comments of August 10, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

We concur that a plan to mitigate potential water quality impacts associated with the project needs to be implemented prior to construction. Consequently, the applicant will prepare an appropriate sediment and erosion control plan in accordance with all applicable State and County requirements. In addition, the Integrated Golf Course Management Plan (IGCMP) utilizing "best management practices" has been prepared and included in the Draft EIS as Appendix I-7, and all of the Department of Health's Twelve Conditions for Golf Courses will be implemented.

Non-point pollution from runoff generated by residential land uses will be mitigated by design guidelines for residential landscaping, management of runoff through on-site drainage improvements and retention basins, and by strict adherence to State and County rules and regulations. During construction, potential non-point pollution from runoff will be mitigated through adherence to State National Pollution Discharge and Elimination System regulations and implementation of erosion and sedimentation control measures as required by the County for grading permit approval. A Water Quality and Marine Life Monitoring and Mitigation Program, as detailed in Appendix I-4, will also be implemented to further ensure the protection of coastal waters.

In order to maintain and enhance the natural qualities of the Conservation District, the applicant will initiate a management program, coordinated with DLNR, to manage the uses of this area to ensure that increased use and accessibility to the shoreline area will not adversely affect the area's resources. As this management plan evolves, the CZM Program and DLNR will be consulted. As described in the Draft EIS, all necessary approvals will be in place before the proposed access improvements and trail system is implemented.

1042 FORT STREET MALL, SUITE 300 HONOLULU, HAWAII 96813 TELEPHONE: (808) 521-5631 FAX: (808) 523-1402
BRANCH OFFICE: HILO LAGOON CENTER 101 AUPUNI STREET, SUITE 310 HILO, HAWAII 96720 TELEPHONE: (808) 961-3333 FAX: (808) 961-4989

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

JOHN WAIHEE
GOVERNOR OF HAWAII

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:

August 10, 1993

93-082/epo

Ms. Virginia Goldstein, Director
Planning Department
County of Hawaii
25 Aupuni Street, Room 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Subject: Request for Comments
Draft Environmental Impact Statement (DEIS)
Villages at Hokukano
Kealakekua, Hawaii
TMK: 8-1-04: por. 3,
7-9-12: 3, por. 4, 5, & 11
7-9-06: 1

Thank you for allowing us to review and comment on the subject document. We have the following comments to offer, in addition to our comments found in our letter dated April 28, 1993 (attached):

Drinking Water

1. The DEIS indicates that the project will include the development of new sources of potable water. However, it does not indicate where these wells will be situated. As new sources of water are developed, it will be necessary to comply with Hawaii Administrative Rules, Title 11, Chapter 20, Rules "Relating to Potable Water Systems." Section 11-20-29 requires that all new sources of potable water serving a public water system be approved by the Director of Health prior to its use. Such an approval is based primarily upon the submission of a satisfactory engineering report which addresses the requirements in Section 11-20-29.

2. The engineering report must identify all potential sources of contamination and evaluate alternative control measures which could be implemented to reduce or eliminate the potential for contamination, including treatment of the water source. In addition, water quality analyses, performed by a laboratory certified in the state of Hawaii, must be submitted as part of the report to demonstrate compliance with all drinking water standards.

3. Section 11-20-30 of Chapter 20 requires that new or substantially modified distribution systems for public water systems be approved by the Director. However, if the water system is under the jurisdiction of the County of Hawaii, the Department of Water Supply will be responsible for the review and approval of the plans.

4. The DEIS indicates that the proposed development will have a dual water system. The potable and nonpotable water systems must be carefully designed and operated to prevent cross-connections and backflow conditions. The two systems must be clearly labeled and physically separated by air gaps or reduced pressure principle backflow preventers to avoid contaminating the potable water supply. In addition, all nonpotable spigots and irrigated areas should be clearly labeled with warning signs to prevent the inadvertent consumption of nonpotable water.

Underground Injection Control

1. The comments as described in Department of Health's (DOH) letter dated April 28, 1993, are still applicable.

2. Based on the project's "Integrated Golf Course Management Program: The Villages at Hokukano" prepared by W. Lee Berndt, the project expresses its intent to implement an environmental monitoring program to address groundwater concerns and to aid in the management and use of chemicals. Although the commitment to implement a groundwater monitoring plan is expressed in Berndt's document, we have not seen any mention of the DOH's "Twelve (12) Conditions applicable to all new golf course development in the DEIS. Because of the lack of reference to the DOH's 12 Conditions, we would like to again recommend that the golf course development be subject to the "Twelve Conditions" (attached).

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

Very truly yours,

JOHN C. LEWIN, M.D.
Director of Health

c: Safe Drinking Water Branch
Oceanside 1250
PBR Hawaii

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

John C. Lewin, M.D., Director of Health
Department of Health
State of Hawaii
P.O.Box 3378
Honolulu, Hawaii 96801

**SUBJECT: SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Dr. Lewin:

Thank you for your comments of August 10, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

Drinking Water

1) All new sources of water will comply with Hawaii Administrative Rules, Title 11, Chapter 20 Rules "Relating to Potable Water Systems", as well as Section 11-20-29. This will be noted within the Final EIS.

3-4) Other comments pertaining to regulatory requirements for the distribution system, including those for possible dual water system, are appreciated and will be adhered to, as appropriate.

Underground Injection Control

2) The proposed Integrated Golf Course Management Program, including the groundwater monitoring plan, will adhere to the State's 12 Conditions Applicable to All New Golf Course Development .

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Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

August 7, 1993

Virginia Goldstein, Dir.
Planning Dept.
25 Aupuni St
Hilo Hawaii 96720
FAX'd

Re: Draft EIS / Hokukano Villages

Dear Ms. Goldstein,

This is in regard to (a) the proposed Hokukano Villages' 27 hole golf course, (b) dedicated ag land and (c) use of the "lodge."

(a) Amicable discussions with the applicant were held regarding state of the art golf course development and turf management. The Kahala Capitol/Cyanotech agreement regarding Kahala Capitol's proposed golf course at O'oma was discussed as the basis for developing the Hokukano golf course. The applicant appeared to be genuinely interested in making their golf course as environmentally sound as possible and agreed to study the Kahala/Cyanotech.O'oma agreement in regard to adopting it for their project.

Will the applicant agree to adopt the Kahala Capitol/Cyanotech O'oma golf course agreement as the basis for developing and managing their golf course?

If not, why not?

If some but not all, please specify which parts you can not comply with.

Do you intend to surpass any of the standards, and if so what would they be?

Please include the Kahala/Cyanotech/O'oma agreement in the final EIS.

(b) Amicable discussions were also held with the applicant regarding dedicating farmable and water serviced ag land (approximately 75 acres) abutting the residential area(s) to community agriculture on a free or low cost basis. The applicant was favorably disposed to this idea and was planning on include it into the Hokukano development plan.

Has this agricultural concept been incorporated into the development plan?

If not, will it?

(c) What is the rule, condition, law etc. that will guarantee that the "members lodge" does not accomodate transient guests and in effect become a de facto "hotel?"

Yours for a better way,

Jerry Rothstein, CDCM
75-123 Royal Poinciana Dr.
Kailua-Kona Hawaiiisland 96740
329-1568 // FAX 329-7651

cc: Oceanside 1250
FBR Hawaii
OEQC Bulletin

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Jerry Rothstein, CDCW
76-123 Royal Poinciana Drive
Kailua-Kona, Hawaii 96740

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Rothstein:

Thank you for your comments of August 7, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

Villages at Hokukano 27-Hole Golf Course

The developer has reviewed the agreement as you requested. The developer shares your concern and goals relative to proper pest control and fertilization. Their sources indicate that most "biorational" approaches are either unproven in Hawaii and/or have not achieved the desirable results of providing a high quality golf turf experience. Properly managed, applied, and monitored chemicals are not hazardous. In this regard, the developer's integrated golf course management plan will prevent detrimental affects. The developer is willing to adopt reasonable, proven biorational methods if, in their reasonable judgement, the desired results are achieved. Furthermore, the developer will be proactive in the controlled testing of new biorational methods for further widespread use, if testing shows success.

The developer finds it desirable and necessary to retain total control of its golf course operations, subject to governmental policy, regulations, and law. Well intended suggestions from all parties, governmental and nongovernmental, will always be welcome, considered, and addressed. New and innovative approaches, as discussed herein, will be considered for the golf course, agricultural, and residential components of the project.

Agricultural Concept

As shown in Figures 13 and 14, the proposed development plan includes an agricultural use concept which would replace the existing scrub vegetation with crop types currently grown in the area. Among others, these may consist of plumeria, papaya, macadamia, and coffee. A wide range of other potential crops is also provided in the Draft EIS. Although the land would remain as the lot owners' property, an easement or leasing arrangement would be created to allow qualified

farmers to engage in agricultural operations on designated parcels. Presently, the cost for farming these areas is being studied, however, it is clear that no agricultural activity would be feasible without sale of the building site to subsidize the capital expense required to initiate the agricultural operations. Our initial studies indicate that after an initial start-up period, which would be subsidized by the developer, the commercial agriculture activities proposed for this area can be self sustaining.

Members Lodge

Regarding the potential restrictions of the lodge use, such questions are perhaps best directed to the County Planning Department, which could more appropriately explain the rules and regulations pertaining to the County Code.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

KONA CONSERVATION GROUP
73-4504 Kohanaiki Road
Box 10, Kailua-Kona 96740

August 7, 1993

Planning Director Virginia Goldstein
County of Hawaii
25 Aupuni Street, Suite 109
Hilo, HI 96720

SUBJECT: Comments to Draft EIS, Villages at Hokukano, June 1993

Dear Ms. Goldstein:

Please accept these comments to the Draft EIS on Villages at Hokukano.

1. Protection of Class AA waters and Kealakekua Bay:

   A. The DEIS does not state how far away Kealakekua Bay is from the project site. In the Volume II study, p. I-3-52 is the statement that it is about 3.7 km away. This should have been stated in the DEIS also, as it is required that the DEIS be written as a self-contained document that does not require the reviewer to dig out of the supporting study. Isn't this only about 2.3 miles away? The DEIS should have contained detailed information about the ocean currents that could take pollutants from the project site to Kealakekua Bay, especially during a storm, and the possible negative impacts to the marine life in the bay, and subsequently to its designation as a marine life conservation area, etc. The significance of this bay needs to be disclosed and thoroughly discussed because of its proximity to the project site.

   B. Monitoring of the waters offshore appears to be inadequate:
      (1) On p. 147, the DEIS states that "coastal marine waters will continue to be monitored on an ongoing basis to detect problems and take appropriate action. However, it does not say how often monitoring will be done. The reviewer must read in Volume II, page I-4-3, to find that it will be "carried out on a QUARTERLY BASIS and the marine life studies will be done TWICE A YEAR. Further, it states that water quality sampling will be done for only FIVE YEARS in the area WITHIN 1 KM OF THE SHORELINE only. (p. I-4-5)
         Isn't 1 km too narrow a band to sample?
         Isn't Phase I mainly the golf course construction?
         What about negative impacts from chemicals used by the residents, which will be after Phase I? High-priced home owners are known to use more chemicals than average to keep their lawns manicured. This must be monitored, expecially in this sensitive location so close to Kealakekua Bay.

2. Protection of archaeological sites:

   A. What is the opinion of native Hawaiians such as members of Ka Lahui and the Big Island Burial Council on the proposal that those sites that are recommended for preservation will be "integrated" into the golf course plan? Can the integrity of the sites and site complexes be preserved under this arrangement? Isn't there a basic contradiction in the dual purposes of preserving these sites with respect and providing a playground for the very rich?

B. What importance has been placed on the Kona Field System, which the noted archaeologist T. Stell Newman described as "the most extensive and monumental work of ancient Hawai'i." (p. III-1-76, 424, 77-82) What will be done to preserve it? To what extent will the integrity of the Kona Field System be preserved, or will only a few individual features be preserved?

C. What does the Burial Council thank of the 289 sites recommended for resource recovery, or destruction after information isgathered from them?

3. Access to the shoreline, along the shoreline:
Although numerous statements seem to indicate that "the public shall be provided access to the shore...through the provision of public parking and a pedestrian access trail system" (p. 160), it also says that this shoreline trail system will be "managed and maintained by a community homeowners' association or other non-profit entity established by the developer..." (p. 102) This seems to say that the public access may be limited. This needs to be spelled out. Will it be public or not?

4. The highway bypass road:

A. How realistic and feasible is the plan for the developer to pay for the cost of the highway bypass and then get back some of the cost by assessing future landowners for their portion of the cost? Has this been tried before? Here? How workable is it? What problems are involved in such a plan? Won't this encourage the establishment of a commercial strip along the highway so that thes costs can be paid back to the developer? What happens if there is no development along the bypass--how will the developer regain some of those costs as anticipated?

B. What are the alternative alignments of the bypass? Residents are concerned about the effect of this bypass on them--will their home get moved? will they front the bypass? Where are the connection points considered for the south end? what are the possible configurations being considered? The affected residents need to know.

C. The bypass and business in Kainaliu: Some business people I talke with in Kainaliu expressed the concern that if commercial development arises along the bypass, they will be negatively impacted a lot more than if the bypass is merely a high-speed highway. These alternatives need to be explored.

D. The bypass and traffic: One reason being given for the bypass as a benefit to the community is that it will relieve peak-hour traffic in Kainaliu. Have alternatives been considered, such as not permitting left-hand turns during the peak hours, no parking in Kainaliu during peak hours, more off-street parking provided? Just by not allowing parking during peak hours, all four lanes would be open for moving traffic.

5. Air quality:

A. The vog: there is no mention in the DEIS of the vog which has been prevalent in Kona for the past ten years. (p. 5, 32). It should be stated in the EIS that on most days, it is so bad that we cannot even see the horizon from this area. This nature-made pollution must be considered BEFORE we add any man-made and thus controllable pollution to the air. One must read p. I-5-5 and 14 for this information.

B. Disclosure of vog situation. It seems desirable to disclose this information in sales brochures and in deeds so that those prospective buyers with respiratory problems will be forwarned. Isn't this a requirement?

6. Agriculture:

Can the 367 lots called agricultural/residential lots really be considered as such? The developer says he plans to "add approximatel 75 acres of land ...to productive agricultural use", yet the price for these lots ranges from $460,000 to $930,000 for the one to three-acre lots. What do agriculture experts say about the feasibility or likelihood of agriculture being seriously undertaken in this project? (p.5 IV-1-4,6,9) Further, the buyers anticipated for these lots come from Hawaii- 40%; mainland- 40%, and Japan and other foreign lands-20%. Ho realistic are these figures? The EIS needs to justify its assumption that agriculture can reasonably be expected on these high-priced lots.

In the water systems study (II,3-7), it says that this project consists of... and POSSIBLY AGRICULTURAL USE." So, it's iffy, isn't

How does the developer reconcile the statement that this area is "only marginally suited for agricultural purposes..." (p.5), yet clai to create an agricultural/residential component on the same soil? How serious is the plan? How much more chemicals might have to be use in this area compared to other places with better soil in place? This impact of chemicals used by residents on water quality must be discus

7. Sewage:

How far away is the Heeia STP? Is this considered as "nearby" accord ing to the County General Plan such that connection from the project might be considered as permitted? (p.159). The developer says he migh have a plant on the site or connect to Heeia's. What costs should be then assessed as a fair share for this project? Might the low volume reported be increased tremendously as other projects in that area come to fruition? What commitments does the County already have? (The DEIS seems to suggest that the volume now is so low compared to the plant' capacity that it would be allowed.) (p. 91, II-4-8).

If there is a plant onsite, what provisions have been made to prevent odor from drifting onto the subdivision that is now located below the Kealakekua Post Office or onto the business area?

What about separating the gray water? (II-4-22). The definition is given but no consideration about action. The many benefits of separating gray water should be considered in a project of this size and sensitive location.

8. The cost-benefit ratio:

A. Second home buyers and retirees:

p. 98: the residents of this development are expected to be second home buyers and retirees. These types of residents add greatly to the public costs for this project, thus lowering the benefit-to-cost ratio tremendously because second home buyers are mostly part-time residents but require services year-round and retirees require more medical care and other public services while contributing little or nothing to the State income tax revenues. They also contribute less in sales tax. These differences in the nature of these categories of residents do not appear to have been factored into the cost-benefit analysis in Section IV-2. Since more than 20 to 30% of the residents in this development are expected to be new in-migrants to the State,

this development will cost more to the taxpayers of Hawaii than it will benefit us. Tis statement is made on the basis of the analysis reported in HAWAII TOURISM IMPACT PLAN, Volume II, State of Hawaii DPED, 1972, pages 53-59. This study seriously questions the feasibility of encouraging projects that specifically induce second home buyers and retirees. The EIS needs to be revised to reflect the cost benefit ratio based on this cited study, with refinements as needed.

Statements such as "the tax revenues generated by this project should more than cover the cost of additional emergency health care and hospital services..." appear to not have a reliable basis.(p.99)

Cost of education: (p. 98)
"The number of school children...is expected to low due to the second home and retirement home emphasis of the project...the DOE estimates that 298 students would be added...the project at buildout is expected to occur over a 32 year period, allowing sufficient time for the State DOE to accommodate any increase in school population as a result of the proposed project." As a mitigation measure, the developer "has discussed with the DOE their plans...and will continue to coordinate with the DOE in order to assure that adequate public school services are provided to project residents." So, there seems to be no commitment to help defray the cost of education directly attributable to this project. The EIS needs to discuss the possibility that buyers with more children will in-migrate to this state, adding increased costs for education. Again, referring to the cost-benefit study cited above, a news article a week ago said that about $9 million was appropriated for an elementary school in Waikoloa Village, a development that was also geared for the second home/retirement market. The EIS needs to address the projected costs and who will bear them.

10. Need for the project:
   A. Number of golf courses already on this island: 13; planned- 32. Do we really NEED more? Ka Lahui and the State Green Party both state clearly they are opposed to golf course development because of all the negative impacts.
   B. Marketing tool: (I-7-3) "The golf course will serve as a MARKETING TOOL FOR THE REAL ESTATE, INFLUENCING property buyers from ALL REGIONS OF THE WORLD." So, who will benefit from this project?
   C. Housing shortage: The DEIS claims that this project will help alleviate the housing shortage. (78,155,130)

11. Unresolved issues: all the unresolved issues should be more fully addressed in A REVISED DRAFT EIS. Alternatives must be fully discussed so that reviewers have a solid basis for reviewing the alternatives and deciding whether all issues have been fully explored.

PJ

12. For the DEIS to be legally acceptable by the County Planning Director the burden of proof is upon the developer to first show that:
    A. the cumulative effects of the chemicals proposed for use in this development will not damage the marine flora and fauna of the coastal waters, and especially nearby Kealakekua Bay, and
    B. the long-term effects of the project will be of benefit to the residents of the County and the State, economically and socially.

Only major concerns have been brought out here. If there are any errors of fact or assumption, please let me know.

Sincerely,

for Lois Tyler
DOUBLAS BLAKE
President

cc: PBR
Oceanside 1250
OEQC

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Douglas Blake, President
Kona Conservation Group
73-4504 Kohanaiki Road, Box 10
Kailua-Kona, Hawaii 96740

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Blake:

Thank you for your comments of August 7, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

1) Protection of Class AA Waters and Kealakekua Bay

A) Kealakekua Bay is located between 1.3 and 2.3 miles from the nearest boundary of the proposed project as depicted in Figure 2 of the Draft EIS. As indicated in Appendix I, Sections 3, 4, and 7, an elaborate system of onsite drainage improvements and retention basins will ensure that project related chemicals used within the project boundaries will not enter coastal waters. In addition, the predominantly northern ocean currents and natural dilution associated with over one mile of ocean water establish a significant barrier between the project and Kealakekua Bay. As stated within the Draft EIS and detailed within the Water Quality and Marine Life Monitoring Study and Mitigation Plan (Appendix I-4), impacts from development related activities to the coastal marine waters have not been evidenced in waters fronting other developed areas of West Hawaii. The reports note that at Waikoloa, long term studies have not found any products from pesticides, herbicides or fungicides used at Waikoloa in the waters fronting the resort. Also, ongoing monitoring of the aquatic biota has found no change in any of the species. This suggests that there should not be a contamination problem of the coastal waters with the proposed development, especially in light of the numerous design and management controls proposed for the Hokukano development.

B) To ensure that the proposed project does not impact the water quality of coastal waters, the applicant will monitor ocean water quality for any significant changes due to development activities and, if indicated, will implement appropriate corrective measures. This monitoring plan provides for much greater protection than likely occurs from the current, unmonitored runoff associated with agricultural uses of surrounding properties. Although the monitoring procedures described within the Draft EIS were developed prior to the recommendations of the West Hawaii Coastal Monitoring Task

Force, which came out in May 1992, the proposed program mirrors those elements presented in the West Hawaii Coastal Monitoring Program Monitoring Protocols and Guidelines. The developer will adhere to these guidelines and recognizes that they represent a minimum from which we may add additional sampling sites.

Regarding the distance offshore for the monitoring sites, presumably any contaminants that would be coming from the land would have the greatest opportunity for detection at those sample sites that are directly adjacent to the shoreline or in line of the shoreline, e.g., coastal wells or monitoring wells. Sampling water close to the source of contamination offers the best opportunity for early detection and remediation. Regarding the duration of monitoring, this would be determined by the permit agency, following their review of the timeline of the project. In the absence of a timeline when the monitoring and mitigation plan was written, a five year monitoring period following complete buildout was recommended, assuming that no detrimental conditions are encountered. However, it should be realized that a longer term monitoring program may be required by the permit agencies as a part of the land use approval process. Thus, the duration of sampling has not been fully determined at this point.

Regarding the comment on the impacts from chemicals used by homeowners, we are not aware of any information as to use patterns of pesticides with respect to individual income levels. Although guidelines will be established for use of chemicals applied in residential areas, enforcement of such guidelines may not be practical inasmuch as these regulations would not apply to residential areas located directly mauka of the proposed development. It would be difficult to determine the source of the impact detected. It also seems reasonable to assume that the proposed project would not be regulated in a manner that differs from other residential areas on the Island of Hawaii.

2) Protection of Archaeological Sites

A) In a letter regarding the proposed development, Ka Lahui expressed concern regarding impacts to the exercise of traditional religious and access rights of native Hawaiians. They also recommended that the EIS contain a more complete description of the evaluation and criteria for archaeological sites, along with a description of all aspects of Hawaiian life in and around the project site before and after 1776. A copy of the letter from Ka Lahui will be enclosed within the Final EIS. As no alteration of known burial sites onsite are currently planned, the Hawaii Island Burial Council has not been formally consulted. However, should any impact, alteration or relocation of burial sites be considered, such measures will be reviewed with the Council, which serves as an advisory body to the Department of Land & Natural Resources, Historic Site Preservation Division (DLNR-HSPD). Approval of an archaeological site preservation plan from the DLNR-HSPD will be required prior to any land alteration or grading activity on the proposed development.

In conducting the initial archaeological survey, the consulting archaeologist, Cultural Surveys of Hawaii, attempted to consolidate related features into site complexes, such that if a few features within a complex were deemed significant, then the whole complex was deemed significant and recommended for preservation due to its overall association. In this manner, it is felt that the integrity of sites and site complexes can

and will be preserved with appropriate buffer areas according to the recommended procedures and guidelines approved by the DLNR-HSPD.

B) Much of the Kona Field System, which extends far beyond the project boundaries, will remain unchanged and better maintained within the project boundaries by the applicant than if left in its current use. As noted in the Archaeological Inventory Report (Appendix III-1), various historic and modern land modifications, including "chain dragging," bulldozing and stone clearing, associated with ranching activities, sugar cane cultivation, and urban activities have apparently destroyed much of the evidence of the Kona Field System in this area.

C) As noted previously, no impact, alteration, or relocation of known burial sites are planned at this time. Should such measures be considered in the future, the Hawaii Island Burial Council will be consulted and their recommendations followed in development of the final site preservation plan for the proposed project.

3) Access to the Shoreline

In order to maintain the natural qualities of the Conservation District, the applicant will initiate a management program, coordinated with DLNR, to manage the uses of this area to ensure that increased use and accessibility to the shoreline area will not adversely affect the area's resources. As this management plan evolves, the Coastal Zone Management (CZM) Program and DLNR will be consulted. As described in the Draft EIS, all necessary approvals will be in place before the proposed access improvements and trail system are implemented. The trail system will not, however, be dedicated to the public but will be available for use by the public.

4) Highway Bypass Road

A) Highway Bypass Proposal: The general proposal put forth by the developer has been discussed with the State Department of Transportation. The details for financing this project have not been finalized at this point. The developer would not support any commercial rezoning along the proposed bypass road.

B) Alternative Alignments of the Bypass: Individuals within the community, especially those in the area of the proposed bypass road, have been consulted either through community meetings or through personal discussions or correspondence. The proposed alignment has been planned to minimize the potential impacts to existing residents to the furthest extent practical.

C) Commercial Development Along the Bypass Road: As noted, the developer would not support any commercial rezoning along the proposed bypass road.

D) The Bypass and Traffic: As Mamalahoa Highway currently operates at or near capacity conditions, and widening Mamalahoa Highway to a four lane road does not appear feasible due to the existing residential and commercial development along the highway and limited available right-of-way, there are few alternatives to the proposed bypass road in addressing future roadway requirements, either with or without the proposed development. Other traffic mitigation measures, as suggested, have been investigated,

however, these were found to generate multiple impacts to local traffic conditions and would not address the long term need for additional roadway capacity in the region.

5) Air Quality

A) Air quality implications associated with volcanic eruptions are described in the Air Quality Study, Appendix I, Section 5, pages 2, 11 and 12. As indicated in the report, current levels of sulfur dioxide generally associated with volcanic emissions do not exceed State air quality standards. After project buildout, State and Federal air quality limits will not be exceeded.

B) The project will adhere to all State and Federal requirements regarding disclosure information within sales brochures and purchase documents.

6) Agriculture

A) Agricultural Feasibility: The developer proposes to underwrite the costs of providing the necessary onsite improvements to adequately prepare the site for agricultural activity. This would include such elements as land preparation and irrigation installation. While some of these lands are considered marginally suited for agriculture, the land preparation plan would be designed to mitigate these factors and renew lands into productive acreage. As envisioned and depending upon chosen crops, the plan may not be self sustaining until several years after planting and, until then, the developer and subsequently the homeowners' association would contribute the ongoing costs on an ongoing basis. Our studies indicate that these orchard crops can generate revenues in excess of the operating costs so that a positive cash flow can be realized by the growers.

B) Impacts from Agricultural Chemicals: The use of chemical products in the agricultural program would be used according to all applicable regulations. The utmost care would be used in the storage, loading, mixing, and application of these products, and these activities would be performed by fully trained personnel. It is intended that these products would be part of a fully integrated pest management program, along with other biologic and physical management regimes. These products would all be monitored by an onsite water monitoring program.

7) Sewage Treatment

The Heeia Sewage Treatment Plant (STP) is privately owned by Kamehameha Investment Company. If the use of this facility is the preferred alternative, costs associated with connecting to the plant, sewage treatment, and disposal options (use of grey water) will be negotiated between the applicants and the STP owners at the appropriate time in the development process.

8) Cost-Benefit Ratio

A) As described in Appendix IV of the Draft EIS, the fiscal impact of the proposed project is projected to produce a substantial net fiscal benefit. This is even more substantial for second-home buyers who contribute significantly in real property and sales taxes, do not generally utilize public health services, require less potable water, and generate less

liquid and solid waste than full time residents. Although police and fire protection is needed throughout the year, these costs are relatively minor when compared to the net fiscal benefits generated from the tax revenues of the second-home buyers.

The Hawaii Tourism Impact Plan cited in your comments, describes a 1972 West Hawaii development proposed by Boise Cascade with a project buildout scheduled for 1994. Although this fiscal impact analysis does describe a short-term deficit during the initial phases of development, the study concludes: "The analysis of costs and revenues generated at the State level reveals that at its completion the resort area of the Boise development should produce about 3.5 times as much revenue to the State as it will cost for State services required by the development. . . . Together, the resort and recreational village should pay their way only if the proportion of new State residents in the population is not more than 20 to 30 percent." It is important to note that in 1972, the improvements and associated costs required of developers was significantly less than currently contributed.

10) Need for the Project

A) Although the financial feasibility of a stand alone golf course may be questionable, the Villages at Hokukano golf course is planned primarily as an amenity to the master planned, residential community. The market feasibility of the project has been clearly established through the market assessment (Appendix IV-1).

B) Based on 1989 U.S. Census information, the distribution of families within the County of Hawaii by income is shown in the following table.

| Income Range | Number of Families |
|---|---|
| Less than $14,999 | 5,609 Families |
| $15,000 to $24,999 | 5,375 Families |
| $25,000 to $34,999 | 5,174 Families |
| $35,000 to $49,999 | 6,072 Families |
| $50,000 to $74,999 | 5,405 Families |
| $75,000 to $99,999 | 1,736 Families |
| $100,000 to $149,999 | 857 Families |
| $150,000 and Up | 426 Families |

As noted previously, census data also indicates the 1989 median income to be $33,186. Adjusting for inflation, this equates to an estimated median income of $42,325 in 1993 dollars. Also, as stated, because of the site characteristics, views and amenities offered at the Villages at Hokukano, the lot prices would likely appeal to residents in the upper income categories.

11) Unresolved Issues

According to Chapter 343, HRS, the purpose of the EIS law is to "establish a system of environmental review which will ensure that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations." It is not to resolve all issues, but to provide decision makers with the knowledge necessary to make informed

decisions. Alternatives considered are described in Section 3 of the Draft EIS. Selection of the appropriate alternative is more appropriate during the entitlement review process.

12) EIS Requirements

Acceptance of the EIS does not constitute approval of project entitlements by either the State or County. According to Section 11-200-23 of Title 11, Department of Health Chapter 200 Environmental Impact Statement Rules, the EIS is acceptable if the Statement "fulfills the definition of an EIS and adequately discloses and describes all identifiable environmental impacts and satisfactorily responds to review comments." The cumulative effects on marine flora and fauna of chemicals proposed for use by the project have been extensively studied and mitigation measures proposed in Appendix I, Sections 3, 4, and 7 of the Draft EIS. Identifying beneficial impacts, socially and economically, is not a requirement of the EIS process, but have been provided in Section 4.0 and Appendix IV-1 and IV-2 of the Draft EIS.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

From: Mrs. Valerie Rounsfell fax # 324-4513
home # 323-3637

To: Planning Director Virginia Goldstein H 961-8379
K 329-1977

Concerning the Villages at Hokukano Kealakekua, Kona,
also the new by pass road at Napoopoo intersection

Aloha;

We are very glad that you are putting so much effort in trying to hear from the people + their thoughts on this project. On the whole it is a reasonable project for the developing Kona Coast.

I'm personally concerned about my new home the county allowed me to build 3 yrs ago. If you can see where our home is we are concerned where the phase II bypass road connects to Napoopoo Rd. as we are located on the Mauka Mist Farm across from the Chevron Station in Keopuka. top key map enclosed.

On page 17415 Section 6.4 Unsolved issues.

We went to one of the public informational meetings + shared with the developers where our home is located.

A letter came from Libbie Kamisugi after speaking to her at the public meeting, also enclosed.

We are very concerned because they talk about not having a precise alignment of road set. We are opposed to any road coming through our home or our property. We enjoy the rural country quite. We live in Kona because we aren't in a hurry to get any where.

We suggest an alternative road to access the Villages at Hokukano. Extend Alii Drive South which would displace no one that I know of. The road could then connect with the Kealakekua Road called Halekii Street. Which would be a fast bypass to Keauhou, Kona Surf, Alii Dr. & take pressure off Kainaliu & Honalo.

The new owners of the Villages would save lots of time going to Alii Dr. from their location.

Please continue to keep me informed about the situation. Thank-you for your time & interest about my letter.

Mrs. Valerie Rounsfull

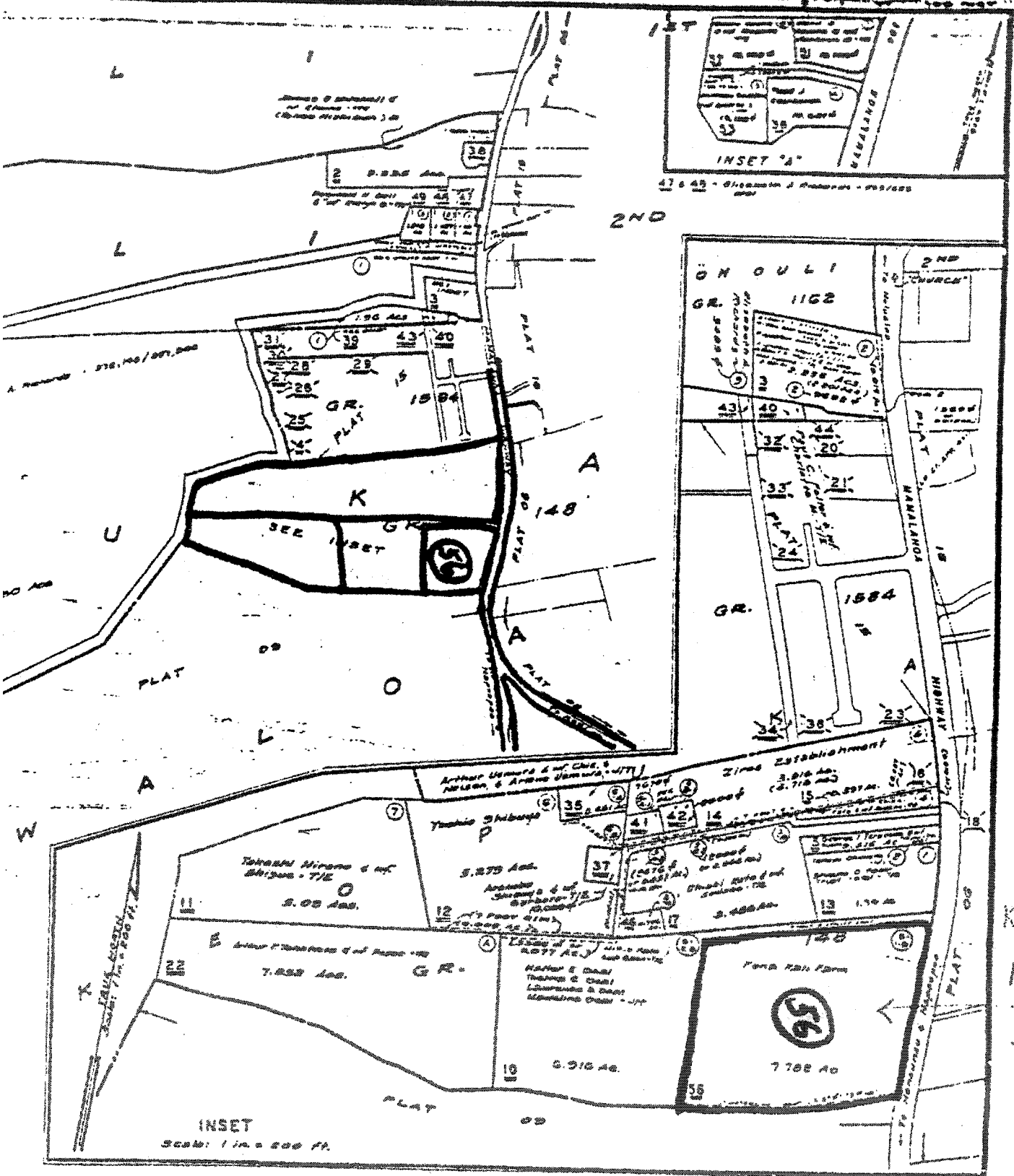
Also concerned are Gary Rounsfull
Donald Stewart
Barbara Stewart

8/7/93

VR

4 pages to fax

FOR PROPERTY ASSESSMENT PURPOSES
SUBJECT TO CHANGE




3 1691

41 Donald G. Isbell Trust - 1/2
Virginia Isbell Trust - 1/2

42 Modesto A. Quemuel

39

Parcels Grouped: 4, 6, 7, 9, 16, 18, to 21, incl., 23, to 31, incl., 34, 36, 44, 54, 55

FOR PROPERTY ASSESSMENT PURPOSES
SUBJECT TO CHANGE

DEPARTMENT OF TAXATION
PROPERTY TECHNICAL OFFICE
TAX MAPS BRANCH
STATE OF HAWAII
TAX MAP
THIRD TAXATION DISTRICT

| ZONE | SEC | PLAT |
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| 8 | 1 | 07 |

SCALE: 1 IN = AS NOTED

Kona Kai Farms
Rounsf
+
Stewa

Copy of letter

*Offices of:*
LIBBIE KAMISUGI
Real Estate Consultants & Developers

November 5, 1992

Mr. & Mrs. Gary Rounsfull
Kona Kali Farm
P. O. Box 876
Capt. Cook HI 96704

Dear Valarie and Gary,

Enclosed is a tax map which shows the location of your parcel, TMK (3) 8-1-07:56. At the community meeting you saw a schematic conceptual drawing with the highway alignment appearing to go through or near your property. Much is yet to be done relative to highway engineering, archaeology studies, environmental impact statements and other items before alternative routes can be laid out with any degree of reliability. At that time there will be additional public meetings, public hearings, and meetings with individuals such as yourselves to discuss alternative alignments and their potential effects.

As you know, there has been considerable public concern over several issues related to the Mamalahoa Highway. One of those issues is the safety aspect of the Napoopoo Road intersection with the Mamalahoa Highway at the blind curve. Another is the considerable amount of traffic movement and the potentially negative effects on business. A third relates to the issues of safety under the congested conditions as well as the ability for emergency vehicles to have quick ingress and egress to the Hospital. The final alignment of the proposed bypass certainly would and should be considerate of everyone's property through which it might pass. It is for these reasons that public hearings will be held and a new environmental impact statement will probably be prepared so that all of these issues and others can be properly and completely addressed.

Feel free to contact Dick Frye (808) 326-2966 at any time to further discuss the issues or receive an update on the activities relative to the proposed bypass routes.

Very Truly,

Libbie

Libbie Kamisugi

cc: Dick Frye

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Ms. Valerie Rounsfull
P.O.Box 876
Captain Cook, Hawaii 96704

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. Rounsfull:

We received a copy of your letter of August 7, 1993, to the County Planning Director concerning the above project. In that your letter references the Draft Environmental Impact Statement (EIS), we would like to address your concerns to the highway bypass road proposed by the developer, Oceanside 1250, as described within the Draft EIS.

It is true that the proposed bypass road alignment is only preliminary and subject to further design considerations, community input and governmental review. The current alignment, however, is thought to be viable and acceptable, and would not pass through your home or property. Of benefit to your property and others in your area should be the resulting decrease in traffic congestion on the Mamalahoa Highway once the bypass road is complete, as many of the vehicles passing mauka of your residence in the morning rush hour would opt for travel along the bypass road to their destinations in the Kailua, Keahole and South Kohala areas. Lessening the traffic congestion that currently exists along Mamalahoa Highway will add to the generally quite and rural atmosphere of the homes in the area of the Mamalahoa Highway. It is also felt that the bypass will provide a much needed positive impact for access to the Konawaena School area and, more critically, allow better access to the hospital.

1042 FORT STREET MALL, SUITE 300 HONOLULU, HAWAII 96813 TELEPHONE: (808) 521-5631 FAX: (808) 523-1402
BRANCH OFFICE: HILO LAGOON CENTER 101 AUPUNI STREET, SUITE 310 HILO, HAWAII 96720 TELEPHONE: (808) 961-3333 FAX: (808) 961-4989

We hope that this addresses your concerns in this regard. However, should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: G. Rounsfull
D. Stewart
B. Stewart
V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

He a'alii ku makani mai
Voho makani nana e kula'i


I am a wind resisting A'alii
No wind can push me over

# Ka 'Ohana O KaLae

*A Ka'u Hawaiian Grassroots Organization*

P.O. Box 672 • Naalehu, Hawaii 96772
Phone: 935-1663 • 929-9529

August 6, 1993

Virginia Goldstein, Planning Director
County of Hawai'i
25 Aupuni St., Suite 310
Hilo, Hawai'i 96720

Re: Response to Draft EIS : "Villages at Hokukano", a private golf club and residential development proposed near Kealakekua, Kona

Aloha, Ms. Goldstein:

As a native Hawaiian organization concerned with cultural preservation and perpetuation of traditional practices, Ka 'Ohana O KaLae finds that the Draft EIS for the so-called "Red Hill project" is inadequate and unacceptable. Given the evidence of impacts felt by native Hawaiians from innumerable similar projects, we see no reason to repeat the same problems.

Our ability to continue to exercise our Hawaiian lifestyle is impeded, for instance, when archaeological sites are deemed somehow less significant, slated for "data recovery", an extremely limited interpretation tool, and then bulldozed. The cultural (archaeological) sites in this area are extensive and inter-related; they should not be destroyed. The entire project is also clearly in the area of the Kona field system, an important cultural feature which should be slated for restoration, not for demolition. We would hope that you would be able to understand the importance of these issues, given your professional background.

We are also concerned with the impact of chemical runoff on our island's marine ecosystem. We depend on the ocean for our food. The Draft EIS proposes the use of certain chemicals containing 2-4-D, known to have severe impacts on flora and fauna, including neurological damage in humans. This type of chemical pollution is entirely unacceptable to us. We now know the effects of these pollutants. There is no conceivable excuse for continuing to allow their use, especially near a relatively pristine bay on a fragile island.

Finally, there seems no need for this project at all. There are already more golf courses here than the island can sustain. The projected housing development would do little to ease existing need for housing on the island, but would exacerbate infrastructure and other social problems. With the great majority of lotowners expected to be from elsewhere, another impact on the community would be created.

We urge you to carefully consider the impacts of allowing such developments in South Kona, and send this project back to square one, where they learn about the value of what they have, and preserve it, rather than destroy it. Mahalo.

With lifelong commitment,

Ka ohana O Kalae

Ka 'Ohana O KaLae

Palikapu Dedman, President

Margaret McGuire, Secretary

cc: James Leonard, PBR Hawaii

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Ms. Margaret McGuire, Secretary
Ka 'Ohana O Ka Lae
P.O. Box 672
Naalehu, Hawaii 96772

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. McGuire:

Thank you for your comments of August 6, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

Impacts Felt by Native Hawaiians

We agree that some development projects in the past have impacted the cultural preservation and "perpetuation of traditional practices" of native Hawaiians. However, we do not believe that the proposed project is "similar" or that the same problems will be repeated. Great effort has been made to preserve as many archaeological sites as possible. Sites identified by the project archaeologist for data recovery will not necessarily be disturbed, as most will remain untouched. We concur that the cultural sites in this area are extensive and some are interrelated, and that significant sites should not be destroyed. Much of the Kona Field System, which extends far beyond the project boundaries, will remain unchanged and be better maintained within the project boundaries by the applicant than if left in its current use. As noted in the Archaeological Inventory Report (Appendix III-1), various historic and modern land modifications, including "chain dragging", bulldozing and stone clearing, associated with ranching activities, sugar cane cultivation, and urban activities have apparently destroyed much of the evidence of the Kona Field System in this area.

Use of Chemicals

Regarding the potential impacts of chemical runoff to the island ecosystem, we agree that this type of chemical pollution is unacceptable. In this regard, the developer will only use lawful chemicals and will be sure they are only applied by properly trained personnel in accordance with label directions. To address the potential impacts to both ground and nearshore ocean waters from sedimentation or chemical runoff, the developer has proposed several measures to ensure that these types of impacts do not occur. As described in detail within the Draft EIS, these include design

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BRANCH OFFICE: HILO LAGOON CENTER 101 AUPUNI STREET, SUITE 310 HILO, HAWAII 96720 TELEPHONE: (808) 961-3333 FAX: (808) 961-4989

and drainage measures intended to prevent runoff from reaching the coastal waters; management procedures intended to minimize the use of chemical products and to ensure that all chemicals are applied according to applicable regulations by fully trained personnel; and monitoring procedures to ensure ongoing monitoring of surface, groundwater and coastal marine waters for chemicals being used on the golf course or landscaped areas and, if indicated, to implement appropriate corrective measures.

Community Benefits

Regarding the potential benefits to the community, we believe these are many, primarily the creation of jobs, expanded recreational activities, housing, and shoreline access, as well as improvements to area infrastructure, such as power, roads, sewers, and water. Rather than being a burden to the area's infrastructure, the project will have a positive impact on the regional roadway system through the creation of the proposed South Kona Bypass Road and improvements to the County water system through joint development of additional sources and water distribution systems. As noted, the project is anticipated to generate three to eight times more in new tax revenues than projected expenditures on the County level, and eight to ten times new revenues to expenditures on the State level. What this means is that, on a per resident basis, the project will generate far more in additional taxes than would be spent for public services and infrastructure improvements.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

JOHN WAIHEE
GOVERNOR

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET, SUITE 300
HONOLULU, HAWAII 96813
FAX (808) 587-0600

IN REPLY REFER TO:
93:PPE/3802

August 6, 1993

The Honorable Virginia Goldstein
Planning Director
County of Hawaii Planning Department
25 Aupuni Street, Suite 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Re: Draft EIS for the Villages at Hokukano

We have reviewed the subject draft EIS and offer the following comments.

The draft EIS does not adequately address the housing objectives and policies of the Hawaii State Plan (§226-19). For example, will the proposed project provide greater opportunities for Hawaii's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals.

Additionally, policies A(3) and B(3) of the State Housing Functional Plan seek to ensure that housing projects and projects which impact housing provide a fair share/adequate amount of affordable homeownership/rental opportunities. How will the project address these policies?

Thank you for the opportunity to comment.

Sincerely,

Sandra S. Nakamura

for JOSEPH K. CONANT
Executive Director

c: OEQC
Oceanside 1250
PBR Hawaii

PBR HAWAII

LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Joseph K. Conant, Executive Director
State of Hawaii
Housing Finance and Development Corporation
677 Queen Street, Suite #300
Honolulu, Hawaii 96813

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Conant:

Thank you for your comments of August 6, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

As noted in Section 5.1.2.1 of the Draft EIS, in addressing the policies on housing within the State Plan by meeting the requirements for affordable housing that would accompany land use approvals, the project would provide a range of housing options for Hawaii residents. As the County is currently reevaluating their policy with regard to affordable housing, it would be premature at this time to assess the full impact to the housing market, however, in providing up to 1,440 homes, which would be suitable as primary residences, the proposed project will add significantly to the County's housing supply, lessening the market demands on lower priced homes. These homes would be priced for the intended market, safe, sanitary, liveable, and located in a suitable environment that accommodates the needs and desires of families and individuals who would reside in these homes.

Also, in addressing the policies of the State Housing Functional Plan, as stated above, the County is reevaluating its policy on affordable housing, thus, it would be premature at this time to determine the developer's fair share or amount of affordable homes or rental opportunities as a result of the proposed project. The developer intends to meet its obligations in providing affordable housing in a manner which is consistent with State and County policies at the time of land use approvals.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

# University of Hawaii at Manoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawaii 96822
Telephone: (808) 956-7361


August 6, 1993
RE:0632

Ms. Virginia Goldstein, Planning Director
County of Hawaii Planning Department
25 Aupuni Street, Room 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Draft Environmental Impact Statement
Villages at Hokukano
North & South Kona, Hawaii

The applicant proposes to construct a 27-hole golf course, golf clubhouse, private members' lodge and residential development on 1,540 acres located on the border of the North and South Kona districts at Hokukano, Hawaii. The subject property is presently used for grazing, and adjacent land uses include pasture, residence, and agricultural activities.

We have been assisted in this review by Yu-Si Fok, Civil Engineering; Henry Gee, Water Resources Research Center; Richard Green, Agronomy & Soil Science; Terry Hunt, Anthropology; and Huilin Dong, Environmental Center.

## GENERAL COMMENTS

Overall, our reviewers find this Draft EIS well-written and reasonably comprehensive. In particular, we note that the archaeological analyses were professionally conducted, and the conclusions were appropriately derived. However, we suggest that the format of the Final EIS be modified somewhat to address the following two concerns.

1. Legibility of Figures. The reduced size of figures, particularly those with detailed topographic contours, compresses information to such degree that the figures are effectively illegible. Discerning the relationship of the proposed layouts for golf courses with slope characteristics is virtually impossible. Figure 9 similarly is too compressed to be useful.

2. Conservation of Paper. Considerable savings of paper could have been achieved by single-spacing and printing the document on both sides of each page.

In addition to these general comments, our reviewers noted the following specific concerns.

WATER QUALITY

Appendix I-7 relating to water quality is generic in nature and content, with no site specific information to assist either the client or regulators in decision making. Existing chemical practices on golf courses in Hawaii, and the availability of specific chemicals need to be further discussed. For example, ammonium nitrate is listed in Table 10, but it can't be purchased in Hawaii because of its explosive potential. There is no information about the soils, topography or climate of the site, all factors which must be understood in developing management practices. This report is no more useful than the published book which they reference: Balogh and Walker (1992) Golf Course Management and Construction: Environmental Issues. Thus, the information provided in the report is generally sound but does not contain the local information required and related analyses to be useful to decision makers. Its inclusion as an appendix appears to be little more than a self-serving justification of the developer's proposal with no material specification for site-specific environmental mitigation. As such, it appears to be dangerously close to blatant project advocacy at worst, and at best, a waste of time and paper.

The EIS has not provided sufficient information regarding storage basins relative to the Hawaii State Department of Health proposed guidelines for water reclamation. The DOH guidelines specify under A, Storage Basins, Item 6: "system storage capacity shall be sufficient to assure the retaining of the reclaimed water under adverse weather conditions, etc." What will be the impact of heavy runoff from the proposed project in conjunction with the 0.56 mgd reclaimed sewage? What are the aggregate capacities of the proposed retention ponds or storage reservoirs?

A waste water disposal plan is not included in this Draft EIS.

WATER RESOURCES

The discussions on the water supply appear to be inadequate. Reliable sources have been identified to meet only 367 of the 1440 proposed housing units, with only vague references to potential additional sources. Until more specific information is available on either county water supply capabilities or alternative private sources, impacts on county infrastructure or community demand/supply dynamics will remain speculative, and water supply will be an unresolved issue. Contrary to the statement on page 176, lines 12-14, it is more accurate to state that it would be premature for the county to proceed with land use approvals prior to the identification of adequate, reliable water sources for the proposed project.

SOCIO-ECONOMIC FACTORS

The proposed second phase development will include residential lots to accommodate approximately 1073 predominantly single-family residential homes. This residential lot development plan is based upon assumptions of a tight market housing supply and an increased demand for affordable housing from a growing population on the island of Hawaii. The inadequate supply of affordable housing is believed to be attributable to high land costs, the presence of many resort and high-market units, and pent-up demand for affordable housing.

Upon reviewing the economic and social factors, we feel that the assumed benefits of this residential plan in meeting the future demand needs to be carefully examined. Among many of our concerns are:

1. No projected housing demand in the island of Hawaii in general and in the district in particular is available in this assessment, except for the projected demand for housing units to accommodate the operational employees and the new in-migrant households. "As pointed out in the employment section, most construction and operational employment is expected to be filled by the resident population commuting from North and South Kona. Additional temporary and permanent housing demand generated by the project should not be significant. Conditions of the development approval, however, will require monitoring of this demand and supply of housing stock as the project progresses to ensure future housing needs are met (4.4 SOCIAL-ECONOMIC FACTORS, P82)."

2. The discussion on "affordable housing" needs to be substantiated. Once again, the market demand for these housing units along with their cost ranges needs to be estimated.

3. The private golf club and low density housing lots may fit well with the ambient rural environment, however, the cumulative effect of the life styles promoted and employment generated are not rural in character. The far-reaching social consequences of this project can't be completely explained by market analysis.

We are grateful for the opportunity to review this Draft EIS, and we hope our comments are helpful.

Sincerely,

John T. Harrison, Ph.D.
Environmental Coordinator

cc: OEQC
Oceanside
PBR Hawaii
Roger Fujioka
Yu-Si Fok
Henry Gee
Richard Green
Terry Hunt
Huilin Dong

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

John T. Harrison, Ph.D., Environmental Coordinator
University of Hawaii at Manoa
Environmental Center, Water Resource Research Center
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

**SUBJECT: SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT VILLAGES AT HOKUKANO APPLICANT: OCEANSIDE 1250 TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11; 8-1-4: 03 POR; 7-9-6: 01**

Dear Dr. Harrison:

Thank you for your comments of August 6, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

General Comments

1) Legibility of Figures: Regarding the relationship of the proposed golf course and slope characteristics of the project site, the golf course is planned in the area of the 30 to 400 foot elevation, an area of relatively milder slopes. The golf course was planned in this area and limited to 27 holes in order to minimize the amount of land alteration required for golf course construction and to ultimately achieve a better fit to the land. The slope characteristics of the project site are shown in Figure 9 of the Draft EIS following page 32. Should you require more detail regarding the site topography in relationship to the golf course development, a full scale plan is available upon request.

2) Conservation of Paper: We appreciate your comment in this respect and will make every effort to conserve on paper by using double sided printing for all portions of the Final EIS.

Water Quality

1) With respect to your comment on the need for more site specific information within the Integrated Golf Course Management Program (Appendix I-7), the developer, in conjunction with their Integrated Pest Management (IPM) specialist, is in the process of collecting and analyzing soil samples from the site in order to serve as a basis for a preliminary screening of potential chemicals that may be used as part of the IPM program. This process will take into consideration the soils, topography and climate of the site. We agree that these are all factors that must be understood to effectively monitor chemical applications, however, such factors are typically compiled and analyzed at later stages of the IPM program development.

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The Integrated Golf Course Management Program, which includes the parameters and protocols of the proposed IPM program, is intended to present a common sense approach toward managing a golf course in an environmentally sensitive manner. The fact that these procedures could be applied to "any" golf course may be true, but these should be, in order to maintain an environmentally sensitive approach to golf course development and management. This report, however, was written specifically in relationship to the golf course at the Villages at Hokukano, in referring to site specific design measures, such as special design, grading, and drainage features for the proposed golf course. These design features, combined with the proposed management practices described in the IPM program, will contribute toward an effective program aimed at protection of the groundwater and coastal environment.

Regarding the capacities of proposed retention ponds or storage reservoirs, this information was not included within the Draft EIS because the type of wastewater treatment system has yet to be determined (onsite or offsite) and the sizing of storage ponds is not known at this time. There is sufficient site flexibility to meet design criteria, as will become evident in the future stages of design and permitting. Should a sewage treatment plant (STP) be located onsite, the storage basins will be engineered to meet or exceed State and County requirements in terms of system storage capacity and wastewater disposal. Similarly, a wastewater disposal plan, as described within the State's 12 Conditions Applicable for All New Golf Course Development, is not included as this element will be prepared in a later point in the permitting process following a decision on the wastewater treatment system options. The developer will adhere to the State's 12 Conditions Applicable for All New Golf Course Development, as promulgated by the State Department of Health.

Water Resources

1) An evaluation of water resources was prepared for the Villages at Hokukano project by Waimea Water Services, and is included as Appendix II-5 of the Draft EIS. Based on the assessment of the consulting hydrologist, there are projected to be sufficient groundwater resources in the study area to meet the potable requirements of the proposed project. It is likely that the additional potable water demands beyond that for the initial phase of development will be developed in cooperation with the County Department of Water Supply, with an additional well probably located above the 1400 foot elevation. As noted in Section 4.6.2, the project has water commitments from the County under the Kealakekua Water Source agreement for 499 units, sufficient to meet the initial phase of development. The developer has had ongoing discussions and correspondence with the Department of Water Supply regarding the existing potable water commitments and coordination on development of additional sources to meet the project and regional water requirements. Per your comment, it may be more accurate to state that the identification of adequate and reliable water sources, along with the transmission, storage and distribution system requirements, will need to be identified at the time of application for rezoning and subdivision approval.

Socio-Economic Factors

1) Per your comments on the socio-economic factors, those pertaining to the project related impacts are discussed within the Draft EIS and will be elaborated upon within the Final EIS, especially with regards to the potential impacts to the island and district housing supply, and the cumulative social impacts to the rural environment.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

Deborah L. Chang
P.O. Box 3226
Līhu'e, HI 96766-6226
August 6, 1993

Ms. Virginia Goldstein
Planning Director
County of Hawaii Planning Department
25 Aupuni St., Suite 109
Hilo, HI 96720

Dear Ms. Goldstein:

SUBJECT: Villages at Hōkūkano, North & South Kona Districts

After reviewing the Draft Environmental Impact Statement for the above project, I have the following comments and questions:

- **Hawai'i County should give priority approval to projects that will significantly provide the kind of housing and water development needed by people who are already residents of the Big Island.**

With regards to the Big Island's housing needs, the DEIS fails to establish a need for this project. The Villages at Hokukano's overall objective "to develop a high quality residential/recreational community" (p.19) with an emphasis on second and retirement homes (p.99) will increase the already adequate (excessive?) supply of high-priced market units and contribute to the upward trend of land prices in West Hawai'i. Is that what the people of Hawai'i County need? As it is, many born and raised in Hawai'i are unable to afford their own home or even a rental. How is this project adding "significantly" to the "variety of housing available," as claimed on p. 170?

- **The term, "King's Trail," is a misnomer and should not be used to identify the major, historic thoroughfare located in the project area.**

I would appreciate being corrected if I'm wrong, but to my knowledge there are no pre-1900s maps or authoritative, historic accounts of any ancient Hawaiian trail named, "The King's Trail." It appears to be a popular, modern term without historical basis. I suggest "Alaloa," or Long Trail as an appropriate, traditional term for major prehistoric and early historic routes that were used by the general population of old Hawai'i.

- **Many ancient Hawaiian trails are owned in fee by the government of Hawai'i per the Highways Act of 1892 and any modifications to such trails must first be reviewed and approved by State of Hawai'i agencies.**

The DEIS conspicuously lacks details on proposed trail systems and how historic trails will be "improved to new standards" (Figure 21). "Some routing movements to achieve compatibility with the proposed development" (p.100) are intended for the "King's Trail." Any proposed changes of historic trail structures and routings need to be clarified and reviewed by agencies such as the Department of Land and Natural Resource's Historic Preservation Division and the Na Ala Hele Statewide Trail and Access System. Community organizations and individuals with experience in historic trail preservation should also be consulted. In addition, the "Ala Kahakai" (Trail by the Sea) which would be partially located along the project's shoreline is being studied for inclusion in the National Trails System. The Ala Kahakai should be noted in the Final EIS as a possible public trail system traversing that area. It's location would likely coincide with existing historic trails in the project area.

- **Historic site preservation is more meaningful and instructive when "significant" and "insignificant" sites are preserved in related complexes.**

Unfortunately, preservation of only those historic sites deemed "significant" can result in a disjointed hodgepodge of individual sites. When all "insignificant" sites are destroyed, we lose the opportunity to more fully understand the way of life of early Hawaiians in the subject area. Trail systems can help to connect related site complexes.

Mahalo for this opportunity to comment on the proposed project.

Sincerely,

Deborah L. Chang

Deborah L. Chang

cc:
Office of Environmental Quality Control
Oceanside 1250
PBR Hawaii
Christina Meller
Na Ala Hele Advisory Council

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Ms. Deborah L. Chang
P.O. Box 3226
Lihu'e, Hawaii 96766-6226

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. Chang:

Thank you for your comments of August 6, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

County of Hawaii Policy Giving Priority to Needed Housing and Water Projects

As stated in the Draft EIS and detailed in the Market Assessment (Appendix IV-1), the proposed project would meet the projected demand for housing for a portion of the housing market. Population projections forecast a growing demand for housing in all market segments as people move to this area because of its location and climatic advantages. In meeting this demand, this project will effectively increase the available housing supply and reduce the demand for lower priced homes which are available for other, less affluent, market segments. Also, as noted in Sections 4.4.2 and 5.2 of the Draft EIS, in meeting the affordable housing requirements which are anticipated conditions of approval, the project will have a direct, positive impact on all segments of the housing market.

Historic Trail

The name "King's Trail" was used because of its common usage in reference to this trail. Your suggestion of referring to this trail as the "Ala Loa" has been made by others and is one that we would be pleased to use. However, the Department of Land & Natural Resources (DLNR) has recommended the trail be referred to as "Ala Aupuni", in conjunction with its historical reference as a "government road". It is our goal to use the most appropriate name.

Highways Act of 1892

We concur that any changes of historic trail structures and routings need to be clarified and reviewed by appropriate agencies. The applicant has initiated these discussions with Na Ala Hele and DLNR's Historic Preservation Division. Numerous community organizations and individuals have also visited the site and have seen first hand the remnants of trail systems which may have existed. The partial location of the Ala Kahakai will be noted in the Final EIS as a possible trail system traversing the area near the shoreline.

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Historic Site Preservation

We concur that historic preservation is more meaningful and instructive when related complexes can be preserved with both significant and insignificant sites as appropriate. In many respects we feel this has been accomplished as, during their field inventory surveys, the consulting archaeologists tried to incorporate all associated features within a single site complex. If a few features within the complex were deemed significant, the whole site complex was deemed significant due to their overall association. It should also be noted that many of the sites not slated for preservation will indeed be saved and protected through careful site planning. In addition, it is thought that nearly all sites within the coastal zone of the State Conservation District will be preserved. We feel that it is especially important to the interpretive program that related site complexes are protected, and if possible, connected by foot trails, allowing for, as you stated, "the opportunity to more fully understand the way of life of early Hawaiians in the subject area."

We thank you for your thoughts on this project. Should you have any additional questions or concerns, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

August 6, 1993

RE: The Villages at Hokukano Project

To Whom It May Concern:

I am a resident of Napoopoo Village and live very near to Kealakekua Bay. I swim in the bay very frequently and enjoy the natural splendors and marine life the waters have to offer. Over the years I have noticed a decrease in coral life and fish. I can only surmise that man's intervention had something to do with that.

Fresh water enters the bay constantly from the underground lava tubes and caves. This water comes from existing water tables which lead to the ocean. Any chemicals, pesticides and fertilizers used to create proposed golf courses and developments ultimately seep into the water table as a result of rainfall permeating these soils. My concern is that our beautiful Kealakekua Bay will ultimately suffer irreprable contamination, further reducing the biological diversity of these waters.

Although the proposed project is 2.3 miles away from the bay itself, currents can easily bring these pollutants to this pristine site. This is too close for comfort as far as I am concerned.

Over the past 15 years I have seen the Kohala Coast expand with it's resorts and golf courses. I moved further south hoping to live in a smaller, quieter community with less development. Bringing a project of this proportion would change the small-town feeling of Kealakekua just as it has changed that of Kailua-Kona. Most of the long-time residents here are just concerned with schools for their children, the community events and enjoying the shoreline and beaches. I speculate that an extremely small percentage of the local community will be able to afford the exhorbitant prices of the homes in this project site. Any possible benefit to the community this new project has to offer could not possibly out-weigh the damage it can cause to both the environment and the community. What we need is more low income housing, maintained state parks and playgrounds. That kind of development makes sense to me. The Hokukano project just makes money...for a few.

Sincerely,

Maryna Allan

Maryna Allan
Napoopoo

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Ms. Maryna Allan
P.O.Box 602
Kealakekua, Hawaii 96750

**SUBJECT: SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. Allan:

Thank you for your comments of August 6, 1993, regarding the Villages at Hokukano project. This letter is in response to those comments and concerns raised in your correspondence.

Your concern regarding the potential impacts from chemicals, pesticides and fertilizer use on the proposed golf course to ground and ocean waters is a concern equally shared by the developer. The developer realizes and values the importance of the region's marine resources and therefore, finds water pollution to be unacceptable. As stated within Section 4.2.3 of the Draft Environmental Impact Statement (EIS), several measures are being proposed by the developer as part of the golf course planning, design and operation in order to mitigate, to the furthest extent practical, the potential impacts to groundwater or coastal waters fronting the proposed project from the golf course development and operation. These include:

- Implementing an Integrated Golf Course Management Program aimed at minimizing the use of chemicals for golf course maintenance and ensuring the safe handling and storage of all chemicals;
- Adopting Hawaii proven biorational pest control methods, when appropriate;
- Engineering the golf course with bowl-shaped fairway construction and with a subsurface drainage system designed to collect stormwater runoff or excess irrigation and conduct this to irrigation ponds for reuse on the golf course;
- Incorporating a "reduced turf" golf course design, which reduces fairway areas and requirements for water, fertilizers and chemicals; and
- Implementing a Water Quality Monitoring and Mitigation Program to ensure ongoing monitoring of soil, groundwater and coastal water conditions for chemicals used in the golf course and landscaping and, if indicated, implementing appropriate mitigation measures.

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Taken collectively, these measures represent the state of the art in developing an environmentally sensitive golf course and will ensure the protection of groundwater and coastal water fronting the proposed project from development related impacts.

Your letter also comments that a project of this proportion would change the small town feeling of Kealakekua and what is needed is more low income housing, maintained State parks and playgrounds. In planning the Villages at Hokukano project, the developer had considered including affordable housing as part of the proposed project. However, as discussed in Section 3.2.4 of the Draft EIS, this alternative would have required additional market units in order to make the project financially viable. The resulting development density from this alternative was over twice that which is currently proposed and was found to be not in keeping with the rural character of the surrounding area, nor would it have allowed for a sensitive design that preserves the unique characteristics of the site. The developer fully intends to address the affordable housing requirements that may be imposed as part of the State and County land use approvals, but believes such elements should be located within a more urban setting, where the necessary density for affordable housing is more suitable.

The proposed project has been planned in a manner which would be in keeping with the rural character of the area by maintaining low density, predominantly single family neighborhoods, integrated with generous open space elements. Additionally, by contributing to the construction of the planned South Kona bypass road, this will help to alleviate traffic congestion that currently exists within the villages of Honalo, Kainaliu and Kealakekua, thus returning a more rural ambiance to these towns.

We appreciate your thoughts and concerns regarding the proposed project. Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

Stephen K. Yamashiro
*Mayor*

Virginia Goldstein
*Director*

Norman Olesen
*Deputy Director*

County of Hawaii
PLANNING DEPARTMENT
25 Aupuni Street, Room 109 • Hilo, Hawaii 96720-4252
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COPY

August 5, 1993

Mr. Richard Frye, Project Manager
Oceanside 1250
74-5620A Palani Road, Suite 200
Kailua-Kona, HI 96740

Dear Mr. Frye:

Draft Environmental Impact Statement (DEIS)
Applicant: Oceanside 1250
Request: Villages at Hokukano
Tax Map Key: 7-9-06:1; 7-9-12:3, Pors. of 3 & 4; 8-1-04:Por. of 3

We have completed our review of the referenced document and have the following comments to offer:

**Page 11, Table 1 - Project Approvals Required.**

For approvals needed from the County of Hawaii, the following actions and its approving agencies need to be corrected or clarified:

a. General Plan Amendments are approved only by the County Council.

b. Special Management Area Use Permits (minor or major) are not acted upon by the County Council.

c. Use Permits are issued by the Planning Commission.

d. Change of Zone are approved by the County Council.

e. Subdivision approvals are issued only by the Planning Director.

**Chapter 2.4 - Project Description (from Page 19).**

As required under Section 11-200-17(e)(7), Hawaii Administrative Rules (HAR), provide a historical perspective of the proposed development as it relates to the historical uses of the subject properties and immediately surrounding areas.

**Chapter 4.6 - Infrastructure and Public Facilities.**

Clarifying discussion is needed regarding the construction of Phase I of the proposed development and the timing of the proposed installation of the Mamalahoa Highway By-Pass. The Traffic Impact Analysis Report (TIAR) included within the DEIS analyzed states that "Roadway capacity analyses reveal that Mamalahoa Highway would operate at LOS F north and south of Halekii Street for base year 2005 conditions without the by-pass road during both AM and PM peak hours." "Construction of the by-pass road would increase capacity and reduce congestion through the Mamalahoa Highway corridor . . . .". Year 2005 has been recognized by the TIAR report as the anticipated completion date for Phase I of the development. This date would coincide with the base year conditions of LOS E for traffic along the Mamalahoa Highway **without** the proposed development and By-Pass. While we understand that timing of the By-Pass construction has not been determined (Page 164, 6.4 - Unresolved Issues), further discussion and information is necessary to address this potential conflict between the phasing of the proposed development, the construction of the proposed By-Pass, and the Year 2005 traffic conditions. We would also recommend that a discussion on interim measures to address impacts to traffic during construction of the proposed development, especially Phase I.

Chapter 5 - Relationship of Project to Land Use Plans, Policies.

Section 5.2.2.1 - Economic (from Page 144)

DEIS cites conformance with policy of General Plan that "The County of Hawaii shall encourage the development of a visitor industry which is consistent with the social, physical and economic goals of the residents of the County." However, the DEIS responds on the following page that "the proposed project is generally residential, rather than tied to the visitor industry . . . .". These statements seem to conflict with one another. Please clarify this relationship.

Section 5.2.2.3 - Environmental Quality (Page 146)

Typographical error - "Environmental quality controls are to be incorporated either as standards in appropriate [?] or as conditions of approval."

Section 5.2.2.13 - Land Use (Page 161)

DEIS cites proposed development as complementing a policy of the General Plan to "Promote and encourage the rehabilitation and use of urban and rural areas which are serviced by basic community facilities and utilities." Please explain how the proposed development will complement this policy.

Section 5.2.2.13 - Land Use (Page 166)

DEIS cites a General Plan standard for single family residential uses that "Major traffic routes shall not be located through single-family residential areas." The DEIS refers to the proposed development as a "predominantly single-family residential and residential/agricultural lots . . . .". Would this policy be appropriate given the location of the proposed Mamalahoa Highway By-Pass alignment which would traverse the project site?

Should you have any questions regarding these comments, please feel free to contact Rodney Nakano or Daryn Arai of this office at 961-8288.

Sincerely,

Virginia Goldstein

VIRGINIA GOLDSTEIN
Planning Director

DSA:mjh
LHOKUK06.DSA

xc: Mr. Brian Choy - OEQC
: Mr. James Leonard - PBR, Hawaii
: West Hawaii Office

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Ms. Virginia Goldstein, Planning Director
County of Hawaii Planning Department
25 Aupuni Street, Room 109
Hilo, Hawaii 96720-4252

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. Goldstein:

Thank you for your comments of August 5, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

Project Approvals Required

Table 1 on page 11 of the Draft EIS will be revised for the Final EIS, as recommended.

Project Description

The historical perspective of the proposed development as it relates to the historical uses of the subject properties and immediately surrounding areas is provided in Volume II, Section III of the Draft EIS. Section 4.3 of Volume I will be expanded to include a more complete description of the historical uses of the property.

Infrastructure and Public Facilities

Regarding the timing of the proposed bypass road in relation to the project development, the developer proposes to construct a portion of the bypass road from Kuakini Highway to the project site to serve as the project's primary accessway. This portion of the bypass road between Kuakini Highway and the Villages at Hokukano would be constructed before homes are occupied within the project site. The developer intends to use Haleki'i Street during initial construction of the project, before major construction hauling activities begin. Signalization of the Mamalahoa Highway/Haleki'i Street intersection is to be completed before start of these temporary construction activities. The developer intends to begin construction of the portion of the bypass road from Kuakini Highway to the site as a construction haul road to handle major construction hauling activities once these begin, in which case, signalization of the Kuakini Highway/bypass road intersection may be required. For approximately 6 to 8 months, construction traffic will need to

use Haleki'i Street for access to the site. During this short period, construction traffic will be relatively light. Additionally, the community will benefit from the traffic signal that is to be installed at Mamalahoa Highway/Haleki'i Street to improve traffic control problems that exist now and to prevent the project's construction traffic from adding to the problem. As other development projects are able to participate, the remainder of the proposed bypass (Haleki'i Street to Napo'opo'o Road) could be completed.

Relationship of Project to Land Use Plans, Policies

The proposed project, as stated in the Draft EIS, is designed as a residential development. Only the golf course could be considered as an amenity that would attract visitors (as well as local residents). As such, the project is not exclusively oriented toward promoting the visitor industry. Consequently, the General Plan policy cited in your comments does not require that every new project support the visitor industry, but that visitor related projects be developed in a manner consistent with the social, physical and economic goals of the residents of the County.

Environmental Quality

The typographical error referenced on page 146 will be corrected to read "Environmental quality controls are to be incorporated either as standards incorporated in appropriate ordinances or as conditions of approval."

Land Use (Page 161)

As described in the Draft EIS, the proposed project currently has access, water, electrical, and communication facilities adequate to accommodate the first phase of development. As Phase 2 is implemented, infrastructure improvements will be implemented by the developer to provide the necessary level of service for the land uses and densities proposed. The project would benefit by its proximity to the town of Kealakekua, which is described in the County General Plan as an urban and rural center (Support Document, page 81), and the community facilities and utilities which service this area. It is also expected that the proposed project will contribute to needed improvements of existing community infrastructure and services by providing new revenues to the State and County and by contributing to regional infrastructure improvements, such as roadways, the County water system, and the electrical utility. Thus, the proposed project would compliment the policy within the County General Plan to "promote and encourage the rehabilitation and use of urban and rural areas which are serviced by basic community facilities and utilities".

Land Use (Page 166)

The proposed bypass highway described in the Draft EIS will not be located through single-family residential areas. The proposed residential/agricultural lots are approximately 2 to 3 acres in size with access provided by the interior roadway system. Inasmuch as similar densities are characteristic of existing residential development along the Mamalahoa Highway, the proposed densities of the project and location of the bypass highway are not inappropriate or dissimilar. No driveway access would be permitted directly onto the proposed bypass and appropriate setbacks, as buffers, will be incorporated as part of the development plans.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

JOHN WAIHEE
GOVERNOR OF HAWAII

KEITH W. AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER, II
DONA L. HANAIKE

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

P. O. BOX 621
HONOLULU, HAWAII 96809

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

REF:OCEA:KCK

AUG 5 1993

File No.: 93-691
DOC. ID.: 3266

The Honorable Virginia Goldstein, Director
Planning Department
County of Hawaii
25 Aupuni Street, Room 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Subject: Draft Environmental Impact Statement (DEIS): Villages of Hokukano, North and South Kona, Hawaii, TMKs: 7-9-06: 1; 7-9-12: 3, por. 4 and 5, 11; 8-1-04: por. 3

We have reviewed the DEIS information for the subject project received by our Department on June 23, 1993, and have the following comments:

Commission on Water Resource Management

The Commission on Water Resource Management (CWRM) staff comments that it has reviewed the developer's plans for the provision of water for the project. CWRM believes that the irrigation of the project's golf course and landscaping with brackish water derived from on-site wells, would not reduce the quality of the underlying basal ground water beyond their present levels. However, CWRM is concerned with the potential for ground-water degradation resulting from the application of fertilizer or biocides and the use of wastewater effluent.

To address this concern, CWRM would recommend that approvals for this project be conditioned upon the developer's acceptance of the State Department of Health's requirements for golf course development.

Division of Land Management

The Division of Land Management (DLM) reiterates its comments contained in our previous letters dated May 25, 1993 and June 2, 1993, regarding the Special Management Area Permit (SMA 93-1), Use Permit (UP 93-2), and Zone Change (REZ 92-5) applications for this project (see attachments).

In addition, DLM comments that the unresolved issues relating to existing historic trails and public road rights-of-way (pages 10, 176-177) within the project area, must be resolved to the satisfaction of all State agencies prior to the issuance of the Final EIS and its publication in the Office of Environmental Quality Control (OEQC) Bulletin.

Division of Aquatic Resources

The Division of Aquatic Resources also reiterates its comments contained in our previous letters regarding this project (see attachments).

We will forward our Forestry and Wildlife and Historic Preservation Divisions' comments as they become available.

Thank you for the opportunity to comment on this matter.

Please feel free to call Steve Tagawa at our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Very truly yours,

KEITH W. AHUE

Attachments

cc: Richard Frye, Project Manager, Oceanside 1250
James Leonard, Managing Director, PBR Hawaii
Brian Choy, Director, OEQC

JOHN WAIHEE
GOVERNOR OF HAWAII

KEITH W. AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

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AQUACULTURE DEVELOPMENT PROGRAM
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CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

REF:OCEA:SKK

FILE NO.: 93-480
DOC. NO.: 2790

MAY 25 1993

The Honorable Virginia Goldstein, Director
Planning Department
County of Hawaii
25 Aupuni Street, Room 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

SUBJECT: Special Management Area (SMA 93-01) and Use Permit (UP 93-02) Application: Oceanside 1250 (Villages of Hokukano), North and South Kona, Hawaii, TMK: 7-9-12: por. 3, por. 5 and 11; 8-1-04: por. 3

We have reviewed the SMA and UP application information for the Villages of Hokukano golf course project transmitted by your memorandum dated February 25, 1993, and appreciate the additional time necessary to make the following comments:

Brief Description:

The applicant, Oceanside 1250, is seeking a Use Permit and SMA Permit from the County of Hawaii to develop a 27-hole golf course, clubhouse, driving range and related facilities on approximately 350 acres of Agricultural District land located along the Kona coastline, between Keahou and Kealakehua Bays.

The golf course is part of the 1540-acre master planned community which would be known as the Villages of Hokukano. The applicant is also seeking a Change of Zone from A-5a and Unplanned to A-1a to allow for the creation of approximately 367 one-three acre subdivision lots. When completed, the "Villages of Hokukano" master planned community would encompass 1,440 residential lots.

Approximately 140 acres of the seaward portion of the proposed master plan area is located within the Conservation District. The Project area is presently used for grazing cattle. The proposed development will not include the Conservation District land.

Division of Forestry and Wildlife

1) A representative from the Villages of Hokukano gave a presentation at a Na Ala Hele Advisory Council meeting on November 4, 1992. The initial impression of the council was generally favorable and appeared that the concerns of Na Ala Hele were adequately addressed. However, the Environmental Assessment (EA) will be referred to for discussion at the next Na Ala Hele meeting on April 15, 1993. A response from the council will follow.

2) Two notable native plant species were found during the botanical survey; Chamaesyce celastroides var. amplectens (approx. 200 individuals) and Capparis sandwichiana (1 individual). Capparis sandwichiana is a candidate 2 plant, and may be on the Federal Endangered Species list in the future. One individual was found growing among a colony of approximately 200 Chamaesyce celastroides var. amplectens plants. It would be desirable for this patch of native vegetation to remain intact.

3) Although no map was readily available to indicate where the plants are located, the survey did mention that these plants are growing on a rocky ridge. Unless leveling of the ridge is planned, these native plants may be included as part of the landscape plan instead of being removed. No mention of these plants is made in the Integrated Golf Course Management Program, which notes merely that clearing of vegetation will be done.

4) Page I-7-7 of the survey states that indigenous vegetation is a factor included in the design approach. There is no follow-up to this comment. Whether this refers to future plantings or to the indigenous plants already in place is unknown.

Division of Land Management

The Division of Land Management comments that:

1) The "Hokukano Village" site, identified as a portion of TMK: 8-1-04: 3, is owned by the State of Hawaii in fee simple. This area was excluded from Grant No. 1651, dated April 4, 1985 to Charles Hall and, hence, remains in government ownership.

2) An unlocated School Grant 10, Apana 2, adjoins the east boundary of the "Hokukano Village" site. Although this school grant remains unlocated (no modern metes and bounds survey description and survey map), the State of Hawaii claims fee simple ownership of the parcel.

3) A public road right-of-way traverses over and across Grant No. 1651 which the State of Hawaii or County of Hawaii has probable cause for claiming fee simple ownership. In the survey description under Civil No. 3498 (Quiet Title Action) filed in 1974 by the Greenwell family, this public road right-of-way (old government road) is encumbered as an easement. Further, this public road is not shown on the preliminary development plan and no mention of its existence is summarized anywhere in the SMA and UP application.

Division of Aquatic Resources

The Division of Aquatic Resources (DAR) comments that according to the applications, the planning and management of the proposed golf course is expected to include practices that are environmentally sensitive to the marine environment, that channels excess irrigation water and runoff to collecting points for reuse, minimizes fertilization and pesticide/herbicide rates, and establishes a monitoring plan.

A marine community and water quality impact assessment was performed by Dr. Richard Brock. He found water quality and marine community to be typical of well-flushed open coastal conditions of the Kona coast. Additionally, he found diverse fish populations and attributed it to the undeveloped nature of the adjacent coastline.

In a similar situation at Waikoloa, Dr. Brock observed a significant increase in inorganic compound concentrations which may have come from a golf course built near the shoreline. He noted however, that this increase did not bring about a notable change in adjacent marine communities. He attributed the increase to:

1. Large numbers of marine herbivores that controlled marine algae proliferation;

2. Well flushed open coastal area and the ocean's capacity to dilute pollutants;

3. The adaptation of marine organisms to highly variable nutrient concentrations.

Hence, Dr. Brock reasons that because environmental conditions are similar, he does not expect a similar increase in inorganics to result in a significant adverse change to the marine environment.

According to Dr. Brock, there is a monitoring and mitigation plan included in this proposed development. The monitoring plan include establishing baseline information for marine communities and water quality parameter profiles (already completed), continued year monitoring plan after construction is completed, and an action mitigation plan. The action mitigation plan would be activated when the following is detected:

1. An increase in nutrients in coastal waters;
2. A decrease or significant change in dominant marine species, or;
3. The detection of pesticides/herbicides used on the planned development.

The plan calls for changes in management until these problems are resolved.

DAR also comments that the scenario as proposed, given the area's low rainfall (35 inches per year, average) and the proposed environmentally-sensitive management practices, it is unlikely that the proposed monitoring of selected parameters will detect any significant changes in chemical constituency or marine communities. As Dr. Brock notes at Waikoloa, it is probable that even significant water quality changes may not result in observable impacts (with present monitoring technologies).

Greater impacts to the marine environment may result from the increased fishing activity encouraged through improved public access than those which result from excess nutrient and pollutant runoff produced by the development.

DAR expects decreases to selected stocks of marine food and game fish populations in this area once it is opened to the public for fishing. Creel censuring done both before and after the project, may be able to detect changes in the fish populations which result from the increased public access. This censuring may also provide data that is more reflective of the impacts to the marine environment.

Our Historic Preservation Division comments will be forwarded as they become available.

We have no other comments to offer at this time. Thank you for the opportunity to comment on this matter.

Please feel free to call Steve Tagawa of our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Very truly yours,

KEITH W. AHUE

AUG 10

PBR HAWAII

LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

August 9, 1993

Mr. Keith W. Ahue, Chairperson
Board of Land & Natural Resources
Department of Land & Natural Resources
P.O.Box 621
Honolulu, Hawaii 96809

**SUBJECT: SPECIAL MANAGEMENT AREA APPLICATION (SMA 93-1)**
**USE PERMIT APPLICATION (UP 93-2)**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 05 POR, 11; 8-1-4: 03 POR**

Dear Mr. Ahue:

Thank you for your letter of May 25, 1993, in which you provide comments from various divisions of the Department of Land & Natural Resources on the subject applications. This letter is to respond to some of those comments and questions raised in your letter.

Division of Forestry & Wildlife

1) Regarding coordination with the Na Ala Hele Advisory Council, we attended the Na Ala Hele Advisory Council meeting of July 14, 1993, where the Draft EIS for the Villages at Hokukano project was discussed. At that meeting, Mr. Dick Frye of Oceanside 1250, reviewed with the Council, plans for the proposed project and in particular, those plans relating to the protection and enhancement of existing trails, including the King's Trail, and provisions for public shoreline access. The Council responded favorably to these plans and we understand that a letter will be forthcoming with the Council's comments to the Draft EIS.

2 - 3) Regarding reference to the three native species found on the site, as stated in our applications, where practical, these species will be incorporated as part of the landscape plans for the project. At this time, we have not developed our landscape plans which will be prepared during the permit process. Up to this point, we have been studying various options for plant use, with particular focus on the use of plants, such as native species, which require less water and are better suited to the site's climatic and geographic zone. I would like to point out that, as planned, approximately 50% of the site would remain in a common landscape, using in many cases the existing vegetation, which will increase the potential use of existing or relocated native species. Also, we have confirmed with our

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BRANCH OFFICE: HILO LAGOON CENTER 101 AUPUNI STREET, SUITE 310 HILO, HAWAII 96720 TELEPHONE: (808) 961-3 FAX: (808) 961-4989

flora consultant, Dr. Evangeline Funk, that no existing or proposed additions to the list of potentially rare, threatened, or endangered species occur within the project site. The single capparis plant, as a candidate 2 plant, could readily be preserved in place, or relocated to an alternate site. Please note, however, that this and the colony of native Euphorbs are located at the approximately 470 foot elevation and outside the petition area for the proposed golf course.

Division of Land Management

1) The Hokukano Village site, as a State owned parcel, has been specifically excluded from our metes and bounds description of the project. Oceanside 1250, however, has been working with the State Historic Preservation Office towards a mutually agreeable arrangement for the care and management of the Hokukano Village area.

2 - 3) Regarding the State's claim to portions of Grant 10, Apana 2, we understand is adjacent to the "Hokukano Village" site, and outside the property boundaries, however, we are currently researching this portion to determine its precise location. We will keep the Division of Land Management informed of our findings once these are received.

Regarding the public road right-of-way (Old Government Road) which crosses Grant 1651, Oceanside 1250 does not dispute the State's claim over ownership of these portions, and is currently working with the Land Management Division to ensure that the State's interest with regards to those portions of the Government Road which traverse the site, are protected. The Government Road is shown on the golf course development plans as the King's Trail, which is noted for preservation, in accordance with the recommendations of the consulting archaeologist. The King's Trail forks near the area of Pu'u Ohau, at which point the location of the trail is not evident until a point near the southern project boundary. At the point of the fork near Pu'u Ohau, another trail known as the Cart Trail departs and follows a path somewhat parallel to the shoreline. We will be working with the Division of Land Management, as well as the State Historic Preservation Office, in determining the location of the King's Trail and the procedures for its protection and enhancement.

Division of Aquatic Resources

We appreciate the Division's comments related to the potential impacts to the marine environment as a result of increased public access and fishing activity in this area. This is an important aspect, which will need to be considered in our ongoing monitoring of the marine environment and the proper management of the shoreline area fronting the property.

Again, we appreciate your comments to the subject applications and look forward to working with your Department and pertinent agencies in fully addressing these and related issues as we move forward in the further planning of the Villages at Hokukano project.

Sincerely,

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: Virginia Goldstein, Hawaii County Planning Department
Yutaka Takeda, JAL Research & Development
Lyle Anderson, The Anderson Companies
R.T. "Dick" Frye, Oceanside 1250
Benjamin Kudo, Dwyer Imanaka Schraff & Kudo
David Hulse, PBR HAWAII (Honolulu)

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Keith W. Ahue, Chairperson
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Ahue:

Thank you for your comments of August 5, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

Commission on Water Resource Management

The applicant will adhere to the twelve applicable Department of Health conditions regarding golf course development.

Division of Land Management

The applicant has met with representatives of the DLNR to resolve the issues relating to historic trails and public road rights-of-way. In our response to the previous comments from the DLM regarding the public road right-of-way (Government Road) which crosses Grant 1651, we stated that the developer, Oceanside 1250, does not dispute the State's claim over these portions. The developer is working with the DLM to ensure that the State's interests are protected with regard to those portions of the Government Road which traverse the site. A copy of this correspondence is attached for your reference.

Regarding the DLM's comments in resolving all issues pertaining to the public road right-of-way prior to issuance of the Final EIS, according to Chapter 343, HRS, the purpose of the EIS law is to "establish a system of environmental review which will ensure that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations." It is not to resolve all issues, but to provide decision makers with the knowledge necessary to make informed decisions. Acceptance of the EIS does not constitute approval of project entitlements by either the State or County. According to Section 11-200-23 of Title 11, Department of Health Chapter 200 Environmental Impact Statement Rules, the EIS is acceptable if the Statement "fulfills the definition of an EIS and adequately discloses and describes all

identifiable environmental impacts and satisfactorily responds to review comments." As noted previously, the developer is currently working with the DLM to ensure the State's interests are protected with regard to those portions of the "Government Road" which traverse the site.

Division of Aquatic Resources

Our August 9, 1993, response to DLNR's comments regarding the Special Management Area (SMA 93-1) Application, Use Permit (UP 93-2) Application, and Rezoning (REZ 92-5) Application is also attached for your consideration.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

Enclosures

JOHN WAIHEE
GOVERNOR

BRIAN J. J. CHOY
Director

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185

August 4, 1993

Ms. Virginia Goldstein, Director
County of Hawaii Planning Department
25 Aupuni Street, Room 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Subject: Draft Environmental Impact Statement for the Villages at Hokukano, County of Hawaii

Thank you for the opportunity to review the subject document. We do not have any comments to offer.

Sincerely,

Brian J. J. Choy
Director

BC:jt

c: Oceanside 1250
PBR Hawaii, Inc.

PBR HAWAII

LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Brian J.J. Choy, Director
Office of Environmental Quality Control
220 South King Street, Fourth Floor
Honolulu, Hawaii 96813

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Choy:

Thank you for you letter of August 4, 1993, concerning the above project. We appreciate your review of the subject Draft Environmental Impact Statement (EIS).

Should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R.T. "Dick" Frye, Project Manager at Oceanside 1250 or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

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JOHN WAIHEE
Governor

YUKIO KITAGAWA
Chairperson, Board of Agriculture

ILIMA A. PIIANAIA
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State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
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Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96823-2159

August 2, 1993

TO: Virginia Goldstein, Director
Planning Department
County of Hawaii

FROM: Yukio Kitagawa, Chairperson
Board of Agriculture

SUBJECT: Draft Environmental Impact Statement (DEIS) for the Villages at Hokukano

| | | |
|---|---|---|
| Applicant: | Oceanside 1250 | |
| Request: | Develop a master planned residential and recreational community | |
| Area: | 1,540 acres | Kona, Hawaii |
| Tax Map Key: | 7-9-06: | 01 |
| | 7-9-12: | 03, portion of 04, portion of 05, portion of 11 |
| | 8-1-04: | portion of 03 |

The Department of Agriculture (DOA) has reviewed the subject DEIS and has the following concerns.

According to the DEIS, the applicant proposes to develop a residential community with recreational facilities including a 27-hole golf course, driving range, clubhouse, hiking trails and supporting infrastructure.

References to the Agricultural Lands of Importance to the State of Hawaii (ALISH) system, the Soil Conservation Service Soil Survey, and the Land Study Bureau Detailed Land Classification are correct.

In the preliminary development plan, the developer proposes to include in the residential component approximately 367 one- to three-acre lots "with provisions to encourage agriculture" (DEIS, Section 2.4, page 19). The applicant has proposed an agricultural program concept by which "commercially viable agricultural activities that are compatible with residential uses to be integrated in the areas of the project most suited to agricultural uses" (ibid, page 23 and pages 40-45).

While our Department is encouraged by the applicant's efforts to develop an agricultural program concept to encourage agricultural activities, we have the following concerns:

(I) Land uses within the residential/agricultural lots

While the developer has proposed an agricultural program concept that "demonstrates an appropriate blending of residential and agricultural uses" (ibid, page 45) our main concern is that the proposed agricultural lots be put into bona fide agricultural use.

In the brief description of the proposed agricultural program, it appears that agricultural uses are mainly for landscaping purposes (ibid, pages 5, 23, 45, and Figure 14). From Figure 14, it appears that the distribution of lands for agricultural use within the residential/agricultural lots is not contiguous. The Agricultural Use Zone in Figure 14 appears to be confined mainly along the fringes for landscaping considerations. We believe economically viable orchard-type agriculture as suggested in the agricultural program concept (ibid, page 43-44) would require fairly large and contiguous acreage.

(II) Water Requirements

Another concern of ours is the adequacy of the estimated average daily water demands for agriculture. Table 3 (ibid, page 47) indicates that the daily water demands, assuming drip irrigation is used, would be about 2,000 gallons per acre per day. Based on our information, a typical orchard crop like papaya would require significantly more water than suggested in Table 3, with or without drip irrigation. Typically, papaya farms have an average of about 700 trees per acre which require an estimated 7 gallons of water per day per tree. This works out to approximately 4,900 gallons of water per acre per day which is 2,900 gallons more than the estimated water needs in Table 3. The precise determination of water needs would also depend on other factors like the rate of pan evaporation, the porosity of soil, and the spacing between individual trees.

It would be useful if Table 3 of the DEIS (page 47) could be accompanied by a detailed description of the calculations of the estimated average daily water demands of all the tree crops listed in the agricultural program concept (page 43-44).

(III) Management of Agricultural Opportunities

We are encouraged to see included in the agricultural program concept the provision of a financial structure to help minimize the start-up costs for farmers (ibid, page 44). We note that part of the financial plan will allow lot owners to lease land to farmers for agricultural operations at an affordable rate thereby minimizing start-up costs. However, the implementation of this

financial plan is not fully explained. We would prefer to see a more detailed description of the proposed financial structure including the stages of implementation, the parties responsible, and the source of funding.

Another area of ambiguity in the agricultural program concept concerns the management of agricultural lots. Although it is proposed in the DEIS that the responsibility of managing the agricultural lots "would likely" be the homeowners' association (ibid, page 44), it has been our experience that the specification of management organization in a traditional agricultural subdivision is the key to the survival of the individual farm businesses. Furthermore, will there be continued support for agricultural activities and ventures if the proposed farms do not meet the homeowners' association's expectations?

We want to see assurances in the final EIS that every reasonable effort be given to establish economically viable agricultural use of the properties.

Thank you for the opportunity to comment.

c: Office of State Planning
Office of Environmental Quality Control
PBR Hawaii, James Leonard
Oceanside 1250, Richard Frye

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Yukio Kitagawa, Chairperson
Board of Agriculture
1428 South King Street
Honolulu, Hawaii 96814-2512

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Kitagawa:

Thank you for your comments of August 2, 1993, regarding the Draft Environmental Impact Statement (EIS) for the Villages at Hokukano. This letter is in response to those comments and concerns raised in your correspondence.

I. Land Uses Within the Residential/Agricultural Lots

While the agricultural concept, as described, does not fit the role of a large agribusiness operation, it is intended as a bona fide agricultural use for those delineated areas. The primary goal is to provide an appropriate agriculture operation, and while this may result in an added benefit of a desirable landscape element, landscaping is not the primary aim of the program.

Large, contiguous parcels of land may be needed to support a large agribusiness operation, however, this concept has been conceived as an alternate type of operation. The plan seeks to achieve a balance of improvements and production that is more in keeping with a very modest return on investment. As envisioned, the plan would not likely be self sustaining until several years after planting, depending on the chosen crops, and until then, the developer and homeowners' association would contribute to the ongoing, uncovered costs. Our study shows that eventually, through proper capitalization, operation management and marketing, these orchard crops can generate a positive cash flow.

II. Water Requirements

After further investigation of the concept, it is likely that papaya will not be used as a crop in the agricultural program because it is not as viable an orchard crop for this area as others. Orchard crops that meet the estimated water demands, as outlined in Table 3, will be considered for use in the program. You may note that most orchard crops will do well on one inch per week of drip irrigation or about 60 inches of moisture per year. Our study shows that, for the proposed crop list, water requirements would average from 1,015 gallons/acre/day for coffee to 3,021 gallons/acre/ day for crops such as lychee and mango. Since it is likely that a mixture of crops will be chosen for the program, an appropriate average (2,000 gallons/acre/day) of these figures was

1042 FORT STREET MALL, SUITE 300 HONOLULU, HAWAII 96813 TELEPHONE: (808) 521-5631 FAX: (808) 523-1402
BRANCH OFFICE: HILO LAGOON CENTER 101 AUPUNI STREET, SUITE 310 HILO, HAWAII 96720 TELEPHONE: (808) 961-3333 FAX: (808) 961-4989

used to calculate the estimated water needs found in Table 3. You are correct in assuming that irrigation needs would also depend upon soil and climatic conditions, but it is expected that water requirements will fall within a range from 80% to 120% of onsite plan evaporation rates.

III. Management of Agricultural Activities

The complete details of the financial plan have not been formulated at this time. It is likely that much of the ongoing costs of operation and management not supported by the growers would be handled first by the developer and subsequently by the homeowners' association. While it is too soon to detail the entire program, this management and operation organization will be specified well in advance of the start of the program.

It is felt that through the implementation of a well planned operation and management system, in combination with the necessary infrastructure and site improvements, this program will meet its objectives. It is expected that, eventually, each orchard crop can be brought to the point that revenues exceed operating costs and a positive cash flow would be provided for the growers. Natural events which are not under control of the program participants may have a negative effect on the ultimate success of the program, however, the plan will seek to mitigate these factors, if and when they should occur.

Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

August 1993

County of Hawaii Planning Department
25 Aupuni Street, Room 109
Hilo, Hawaii 96720
Attention: Virginia Goldstein

Re: Hokukano Villages EIS

I am writing as a resident of South Kona who objects to and opposes the proposed project on the makai lands of the former Greenwell, Paris and Wall ranches. The realtors, developers and other parties involved have obsequiously courted the local people to win favor for their project. Nevertheless, what they propose is completely out of character for the existing community and land uses of the South Kona area. Only the extraordinary resident of Kona would be able to afford the up-scale house lots they propose to surround their 27-hole golf course with. My primary objection to their project is therefore on economic grounds. What they will contribute to this community is an influx of population to overtax the already strained infrastructure of public services.

I live in Captain Cook mauka, just below the former Sherwood Greenwell Kealakekua Ranch lands. Kealakekua Development Corporation, a Japan outfit, has purchased these lands and has submitted their proposal to this agency for a similar project of golf course surrounded by expensive house lots. Both of these projects propose land use below the customary minimum lot size (5 acres) for this area which is still primarily agricultural and rural. The projects these two developers propose would have a socially destructive impact on the South Kona area. Projects such as these, centered as they are on golf courses, which are resort uses, should be limited to areas such as S. Kohala and N. Kona, where county and state plans are already preparing for such uses.

Finally, the public should be informed of the plans by these two developers to deal with the increasing traffic congestion on Mamalahoa Highway in order to gain access to their property. Will they really alleviate the situation, or only secure permission for their projects by a piecemeal "solution"?

Please consider other land uses for the ranch lands in this area in the future, uses which will be attractive to the former ranchers, which will make the beautiful lands more accessible to the public, which will not endanger our fragile ocean ecosystem or our forest watershed, and which will help people who have their roots and lives in Kona to stay here, rather than have to move out to an unknown city while strangers move in to their homeland. Please do not give you approval to Hokukano Villages, nor to Kealakekua Development Corporation. Mahalo.

Sincerely,

Shanti Devi, POB 1272 Captain Cook, Hawaii 96704

PBR
HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Ms. Shanti Devi
P.O. Box 1273
Captain Cook, Hawaii 96704

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. Devi:

We received your letter to the County Planning Department dated August 1, 1993. Although your comments are in reference to the type of development planned at the project site rather than to the project's Draft Environmental Impact Statement (EIS), we would like to address your concerns as they relate to the Villages at Hokukano project described in the Draft EIS.

You state that the proposed project would be out of character with the existing community and proposed land uses in the South Kona area. The land uses surrounding the project site include extensive and intensive agricultural uses, with residences to the north and south and a concentration of residential and commercial uses directly mauka of the project in the town of Kealakekua. Although there are some subdivisions directly mauka of the project site with lot sizes of 10,000 to 15,000 square feet, the area of the surrounding community can be characterized as a rural environment due to the significant presence of agriculture (orchard and grazing uses) interspersed with residential development, as well as village business serving the community's needs.

The proposed project has been planned in a manner that would be in keeping with the rural character of the surrounding area by maintaining low density neighborhoods integrated with the various open space elements, such as the golf course, natural and landscaped buffer areas, historic park area and a shoreline park area. Collectively, these elements will likely comprise nearly 40% of the total property area.

Additionally, of the remaining area planned for residential uses, over 60% would remain in large lots of one to three acres. This would be in the upper portion of the project site, serving as a buffer between the existing residential communities mauka of the project site and the residential neighborhoods that are planned within the project area.

1042 FORT STREET MALL, SUITE 300 HONOLULU, HAWAII 96813 TELEPHONE: (808) 521-5631 FAX: (808) 523-1402

Your letter also stated that the project would overtax the already strained infrastructure of public services. By "public services", we assume this to mean fire, police, medical, educational and recreational facilities. As covered in Section 4.6 of the Draft EIS, the potential project related impacts to these public service facilities are not expected to be significant for the following reasons:

1) The revenues to the State and County generated by the proposed project are projected to far exceed the governmental expenditure for such services;

2) Project buildout is expected to occur over a 30 year period or greater, allowing sufficient time to coordinate with various State and County Agencies in the planning for needed public service infrastructure improvements; and

3) The provisions for project related recreational components are planned to meet the development related needs, and planned improvements for public access to the shoreline area are expected to enhance public recreational opportunities for the region.

Your letter also describes the Villages at Hokukano as a resort project and suggest that such uses should be allocated to the areas of South Kohala and North Kona, which are planned for such uses. The proposed project, however, would differ from the resort projects in North Kona and South Kohala. The resort areas of Keauhou, Waikoloa, Mauna Lani, and Mauna Kea, are centered on large coastal hotels and include other commercial and multi-family uses. In contrast, the proposed project is envisioned as a master planned residential community with homes which are predominantly single family in character. No commercial areas are planned as part of the project, which would benefit from its proximity to the existing commercial uses at Kealakekua, Kainaliu, and Captain Cook. The proposed lodge facility would be internal to the project and is intended to support the golf course and other recreational uses of the project. The lodge would be available to members and their guests, and is not intended to be open to the public.

Lastly, you also ask if the project, in dealing with the growing congestion along Mamalahoa Highway, will really alleviate the situation, or simply offer a piecemeal solution in order to obtain permission for development. In this regard, the highway bypass road, as proposed, seeks to address the project related traffic impacts in a realistic and timely manner. The proposal put forth by Oceanside 1250 has been evaluated by their traffic engineer, Parsons Brinckerhoff Quade & Douglas (PBQD), and the recommendations for the extent of regional improvements and the timing for such improvements in relationship to the phases of development are included within Section 4.6 of the Draft EIS. It is expected that such mitigation measures will be implemented in a timely and effective manner, as these are generally included as conditions to the requisite State and County land use approvals and permits.

We hope the above addresses your concerns related to this project, however, should you have any additional questions or concerns, please don't hesitate to contact either Mr. R. T. "Dick" Frye,

Project Manager at Oceanside 1250, or myself. A copy of your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

# NA ALA HELE
Hawai'i Trail & Access System

July 30, 1993

Ms. Virginia Goldstein
Director, Hawai'i County Planning Dept.
25 Aupuni St., Hilo, HI 96720

Dear Ms. Goldstein:

Subject: Proposed Villages at Hokukano, Kona, Hawai'i, Draft EIS re: Public access and trail system

A field inspection of the Villages of Hokukano site indicates that lateral public access along the shoreline is adequate, as is the mauka-makai vehicular access. Also lateral pedestrian access through the property along the old West Hawai'i Rail Road bed and along portions of the old alaloa provide further public benefits.

The Council received copy of the Record Research of Roadways and Trails after our July 15 meeting. Examination of this report shows no documentation of mauka-makai trails except for a short section of an ala li'ili'i on the Kohala side of Grant 865. However from knowledge of how the ahupua'a system was set-up, we know many ahupua'a did contain mauka-makai trails. Page 76 of the DEIS states that the mauka-makai boundary walls of the ahupua'a are recommended for preservation. We would like to request that the developer consider the possibility of re-creating at least one mauka-makai trail paralleling an ahupua'a wall wherever it could best be incorporated into the overall trail network.

Thank-you for this opportunity to comment.

Sincerely,

Michael Tomich
Na Ala Hele, Council Member

copies to: Buck, Mike
Frye, Dick
Hibbard, Don
Meller, Chris

04033

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Michael Tomich, Council Member
Na Ala Hele
Department of Land & Natural Resources
Division of Forestry & Wildlife
P.O.Box 4849
Hilo, Hawaii 96720

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Tomich:

Thank you for your letter of July 30, 1993, regarding the subject project. With regard to your comment on mauka-makai trails, Oceanside 1250 is currently studying the inclusion of a mauka-makai trail as part of the overall trail system within the property. It is likely that the mauka-makai trail would parallel an ahupua'a wall for at least a portion of its route. We look forward to reviewing any suggested alignment with the Council once this is completed.

Again, thank you for your comments. Should you have any additional questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO:
11010
Ser N4(239)/2822
29 Jul 93

Ms. Virginia Goldstein
Planning Director
County of Hawaii Planning Department
25 Aupuni Street, Suite 109
Hilo, HI 96720

Dear Ms. Goldstein:

DRAFT ENVIRONMENTAL IMPACT STATEMENT, VILLAGES AT HOKUKANO, COUNTY OF HAWAII

Thank you for the opportunity to comment on the subject Draft Environmental Impact Statement (DEIS) dated June 1993. The Navy has no comments to offer at this time.

Our point of contact is Mr. Stanford Yuen, Facilities Engineer, at 471-3324.

Sincerely,

STANFORD B. C. YUEN
Facilities Engineer
By direction of
the Commander

Copy to:
Mr. Richard Frye
Oceanside 1250
74-5620A Palani Road
Suite 200
Kailua-Kona, HI 96740

Mr. James Leonard
PBR Hawaii
101 Aupuni Street
Suite 310
Hilo, HI 96720

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Stanford B.C. Yuen, Facilities Engineer
Department of the Navy
Naval Base Pearl Harbor
Box 110
Pearl Harbor, HI 96860-5020

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Yuen:

Thank you for you letter of July 29, 1993, concerning the above project. We appreciate your review of the subject draft Environmental Impact Statement (EIS).

Should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R.T. "Dick" Frye, Project Manager at Oceanside 1250 or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

JOHN WAI
Gove
MUFI HANNEMA
Dire
BARBARA KIM STANT
Deputy Dire
RICK EGC
Deputy Dire
TAKESHI YOSHIM
Deputy Dire

DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT & TOURISM

Central Pacific Plaza, 220 South King Street, 11th Floor, Honolulu, Hawaii
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804 Telephone: (808) 586-2406 Fax: (808) 586-2377

July 28, 1993

Ms. Virginia Goldstein
Planning Director
Planning Department
County of Hawaii
25 Aupuni Street, Suite 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

The Department of Business, Economic Development & Tourism is pleased to submit the enclosed comments on the Draft Environmental Impact Statement for the Villages at Hokukano.

The comments were provided by the Land Use Commission. Questions regarding these comments may be directed to Esther Ueda, LUC Executive Officer at 587-3826.

Thank you for the opportunity to comment.

Sincerely,

Mufi Hannemann

Enclosure
cc: Mr. Richard Frye
Mr. James Leonard

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Mufi Hannemann, Director
Department of Business, Economic Development and Tourism
220 South King Street, 11th Floor
Honolulu, Hawaii 96813

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Hannemann:

Thank you for your letter of July 28, 1993 transmitting the comments from the State Land Use Commission regarding the subject Draft Environmental Impact Statement (EIS). A response to the Land Use Commission is enclosed for your reference.

Should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R.T. "Dick" Frye, Project Manager at Oceanside 1250 or myself. Your letter, and this response, will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

Enclosure

1042 FORT STREET MALL, SUITE 300 HONOLULU, HAWAII 96813 TELEPHONE: (808) 521-5631 FAX: (808) 523-1402

WAIHEE
ERNOR

ESTHER UEDA
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone: 587-3822

July 19, 1993

Subject: Draft Environmental Impact Statement (DEIS) for the Villages at Hokukano, Hawaii, TMK Nos.: 8-1-04: 03 (por.); 7-9-12: 03, 04 (por.); 05 (por.), 11; 7-9-06: 01

We have reviewed the DEIS for the subject Villages at Hokukano project and have the following comments:

1) We confirm that the project site, as shown on Figure 22 of the DEIS, is located within the State Land Use Agricultural and Conservation Districts.

2) Based on page 103 of the DEIS, we understand that a petition for district boundary amendment in connection with the project will be filed with the Land Use Commission in the future. However, the location of the amendment area in relation to the project site is not clear. We suggest that the Final EIS include a map showing the location of the area proposed for the district boundary amendment.

We have no further comments to offer at this time.

EU:BS:th

PBR
HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Ms. Esther Ueda, Executive Officer
Land Use Commission
Department of Business, Economic Development and Tourism
335 Merchant Street, Suite 104
Honolulu, Hawaii 96813

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
VILLAGES AT HOKUKANO; APPLICANT: OCEANSIDE 1250
TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;
8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. Ueda:

Thank you for your letter of July 19, 1993 concerning the above project. We are responding to the comments provided by your office regarding the subject Environmental Impact Statement (EIS).

With regard to the question about the area that would be subject to the future Urban District Boundary Amendment to the State Land Use Commission, the boundaries of this area, which total approximately 763 acres, would be similar to that shown as Phase 2 in the Phasing Plan, Figure 5, including the area of the golf course and golf clubhouse. As noted within the Draft EIS, the upper portion of the proposed project, which includes approximately 637 acres, would remain in the State Agriculture district, and the approximately 140 acres along the shore would remain within the State Conservation District. As suggested, a figure showing the proposed area of the SLUC district boundary amendment will be included within the FEIS.

Again, thank you for your comments. Should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R.T. "Dick" Frye, Project Manager at Oceanside 1250 or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: M. Hannemann, Department of Business, Economic Development and Tourism
V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

(P)1518.3

JUL 1 3 1993

County of Hawaii
Planning Department
25 Aupuni Street, Suite 109
Hilo, Hawaii 96720

Attention: Ms. Virginia Goldstein

Gentlemen:

Subject: Villages at Hokukano
Draft EIS

Thank you for the opportunity to review the subject document. We have no comments to offer.

If there are any questions, please have your staff contact Mr. Ralph Yukumoto of the Planning Branch at 586-0488.

Very truly yours,

GORDON MATSUOKA
State Public Works Engineer

RY:jy
cc: Oceanside 1250
✓PBR Hawaii
OEQC

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Gordon Matsuoka
State Public Works Engineer
Department of Accounting and General Services
P.O.Box 119
Honolulu, Hawaii 96810

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Matsuoka:

Thank you for you letter of July 13, 1993 concerning the above project. We appreciate your review of the subject Draft Environmental Impact Statement (EIS).

Should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R.T. "Dick" Frye, Project Manager at Oceanside 1250 or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

UNITED STATES
DEPARTMENT OF
AGRICULTURE

SOIL
CONSERVATION
SERVICE

P. O. BOX 50004
HONOLULU, HI
96850-0001

July 7, 1993

Ms. Virginia Goldstein, Director
Planning Department
County of Hawaii
25 Aupuni Street, Suite 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Subject: Villages at Hokukano
Environmental Impact Statement

We have reviewed the Environmental Impact Statement (EIS). We note that mitigative measures have been proposed to minimize the anticipated adverse impacts upon the natural resources presently located on the development site. It is important to ensure their timely and effective installation.

Thank you, for the opportunity to review the EIS. Should you have any questions, please contact Mr. Mike Tulang at 541-2606 or Ms. Sandy Higa at 322-2484.

NATHANIEL R. CONNER
State Conservationist

cc: Office of Environmental Quality Control, State of Hawaii, 220 South King Street, Honolulu, Hawaii 96813.
PBR HAWAII, 101 Aupuni Street, Suite 310, Hilo, Hawaii 96720.

MTANG

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Nathaniel R. Conner, State Conservationist
Soil Conservation Service
United States Department of Agriculture
P.O.Box 50004
Honolulu, Hawaii 96850-0001

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT VILLAGES AT HOKUKANO; APPLICANT: OCEANSIDE 1250 TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11; 8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Conner:

Thank you for your letter of July 7, 1993 and your comments to the subject Environmental Impact Statement (EIS).

In response to your comment on the timely and effective implementation of proposed mitigation measures, it is anticipated that those measures proposed by the developer to mitigate potential project related impacts would be implemented in relation to initiation of the various elements of the development. Such measures are typically included as conditions of approval at the time of land use permit or approval. For instance, in regard to erosion and sedimentation control, the County of Hawaii generally requires that an Erosion and Sedimentation Control Plan be approved by the Chief Engineer prior to grading permit approval.

Again, thank you for your comments. Should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R.T. "Dick" Frye, Project Manager at Oceanside 1250 or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

JOHN WAIHE
Governo
MUFI HANNEMANI
Directo
BARBARA KIM STANTOI
Deputy Directo
RICK EGGEI
Deputy Directo
TAKESHI YOSHIHAR.
Deputy Directo

# DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

ENERGY DIVISION, 335 MERCHANT ST., RM. 110, HONOLULU, HAWAII 96813 PHONE: (808) 587-3800 FAX: (808) 587-3820

93:1295e

June 30, 1993

Ms. Virginia Goldstein
Planning Director
County of Hawaii Planning Department
25 Aupuni Street, Suite 109
Hilo, Hawaii 96720

Dear Ms. Goldstein:

Subject: Draft Environmental Impact Statement
For Villages at Hokukano, Big Island

Thank you for the opportunity to review and comment on the subject Draft Environmental Impact Statement for a golf course and residential development.

We note that you have considered our concerns for energy efficient designs in the document. We would also like to call your attention to the Model Energy Code, developed under the auspices of this department. We urge that you use the code as a guide for this project. We have previously provided copies of the code to your Department. If you need additional copies, please contact Mr. Howard Wiig at 587-3811.

Sincerely,

Tom O'Brien

for Maurice H. Kaya
Energy Program Administrator

MHK/ER:be

cc: Richard Frye
James Leonard
OEQC

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Mr. Maurice H. Kaya
Energy Program Administrator
Energy Division
Department of Business, Economic Development & Tourism
335 Merchant Street, Suite 110
Honolulu, Hawaii 96813

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Mr. Kaya:

Thank you for your letter of June 30, 1993, concerning the above project in which you suggest that the Model Energy Code be used as a guide for the proposed project.

As you know, for residential developments, the proposed Model Energy Code is intended to reduce the energy demand in a typical home primarily in the areas of water heating and air conditioning. As stated within Section 4.6.5 of the Draft Environmental Impact Statement (EIS), in an effort to promote these and other energy conservation measures in the planning and design of homes built within the proposed project, the developer plans to disseminate to lot owners appropriate materials, such as the Hawaii Design Strategies for Energy Efficient Architecture published by the Energy Division of the State's Department of Business, Economic Development and Tourism.

Also, as stated within the Draft EIS, those measures which will be evaluated in part based on their potential life cycle cost savings in the design of project related facilities, such as the golf clubhouse and golf lodge, would include:

a) Siting and landscaping buildings to minimize the heat loads and to effectively utilize natural breezes for cooling indoor and outdoor living and recreational spaces;

b) Use of high efficiency light sources and ballasts for indoor and outdoor lighting purposes, where practical;

c) Use of high efficiency air conditioners, water pumps, and appliances;

d) Use of heat pump, waste heating recovery and solar water heating systems; and

e) Use of occupant sensing or time switch type light and air conditioner controls.

1042 FORT STREET MALL, SUITE 300 HONOLULU, HAWAII 96813 TELEPHONE: (808) 521-5631 FAX: (808) 523-1402

Other planned conservation measures aimed at reducing the maximum electrical demand, which will be implemented where and whenever practical, include power correction factors and scheduling certain types of loads, such as water pumping, to run during off-peak hours.

Again, thank you for your comments. Should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R.T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
G. Leslie
B. Kudo, Dwyer Imanaka Schraff & Kudo
D. Hulse, PBR HAWAII

Planning Director
Virginia Goldstein
25 Aupuni Street, Suite 109
Hilo, HI 96720

Dear Ms. Goldstein,

I am aware of the proposed State road as Bypass Alignment to help facilitate traffic in Kona. I am in favor of this effort. I am also aware of the proposed Alternate Bypass Alignment to save money to the developer. I am against this proposal for many reasons. The main one being, it will be going through several homes in that area. What a waste and heartbreak for those who would have to lose their homes. They would not be paid, I'm sure, for the work and costs of their homes, and relocating would be difficult, if not impossible on the amount of money condemned payments would be. Please don't allow such a tragedy to take place at the great expense of others just to help the developer. Don't let the developer buy the State off.

Thank you,

PBR HAWAII
LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

September 10, 1993

Ms. Rebecca B. Layton
P.O.Box 1132
Captain Cook, Hawaii 96704

**SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**VILLAGES AT HOKUKANO**
**APPLICANT: OCEANSIDE 1250**
**TMK'S: 7-9-12: 03 POR, 04 POR, 05 POR & 11;**
**8-1-4: 03 POR; 7-9-6: 01**

Dear Ms. Layton:

We received a copy of your letter to the County Planning Director that accompanied a facsimile letter from Ms. Valerie Rounsfull dated August 7, 1993, which was submitted in relation to the Draft Environmental Impact Statement (EIS) prepared for the Villages at Hokukano project. We would like to respond to your concerns regarding the proposed highway bypass road, as described within the Draft EIS.

The developer, Oceanside 1250, has carefully studied various alignment positions for the proposed Mamalahoa Highway bypass. Some of the early study versions were abandoned because they impacted existing residential structures. The current alignment, however, does not go through any residences.

Your letter expresses a concern that the highway bypass route proposed by the developer was to save the developer money. The alignment proposed by the State Department of Transportation (DOT) in the 1970's contemplated a highway from approximately the Kamehameha III intersection with Kuakini Highway southward along an alignment similar to the current proposed alignment, but extending much further south as a multi-regional highway to the Papa Bay area. In addition to the existing Haleki'i Street, two connector roads were proposed in the general vicinity of the four villages (Honalo, Kainaliu, Kealakekua, and Captain Cook). The State's proposed alignment and connectors would all have been paid for with tax money and any Federal grants available.

The developer's proposal is to essentially build a portion of the multi-regional highway proposed by the State. There would still be three accesses from the bypass to the villages in locations not too different from the connector roads proposed by the State's multi-regional highway. The State's connector roads would have impacted several residential structures, whereas the proposed alignment will not.

Additionally, it is important to note that, as proposed, the bypass road can be built mostly, if not entirely, with private funds rather than public funds, and can be constructed much sooner than if

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BRANCH OFFICE: HILO LAGOON CENTER 101 AUPUNI STREET, SUITE 310 HILO, HAWAII 96720 TELEPHONE: (808) 961-3333 FAX: (808) 961-4989

built according to the State DOT's priority schedule for highways. Oceanside 1250 has put forth this proposal as a solution that is intended to benefit all concerned.

We hope that this fully addresses your concerns in this regard. However, should you have any questions or concerns regarding this project, please do not hesitate to contact either Mr. R. T. "Dick" Frye, Project Manager at Oceanside 1250, or myself. Your letter and this response will be appended to the Final EIS.

Sincerely,

James Leonard

JAMES M. LEONARD, AICP
Managing Director
PBR HAWAII - Hilo Office

cc: V. Goldstein, Hawaii County Planning Department
B. Choy, Office of Environmental Quality Control
R. Frye, Oceanside 1250
L. Tanimoto, LST, Inc.
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D. Hulse, PBR HAWAII

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Volume II of II: Appendices

# Villages at Hokukano
# Final Environmental Impact Statement
# County of Hawaii

September 1993

Volume II of II: Appendices

# Villages at Hokukano
# Final Environmental Impact Statement
# County of Hawaii

Prepared for:
Oceanside 1250

Prepared by:
PBR HAWAII

September 1993

# Table of Contents

# I. Environmental Reports

# I - 1 Botanical Study

# BOTANICAL SURVEY REPORT OF THE HOKUKANO LANDS, KEAHOU KONA, HAWAII

FOR
1250 OCEANSIDE PARTNERS
7373 NORTH SCOTTSDALE ROAD, SUITE C#226
SCOTTSDALE, ARIZONA 85253

BY
EVANGELINE J. FUNK, PH.D.
BOTANICAL CONSULTANTS
HONOLULU, HAWAII 96835

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## INTRODUCTION

A botanical survey of the 1550 acre Hokukano Lands site was carried out during the first days of November 1991. The purpose of the survey was threefold. The first was to ascertain the species composition of the vegetation cover and to prepare a list of all taxa found on the site. The second was to describe the vegetation types in a general way and to prepare a vegetation map, and third was to locate and identify any proposed or listed threatened or endangered plants species.

## BACKGROUND

The Hokukano Lands are made up of parts of the Kailua and Honu-'apo sections of the island of Hawaii. The area is named for the star Hoku-pokano. The site is near the place where Capt. James Cook was killed and it is where David Nelson, botanist on Cook's third voyage, made one of the earliest plant collections in the Hawaiian Islands (St. John 1976, 1978, 1979). In the 200 years since David Nelson made his collections the introduction of grazing animals and other disturbances have greatly changed the vegetation of the area and all of the plants that Nelson collected are now believed to be extinct.

## METHODS

The botanical survey was conducted by a four person field team. Forays were made from all existing roads and trails. In places where native plants were suspected to be extant, such as the low ridge mauka of Pu'u Ohai, regularly spaced transects were walked. From along the sea cliffs regular forays were made into the coastal zone in a search for anchealine ponds which could possibly exist in the area. All parts of the site were visited and at least ninety-eight percent of the study area vegetation was examined.

## RESULTS

### ENDANGERED SPECIES

No proposed or listed candidate rare, threatened or endangered plant species were found on the site (USFWS 1991).

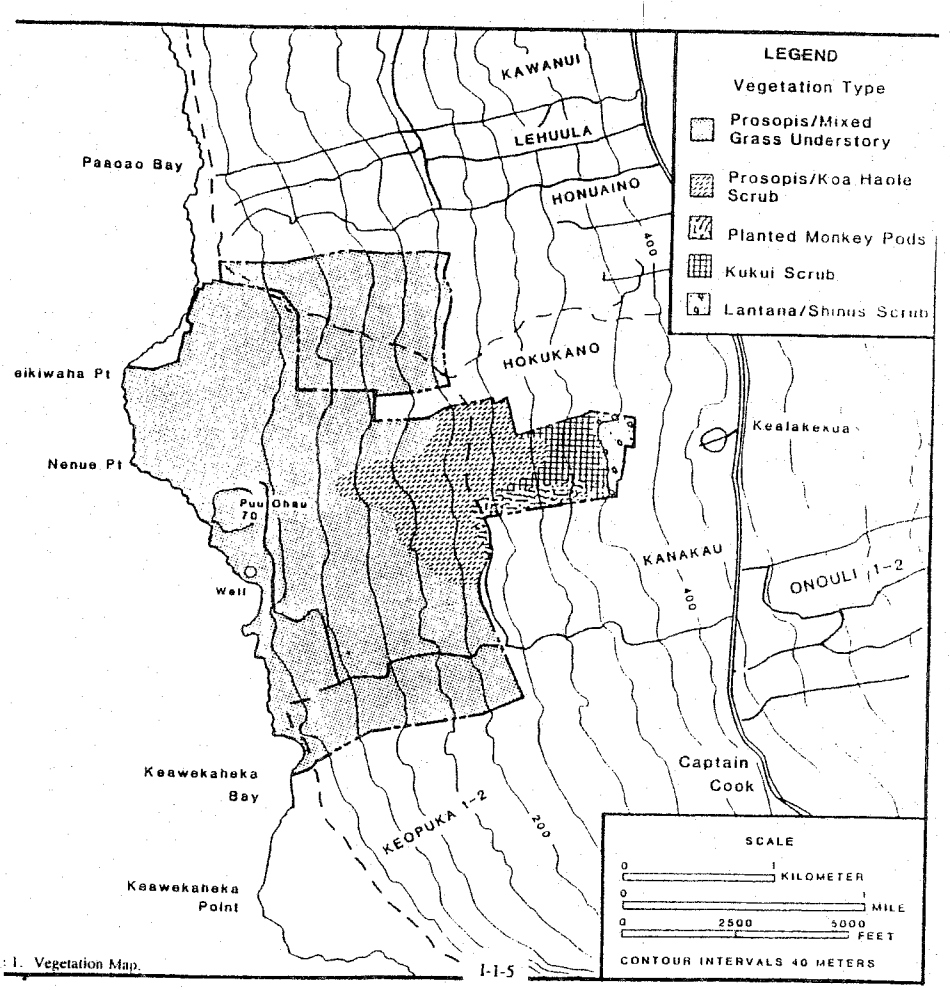
### VEGETATION TYPES

Prosopis/Mixed Grass Understory. This vegetation type is by far the most common on the Hokukano site (Figure 1). It is found from the seacoast cliffs to nearly 700 hundred feet elevation (Figure 2), from the northeast boundary to the southwestern boundary. The canopy is variable, but the principal cover is made up of summer deciduous Prosopis trees (*Prosopis pallida* (Hunb. & Bonpl. ex Willd.) Kunth) which attain a height of from 5 m to 15 m. In some places the canopy is closed (i.e. the crowns of the Prospis trees meet), in others the trees are widely separated (Figure 2). The understory or ground layer is introduced pasture grasses. The big, perennial African grass, *Panicum maximum* Jacq. or Guinea grass is by far the most common along with buffelgrass (*Cenchrus ciliaris* L.) and common sandbur grass (*Cenchrus echinatus* L.). In addition there were many other less common grass species along with weedy forbs (herbacous plants).

Among the unexpected plants found on the site were an unknown weed species belonging to the Hibiscus family and large numbers of a very poisonous Euphorb known as physic nut (*Jatropha curcas* L.). These large shrubs or small trees are found along the jeep trails at lower elevations. Physic nut trees are easily distinguished because they are the only large plant in the area which remains green during the summer months. It is the pleasant-tasting seeds of the plant which are so toxic.

Although most of the Prosopis/Mixed Grass vegetation is heavily grazed by cattle, on the frequent rock outcrops which the cattle avoid, were found patches of *Talinum fruiticosum* (L.) Juss. a purslane with bright yellow-orange flowers from southern U.S.






1. Vegetation Map.

I-1-5

Figure 2. Prosopis Extends to the Seacoast.

Figure 3. Pu'u O'hai and Summer Deciduous Prosopis Trees in the Background.



Koa haole/Prosopis Scrub. The second most common vegetation type on this range is Koa haole/Prosopis Scrub with frequent rock outcrops (Figure 1). Koa haole/Prosopis Scrub if found in the central part of the site on both sides of the old railroad right-of-way and seaward along the rocky ridge to about 350 feet elevation. In this instance, Prosopis is the emmergent tree. The widely scattered Prosopis reaches a height of from 8 m to 10 m and the much more densely growing Koa haole (*Leuceana leucocephela* (Lam.) deWit) is 2 m to 5 m in height. Koa haole, a member of the bean family is often planted on range land because the cattle like it and it is rich in protien (Figure 4). It is easily recognized by the masses of large, brown bean pods it produces.

It was in this vegetation type that the only native plant taxa were found. On the small, rocky ridge, mauka of Pu'u Ohai at about 470 feet there is a fairly large colony (ca. 200 plants) of the native Euphorb, 'Akoko (*Chamaesyce celastroides* var. *amplectens* Deg. & Deg.). There is also a cattle wall at 475 feet. Above the wall where the ridge is steep, the plants are 2 m to 4 m high and unbroused, below the wall where the terrain is gentler the plants are badly broused and some are less than half a meter in height.

A single individual of Maiapilo or Hawaiian Caper (*Capparis sandwichiana* DC) was found growing within the 'Akoko colony. This evergreen, sprawling shrub produces large, moth pollinated, white flowers which bloom at night. It thrives in hot, dry places and is now being used as a landscape plant in other such sites on the Kona Coast.

Three individuals of Hawaiian Wiliwili trees (*Erythrina sandwicensis* Degener) were also found in the Koa haole Scrub. Members of the bean family, these Wiliwili Trees were 12 m to 15 m in height and just beginning to leaf out. Wiliwili Trees produce variably colored flowers from orange to yellow, white or pale green on bare

Figure 4. Koa haole/Prosopis Scrub.

Figure 5. Pale Green Foilage of Kukui Trees is Easily Distinguishable.



wood. They are striking in appearance and have evolved to withstand the harsh environment of the leeward sides of tropical islands.

Kukui Scrub. Kukui Scrub is an irregularly distributed vegetation type which crosses the study site from about 850 feet elevation to about 1100 feet elevation (Figure 1). Kukui, a Polyneian introduction (*Aleurites moluccana* (L.) Willd.) is easily distinguished by its pale green foilage (Figure 5). Kukui is also known as candle nut tree and was highly prized by the early Hawaiians for its high quality oil which was used for many purposes. The Kukui trees range from seedlings to 8 m in height. The understory, in addition to rocky outcrops, is madeup of a variety of introduced plants. There are mulberry (*Morus alba* L.), coffee (*Coffea arabica* L.), Noni trees (*Morinda citrifolia* L.) and two types of Caesalpinia (*Caesalpinia bonduc* (L.) Roxb. and *Caesalpinia major* (Medik.) Dandy & Excell), known to the Hawaiians as Kakalaioa or gray and yellow knickers, plus any number of weed species.

Kukui trees are known to grow in wet places. On the site they occur at the base of one lava flow and are distributed on another flow. It is possible that there is water seepage between these flows.

Lantana/Schinus Scrub. *Lantan camara* L. and *Schinus terebinthifolius* Raddi are both introduced, woody shrubs. From about 1150 feet elevation to the mauka boundary of the site these plants are the dominants along with frequent rock outcrops. Mixed in whith the Lantana/Schinus Scrub (Figure 1) can be found several types of fruit trees, Mango (*Mangifera indica* L.), avacado (Persa americana Mill.), two types of guava (*Psidium cattleianum* Sabine and *Psidium guajava* L.) and payaya (*Carica papaya* L.) among them. There are also several species of introduced grasses, and vines are common. Of the vines, the native moonseed, huehue (*Cocculus trilobus* (Thunb.) DC) is everywhere as is the weedy passion vine, *Passiflora suberosa* L.

Planted Monkeypods. Monkeypod trees (*Samanea saman* (Jacq.) Merr.) are found on

Figure 6. Lantana/Schinus Scrub.

Figure 7. Monkey Pod Trees (arrow) Planted to Provide Shade for Cattle.



south-west side of the jeep road into the site, and along the old railway right-of-way for a short distance (Figure 1). These large trees were probably planted long ago toto provide shade for cattle (Figure 7). They reach a height of 20 to 25 m. The understory is mostly trampled and broused grasses, notably Guinea grass and big prickly shrubs of Apple of Sodom (*Solanum sodomeum* L.) which the cattle don't eat because it is very poisonus.

## CONCLUSIONS

Except for the native taxa discussed in this report, there are very few plants of value on the site. It would be politic to try to save the Euphorbs, Wiliwili trees and the single Capparis and either propagate them or work them into the landscaping plan. Many of the Prosopis trees can be saved and moved about to places where they will provide quick shade. This practice is currently being followed at the new mauka golf course at the Mauna Kea Beach Hotel in South Kohala with good success.

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## SPECIES LIST

In the following species list the plant families have been arranged been alphabetically within three groups, Ferns, Monocotyledons, and Dicotyledons. The genera and species have been arranged alphabetically within the families. The taxonomy and nomenclature follow that of Wagner, Herbst, and Sohmer (1990), St.John (1973), and Neal (1965). For each taxon the following information is provided:

1. An asterisk before the plant name indicates a plant introduced to the Hawaiian Islands since Captain Cook or by the aborigines.
2. The scientific name.
3. The Hawaiian name or the mostly widely used common name.
4. Species abundance. Abundance ratings are for this site only and they have the following meanings:

Uncommon = a plant that was found less than five times.

Occasional = a plant that was found between five to ten times.

Frequent = a plant that was found in widely scattered parts of the site in low numbers.

Common = a plant considered an important part of the vegetation.

Locally abundant = plants found in large numbers over a limited area. For example the plants found in grassy patches.

This species list is the result of an extensive survey of this site completed at the beginning of the rainy season (November 1991) and it reflects the vegetative composition of the flora during a single season. Changes in the vegetation will occur due to introductions and losses and a slightly different species list would result from a survey conducted during a different growing season. In addition there maybe environmental factors such as fire which will lead to species composition alteration.

| SCIENTIFIC NAME | COMMON NAME | ABUNDANCE |
|---|---|---|
| | Ferns | |
| Polypodiaceae - Common Fern Family | | |
| *Phlebodium aureum* (L.) J. Sm. | Rabbit foot fern | Common |
| *Microsorium scolopendra* (Brum.) Copel | Laua'e | Common |
| *Nephrolepis biserrata* (Sw.) Schott. | Sword fern | Locally abundant |
| *Nephrolepis exaltata* (L.) Schott | Sword fern | Common |
| | Monocotyledons | |
| Cannaceae - Cannas Family | | |
| **Canna indica* L. | Indian-shot | Uncommon |
| Commelinaceae - Spiderwort Family | | |
| **Commelina benghalensis* L | Hairy honohono | Occasional |
| *Commolina diffusa* N.L.Burm. | Honohono | Occasional |
| Cyperaceae - Sedge Family | | |
| **Fimbristylis cymosa* R. Br. | Mau'u 'aki'aki | Common |
| *Mariscus* sp. | | Rare |
| Dioscoreaceae - Yam Family | | |
| *Dioscorea bulbifera* L. | Bitter yam | Occasional |
| Liliaceae - Lily Family | | |
| **Cordyline terminalis* (L.) Kunth. | Ti | Occasional |
| Palmae - Palm Family | | |
| **Cocos nucifera* L. | Coconut | Occasional |
| Pandanaceae - Screwpine Family | | |
| *Pandanus tectorius* S. Parkinson ex Z | Hala | Rare |
| Poaceae - Grass Family | | |
| **Bothriochloa bladhii* (Retz.) S.T.Blake | Fuzzy top | Locally abundant |
| **Bothriochloa pertusa* (L.) A Camus | Pitted beardgrass | Locally abundant |
| **Brachiaria mutica* (Frossk) Staph. | California grass | Locally abundant |
| **Cenchrus ciliaris* L. | Buffelgrass | Locally abundant |
| **Cenchrus echinatus* L. | Common sandbur | Locally abundant |
| **Chloris barbata* (L.) Sw. | Swollen fingergrass | Locally abundant |



| SCIENTIFIC NAME | COMMON NAME | ABUNDANCE |
|---|---|---|
| Poaceae - Grass Family Con't | | |
| **Cynodon dactylon* (l.) Pers. | Bermuda grass | Locally abundant |
| **Dactyloctenium eagyptium* (L.) Willd. | Beach wiregrass | Occasional |
| **Digitaria adscendens* (HBK) Henry | Henry's crabgrass | Locally abundant |
| **Digitaria violascens* Link | Smooth crabgrass | Occasional |
| **Eleusine indica* (L.) Gaertn. | Wiregrass | Occasional |
| **Eragrostis tenella* (L.) Beauv. | Lovegrass | Occasional |
| **Oplismenus hertellus* | Basket grass | Locally abundant |
| **Panicum maximum* Jacq. | Guinea grass | Abundant |
| **Pennisetum purpursum* | Elephant grass | Locally abundant |
| **Pennisetum setaceum* (Frosk.) Chiov. | Fountain grass | Rare |
| **Rhynchelytrum repens* (Willd.) Hubb. | Natal redtop | Common |
| **Setaria verticellata* (L.) Beauv. | Bristly foxtail | Common |
| **Sporobolus africanus* (Poir.) Robyns & Tou. | Rattail grass | Occasional |
| Zingiberaceae - Ginger Family | | |
| *Zingiber zerumbet* (L.) Sm. | Shampoo ginger | Common |
| | Dicotlydones | |
| Amaranthaceae - Amaranth Family | | |
| **Amaranthus spinosus* L. | Spiny amaranth | Occasional |
| **Ameranthus viridus* L. | Slender amaranth | Occasional |
| Anacardiaceae - Mango Family | | |
| **Mangifera indica* L. | Mango | Rare |
| **Schinus terebinthifolius* L. | Brazilian pepper | Abundant |
| Apocynaceae - Dogbane Family | | |
| **Catharantus roseus* (L.) D. Don | Periwinkle | Common |
| **Cascabela thevetia* (l.) Lippold | Be-still tree | Rare |
| **Plumera* sp. | Plumera | Occasional |
| Asteraceae - Sunflower Family | | |
| **Ageratum conyzoides* L. | Maile hohono | Uncommon |
| **Bidens cynapiifolia* Kunth | | Common |
| **Bidens pilosa* L. | Spanish needle | Common |
| **Pluchea symphytifolia* (Mill.) Gillis | Sourbush | Uncommon |
| **Sigesbeckia orientalis* L. | Yellow crown beard | Locally abundant |
| **Synedrella nodiflora* (L.) Gaertn. | Nodeweed | Occasional |

| SCIENTIFIC NAME | COMMON NAME | ABUNDANCE |
|---|---|---|
| Bignoniaceae - Bignonia Family | | |
| **Spathodea campanulata* P. Beauv. | African tulip | Occasional |
| Boraginaceae - Borage Family | | |
| **Tournefortia argentia* L. fil. | Tree heliotrope | Uncommon |
| Cactaceae - Cactus Family | | |
| **Opuntia ficus-indica* (L.) Mill. | Panini | Uncommon |
| Capparaceae - Capper Family | | |
| *Capparis sandwichiana* DC | Maiapilo | Rare |
| **Cleome gynandra* L. | Wild Spider Flower | Common |
| Caricaceae - Papaya Family | | |
| **Carica papaya* L. | Papaya | Occasional |
| Chenopodiaceae - Goosefoot Family | | |
| **Chenopodium murale* L. | 'Aheahea | Locally abundant |
| Convolvulaceae - Morningglory Family | | |
| **Ipomoea alba* L. | Moon flower | Occasional |
| **Ipomoea indica* (J. Burm.) Merr. | Koali | Uncommon |
| Crassulacaeae -Orpine Family | | |
| **Kalanchoe pinnata* (Lam.) Pers | Mother-of-thousands | Locally abundant |
| Cucurbitaceae - Gourd Family | | |
| **Cucumis dipsaceus* Ehrrrrenb. ex Spach | Hedgehog Gourd | Occasional |
| **Momordica charantia* L. | Balsam pear | Locally abundant |
| Euphorbiaceae - Spurge Family | | |
| *Aleurites moluccana* (L.) Willd. | Kukui | Common |
| *Chamaesyce celastroides* var. *amplectens* Deg. & Deg. | 'Akoko | Locally abundant |
| **Chamaesyce hirta* (L.) Millsp. | Hairy spurge | Common |
| **Chamaesyce hypericifolia* (L.) Millsp. | Graceful spurge | Occasional |
| **Chamaesyce prostrata* (Aiton) Sma. | Prostrate spurge | Occasional |
| **Jatropha curca* L. | Physic nut | Locally abundant |
| **Ricinus cummunis* L. | Castor bean | Occasional |



| SCIENTIFIC NAME | COMMON NAME | ABUNDANCE |
|---|---|---|
| Fabaceae - Bean Family | | |
| **Acacia farnesiana* (L.) Willd | Klu | Common |
| **Bauhinia blakeana* Dunn C | Hong Kong Orchid | Rare |
| **Caesalpinia bonduc* (L.) Roxb. | Kakalaioa | Common |
| **Caesalpinia major* (Medik.) Dandy & Excell | Yellow knickers | Occasional |
| **Chamaecrista nitiitans* L. | Partridge pea | Common |
| **Crotalaria incana* L. | Fuzzy rattle box | Occasional |
| **Crotalaria incana* L. | Fuzzy rattlepod | Occasional |
| **Desmanthus virgatus* (L.) | Slender mimosa | Locally abundant |
| *Erythrina sandwicensis* Deg. | Wiliwili | Rare |
| **Glycine wightii* (Wight & Arnott) | Rare | |
| **Indigo suffruticosa* Mill | Indigo | Common |
| **Leucaena leucocephala* (Lam). deWit | Koa haole | Common |
| **Mimosa pudica* L. | Sensitive plant | Occasional |
| **Pithecellobium dulce* (Roxb.) Benth | Opiuma | Common |
| **Prosopis pallida* Kunth | Kiawe | Common |
| **Samanea saman* (Jacq.) Merr. | Monkey pod | Common |
| **Senna occidentalis* (L.) Link | Coffee Senna | Common |
| **Senna pendula* var. *advens* Hil. & Bar. | | Occasional |
| **Senna septemtrionalis* (Viv.) H. Irwin & Barneby | Kolomona | Occasional |
| *Tephrosa purpurea* (L.) Pers. | Auhuhu | Common |
| Lamiacee - Mint Family | | |
| **Hyptis pectinata* (L.) Poit | Comb hyptis | Occasional |
| **Ocimum gratissimum* L. | Wild basil | Common |
| *Plectranthus parviflorus* Willd. | Spur flower | Occasional |
| **Salva coccinea* Etl | Scarlet sage | Locally abundant |
| Lauraceae - Laurel Family | | |
| **Persea americana* Mill. | Avacado | Occasional |
| Malvaceae - Hibiscus Family | | |
| **Abutilon grandifolium* (Willd.) Sweet | Hairy abutilon | Common |
| **Malvastrum coromandelianum* (L.) Garke | False mallow | Common |
| **Sida acuta* N. L. Burm | | Occasional |
| **Sida fallax* Walp. | 'Ilima | Common |
| **Sida spinosa* L. | Prickly sida | Occasional |
| Meliaceae - Mahogany Family | | |
| **Melia azerdarach* L. | Chinaberry | Occasional |
| Menispermaceae - Moonseed Family | | |
| *Cocculus trilobus* (Thunb.) DC | Huehue | Common |

| SCIENTIFIC NAME | COMMON NAME | ABUNDANCE |
|---|---|---|
| Moraceae - Mulberry Family | | |
| **Ficus microcarpa* L. fil | Banyan | Occasional |
| **Morus alba* L. | Mulberry | Occasional |
| Myrtaceae - Myrtle Family | | |
| **Psidium cattleianum* Sabine | Waia'wi | Occasional |
| **Psidium guajava* L. | Common guava | Occasional |
| Nyctaginaceae - Four o'clock Family | | |
| **Mirabilis jalapa* L. | Four o'clock | Rare |
| Oxalidaceae - Wood Sorral Family | | |
| *Oxalis corniculata* (Jacq.) Raven | Wood sorrel | Occasional |
| Papaveraceae - Poppy Family | | |
| **Argemone glauca* Pope | Prickly poppy | Rare |
| Passifloraceae - Passion flower Family | | |
| **Passiflora edulis* Sims | Passion fruit | Rare |
| **Passiflora foetida* L. | Love-in-a-mist | Common |
| **Passiflora suberosa* L. | Huehue haole | Common |
| Phytoloccaceae - Pokeweed Family | | |
| **Phytolocca octandra* L. | Southern pokeweed | Occasional |
| Piperaceae - Pepper Family | | |
| *Peperomia leptostachya* Hook. & Arnott | Common | |
| Plumbaginaceae - Plumbago Family | | |
| *Plumbago zeylanica* L. | Ilie'e | Common |
| Portulacaceae - Purslane Family | | |
| **Portulaca oleracea* L. | Pigweed | Common |
| **Talinum paniculatum* (Jacq.) Gaertn. | Jewels of Opar | Rare |
| **Talinum fruiticosum* (L.) Juss. | | Common |
| Rubiaceae - Coffee Family | | |
| **Coffea arabica* L. | Coffee | Common |
| *Morinda citrifolia* L. | Noni | Common |



| SCIENTIFIC NAME | COMMON NAME | ABUNDANCE |
|---|---|---|
| Rubiaceae - Coffee Family con't | | |
| **Pentas lanceolata* (Frosk.) Schun. | Penta | Rare |
| Solanaceae - Nigtshade Family | | |
| *Capiscum frutescens* L. | Bird pepper | Occasional |
| **Datura* sp. | | Rare |
| **Solanum americanum* Mill. | Popolo berry | Occasional |
| **Solanum linnaeanum* Hepper & Jaeger | Apple of Sodom | Common |
| Sterculiaceae - cacao Family | | |
| *Waltheria indica* L. | 'Uhaloa | Common |
| Tiliaceae - Linden Family | | |
| **Triumfetta rhomboidea* Jacq. | | Common |
| Verbenaceae - Verbena Family | | |
| **Lantana camara* L. | Lantana | Common |
| **Stachytarpheta dichotoma* (Ruiz & Pav.) Vahl | | Common |
| **Stachytarpheta urticifolia* (Salisb.) | | Occasional |

# I - 2 Survey of the Avifauna & Feral Mammals

# SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT HOKUKANO, NORTH AND SOUTH KONA, HAWAII

Prepared for

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16 October 1991

## INTRODUCTION

The purpose of this report is to summarize the findings of a two day (12-13 October 1991) bird and mammal field survey of approximately 1550 acres of property located at Hokukano, North and South Kona, Hawaii (Fig. 1). Also included are references to pertinent literature as well as unpublished faunal reports from similar habitat.

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 (estimated) abundance of each species.

3- Determine the presence or likely occurrence of any native fauna particularly any that are considered "Endangered" or "Threatened".

4- If any special or unique wildlife habitat occurs on the property locate such sites and note their possible value to birds and mammals in this region of the island.





## GENERAL SITE DESCRIPTION

Figure One indicates the limits of the area surveyed for birds and mammals. The lands between 1200' and 800' elevation contain a mixture of tall grass and exotic trees such as Kukui (Aleurites moluccana) and Monkeypod (Samanea saman). The lower 3/4 of the property is covered in Koa Haole (Leucaena leucocephala) and Kiawe (Prosopis pallida). No wetlands occur on the site.

Weather during the field survey was clear and warm with winds 5-10 mph from the east.

## STUDY METHODS

Field observations were made with 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, along roads and trails, eight minute counts were made of all birds seen or heard (Fig.1). Between these count (census) stations any unusual observations of birds were also noted. These data provide the basis for the relative (estimated) abundance figures given in

this report (Table 1). Published and 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 the possible species that might occur in the area (Bruner 1989a, 1989b, 1989c, 1989d, 1990a, 1990b, 1990c, 1991; Pratt et al. 1987; Hawaii Audubon Society 1989; David 1989, 1990). Observations of feral mammals were limited to visual sightings and evidence in the form of scats and tracks. No attempts were made to trap mammals in order to obtain data on their relative (estimated) abundance and distribution. One evening was devoted to searching for the presence of owls and the Hawaiian Hoary Bat (Lasiurus cinereus semotus).

Scientific names used herein follow those given in Hawaii's Birds (Hawaii Audubon Society 1989); A Field Guide to the Birds of Hawaii and the Tropical Pacific (Pratt et al. 1987); Mammal Species of the World (Honacki et al. 1982) and Hawaiian Forest Plants (Merlin 1977).

## RESULTS AND DISCUSSION

Resident Endemic (Native) Birds:

No endemic birds were recorded on the survey. The only two likely species that may forage at times in this area are the Short-eared Owl or Pueo (Asio flammeus sandwichensis) and the 'Io or Hawaiian Hawk (Buteo solitarius). Pueo and 'Io can be found in native forest, grasslands, agricultural fields and second growth





exotic forest (Pratt et al. 1987; Hawaii Audubon Society 1989).

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 and Johnson 1983). Of all the shorebirds species which winter in Hawaii the Pacific Golden Plover (Pluvialis fulva) is the most abundant. Plover prefer open areas such as exposed intertidal reef, rocky shorelines, mud flats, lawns, plowed fields and pastures. 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 the 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 (Johnson et al. 1989). Fourteen plover were recorded over the two day survey. Eight Ruddy Turnstone (Arenaria interpres) another species which frequents pastures as well as rocky shorelines, were also observed. In addition two Wandering Tattler (Heteroscelus incanus) were found along the coast near Kaikiwaha Point. Plover, turnstone and tattler are common winter migrants to Hawaii.

Resident Indigenous (Native) Birds:

No indigenous species were recorded. The only species in this category is the Black-crowned Night Heron (Nycticorax nycticorax). The absence of wetland habitat precludes the occurrence of this species or any other waterbird.

Resident Indigenous (Native) Seabirds:

No seabirds were observed on the property. The presence of predators make this site unsuitable for nesting or roosting seabirds.

Exotic (Introduced) Birds:

A total of ten species of exotic birds were recorded during the field survey (Table 1). The most abundant species were Japanese White-eye (Zosterops japonicus), Zebra Dove (Geopelia striata) and Nutmeg Mannikin (Lonchura punctulata).

Based on the location and type of habitat found on the property as well as from data gathered elsewhere in West Hawaii (Bruner 1989a, 1989b, 1989c, 1989d, 1990a, 1990b, 1990c, 1991 and information provided in Pratt et al. 1987; Hawaii Audubon Society 1989 and David 1989, 1990) the following exotic bird species might also occur on or near the property: Barn Owl (Tyto alba), Wild Turkey (Meleagris gallopavo), California Quail (Callipepla californica), Northern Mockingbird (Mimus polyglottus), Saffron Finch (Sicalis flaveola), Yellow-fronted Canary (Serinus mozambicus), Warbling Silverbill (Lonchura malabarica) and Lavender Waxbill (Estrilda caerulescens).





Feral Mammals:

Small Indian Mongoose (Herpestes auropunctatus) and feral cats were observed. The area is still used extensively for cattle ranching. No trapping was conducted in order to assess the relative abundance of mammals.

Records of the endemic and endangered Hawaiian Hoary Bat are sketchy but the species has been reported regularly from West Hawaii (Tomich 1986; Kepler and Scott 1990). On the evening of 12 October four bats were observed foraging over the bay just south of Paaoao Point. The Hawaiian Hoary Bat roosts primarily in trees. Whether or not bats roost on the project site was not determined. Much remains to be known about the natural history of this bat and its ecological requirements here in Hawaii.

## CONCLUSION

A brief field survey such as this one can provide only a limited perspective of the wildlife which utilize the area. Not all species will be observed and information on occurrence and 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 food resources and reproductive success. Species which are migratory will quite obviously be a significant 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; Moulton et al. 1990). Thus only long term studies can provide a comprehensive view of the bird and mammal populations in a particular area. However, when brief studies are viewed in the light of data gathered from other similar habitats the value of the conclusions drawn can be significantly increased.

The following are some general conclusions related to bird and mammal activity on this property:

1- Dense vegetation, size of property and time constraints limited the area that could be searched. Nevertheless all major habitats were visited and census stations were distributed along roads and trails so as to provide a reasonable sample from which relative estimates of bird populations could be derived.

2- No endemic birds were found on the property. The limited number of migratory shorebirds recorded was due to a lack of suitable habitat. Following development and the subsequent creation of more open habitats and lawns, species such as Pacific Golden Plover and Ruddy Turnstone should increase in number at this site.

3- The property supports the typical array of exotic birds one would expect in this type of environment in Hawaii. Some potential species 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. It is also quite possible these unaccounted for species simply at present do not occur on this property. Species such as Common Myna (Acridotheres tristis) and House Sparrow (Passer domesticus) should become more common following urbanization.

4- In order to obtain more definitive data on mammals a trapping program would be required. The sightings of the endangered Hawaiian Hoary Bat were not unusual. Small protected bays along the Kona Coast are sites where bats are regularly seen. This species of bat roosts in trees, thus coastal patches of forest may be one indicator of whether or not bats will likely be found in the area.

5- No unique wildlife habitat was found on this property. Second growth exotic forest and pastureland are common along the Kona Coast. The assemblage of exotic birds at this site are typical of this region.

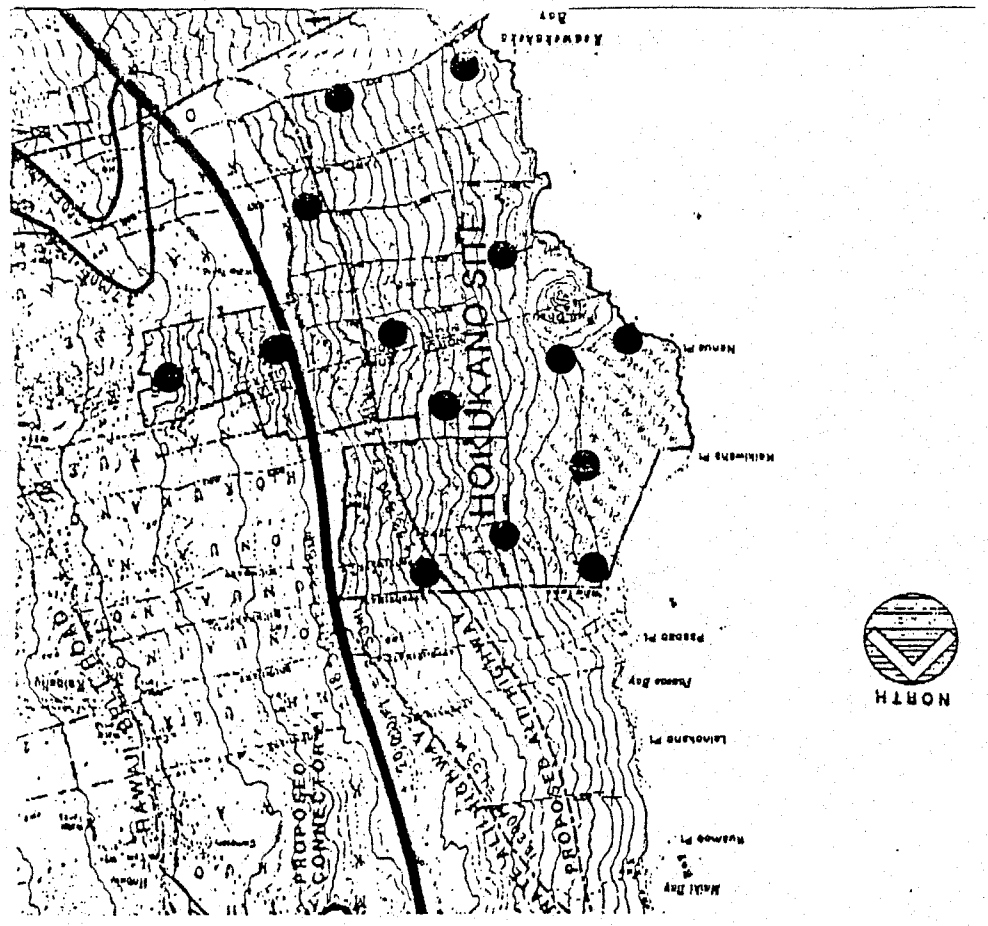


Fig. 1. Location of faunal survey with census stations shown as solid circles.



I-2-10

TABLE

Exotic (introduced) birds recorded at Hokukano, North and South Kona, Hawaii

| COMMON NAME | SCIENTIFIC NAME | RELATIVE ABUNDANCE* |
|---|---|---|
| Black Francolin | Francolinus francolinus | R = 4 |
| Gray Francolin | Francolinus pondicerianus | C = 6 |
| Spotted Dove | Streptopelia chinensis | U = 4 |
| Zebra Dove | Geopelia striata | A = 15 |
| Common Myna | Acridotheres tristis | C = 8 |
| Northern Cardinal | Cardinalis cardinalis | U = 4 |
| Yellow-billed Cardinal | Paroaria capitata | C = 6 |
| Japanese White-eye | Zosterops japonicus | A = 16 |
| Nutmeg Mannikin | Lonchura punctulata | A = 10 |
| House Finch | Carpodacus mexicanus | C = 9 |

I-2-11

* (see page 11 for key to symbols)

KEY TO TABLE 1

Relative (estimate) 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 or on one count only) number which follows is the total number seen or heard over the duration of the survey





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# I - 3 Quantitative Assessment of the Marine Communities and Water Quality

# A QUANTITATIVE ASSESSMENT OF THE MARINE COMMUNITIES AND WATER QUALITY IN AN AREA FRONTING THE PROPOSED VILLAGES AT HOKUKANO DEVELOPMENT

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## EXECUTIVE SUMMARY

This study was undertaken to establish baseline conditions for the marine communities and water chemistry characteristics along a 3.6km section of coastline fronting a proposed development at Hokukano, South Kona, Hawaii. This development proposes to take lands presently used for grazing and put them into resort/residental use. Identified environmental concerns include the potential impact of (1) runoff and sedimentation during construction and (2) changes in water quality due to the subsequent operation of the facilities on the adjacent marine communities and waters fronting the project site.

This study established baseline conditions in the waters fronting the project site (from Paapao Point on the north to Keawekaheka Bay on the south) from shore to the 20m (60 foot) isobath. In total, more than 214 ha (530 acres) were encompassed in this study; five zones or biotopes were identified in this area. These zones are: the biotope of sand which lies principally seaward of the project site, the biotope of Porites compressa at depths from 10 to 30m, the biotope of Porites lobata found at depths between 6 to 15m, the biotope of boulders usually in water from 4 to 10m of depth and the high energy bench biotope that is adjacent to the shoreline. Ten permanent stations were established to sample the benthic (primarily coral) and fish communities in these zones.

In general the marine communities resident to the waters fronting the Hokukano project site are diverse and the fish communities do not show the declines in abundance that have been encountered in many other Hawaiian coastal settings in recent years. No unusual marine species or communities were noted in the study area. A major parameter in structuring Hawaiian coral and benthic communities is wave impact. Coral community development is greatest where the exposure to occasional high energy (i.e., storm generated surf) is least. Much of the storm generated surf impinges on the West Hawaii coast from a NNW to WNW direction. Thus stations that sample communities exposed to these directions usually show poorer coral community development. Similarly, fish community development is greatest where shelter and food resources are best developed. The development of shelter is frequently correlated with the growth of coral, hence where coral development is poor, fish community development may mirror this. The results from some of the stations in this study reflect this.

No threatened or endangered species were encountered in the study area, however several humpback whales were noted well offshore of the site during the March 1992 field effort. Despite not seeing green turtles (a threatened species), it is expected



that turtles must, at a minimum, pass through the waters fronting the project site.

In the study area 24 sites were established to quantiatively assess water quality characteristics. Only one of these sampled a brackish water well, the remaining stations sampled marine waters. The water chemistry sampling shows that a gradient exists from the shore decreasing in a seaward direction for certain dissolved nutrient species (nitrate and ammonia nitrogen and silicate); oceanic waters are typically low in these nutrients. Other measures of water quality (chlorophyll-a and salinity) suggest that the causal mechanism for these gradients is diffuse groundwater input to the ocean. This input is greatest in the small unnamed bay located on the southern flank of Puu Ohau in the project area. Diffuse groundwater percolation to the sea results in the geometric means of the sampled waters not meeting State Department of Health water quality standards for nitrate and ammonia nitrogen and chlorophyll-a. Despite not meeting state criteria, the waters fronting the project site are typical of well-flushed, undeveloped West Hawaii coastal settings. Indeed, the water quality of the marine waters fronting the Natural Energy Laboratory at Keahole Point, Hawaii, a site selected for its pristine water quality characteristics, similarly does not meet a number of the state criteria.

An analysis of potential for impact to marine communities with the development of the Hokukano project site suggests that this is probably greatest during the construction phase of the project (i.e., sediment input to the ocean); later the subsequent operation of the development could result in changes to groundwater chemistry which could impact the marine biota. The porous nature of the substratum and relatively low rainfall characteristics of the project site suggest that if prudent construction techniques are used (i.e., removing vegetation only as immediately needed, use of temporary settlement basins, etc.) the opportunity for negative impact to the marine communities due to sedimentation is low during the construction phase.

Longterm water quality studies (e.g. for dissolved nutrients, pesticides and herbicides) carried out on the West Hawaii coast at Waikoloa suggest that changes may occur to the groundwater chemistry with the development and operation of a major resort/golf course complex. However, changes in groundwater chemistry only involve increases in the concentration of inorganic nutrients; pesticides and/or herbicides have not been detected in water, sediments or organisms. The changes in inorganic nutrients all fall within the range of concentrations encountered at other localities on the West Hawaii coast that have no surrounding development (i.e., completely natural systems). Further, these studies have been unable to detect any quantifiable change in the aquatic biota resident to the Waikoloa area. This apparent insensitivity of the aquatic biota to these changes is

probably related to (1) the presence of numerous herbivores controlling algal growth, (2) high dilution and advection rates of incoming high nutrient groundwater and (3) a probable preadaptation of these organisms to waters with highly variable nutrient concentrations.

These data suggest that if elevation of nutrient levels were to occur following the proposed development, there should be a similar lack of response by the marine communities to this input.



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## INTRODUCTION

### Purpose

The proposed development of lands in the Hokukano project site has served as the impetus to this study. The scale of this proposed project raises concern over the potential for change to marine communities along the approximate 3.6km of presently undeveloped coast. This concern goes beyond assessment of the impacts that may occur with construction, but also encompasses those that could occur later with the subsequent operation of the proposed facilities. These concerns have prompted the study below which is the preliminary phase in the development of a comprehensive management plan to protect the aquatic resources of this coast.

As a first step to this management plan we suggested that a quantitative survey of the biota and extant water quality conditions be conducted to establish baseline conditions against which man's impacts could be assessed. It was further suggested that periodic monitoring surveys be later carried out to define ranges of natural variation as well as to detect any departures from baseline conditions which could be attributable to human activities. This document is the first step in this process; it has been prepared (1) to provide a quantitative description of the marine macrobiota and water quality conditions in the waters fronting the proposed development of the Hokukano project site as well as (2) to serve as the first phase of the comprehensive management plan to protect marine resources along this section of the West Hawaii coast. This plan is presented in Appendix B.

### Strategy

Marine environmental surveys are usually performed to evaluate feasibility of and ecosystem response to specific proposed activities. Appropriate survey methodologies reflect the nature of the proposed action(s). An acute potential impact (such as channel dredging that may be undertaken on other projects) demands a survey designed to determine the route of least harm and the projected rate and degree of ecosystem recovery. Impacts that are more chronic or progressive require different strategies for measurement. Management of chronic stress to a marine ecosystem demands identification of system perturbations which exceed boundaries of natural fluctuations. Thus a thorough understanding of normal ecosystem variability is required in order to separate the impact signal from background "noise".

The potential impacts confronting the marine ecosystem off-



shore of the Hokukano project site are most probably those associated with chronic or progressive stresses. Impacts due to human activities have been probably less in the last thirty or more years along this coastline than in times past due to former higher local population levels. However in recent years, use of the marine resources along the entire Kona coast has probably increased with the growth in the West Hawaii population: among the activities that now commonly occur offshore of Hokukano are fishing as well as non-consumptive dive tours. The proposed modifications to the land with development may bring alterations to the quantity and quality of inputs from land (e.g., via groundwater). Development and increased use of nearshore marine habitat could result in additional nutritional subsidies and other impacts to the ecosystem if mitigation measures were not instituted.

Monitoring strategies for assessing chronic stresses rely on comparative spatial and temporal evaluations of ecosystem structure and function in relation to ambient conditions. Usually in order to reliably detect system perturbations, detailed quantitative descriptions of the pre-development environment are necessary as a "benchmark" against which later studies may be comparatively analyzed. The strategy is to establish a number of permanent stations from which quantitative "baseline" studies are made; later as development proceeds, these permanent station will be resampled at regular intervals, thus sampling will occur at a number of spatial (locations) and temporal (times) scales which should allow quantitative delineation of change if it occurs. If changes are noted, appropriate mitigative actions would be undertaken (see the proposed Marine Life Monitoring and Management Plan). This document reports on the first field effort, thus establishing the primary "benchmark" for the marine communities and water quality characteristics in the nearshore region fronting the Hokukano project site.

## MATERIALS AND METHODS

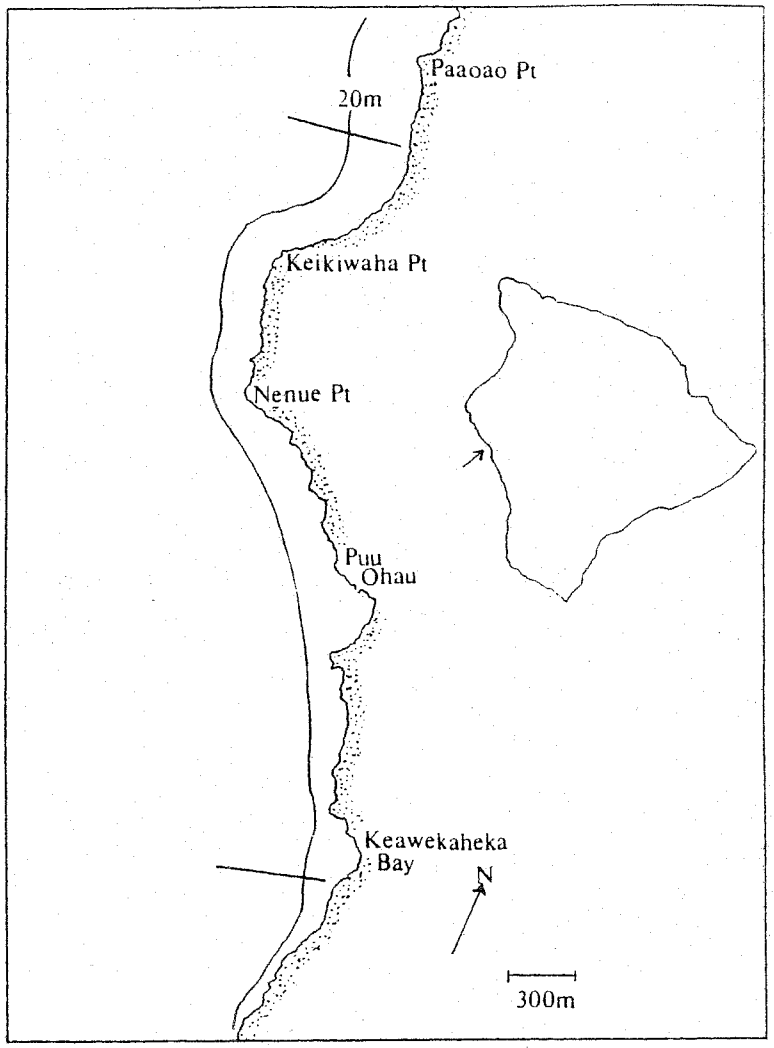
### A. BENTHIC STUDIES

The fieldwork which provided the database for this baseline study of the marine macrobiota offshore of the Hokukano project site and environs was carried out on several occasions between December 1991 through March 1992. The area encompassed in this survey is given in Figure 1; it includes the nearshore region from the shore, seaward to approximately the 20m (60 foot) isobath up to 460m from shore fronting the project site and is bordered by Paapao Point on the north and Keawekaheka Bay about 3.6km to the south.

The methods used in carrying out this study follow those prescribed the the West Hawaii Coastal Monitoring Protocol

FIGURE 1. Map showing the boundaries of the project area. Inset shows the relative location of this project site on the West Hawaii coast. Shoreline is stippled and the 20m (60 foot) isobath is shown as a solid line. Map redrawn from USGS 7.5 minute quadrangle map.





developed by an ad hoc committee comprised of governmental permit agency personnel (county, state and federal), individuals from the university community, private consultants and members of the the interested public. At this date (March 1992) the document outlining these methods is in preparation; the techniques are described below.

The quantitative sampling of macrofauna of marine communities presents a number of problems; many of these are related to the scale on which one wishes to quantitatively enumerate organism abundance. Marine communities offshore of the Hokukano project site may be spatially defined in a range on the order of a few hundred square centimeters (such as the community residing in a Pocillopora meandrina coral head) to major biotopes covering many hectares. Recognizing this ecological characteristic, we designed a sampling program that attempted to delineate all major extant communities in the limits of the study area and to quantitatively describe these communities. Thus, a number of methods were used.

To obtain an overall perspective on the extent of the major communities or "zones" occurring in the study area, divers were slowly towed behind a skiff over most of the study site from shore seaward to the 20m isobath (the outer limits for this study). This exercise allowed the qualitative delineation of major biotopes based partially on the presence of large structural elements (e.g., amount of sand, hard substratum, fish abundance, coral coverage or dominant coral species). Within each of these permanent stations were established and quantitative studies were conducted, including visual enumeration of fish, counts along benthic transect lines and cover estimates in benthic quadrats. Besides these quantitative measures, a qualitative reconnaissance was made in the vicinity of each station by swimming and noting the presence of species not encountered in the transects. All assessments were carried out using SCUBA.

The location of stations were subjectively chosen as being representative of a given biotope and in some cases coincided with water quality sampling points. Subtidally stations were marked using steel stakes placed into the bottom and outfitted with small fishing floats on cord that extended approximately 1.2m above the seafloor. Biotopes approximately paralleled the shoreline so stations sampling the different biotopes were established along an imaginary mauka-makai (onshore-offshore) line. The location of the innermost or shallowest station and the most offshore or deep station were noted using a hand held ground positioning system employing state-of-the-art satellite technology (Magellan GPS Nav 1100) to assist in the subsequent relocation of these sites.

Immediately following site selection, a visual fish census was undertaken to estimate the abundance of fishes. These censuses were conducted over a 25 x 4m corridor and all fishes within this area to the water's surface were counted. Data collected included species, numbers of individuals and with larger fish, an estimate of their length; the length data were later converted to standing crop estimates using linear regression techniques. A single diver equipped with SCUBA, transect line, slate and pencil would enter the water, count and note all fishes in the prescribed area (method modified from Brock 1954). The 25m transect line was paid out as the census progressed, thereby avoiding any previous underwater activity in the area which could frighten wary fishes.

Fish abundance and diversity is often related to small-scale topographical relief over short linear distances. A long transect may bisect a number of topographical features (e.g., cross coral mounds, sand flats, and algal beds), thus sampling more than one community and obscuring distinctive features of individual communities. To alleviate this problem, a short transect (25m in length) has proven adequate in sampling many Hawaiian benthic communities (Brock and Norris 1989).

Besides frightening wary fishes, other problems with the visual census technique include the underestimation of cryptic species such as moray eels (family Muraenidae) and nocturnal species, e.g., squirrelfishes (family Holocentridae), aweoweos or bigeyes (family Priacanthidae), etc. This problem is compounded in areas of high relief and coral coverage affording numerous shelter sites. Species lists and abundance estimates are more accurate for areas of low relief, although some fishes with cryptic habits or protective coloration (e.g., the nohus, family Scorpaenidae; the flatfishes, family Bothidae) might still be misssed. Obviously, the effectiveness of the visual census technique is reduced in turbid water and species of fishes which move quickly and/or are very numerous may be difficult to count and to estimate sizes. Additionally, bias related to the experience of the diver conducting counts should be considered in making any comparisons between surveys. In spite of these drawbacks, the visual census technique probably provides the most accurate non-destructive method available for the assessment of diurnally active fishes (Brock 1982).

After the assessment of fishes, an enumeration of epibenthic invertebrates (excluding corals) was undertaken using the same transect line as established for fishes. Exposed invertebrates usually greater than 2cm in some dimension (without disturbing the substratum) were censused in a 4 x 25m area. As with the fish census technique, this sampling methodology is quantitative for only a few invertebrate groups. e.g., some of the echinoderms and holothurians. Most coral reef invertebrates (other than corals) are cryptic or nocturnal in their habits making accurate assessment of them in areas of topographical complexity very difficult. This, coupled with the fact that the majority of

these cryptic invertebrates are small, necessitates the use of methodologies that are beyond the scope of this survey (e.g., see Brock and Brock 1977). Recognizing constraints on time and the scope of this survey, the invertebrate censusing technique used here attempted only to assess those few macroinvertebrate species that are diurnally exposed.

Exposed sessile benthic forms such as corals and macrothalloid algae were quantitatively surveyed by use of quadrats and the point-intersect method. The point-intersect technique only notes the species of organism or substratum type directly under a point. Along the previously set fish transect line, 50 such points were assessed (once every 50cm). These data have been converted to percentages. Quadrat sampling consisted of recording benthic organisms, algae and substratum type present as a percent cover in six one-meter square frames placed at five-meter intervals along the transect line established for fish censusing (at 0, 5, 10, 15, 20 and 25m).

If macrothalloid algae were encountered in the 1 x 1m quadrats or under one of the 50 points, they were quantitatively recorded as percent cover. Emphasis was placed on those species that are visually dominant and no attempt was made to quantitatively assess the multitude of microalgal species that constitute the "algal turf" so characteristic of many coral reef habitats.

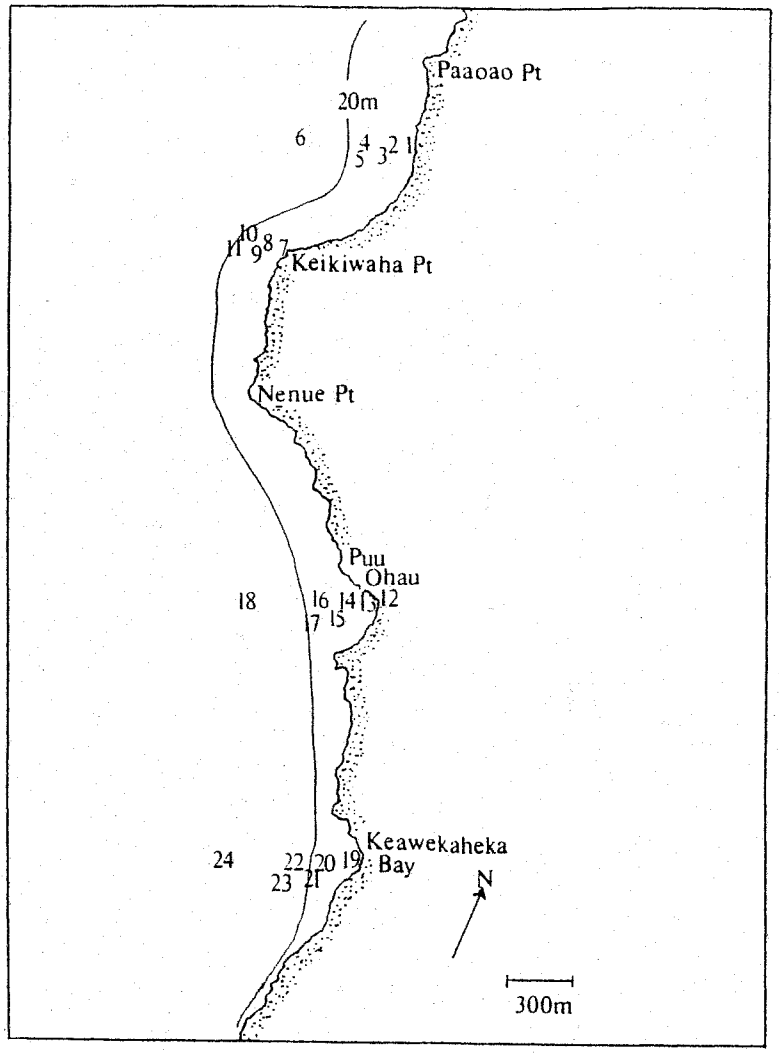
During the course of the fieldwork, notes were taken on the number, size and location of green sea turtles and other threatened or endangered species seen within or near to the study area. Additionally, casual observations were made on recreational use patterns as observed within the study area while carrying out other field studies. Further information on threatened or endangered species was obtained by questioning users familar with the area.

B. WATER CHEMISTRY STUDIES

Water quality parameters were measured at 24 locations (Station numbers 1 through 24). Sample numbers 1-S, 2-S, 4-S, 6-S, 7-S, 9-S, 11-S, 13-S, 14-S, 16-S, 18-S 19-S, 20-S, 22-S and 24-S were taken at the surface (about 20cm below the air-water interface); the other samples were all collected at depth, approximately 1m above the bottom. The location of these stations is presented in Figure 2. Water quality parameters that were evaluated are specific criteria designated for "open coastal waters" in Title 11, Chapter 54, Amended Administrative Rules for Water Quality Standards. These criteria include ammonia nitrogen, nitrate + nitrite nitrogen, total nitrogen, orthophosphate phosphorus, total phosphorus, chlorophyll-a and nephelometric turbidity. Also collected were samples for the non-specific criteria including oxygen, temperature, pH and salinity as well



FIGURE 2. Map showing the locations of the 24 water quality sampling stations assessed in this study. The 20m (60 foot) isobath is shown as a solid line. Map redrawn from USGS 7.5 minute quadrangle map. Shoreline is stippled.






as the nutrient, silica at each station.

Water samples for nutrient analyses were taken in 125ml acid-washed polyethylene bottles. These samples were filtered through glass fiber filters in the field, immediately placed on ice and subsequently frozen until analysis (except for silicate which was refrigerated. Analyses for ammonium, nitrate + nitrite and orthophophate were carried out using standard techniques; inorganic and total (after oxidation) nutrient analyses were determined using manual spectrophotometric techniques on a fiber optic colorimeter. Some samples were collected and measured in triplicate; data are presented as means. The analytical procedures followed those given in Standard Methods (1985) with modifications according to Strickland and Parsons (1972).

Turbidity samples were collected as unfiltered water and stored on ice in 250ml polyethylene bottles until measurements were made. Turbidity was measured on a Monitek Laboratory Nephelometer following the procedures as described in Standard Methods (1985). The instrument was calibrated as specified by the Environmental Protection Agency with standard formazin solutions prior to and after sample measurements. Prior to measurement, samples were throughly mixed to disperse particulate materials and measured in duplicate when all air bubbles disappeared.

Chlorophyll-a samples were collected by filtering known volumes of seawater through glass microfiber filters; filters were stored in acetone and the samples frozen until laboratory analyses were carried out. Laboratory procedures followed Standard Methods (1985) and pigments were extracted and determined fluorometrically. Salinity samples were collected in 250ml polyethylene bottles in the field, filled completely and capped tightly until measurement by tritration (EPA method 325.3) as well as by AGE salinometer in the laboratory. In the field oxygen and temperature were measured using a YSI Model 58 meter and pH was determined using a Cole-Parmer digisense millivolt meter.

## RESULTS

### WATER CHEMISTRY

Water quality parameters as specified by the State Department of Health (DOH) Water Quality Standards were collected and measured at the surface (about 20cm below the water surface) and/or at depth (about 1m above the bottom) at 24 locations fronting the project site. One brackish water well was sampled at Puu Ohau otherwise all water quality samples are marine. The station locations are given in Figure 2. Cultural Surveys Hawaii

located a inland well (at about the 30m contour; probably part of a collapsed lava tube - site 345) that exists near the northern boundary of the site. We spent several hours unsuccessfully trying to locate this site for water quality sampling purposes. We expect to sample this site when additional information regarding the location are made available. At this point in time, we surmise that the water in this well is probably brackish (i.e., 1 to 4°/oo) and the concentration of nutrients would probably be similar to the sampled well on the southern flank of Puu Ohau.

The waters fronting the project site are classified as open coastal waters by the state (Chapter 11-54) and the standards are given in Table 1 for comparative purposes.

Table 2 presents a synopsis of the water chemistry parameters measured in this study. There are several trends apparent in these data: (1) the concentrations of some dissolved nutrients (particularly nitrate nitrogen and silicate) decrease with distance from shore, (2) salinity shows a weak increase with distance from shore and (3) the geometric means for nitrate nitrogen, ammonia nitrogen and chlorophyll-a exceed the the state water quality standards for "dry" coastlines. Dry coastlines are defined as those receiving less than three million gallons of freshwater discharge per shoreline mile per day. Although the gradients are weak, they are related to the diffuse input of groundwater along the shoreline. Both silica and nitrate+nitrite nitrogen usually exist in high concentration in groundwater owing to metabolism of organic material and mineral dissolution; these ions are in low concentration in open ocean waters and hence they (along with salinity) may serve as tracers for freshwater (here low salinity groundwater) input into oceanic settings.

The greatest groundwater input along the shoreline of the project site was located in the small bay along the southern side of Puu Ohau (Stations 13-18). The surface samples (numbers 13-S, 14-S, 16-S) show a distinct salinity depression adjacent to the shoreline and related to the groundwater input. About 50m directly inland of the shore is a small well situated in a gully. This brackish water well is walled, about 75cm in diameter and extends down about 4.6m to the water's surface. At the time of sampling (12 December) the tide was about +43cm (1.4 foot) and there was about 10-12cm of water present. This well is the only brackish water source located and sampled in this study (Sample No. 12) that is situated close to the shore. Groundwater emanating into the sea along the West Hawaii coast is a very common occurrance. The salinity samples taken adjacent to the shoreline fronting the project site showed relatively little freshwater input.

Despite the concentrations of some parameters not meeting state standards in some samples, most of the water quality data are typical of a well-flushed, open coastal marine ecosystem.



TABLE 1. Specific criteria specified by the Department of Health water quality standards for open coastal waters as amended in 1988. Standards converted from ug/l to uM.

| Parameter | Geometric mean not to exceed the given value | Not to exceed the given value more than 10% of the time | Not to exceed the given value |
|---|---|---|---|
| Total Nitrogen (uM) | 10.71*<br>7.85** | 17.86*<br>12.86** | 25.00*<br>17.86** |
| Ammonia Nitrogen (uM) | 0.25*<br>0.14** | 0.61*<br>0.36** | 1.07*<br>0.64** |
| Nitrate+Nitrite Nitrogen (uM) | 0.36*<br>0.25** | 1.00*<br>0.71** | 1.79*<br>1.43** |
| Total Phosphorus (uM) | 0.65*<br>0.52** | 1.29*<br>0.97** | 1.94*<br>1.45** |
| Chlorophyll-a (ug/L) | 0.30*<br>0.15** | 0.90*<br>0.50** | 1.75*<br>1.00** |
| Turbidity (NTU) | 0.50*<br>0.20** | 1.25*<br>0.50** | 2.00*<br>1.00** |

* "Wet" criteria apply when the open coastal waters receive more than three million gallons per day of fresh water discharge per shoreline mile.

** "Dry" criteria apply when the open coastal waters receive less than three million gallons per day of fresh water discharge per shoreline mile.

Applicable to both "wet" and "dry" conditions:

Salinity - Shall not vary more than 10 percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

Orthophosphate was eliminated from the list of requirements in the revised 1988 document but becasue of its biological importance, it was measured in this study. The old "wet" criteria was 0.23uM and "dry" standard was 0.16uM.

TABLE 2. Summary of the water quality parameters as measured at 24 sites in the study. In the body of the table concentrations of dissolved nutrients given in uM. Surface samples are denoted with an "S" and deep bottom samples with a "B". Geometric means are given at the foot of the table for each species measured; single underlined values are at or exceed "dry" Department of Health water quality standards.

| Station | Nitrate N | Ammonia N | Total N | Ortho-P | Total P | Silicate |
|---|---|---|---|---|---|---|
| BRACKISH WATER WELL | | | | | | |
| 12 | 65.34 | 2.59 | 74.90 | 4.87 | 4.99 | 786.37 |
| MARINE WATERS | | | | | | |
| 1-S | 3.88 | 0.34 | 10.94 | 0.28 | 0.50 | 42.69 |
| 2-S | 1.01 | 0.18 | 7.13 | 0.16 | 0.31 | 10.50 |
| 3-B | 0.38 | 0.24 | 7.59 | 0.15 | 0.29 | 3.74 |
| 4-S | 0.36 | 0.12 | 8.49 | 0.14 | 0.28 | 5.37 |
| 5-B | 0.26 | 0.30 | 7.97 | 0.28 | 0.55 | 1.81 |
| 6-S | 0.00 | 0.01 | 6.00 | 0.11 | 0.33 | 2.24 |
| 7-S | 0.12 | 0.09 | 5.11 | 0.09 | 0.28 | 2.98 |
| 8-S | 0.04 | 0.02 | 4.09 | 0.07 | 0.27 | 2.90 |
| 9-B | 0.12 | 0.10 | 3.86 | 0.07 | 0.27 | 4.49 |
| 10-S | 0.02 | 0.05 | 4.09 | 0.07 | 0.25 | 2.78 |
| 11-B | 0.08 | 0.12 | 3.75 | 0.05 | 0.30 | 2.95 |
| 13-S | 3.84 | 0.31 | 8.98 | 0.24 | 0.41 | 62.51 |
| 14-S | 2.13 | 0.26 | 6.71 | 0.16 | 0.28 | 35.88 |
| 15-B | 0.05 | 0.15 | 4.66 | 0.13 | 0.30 | 2.70 |
| 16-S | 1.48 | 0.21 | 6.25 | 0.14 | 0.24 | 23.39 |
| 17-B | 0.03 | 0.13 | 5.80 | 0.09 | 0.24 | 7.85 |
| 18-S | 1.12 | 0.23 | 4.66 | 0.11 | 0.27 | 20.81 |
| 19-S | 1.74 | 0.29 | 5.23 | 0.13 | 0.28 | 24.82 |
| 20-S | 1.37 | 0.27 | 6.93 | 0.12 | 0.25 | 20.22 |
| 21-B | 0.24 | 0.15 | 6.71 | 0.09 | 0.24 | 3.80 |
| 22-S | 0.19 | 0.16 | 7.05 | 0.06 | 0.28 | 4.36 |
| 23-B | 0.13 | 0.22 | 6.25 | 0.08 | 0.25 | 2.67 |
| 24-S | 0.03 | 0.12 | 5.80 | 0.06 | 0.27 | 1.90 |
| GEOMETRIC MEAN | 0.30 | 0.14 | 6.03 | 0.11 | 0.29 | 6.74 |



TABLE 2. Continued.

| Station | Turbidity (NTU) | Chlorophyll a (ug/l) | Salinity (°/oo) | Temp (°C) | Oxygen (% Sat) | pH |
|---|---|---|---|---|---|---|
| BRACKISH WATER WELL | | | | | | |
| 12 | 0.25 | * | 5.50 | 25.5 | 95 | 7.10 |
| MARINE WATERS | | | | | | |
| 1-S | 0.10 | 0.184 | 32.45 | 24.8 | 101 | 8.21 |
| 2-S | 0.06 | 0.168 | 33.77 | 24.4 | 102 | 8.23 |
| 3-B | 0.10 | 0.168 | 34.03 | 24.1 | 101 | 8.20 |
| 4-S | 0.09 | 0.168 | 33.97 | 24.3 | 101 | 8.21 |
| 5-B | 0.06 | 0.090 | 34.14 | 24.3 | 101 | 8.18 |
| 6-S | 0.07 | 0.216 | 34.07 | 25.1 | 102 | 8.13 |
| 7-S | 0.08 | 0.111 | 34.68 | 26.6 | 102 | 8.19 |
| 8-S | 0.06 | 0.148 | 34.72 | 26.2 | 101 | 8.21 |
| 9-B | 0.06 | 0.133 | 34.71 | 26.0 | 101 | 8.01 |
| 10-S | 0.08 | 0.174 | 34.75 | 26.1 | 100 | 8.19 |
| 11-B | 0.07 | 0.153 | 34.72 | 26.0 | 101 | 8.09 |
| 13-S | 0.12 | 0.235 | 32.80 | 26.1 | 101 | 8.26 |
| 14-S | 0.11 | 0.133 | 33.66 | 26.6 | 102 | 8.24 |
| 15-B | 0.08 | 0.153 | 34.71 | 26.0 | 102 | 8.02 |
| 16-S | 0.12 | 0.115 | 33.97 | 27.0 | 103 | 8.22 |
| 17-B | 0.07 | 0.153 | 34.76 | 26.4 | 101 | 7.96 |
| 18-S | 0.07 | 0.132 | 34.19 | 27.1 | 102 | 8.14 |
| 19-S | 0.07 | 0.276 | 33.94 | 26.2 | 100 | 8.22 |
| 20-S | 0.09 | 0.133 | 34.11 | 26.6 | 101 | 8.25 |
| 21-B | 0.08 | 0.112 | 34.72 | 26.5 | 102 | 8.21 |
| 22-S | 0.08 | 0.153 | 34.70 | 26.7 | 101 | 8.23 |
| 23-B | 0.07 | 0.143 | 34.76 | 26.2 | 101 | 8.23 |
| 24-S | 0.06 | 0.153 | 34.77 | 26.7 | 102 | 8.22 |
| GEOMETRIC MEAN | 0.08 | 0.152 | 34.22 | 25.9 | 101 | 8.18 |

The high geometric means for nitrate nitrogen, ammonia nitrogen and chlorophyll-a are probably related to several factors: groundwater input for the case of nitrate, high community metabolism which is characteristic of many coral reef settings for ammonia nitrogen and phytoplankton response to groundwater nutrient input in the case of chlorophyll-a.

BIOLOGICAL

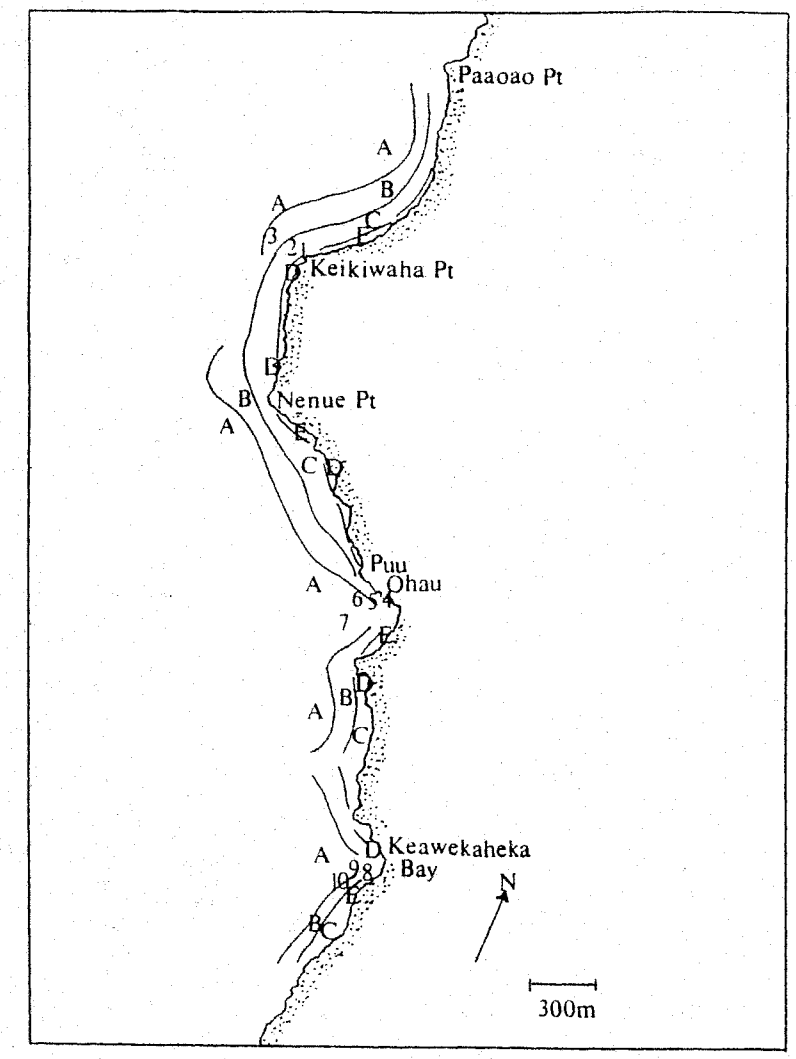
The qualitative reconnaissance to define major biotopes fronting the Hokukano project site extended from the shoreline to approximately the 20m isobath up to 460m from shore and is bordered by Paapao Point on the north and Keawekaheka Bay about 3.6km to the south. (Figure 3). In total more than 214ha (530 acres) were surveyed in this area and five biotopes were recognized. The physical extent of each is shown in Figure 3. It should be noted that the boundaries of each zone are not sharp but rather grade from one to another; these are ecotones or zones of transition. Biotopes were delimited by physical characteristics including water depth, relative exposure to wave and current action, and the major structural components present in the benthic communities. The latter include the amount of sand, hard substratum, and vertical relief present as well as the biological attributes of relative coral coverage, fish abundance, and dominant species of the coral community. Biotopes were named for distinctive features of each as shown in Figure 3.

The biotope of sand dominates areas offshore between Paaoao Point to Keikiwaha Point, fronting the small bay at Puu Ohau as well as offshore of Keawekaheka Bay. In general the biotope of sand occurs in deeper more offshore waters (well outside of the boundaries of this study) and forms a pie-shaped wedge into these bays. Offshore of much of the project site and at depths outside of this study the biotope of sand is a dominant feature. Because of the lack of appropriate shelter and solid substratum, benthic and fish communities are poorly developed in this biotope; Station 7 sampled the communities in this biotope.

Shoreward of the biotope of sand is the biotope of Porites compressa. The biotope of Porites compressa roughly occurs as a "band" paralleling the shoreline which frequently commences in at a depth of about 10 to 12m and may extend to depths in excess of 25m, again outside of the scope of this survey. The dominant feature of this biotope is the coral, Porites compressa. Three stations (numbers 3, 6 and 10) were established to sample this biotope. Inshore of the biotope of Porites compressa is the biotope of Porites lobata which is the dominant coral in this biotope. The biotope of Porites lobata is found at depths from 3.5 to about 10m in the study area. Inshore of the biotope of Porites lobata is either the biotope of boulders or the shallow high energy bench biotope. The biotope of boulders frequently is



Figure 3. Map of the shoreline and waters fronting the Hokukano project site depicting the approximate boundaries of the five biotopes present in this study (solid lines). The biotopes are: A = the biotope of sand, B = the biotope of Porites compressa, C = the biotope of Porites lobata, D = the biotope of boulders and E = the high energy bench biotope. Also shown are the locations of the 10 permanent stations (numbered) established to sample marine communities. The shoreline is stippled; map redrawn from USGS 7.5 minute quadrangle series map.






found just seaward of the shallow high energy bench biotope and often occurs as a rather narrow band of basalt boulders situated at the base of a near vertical slope just shoreward of which is the shallow high energy bench biotope. The biotope of boulders is dominated by basalt boulders affording considerable cover for fishes in water from 2.5 to about 6m in depth. Station 1 sampled this biotope, Stations 4 and 8 sampled the shallow high energy biotope and Stations 2 and 9 sampled the biotope of Porites lobata.

The shallow high energy bench biotope occurs as a seaward extension of a pahoehoe flow into the sea. This biotope is occurs from the shore seaward to the biotope of boulders anywhere from 8 to 30m from shore. Because of wave impact, the substratum in this biotope is rather barren with few corals.

The results of the quantitative surveys carried out in the five biotopes are described below.

The Biotope of Sand

The biotope of sand lies principally seaward of the project area but extends to within about 50m of shore at several locations. As the name implies, the substratum in the biotope of sand is dominated by sand. Because of its shifting nature, the benthic species found in sand habitats are generally adapted for life on an unstable and frequently abrading environment. Many species that are found in this habitat will bury into the sand to avoid predators and the abrasion that occurs with storm waves. Thus many species in the sand biotope are cryptic and difficult to see; among those are many molluscs and crustaceans such as the Kona crab (Rania serrata). Hence, without considerable time spent searching in the biotope of sand, many species in this habitat will not be seen. The biotope of sand is best developed at greater depths; where it enters the shallow water, many of the characteristic species become less abundant.

Benthic communities on sand substrates usually have their greatest development at depths below which wave impact occurs (below 30m). Because of constraints with bottom time at these depths, only a short qualitative survey was done. Species commonly seen in the deeper regions of the biotope of sand include a number of molluscs: the helmet shell (Cassis cornuta), augers (Terebra crenulata, T. maculata and T. inconstans), the leopard cone (Conus leopardus) and flea cone (Conus pulicarius) as well as the sea hare (Brissus sp.), starfish (Mithrodia bradleyi), brown sea cucumber (Bohadschia vitiensis), the Kona crab (Rania serrata), opelu or mackeral scad (Decapterus macarellus), nebeta (Hemipteronotus umbrilatus), the goby-like fish (Parapercis schauslandi), uku or snapper (Aprion virescens), hihimanu or sting ray (Dasyatis hawaiiensis), goby (Gnathelepis anjerensis)

and the weke or white goatfish (Mulloides flavolineatus). Undoubtedly with greater searching, many more species would be encountered in this biotope. Most of these species become less evident in the shallower portions of this biotope and this is reflected in the quantitative data collected at Station 7.

Station 7 was established in 18m of water about 200m offshore of the small unnamed bay located just south of Puu Ohau. The substratum at this station is sand. Table 3 presents the results of the quantitative survey carried out at Station 7; the only species encountered in the quantitative effort were a pair of auger shells (Terebra lanceta), one box crab (Calappa calappa) and a single juvenile nabeta (Hemipteronotus pavoninus). The fish standing crop was estimated to be 0.2 g/m$^2$ at this station.

The Biotope of Porites compressa

The characteristic feature of the biotope of Porites compressa is the usual dominance of the finger coral, Porites compressa. This biotope is usually confined to areas deeper than about 10 to 12m where the impact of waves has attenuated. It is a common feature of the submarine cliffs that commence in about 10m and terminate in about 30m of water fronting much of the project site and elsewhere in Kona.

Small scale cover and shelter is plentiful being provided by the coral Porites compressa. As a result there are a number of small fishes that commonly reside in this biotope. Among these are damselfishes, butterflyfishes, angelfishes, cardinalfishes squirrelfishes, moray eels and small wrasses. The adjacent submarine cliffs provide large scale vertical relief attracting wandering predators such as the mu or emperor (Monotaxis grandoculis), uku or snapper (Aprion virescens) and papio (several species of the family Carangidae).

Three stations were established to sample the biotope of Porites compressa; one of these (Station 3) was located offshore of Keikiwaha Point, another (Station 6) fronting the small unnamed bay just south of Puu Ohau and a third station established offshore of Keawekaheka Bay. In addition Station 5 sampled the ecotone or zone of transition between the biotope of Porites compressa and the biotope lying just shoreward of that, the biotope of Porites lobata in the Puu Ohau area.

Station 3 sampled the biotope of Porites compressa in the waters fronting Keikiwaha Point approximately 65m offshore at a depth of 17.1m. The transect was established roughly parallel to shore along the top of a steep slope dropping into more than 30m of water. The substratum at this station is a mix of live coral, coral rubble and some emergent basalt. The results of the quantitative survey carried out at this station are presented in Table



TABLE 3. Summary of the benthic survey conducted at Station 7 approximately 400m offshore of the small unnamed bay south of Puu Ohau, Hokukano, Hawaii in the biotope of sand on 12 December 1991. Results of the 6m$^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 18m; mean coral coverage is zero (quadrat method).

A. Quadrat Survey

| | Quadrat Number | | | | | |
|---|---|---|---|---|---|---|
| Species | 0m | 5m | 10m | 15m | 20m | 25m |
| Sand | 100 | 100 | 100 | 100 | 100 | 100 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Sand | 96 |
| Rubble | 4 |

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Mollusca | |
| Terebra lanceata | 2 |
| Phylum Arthropoda | |
| Calappa calappa | 1 |

D. Fish Census (4 x 25m)

1 Species
1 Individual
Estimated Biomass = 0.2 g/m$^2$

4. The quadrat survey noted five coral species present having a mean coverage of 27.8 percent; the dominant coral species is Porites compressa. The macroinvertebrate survey noted one he'e or octopus (Octopus cyanea), three sea urchin species (the black urchin - Tripneustes gratilla, the wana or long-spine urchin - Echinothrix diadema and the green urchin - Echinometra mathaei) one starfish (Linckia diplax) and one sea cucumber (Holothuria atra) species. The green sea urchin was the most abundant diurnally exposed macroinvertebrate species at this site. The results of the fish census are presented in Appendix A. In total, 33 species (705 individuals) of fishes were censused. The most abundant fishes were small damselfishes (Chromis vanderbilti and C. agilis, goldring surgeonfish or kole (Ctenochaetus strigosus), parrotofish or uhu (Scarus sordidus) and the unicornfish or kala holo (Naso hexacanthus). The standing crop of fishes was estimated to be 217 g/m$^2$; the species contributing heavily to this high biomass included the ringtail wrasse or po'ou (Cheilinus rhodochrous), the parrotfish or uhu (Scarus sordidus), the redlip parrotfish or palukaluka (Scarus rubroviolaceus), the yellow tang or lau'ipala (Zebrasoma flavescens) and the unicornfish or kala holo (Naso hexacanthus).

The second station (Station 6) sampling the biotope of Porites compressa was established about 90m offshore of Puu Ohau in 13.7 to 15.8m of water. The substratum at this station is a mix of live coral, coral rubble, a small amount of sand and basalt. This transect was situated about 35m seaward of a day-use mooring deployed to reduce anchor damage. Table 5 presents the results of the quantitative survey carried out at Station 6. The quadrat survey noted one soft coral species (Anthelia edmondsoni) and three coral species (Porites lobata, P. compressa and Pocillopora meandrina) having a mean coverage of 60.6 percent. The macroinvertebrate census noted one pair of banded shrimps (Stenopus hispidus) and three sea urchin species (the black urchin - Tripneustes gratilla, the green urchin - Echinometra mathaei and the rough spine urchin - Chondrocidaris gigantea). The results of the fish census are given in Appendix A. In total, there were 36 species (268 individuals) enumerated in this census. The most abundant fishes were the damselfish (Chromis agilis), the bluelined surgeonfish or maiko (Acanthurus nigroris), the goldring surgeonfish or kole (Ctenochaetus strigosus) and the yellow tang or lau'ipala (Zebrasoma flavescens). The biomass of fish was estimated to be 77 g/m$^2$ and the species contributing the most to this standing crop were the smooth puffer or keke (Arothron hispidus), the unicornfish or kala holo (Naso hexacanthus) the goldring surgeonfish or kole (Ctenochaetus strigosus) and the blue lined snapper or taape (Lutjanus kasmira).

Station 10 also sampled the biotope of Porites ocmpressa along the southern edge of Keawekaheka Bay approximately 40m from the shoreline. The substratum at Station 10 is a mix of coral



TABLE 4. Summary of the benthic survey conducted at Station 3 approximately 65m offshore of Keikiwaha Point, Hokukano, Hawaii in the biotope of Porites compressa on 11 December 1991. Results of the 6m$^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 17.1m; mean coral coverage is 27.8 percent (quadrat method).

A. Quadrat Survey

| Species | Quadrat Number 0m | 5m | 10m | 15m | 20m | 25m |
|---|---|---|---|---|---|---|
| Corals | | | | | | |
| Porites lobata | 3 | 3 | 19 | 1.5 | 1 | |
| P. compressa | 55 | 57 | 14 | 2.2 | 2 | |
| P. evermanni | | 8 | | | | |
| Pocillopora meandrina | | | 0.3 | | | |
| Montipora verrucosa | | | | | 0.5 | |
| Sand | | | | 4 | | 17 |
| Rubble | 42 | 32 | 26 | 65.3 | 96.5 | 74 |
| Hard Substratum | | | 40.7 | 27 | | 9 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Algae | |
| Halimeda opuntia | 2 |
| Soft Coral | |
| Anthelia edmondsoni | 2 |
| Corals | |
| Porites lobata | 16 |
| Porites compressa | 14 |
| Rubble | 48 |
| Hard Substratum | 18 |

(Table Continued on Next Page)

TABLE 4. Continued.

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Mollusca | |
| *Octopus cyanea* | 1 |
| Phylum Echinodermata | |
| *Tripneustes gratilla* | 5 |
| *Echinothrix diadema* | 2 |
| *Echinometra mathaei* | 23 |
| *Linckia dipiax* | 1 |
| *Holothuria atra* | 1 |

D. Fish Census (4 x 25m)

33 Species
705 Individuals
Estimated Biomass = 217 g/$m^2$



TABLE 5. Summary of the benthic survey conducted at Station 6 approximately 90m offshore of Puu Ohau, Hokukano, Hawaii in the biotope of *Porites compressa* on 11 December 1991. Results of the 6$m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ranges from 13.7 to 15.8m; mean coral coverage is 60.6 percent (quadrat method).

A. Quadrat Survey

| | Quadrat Number | | | | | |
|---|---|---|---|---|---|---|
| Species | 0m | 5m | 10m | 15m | 20m | 25m |
| Soft Coral | | | | | | |
| *Anthelia edmondsoni* | 1 | | | | | |
| Corals | | | | | | |
| *Porites lobata* | 55 | 32 | 55 | 41 | | 2 |
| *P. compressa* | 12 | 47 | 33 | 28 | 24 | 31 |
| *Pocillopora meandrina* | 2 | | | 1.5 | | |
| Sand | 2 | 4 | | | | |
| Rubble | | | 12 | | 76 | 67 |
| Hard Substratum | 28 | 17 | | 29.5 | | |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| *Porites lobata* | 24 |
| *Porites compressa* | 26 |
| Sand | 4 |
| Rubble | 12 |
| Hard Substratum | 34 |

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Arthropoda | |
| *Stenopus hispidus* | 2 |

(Table Continued on Next Page)

TABLE 5. Continued.

| Species | Number |
|---|---|
| Phylum Echinodermata | |
| Tripneustes gratilla | 4 |
| Echinometra mathaei | 87 |
| Chondrocidaris gigantea | 2 |

D. Fish Census (4 x 25m)

36 Species
268 Individuals
Estimated Biomass = 77 g/m$^2$



rubble (mostly Porites compressa) and live coral. This rubble slopes to the north meeting with a sand bottom about 20m away. Table 6 presents the results of the quantitative survey carried out at Station 10. The quadrat survey noted three species of corals (Porites lobata, P. compressa and Pocillopora meandrina) having a mean coverage of 31 percent. The macroinvertebrate census encountered five diurnally exposed species including a cone shell (Conus lividus), the black urchin (Tripnuestes gratilla), the slate-pencil urchin (Heterocentrotus mammillatus), the long-spine urchin or wana (Echinothrix diadema) and the green urchin (Echinometra mathaei). In the census of fishes, 29 species (269 individuals) were counted. The most abundant fishes were the damselfishes (Chromis vanderbilti and C. agilis), the goldring surgeonfish or kole (Ctenochaetus strigosus), the brown surgeonfish or maiko (Acanthurus nigroris), the blue-lined surgeonfish or ma'i'i'i (Acanthurus nigrofuscus) and the yellow tang or lau'ipala (Zebrasoma flavescens). The standing crop of fishes at Station 10 was estimated to be 65 g/m$^2$ and the species contributing the most to this biomass include a single blue spotted grouper or roi (Cephalopholis argus), saddleback wrasses or hinalea lauwili (Thalassoma duperrey) and orangebar surgeonfish or na'ena'e (Acanthurus olivaceus).

In the vicinity of Stations 3, 6 and 10 were seen a number of organisms not encountered in the quantitative counts. Among these were the corals Pavona varians, P. duerdeni and Pocillopora eydouxi, the wire coral (Cirrhipathes anguina), the blue goatfish or moano kea (parupeneus cyclostomus), undulated moray eel or puhi laumilo (Gymnothorax undulatus), the emperor or mu (Monotaxis grandoculis), jack treveily or omilu (Caranx melampygus) and the half beak or iheihe (Hemiramphus depauperatus).

The Biotope of Porites lobata

The biotope of Porites lobata is situated shoreward of the biotope of Porites compressa in waters from 4 to 10m in depth. In the study site, the biotope of Porites lobata appears as a near continuous feature except where the biotope of sand intervenes as a wedge close to the shoreline. The characteristic feature of this biotope is the presence of the coral, Porites lobata; colonies of this species are known to attain diameters in excess of four meters and at this size may be greater than 200 years of age. In this study several colonies were seen in the Keikiwaha and Nenue Point areas that had basal diameters of up to 3.5m.

Often associated with the large P. lobata colonies is a characteristic assemblage of fishes and invertebrates that diurnally shelter beneath the coral. Among these are some species of commercial interest including the squirrelfish or mempachi

TABLE 6. Summary of the benthic survey conducted at Station 10 approximately 40m offshore in Keawekaheka Bay, Hokukano, Hawaii in the biotope of *Porites compressa* on 14 March 1992. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ranges from 11.6 to 15.2m; mean coral coverage is 31 percent (quadrat method).

A. Quadrat Survey

| Species | Quadrat Number 0m | 5m | 10m | 15m | 20m | 25m |
|---|---|---|---|---|---|---|
| Corals | | | | | | |
| *Porites lobata* | 29 | | 3 | 1.5 | 14 | 35 |
| *P. compressa* | 42 | 5 | 0.5 | 3 | 3 | 49 |
| *Pocillopora meandrina* | 0.8 | | | | 0.1 | |
| Rubble | | 95 | 96.5 | 65.5 | 82.9 | 12 |
| Hard Substratum | 28.2 | | | 30 | | 4 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| *Fungia scutaria* | 2 |
| *Pocillopora meandrina* | 2 |
| *Porites lobata* | 6 |
| *Porites compressa* | 20 |
| Rubble | 54 |
| Hard Sustratum | 16 |

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Mollusca | |
| *Conus lividus* | 1 |
| Phylum Echinodermata | |
| *Tripneustes gratilla* | 6 |
| *Heterocentrotus mammiliatus* | 2 |
| *Echinothrix diadema* | 1 |
| *Echinometra mathaei* | 23 |



TABLE 6. Continued.

D. Fish Census (4 x 25m)

29 Species
269 Individuals
Estimated Biomass = $g/m^2$

(Myripristes amaenus), red goatfish or weke'ula (Mulloides vanicolensis), spiny lobsters or 'ula (Panulirus penicillatus) and the slipper lobster or ula'papa (Paribaccus antarcticus).

Two stations (Stations 2 and 9) were established to sample the biotope of Porites lobata. A third station (Number 5) sampled the zone of transition or ecotone between this biotope and the biotope of Porites compressa.

Station 2 was established about 30m offshore of Keikiwaha Point at a depth of 10.7m. The substratum at this station was a mix of live coral, emergent basalt and coral rubble. Cut into this substratum were small channels that are from 1 to 4m in width, 8 to 15m in length and up to 30cm in depth. These channels have a general orientation perpendicular to shore and are spaced from 3 to 20m apart. Corals are present across much of this substratum. Table 7 presents the results of the quantitative survey carried out at Station 2. The quadrat survey noted the cryptic olive-colored sponge (Halichondria melanadocia) and four coral species (Porites lobata, P. compressa, Montipora verrucosa and Pocillopora meandrina) having a mean coverage of 59 percent. Porites lobata is the dominant coral at this station. The transect line crossed one P. lobata colony having a basal diameter of 3.2m. The macroinvertebrate census noted seven species including two molluscs (Drupa morum and Conus miles) one spiny lobster or 'ula (Panulirus penicillatus), three sea urchin species (the black urchin - Tripneustes gratilla, the long spine urchin or wana - Echinothrix diadema and the green urchin - Echinometra mathaei) and one starfish (Linckia diplax). The results of the fish census for this station are presented in Appendix A. Forty-four species of fishes (462 individuals) were censused. The most abundant species included the squirrelfish or mempachi (Myripristes amaenus), the damselfish (Chromis vanderbilti), the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus), the goldring surgeonfish or kole (Ctenochaetus strigosus) and the yellow tang or lau'ipala (Zebrasoma flavescens). The standing crop of fishes at Station 2 was estimated to be 208 g/m$^2$; the most important contributors to this biomass include the squirrelfish or mempachi (Myripristes amaenus), the redlip parrotfish or palukaluka (Scarus rubroviolaceus), the orangebar surgeonfish or na'ena'e (Acanthurus olivaceus), the goldring surgeonfish or kole (Ctenochaetus strigosus), the orangespine unicornfish or umaumalei (Naso lituratus) and the unicornfish or kala holo (Naso hexacanthus).

Station 9 was established about 30m offshore along the southern side of Keawekaheka Bay in water from 8.2 to 10.4m of depth. The substratum at this station is a north facing wave cut pahoehoe bench that rapidly drops into deeper water. Across this substratum are small channels with intervening ridges or spurs. These ridges are from 4 to 15m wide, up to 25m in length and are



TABLE 7. Summary of the benthic survey conducted at Station 2 approximately 30m offshore of Keikiwaha Point, Hokukano, Hawaii in the biotope of Porites lobata on 11 December 1991. Results of the 6m$^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 10.7m; mean coral coverage is 59 percent (quadrat method).

A. Quadrat Survey

| | Quadrat Number | | | | | |
|---|---|---|---|---|---|---|
| Species | 0m | 5m | 10m | 15m | 20m | 25m |
| Sponge | | | | | | |
| Halichondria melanadocia | | | | | | 0.1 |
| Corals | | | | | | |
| Porites lobata | 87 | 92 | 85.7 | 17 | 1 | 3 |
| P. compressa | | | 1 | 65 | 1 | |
| Montipora verrucosa | 1 | 0.3 | | | | |
| Pocillopora meandrina | | | | 0.2 | | |
| Sand | | | | 4 | | |
| Hard Substratum | 12 | 7.7 | 13 | 13.8 | 98 | 96.9 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| Porites lobata | 34 |
| Porites compressa | 4 |
| Pocillopora meandrina | 2 |
| Rubble | 6 |
| Hard Substratum | 54 |

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Mollusca | |
| Conus miles | 1 |
| Drupa morum | 1 |
| Phylum Arthropoda | |
| Panulirus penicillatus | 1 |

TABLE 7. Continued.

| Species | Number |
|---|---|
| Phylum Echinodermata | |
| Tripneustes gratilla | 2 |
| Echinothrix diadema | 5 |
| Echinometra mathaei | 45 |
| Linckia diplax | 1 |

D. Fish Census (4 x 25m)

44 Species
462 Individuals
Estimated Biomass = 208 g/$m^2$



spaced from 3 to 15m apart. Corals (primarily Porites lobata) are present on the ridges and in the channels. Table 8 presents the results of the quantitative survey carried out at Station 9. The quadrat survey noted a small amount of the alga (Turbinaria ornata) and two soft coral species (Anthelia edmondsoni and Palythoa tuberculosa). Five coral species (Porites lobata, P. compressa, Pavona varians, Pocillopora meandrina and Montipora verrucosa) were present having a mean coverage of 11.3 percent. The macroinvertebrate census noted six species including a large triton's trumpet shell (Tritonalia tritonis), and five sea urchin species (the black urchin - Tripneustes gratilla, the long spine urchin or wana- Echinothrix diadema, the slate-pencil urchin - Heterocentrotus mammillatus, the boring urchin - Echinostrephus aciculatum, and the green urchin - Echinometra mathaei). The fish census noted 27 species (218 individuals). The most abundant fishes present were the damselfish (Chromis vanderbilti) the blue-line surgeonfish or ma'i'i'i (Acanthurus nigrofuscus), the saddleback wrasse or hinalea lauwili (Thalassoma duperrey) and the goldring surgeonfish or kole (Ctenochaetus strigosus). The biomass of fish at Station 9 was estimated to be 385 g/$m^2$; the single largest contributor to this estimated weight was a single whitetip shark (Triaenodon obesus) that was approximately 27kg in weight. Other species that were important in the biomass estimate were the blue goatfish or moano kea (Parupeneus cyclostomus), saddleback wrasse or hinalea lauwili (Thalassoma duperrey), parrotfish or uhu (Scarus sordidus), redlip parrotfish or palukaluka (Scarus rubroviolaceus) and the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus).

In the vicinity of Stations 2 and 9 were seen the coral (Montipora flabellata), the biting blenny (Plagiotremus ewaensis) and the brighteye damselfish (Plectroglyphidodon imparipennis).

The biotope of Porites lobata is not as well defined in the Puu Ohau area as is the biotope of Porites compressa; a third station (Station 5) was established to sample the zone of transition or ecotone between these two biotopes. Station 5 is situated on a broad plateau of pahoehoe that is about 60m wide and projects about 50m seaward. Water depth at the seaward (top) edge of this plateau is about 12m; shoreward a steep slope to shallow water is encountered at a depth of 8m. Lateral to the plateau are deeper channels that are cut in towards the shore; these channels range in width from 4 to 15m, 15 to 35m in length and are up to 7m in depth. The orientation of these channels is perpendicular to shore and they are spaced from 10 to 80m apart in the general area of Station 5.

The permanent transect at Station 5 was oriented parallel to shore across the pahoehoe plateau described above. This station is about 55m offshore at a depth of 11m. The substratum is dominated by both Porites lobata and P. compressa. Table 9 presents the results of the quantitative survey carried out at Stat-

TABLE 8. Summary of the benthic survey conducted at Station 9 approximately 30m offshore in Keawenaheka Bay, Hokukano, Hawaii in the biotope of Porites lobata on 14 March 1992. Results of the 6m$^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ranges from 8.2 to 10.4m; mean coral coverage is 11.3 percent (quadrat method).

A. Quadrat Survey

| Species | Quadrat Number 0m | 5m | 10m | 15m | 20m | 25m |
|---|---|---|---|---|---|---|
| Algae | | | | | | |
| Turbinaria ornata | 0.4 | | | 0.1 | | |
| Soft Corals | | | | | | |
| Anthelia edmondsoni | 0.1 | | | | | |
| Palythoa tuberculosa | | | | 0.1 | | |
| Corals | | | | | | |
| Porites lobata | 38 | 8 | 2 | 8 | 3.5 | 1.5 |
| P. compressa | 2 | 1.2 | | | | 1.3 |
| Pavona varians | | | | | 0.1 | |
| Pocillopora meandrina | 0.2 | | 0.1 | | 0.2 | |
| Montipora verrucosa | 1 | | 0.4 | 0.2 | | |
| Sand | | | 12 | | | 2 |
| Rubble | | 6 | 15 | 23 | 15 | 42 |
| Hard Substratum | 58.3 | 84.8 | 70.5 | 68.6 | 81.2 | 53.2 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| Montipora patula | 2 |
| Porites lobata | 4 |
| Sand | 8 |
| Rubble | 10 |
| Hard Substratum | 76 |

(Table Continued on Next Page)



TABLE 8. Continued.

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Mollusca | |
| Tritonalia tritonis | 1 |
| Phylum Echinodermata | |
| Tripneustes gratilla | 1 |
| Echinothrix diadema | 1 |
| Heterocentrotus mammillatus | 2 |
| Echinostrephus acicuiatum | 5 |
| Echinometra mathaei | 38 |

D. Fish Census (4 x 25m)

27 Species
218 Individuals
Estimated Biomass = 385 g/m$^2$

TABLE 9. Summary of the benthic survey conducted at Station 5 approximately 55m offshore of Puu Ohau, Hokukano, Hawaii in the ecotone between the biotopes of Porites compressa and Porites lobata on 11 December 1991. Results of the 6m$^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 11m; mean coral coverage is 75.2 percent (quadrat method).

A. Quadrat Survey

| | Quadrat Number | | | | | |
|---|---|---|---|---|---|---|
| Species | 0m | 5m | 10m | 15m | 20m | 25m |
| Corals | | | | | | |
| Porites lobata | 31 | 45 | 17 | 11 | 27 | 9 |
| P. compressa | 40 | 23 | 74 | 83 | 58 | 31 |
| Pocillopora meandrina | 2 | | | | | |
| Hard Substratum | 27 | 32 | 9 | 6 | 15 | 60 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| Porites lobata | 24 |
| Porites compressa | 26 |
| Hard Substratum | 50 |

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Echinodermata | |
| Tripneustes gratilla | 23 |
| Heterocentrotus mammillatus | 6 |
| Echinothrix calamaris | 2 |
| Echinometra mathaei | 244 |

D. Fish Census (4 x 25m)

39 Species
354 Individuals
Estimated Biomass = 242 g/m$^2$



ion 5; the quadrat survey noted three coral species (Porites lobata, P. compressa and Pocillopora meandrina) having a mean coverage of more than 75 percent. The macroinvertebrate census noted four sea urchin species (the black urchin - Tripneustes gratilla, the slate pencil urchin - Heterocentrotus mammillatus, the banded urchin - Echinothrix calamaris and the green urchin - Echinometra mathaei) in the 4 x 25m transect area. Thirty-nine species of fishes (354 individuals) were encountered in the visual census (Appendix A). The most abundant fishes were the red goatfish or weke'ula (Mulloides vanicolensis), damselfishes (Chromis vanderbilti and C. agilis), the threespot damselfish (Chromis verator), the goldring surgeonfish or kole (Ctenochaetus strigosus) and the yellow tang or lau'ipala (Zebrasoma flavescens). The standing crop of fishes at Station 5 was estimated to be 242 g/m$^2$ and the species comtributing most heavily to this biomass included the spotted grouper or roi (Cephapholis argus), the red goatfish or weke'ula (Mulloides vanicolensis), the redlip parrotfish or palukaluka (Scarus rubroviolaceus) and the goldring surgeonfish or kole (Ctenochaetus strigosus). In the vicinity of Station 5 was seen the blenny or pao'o kauila (Exallis brevis).

The Biotope of Boulders

The biotope of boulders occurs in shallow water close to the shoreline along the West Hawaii coast. Typically, basalt boulders dominate the substratum in this biotope. These boulders are usually situated in a narrow band that approximately parallels the shoreline just seaward and at the base of a shallow pahoehoe bench where water depths typically increase from 3-5m to 5 to 9m. The width of the biotope of boulders is usually about 30 to 40m and this zone is a near-continuous feature along much of the West Hawaii coastline. In the Hokukano study area the biotope of boulders is occasionally broken by the intervention of the shallow high-energy bench biotope or the biotope of sand. The physical extent of the biotope of boulders is depicted in Figure 3.

Because this biotope is found in shallow water, it is subjected to occasional impact of storm surf which retards the development of corals. Other than some encrusting coralline and microalgal species, as well as a small amount of two coral species (Pocillopora meandrina and Porites lobata) there is little obvious sessile biota in this biotope. One station (number 1) sampled the biota in this biotope.

Station 1 was established about 8m seaward of Keikiwaha Point in 7m of water in the biotope of boulders. As described above, the substratum at this station is pahoehoe overlain with large (mean diameter about 2m) boulders spaced from 0.1 to 4m apart. The results of the quantitative survey carried out at

Station 1 are given in Table 10. The quadrat survey noted a small amount of one algal species (Turbinaria ornata), a sponge (Spongia oceania) and four coral species (Porites lobata, Pocillopora meandrina, Montipora verrucosa and M. flabellata) having a mean coverage of 8.1 percent. The census of macro-invertebrates noted three sea urchin species (the ubiquituous green sea urchin - Echinometra mathaei, the boring urchin - Echinostrephus aciculatum, and the black sea urchin - Tripneustes gratilla). In the fish census 39 species (434 individuals) were counted as given in Appendix A. The most abundant fishes at Station 1 were the manybar goatfish or moano (Parupeneus multifasciatus), damselfish (Chromis vanderbilti), saddleback wrasse or hinalea lauwili (Thalassoma duperrey), blue lined surgeonfish or ma'i'i'i (Acanthurus nigrofuscus), brown surgeonfish or maiko (Acanthurus nigroris) and the goldring surgeonfish or kole (Ctenochaetus strigosus). The standing crop of fishes at Station 1 was estimated to be 234 g/$m^2$; the species contribution heavily to this biomass include the spectacled parrotfish or uhu uliuli (Scarus perspicillatus), the saddleback wrasse or hinalea lauwili (Thalassoma duperrey), the redlip parrotfish or palukaluka (Scarus rubroviolaceus), the orangespine surgeonfish or umaumalei (Naso lituratus) and the black triggerfish or humuhumu 'ele'ele (Melichthys niger). In the vicinity of Station 1 were seen the soft coral (Anthelia edmondsoni), the whitemouth moray or puhi 'oni'oni (Gymnothorax meleagris), the brown moray or puhi paka (Gymnothorax flavimarginatus) and the blenny (Cirripectes vanderbilti).

The boulder zone is well developed offshore of Nenue Point in water about 8 to 10m in depth. A short qualitative reconnaissance was undertaken in this area to develop a list of species encountered over a 20 minute period of observation. Species noted include corals (Montipora verrucosa, Porites lobata, Pocillopora meandrina, Cyphastrea ocellina and Leptastrea purpurea), soft corals (Palythoa tuberculosa and Anthelia edmondsoni), the coral eating starfish (Acanthaster plancii), the spiny lobster or 'ula (Panulirus penicillatus), the drupe shell (Drupa morum), the undulate moray or puhi laumilo (Gymnothorax undulatus), the whitespot squirrelfish or ala'ihi (Adioryx lacteoguttatus), trumpetfish or nunu (Aulostomus chinensis), squirrelfishes - the ala'ihi (Adioryx xantherythrus) and the mempachi (Myripristes amaenus), hawkfishes: the po'opa'a (Cirrhitus pinnulatus), the hilu piliko'a (Paracirrhites forsteri), and the piliko'a (Paracirrhites arcatus), the emperor or mu (Monotaxis grandoculis), the chub or nenue (Kyphosus bigibbus), yellow goatfish or weke'ula (Mulloides vanicolensis, the sidespot goatfish or malu (Parupeneus pleurostigma), the blue goatfish or moano kea (Parupeneus cyclostomus), the doublebar goatfish or munu (Parupeneus bifasciatus), the manybar goatfish or moano (Parupeneus multifasciatus), fourspot butterflyfish (Chaetodon quadrimaculatus), multiban butterflyfish or kikakapu (Chaetodon multicinctus), longnose butterflyfish or lauwiliwili



TABLE 10. Summary of the benthic survey conducted at Station 1 approximately 8m offshore of Keikiwaha Point, Hokukano, Hawaii in the biotope of boulders on 11 December 1991. Results of the 6$m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 7m; mean coral coverage is 8.1 percent (quadrat method).

A. Quadrat Survey

| Species | Quadrat Number 0m | 5m | 10m | 15m | 20m | 25m |
|---|---|---|---|---|---|---|
| Algae | | | | | | |
| Turbinaria ornata | | | | | | 0.1 |
| Sponges | | | | | | |
| Spongia oceania | | 0.1 | | | | 0.1 |
| Corals | | | | | | |
| Porites lobata | 3 | 3 | 7 | 12 | 11 | 9 |
| Pocillopora meandrina | 0.3 | | 0.1 | 0.1 | | 0.1 |
| Montipora verrucosa | 1 | | 1 | | 1 | |
| M. flabellata | | | | | | 0.1 |
| Sand | | | 1 | | | |
| Hard Substratum | 95.7 | 96.9 | 90.9 | 87.9 | 88 | 90.6 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Soft Coral | |
| Palythoa tuberculosa | 2 |
| Corals | |
| Porites lobata | 8 |
| Montipora verrucoas | 2 |
| Sand | 2 |
| Hard Substratum | 86 |

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Echinodermata | |
| Echinometra mathaei | 202 |
| Echinostrephus aciculatum | 9 |
| Tripneustes gratilla | 4 |

TABLE 10. Continued.

D. Fish Census (4 x 25m)

39 Species
434 Individuals
Estimated Biomass = 234 g/$m^2$



nukunuku'oi'oi (Forcipiger flavissimus, sergeant major or mamo (Abudefduf abdominalis), brighteye damselfish (Plectroglyphidodon imparipennis), damselfish Chromis vanderbilti), 'omilu or blue trevelly (Caranx melampygus), snapper or gurutsu (Alphareus furcatus) yellowstripe wrasse or hilu (Coris flavovittata), yellowtail coris or hinalea 'akilolo (Coris gaimard), saddleback wrasse or hinalea lauwili (Thalassoma duperrey), christmas wrasse or 'awela (Thalassoma fuscum), bird wrasse or 'akilolo (Gomphosus varius), parrotfish or uhu (Scarus sordidus), spectacled parrotfish or uhu'ahu'ula (Scarus perspicillatus), redlip parrotfish or palukaluka (Scarus rubroviolaceus), moorish idol or kihikihi (Zanclus cornutus), whitespot surgeonfish Acanthurus guttatus), convict tang or manini (Acanthurus triostegus), whitebar surgeonfish or maikoiko (Acanthurus leucoparieus), orangeband surgeonfish or na'ena'a (Acanthurus olivaceus), eye-stripe surgeonfish or palani (Acanthurus dussumieri), achilles tang or paku'iku'i (Acanthurus achilles), brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus), goldring surgeonfish or kole (Ctenochaetus strigosus), black surgeonfish (Ctenochaetus hawaiiensis), yellow tang or lau'ipala (Zebrasoma flavescens), sailfin tang or mane'one'o (Zebrasoma veliferum), orangespine unicornfish or umaumalei (Naso lituratus), lei triggerfish or humuhumu lei (Sufflamen bursa), black triggerfish or humuhumu 'ele'ele (Melichthys niger), the toby (Canthigaster jactator) and the spotted puffer or 'o'opuehue (Arothron meleagris).

Shallow High Energy Bench Biotope

The shallow high energy bench biotope is a seaward subtidal extension of the pahoehoe bench that fronts much of the project shoreline. The substratum in this biotope is pahoehoe and usually is restricted to water from 1 to about 5m in depth. Because of the shallow water, the benthic communities in this biotope are exposed to the impact of wave energy. As a consequence of this occasionally harsh circumstance, benthic communities are not well developed and corals found here frequently occur in prostrate growth forms. This biotope occurs as a common element along much of the coastline fronting the Hokukano project site and is found where the pahoehoe bench extends subtidally for some distance offshore. This biotope does not usually extend more than 30m offshore of the emergent pahoehoe shoreline. Where the shallow high energy bench biotope does not occur and the pahoehoe bench drops rapidly away from shore to 5-10m depths, the biotope of boulders is usually present and shallow high energy bench biotope is absent. The biotope of boulders is often present seaward of the shallow high energy bench biotope as a narrow band. Two stations (number 4 and 8) sampled the shallow high energy bench biotope.

Station 4 is situated about 20m from shore and 8m south of a small subtidal day-use mooring. The station is oriented parallel

to shore and commences in 9m of water and terminates in 3m of water. The substratum at this station is pahoehoe with is primarily in 3-4m of water and dropping away to 9m of depth. On the flat, small channels are present being from 1 to 2.5m wide, up to 0.3m deep and range from 5 to 15m in length. These channels are spaced from 2 to 15m apart. The results of the quantitative survey carried out at Station 4 are presented in Table 11. The quadrat survey noted three coral species present (Porites lobata, Pocillopora meandrina and Montipora verrucosa) having a mean coverage of 13 percent. The macroinvertebrate census encountered 9 species including the rock oyster (Spondylus tenebrosus), reticulated cowry (Cyprea reticulata), lined cone (Conus distans), large terebellid polychaete (Loimia medusa), black sea urchin (Tripneustes gratilla), slate-pencil urchin ( Heterocentrotus mammillatus), boring urchin (Echinostrephus aciculatum), banded urchin (Echinothrix calamaris) and the long spine urchin or wana (Echinothrix diadema). The fish census noted 44 species of fishes (600 individuals). The most abundant species of fish include damselfishes (Chromis vanderbilti and C. agilis), saddleback wrasse or hinalea lauwili (Thalassoma duperrey), brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus) and the goldring surgeonfish or kole (Ctenochaetus strioqsus). The standing crop of fishes was estimated to be 289 g/m$^2$ and the species contributing the greatest biomass to this estimate were the squirrelfish or mempachi (Myripristes amaenus), blue trevelly or 'omilu (Caranx melampygus), saddleback wrasse or hinalea lauwili (Thalassoma duperrey), orangespine unicornfish or umaumalei (Naso lituratus) and the black triggerfish or humuhumu 'ele'ele (Melichthys niger).

Station 8 was established about 15m offshore in Keawekaheka Bay along the southern side of the bay in water from 3 to 5.5m in depth. The substratum at this station is pahoehoe with spur and groove development. The grooves or channels are from 1.5 to 7m in width, up to 50m in length and from 1 to 3m in depth. These channels are spaced from 1 to 8m apart. The channels are oriented perpendicular to shore. Some potholes are also present on the intervening spurs or ridges and these are from 0.75 to 2m in diameter, up to 1.5m in depth and are spaced from 1 to 8m apart. The transect sampling this station was oriented parallel to shore and spanned two channels.

The results of the quantitative survey carried out at Station 8 are presented in Table 12. The quadrat survey noted a small amount of soft coral (Anthelia edmondsoni) and five coral species (Porites lobata, Pocillopora meandrina, Montipora verrucosa, Leptastrea purpurea and Pavona varians) which had a mean coverage of 9.7 percent. The macroinvertebrate census noted nine species including the rock oyster (Spondylus tenebrosus), the drupe shell (Drupa morum), black urchin (Tripneustes gratilla), boring urchin (Echinostrephus aciculatum), green urchin (Echinometra mathaei), black boring urchin (Echinometra



TABLE 11. Summary of the benthic survey conducted at Station 4 approximately 20m offshore of Puu Ohau, Hokukano, Hawaii in the shallow high energy bench biotope on 11 December 1991. Results of the 6m$^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ranges from 3.7 to 9.1m; mean coral coverage is 13 percent (quadrat method).

A. Quadrat Survey

| | Quadrat Number | | | | | |
|---|---|---|---|---|---|---|
| Species | 0m | 5m | 10m | 15m | 20m | 25m |
| Corals | | | | | | |
| Porites lobata | 3 | 2 | 2 | 3 | 2 | 36 |
| Pocillopora meandrina | 0.1 | 7 | 6 | 6 | 1 | 9 |
| Montipora verrucosa | 1 | | | | | |
| Hard Substratum | 95.9 | 91 | 92 | 91 | 97 | 55 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| Porites lobata | 2 |
| Pocillopora meandrina | 2 |
| Pavona duerdeni | 2 |
| Hard Substratum | 94 |

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Mollusca | |
| Conus distans | 1 |
| Cypraea reticulata | 1 |
| Spondylus tenebrosus | 2 |
| Phylum Annelida | |
| Loimia medusa | 1 |

(Table Continued on Next Page)

TABLE 11. Continued.

| Species | Number |
|---|---|
| Phylum Echinodermata | |
| *Tripneustes gratilla* | 1 |
| *Heterocentrotus mammillatus* | 3 |
| *Echinostrephus aciculatum* | 1 |
| *Echinothrix calamaris* | 2 |
| *Echinothrix diadema* | 13 |
| *Echinometra mathaei* | 15 |

D. Fish Census (4 x 25m)

44 Species
600 Individuals
Estimated Biomass = 289 g/$m^2$



TABLE 12. Summary of the benthic survey conducted at Station 8 approximately 15m offshore in Keawekaheka Bay, Hokukano, Hawaii in the shallow high energy bench biotope on 14 March 1992. Results of the 6$m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ranges from 3 to 5.5m; mean coral coverage is 9.7 percent (quadrat method).

A. Quadrat Survey

| | Quadrat Number | | | | | |
|---|---|---|---|---|---|---|
| Species | 0m | 5m | 10m | 15m | 20m | 25m |
| Soft Coral | | | | | | |
| *Anthelia edmondsoni* | | 1 | 0.4 | 1 | 0.1 | 0.1 |
| Corals | | | | | | |
| *Porites lobata* | 12 | 0.1 | 18 | 1 | 5 | 13 |
| *Pocillopora meandrina* | 8.5 | 0.1 | | | | 0.1 |
| *Montipora verrucosa* | 0.1 | | | | 0.2 | |
| *Leptastrea purpurea* | | | 0.1 | | | 0.1 |
| *Pavona varians* | | | | | 0.1 | |
| Rubble | | | 8 | | 40 | |
| Hard Substratum | 79.4 | 98.8 | 73.5 | 98 | 54.6 | 86.7 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| *Porites lobata* | 4 |
| *Pocillopora meandrina* | 2 |
| Rubble | 8 |
| Hard Substratum | 86 |

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Mollusca | |
| *Spondylus tenebrosus* | 2 |
| *Drupa morum* | 4 |

(Table Continued on Next Page)

TABLE 12. Continued.

| Species | Number |
|---|---|
| Phylum Echinodermata | |
| Tripneustes gratilla | 3 |
| Echinostrephus aciculatum | 1 |
| Echinometra mathaei | 32 |
| Echinometra oblongata | 1 |
| Echinothrix diadema | 5 |
| Echinothrix calamaris | 2 |
| Linckia diplax | 1 |

D. Fish Census (4 x 25m)

22 Species
195 Individuals
Estimated Biomass = 111 g/$m^2$



oblongata), long spine urchin (Echinothrix diadema), banded urchin (Echinothrix calamaris) and the green starfish (Linckia diplax). By far the most abundant macroinvertebrate was the green sea urchin (Echinometra mathaei). In the fish census 22 species (195 individuals) were counted (Appendix A). The most abundant fishes at Station 8 were the damselfish (Chromis vanderbilti), brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus), blue lined surgeonfish or maiko (Acanthurus nigroris) and the yellow tang or lau'ipala (Zebrasoma flavescens). The biomass of fish at Station 8 was estimated to be 111 g/$m^2$ and the species contributing heavily to this standing crop include the redlip parrotfish or palukaluka (Scarus rubroviolaceus), the whitebar surgeonfish or maikoiko (Acanthurus leucoparieus), the orangespine surgeonfish or umaumalei (Naso lituratus).

In the vicinity of Station 4 and 8 were seen the hawkfish or po'opa'a (Cirrhites pinnulatus) and the blue-eye damselfish (Plectroglyphidodon johnstonianus).

A short reconnaissance was made of the rocky intertidal region at several points along the project site. High in the intertidal were seen the grey littorine snail (Littorina pintado), the false opihi (Siphonaria normalis); further towards the water are seen the chiton (Acanthochiton viridis), a small amount of algae or limu including Grateloupia phuquoensis, 'aki'aki (Ahnfeltia concinna) and hulu'ilio (Giffordia breviarticulata) as well as the pupipi (Nerita picea) and the opihi (Patella sandwichensis). Further subtidally, other species seen include, the drupe shell (Drupa nodus), the Mauritius cowry (Cypraea mauritiana) and the large opihi (Patella talcosa).

During the course of the fieldwork considerable effort was made to determine if any green sea turtles (Chelonia mydas) were present in the waters fronting the Hokukano project site. Green turtles are a threatened species having been given that status in 1977-78. No turtles were seen during the course of the fieldwork despite the fact that more than 80 man-hours were spent in the water fronting the project site. Green turtles are a common element in the nearshore waters along much of the West Hawaii coast albeit most individuals seen are juveniles (i.e., having straight line carapace lengths >75cm). Green turtles typically resting on the bottom or under shelter and will forage on algae under the cover of darkness frequently on the intertidal bench habitat (Balazs 1980). Over much of the project site many areas were seen that could serve as appropriate resting habitat (i.e., caves, ledges, etc.) but very little algal forage was apparent anywhere in the project site. Very little algae were seen intertidally (such as Pterocladia capillacea) and this may be related to the high densities of herbivorous sea urchins (Colobocentrotus atrata, Echinometra oblongata and E. mathaei) which probably serve to effectively graze most of the algae down.

A well-known pod of spinner porpoises (Stenella longirostris) is resident to Kealakekua Bay (probably a resting area) about 3.7km to the south of the southern boundary of the project site. No spinner porpoises were seen during the course of the fieldwork. During the March 1992 field effort at least 6 humpback whales (Megaptera novaeangliae) were seen seaward of the study site. None of the whales appeared to get within 1 to 1.5km from the shoreline. Humpback whales are endangered and winter in Hawaiian waters from October through April. Interestingly, humpback whales were seen only in the March survey effort.

During the time of our field study considerable recreational use of the waters fronting the project site was noted. SCUBA and snorkel dive tours utilize these waters and many fishing boats do likewise. On the morning of 14 March 1992, at least six dive tour boats were anchored along the project site and two fishing boats were in the area through the morning hours. By 1100 hours the dive charter vessels had left and five of them returned by 1300 hours. During the course of the day at least 14 troll vessels had passed through the shallow waters fronting the project site. The waters offshore are important to the fishing charter industry -- Puu Ohau is locally known as "Red Hill" and is an area where many Pacific blue marlin (Makaira nigricans) are caught.

## DISCUSSION

### WATER QUALITY STUDIES

Groundwater inputs to the nearshore waters are evident in the water quality data particularly for the Puu Ohau and Keawekaheka Bay areas. Weak gradients in nitrate + nitrite nitrogen, silicate and salinity exist; similarly, chlorophyll-a is higher right adjacent to the shoreline. Because oceanic waters are low in these and other dissolved nutrient species, a concentration gradient is established.

The "composite" nutrient parameters of total nitrogen and total phosphorus yield the least information about water quality of the nutrient species measured in this study. The lack of definitive information from these parameters is the result of the makeup of these two composite species. Total phosphorus and nitrogen include a myriad of unspecified groups of dissolved organic materials, some of which are not found in groundwater and are of unknown biological function.

The geometric means for several parameters (i.e., nitrate + nitrite N, ammonia N, and chlorophyll-a) exceeded State DOH



standards for "dry" coastlines at the times of sampling; this is probably related to the input of high nutrient groundwater into the ocean. Chlorophyll-a is a measure of phytoplankton biomass. The input of inorganic nutrients via groundwater seepage to nutrient-poor nearshore waters will enhance phytoplankton biomass.

Despite the geometric means of the above parameters exceeding "dry" criteria, none of them exceeded values specified by DOH as "not to exceed the given value more than 10% of the time" or the "wet" criteria. It is interesting to note that State standards for open coastal waters are frequently exceeded irrespective of the presence of nearby coastal development. Brock and Kam (1989) found that under dry conditions nitrate + nitrite nitrogen concentrations are equal to "dry" criteria for waters fronting Lahaina, Maui (a developed area) and that chlorophyll-a exceeded the "wet" criteria; following a heavy rain (858mm or 3.38 inches over a 24-hour period) nitrate + nitrite nitrogen, turbidity and chlorophyll-a all exceeded state standards (Brock 1990a). At Mahukona, Hawaii an area with little surrounding development both chlorophyll-a and ammonia nitrogen exceeded DOH "dry" standards (Marine Research Consultants 1989, Brock 1990b). A weekly ocean water quality monitoring program has been in place at the Natural Energy Laboratory of Hawaii (NELH) at Keahole Point, Hawaii since 1982. The waters offshore of Keahole Point are considered to be pristine; the presence of high quality deep ocean water adjacent to shore was an important factor in locating the NELH facility there. The longterm mean for ammonia nitorgen at Keahole Point is 0.36uM which exceeds state "dry" standards. The fact that pristine Kona waters exceed state standards for ammonia nitrogen suggests that the standard may be too stringent. Other longterm means from NELH are similar to the concentrations of nutrients measured in the waters fronting Hokukano; nitrate NELH = 0.20uM, Hokukano = 0.30uM; orthophosphate: NELH = 0.16uM, Hokukano = 0.11uM; ammonia nitrogen: NELH = 0.36uM, Hokukano = 0.14uM. The NELH data are courtesy of the University of Hawaii Analytical Services Laboratory.

### BIOLOGICAL STUDIES

Despite considerable effort, no anchialine pools were located on this project site. Anchialine pools are landlocked coastal brackish water pools with no obvious surface connection to the sea. They are interconnected to the ocean through the porous substratum in which they are situated. Anchialine ponds usually harbor a distinctive assemblage of organisms, some of which are found nowhere else. This community is dominated by a number of red caridean shrimps, of which the most abundant and characteristic species is the 'opae'ula or Halocaridina rubra. 'Opae'ula live not only in the anchialine pools but also in the interconnected watertable beneath the pools. Colonization of anchialine pools by these shrimp and other aquatic species is probably via

the watertable.

As noted above, the small well located about 50m from the shoreline along the south side of Puu Ohau (water quality sample no. 12) is narrow and about 5m to the water's surface. We were unable to ascertain the presence or absence of anchialine species in the well because the opening was to narrow for safe passage; it is probably safe to assume that 'opae'ula are present in this well. This species is present in most coastal brackish water features that lack fishes. The well appears to have been dug by man sometime in the past thus is probably not a natural feature.

The unsampled cave with water at the north end of the property at approximately the 30m contour (Cultural Surveys Hawaii site no. 345) has "large prawns present" (Mr. Doug Borthwick, pers. comm.). The species present is probably the exotic Tahitian prawn (Macrobrachium lar). The presence of this species suggests that this body of water is interconnected to the sea via the underlying watertable and that the water in the cave does have a measurable salinity. Macrobrachium lar recruits to these settings via larvae from the ocean. This site will be sampled both for water quality and biota.

Studies conducted on coral reefs in Hawaii and elsewhere have estimated fish standing crops to range from 20 to 200g per square meter (Brock 1954, Brock et al. 1979). Eliminating the direct impact of man due to fishing pressure and/or pollution, the variation in standing crop appears to be related to the variation in the local topographical complexity of the substratum. Thus habitats with high structural complexity affording considerable shelter space usually harbor a greater estimated standing crop of coral reef fish; conversely, transects conducted in structurally simple habitats (e.g., sand flats) usually result in a lower estimated standing crop of fish (5 to 20g/$m^2$). Goldman and Talbot (1975) noted that the upper limit to fish biomass on coral reefs is about 200g/$m^2$. Ongoing studies (Brock and Norris 1989) suggest that with the manipulation (increasing) of habitat space or food resources (Brock 1987), local fish standing crops may approach 2000g/$m^2$. Thus under certain circumstances, coral reefs may be able to support much larger standing crops of fishes than previously realized.

A summary of the standing crop of fishes by family for all stations is presented in Table 13. Unusually high standing crops were encountered at Stations 1, 2, 3, 4, 5, and 9; other than Station 9 the high biomass is probably related to the large amount of shelter available for fishes as well as to the probable low fishing pressure exerted in the waters fronting the project site. The high estimated standing crop at Station 9 is related to a single whitetip shark (estimated weight 27kg) that swam through the transect area while the census work was in progress. Without the whitetip shark the estimated standing crop is 113



TABLE 13. Summary of the biomass estimates (in g/$m^2$) calculated from estimated individual fish lengths in the field for families of fishes that collectively contributed 97 percent or more to the standing crop of fishes at the ten permanent stations sampled in this study.

| | Station Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Family | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Acanthuridae | 8441 | 6999 | 8605 | 10439 | 3930 | 3101 | | 5959 | 2900 | 2632 |
| Balistidae | 1639 | 2744 | 180 | 3995 | 231 | 569 | | 1813 | 748 | 258 |
| Canthigasteridae | | 4 | | 26 | | | | 4 | | |
| Carangidae | | | | 2679 | | | | 150 | | |
| Chaetodontidae | 10 | 132 | 374 | 229 | 355 | 200 | | 18 | 49 | 55 |
| Chanidae | | | 5443 | | | | | | | |
| Cirrhitidae | 65 | 184 | 4 | 131 | 407 | 144 | | 34 | | 33 |
| Holocentridae | | 5914 | | 2764 | 1302 | 246 | | | 422 | 88 |
| Kyphosidae | | | | 429 | | | | | | |
| Labridae | 1966 | 1023 | 1121 | 3170 | 1405 | 753 | 20 | 520 | 1430 | 1186 |
| Lutjanidae | 202 | 105 | 693 | 70 | 751 | 670 | | | | 202 |
| Monacanthidae | | | | | | | | | 46 | |
| Mullidae | 1705 | 150 | 747 | | 7709 | 250 | | 394 | 2715 | 475 |
| Muraenidae | | 171 | | | | | | | | |
| Pomacentridae | 162 | 173 | 1023 | 944 | 786 | 99 | | 48 | 43 | 78 |
| Scaridae | 9168 | 2268 | 3412 | 1686 | 5478 | 140 | | 1732 | 2920 | 366 |
| Serranidae | | 472 | | 1077 | 1355 | | | | | 1077 |
| Tetraodontidae | 3 | | | | | 1445 | | | | |
| Triakidae | | | | | | | | | 27215 | |
| Zanclidae | 55 | | 48 | 110 | 55 | 55 | | 422 | 55 | |
| Total Station Percent | 99.9 | 97.6 | 100 | 99.3 | 98.1 | 99.3 | 100 | 100 | 100 | 99.6 |

$g/m^2$. Two families of fishes dominate the biomass estimates; these are the surgeonfishes (Acanthuridae) and the parrotofishes or Scaridae. The acanthurids comprise 31 percent of the biomass over all stations and the scarids, 13 percent. Fishes in both of these families are primarily herbivorous. The standing crop of fishes met with at the other stations are typical for many Hawaiian localities. The lack of fishes over sand (Station number 7) is not unusual. Standing crop estimates in Hawaiian sand habitats range from 0 to about $20g/m^2$ (Brock 1954, Brock et al. 1979).

Excluding the corals, the invertebrate censuses did not yield any unusual results; species common to the habitats examined in this study are the same as one would commonly encounter elsewhere on the West Hawaii coast or in other similar Hawaiian habitats. As noted above, the census techniques used here for macroinvertebrates assesses only those species that are large (greater than 2cm in some dimension), diurnally exposed, and are motile. The method is probably accurate for some of the echinoderm species but little else. Thus the macroinvertebrate census data are of limited value for describing the benthic community. Sessile and/or colonial forms are assessed by use of the quadrat and the point-intersect technique.

Physical disturbance from occasional storm surf is one of the most important parameters in determining the structure of Hawaiian coral communities (Dollar 1982). Numerous studies have shown that occasional storm generated surf may keep coral reefs in a non-equilibrium or sub-climax state (Grigg and Maragos 1974, Connell 1978, Woodley et al. 1981, Grigg 1983). Indeed, the large expanses of near-featureless lava or limestone substratum present around much of the Hawaiian Islands at depths less than 30m attest to the force and frequency of these events (Brock and Norris 1989). These same wave forces also impinge and impact fish communities (Walsh 1983).

The results of the biological survey of the waters fronting the Hokukano project site suggest that portions of this project site, like many other Hawaiian marine communities receives considerable, albeit occasional, wave impact. In general, the open substratum present in the shallow high energy bench biotope as well as certain areas in the biotope of Porites compressa (especially in Keawekaheka Bay) is probably the result of wave action retarding the development of the coral communities. The small size of many of the coral colonies suggests that wave forces are important in structuring the benthic communities in these areas. The impact of wave forces is attenuated with increasing depth such that, in general, benthic community development is greater with increasing depth at the project site.

The results of the biological survey show that benthic and fish community development is greatest in the biotope of Porites compressa and the biotope of Porites lobata and least in the



biotope of sand. The important quantitative measures (i.e., number of coral species and cover, number of fish species and biomass) made in these communities are summarized in Table 14. The communities in these biotopes have the greatest biological development which is probably related to relative lack of disturbance by wave impact in deeper water as well as the abundance of hard and stable substratum. Both of these factors are requisites for the success of corals. The stable hard substratum and coral development creates shelter which is necessary for most fish species. If the assumptions about the requisites for successful coral and fish population growth are correct, this suggests that the diversity in the benthic and fish communities resident to the study area is related to the presence of appropriate hard substratum generally protected from storm surge and surf.

## POTENTIAL IMPACTS TO MARINE COMMUNITIES WITH THE PROPOSED DEVELOPMENT

The diversity of the nearshore communities at fronting the Hokukano project site and environs have persisted under the present conditions of occasional storm surf and groundwater inputs. Groundwater inputs to the nearshore marine communities in the study area appears to be low based on the small surface salinity depressions encountered relative to other areas along the West Hawaii coast. Surface runoff due to high rainfall is probably a rare event in the Hokukano project area due to the arrid nature and the probable high porosity of the substratum of this area. However, some surface runoff may occur with high rainfall. Casual examination of the sand substratum in the study area snows a relatively high percentage of basalt mixed with the carbonate sand probably from the breakdown of basalt rock with storm surf as well as erosion of the shoreline during periods of high surf. Despite these impacts, the marine communities have persisted.

Without attention given to the appropriate measures (e.g., settlement basins and the development of appropriate drainage systems, etc.) during development of the site, sediment could possibly be carried to the sea if a high rainfall event were to occur when vegetative cover was low or absent. Sedimentation has been implicated as a major environmental problem for coral reefs. Increases in turbidity may decrease light levels resulting in a lowering of primary productivity. Perhaps a greater threat would be the simple burial of benthic communities that may occur with high sediment loading. Many benthic species including corals are capable of removing sediment settling on them but there are threshold levels of deposition where cleaning mechanisms may be overwhelmed and the individual becomes buried. However the impact of sedimentation on Hawaiian reefs may be overstated. Dollar and Grigg (1981) studied the fate of benthic communities

TABLE 14. Summary of the quantitative biological observations made at 10 stations sampling five biotopes recognized in this study.

| Biotope | Station No. | Depth (m) | No. Coral Spp. | Mean Cover (%) | No. Fish Spp. | Biomass ($g/m^2$) |
|---|---|---|---|---|---|---|
| Biotope of Sand | 7 | 18 | 0 | 0 | 1 | 0.2 |
| Biotope of *Porites compressa* | 3 | 17 | 5 | 28 | 33 | 217 |
| | 6 | 14-16 | 3 | 61 | 36 | 268 |
| | 10 | 12-15 | 3 | 31 | 29 | 65 |
| | Means | 15 | 4 | 40 | 33 | 183 |
| PC/PL Ecotone | 5 | 11 | 3 | 75 | 39 | 242 |
| Biotope of *Porites lobata* | 2 | 11 | 4 | 59 | 44 | 208 |
| | 9 | 8-10 | 5 | 11 | 27 | 385 |
| | Means | 10 | 5 | 35 | 36 | 297 |
| Biotope of Boulders | 1 | 7 | 4 | 8 | 39 | 234 |
| Shallow High Energy Bench Biotope | 4 | 7 | 3 | 13 | 44 | 289 |
| | 8 | 5 | 5 | 10 | 22 | 111 |
| | Means | 6 | 4 | 12 | 33 | 200 |



at French Frigate Shoals in the Northwest Hawaiian Islands following the accidental spill of 2000 tons of kaolin clay. These authors found that after two weeks there was no damage to the reef corals and associated communities except where the organisms were actually buried by the clay deposits for a period of more than two weeks.

If permitted to proceed, the proposed development will increase the potential for runoff during the construction phase. Historically, impacts to marine communities due to sedimentation have been virtually non-existent on the West Hawaii coast due to low rainfall, high substrate porosity and little soil on the coastal plains. If prudent construction practices are followed (i.e., not uncovering too much soil at any one time, building temporary catchment and settling basins, etc.) little or no sediment should reach the sea even with a high rainfall event. Following project completion, the soil should be covered and/or planted such that the opportunity for sediment from the project site to reach the sea will be less than at present.

The chemical environment may, to a large degree, dictate the structural and functional characteristics of aquatic communities thus alteration in this environment may serve to change marine communities. If changes in physio-chemical inputs are not too great, a potential for chronic, low-level disturbance can result in adjacent aquatic communities. In the development and operation of a coastal community in a low rainfall setting such as at Hokukano, chronic disturbance may possibly come from the irrigation and upkeep of golf courses. In many dry coastal Hawaiian communities, golf courses are irrigated by a combination of brackish groundwater and treated resort/residential sewage effluent. In addition, dry fertilizers, pesticides and herbicides are applied to these courses as needed. The nutrient subsidy from fertilizers and sewage as well as the pesticides and herbicides placed on these golf courses could migrate downward to the groundwater table and move laterally in the low salinity watertable towards the shoreline.

The potential for such impact may be addressed through an examination of water quality data collected on the West Hawaii coast at Waikoloa (about 55km to the north of the project site). A relatively longterm and routine water quality and aquatic community monitoring program has been in place at Waikoloa and is carried out by the University of Hawaii. A characterisitic feature of West Hawaii is its diffuse groundwater discharge at the shoreline due to the island's geologically young lavas (Cox *et al*. 1969). The high porosity of these young lavas will not support water contained above sealevel near the shoreline, resulting in a system where groundwater moves rapidly through the lava towards the sea and seawater readily intrudes (Cox *et al*. 1969). In this porous setting are depressions or pools that extend down into the watertable; these ponds are termed anchial-

ine pools but are not present on the project site.

The characteristics of the groundwater entering the ocean at Waikoloa have been described by Maciolek and Brock (1974), Bienfang (1977), Ziemann (1984, 1985), U.S. Army Corps of Engineers (1985), Brock and Norris (1987, 1988a), Brock et al. (1988) and Brock and Kam (1990). Since April 1986 a regular program of water quality sampling and monitoring of benthic communities has been undertaken; the program monitors tide state, salinity, nutrient, pesticide and herbicide levels in anchialine pools, the nearshore marine environment and at other West Hawaii locations with no surrounding development.

Summarizing the data presented by Brock and Norris (1987, 1988a), Brock et al. (1988) and Brock and Kam (1990), the concentration of inorganic nutrients is high in inland (mauka) pools and decreases in a seaward direction. Inland of the pools is golf course development; mauka of the golf course and planted grounds are a series of wells dug for irrigation purposes. Nutrient concentrations are low in the wells. Brock and Norris (1988a) concluded that the source of high nutrient levels observed in the pools was from the Waikoloa golf course which is heavily fertilized with sewage enriched irrigation water and commercial fertilizers. It was suggested that leaching of these materials through the thin topsoil to the groundwater beneath was occurring. Brock and Norris (1988a) found no statistically significant changes in water quality from the 1986-1988 period during the operation of the resort but significant changes had occurred in comparing the period prior to resort development (1977) to the 1986-88 period. The observed increases were for nitrate + nitrite nitrogen and orthophosphate. Despite these changes, these authors note that the 1986-88 mean concentrations of nitrate + nitrite nitrogen, ammonia nitrogen, orthophosphate, silicate, total organic carbon in the waters from the developed Waikoloa setting fall well within the range of values measured in anchialine and shoreline areas along the West Hawaii coast with no surrounding development. Furthermore the concentration gradient in nutrients at Waikoloa shows minimal elevation at the shoreline and 100m seaward of the shore is not detectable (Brock and Norris 1988a). Other than arsenic, pesticides and herbicides applied at Waikoloa are not detectable; arsenic concentrations were the same in groundwater from either developed or control areas (with no surrounding development) as well as in Kona drinking water suggesting that low levels of arsenic contamination are natural in Kona coast groundwater (Brock and Norris 1988a, Brock and Kam 1990). More recently, tissue samples of long-lived shrimp (at least 10 years) from pools at Waikoloa and elsewhere were subjected to an organophosphate "screen" by the State Department of Health and no evidence of organophosphate insecticides or herbicides were noted despite use of some of these materials at that site.



Mean nitrate + nitrite nitrogen concentrations reported by Brock and Norris (1988a) range from a high in mauka pools of 90uM to 2.7uM at the shoreline. In other locations naturally occurring nitrate nitrogen levels are greater; Johannes (1980) reported groundwater nitrate levels between 115 to 380uM from Perth, Australia and Marsh (1977) noted nitrate nitrogen concentrations in Agana, Guam groundwater of 177uM. The highest known concentration of nitrate + nitrite nitrogen consistently found along the West Hawaii coast was 180uM in the Kukio land division, an area with no surrounding or upland development (Brock and Kam 1990, Brock unpublished data). Thus, high nitrate values are a naturally occurring phenomena in groundwater entering the sea on Hawaiian coastlines. These high nitrate values are probably related to the speed at which groundwater emanates to the sea; with longer residence times, nitrate concentration could increase in the groundwater.

Periodic sampling of the aquatic biota of the anchialine pools at Waikoloa since 1972 (Maciolek and Brock 1974) to present have yielded no obvious change in ponds where exotic fish (i.e., non-native species such as topminnows and tilapia) have not been introduced. Brock and Norris (1988a) point out that the aquatic biota is unaffected by the nutrient loading. Possible mechanisms to the apparent insensitivity of the aquatic biota to the excess nutrients may be the characteristic short water residence time of ponds and the usual presence of large numbers of the herbivorous shrimp (opae'ula). Through their grazing, these crustaceans appear to keep many macrothalloid algal species and possibly phytoplankton from otherwise dominating the system. Also, the insensitivity of the biota to high nutrient levels may be a reflection of their living in a habitat that naturally has a highly variable nutrient chemistry thus they are preadapted to such a system.

With the extremely low inorganic nutrient concentrations that typify marine waters, benthic algae rapidly strip out the nutrients found in any incoming groundwater at Waikoloa (Brock and Norris 1988a). Macrothalloid algal species are rare at Waikoloa probably due to the high grazing pressure exerted by herbivorous fishes and sea urchins in the shallow subtidal areas (Brock and Norris 1988b). The marine baseline survey of the waters fronting Waikoloa carried out in August 1988 found no unique or unusual marine communities but rather the marine fish and benthos of Waikoloa are very similar to those encountered elsewhere in other West Hawaii reef sites; there was no evidence of man-induced disturbance in these communities (Brock and Norris 1988b) suggesting that what little nutrient input has occurred has had no discernible impact.

The longterm studies at Waikoloa suggest that coastal resort development (in particular, golf courses) may increase the concentration of inorganic nutrients in the underlying groundwater

but that these changes are (1) not chemically detectable outside of 100m of shore, and (2) do not manifest any discernible change in the aquatic communities whether these communities are in brackish or marine waters. The Waikoloa development is situated on a very porous substrate of pahoehoe and a'a lava located just a few meters above mean sealevel and having only a thin (about 30cm) layer of soil for planting.

The Waikoloa data suggest that development of the Hokukano project site may, over a long period of time, increase the concentration of inorganic nutrients in the underlying watertable but that the increases will not exceed concentrations seen in a number of other natural systems in Hawaii. These data further suggest that there should be no discernible impact on marine communities due to any change in nutrient chemistry.



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APPENDIX A. Results of the quantitative visual censuses conducted at ten locations offshore of the Hokukano project site, Hawaii in the period from December 1991 through March 1992. Each entry in the body of the table represents the total number of individuals of each species seen; totals are presented at the foot of the table along with an estimate of the standing crop ($g/m^2$) of fishes present at each location.

| Family and Species | Station Number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| ACANTHURIDAE | | | | | | | | | | |
| Acanthurus olivaceus | 1 | 2 | 3 | 1 | 1 | | | 1 | 1 | 3 |
| A. nigroris | 24 | 13 | 29 | 13 | 8 | 26 | | 13 | | 26 |
| A. nigrofuscus | 29 | 16 | | 44 | | 7 | | 13 | 55 | 19 |
| A. achilles | 4 | 10 | | 4 | 5 | | | | | |
| A. dussumieri | 6 | 1 | | 1 | | 2 | | 9 | 1 | |
| A. mata | 10 | | 3 | 4 | 1 | | | | | |
| A leucoparieus | 3 | | | 6 | 3 | | | 16 | | |
| A. xanthopterus | | | 1 | | | | | | | |
| A. guttatus | | | | 3 | | | | | | |
| Ctenochaetus strigosus | 24 | 49 | 64 | 55 | 78 | 50 | | 3 | 22 | 62 |
| C. hawaiiensis | | | | 8 | | 1 | | 2 | | |
| Naso lituratus | 10 | 3 | 4 | 12 | 2 | 5 | | 5 | 5 | 1 |
| N. hexacanthus | | 13 | 37 | | | 6 | | | | |
| N. unicornis | | 1 | 2 | | | | | | | |
| Zebrasoma flavescens | 18 | 17 | 17 | 19 | 20 | 27 | | 20 | 11 | 21 |
| Z. veliferum | 1 | | | | | | | | | |
| APOGONIDAE | | | | | | | | | | |
| Apogon kallopterus | | 4 | | | | | | | | |
| AULOSTOMIDAE | | | | | | | | | | |
| Aulostomus chinensis | | 2 | | 2 | | | | | | |
| BALISTIDAE | | | | | | | | | | |
| Melichthys niger | 6 | 14 | | 17 | | | | 9 | 3 | |
| M. vidua | 1 | 1 | | 1 | | 1 | | | | |
| Sufflamen bursa | 2 | 3 | 2 | 8 | 2 | 2 | | 4 | 3 | 3 |
| Xanthichthys auromarginatus | | | | | | 4 | | | | |
| BLENNIIDAE | | | | | | | | | | |
| Exallis brevis | | 1 | | | | | | | | 1 |
| Cirripectus vanderbilti | | | | | | | | | | 1 |
| CANTHIGASTERIDAE | | | | | | | | | | |
| Canthigaster jactator | | 1 | | 1 | | | | 1 | | |
| C. rivulata | | | | 1 | | | | | | |
| | | 61 | | | | | | | | |



APPENDIX A. Continued.

| Family and Species | Station Number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CARANGIDAE | | | | | | | | | | |
| Caranx meiampygus | | | | 1 | | | | | | |
| Scomberoides laysan | | | | 1 | | | | 1 | | |
| CHAETODONTIDAE | | | | | | | | | | |
| Chaetodon lunula | | 1 | | | 2 | | | | | |
| C. quadrimacuiatus | 1 | 1 | | 2 | | 1 | | | | |
| C. multicinctus | 1 | 4 | 13 | 4 | 7 | 11 | | | 6 | 6 |
| C. ornatissimus | | 2 | 2 | 2 | 3 | 1 | | | | |
| Forcipiger flavissimus | | | 2 | 4 | 6 | 1 | | 2 | | |
| F. longirostris | | | | | | | | | 1 | |
| CHANIDAE | | | | | | | | | | |
| Chanos chanos | | | 1 | | | | | | | |
| CIRRIHITIDAE | | | | | | | | | | |
| Paracirrihitus forsteri | | 2 | | | | 1 | | | | |
| P. arcatus | 3 | 4 | 9 | 8 | | 2 | | 6 | | 2 |
| Cirrhitops fasciatus | 1 | 1 | | | | | | | | |
| Cirrhitus pinnulatus | | | | | 1 | | | | | |
| FISTULARIIDAE | | | | | | | | | | |
| Fistularia commersoni | | | | 1 | | | | | | |
| HOLOCENTRIDAE | | | | | | | | | | |
| Myripristis amaeneus | | 42 | | 15 | 13 | 3 | | | 3 | |
| Adioryx diadema | | | | | | | | | | 4 |
| A. lacteoguttatus | | | | | | | | | | 3 |
| KYPHOSIDAE | | | | | | | | | | |
| Kyphosus bigibbus | | | | 1 | | | | | | |
| LABRIDAE | | | | | | | | | | |
| Bodianus bilunulatus | 2 | | | | | | | | | 1 |
| Cheilinus unifasciatus | | 1 | 1 | 1 | 1 | 1 | | | | |
| Thalassoma duperrey | 47 | 12 | 11 | 58 | 5 | 4 | | 9 | 27 | 22 |
| T. ballieui | 2 | 1 | 1 | | 1 | 4 | | | 3 | 2 |
| T. fuscum | | | | | | | | 6 | | |
| Stethojulis balteata | 1 | | | | | 1 | | 1 | 1 | |
| Coris gaimard | | | | | | | | | | 2 |
| C. flavovittata | | | | | 1 | | | | | |
| Gomphosus varius | 4 | 1 | | 2 | 2 | 1 | | | 1 | |
| Pseudojuloides cerasinus | | | 20 | | | 13 | | | | 1 |
| | | 62 | | | | | | | | |

APPENDIX A. Continued.

| Family and Species | Station Number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| LABRIDAE | | | | | | | | | | |
| Labroides phthirophagus | 2 | 2 | | | 1 | | | | 1 | |
| Pseudocheilinus octotaenia | 1 | 1 | 4 | | 1 | 1 | | | | 5 |
| P. tetrataenia | 1 | | 4 | | | | | | | 1 |
| Xyrichthys lecluse i | | | | | 1 | | | | | |
| Hemipteronotus umbrilatus | | | | | | | 1 | | | |
| LUTJANIDAE | | | | | | | | | | |
| Alphareus furcatus | 1 | 1 | 1 | 1 | 1 | 1 | | | | 1 |
| Lutjanus kasmira | | | | | | 1 | | | | |
| MONACANTHIDAE | | | | | | | | | | |
| Cantherhines sandwichiensis | | | | | | | | | 1 | |
| MULLIDAE | | | | | | | | | | |
| Mulloides vanicolensis | | | | | 31 | | | | | |
| Parupeneus pleurostigma | | | | | | | | | 2 | |
| P. multifasciatus | 26 | 1 | 17 | | | 8 | | | 4 | 5 |
| P. cyclostomus | 1 | 1 | | | | | | | 2 | |
| P. bifasciatus | 5 | | | | | | | 1 | | |
| MURAENIDAE | | | | | | | | | | |
| Gymnothorax flavimarginatus | | 1 | | | | | | | | |
| OSTRACIONTIDAE | | | | | | | | | | |
| Ostracion meleagris | 1 | | | | | | | | | |
| POMACANTHIDAE | | | | | | | | | | |
| Centropyge potteri | | 1 | 4 | | 3 | 4 | | | | 3 |
| POMACENTRIDAE | | | | | | | | | | |
| Chromis vanderbilti | 173 | 217 | 246 | 235 | 58 | 9 | | 64 | 54 | 31 |
| C. hanui | | 8 | 6 | | 7 | 14 | | | | |
| C. agilis | | 1 | 150 | 24 | 47 | 48 | | | 2 | 38 |
| C. ovalis | | | | | 14 | | | | | |
| C. verator | | | 27 | 12 | 17 | | | | | |
| Plectroglyphidodon imparipennis | | | | 3 | | | | | | |
| P. johnstonianus | 4 | 4 | 1 | | | 4 | | | | |



APPENDIX A. Continued.

| Family and Species | Station Number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| POMACENTRIDAE | | | | | | | | | | |
| Stegastes fasciolatus | 1 | 1 | | 8 | 2 | | | | | |
| Abudefduf abdominalis | | | | 9 | | | | | | |
| SCARIDAE | | | | | | | | | | |
| Scarus sordidus | 1 | | 13 | 2 | 2 | 1 | | 3 | 5 | 1 |
| S. rubroviolaceus | 9 | 1 | 5 | 1 | 2 | | | 1 | 1 | 2 |
| S. psittacus | 5 | | | | | | | | | |
| S. perspicillatus | 1 | | | | | | | | | |
| Calatomus carolinus | 1 | | 4 | 1 | 1 | | | | 1 | 1 |
| SERRANIDAE | | | | | | | | | | |
| Cephalopholis argus | | 1 | | 1 | 1 | | | | | 1 |
| SPARIDAE | | | | | | | | | | |
| Monotaxis grandoculis | | | | 1 | 1 | | | | | |
| TETRAODONTIDAE | | | | | | | | | | |
| Arothron hispidus | | | | | | 1 | | | | |
| TRIAKIDAE | | | | | | | | | | |
| Triaenodon obesus | | | | | | | | | 1 | |
| ZANCLIDAE | | | | | | | | | | |
| Zanclus cornutus | 1 | | 1 | 2 | 1 | 1 | | 5 | | |
| Total Number of Species | 39 | 44 | 33 | 44 | 39 | 36 | 1 | 23 | 27 | 29 |
| Total Number of Individuals | 434 | 462 | 705 | 600 | 354 | 268 | 1 | 195 | 218 | 269 |
| Estimated Biomass ($g/m^2$) | 234 | 208 | 217 | 289 | 242 | 77 | 0.2 | 111 | 385* | 65 |

*Without the Whitetip shark estimated biomass is $113 g/m^2$

# I - 4 Water Quality & Marine Life Monitoring Study & Mitigation Plan

# APPENDIX B

# WATER QUALITY AND MARINE LIFE MONITORING AND MITIGATION PLAN - HOKUKANO PROJECT SITE

R.E. Brock

## 1.1 Introduction

With any coastal development there exists the potential for negative impacts to occur to resident aquatic biota. These may be direct impacts, such as those that occur during coastal construction or they may be more indirect resulting from gradual, long-term disturbances, as may occur with non-point source discharges causing gradual but chronic impacts to the aquatic community. Short-term impacts and potential mitigation measures are often addressed in detail through the EIS process, however, the long-term impacts can be overlooked.

The County of Hawaii, recognizing the potential for long-term negative impacts to the nearshore marine environment resulting from coastal development, has required developers to prepare and initiate monitoring and mitigation programs aimed at adverting these potentially chronic impacts. Recently, permit agencies, developers and concerned citizens have come together and are in the process of outlining a protocol to be used in monitoring water quality and marine biota of the West Hawaii coast to insure (1) standardization of methods thus allowing comparison of results across projects and (2) use of the best and most cost effective available technology and techniques to insure the best protection possible for the resources.

This resource management and protection plan has been developed utilizing the information and methodologies in the above draft protocol; these methods are generally accepted in the scientific community at the time this document was written. As techniques and methods improve and become accepted, they will be incorporated into the monitoring and management strategy herein. The implementation of this plan cannot guarantee total resource protection and parties involved in the preparation of this plan shall not be held liable for any problem arising in the future with respect to plan implementation, the resource or to any individual, corporation or other entity.

It is expected that the developer, his assigns or owner/operator(s) will employ only competent, professionally trained personnel to carry out the duties of the monitoring program.

## 1.2 Objectives

The objectives of the water quality and marine life monitoring and mitigation plan are to meet conditions as may be stipulated in the County of Hawaii SMA permits that would be issued if this project proceeds. Specifically, this plan develops a water quality and marine life monitoring program that should insure the continued viability of the nearshore marine resources and water quality conditions as they presently exist on the Hokukano coastline.

The intent of the program is to avoid and prevent any activity that would result in negative impact to ground and marine water quality as well as to nearshore marine biota. Because the marine waters fronting the Hokukano project site are Class AA waters as defined by the State Department of Health, they are to remain "...in their natural pristine state with an absolute minimum of pollution or alteration of water quality from any human-caused source or action" (Hawaii Administrative Rules, Chapter 11-54-01). Thus the objective of the monitoring program is to insure that these waters are not impacted by the proposed construction and subsequent maintenance of the improvements that the project proposes to develop.

The maintenance of existing marine communities and water quality is a major goal of the program. To meet this goal and the above objectives, three activities must be completed. These activities are (a) acquisition of comprehensive baseline information, (b) carrying out a monitoring program through the period of construction and for a period of five years following completion of construction and (c) having an approved mitigation plan in place to be used if problems arise.

Quantitative baseline studies have been completed for both the water quality characteristics and the marine biota (see companion document). Monitoring will focus on selected chemical and biological parameters as stipulated by the Board of Health and the draft West Hawaii Water Quality and Marine Life Monitoring Protocol document. Water quality parameters to be routinely measured include nitrate nitrogen, ammonia nitrogen, total nitrogen, orthophosphate, total phorphosus, silica, salinity, temperature, pH, oxygen, turbidity as well as the biological characteristics of chloropnyll-a and bacteria (total coliform, fecal coliform, streptococcus). Marine community monitoring will include for fish determinations of the numbers of individuals of each species and estimates of biomass by species, coverage of all exposed macrobenthos (corals, sponges, tunicates, sessile polychaetes, algae, etc.) as well as counts of all diurnally exposed macroinvertebrates. All sampling will be conducted at permanently marked stations as stipulated in the State of Hawaii Department of Health Chapter 54 of Title 11 Administrative Rules.



Insecticide and herbicides are monitored on an annual basis in sediments and possibly in the tissues of specific species (as yet to be determined). Sampling will focus on those specific compounds that have been previously used on the project site. Since the project site is undeveloped, baseline information on pesticides in sediments fronting the project site will be developed by use of organochlorine and organophosphorus screens (useful for determining the presence of more than 30 different pesticides).

In general, monitoring of water quality parameters will be carried out on a quarterly basis and the marine life studies will be done twice a year. Monitoring schedules may change depending on the activities occurring (see below). Schedules as provided here should provide timely information regarding any change that may adversely impact the nearshore waters and communities resident to them. Early detection of change afforded by the monitoring program will allow for timely implementation of appropriate mitigation measures to correct the problem(s).

## 1.3 Monitoring Plan

Following completion of baseline studies, the monitoring program will focus on delineating any change that may occur in measured water quality or marine community parameters. If statistically significant changes are noted, the mitigation plan is implemented.

The monitoring program will use the same methods as employed in the baseline thus all data can be comparatively analyzed. Following the acquisition of baseline information, the monitoring program during construction will monitor water quality parameters on a quarterly basis at a minimum; this schedule may be increased as determined by permit agencies working with the monitoring program personnel. Unless a significant problem is encountered requiring prompt attention, reporting will be annually with a report developed to meet permit agency requirements.

If a degradative problem is discovered through routine monitoring, permit agencies (County of Hawaii, Department of Land and Natural Resources, Department of Health, US Corps of Engineers, National Marine Fisheries Service and the US Fish and Wildlife Service) will be notified and corrective actions implemented. Degradative problems that will trigger notification of permit agencies and prompt corrective action include (1) the finding of any herbicide or insecticide used on the premises in nearshore marine waters, (2) a statistically significant increase (over

baseline data) of inorganic nutrient concentrations in nearshore marine waters, (3) a statistically significant decline in the quantitative measures of dominant marine species (such as coral coverage) that cannot be uniequivocally related to natural events such as storms, or (4) any other change in the nearshore marine communities fronting the Hokukano project site that in the professional opinion of the monitoring program personnel warrants such notification. Notification will be made within 48 hours from the time of first detection.

Notification of a problem to the developer and/or subsequent owner/operator(s) as well as permit agencies will trigger appropriate corrective measures. The cost of any corrective action(s) will be borne by the developer, his assigns and/or the owner/operator(s).

As stated previously, only scientifically accepted methods for sampling and reporting will be used as now given in the draft West Hawaii Water Quality and Marine Life Monitoring Protocol; these may be subject to change as required by the County of Hawaii and other permit agencies. The environmental monitor will have the authority to modify techniques and protocols to meet changing resource protection needs. Any change to the present program and protocol must be approved by the Planning Director, County of Hawaii prior to implementation.

### 2.3.a Phases in the Monitoring Program

The water quality and marine life monitoring and mitigation plan will be undertaken in three phases that are related to the construction activities of the development. These are detailed below:

#### Preconstruction Phase

During the preconstruction phase which is in effect until commencement of construction, baseline information is assembled. The demarcation of a quantitative baseline allows one to identify impacts or measure change that may subsequently occur with development. The first step in devloping the baseline information has been accomplished (see companion document).

#### During Construction Phase

The developer will employ management practices as to avoid impacts to the quality of the groundwater or biota. Temporary settlement basins will be used where needed to reduce the possiblity of runoff occurring as durng a storm event. Permanent drainage systems will be developed to maximize percolation and



minimize stormwater runoff to the ocean.

During construction, water quality monitoring will continue at a minimum quarterly schedule and the marine life monitoring will be semiannual; this schedule may be increased if deemed necessary. It is probable that water quality monitoring could be increased to a monthly monitoring (for specific criteria) and the monitoring of marine communities may remain at on a semiannual schedule. It is expected that pesticide sampling will remain on an annual schedule. The rationale for this approach is related to the findings to date on coastal development and impacts to aquatic communities on the West Hawaii coast. As noted in the companion baseline document, data from the large-scale, long-term development at Waikoloa suggests that the first detectable changes to occur are with changes in the chemistry of the ground water. These changes are apparent well in advance of any change in the biota; thus an appropriate strategy in monitoring during construction is to focus first on statistically significant change in chemical parameters. If changes in water chemistry are noted, a search for quantitative change in the aquatic biota is made. The methods used in the monitoring will be identical to those used in the baseline studies. If discernible impacts are evident, the mitigation plan is put into effect (see Section 1.4).

#### Post Construction

Following the termination of construction, the level of monitoring will be reduced to a quarterly sampling effort for water quality parameters and semiannually for marine communities. Pesticide sampling will continue on an annual cycle. All sampling should continue for a period of five years following the termination of all construction in the area within 1km of the shoreline. At the end of five years, the program will be reviewed by the permit agencies and a determination made as to the scale and frequency at which the program should continue. The goal of the post construction monitoring is to insure that no long-term change(s) in water quality and marine communities occur that are attributable to the development.

#### Reporting

All monitoring activities will be presented in an annual report to be submitted to interested permit agencies (Hawaii County Planning Department, Department of Health, Department of Land and Natural Resources, US Corps of Engineers, National Marine Fisheries Service and the US. Fish and Wildlife Service. The frequency of reporting will be modified only if a change

water quality or biota is noted as described in Section 1.3 and corrective measures are implemented. Under those circumstances, reporting may be variable, occurring on an "as need" basis (probably no greater than monthly). Reports will be written with as much statistical and/or quantitative interpretation as is possible with the extant data. Reports will be made available to any interest group, county, state or federal agency wishing to develop a regional or comprehensive database.

### 1.4 Mitigation Plan

If significant change occurs in water quality parameters and/or marine biota offshore of the project site, the mitigation plan would be implemented. The objective of this plan is to reverse detrimental impacts to aquatic communities; as discussed above, negative impacts to marine communities will probably be mediated through changes in water quality. Thus the mitigation plan focuses first on reversing detrimental water quality characteristics if problems have arisen. The monitoring program will identify the problem (using comparative analysis of baseline information); the mitigation plan will attempt to reverse the problem and subsequently, the monitoring program will determine if the mitigation plan has been successful. If not, the process is reiterated. Monitoring schedules during the process of mitigation are expected to be increased until the problem(s) is solved. This approach has been successfully used in the Waikoloa Anchialine Pond Preserve Program.

During the construction phase, the water quality monitoring will be on a quarterly schedule at a minimum; this level of effort will continue over into the post construction phase. Biological resource monitoring will be on a semiannual basis. If a problem is encountered which triggers a mitigative action, monitoring will be increased to reflect a level consistent with understanding the changes occurring. The costs of these increased efforts will be borne by the developer, his assigns or the owner/operator(s). The steps to be followed in this plan include the identification of the problem, locating the source of the problem, and lastly, halting or modifying the activity at the source to alleviate the problem. The monitoring program will determine if the effort has been successful.

A key to success in the mitigation plan lies with the cooperation of all parties concerned; personnel in the monitoring and management program must cooperate with the construction and later the grounds and maintenance personnel. This is particularly true for problems mediated by change in inorganic nutrient levels in the groundwater. A close working relationship between the monitoring program and construction and/or maintenance personnel provides the ingredients for a rapid response to environmental problems as they arise. Rapid response serves to protect the environmental integrity of the site and nearshore waters fronting the project. Responsibility for the success of the mitigation program must ultimately lie with the developer and this responsibility should be included in the convenants if ownership changes. Similarly, costs incurred in any mitigative action must be borne by the developer.

Some change to marine communities is anticipated with the development of the Hokukano parcel. Today access is limited and the structure (i.e., species richness, biomass, etc.) of the nearshore fish communities reflect that. Fishing pressure in the area is presently light but will increase with easy public access. The cause and effect relationship between exploitation and condition of the resource is difficult to quantitatively determine but is assumed to occur. Qualitatively these changes have been encountered at numerous areas of the West Hawaii coast (Brock, personal observations); they have not been linked with changes in the groundwater chemistry but rather with the ease of access and thus increased resource exploitation. Because the monitoring program is quantitatively assessing both groundwater characteristics as well as fish community structure, the impact of exploitation may be quantitatively divisible in the dataset.

### 1.5 Funding

The cost of water quality and marine life monitoring program will be carried by the developer, his assigns or owner/operator(s). These costs shall include but not limited to those associated with routine monitoring and reporting as well as providing funds for mitigative action on an "as need" basis. All monies shall be provided to the monitoring program on a timely basis such that the sampling schedule of the program is not jeopardized.

# I - 5 Air Quality Study

# AIR QUALITY STUDY

# FOR THE PROPOSED

# VILLAGES AT HOKUKANO PROJECT

## NORTH AND SOUTH KONA, HAWAII

Prepared for:

1250 Oceanside Partners

December 1992


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## CONTENTS



## FIGURES



## TABLES





## TABLES (cont.)

## 1.0 SUMMARY

1250 Oceanside Partners is proposing to develop the Villages at Hokukano Project on 1540 acres of land straddling the North and South Kona Districts on the island of Hawaii. Major elements of the project include 1440 single-family residential units, a 27-hole golf course, a 100-unit lodge, and shoreline conservation and community park areas. A phased development plan is contemplated with construction of the first phase beginning in 1995. This study examines the potential air quality impacts that could occur as a result of the construction and use of the proposed project. Mitigative measures to lessen project impacts are suggested where possible and appropriate.

Both federal and state standards have been established to maintain ambient air quality. At the present time, six parameters are regulated including: particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii state air quality standards are more stringent than the comparable national limits except for the standards for sulfur dioxide which are set at the same levels as the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its leeward and coastal situation. Winds are predominantly light and variable due to the wind shadow effects of Mauna Loa. Kona storms generate occasional strong winds from the south or southwest during winter. Temperatures in the Hokukano area are generally very consistent and moderate with average daily temperatures ranging from about 60°F to 80°F. The extreme minimum temperature recorded at nearby Kainaliu is 48°F, while the extreme maximum temperature is 89°F. Average annual rainfall in the area at the



elevation of the site amounts to about 38 inches with each month typically contributing between 2 and 4 inches.

Air quality in the vicinity of the project is presently mostly affected by emissions from natural, agricultural and/or vehicular sources. The dominant factor for the past several years has been the volcanic haze (vog) from Kilauea Volcano which eventually drifts into the Kona and Kohala areas from more than 50 miles away. Other natural sources of air pollution that may affect the air quality of the site include the ocean, plants and wind-blown dust. Mamalahoa Highway, located mauka of the project site, is a major arterial roadway. Prevailing onshore winds during the daytime tend to carry emissions from motor vehicles traversing this roadway away from the project site.

Very little air quality monitoring data from the State Department of Health are available for the Kona area. Based on what little data are available, it appears likely that both state and national ambient air quality standards are currently being met despite the persistent vog.

Based on the air quality assessments prepared for this project, it was concluded that the proper implementation of the project will not cause the exceedance of state or federal air quality standards, although there are certain minor impacts that maybe realized. Short-term impacts from fugitive dust will likely occur during project construction phases. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control

plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, use of wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas as early as practical in the construction schedule will also reduce dust emissions. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

After construction, depending on the volume of traffic generated and the capacity of area roadways, long-term impacts on air quality could potentially occur indirectly as a result of emissions emanating from vehicular traffic coming to and from the development. Access to the project will be accomplished primarily via Mamalahoa Highway, a proposed new bypass road and the extension of Halekii Street. To assess the impact of emissions from these vehicles, an air quality modeling study was undertaken to estimate current maximum ambient concentrations of carbon monoxide along roadways leading to and from the project area and to predict future levels of air pollution both with and without the proposed project. Based on the modeling results, present carbon monoxide concentrations were estimated to be well within both state and national ambient air quality standards. Future scenarios studied included the years 2005 and 2010 both with and without the project. The results of these studies indicated that project traffic through these stages of development would have only a slight negative impact at intersections along the bypass road and would result in improved air quality near the intersection of Halekii Street and Mamalahoa Highway. With or without the project, all locations in the area would comply with the national standards. Although potential exceedances of the more stringent state standards for



carbon monoxide are indicated near the bypass/Kuakini Highway intersection, the proposed project would contribute little to the problem. Because the state standards are set at such stringent levels, it is likely that they are currently exceeded at many locations in the state that have even moderate traffic volumes. Due to the minimal air quality impacts from project traffic that were predicted, no measures were recommended to mitigate these emissions other than the roadway improvements recommended by the traffic consultant.

Pesticides will be used to maintain golf course grasses. If applied during low wind conditions using proper application techniques, contamination of nearby, downwind areas by airborne drift should not be a problem. Use of shrouded spray equipment fitted with computerized flow controllers, maintaining a buffer distance of at least 100 feet between target spray areas and populated locations, and planting vegetation screens along populated areas of the golf course perimeter will provide added measures of protection.

Depending on the demand levels, long-term impacts on air quality are also possible due to indirect emissions associated with a development's electrical power and solid waste disposal requirements. Quantitative estimates of these potential impacts were not made, but based on the estimated emission rates involved and the relative changes in demands, the attendant impacts are expected to be small. The promotion of energy conservation and recycling programs within the proposed development could serve to reduce any impacts.

## 2.0 INTRODUCTION AND PROJECT DESCRIPTION

1250 Oceanside Partners is proposing to develop the Villages at Hokukano Project on 1540 acres of land located above Keikiwaha and Nenue Points in the North and South Kona Districts on the island of Hawaii (see Figure 1). Major elements of the proposed project include 1440 single-family residential dwelling units, a 27-hole golf course, a 100-unit lodge, shoreline conservation areas and 5 acres of community parks. Presently, the land comprising the project site is undeveloped. Construction of the proposed project is expected to begin sometime during 1995 and be completed in phases. The first phase will include the lodge, golf course and 367 single-family residential units and is planned for completion by 2005. Other phases will include the remaining single-family residential units for which construction will extend over a 40 to 50 year period.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short- and long-term direct and indirect impacts on future air quality that could result from construction and use of the proposed facilities as planned. Measures to mitigate these impacts are suggested where possible and appropriate.

## 3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, AAQS have been



established for six air pollutants. These regulated air pollutants include: particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. National AAQS are stated in terms of primary and secondary standards. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow one exceedance per year.

State of Hawaii AAQS are in some cases considerably more stringent than comparable national AAQS. In particular, the State of Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit.

Under the provisions of the Federal Clean Air Act [1], the U.S. Environmental Protection Agency (EPA) is required to periodically review and re-evaluate national AAQS in light of research findings more recent than those which were available at the time the standards were originally set. Occasionally new standards are created as well. Most recently, the national standard for particulate matter has been revised to include specific limits for particulates 10 microns or less in diameter (PM-10) [2]. The State of Hawaii has not explicitly addressed the question of whether to set limits for this category of air pollutant, but national AAQS prevail where states have not set their own more stringent levels.

Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make them essentially the same as national limits. It has been proposed in various forums that the state also relax its carbon monoxide standards to the national levels, but at present there are no indications that such a change is being considered.

## 4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affect the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state and most of the year, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

The area above Keikiwaha and Nenue Points, the site of the proposed project, is located near the midpoint of the western coast of the island of Hawaii. The topography of this island is dominated by



the great volcanic masses of Mauna Loa (13,653 feet), Mauna Kea (13,796 feet), and of Hualalai, the Kohala Mountains and Kilauea. The island consists entirely of the slopes of these mountains and of the broad saddles between them. Mauna Loa and Kilauea, located on the southern half of the island, are still active volcanoes. The site of the proposed project occupies a portion of the lower western slopes of Mauna Loa/Hualalai extending from the shoreline up to an elevation of about 1200 feet.

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. Much of the western coast of the island of Hawaii, however, is sheltered from the trade winds by high mountains, except when unusually strong trade winds sweep through the saddle between the Kohala Mountains and Mauna Kea and reach northern leeward areas. Due to wind shadow effects caused by Mauna Loa, winds in the Hokukano area are usually light and variable. When trade winds are strong, a large eddie tends to form near the southern tip of the island causing a weak return flow from the west within the project area. In winter, the passage of storms can bring very strong "Kona" winds for brief periods from the south or southwest. When trade winds or Kona winds are absent or weak, local winds such as land/sea breezes and/or upslope/downslope winds tend to dominate the wind pattern for the area. During the daytime, light winds typically move onshore because of seabreeze and/or upslope effects. At night, winds generally are land breezes and/or drainage winds which move downslope and out to sea.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air

pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depends to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade wind tend to have the least temperature variation, while inland and leeward areas often have the most. The project site's leeward location and low-level elevation results in a relatively moderate temperature profile compared to windward locations near sea level. At Kainaliu, located a short distance mauka of the project at an elevation of about 1500 feet, average daily minimum and maximum temperatures are 61°F and 79°F, respectively [3]. The extreme minimum temperature on record at this location is 48°F, and the extreme maximum is 89°F. Temperatures at the project site are probably a few degrees warmer due to the lower elevation.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is oftentimes measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Kona area, stability class 5 or 6 is generally the highest stability class that occurs, developing during clear, calm nighttime or early morning hours when temperature inversions form either due to radiational cooling or to downslope winds that push warmer air aloft. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.



Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas may also experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Although there are no mixing height data for the project area, mixing heights elsewhere in the state typically are above 3000 feet (1000 meters). Mixing heights in the project area probably tend to be somewhat lower on the average due to the fact that light winds often prevail and also because sea breeze conditions often develop during the daytime.

Rainfall can have a beneficial effect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it may also "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The climate of the Hokukano area is wetter than might be expected for a leeward location. This is due to the persistent onshore and upslope movement of marine air caused by both eddie and seabreeze or mountain slope effects. Some of the rainfall occurs during summer afternoons and evenings as a result of this onshore and upslope movement of moisture-laden marine air, and some occurs in conjunction with winter storms. At nearby Napoopoo located about 4 miles to the south of the project site within Kealakekua Bay, average annual rainfall amounts to about 38 inches with each month registering about 2 to 4 inches [3]. Rainfall over the project

site is probably somewhat higher, especially near the highest elevations.

## 5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from natural, agricultural and/or vehicular sources. Natural sources of air pollution emissions which may affect the project area but cannot be quantified very accurately include the ocean, plants, wind-blown dust and volcanoes. Of these natural sources of air pollution, volcanoes are the most significant. Volcanic emissions have chronically plagued the project area since the latest eruption phase of Kilauea Volcano began in 1983. Air pollution emissions from Kilauea consist primarily of sulfur dioxide. After entering the atmosphere, these sulfur dioxide emissions are carried away by the wind and either washed out as acid rain or gradually transformed into particulate sulfates. Although emissions from Kilauea are vented more than 50 miles east of the project site, the prevailing wind patterns eventually carry the emissions into the Kona and South Kohala areas. These emissions can be seen in the form of the volcanic haze (vog) which persistently hangs over the area. The American Lung Association is currently studying the character and concentrations of volcanic air pollution in the Kona area. Preliminary results indicate that sulfate levels are up to five times higher in the Kona area compared to Hilo. Potential impacts on human health from the vog are still under study.

The project site is located makai of and below Mamalahoa Highway near the Halekii Street intersection. Exhausts from motor vehicles traversing these roadways will tend to be carried away from the site by the prevailing onshore winds during the daytime when traffic is heavier. At nighttime, downslope drainage winds will



likely carry traffic-related emissions over the site. Any high levels of air pollution presently occurring in the area due to motor vehicle emissions are likely confined to limited areas near intersections where and when traffic congestion occurs during poor dispersion conditions.

The State Department of Health operates a network of air quality monitoring stations at various locations around the state. Unfortunately, very little data are available for the island of Hawaii. As indicated in Table 2, the only existing monitoring data anywhere near the project site consist of sulfur dioxide and particulate measurements that were made at Kealakekua during 1985 and 1986. During this two-year period, measurements of 24-hour average sulfur dioxide concentration at this location were consistently low with daily mean values ranging from less than 5 to 12 $\mu g/m^3$. No exceedances of the state/national 24-hour AAQS for sulfur dioxide were recorded. Twenty-four hour average particulate concentrations ranged from 4 to 28 $\mu g/m^3$; no violations of the state AAQS were measured.

At this time, there are no reported measurements of lead, ozone, nitrogen dioxide or carbon monoxide in the project vicinity. These are primarily motor vehicle related air pollutants. Lead, ozone and nitrogen dioxide typically are regional scale problems; concentrations of these contaminants generally have not been found to exceed AAQS elsewhere in the state. Carbon monoxide air pollution, on the other hand, typically is a microscale problem caused by congested motor vehicular traffic. In traffic congested areas such as urban Honolulu, carbon monoxide concentrations have been found to occasionally exceed the state AAQS. Present concentrations of carbon monoxide in the project area are estimated later in this study based on mathematical modeling of motor vehicle emissions.

## 6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions which could directly result in short-term air quality impacts during the construction phase: (1) fugitive dust from vehicle movement and site excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there could also be short-term impacts from slow-moving construction equipment traveling to and from the project site and from a temporary increase in local traffic caused by commuting construction workers.

Fugitive dust emissions may arise from the grading and dirt/rock-moving activities associated with site preparation. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of earth-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [4] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions from project construction would probably be somewhere near this level or below due to the normal rainfall in the area. In any case, State of Hawaii Air Pollution Control Regulations [5] stipulate that emissions of fugitive dust from construction activities cannot be visible beyond the property line. Thus, an effective dust control plan for the project construction phase is essential.



Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens could become necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is oftentimes a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of roadways and parking areas and/or establishment of landscaping as early in the construction schedule as practical can also lower the potential for fugitive dust emissions.

On-site mobile and stationary construction equipment will also emit some air pollutants in the form of engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Traffic conditions in the project area already are reaching over capacity conditions during peak traffic periods. Slow-moving construction vehicles traveling on roadways leading to and from the project site could potentially exacerbate the problem and thereby indirectly impact air quality by obstructing the normal flow of

traffic to such an extent that overall vehicular emissions are increased. This impact can be mitigated by moving heavy construction equipment during periods of low traffic volume. Likewise, the schedules of commuting construction workers can be adjusted to avoid peak hours in the project vicinity. Thus, most if not all potential short-term air quality impacts from project construction can be mitigated.

## 7.0 LONG-TERM IMPACTS OF PROJECT

### 7.1 Roadway Traffic

After construction is completed, use of the proposed facilities will result in increased motor vehicle traffic on nearby roadways, potentially causing impacts on ambient air quality in the long term within the project vicinity. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides, and those burning leaded gasoline contribute lead to the atmosphere. The use of leaded gasoline in new automobiles is now prohibited. As older vehicles continue to disappear from the numbers of those currently operating on the state's roadways, lead emissions are approaching zero. Nationally, so few vehicles now require leaded gasoline that the EPA is proposing a total ban on leaded gasoline to take effect immediately. Even without such a ban, reported quarterly averages of lead in air samples collected in urban Honolulu have been near zero since early 1986. Thus, lead in the atmosphere is not considered to be a problem anywhere in the state.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. Just recently, the President signed into law the Clean Air Act Amend-



ments of 1990. This new legislation requires further emission reductions be phased in beginning in 1994. Even without the new restrictions on motor vehicle emissions, current emission standards for new vehicles will lower average emissions each year as more and more older vehicles leave the state's roadways. Carbon monoxide emissions, for example, will go down by about 25 percent on the average by the year 1995 compared to the amounts now emitted due to the replacement of older vehicles with newer models.

To evaluate the potential long-term indirect ambient air quality impact of increased roadway traffic associated with a project such as this, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways leading to and from the project. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single new development.

For this project, several scenarios were selected for the carbon monoxide modeling study: year 1992 with present conditions, year 2005 both with and without the project, and year 2010 both with and without the project. Year 2005 includes the first phase of development, while year 2010 includes an additional 200 homes to be constructed during the first portion of additional phases. To begin the modeling study, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. The project traffic study [6] indicates that traffic entering onto and exiting from Mamalahoa

Highway at Halekii Street will be one area of concern. Traffic intersections along the proposed new bypass road is another area that would be potentially affected by project traffic. These areas of potential traffic congestion were also selected for air quality analysis.

Modeling of the present scenario and also the future with and without project cases was performed assuming the existing roadway configuration at the Mamalahoa Highway/Halekii Street intersection with or without the proposed bypass. Presently, Halekii Street forms an unsignalized T-intersection with Mamalahoa Highway with left and right turn lanes on both roadways. For the future with bypass scenarios, it was assumed that the three intersections studied along the bypass (Mamalahoa Highway, Halekii Street and Kuakini Highway) will be signalized. Per the project traffic study, two left turn lanes were assumed both on the southbound approach of the bypass at Kuakini Highway and on the westbound approach of Mamalahoa Highway at the bypass. Present and future conditions and configurations of these roadways are described in more detail in the project traffic impact assessment report referenced above.

The main objectives of the modeling study were to estimate both current and projected levels of maximum 1-hour average carbon monoxide concentrations which could then be directly compared to the national and state AAQS. The traffic impact assessment report indicates that traffic volumes both are and will be roughly about the same during both the afternoon and the morning peak hours. Worst-case emission and meteorological dispersion conditions typically occur during the morning hours at many locations. Thus, worst-case air pollution concentrations can be expected to occur during the morning in the project area. However, to ensure that worst-case conditions were identified and that there were no



unusual afternoon queuing effects, both morning and afternoon peak hour conditions were analyzed.

The EPA computer model MOBILE4.1 [7] was used to calculate vehicular carbon monoxide emissions for each of the years studied. One of the key inputs to MOBILE4.1 is vehicle mix. Based on recent vehicle registration figures, the present and projected vehicle mix in the project area is estimated to be 91.9% light-duty gasoline-powered vehicles, 5% light-duty gasoline-powered trucks and vans, 0.5% heavy-duty gasoline-powered vehicles, 0.6% light-duty diesel-powered vehicles, 1% heavy-duty diesel-powered trucks and buses, and 1% motorcycles.

Other key inputs to the MOBILE4.1 emission model are the cold/hot start fractions. Motor vehicles operating in a cold- or hot-start mode emit excess air pollution. Typically, motor vehicles reach stabilized operating temperatures after about 4 miles of driving. For traffic operating within the immediate project area, it was assumed that about 25 percent of all vehicles would be operating in the cold-start mode and that about 5 percent would be operating in the hot-start mode. These operational mode values were estimated based on a report from the California Department of Transportation [8] and taking into consideration the likely origins of traffic in the project area.

Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively. These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this and emission estimates given by MOBILE4.1 are inversely proportional to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE4.1, these data were then input to the latest version of the computer model CALINE4 [9]. CALINE4 was developed by the California Transportation Department to simulate vehicular movement and atmospheric dispersion of vehicular emissions. It is designed to predict 1-hour average pollutant concentrations along roadways based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Input peak-hour traffic data were obtained from the traffic study cited previously. The traffic volumes given in the traffic study for the future scenarios include project traffic as well as traffic from other growth that is expected to occur in the area. Traffic queuing estimates were made based on the project traffic study, Transportation Research Board procedures [10], U.S. EPA guidelines [11], and traffic observations at the subject intersections. Vehicles using Mamalahoa Highway and/or the bypass road were assumed to accelerate to 30 mph, while traffic on Halekii Street was assumed to move at 25 mph. Deceleration and acceleration times of 12 and 14 seconds, respectively, were assumed for vehicles traveling at 30 mph, whereas values of 10 and 11 seconds were assumed for those traveling at 25 mph.

Model roadways were set up to reflect actual roadway geometry, physical dimensions and operating characteristics. Presently, there are no pedestrian walkways along Mamalahoa Highway within the project area, although people frequently walk along the shoulder on the makai side. Halekii Street currently does have sidewalks. Concentrations predicted by air quality models generally are not considered valid within the roadway mixing zone. The roadway mixing zone is taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within



10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones where a sidewalk or other public area would likely exist. In areas where sidewalks likely would not exist, model receptor sites were located near the edge of the road right-of-ways at distances of about 10 meters from the traveled portions of the roadways near the intersections studied. All receptor heights were placed at 1.5 meters (5 feet) above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for morning scenarios and stability category 4 was assumed for afternoon cases. These are the most conservative stability categories that can be used for estimating pollutant dispersion at suburban or undeveloped locations. A surface roughness length of 100 cm was assumed with a mixing height of 300 meters. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at relatively low levels. Spot check measurements made during October 1992 were at 0.5 ppm or less. Hence, background contributions of carbon monoxide from sources or distant roadways not directly considered in the analysis were accounted for by adding a background concentration of 0.5 ppm to all predicted 1992 concentrations. This background level was assumed to persist for the 2005 and 2010 scenarios.

Predicted Worst-Case 1-Hour Concentrations

Table 3 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS (which limit ambient carbon monoxide concentrations to 10 $mg/m^3$ and 40 $mg/m^3$, respectively). The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the estimated present worst-case 1-hour carbon monoxide concentration near the Mamalahoa Highway/Halekii Street intersection is 4.8 $mg/m^3$. Without the bypass and without the project, this value was estimated to increase to 10.4 $mg/m^3$ during the morning peak traffic period by the year 2005.

With the bypass and with or without the project, maximum concentrations by 2005 or 2010 in the vicinity of the Mamalahoa Highway/Halekii Street intersection would be considerably less due to the reduced traffic volume. With the project, predicted concentrations are lower at this location due to the assumed connection of Halekii Street with the bypass.

Predicted future concentrations near Mamalahoa Highway at the bypass intersection were estimated to reach 8.5 $mg/m^3$ during the morning peak hour in the 2010 with-project scenario. Without the project, concentrations for future scenarios were estimated to be only slightly lower.

Concentrations in the vicinity of the Halekii Street intersection with the bypass would likely increase substantially with the



project due to the creation an intersection that would otherwise not exist. Estimated worst-case concentrations ranged from 6.9 $mg/m^3$ during the afternoon in the year 2005 to 8.7 $mg/m^3$ during the morning in the year 2010.

At the Kuakini Highway intersection with the bypass, estimated worst-case morning and afternoon concentrations in 2005 without the project were 8.4 and 6.4 $mg/m^3$, respectively. With the project, the morning value was estimated to increase to 9.1 $mg/m^3$ while the afternoon concentration was estimated to remain the same. In the year 2010, a maximum 1-hour concentration of 9.8 $mg/m^3$ was predicted without the project and a value of 10.1 $mg/m^3$ was predicted with the project. These would both occur during the morning; afternoon values were estimated to be approximately 3 $mg/m^3$ lower.

Estimated present worst-case concentrations in the project area were well within both state and national standards. In 2005 without the bypass, maximum concentrations near the Mamalahoa Highway/Halekii Street intersection were predicted to slightly exceed the state limit of 10 $mg/m^3$ while remaining well within the national standard of 40 $mg/m^3$. With the bypass, all estimated worst-case concentrations for all locations and scenarios studied were within both state and national standards except for the Kuakini Highway intersection with the bypass road in the 2010 with-project case. This location/scenario indicates a slight potential for exceedance of the state standard but concentrations would be well within the national standard.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of

0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological dispersion conditions are more variable (and hence more favorable) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One recent study based on modeling [12] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [11] recommend using a value of 0.6 to 0.7 unless a locally derived persistence factor is available. Recent monitoring data for Honolulu reported by the Department of Health [13] suggests that this factor may range between about 0.35 and 0.55 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 is probably most appropriate for this application.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 4. For the 1992 scenario, the estimated worst-case 8-hour carbon monoxide concentration in the project area was 2.4 $mg/m^3$ at the intersection of Mamalahoa Highway and Halekii Street. Without the bypass, this was estimated to increase to 5.2 $mg/m^3$ by the year 2005. With the bypass, the highest concentrations in the project area were estimated to occur near the bypass intersection with Kuakini Highway with or without the project. With the project and with the bypass, a worst-case concentration of 5.0 $mg/m^3$ is predicted at this location in the year 2010; without the project, the estimated concentration was only slightly lower. Other locations and scenarios studied indicated maximum 8-hour concentrations between about 1 and 4 $mg/m^3$. Predicted concentrations for all scenarios and all locations were well within the national standard which is set at



10 $mg/m^3$. Predicted concentrations were also within the state standard except for the 2010 with-project scenario at the Kuakini Highway/bypass intersection where concentrations were estimated to equal the state limit of 5 $mg/m^3$.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is not very likely, and it may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. It should also be noted that predictions for future years do not account for any reductions in emissions that may result from the new Clean Air Act Amendments of 1990 and thus concentrations could be lower than projected.

### 7.2 Golf Course Pesticide Usage

Once the project is completed and the golf course is in use, various chemical pesticides will be used to maintain grass quality. Impacts on air quality can potentially occur when chemicals drift away from areas targeted for treatment. Residences or persons in areas located immediately adjacent to the proposed golf course could potentially be exposed if drift should occur.

Table 5 shows a typical pesticide program for an 18-hole golf course in Hawaii. Herbicides are applied to greens, tees, fairways

and perimeter areas, and insecticides and fungicides are used on greens and tees and for spot treatment of fairways. Herbicide products typically used include: MSMA, bensulide, 33 Plus, metribuzin and glyphosate. These chemicals typically are applied 2 to 6 times per year. Chlorpyrifos is used as an insecticide on an as needed basis, and metalxyl and chlorothalonil are used to control fungi as required. An integrated pest management plan designed specifically for this project will likely be prepared which may deviate from that given in Table 5.

Golf course pesticides are applied with ground spray equipment. Typically, this includes tractor-mounted spray bars for fairways and perimeter areas and portable sprayer units for greens and tees and spot treatment of fairways. Pesticide chemicals are diluted with water in a mixing compartment, and the solutions are then applied under 20 to 40 pounds per square inch (psi) pressure to the target area by flat-fan type nozzles at about 1 to 3 feet above ground.

Drift from spray equipment can occur by two different means. Vapor drift occurs when a chemical vaporizes after being applied to the target area. The vapors may then be carried downwind to adjacent locations. The amount of vaporization that occurs depends mostly on the ambient temperature and the volatility of the pesticide being used. Higher ambient temperatures promote more vaporization to take place. Ambient temperatures in the project area are relatively warm, which will tend to promote evaporation. In any case, the chemicals which will likely be used (see Table 5) have a low volatility within the temperature range that occurs in the area. Thus, vapor drift from the application of pesticides at the proposed golf courses should not be a problem.



Physical droplet drift occurs when the wind moves spray particles away from the target spray area. Pesticide solutions from spray equipment vary in size from large rain-drop size droplets down to small fog-sized mists. Table 6 shows the droplet size range distribution by volume for a flat-fan nozzle sprayer such as is typically used on a golf course. As indicated in the table, about 85 percent of the spray volume is typically larger than about 100 microns diameter when applied at 20 psi; this percentage reduces to about 70 percent when applied at 40 psi.

Large droplets are deposited on or very near the target area, while small droplets can drift significant distances downwind before being deposited. Figure 2 shows the approximate drift distances for various sizes of droplets from spray equipment falling 10 feet in a 3 mph wind. Droplets smaller than about 100 microns diameter can drift from several hundred to several thousand feet downwind when applied under these conditions. Normally, as mentioned above, the drop distance from a golf course sprayer will be about 3 feet or less, and thus the potential drift distances will be smaller than those shown in the figure.

Table 7 compares downwind distances for droplet drift from nozzle spray equipment to diminish to 1 percent when spraying is performed using various types of nozzles and under various spray height, pressure and wind speed conditions. These tests were performed using agricultural spray equipment at a location in North Dakota. As can be seen from the table, 99 percent of the spray was deposited within 17 feet even under wind speeds up to 10 mph. Lower spray heights, lower application pressures, use of thickeners and use of nozzles producing larger droplets all reduced the distance to the 1 percent value.

AAQS have not been established for any of the pesticides presently in use, although occupational safety and health standards have been established for some of the chemical ingredients. Most pesticide products carry warning or caution labels on their containers. The primary purpose of these labels is to provide occupational safety and health guidance regarding proper handling and application. Pesticide applicators are trained and certified in proper application techniques, particularly with respect to minimizing pesticide drift. Measures available to control drift from pesticide application include:

1) using coarse nozzle and low pressure spray equipment;

2) using shielded or shrouded sprayers;

3) using flow-control computers;

4) using thickener additives;

5) using non-volatile or low-volatile chemicals;

6) applying at lowest possible height and during low wind speed conditions when the wind direction will carry any drift away from populated areas;

7) applying during periods when temperatures are cooler and humidities are higher and when ground-based temperature inversion conditions are absent;

8) maintaining an adequate buffer distance (at least 100 feet) between sprayer and populated areas;

9) planting trees and shrubs around golf course perimeters to intercept drift at golf course boundaries.



If proper safety precautions are followed, the potential for serious air quality degradation from chemical spraying for turfgrass maintenance can be virtually eliminated.

### 7.3 Electrical Demand

The proposed project will also cause indirect emissions from power generating facilities as a consequence of electrical power usage. Peak project power demand at full build-out is not expected to exceed about 13 megawatts. Average daily electrical demand of the project when fully developed should not exceed about 0.2 million kilowatt-hours (assuming average project power demand is approximately 70 percent of peak project power demand). This power demand will most probably be provided mainly by oil-fired generating facilities located on the island, although geothermal generating plants could provide a significant portion of the island's electrical energy demand by the time of project completion. In order to meet the electrical power needs of the proposed project, power generating facilities will have to be expanded and/or burn more fuel, and hence more air pollution will be emitted at these facilities. Given in Table 8 are estimates of the indirect air pollution emissions that will result from the project electrical demand assuming all power is provided by burning more fuel oil at Hawaii's oil-fired power plants.

### 7.4 Solid Waste Disposal

Solid waste generated by the project when fully completed is expected to amount to less than 10 tons of refuse (about two 6-ton truckloads) per day. Presently, the refuse district handles about 360 tons per day. Most if not all project refuse will likely be hauled away and landfilled at the county landfill. If all refuse is landfilled, the only air pollution emissions associated with

project solid waste disposal (assuming problems similar to those which currently exist at the Kailua Landfill are avoided) will be due to exhaust fumes and fugitive dust from trucks and heavy equipment used to place the refuse in the landfill.

## 8.0 CONCLUSIONS AND RECOMMENDATIONS

The most significant potential short-term air quality impact will be the emission of significant quantities of fugitive dust during project construction phases. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month. To control dust, active work areas and temporary unpaved work roads should be watered at least twice a day on days when rainfall does not occur. Dirt-hauling trucks should be covered when traveling to prevent windage. Use of wind screens and/or limiting the area that is disturbed at any given time may also be required to contain fugitive dust emissions. Mulching, if feasible, of areas of the site that have been disturbed and left inactive for long periods of time will reduce wind erosion. However, due to the low wind speeds that typically occur in the area, wind erosion will likely not be a chronic problem. A routine road cleaning and/or tire washing program will help to reduce fugitive dust emissions that occur as a result of trucks tracking dirt onto existing paved roadways. Paving of parking areas and establishment of landscaping early in the construction schedule will also help to control dust.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting



construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

The primary potential long-term air pollution impact from the project will arise indirectly from increased motor vehicle traffic associated with the project. Potential increased levels of carbon monoxide concentrations along roadways leading to and from the proposed development will be the primary concern. Based on mathematical modeling of projected vehicular traffic and on atmospheric dispersion estimates of vehicular emissions, maximum carbon monoxide concentrations along roadways in the project vicinity in the year 2005 (after completion of the first phase of the project) will be higher than existing levels but will remain within both state and national air quality standards assuming the proposed bypass is built. Air quality in the vicinity of Mamalahoa Highway and Halekii Street would improve with the project compared to without it due to the connection of Halekii Street with the bypass (resulting in reduced traffic volumes through the intersection). By 2010, it was projected that carbon monoxide levels could begin approaching the state standards at some locations, such as the intersection of the bypass with Kuakini Highway, with or without the project, but worst-case values would remain well within the national limits. It should be noted here that projected exceedance of the state carbon monoxide standards is not unusual. The state standards are set at such low levels that they are probably currently exceeded at many intersections in the state that have even moderate traffic volumes. It is also worth noting that, although the national AAQS allow higher levels of carbon monoxide, the national standards were developed after extensive research with the objective of defining levels of air quality that would protect the public health with an adequate margin of safety.

Options available to mitigate long-term, traffic-related air pollution from increased project motor vehicle traffic are to improve roadways, reduce traffic or reduce individual vehicular emissions. Estimates of carbon monoxide concentrations from emissions emanating from vehicular traffic associated with the development through the year 2010 include any roadway improvements suggested in the traffic impact study for the project. With these improvements, maximum projected carbon monoxide concentrations in the project area are only slightly higher compared to the without project scenarios and well within the national standards. Thus, no further mitigation measures appear to be necessary through this stage of development.

Pesticides will be used to maintain golf course grasses. Compliance with safety guidelines for the spraying of chemicals for golf course maintenance should mitigate potential air quality impacts from this activity. Pesticides should be applied using low-pressure, coarse-nozzle spray equipment less than 3 feet above the ground and only during light wind conditions. Use of shrouded spray equipment will also reduce pesticide drift. Maintaining a 100-foot buffer distance from populated areas and the planting of trees and shrubs along the golf course perimeters will provide further practical mitigation measures.

Any long-term impacts on air quality due to indirect emissions from power generating facilities supplying the project with electricity and from the disposal of solid waste materials generated by the project will likely be small based on the estimated project demand levels compared to the current island-wide electrical and solid waste disposal demands. Nevertheless, indirect emissions from project electrical demand could be reduced somewhat by incorporating energy-saving features into project design requirements. This might include the use of solar water heaters; designing building



spaces so that window positions maximize indoor light without unduly increasing indoor heat; using landscaping where feasible to provide afternoon shade to cut down on the use of air conditioning; installation of insulation and glazed doors to reduce the effects of the sun and heat; movable, controlled openings for ventilation at opportune times; and possibly automated room occupancy sensors. The promotion of conservation and recycling programs within the proposed development could reduce solid waste which would reduce any related air pollution emissions proportionately.

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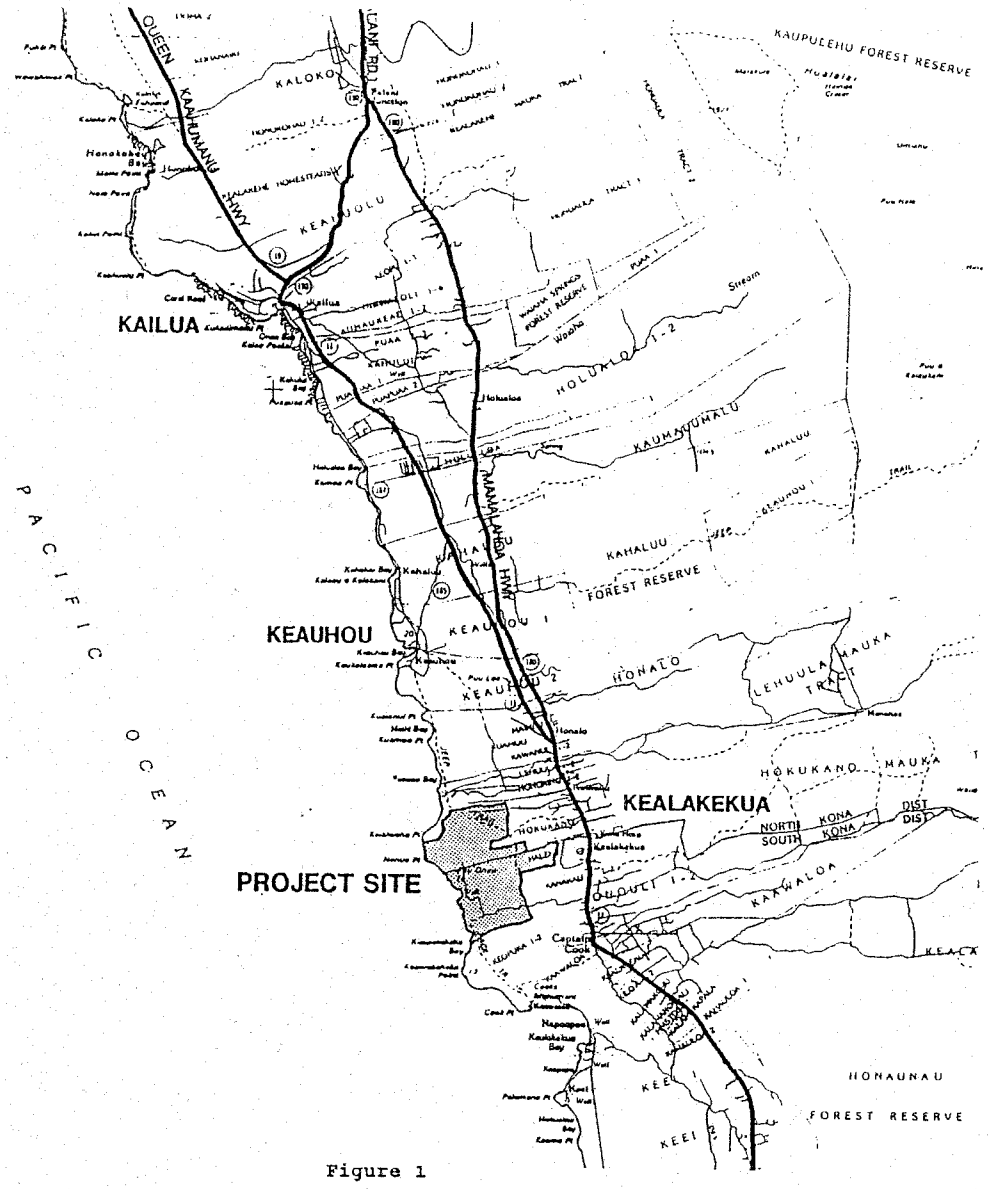


Figure 1

PROJECT LOCATION MAP

source: USGS, 1980



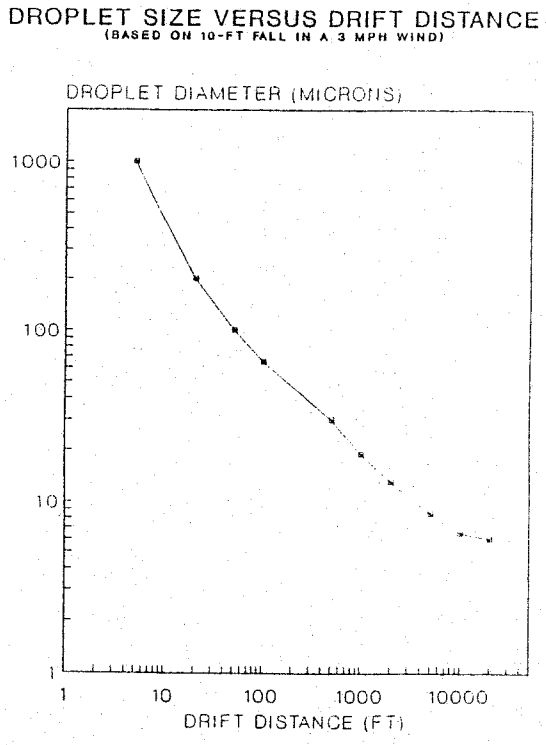


**Figure 2**

Source: "Spray Equipment and Calibration", V. Hofman, et al., Cooperative Extension Service, North Dakota State University, Fargo, North Dakota, Report No. AE73, Revised, January 1986.

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

| Pollutant | Units | Averaging Time | Maximum Allowable Concentration | | |
|---|---|---|---|---|---|
| | | | National Primary | National Secondary | State of Hawaii |
| Suspended Particulate Matter | $\mu g/m^3$ | Annual | - | - | 60[a] |
| | | 24 Hours | - | - | 150[b] |
| Particulate Matter[c] | $\mu g/m^3$ | Annual | 50 | 50 | - |
| | | 24 Hours | 150[b] | 150[b] | - |
| Sulfur Dioxide | $\mu g/m^3$ | Annual | 80 | - | 80 |
| | | 24 Hours | 365[b] | - | 365[b] |
| | | 3 Hours | - | 1300[b] | 1300[b] |
| Nitrogen Dioxide | $\mu g/m^3$ | Annual | 100 | 100 | 70 |
| Carbon Monoxide | $mg/m^3$ | 8 Hours | 10[b] | - | 5[b] |
| | | 1 Hour | 40[b] | - | 10[b] |
| Ozone | $\mu g/m^3$ | 1 Hour | 235[b] | 235[b] | 100[b] |
| Lead | $\mu g/m^3$ | Calendar Quarter | 1.5 | 1.5 | 1.5 |

[a]Geometric mean

[b]Not to be exceeded more than once per year

[c]Particles less than or equal to 10 microns aerodynamic diameter



Table 2

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST VILLAGES AT HOKUKANO PROJECT

| Parameter / Location | 1985 | 1986 |
|---|---|---|
| Sulfur Dioxide / Kealakekua, Kona | | |
| Period of Sampling (months) | 7 | 8 |
| No. of 24-Hr Samples | 31 | 40 |
| Range of 24-Hr Values ($\mu g/m^3$) | <5-8 | <5-12 |
| Average Daily Value ($\mu g/m3$) | <5 | <5 |
| No. of State AAQS Exceedances | 0 | 0 |
| Particulate / Kealakekua, Kona | | |
| Period of Sampling (months) | 7 | 8 |
| No. of 24-Hr Samples | 34 | 40 |
| Range of 24-Hr Values ($\mu g/m^3$) | 6-22 | 4-28 |
| Average Daily Value ($\mu g/m^3$) | 12 | 16 |
| No. of State AAQS Exceedances | 0 | 0 |

Source: State of Hawaii Department of Health, "Hawaii Air Quality Data for the Period of January 1985 to December 1987"

**Table 3**

**ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR VILLAGES AT HOKUKANO PROJECT (milligrams per cubic meter)**

| Roadway Intersection | Year/Scenario: 1992/ Present AM | PM | 2005/ Without Project AM | PM | 2005/ With Project AM | PM | 2010 Without Project AM | PM | 2010 With Project AM | PM |
|---|---|---|---|---|---|---|---|---|---|---|
| Without Bypass: | | | | | | | | | | |
| Mamalahoa Highway at Halekii Street | 4.8 | 4.8 | 10.4 | 9.3 | - | - | - | - | - | - |
| With Bypass: | | | | | | | | | | |
| Mamalahoa Highway at Halekii Street | - | - | 1.8 | 2.1 | 1.4 | 1.3 | 2.1 | 2.8 | 1.4 | 1.4 |
| Mamalahoa Highway at Bypass | - | - | 7.6 | 4.4 | 7.2 | 4.5 | 8.4 | 4.6 | 8.5 | 4.5 |
| Bypass at Halekii Street | - | - | 0.5 | 0.5 | 7.8 | 6.9 | 0.5 | 0.5 | 8.7 | 7.5 |
| Bypass at Kuakini Highway | - | - | 8.4 | 6.4 | 9.1 | 6.4 | 9.8 | 6.8 | 10.1 | 7.6 |

Hawaii State AAQS: 10
National AAQS: 40



**Table 4**

**ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR VILLAGES AT HOKUKANO PROJECT (milligrams per cubic meter)**

| Roadway Intersection | Year/Scenario: 1992/ Present | 2005/ Without Project | 2005/ With Project | 2010 Without Project | 2010 With Project |
|---|---|---|---|---|---|
| Without Bypass: | | | | | |
| Mamalahoa Highway at Halekii Street | 2.4 | 5.2 | - | - | - |
| With Bypass: | | | | | |
| Mamalahoa Highway at Halekii Street | - | 1.0 | 1.2 | 1.4 | 0.7 |
| Mamalahoa Highway at Bypass | - | 3.8 | 3.6 | 4.2 | 4.2 |
| Bypass at Halekii Street | - | 0.2 | 3.9 | 0.2 | 4.4 |
| Bypass at Kuakini Highway | - | 4.2 | 4.6 | 4.9 | 5.0 |

Hawaii State AAQS: 5
National AAQS: 10

Table 5

TYPICAL PESTICIDE PROGRAM FOR AN 18-HOLE GOLF COURSE IN HAWAII

| Chemical Group/Location | Area (acres) | Chemical | Frequency | Application Rate | Annual Total |
|---|---|---|---|---|---|
| Herbicides | | | | | |
| Greens | 3 | MSMA | 6 times/yr | 2 lbs/acre | 36 lbs |
| | | bensulide | 2 times/yr | 12 lbs/acre | 72 lbs |
| Tees | 3 | MSMA | 6 times/yr | 2 lbs/acre | 36 lbs |
| | | 33 Plus | 3 times/yr | 1 pint/acre | 9 pints |
| | | bensulide | 2 times/yr | 12 lbs/acre | 72 lbs |
| Fairways | 50 | MSMA | 6 times/yr | 2 lbs/acre | 600 lbs |
| | | 33 Plus | 3 times/yr | 1 pint/acre | 19 gal |
| | | metribuzin | 2 times/yr | 0.75 lb/acre | 75 lbs |
| Perimeter areas | 20 | glyphosate | 3 times/yr | 1.5 lbs/acre | 90 lbs |
| cides | | | | | |
| Greens | 3 | chlorpyrifos | As needed | 1 lb/acre | 18 lbs |
| Tees | 3 | chlorpyrifos | As needed | 1 lb/acre | 18 lbs |
| Fairways | Local | chlorpyrifos | As needed | 1 lb/acre | 50 lbs |
| Fungicides | | | | | |
| Greens | 3 | metalaxyl | As needed | 1.3 lbs/acre | 25 lbs |
| | | chlorothalonil | As needed | 8 lbs/acre | 72 lbs |
| Tees | 3 | metalaxyl | As needed | 1.3 lbs/acre | 25 lbs |
| | | chlorothalonil | As needed | 8 lbs/acre | 72 lbs |
| Fairways | Local | chlorothalonil | As needed | 8 lbs/acre | 250 lbs |

Source: "Environmental Impact of Fertilizer, Herbicide and Pesticide Use on the Proposed Bayview Golf Course Expansion", Charles L. Murdoch and Richard E. Green, April 6, 1989.



Table 6

DROPLET SIZE RANGE DISTRIBUTION BY VOLUME FOR FLAT FAN NOZZLE SPRAY EQUIPMENT

| Droplet Size Range (microns) | Percent of Total Volume @20 PSI | Percent of Total Volume @40 PSI |
|---|---|---|
| 0-21 | 0.1 | 0.4 |
| 21-63 | 3.0 | 10.4 |
| 63-105 | 10.7 | 20.1 |
| 105-147 | 16.2 | 25.4 |
| 147-210 | 36.7 | 35.3 |
| 210-294 | 27.5 | 7.7 |
| >294 | 5.8 | 0.7 |

Source: "Spray Equipment and Calibration", V. Hofman, et al., Cooperative Extension Service, North Dakota State University, Fargo, North Dakota, Report No. AE73, Revised, January 1986.

**Table 7**

**DOWNWIND DISTANCES FOR DRIFT FROM NOZZLE SPRAY EQUIPMENT TO DIMINISH TO 1 PERCENT**

| Run Number and Comparison | Pressure (PSI) | Wind Speed (mph) | Downwind Distance (ft) |
|---|---|---|---|
| 1. Regular flat fan at 14" height | 40 | 3.5 | 7 |
| Regular flat fan at 27" height | 40 | 3.5 | 13 |
| 2. Regular flat fan at low pressure | 25 | 9.9 | 15.5 |
| Regular flat fan at high pressure | 40 | 9.9 | 17 |
| 3. Regular flat fan at 18" height | 30 | 5.3 | 14 |
| Low pressure flat fan at 18" height | 15 | 5.3 | 11 |
| 4. Regular flat fan with thickener | 30 | 8.2 | 7 |
| Regular flat fan w/o thickener | 30 | 8.2 | 16.5 |
| 5. Flooding flat fan at 13" height | 10 | 4.2 | 5.5 |
| Regular flat fan at 18" height | 30 | 4.2 | 9 |
| 6. Raindrop nozzle at 18" height | 40 | 10.3 | 7 |
| Regular flat fan at 18" height | 30 | 10.3 | 16 |

Source: "Spray Equipment and Calibration", V. Hofman, et al., Cooperative Extension Service, North Dakota State University, Fargo, North Dakota, Report No. AE73, Revised, January 1986.



**Table 8**

**ESTIMATED INDIRECT AIR POLLUTION EMISSIONS FROM VILLAGES AT HOKUKANO PROJECT ELECTRICAL DEMAND[a]**

| Air Pollutant | Emission Rate (tons/year) |
|---|---|
| Particulate | 16 |
| Sulfur Dioxide | 200 |
| Carbon Monoxide | 43 |
| Volatile Organics | 16 |
| Nitrogen Oxides | 200 |

[a]Based on U.S. EPA emission factors for utility gas turbines [4]. Assumes electrical demand of 0.2 million kw-hrs per day and low-sulfur (0.5%) oil used to generate power.

# I - 6 Noise Impact Assessment

D.L. ADAMS ASSOCIATES, LTD.
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DARBY
& ASSOCIATES
ACOUSTICAL CONSULTANTS

#92-34
December 22, 1992

PBR Hawaii-Hilo Office
Hilo Lagoon Center
101 Aupuni Street, Suite 310
Hilo, HI 96720

Attention: Mr. James M. Leonard, AICP
Managing Director

RE: Noise Impact Assessment, Villages at Hokukano, North/South Kona, Hawaii

Dear Mr. Leonard:

An environmental noise impact study was conducted for the proposed Villages at Hokukano Project in North/South Kona. The results of that study are presented below.

## 1.0 SUMMARY

1.1 The proposed project site is currently exposed to low noise levels of less than 39 dBA, typical of quiet rural and remote pasture areas. The dominant noise sources include wind, birds, and surf.

1.2 The only nearby noise sensitive area is the Kona Scenic Subdivision which currently experiences a background noise level of approximately 41 dBA, typical of quiet residential neighborhoods.

1.3 Traffic noise increases along Halekii Street due to project generated traffic should offer minimal impact to noise sensitive locations along Halekii Street. Traffic noise levels along Mamalahoa Highway, due to the development of the project, are predicted to decrease and, thus, offer no noise impact to noise sensitive locations along Mamalahoa Highway. Traffic noise level decrease along Mamalohoa Highway is further explained in Section 5.1.

1.4 Provided appropriate noise control measures are incorporated in the design, noise levels due to the operation of equipment associated with

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air-conditioning and ventilating should not significantly impact noise sensitive locations within the project development.

1.5 The dominant noise source during project construction will probably be earth moving equipment, such as bulldozers and diesel-powered trucks. Any noise impact from such activity on the existing Kona Scenic Subdivision residential area should, however, be relatively short-term.

1.6 Blasting, if required, could also have noise impacts. However, with the appropriate blast design techniques, the noise from blasting can be controlled within acceptable limits at the closest noise sensitive areas.

1.7 Some of the proposed residential areas closest to the proposed state by-pass road may be exposed to future hourly Leq noise levels of greater than the FHWA recommended limit of 67 dBA if less than 50 feet from the by-pass road. If residential home setbacks 50 feet from the by-pass road of 50 feet or more cannot be achieved, other noise mitigation should be implemented to conform with FHWA traffic noise exposure guidelines.

1.8 Noise associated with the operation of the proposed golf clubhouse may impact the closest proposed homes if not properly mitigated. Additionally, equipment associated with grounds maintenance of the proposed 27-hole golf course may impact nearby residential homes, however, such activities take place during the daytime and are usually of short duration. Therefore, they should not be considered objectionable.

1.9 Due to the distance from Keahole Airport, noise from airport activities should not impact the proposed development. Occasional high altitude fly-overs of such aircraft as single-engine planes and helicopters may at times be audible. However, fly-overs should be infrequent and, therefore, their impact to the proposed development should be minimal.

## 2.0 PROJECT DESCRIPTION

The Hokukano Development involves approximately 1,540 acres of land along the Kona Coast of the island of Hawaii. The project site and vicinity is shown in Figure 1. Currently, the project area is undeveloped land partly used for cattle grazing. The project is bounded on its makai side by shoreline. The areas to the north and south of the project site are similar undeveloped lands. A

residential area, Kona Scenic Subdivision, borders the mauka side of the project site. Additionally, commercial businesses exist along Mamalahoa Highway approximately one-half mile from the mauka border of the project site.

The proposed plan encompasses all 1,540 acres of the project site. Low and medium density residential areas are proposed for 1,000 acres with a total of 1,440 dwelling units. The remaining 540 acres are proposed for a 27-hole golf course with a clubhouse, a 100-room lodge, and park and conservation areas. A proposed state by-pass road which will run parallel to Mamalahoa Highway will pass through the mauka portion of the proposed project site [Reference 1]. The Hokukano Development Plan is shown in Figure 2 with the Land Use Summary listed in Figure 3.

## 3.0 NOISE STANDARDS AND GUIDELINES

Currently, the County of Hawaii does not have or enforce any community noise regulations. However, the State Department of Health noise regulations, which have been adopted and enforced for Oahu are presented here as a guideline in assessing community noise on Hawaii. Additionally, various federal agencies specify guidelines in assessing environmental noise and set noise limits as a function of land use. Federal agencies, however, do not have the authority to enforce such noise limits, and thus present them as recommended guidelines only.

3.1 State Department of Health - The State Department of Health (DOH) specifies noise levels that shall not be exceeded for more than 10% of the time during any 20-minute period [Reference 2]. These are enforced for any location at or beyond the property line. The specified noise limits vary depending on the land use and time of day as shown in Figure 4. DOH also specifies the following with respect to adjacent zoning and order of precedence.

> "Where the allowable noise level between two adjacent zoning districts differ, the lower allowable noise level shall be used. For example, the allowable noise level for the residential district shall be used at the property line between residential and business districts.
>
> The limits specified in the allowable noise levels table shall apply subject to the order of precedence in which uses were initiated after the effective date of this rule; provided that a new order of precedence is established when any use is discontinued. The initiation of use shall be measured by the date of





> rezoning. For example, if agricultural or industrial operations are conducted next to a lot used as residence, the agricultural or industrial limits would apply if the agricultural or industrial operations had been initiated after the effective date of this rule. Residential limits would apply if the building permit for the residence was obtained before agricultural or industrial operations had been initiated."

3.2 U.S. Department of Housing and Urban Development - The U.S. Department of Housing and Urban Development (HUD) has established Site Acceptability Standards for interior and exterior noise for housing [Reference 3]. These standards are based on day-night equivalent sound levels, Ldn (see Appendix A), and identify the need for noise abatement, either at the site property line or in the building construction. HUD Site Acceptability Criteria rank sites as Acceptable, Normally Unacceptable, or Unacceptable. "Acceptable" sites are those where noise levels do not exceed an Ldn of 65 dB. Housing on acceptable sites do not require additional noise attenuation other than that provided in customary building techniques. "Normally unacceptable" sites are those where the Ldn is above 65 dB but does not exceed 75 dB. Housing on normally unacceptable sites requires some means of noise abatement, either at the property line or in the building construction, to assure the interior noise levels are acceptable. "Unacceptable" sites are those where the Ldn is 75 dB or higher. The term "unacceptable" does not necessarily mean that housing cannot be built on these sites, but rather that more sophisticated sound attenuation would likely be needed.

3.3 U.S. Federal Highway Administration - The Federal Highway Administration (FHWA) has established a set of design goals for traffic noise exposure [Reference 4]. The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, Leq (see Appendix A). For example, Category B, defined as picnic and recreation areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals, has a corresponding maximum exterior Leq of 67 dB and a maximum interior Leq of 52 dB. These limits are viewed as design goals, and all projects which are developed to meet these limits are deemed in conformance with the FHWA noise standards.

3.4 U.S. Environmental Protection Agency - The U.S. Environmental Protection Agency (EPA) has identified a range of yearly day-night equivalent sound levels, Ldn, sufficient to protect public health and welfare from the effects of environmental noise [Reference 5]. The EPA has established a goal to reduce exterior environmental

noise to an Ldn not exceeding 65 dB and a future goal to further reduce exterior environmental noise to an Ldn not exceeding 55 dB. Additionally, the EPA states that to protect against hearing damage, one's 24-hour equivalent sound level exposure, Leq, at the ear should not exceed 70 dB. The EPA emphasizes that these goals are not intended as regulations as they have no authority to regulate noise levels. Rather these goals are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

## 4.0 EXISTING ACOUSTICAL ENVIRONMENT

4.1 General - Ambient noise measurements were conducted on September 16, 1992 to assess the existing acoustical environment within and adjacent to the project site. The measurement locations are shown in Figure 5 and are described below.

A Near the entrance gate to the project site at the end of Halekii Street and near Kona Scenic Subdivision and the ballpark.

B Near the center of the project site within undeveloped lands.

C Near the South/Makai corner of the project site within undeveloped lands.

D Near the North/Makai corner or the project site within undeveloped lands.

E Along Manawa Street within Kona Scenic Subdivision.

Noise level measurements were taken over 10-minute sampling periods using a Larson-Davis Laboratories Model 700 Sound Level Meter. The noise measurement results, in terms of the Equivalent-Continuous Noise Level (Leq), the minimum noise level (Lmin), the maximum noise level (Lmax), and the noise levels exceeded 90%, 50%, 10%, and 1% of the time (L90, L50, L10, and L1, respectively), are summarized in Table 1. These statistical noise levels are commonly used to describe environmental noise. For example, the 90-Percentile Exceedence Sound Level, L90, represents a measure of the residual or ambient noise, minimally influenced by nearby discrete events. A brief description of acoustical terminology is presented in Appendix A.

4.2 Project Site - The proposed project site is currently exposed to low noise levels. The measured existing background noise levels (L90) were between 33 and 39 dBA within the project site, which is





typical of quiet rural areas. The dominant identifiable noise sources were wind, birds, and at locations along the makai side of the project site, surf.

4.3 Project Vicinity - The similar undeveloped lands to the north and the south of the proposed project site should experience an acoustical environment similar to the project site with wind, birds, and surf being the dominant noise sources. The Kona Scenic Subdivision, which borders the mauka side of the project site, experiences a background noise level (L90) of approximately 38 to 41 dBA which is typical of quiet residential neighborhoods.

## 5.0 POTENTIAL NOISE IMPACT DUE TO THE PROJECT DEVELOPMENT

5.1 Additional Traffic Generated by the Project - The measured traffic noise levels and the predicted traffic volumes [Reference 1] were used in conjunction with the Federal Highway Administration (FHWA) noise prediction model [Reference 6] to estimate the traffic noise created as a result of the project. The traffic noise was predicted at two locations, location A along Halekii Street and location B along Mamalahoa Highway as shown in Figure 6. The existing (1992) and projected future (2005 and 2010) traffic noise levels during peak traffic hours are listed in Table 2. Additionally, the projected future (2005 and 2010) traffic noise level increases during peak traffic hours are summarized in Table 3. The predicted traffic noise level increase along Halekii Street due to additional traffic generated by the project is less than 0.7 dBA. This corresponds to an unnoticeable change in perceived loudness and, thus, a minimal impact on noise sensitive locations along Halekii Street. The traffic noise levels along Mamalahoa Highway due to the development of the proposed project are predicted to decrease. This is due to the following:

1. The proposed state by-pass road will divert traffic from Mamalahoa Highway to the by-pass road, thus decreasing the traffic volume on Mamalahoa Highway, and

2. The project proposed lengthening of Halekii Street to intersect with the by-pass road will divert some local Halekii traffic currently using Mamalahoa to using the by-pass road, thus again decreasing the traffic volume on Mamalahoa Highway.

5.2 Noise Generated by Activities Within the Project Site - Activities within the proposed residential areas and the 85-room lodge facility may be potential sources of noise affecting noise sensitive areas both nearby and within the project site. Although the County of

Hawaii does not presently enforce any community noise regulations, noise from these sources may cause annoyance if not properly mitigated. Such noise sources may include mechanical equipment associated with air-conditioning and ventilating, exhaust fans, other stationary equipment, or parking lot activity associated with the 85-room lodge. Therefore, mitigative measures, e.g., acoustic enclosures, barrier walls, etc., should be implemented to control noise from such noise sources.

5.3 Construction Noise - Development of the project site will involve excavation, grading and the construction of infrastructure and buildings. The various construction phases of a development project may generate significant noise. The actual noise levels are dependent upon the methods employed during each stage of the construction. Ranges of typical construction equipment noise levels in dBA are shown in Figure 7. Earthmoving equipment, such as bulldozers and diesel-powered trucks, will probably be the loudest equipment used during construction. Any noise impact from these operations on the existing Kona Scenic Subdivision residential area should, however, be relatively short-term.

Blasting, if required, could also have noise impacts. However, blasting at construction sites near populated areas is usually accomplished by using numerous small charges detonated with small time delays. Blast mats can also be used to assist in directing the explosive energy into the rock and muffle the noise. Thus, with the appropriate blast design techniques, the noise from blasting can be controlled within acceptable limits at the closest noise sensitive areas.

## 6.0 POTENTIAL NOISE IMPACT ON THE PROJECT

6.1 Traffic Noise - The proposed residential areas closest to the proposed state by-pass road will be exposed to predicted (future 2010) hourly equivalent continuous noise levels, Leq, of approximately 67 dBA at a distance of 50 feet from the by-pass road (see Location C in Figure 6). The Federal Highway Administration (FHWA) has specified a design goal of Leq = 67 dBA for traffic noise exposure for land uses defined under Category B, as previously discussed. Therefore, if residential home setbacks of at least 50 feet from the state by-pass road cannot be achieved, other noise mitigation measures should be implemented.

Such noise mitigation include providing sound barriers next to the by-pass road (such as walls or landscaped earth berms, which must be high enough to clearly block line-of-sight to the traffic), and appropriate building orientation and design, such as:





1. Avoiding the use of multi-story homes in these areas, and orienting the buildings so that bedroom windows do not directly face the road.

2. Restricting the use of jalousie windows to non-critical areas, such as bathrooms, laundries, etc.

3. Air-conditioning of noise sensitive areas, such as bedrooms, so that windows may be kept closed for noise reduction purposes.

4. Providing additional sound absorptive treatment in bedrooms (carpets with padding, louvered closet doors, etc.), to reduce build-up in the reverberent sound field.

Residential areas closest to Halekii Street will be exposed to predicted (future 2010) Leq levels of approximately 60 dBA at a distance of 50 feet from Halekii Street (see Location D in Figure 6). This traffic noise exposure level conforms to the guidelines set by the FHWA for residential areas and, thus, should offer minimal impact to the proposed homes near Halekii Street.

6.2 Golf Course Operations - A 27-hole golf course is proposed for approximately 350 acres of the project site. Potential noise sources from golf course operations include the clubhouse, a public address system, and ground maintenance activities. Residential areas are proposed within approximately 400 feet of the golf clubhouse. If noise sources at and near the clubhouse (e.g., golf cart chargers, pumps, refrigeration and air-conditioning equipment, exhaust fans, and other stationary equipment) are not controlled properly, they could impact the closest proposed homes. Additionally, a public address system near the clubhouse could also impact nearby residential areas. In order to minimize the noise impact on the homes, public address speakers should be oriented such that announcements are not projected directly into the nearby residential areas. Equipment associated with ground maintenance activities (e.g., tractors, lawn mowers, leaf blowers, etc.) may also impact nearby residential areas. However, such activities are transient about the golf course for short periods and, therefore, should not be considered objectionable.

6.3 Aircraft Noise - The proposed project site is approximately 16 miles south of the Keahole Airport, thus noise from airport activities should not be evident within the project site. However, due to the tourism and sight-seeing nature of the island, small aircraft such as single-engine airplanes and passenger helicopters, may occasionally fly over the project site at high altitudes. During field noise measurements within the project site, a maximum sound level, Lmax,

of approximately 54 dBA was experienced from one single-engine aircraft fly-over at greater than 1,000 feet. Although at times faintly audible, aircraft operations should be infrequent and, therefore, aircraft noise should not significantly impact the proposed development.

Please call if you have any questions concerning this environmental noise assessment of the proposed Hokukano Development.

Sincerely,

W. Brent Ferren

W. Brent Ferren

WBF/ld.rpt

cc: Mr. Richard Frye
1250 Oceanside Partners

REFERENCES

1. *Draft Report Hokukano - Traffic Impact Assessment*, Parsons Brinkerhoff Inc., Fax Received September 22, 1992.

2. *Chapter 43 - Community Noise Control for Oahu*, Department of Health, State of Hawaii, Administrative Rules, Title 11, November 6, 1981.

3. *Department of Housing and Urban Development Environmental Criteria and Standards*, Title 24 CFR Part 51, Federal Register, Vol. 44, No. 135, July 12, 1979; Amended 49 FR 880, January 6, 1984.

4. *Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise*, Title 23 CFR Part 772, June 19, 1973; Revised 47 FR 29654, July 8, 1982.

5. *Toward a National Strategy for Noise Control*, U.S. Environmental Protection Agency, April 1977.

6. *FHWA Highway Traffic Noise Prediction Model*, FHWA - RD - 77 - 108; U.D. Department of Transportation, December 1978.



TABLE 1

NOISE LEVELS MEASURED WITHIN AND ADJACENT TO THE PROPOSED PROJECT SITE ON SEPTEMBER 16, 1992

| Location | Measured Noise Levels (dBA) | | | | | | | Dominant Noise Source |
|---|---|---|---|---|---|---|---|---|
| | Leq | Lmin | L90 | L50 | L10 | L01 | Lmax | |
| A | 42 | 37 | 38 | 41 | 45 | 49 | 52 | Nearby Homes (Lawn Mowing); Wind; Occasional Traffic/Dogs |
| B | 40 | 33 | 33 | 37 | 40 | 52 | 54 | Wind/Birds; Distant Aircraft |
| C | 41 | 38 | 39 | 40 | 42 | 45 | 51 | Wind; Birds/Surf |
| D | 37 | 34 | 35 | 36 | 38 | 43 | 51 | Wind; Birds |
| E | 45 | 38 | 41 | 44 | 48 | 50 | 52 | Nearby Homes (Talking); Occasional Traffic/Dogs |

#92-34.NLM

TABLE 2

EXISTING (1992) AND PROJECTED FUTURE (2005 AND 2010) TRAFFIC NOISE LEVELS (dBA) DURING PEAK TRAFFIC HOURS

| | Locations | |
|---|---|---|
| | A | B |
| **Existing 1992** | | |
| AM | 55.1 | 63.4 |
| PM | 56.8 | 63.2 |
| **Future 2005 Without Project** | | |
| AM | 56.5 | 61.5 |
| PM | 58.2 | 61.1 |
| **Future 2005 With Project** | | |
| AM | 57.1 | 61.0 |
| PM | 58.8 | 60.1 |
| **Future 2010 Without Project** | | |
| AM | 57.1 | 62.1 |
| PM | 58.8 | 61.8 |
| **Future 2010 With Project** | | |
| AM | 57.8 | 61.6 |
| PM | 59.4 | 60.7 |

Note: Noise levels are equivalent continuous noise levels (dBA) at an arbitrary 100 ft. reference distance.

#92-34.EAP



TABLE 3

PROJECTED FUTURE (2005 AND 2010) TRAFFIC NOISE LEVEL (dBA) INCREASES DURING PEAK TRAFFIC HOURS

| | Locations | |
|---|---|---|
| | A | B |
| **Future 2005 Traffic Noise Level Increases (dBA) Without the Project** | | |
| AM | 1.4 | -1.9 |
| PM | 1.4 | -2.1 |
| **Future 2010 Traffic Noise Level Increases (dBA) Without the Project** | | |
| AM | 2.0 | -1.3 |
| PM | 2.0 | -1.4 |
| **Future 2005 Traffic Noise Level Increases (dBA) Due to Project Generated Traffic** | | |
| AM | 0.6 | -0.5 |
| PM | 0.6 | -1.0 |
| **Future 2010 Traffic Noise Level Increases (dBA) Due to Project Generated Traffic** | | |
| AM | 0.7 | -0.5 |
| PM | 0.6 | -1.1 |

#92-34.PFT

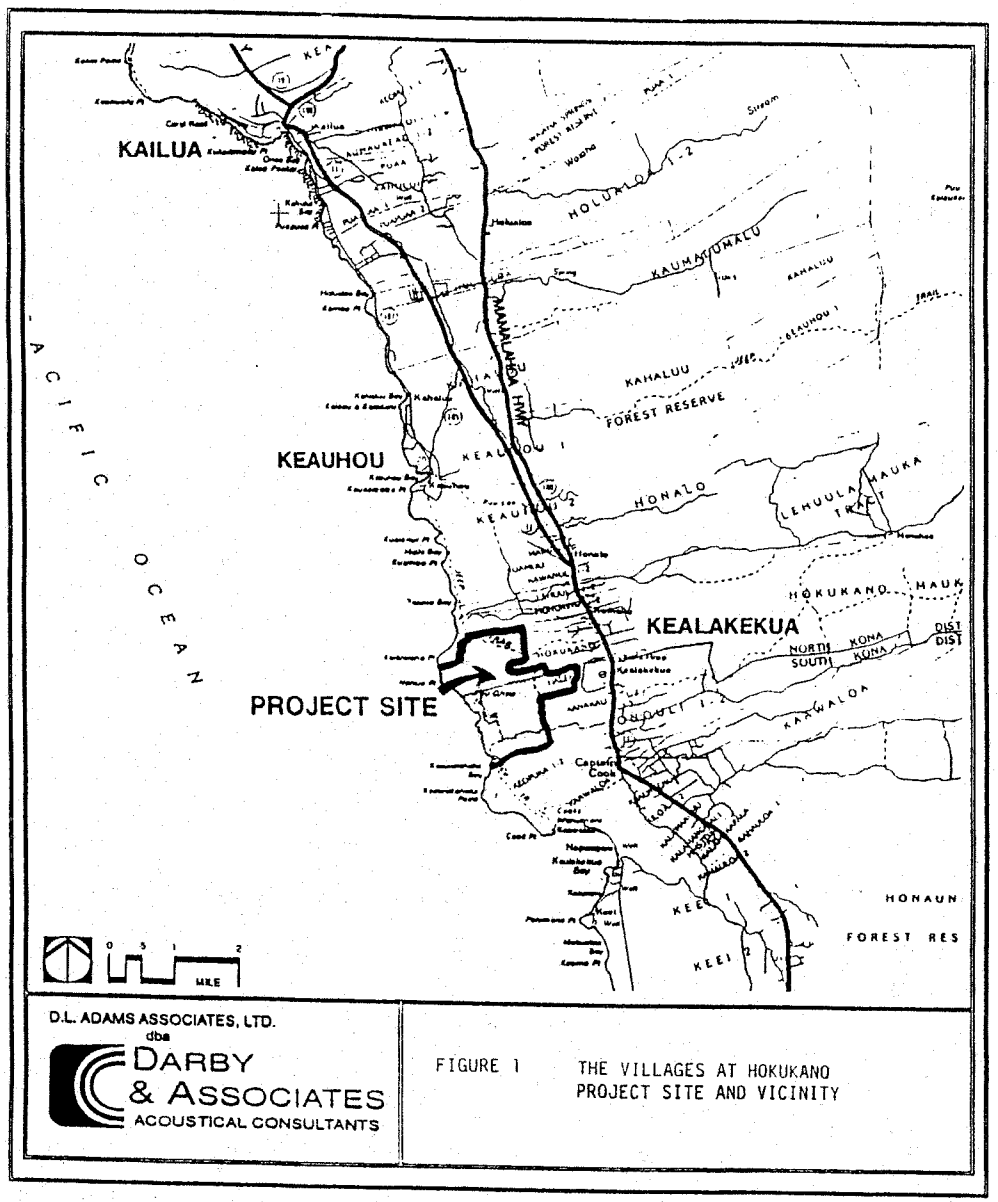


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FIGURE 1 THE VILLAGES AT HOKUKANO
PROJECT SITE AND VICINITY



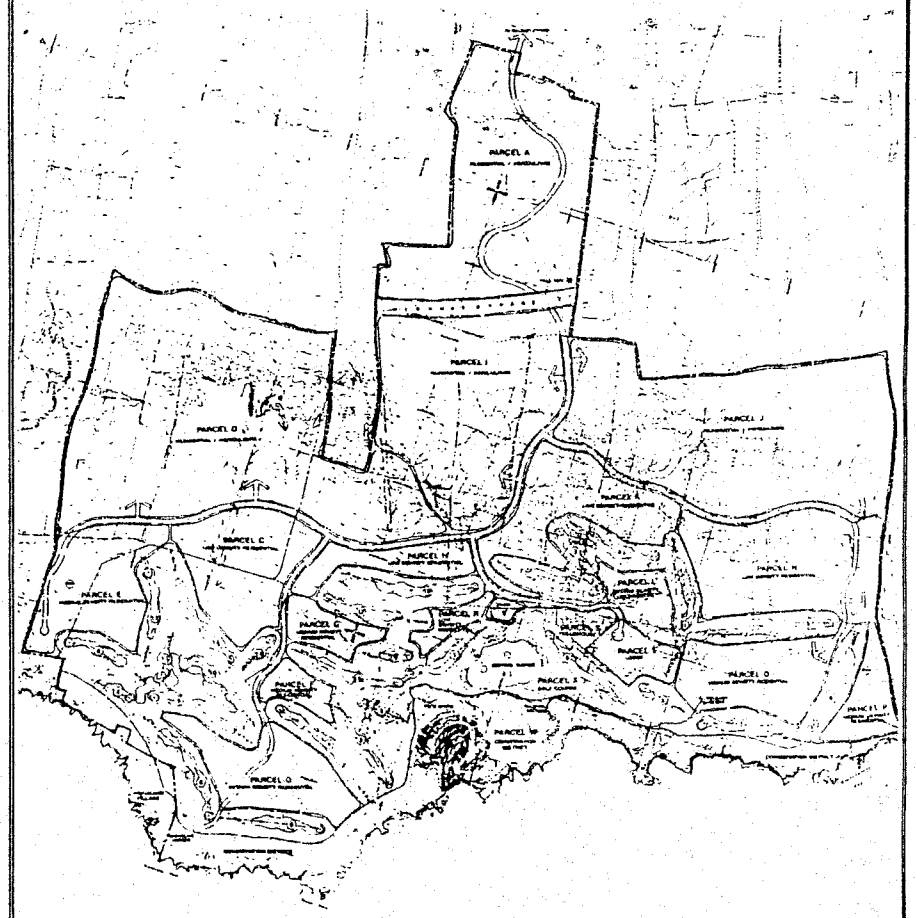


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FIGURE 2 THE VILLAGES AT HOKUKANO
DEVELOPMENT PLAN

## LAND USE SUMMARY

| Parcel | Area | Yield | Use | Gross Density |
|---|---|---|---|---|
| A | 118.0 | 60 | Residential/Agriculture | .5 du/ac |
| C | 47.3 | 95 | Residential | 2.0 du/ac |
| D | 226.0 | 154 | Residential/Agriculture | .5 du/ac |
| E | 45.5 | 140 | Residential | 3.0 du/ac |
| F | 8.5 | 35 | Residential | 4.0 du/ac |
| G | 12.0 | 50 | Residential | 4.0 du/ac |
| H | 20.0 | 40 | Residential | 2.0 du/ac |
| I | 123.5 | 65 | Residential/Agriculture | .5 du/ac |
| J | 170.0 | 88 | Residential/Agriculture | .5 du/ac |
| K | 46.0 | 100 | Residential | 2.1 du/ac |
| L | 15.0 | 50 | Residential | 3.1 du/ac |
| N | 66.0 | 139 | Residential | 2.1 du/ac |
| O | 35.0 | 140 | Residential | 4.0 du/ac |
| P | 17.0 | 68 | Residential | 4.0 du/ac |
| Q | 42.5 | 200 | Residential | 4.7 du/ac |
| R | 7.5 | 16 | Residential | 2.1 du/ac |
| Subtotal | 1000.0 Acres | 1440 Units | | |
| S | 4.0 | -- | Golf Clubhouse | -- |
| T | 14.0 | 100 | Lodge | -- |
| V | 2.0 | -- | Historic Park | -- |
| W | 140.0 | -- | Conservation District | -- |
| X | 349.0 | -- | Golf Course | -- |
| Y | 17.0 | -- | By-Pass | -- |
| Z | 14.0 | -- | Roads | -- |
| Subtotal | 540.0 Acres | 100 Units | | |
| TOTAL | 1540 Acres | 1540 Units | | |

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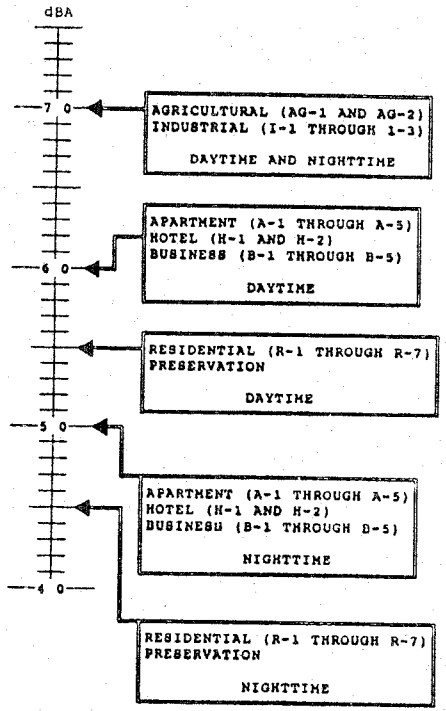
FIGURE 3 THE VILLAGES AT HOKUKANO DEVELOPMENT PLAN LAND USE SUMMARY






NOTE: THE REGULATION STATES THAT THE ALLOWABLE LEVELS SHALL NOT BE EXCEEDED FOR TEN PERCENT OF THE TIME WITHIN ANY TWENTY MINUTE PERIOD

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FIGURE 4 ALLOWABLE NOISE LEVELS FOR VARIOUS ZONING DISTRICTS; COMMUNITY NOISE CONTROL FOR OAHU; STATE OF HAWAII, DEPARTMENT OF HEALTH

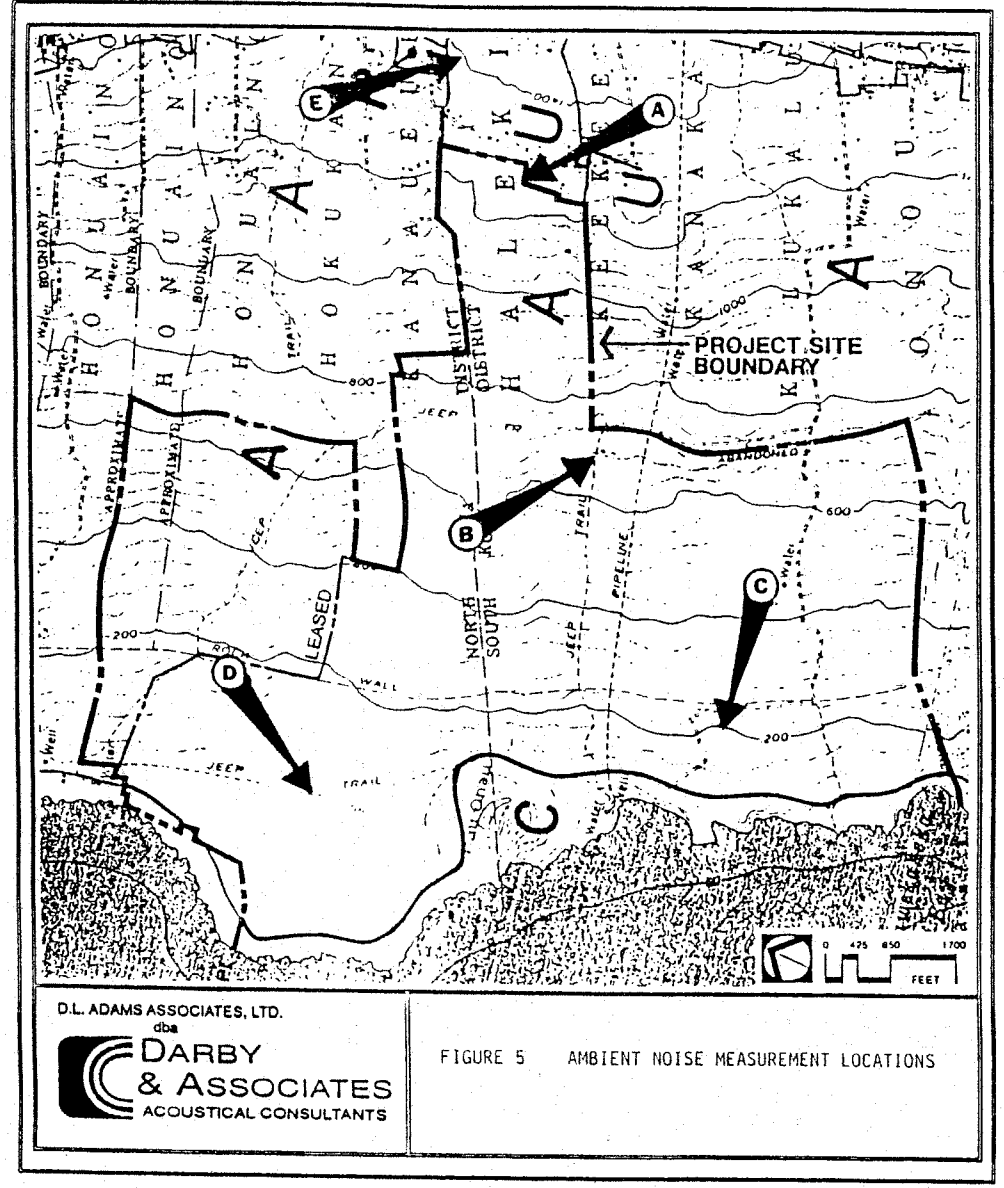


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FIGURE 5 AMBIENT NOISE MEASUREMENT LOCATIONS



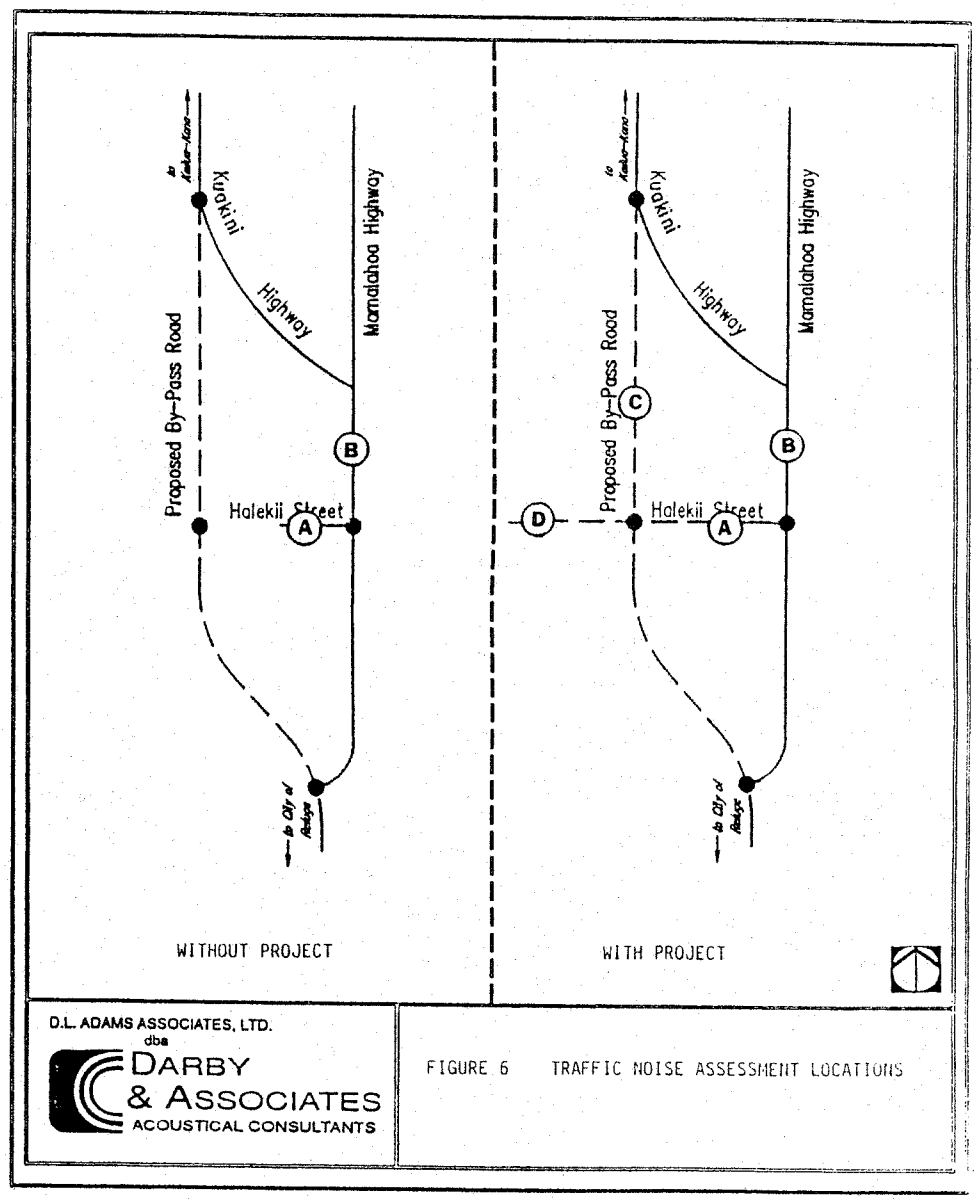


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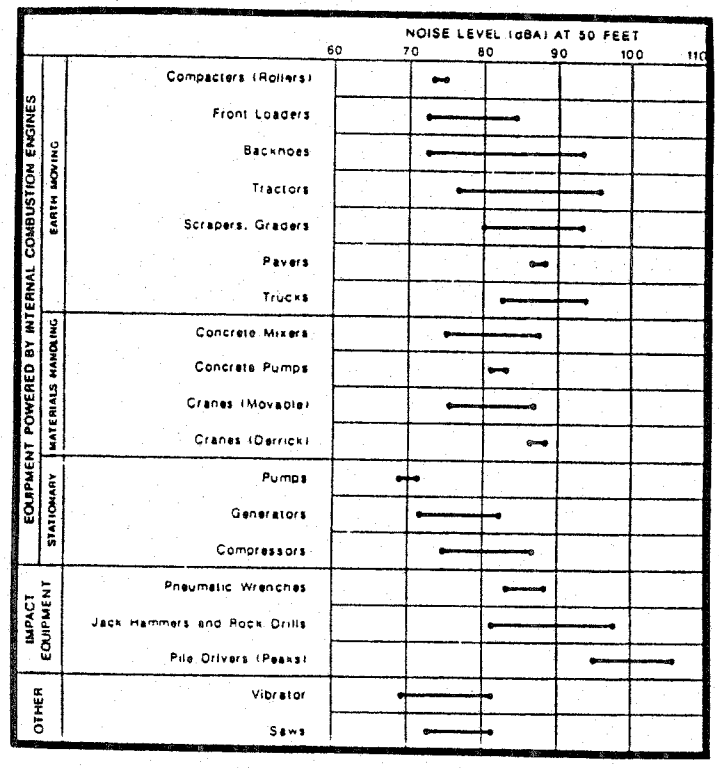
FIGURE 6 TRAFFIC NOISE ASSESSMENT LOCATIONS




Note: Based on Limited Available Data Samples

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FIGURE 7 TYPICAL SOUND PRESSURE LEVELS FROM CONSTRUCTION EQUIPMENT

SOURCE: U.S. ENVIRONMENTAL PROTECTION AGENCY 1972



## APPENDIX A

## ACOUSTICAL TERMINOLOGY

### Sound (Noise) Level

Sound or noise consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. It is measured using precision instruments known as sound level meters, in terms of decibels (dB). Sound Level or Sound Pressure Level is defined as:

$$SPL = 20 \log (P/Pref) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and Pref is 20 micropascals, which is approximately the lowest sound pressure that can be detected by the human ear. For example, if P is 20 micropascals, then SPL = 0 dB, or if P is 200 micropascals, then SPL = 20 dB. The relation between sound pressure in micropascals and sound pressure level in decibels (dB) is shown in Figure A-1.

The sound level that results from a combination of noise sources is not the sum of the individual sound levels, but rather the result is the logarithmic sum. For example, two sound levels of 50 dB produce a combined level of 53 dB, not 100 dB; two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotion and expectations. However, in general, a change of 1 or 2 dB in the level of a sound is difficult for most people to detect, a 3 to 5 dB change corresponds to a small but noticeable change in loudness, and a 10 dB change corresponds to an approximate doubling or halving in loudness.

### A-Weighted Sound Level

The human ear is more sensitive to sound with frequencies above 1000 Hertz (Hz), than with frequencies below 125 Hz. Due to this type of frequency response, a weighting system, A-weight, was developed to approximate the frequency response of the human ear. A-weighted sound level (dBA) de-emphasizes the low frequency portion of the spectrum of a signal. The A-weighted (dBA) level of a sound is a good measure of the loudness of that sound, and so different sounds having the same A-weighted level sound about equally as loud. Typical values of the A-weighted sound level of various noise sources are listed in Figure A-1.

#92-34.IAP

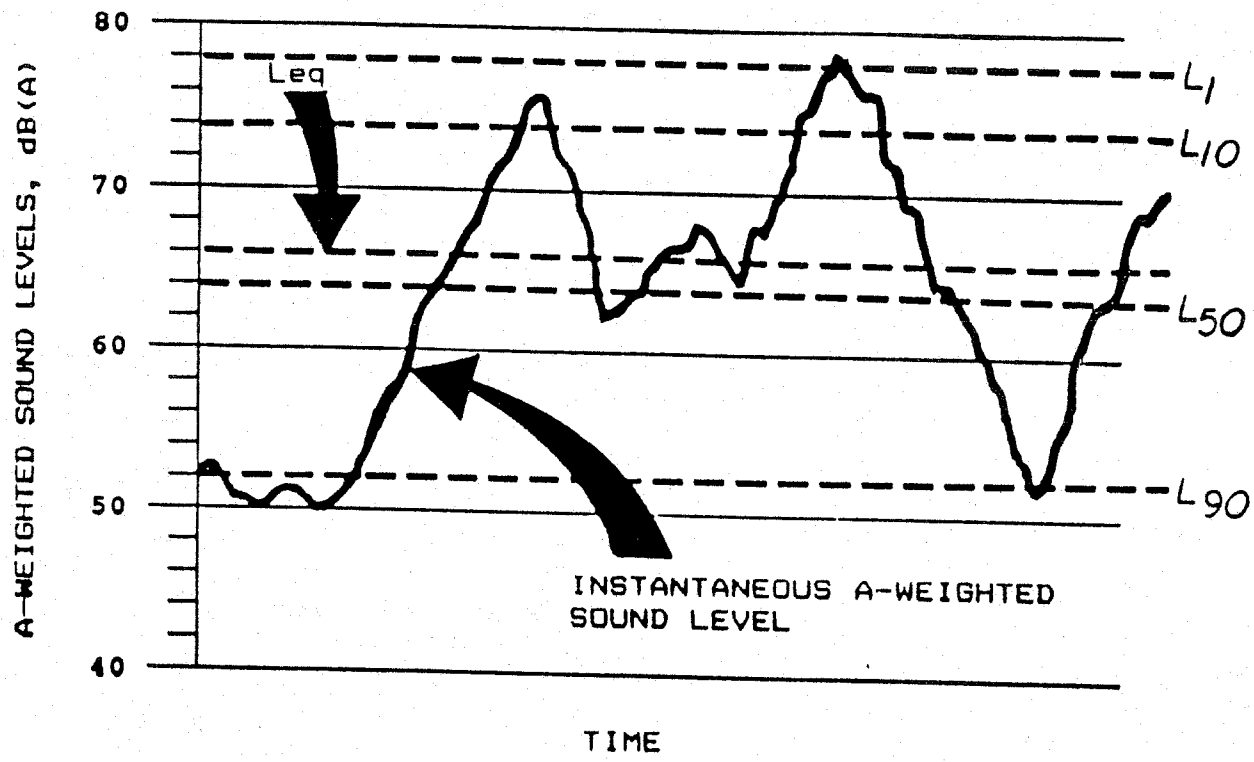


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FIGURE A-2 Sample of a comparison of an instantaneous A-weighted sound level and the corresponding statistical sound levels.

Appendix A
Acoustical Terminology
(Continued)

Statistical Sound (Noise) Levels

The sound levels of long-term noise producing activities, such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, several statistical noise levels have been developed and instrumentation are available to measure them. Common statistical sound levels include Equivalent Continuous Noise Level, Leq, and Percentile Exceedence Level, Lx.

The Equivalent Continuous Noise Level, Leq, represents a constant level with the same amount of total acoustic energy as that contained in the actual time-varying sound being measured over a specific time period. Leq is commonly used to describe community noise, traffic noise, and hearing damage potential.

A Percentile Exceedence Level, Lx, represents the sound level which is exceeded for x% of the measured time period. For example, L10 = 60 dBA describes that over the measured time period, the measured noise exceeded 60 dBA for 10% of the time. Common Percentile Exceedence Levels include L1, L10, L50, and L90, which are widely used to assess community and environmental noise. Figure A-2 illustrates the relationship between selected statistical noise levels.

Day Night Average Sound Level

The Day Night Average Sound Level, Ldn, is essentially the Equivalent Continuous Noise Level measured over a 24-hour period. However, in calculating the Ldn, 10 dBA is added to the noise levels recorded between 10 pm and 7 am to account for people's higher sensitivity to noise at night. The Ldn is a commonly used noise descriptor in assessing land use compatibility, and is used by federal and local agencies and standards organizations.

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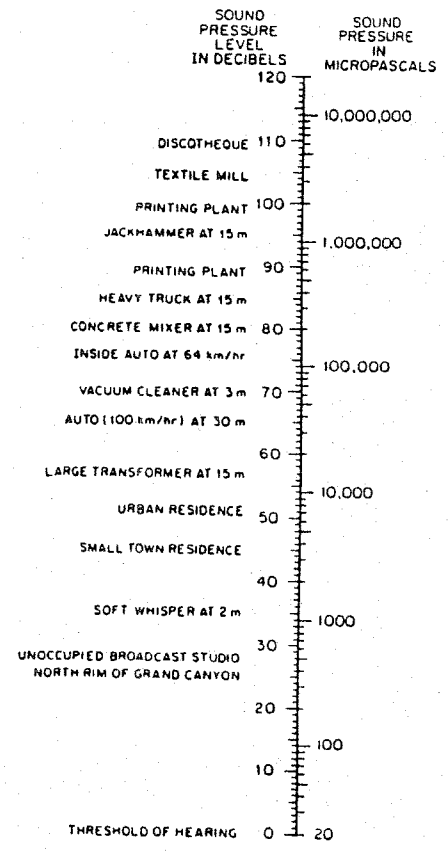


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FIGURE A-1 The relation between sound pressure, P, and sound pressure level, SPL. Also shown are typical values of A-weighted sound levels of various noise sources.

# I - 7 Integrated Golf Course Management Program

*INTEGRATED GOLF COURSE MANAGEMENT PROGRAM*

*The Villages at Hokukano*

*prepared for*

*1250 Oceanside Partners*

*by*

*W. Lee Berndt, Ph.D.*
*Certified Professional Agronomist*

*January, 1993*



TABLE OF CONTENTS

*PROJECT OVERVIEW*

Introduction

The "Villages at Hokukano" is a proposed low density residential golf community being developed by 1250 Oceanside Partners. It has been designed within the boundaries of a 1,540 acre parcel located on the border of the North and South Kona districts on the Big Island of Hawaii. The parcel is approximately ten miles south of Kailua-Kona.

The master plan features predominantly single-family residential neighborhoods ranging in densities from 0.5 to 5.0 units per acre. In addition, the plans include establishing a historic park, a significant conservation district, a series of coastal trails, and a 100-unit members lodge. One special project amenity will be a 27 hole championship golf course designed by Jack Nicklaus. The golf course will serve as a marketing tool for the real estate, influencing property buyers from all regions of the world. It will also provide a visually pleasing open space element for the entire project.

The presence of the golf course will provide several benefits to the surrounding communities including short term and long term employment. It will provide 30-35 full time jobs, not including the professional staff or other service oriented personnel. It will bolster the local housing market and construction industry, provide for additional tax-based revenues, generate limited tourism, and stimulate the local economy with reference to sales and services. In short, development of the golf course should translate into a positive economic impact for the area.

In addition to the economic benefits, the presence of the golf course should have a positive impact on the local environment. Well maintained turfgrass within an appropriate golf course



design can absorb pollutants, fix carbon dioxide, generate oxygen, provide a cooling effect, trap dust, dampen noise, and stabilize soil. The physical design of the course will help to retain run-off and associated sediment originating at higher elevations. This in turn will help to preserve the pristine character of the ocean. The transition zones from open space to native vegetation will also serve as habitat and sanctuary for many species.

Purpose of the Document

Even though the golf course can and will offer many benefits, its development and management can be perceived as being detrimental to Hawaii's fragile environment. Thus, Hokukano has approached such concerns in a sensible, responsible manner. Development of an integrated golf course management program (IGCMP) is part of that approach. The fully developed IGCMP is intended to coordinate modern "best management practices" related to the major aspects of golf course development and operation. The following document has been written to provide an overview of that program. There are special references to managing turfgrass and the key elements of golf course construction. Further, strategies are referenced for dealing with issues such as erosion control, water quality monitoring, and the use of fertilizers, pesticides, and irrigation water.

*GOLF COURSE CONSTRUCTION AND MANAGEMENT PHILOSOPHY*

Best Management Practices

Best management practices (BMPs) can herein be defined as a modern direction or focus of construction and management implemented to promote sensitivity to the environment. The direction or focus is intended to produce high quality turfgrass

which is essential to the subsistence of a premium golf course. At the same time it is an important element in protecting against potential threats to the environment, especially with reference to water quality. Towards that end Hokukano will develop and follow a best management practices protocol. Critical to the successful implementation of an effective program will be the attitude of the contractors and management staff towards performing their functions in a manner consistent with the BMP goals listed below. Presently, the goals of BMPs according to Balogh et al. (1992) are to:

1) **minimize the offsite transport of nutrients, sediments, and pesticides**
2) **control the rate, type, and method of chemical applied**
3) **minimize chemical loading by using an integrated pest management concept and by utilizing fertility testing schemes**
4) **implement surfacewater and groundwater conservation practices**
5) **educate turf professionals and the public on the relationship of environmental issues and systems management**

To help meet these goals and to minimize risk to the environment Hokukano's BMP strategies will generally consist of:

1) **employing an environmentally conscious, well educated, responsible construction and management staff**
2) **implementing a course design that is conducive to environmental responsibility**
3) **practicing environmentally sound construction methods**
4) **establishing then maintaining a healthy, vigorous, high quality turf that is inherently resistant to imposed stresses such as pests, drought, and practical use**



5) **practicing an integrated problem solving approach in management**
6) **performing cultural practices in an environmentally responsible manner**
7) **utilizing state-of-the-art management tools**
8) **creating a system of checks designed to continuously evaluate the efficacy of the BMPs**
9) **contributing to the BMP knowledge base through research and experience**

The protocol will be continuously updated as the BMP's knowledge base is expanded. Central to expanding the BMP's knowledge base will be continuing education involving technical research aimed at better understanding interactions between construction practices, maintenance practices, and the environment.

*GOLF COURSE CONSTRUCTION ISSUES*

General Design Approach

The design intent at Hokukano is to develop a golf course in harmony with the land rather than to impose a design upon it. The general approach used by the designers has been to locate the course within the confines of the property so as to minimize impact to the natural lay of the land. Special land forms or other nuances have been used to develop a suitable theme for the course, and well identified parameters of work have given a clear definition in formulating the most appropriate routing plan. Factors considered thus far in the routing have included included:

1) **natural drainage characteristics**
2) **slopes**

3) **indigenous vegetation**
4) **archaeological areas and features**
5) **special land forms**
6) **environmentally sensitive areas**
7) **buffers**
8) **costs of construction**
9) **erosion and sedimentation control**

Clearing and Grading

In order to implement the design, a certain amount of vegetation clearing and terrain grading will take place. The intent of the designers and developers is to minimize the necessity of clearing healthy specimen trees by incorporating them into the design strategy when practical. The designers and developers also intend that grading of terrain be a blending and sculpting of land rather than a general movement of massive amounts of earth.

Because the design strategy involves concave, collecting shapes grading work will enhance drainage control for the property. Thus, directing and controlling surface drainage will be made easier, and run-off can be intentionally diverted to established retention basins. This design concept will help to control sediments, nutrients, and pesticides carried with run-off thereby avoiding the potential for off-site impacts.

Construction Time Frame

The construction period without weather interference should be approximately nine months. Soil conditions, and contractor size and competence will be two other factors to consider. An additional three to eight months may be needed after completion of construction for grassing and grow-in.





Erosion and Sedimentation Control

The involuntary movement of soil during the construction period can be an environmental concern. Soil can be transported through the actions of water or wind, and is especially vulnerable to facilitated transport when in an open, disturbed condition. In keeping with the BMP's philosophy, and the Twelve Conditions Applicable to Golf Course Development set forth by the Department of Health, Hokukano will establish and follow an erosion control plan during construction. The plan will be implemented in conjunction with county and state guidelines and regulations, and in consultation with the Department of Agriculture and the Soil Conservation Service. The goal of the plan will be to minimize the inadvertent movement and/or loss of soil and thereby prevent any associated degradation of environmental quality, especially with reference to water quality. Strategies to be implemented to meet this goal will include:

1) **using design and construction methods which minimize the need for disturbance of soils including staged construction if relevant and practical**
2) **utilizing erosion control methods implementing siltation devices or soil stabilizing devices during the construction phase**
3) **using accepted dust control practices during earthwork**
4) **preventing the extended exposure of open earth as much as is practical during construction**
5) **utilizing temporary vegetation to mitigate extended exposure of open earth if necessary**
6) **establishing permanent vegetation on open earth as soon as possible**
7) **maintaining a perspective conducive to conserving soil and preventing erosion related problems**

To ensure that soil resources are conserved after the construction phase Hokukano will employ strategies such as:

1) designing the development with regard to diverting or re-directing surface drainage which flows onto or across the golf course to settling basins via grassy swales and berms, and drain inlets
2) frequently maintaining the settling basins and retention areas
3) managing soil to help maintain structure and prevent consolidation or compaction
4) maintaining a healthy, dense stand of turfgrass and other permanent vegetation
5) precisely controlling irrigation events
6) constantly monitoring the site for erosion related problems and mitigating any problems as soon as possible

Strategies such as the ones listed will help to prevent degradation of water quality because interactive erosion variables that may lead to the movement or loss of soil will be controlled to the extent practical. However, the developers will ensure that the strategies have been effective and that the goals of the erosion control plan have been met by:

1) collecting baseline water quality information prior to the construction phase
2) implementing a routine water quality monitoring plan during the construction phase and after construction
3) checking the site frequently for erosion related problems
4) mitigating any problems detected by the monitoring or observance using acceptable procedures

There are many different methods used to help prevent erosion.



One will involve minimizing the total area to be disturbed by implementing a strategic design in balance with the lay of the land. Another will be to prevent the untimely disturbance of soil by implementing staged construction when practical. Staged construction involves disturbing limited portions of the site at select times and stabilizing these sites prior to additional disturbance. Using such methods the exposure of disturbed soil is minimized and there is a lesser chance of erosion taking place.

To minimize erosion on disturbed areas the contractors will utilize erosion control, soil stabilization, and dust control methods where appropriate. Such methods include silt fencing and sediment catchments to trap sediment, check dams or terraces to slow the velocity of run-off, erosion matting or mulching and temporary vegetation to stabilize soils, and the frequent moistening of disturbed sites to prevent formation of dust. Long term stabilization structures for highly erodible areas could include rip-rap, bulkheads, and the planting of trees with stabilizing root systems. The appropriate method to be used will be dependent on the specific site and the specific needs for that site. It will be very important for the contractors to maintain the erosion control arrangements so that they function properly. It will also be important to maintain vegetation on steeper slopes which may be prone to erosion. As construction wanes, it will be important to establish a permanent vegetation cover as quickly as practical. Establishing turfgrass and other vegetation is a BMP for erosion control.

Once construction ceases the design of the golf course will in itself promote conservation of soil for much of the entire property. The course will act as a buffer separating up-slope

development from the coastline. Surface drainage onto and across the course will be internalized to control run-off to the ocean. Capturing of drainage water will be encouraged at strategically located settling basins. Any sediment moving with surface water will be trapped at these locations. This will also help to prevent nutrient or pesticide losses related to surface drainage. In addition, the maintenance of a vigorous, dense turf coupled with soil management practices designed to prevent compaction and consolidation will help to reduce surface water movement. It will do so by slowing the velocity of sheet flow helping to make it conducive to absorption into the turfgrass rootzone. A sub-surface drainage system will be instituted to help facilitate water movement from infiltration basins to collection points, then subsequently back to water reservoirs. In this way drainage water can be recycled and re-used for irrigation.

Construction Noise

During the construction phase it is desirable to avoid excessive noise. Thus, the contractors will be obliged to follow all local regulations pertaining to noise abatement including adhering to construction time schemes and utilizing noise abatement devices where required.

*GOLF COURSE TURFGRASS MANAGEMENT*

Introduction

In order to better understand the concept of managing turfgrasses in an environmentally responsible manner it would be appropriate to briefly describe the specific turfgrass management areas on the course, and then discuss the focus or direction of management for those areas. Additionally, it would be appropriate to indicate who has which management responsibilities, describe





certain limitations to culturing turfgrass, and discuss the management tools available to help negate those limitations.

Turfgrass Management Areas

In part, the successful management of the golf course at Hokukano will depend on sustaining high quality turfgrass on a few very highly defined areas. At least ten specific management areas with differing cultural requirements exist (Table 1). Successfully culturing turfgrasses in those specific areas will depend initially on selecting the proper turfgrass for the area, applying the proper cultural practice at the appropriate time, and mitigating imposed stress events. Best management practices will be utilized extensively toward that end in the turf maintenance scheme.

Key Management Personnel

*Upper Level Management.* Ultimate responsibility for the management of the golf course at Hokukano, including the implementation of BMPs, rests with the upper level management staff. This group will be comprised of the owners and the general management. In collaboration with the design team, they will have instituted the quality expectations for the course. To oversee the turfgrass management concerns on a day to day basis, and to ensure that those quality expectations are met, the upper level management will employ a qualified golf course superintendent who will follow and contribute to the BMP's protocol.

*Golf Course Superintendent.* The individual chosen as superintendent for Hokukano will be well versed in turfgrass science, and will possess documentation to evidence that. They will have a great deal of prior turfgrass maintenance experience

Table 1. Designation of turfgrass management areas and turfgrass types on a high quality warm season golf course. The relative level of cultural intensity and the relative level of pesticide input for these areas in general is detailed in Tables 2 and 3.

| Management Area | Appropriate Turfgrass Types* |
|---|---|
| Green Surface | Tifdwarf Bermudagrass |
| Collar | Tifdwarf Bermudagrass |
| Green Surround | Tifway 419 Bermudagrass |
| Approach | Tifway 419 or Tifgreen 328 Bermudagrass |
| Tee Surface | Tifway 419 or Tifgreen 328 Bermudagrass |
| Tee Surround | Tifway 419 Bermudagrass |
| Fairway | Tifway 419 or Tifgreen 328 Bermudagrass |
| Rough | Tifway 419 Bermudagrass or Seashore Paspalum |
| Amenity Turf | Tifway 419 Bermudagrass or Seashore Paspalum |
| Ornamental Lawn | Tifgreen 328 or Tifdwarf Bermudagrass |

* Other turf types, may be more appropriate for specific locations depending on the style of the course, the specific design, soil conditions, local climate, and quality expectations.





Table 2. Turfgrass management area matrix. This array describes the relative level of cultural intensity for specific warm season turfgrass sections on an average modern golf development.

| | Modified Soil | Percent of Area* | Auxiliary Drainage | Fertilizer Requirement | Irrigation Requirement** | Mowing Frequency | Cultivation Frequency |
|---|---|---|---|---|---|---|---|
| Greens Surface | yes | 2 | yes | high | medium | high | high |
| Collar | yes | <1 | yes | high | medium | high | high |
| Green Surround | no | 3 | no | medium | medium | medium | medium |
| Approach | no | <1 | yes/no | medium | medium | high | high |
| Tee Surface | yes | 2 | yes/no | high | medium | high | high |
| Tee Surround | no | 2 | no | medium | medium | medium | medium |
| Fairway | no | 40 | yes/no | medium | medium | high | high |
| Rough | no | 45 | no | low | low | low | low |
| Amenity Turf | no | 5 | no | low | low | low | low |
| Ornamental Lawn | no | <1 | no | high | medium | high | low |

* Denotes the estimated average percent of turfed area occupied by that section. Actual percentage will vary according to course design.

** Irrigation requirements will vary depending on soil types. Coarse textured soils low in organic matter need more irrigation relative to fine textured soils.

with warm season grasses, and will have a credible work history. He or she will also possess an appropriate pesticide applicators license, and be well versed in the integrated pest management philosophy. The superintendent will also be computer literate and fluent in appropriate languages. In addition, they will maintain an open mind and keep informed on new trends in the industry. They will also have the ability to make high pressure decisions which can affect people as well as the course itself. An aspect that would be most important is that they possess an environmentally conscious attitude in order to successfully implement the BMP philosophy.

The duties of the superintendent will include assuming responsibility for the entire turfgrass maintenance operation. Such duties will involve purchasing, applying, and storing pesticides and fertilizers. Additionally, the superintendent will be regulating course related water use. Thus, he or she will be responsible for maintaining the integrity of both the local and adjacent environments, and protecting the safety of employees and local patrons. A BMPs philosophy would be foremost in living up to those responsibilities.

*Supporting Staff.* To support the superintendent in his or her duties there are other key personnel positions. The superintendents working assistant is usually charged with running the maintenance crew on a day to day basis. Additionally, he or she is charged with performing many of the superintendents functions, although responsibility always rests with the superintendent. Thus, the assistant will possess the same qualifications as the superintendent, with the exception of experience. All superintendents get to be such by previously being assistants.





Table 3. Turfgrass management area matrix. This array describes the relative level of pesticide input for specific warm season turfgrass sections on an average modern golf development.

| | Insecticide Requirement | Fungicide Requirement | Herbicide Requirement | Fumigant Requirement | Nematicide Requirement |
|---|---|---|---|---|---|
| Greens Surface | high | high | medium | initial* | medium |
| Collar | high | high | medium | initial | medium |
| Green Surround | medium | low | high | none | low |
| Approach | medium | medium | medium | none | medium |
| Tee Surface | high | high | medium | initial | medium |
| Tee Surround | medium | low | high | none | low |
| Fairway | medium | high | medium | none | medium |
| Rough | low | low | low | none | low |
| Amenity Turf | low | low | low | none | low |
| Ornamental Lawn | medium | low | medium | initial | low |

* Fumigants are used only prior to turfgrass establishment during seedbed preparation.

The mechanic is typically charged with maintaining the turf management equipment. This often means maintaining the shop complex, the fuel depot, the equipment wash bay, and managing the storage and disposal of hazardous waste such as used oil and waste coolant. By virtue of his duties the mechanic must be environmentally responsible.

Other key positions requiring a commitment to the environment include the irrigation technician(s) and the pesticide applicator(s). The irrigation technician will be charged with maintaining the function of the irrigation system, and regulating its use, on a day-to-day basis. He or she is often responsible for regulating daily course water use. The pesticide applicator will be responsible for the handling, mixing, and subsequent application of all pesticides on a day-to-day basis, under the direction of the superintendent. Thus, he or she will also possess a pesticide applicators license. Both positions require a considerable level of environmental responsibility.

In summary, all people working on the golf course will take responsibility for environmental protection in some fashion. The people maintaining the golf course, and most importantly their collective attitudes and perspectives, will be the single most important determinant in protecting the environment from any effects related to maintaining high quality turfgrass. For this reason continuing education will be stressed.

To help ensure that the appropriate attitude and perspective is established and remains in place, and to help facilitate the quality aspect that upper level management has requested, professional golf course consultants will be employed. Trained agronomists from the Jack Nicklaus design team, as well as a



certified professional independent agronomist, will be retained. These consultants will periodically evaluate the golf course superintendent and the maintenance practices he or she has instituted, and the condition of the course itself.

Limitations to Culturing Turf

A major limitation in culturing fine quality turfgrass is the activity of pests. There are several categories of pests including weeds, disease causing organisms, and insects. Specific pests likely to afflict Hokukano are to be found in Tables 4, 5, and 6. The unchecked activities of turfgrass pests impose stresses on the turf which may in turn limit its quality. For that reason pest control to alleviate imposed stress is one of the major cultural practices to be performed. Pest control, like other cultural practices, should be thought of as a management tool. Pest control will be instituted in a BMP manner.

Major Turfgrass Management Tools

*Integrated Pest Management.* Integrated pest management (IPM) is the implementation of pest control based on predicted economic, ecological, and sociological consequences. It is the central decision making process related to determining which pest control measures are most appropriate. A basic IPM philosophy does not advocate eradication of pest populations. Rather, IPM favors suppression of the pest to the level that damage is acceptable in both an economic and aesthetic sense. The dynamic IPM concept emphasizes control of the pest using genetic, cultural, chemical, structural, and biological methods.

In keeping with the BMP protocol Hokukano will develop and implement a comprehensive IPM plan. The goal of the plan will be

Table 4. Common weeds of turfgrass in Hawaii. Weeds are comprised of three basic types: grassy weeds, sedges, and broadleaf weeds. Not all weeds will be present at any given time.

| Weed Type | Common Name | Scientific Name |
|---|---|---|
| Grassy Weeds | Annual Bluegrass | *Poa annua* |
| | Bahiagrass | *Paspalum notatum* |
| | Dallisgrass | *Paspalum dilitatum* |
| | Goosegrass | *Elusine indica* |
| | Henry's Crabgrass | *Digitaria adscendens* |
| | Hilograss | *Paspalum conjugatum* |
| | Kikuyugrass | *Pennisetum clandestinum* |
| | Lovegrass | *Eragrostis pilosa* |
| | Smutgrass | *Sporobolus poiretti* |
| | Rattailgrass | *Sporobolus africanus* |
| | Stargrass | *Chloris divaricata* |
| | Swollen Fingergrass | *Chloris barbata* |
| | Vaseygrass | *Paspalum urvillei* |
| Sedges | Green Kyllinga | *Kyllinga monocephala* |
| | Purple Nutsedge | *Cyperus rotundus* |
| | Yellow Nutsedge | *Cyperus esculentes* |
| | White Kyllinga | *Cyperus brevifolus* |
| Broadleaf Weeds | Alternanthera | *Alternanthera repens* |
| | Asiatic Pennywort | *Centella asiatica* |
| | Broadleaf Plantain | *Plantago major* |
| | Buttonweed | *Borreria laevis* |
| | Creeping Indigo | *Indigofera endecaphylla* |
| | Dandelion | *Taraxacum officinale* |
| | Drymaria | *Drymaria cordata* |
| | Garden Spurge | *Euphorbia hirta* |
| | Kaimi Clover | *Desmodium canum* |
| | Marsh Pennywort | *Hydrocotyle sibthorpiodes* |
| | Pink Woodsorel | *Oxalis martiana* |
| | Prostrate Spurge | *Euphorbia prostrata* |
| | Prostrate Pigweed | *Amaranthus graecizans* |
| | Purslane | *Portulaca oleracea* |
| | Sensitive Plant | *Mimosa pudica* |
| | Spiny Pigweed | *Amaranthus spinus* |
| | Spotted Spurge | *Euphorbia maculata* |
| | Synderella | *Synderella nodiflora* |



Table 5. Insect pests of turfgrass in Hawaii. Broad groups consist of caterpillars and worms, beetles, mites, and scale type insects.

| Broad Group | Common Name | Scientific Name |
|---|---|---|
| Caterpillars & Worms | Bagworm | *Brarachycyttarus* spp. |
| | Black Cutworm | *Agrotis ipsilon* |
| | Fiery Skipper | *Hylephila phyleus* |
| | Grass Webworm | *Herpetogramma licarsisalis* |
| | Lawn Armyworm | *Spodoptera mauritia* |
| | Sod Webworm | *Herpetogramma phaeopteralis* |
| Beetles | Chinch Bug | *Blissus insularis* |
| | Hunting Billbug | *Sphenophorus venatus* |
| | Rhodesgrass Mealybug | *Antonina gramini* |
| Mites | Bermudagrass Mite | *Eriophyes cynodoniensis* |
| | Stunt Mite | *Aceria neocynodonis* |
| Scales | Bermudagrass Scale | *Odonapsis ruthae* |

Table 6. Diseases of turfgrass common to Hawaii. Turfgrass diseases can be caused by fungi, bacteria, and other micro-organisms.

| Causal Group | Disease | Causal Organism |
|---|---|---|
| Fungi | Anthracnose | Colletrichum graminicola |
| | Bermudagrass Decline | Gaeumanomyces graminis |
| | Brown Patch | Rhizoctonia spp. |
| | Dollar Spot | Lanzia spp. |
| | Fairy Ring | Basisiomycetes |
| | Leaf Spot | Bipolaris spp. |
| | Pythium | Pythium spp. |
| | Rust | Puccinia spp. |
| Bacteria | Bacterial Wilt | Xanthamonas spp. |
| | Bacterial Stripe | Xanthamonas spp. |
| Others | Algae | Thallophyta |
| | Black Layer | Sulfate-reducing Bacteria |
| | Slime molds | Mucilago spp. |
| | White Leaf | Mycoplasma? |



to achieve effective pest control in an ecologically sound manner thereby lessening one of the major limitations to culturing fine quality turf. A secondary goal will be to reduce the overall reliance on pesticides for that purpose. The advantages to be recognized in implementing an IPM concept include:

1) **increasing the chances of pest control success by using an integrated problem solving approach**
2) **increasing pesticide effectiveness by utilizing pesticides in a more judicious and prudent manner**
3) **enhancing the understanding of relationships between management areas, pests, non-target entities, and the general ecosystem**
4) **reducing the economic burden of pest management**
5) **reducing the potential for pesticide encroachment into the environment**
6) **reducing the overall use of pesticides**

There are several components for consideration in any IPM plan:

1) Delineating the management area: this includes defining the specific areas to which IPM will be applied. Each specific area of the development will need its own unique IPM plan according to intensity of management and expectations of quality.

2) Initial information gathering: this includes compiling background information on potential pests and non-target entities. Such information would include identification of species, documenting life cycles, finding appropriate cultural and biological controls, finding applicable chemical controls, documenting prior pest pressure histories, documenting prior records of successful and unsuccessful pest control, and obtaining any other applicable information which contributes to the knowledge base.

3) Monitoring pests and non-target entities within the management area: this will include making frequent observations to determine which pests and non-target organisms are present, to what extent they are present, where they are, and how active they are in that area. Monitoring pests is made easier with the use of ELIZA diagnostic kits and computerized pest

prediction models.

4) Establishing economic damage thresholds: this aspect involves establishing the degree of pest injury which becomes unacceptable to the management area. Management areas will have differing levels of acceptable pest damage, depending on quality expectations.

5) Establishing action levels: this aspect will involve correlating the pest population level, along with other variables such as weather or cultural practices, with the degree of injury deemed unacceptable from that pest. This procedure often takes a long time with constant work.

6) Establishing effective treatments: involved in this phase will be the establishment of sound biological, cultural, genetic, or chemical treatment regimes. The ideal direction behind implementing effective treatment strategies involves mixing methods which are most effective against the target, least disruptive to non-targets, and produce minimal impact to the environment.

7) Establishing a decision making process: the decision making process will be central to the IPM concept. The aforementioned components, when coupled with practical experience, should facilitate an informed decision making process.

8) Evaluating treatment assessment: this portion will essentially be a follow-up to the treatment phase, and could be considered highly integrated with the monitoring phase. In essence it will be an evaluation of how effective the treatments were in impacting the target, and in bypassing the non-target or minimizing environmental impacts.

9) Record keeping: this is probably one of the single most important phases to deal with in IPM. Hokukano will keep highly accurate, very detailed records on all aspects of it's pest control program.

*Turfgrass Pesticides*. The judicious use of pesticides helps to culture high quality turfgrass that resists imposed stresses. Thus, the occasional use of pesticides as part of the IPM concept will be necessary at Hokukano. For that reason, a pesticide use plan will be developed. The plan will detail pesticide storage, loading/mixing, and application, and will be developed in accordance with Department of Health guidelines. The goal of the plan will be to prevent the contamination of groundwater and surfacewater, or other non-targets, by preventing pesticide





losses and reducing overall use. A secondary goal will be to achieve effective pest control. Strategies toward that end will include:

1) using appropriate pesticides for specific pests according to label directions strictly following state and federal regulations
2) using only pesticides registered for use in Hawaii
3) applying pesticides on an as needed basis utilizing the IPM concept when applicable
4) properly calibrating pesticide application devices
5) avoiding pesticide application to non-target areas considering wind and precipitation
6) precisely controlling the timing and duration of irrigation events after application
7) controlling run-off by implementing a course design which diverts drainage to specific locations for infiltration and/or subsequent collection utilizing vegetated buffers, swales, berms, and drainage inlets
8) re-applying collected excess drainage water to the course via irrigation
9) maintaining a perspective conducive to preventing the loss of pesticides including proper handling, storage, mixing, and application
10) developing a spill contingency plan
11) implementing new pesticide related technologies as they develop and become accepted
12) placing only qualified, responsible people in charge of the work

Strategies such as these will help prevent the deterioration of water quality by establishing control of the interactive

variables that may lead to the inadvertent loss of pesticides. They will also help by reducing the reliance on pesticides, and by encouraging the use of pesticides only under appropriate conditions. The developers will ensure that the strategies have been effective and that the goals of the pesticide use plan have been met by:

1) **collecting baseline water quality information prior to the application of pesticides**
2) **implementing a routine water quality monitoring plan during the maintenance phase**
3) **mitigating any problems detected by the monitoring using acceptable procedures**

General criteria for safe pesticide use at Hokukano can be found in Table 7. A listing of commercially available pesticides for use on turfgrass is presented in Table 8. Management guidelines suggested to help prevent non-point contamination of both groundwater and surfacewater are presented in Table 9.

Only pesticides which have been specifically approved for use in Hawaii will be considered for use at Hokukano. The decision to use pesticides, and pesticide selection, will be based in part on the IPM threshold/action level idea, and the specific pest at hand. The turf manager will use pesticides only when deemed necessary, and base pesticide selection on efficacy towards the pest and criteria that mitigate environmental impacts.

Pesticides will be applied only according to specific label instructions by persons possessing a pesticide applicators license, who are knowledgeable in the use of pesticides, and are familiar with the IPM plan for Hokukano. Applying pesticides in



Table 7. General elements of safe pesticide use. These elements will be considered at Hokukano during all pesticide related operations.

1) Always read the entire label. Using a pesticide in contradiction to the label, or in a manner inconsistent with label directions is a violation of law. All pesticide use shall comply with local, state, and federal regulations, including OSHA and EPA regulations. Only chemicals specifically labeled for application will be applied.

2) Store pesticides only in original container. Keep all pesticides out of the reach of children and away from irresponsible persons. Follow all storage requirements as prescribed by the label and Department of Health requirements.

3) Never smoke, eat, or drink while applying pesticides.

4) Always use personal protective equipment as recommended by the label. Avoid direct contact with pesticides. Bathe and change into clean clothing after application.

5) Properly dispose of all used containers according to label directions.

6) Calibrate application equipment precisely. Use closed systems for loading and mixing pesticides when appropriate.

7) Avoid spills. If spills occur take immediate action to contain the spill. Make proper notification, if necessary.

8) All agricultural chemicals should be treated with caution.

*Note: Modern pesticides are developed and tested under strict protocols designed to provide maximum safety to users. However, care and common sense should prevail during their handling or use.*

Table 8. Partial listing of commonly used turfgrass pesticides. Not every pesticide is registered for use in every state. User must comply with local, state and federal laws pertaining to pesticides as described on the label. Using pesticides in a manner inconsistent with the label is a violation of law.

| COMPOUNDS | PESTS CONTROLLED |
|---|---|
| Insecticides | |
| acephate (Orthene) | fire ants, army worms |
| Bacillus popilliae (Grub Attack) | grubs |
| Bacillus thuringiensis (Worm Ender) | webworms |
| bendiocarb (Turcam) | grubs, chinchbugs |
| carbaryl (Sevin) | ants, cutworms, leafhoppers, grubs |
| carbophenothion (Trithithion) | bermudagrass mites, scales |
| chloropyrifos (Dursban) | mites, billbugs, chinch bugs, webworms |
| chloropyrifos + DDVP (Dursban Plus) | ants, cutworms |
| chloropyrifos + pyrethrin (Sharp Shooter) | chinchbugs, turfgrass weevil |
| cyfluthrin (Tempo) | billbugs, chinchbugs |
| diazinon (Diazinon) | ants, armyworms, billbugs |
| dicofol (Kelthane) | mites |
| ethion (Ethion 4) | chinchbugs, webworms |
| ethoprop (Mocap) | grubs, webworms |
| fenamiphos (Nemacur) | nematodes |
| fensulfothion (Terracur) | grubs, nematodes |
| fenoxycarb (Logic) | fire ants |
| fluvalinate (Mavrik Aquaflow) | chinchbugs, cutworms |
| fonofos (Crusade) | cutworms, webworms |
| hydramethlynon (Amdro) | ants, fire ants |
| isazofos (Triumph) | grubs, chinch bugs |
| isofenphos (Oftanol) | grubs, ataenius beetle |
| lindane (Gamma-Mean 400) | cutworms, webworms |
| malathion (Malathion) | mosquitos, flies |
| methomyl (Lannate) | webworms |
| trichlorfon (Dylox) | army worms, grubs, cutworms |



Table 8. Continued page 2

| | |
|---|---|
| Fungicides | |
| anilazine (Dyrene) | dollar spot, rust, leaf spot |
| benomyl (Tersan 1991) | summer patch, anthracnose |
| Cadmium Chloride (Caddy) | Typhula blight, pink snow mold |
| chloroneb (Terraneb SP) | Pythium, brown patch, Typhula blight |
| chlorothalonil (Daconil 2787) | leaf spot, brown patch, Fusarium patch |
| ethazole (Koban) | Pythium |
| fenarimol (Rubigan) | summer patch, dollar spot, red thread |
| fosetyl Al (Aliette) | Pythium |
| flutalonil (Prostar) | fairy ring |
| iprodione (Chipco 26019) | melting out, dollar spot, brown patch |
| mancozeb (Fore) | leaf spot, melting out, rust |
| maneb (Maneb-4) | smut, leaf spot |
| mercury chloride (CaloChlor) | Typhula blight, Fusarium patch |
| metalaxyl (Subdue) | Pythium*, yellow tuft |
| myclobutanil (Eagle) | brown patch, leaf spot |
| PCNB (Scott's FFII) | Fusarium patch, Typhula blight |
| PMAS (PMAS) | Fusarium patch, Typhula blight |
| propamocarb (Banol) | Pythium |
| propiconazole (Banner) | powdery mildew, rusts |
| thiophanate ethyl (Cleary's 3336) | melting out, dollar spot* |
| thiophanate methyl (Fungo 50) | take all patch, summer patch |
| thiophanate methyl and mancozeb (Duosan) | dollar spot, brown parch |
| thiram (Tersan 75) | rust, brown patch, Typhula blight |
| triademefon (Bayleton) | summer patch, necrotic ring spot |
| vinclozalin (Vorlan) | dollar spot, melting out |
| * = resistance can be a problem | |
| Herbicides | |
| AMA (Super Methar) | grassy weeds |
| asulam (Asulox) | grassy weeds |
| atrazine (AAtrex)* | broadleaves, grassy weeds |
| benefin (Balan)* | grassy weeds |
| benefin + trifluralin (Team)* | grassy weeds |
| bensulide (Betasan)* | grassy weeds |
| bentazon (Basagran) | nutsedge |

Table 8. Continued page 3

| Herbicides Continued | |
|---|---|
| bromoxonil (Buctril) | broadleaves |
| chlorflurenol (Maintain) | growth regulator, broadleaves |
| chlorsulfuron (Lesco TFC) | grassy weeds |
| 2,4-D (A-4D Lesco) | broadleaves |
| 2,4-D + dicamba (Pro Triple D) | broadleaves |
| 2,4-D + dichlorprop (Weedone DPC) | broadleaves |
| 2,4-D + dichlorprop + dicamba (Super Trimec) | broadleaves |
| 2,4-D + mecoprop | broadleaves, grassy weeds |
| 2,4-D + MCPP (Lescopar) | |
| 2,4-D + dicamba + mecoprop (Trimec) | broadleaves, grassy weeds |
| 2,4-D + dicamba + mecoprop + MSMA (Trimec Plus) | broadleaves, grassy weeds |
| 2,4-D + triclopyr (Turflon D) | broadleaves, woody plants |
| DCPA (Dacthal)* | grassy weeds, broadleaves |
| dicamba (Banvel) | broadleaves, brush |
| diclofop methyl (Illoxan) | |
| dichlorprop (Weedone DPC) | aquatic weeds, brush |
| DSMA (Crab Kleen) | grassy weeds |
| diquat (Diquat) | aquatic weeds |
| endothall (Endothall) | aquatic weeds |
| EPTC (Eptam) | grassy weeds |
| ethofumesate (Prograss) | annual bluegrass |
| fenoxaprop-ethyl (Acclaim) | grassy weeds |
| fluazifop-butyl (Fusilade) | grassy weeds in ornamentals |
| fluridone (Sonar) | aquatic weeds |
| flurprimidol (Cutless) | growth regulator, annual bluegrass |
| glyphosate (Roundup) | non-selective |
| imazaquin (Image) | purple nutsedge |
| isoxaben (Gallery)* | annual grasses, broadleaves |
| MCPA (Weedar) | broadleaves |
| MCPP | clover, broadleaves |
| MCPP-2,4-D | clover, broadleaves |
| mecoprop (MCPP) | clover, broadleaves |
| mefluidide (Embark) | growth regulator |
| metribuzin (Sencor) | grassy weeds |



Table 8. Continued page 4

| Herbicides Continued | |
|---|---|
| metsulfuron methyl (DMC Weed control) | broadleaves, grassy weeds |
| MSMA (Bueno) | grassy weeds |
| oryzalin (Surflan) | |
| oxadiazon (Ronstar)* | grassy weeds |
| paraquat (Paraquat) ns | non selective |
| pendimethalin (Pre-M) | grassy weeds, broadleaves |
| pronamide (Kerb)* | grassy weeds |
| sethoxydim (Poast) | grassy weeds |
| siduron (Tupersan) | annual grasses in newly seeded areas |
| simazine (Princep) | grassy weeds, broadleaves |
| sulfometuron (TFC) | tall fescue |
| triclopyr (Turflon R Amine) | broadleaves, grassy weeds |
| triclopyr + 2,4-D (Ester) (Turflon D) | |
| triclopyr + 2,4-D (Amine) (Turflon II Amine) | |
| triclopyr + clopyralid (Confront) | broadleaves, grassy weeds |
| trifluralin (Treflan, Biobarrier) | |
| * = preemergent control | |
| **Fumigants** | |
| metam-sodium (Vapam) | non-selective, ground pearls |
| methyl bromide (Dowfume) | non-selective |
| **Nematicides** | |
| fenamiphos (Nemacur) | nematodes |
| fensulfothion (Dasanit) | nematodes |
| **Rodenticides** | |
| warfarin (Warfarin) | rats, mice |
| pival (Pindone) | rats, rodents |
| strychnine | gophers, moles |

Table 9. Management guidelines related to turfgrass pesticide use and water quality at Hokukano. Guidelines have been adapted from several sources.

| |
|---|
| 1) To protect water quality all pesticide applicators will be properly trained in the use and application of pesticides. Only pesticides labeled for application to turfgrass in Hawaii will be considered for application. All local, state, and federal regulations pertaining to pesticide use, storage, and handling will be strictly followed. |
| 2) Application equipment will be precisely calibrated and maintained to ensure precise distribution at the intended rate. Pesticide use rate will be determined by label instructions. Application equipment will possess computer controlled flow regulation devices (when available) to ensure accurate delivery. |
| 3) Pesticide application will be accurately timed relative to precipitation events, rainfall, and wind to help prevent leaching, run-off or drift. Pesticide application will be restricted prior to anticipated storm events, or during high winds. |
| 4) A buffer zone between water bodies or non-target zones and application zones will be maintained to increase the transport distance and to prevent contamination via pesticide movement. |
| 5) Selection of pesticides will be based on education and experience. Additionally, the user will consider efficacy of treatment and the criteria that reduce off-site movement and potential adverse impacts. |
| 6) Pesticide containers will be properly disposed of according to label directions to reduce the threat of non-target exposure. |

*Adapted from Balogh and Anderson, 1992.*



contradiction to or in a manner inconsistent with label instructions is a violation of law and will not be tolerated. Factors involved in applying the pesticide correctly according to the label directions must include making certain that the application device is properly calibrated to deliver a precise amount. Hokukano will implement modern application equipment fitted with flow control computers that regulate the amount of pesticide output. Such will ensure that the correct amount of material is being delivered to the target regardless of variations in speed or changes in terrain. The actual rate of material applied will be dictated strictly by the label instructions. Precise records indicating how much of which material was applied will be kept.

The user will also ensure that the pesticide is applied only to the intended target area. Thus, there will be considerations regarding precipitation, wind, and local environmental conditions. Pesticides will not be applied just prior to anticipated storm events or during inappropriate conditions such as high winds (which are rare at this location). The utilization of a state-of-the-art irrigation system coupled to a computerized scheduling program will also help to prevent the leaching or run-off of pesticides which can be attributable to excessive or inappropriate irrigation events.

The pesticide storage building will be configured to follow all proposed and existing EPA regulations. It will emphasize containment in the event of a pesticide spill or leak. Because of containment, cleanup in the event of a spill is made easier and the potential for contamination of the adjacent environment is reduced. The pesticide storage building will also be separate from the maintenance building, be well away from employee work

areas, be well away from groundwater wells or bodies of water, and have limited access. There will be adequate forced air ventilation. There will be stable storage shelving within the building, and it will be adequately lit and free from clutter. An important point is that the building will meet local fire codes. Fire extinguishers and audible fire alarms within the building will probably be mandated by EPA. An emergency shower and eyewash station will be adjacent to the entrance. In addition, the storage building will be adequately posted with notification of pesticides in storage. The building will be plainly marked with warning signs. An emergency spill response station will be situated near the building. Additionally, a complete listing of stored materials will be kept on hand.

An area of the maintenance facility will be devoted exclusively for the loading and mixing of pesticides. This area will also be configured to conform to proposed EPA regulations. It will be in close proximity to the storage building to minimize transport distance, and will likewise emphasize pesticide containment. Any materials spilled in the confines of this area during the loading/mixing process will not be allowed to escape to the outside environment. In most instances the area is configured as an impervious pad with a 1-2% pitch to a center recovery sump, which suffices for containment. The loading/mixing pad will also be well away from general work areas and will permit limited employee access. It will be configured to prevent the accumulation of rainwater, and be large enough to accommodate all pesticide application devices. Spill clean-up material will be close at hand, and an emergency shower/eyewash station will be in close proximity.

It will also be appropriate to develop a workable pesticide spill





contingency plan. Appropriate employees will be well versed in the plan, and know exactly what to do in the event of a pesticide spill in the storage or loading/mixing areas. The contingency plan in general will involve several procedures:

1) the spill will be contained if possible
2) management will be notified of any spill
3) uninvolved employees and patrons will be kept away from the spill
4) proper agencies as dictated by local, state or federal laws, and the seriousness of the spill, will be notified
5) the pesticide will be recovered according to manufacturers instructions by appropriately trained persons
6) arrangements for proper disposal of all contaminated or recovered materials will be made
7) the spill site will be evaluated to ensure remediation compliance
8) most importantly, the management staff will have a perspective conducive towards implementing the aforementioned concepts

*Biological Controls.* In addition to using pesticides, alternative pest control strategies will involve certain biological or genetic manipulations. Bio-control methods usually involve manipulating the pest using other life forms. Bio-control can involve placement or encouragement of natural predators and natural antagonists. Bio-control can also involve gene manipulation of the plant, or of the antagonist/predators.

Biological control of pest populations has not been extensively researched to date. In fact, research in earnest is only now beginning. This poses at least two separate problems:

1) long term effects of releasing predators or antagonists, and the long term effects of genetic manipulations, are essentially unknown
2) the effectiveness of the bio-control process itself has not been fully established

For those reasons Hokukano will be receptive to the full scale use of bio-control products only after the effects and the effectiveness of the products have been fully demonstrated. Bio-control products that have been intensively studied and have been accepted for general use will be considered, when their use is appropriate. To aid in this establishment process Hokukano will be amenable to granting certain forms of on-site turfgrass research addressing IPM/bio-control questions. Research granting would be limited to qualified turfgrass/landscape oriented researchers. Allowances would be determined through the classical proposal method. Proposals would be assessed by an objective, knowledgeable panel.

*Turfgrass Fertilizers.* Application of nutrient fertilizer is necessary to culture healthy, dense, stress resistant turf. Thus, a major turf cultural practice at Hokukano will involve fertilization. For that reason a fertilizer use plan will be developed detailing storage and application. The goal of the plan will be to prevent the contamination of groundwater and surfacewater, or other non-target sites, by preventing nutrient losses. Strategies toward that end will include:

1) utilizing slow-release nitrogen carriers when appropriate
2) providing only the amount of nitrogen that the plants can take up at any given time by using light rates frequently





3) precisely controlling the timing and duration of irrigation events after application
4) estimating the need for nitrogen and timing the nitrogen application based on several conditional factors including the area to be fertilized, traffic, stresses, and impending weather including wind and precipitation
5) precisely calibrating nutrient application devices
6) implementing a soil and plant tissue testing regime for nutrients other than nitrogen
7) controlling run-off implementing a course design which diverts drainage to specific locations for collection utilizing vegetated buffers, grassy swales, berms, and/or drainage inlets
8) maintaining a perspective conducive to preventing the loss of nutrients including proper handling, storage, and loading
9) implementing new fertilizer technologies as they develop and become accepted

These strategies will help to prevent the deterioration of water quality because they will establish control of the interactive variables that may lead to the inadvertent loss of nutrients, and make the need for fertilization more objective. The developers will ensure that the employed strategies have been effective and that the goals of the fertilizer use plan have been met by:

1) collecting baseline water quality information prior to the application of fertilizers
2) implementing a routine water quality monitoring plan
3) mitigating any problems detected by the monitoring using acceptable procedures

Several types of commercially available nitrogen carriers to be

considered for use at Hokukano are found in Table 10. Typical annual use totals are found in Table 11.

Highly maintained turfgrass areas such as greens, tees, and fairways will receive combinations of both quickly available and slowly available nitrogen. The current trend for fine turf is to utilize slow release carriers for sustained, long term supply of nitrogen, supplementing the turf as needed with quickly available carriers at very light rates. In theory, the practice is aimed at providing only the amount of nitrogen that can be uptaken by the plant at a given time. Using light rates will help to prevent nitrogen losses due to leaching, providing irrigation events are appropriately timed. Lesser maintained areas, such as roughs, can usually get by on the slow release forms. No high quality golf course can utilize only slow release forms of nitrogen.

The utilization of a state-of-the-art irrigation system coupled to scheduling computers will also help to prevent the release of nutrients via leaching or run-off that might otherwise be caused by excessive irrigation events. By using this type of system the intensity and duration of irrigation events can be appropriately manipulated for each specific section of the course.

The need for the actual amount of nitrogen for any given area will depend on many factors including the specific turf types present, the level of traffic or other stresses imposed on the turf, the type of carriers utilized, the age of the turf, the specific soil type, the level of applied irrigation, climactic patterns, nutrient loading from irrigation, and the specific purpose for which the nitrogen is applied. Timing the application will depend on specific growth patterns of the turf,



Table 10. The major nitrogen carriers available for use in turfgrass management programs. Blends and specific formulations utilizing these carriers plus potassium, phosphorus, and other nutrients are available to to suit specific needs.

| Carrier | Class* | Analysis** | Release Rate | Temperature Release Dependence | Water Solubility |
|---|---|---|---|---|---|
| Ammonium Nitrate | Inorganic | 31-0-0 | Quick | Low | High |
| Ammonium Sulfate | Inorganic | 21-0-0 | Quick | Low | High |
| Calcium Nitrate | Inorganic | 15-0-0 | Quick | Low | High |
| Urea | Organic | 46-0-0 | Quick | Low | High |
| Ureaformaldehyde | Organic | 38-0-0 | Medium | High | Medium |
| IBDU | Organic | 31-0-0 | Medium | Medium | Medium |
| Sulfur-coated Urea | Coated | 32-0-0 | Medium | Medium | Low |
| Resin-coated Urea | Coated | 20-0-0 | Medium | High | Low |
| Sewage Sludge | Natural | 6-2-4 | Slow | High | Low |
| Protein Waste | Natural | 10-3-4 | Slow | High | Low |

Adapted from Beard, 1982.

* Carrier classes technically are synthetic-inorganic, synthetic-organic, synthetic-organic coated, and natural-organic.
** Analysis can vary somewhat depending on formulation.

Table 11. Estimated annual nitrogen totals for specific turfgrass management areas. These expectations reflect the utilization of bermudagrass varieties for all areas.

| Management Area | Pounds Actual Nitrogen per 1,000 s.f. |
|---|---|
| Green Surface | 6-12 |
| Collar | 6-12 |
| Green Surround | 4-8 |
| Tee Surface | 6-12 |
| Tee Surround | 4-8 |
| Approach | 4-10 |
| Fairway | 4-10 |
| Rough | 3-6 |
| Amenity Turf | 3-6 |
| Ornamental Lawn | 4-10 |

*Adapted from Beard*, 1982.



and experience.

The device used for applying nitrogen will be properly calibrated to ensure delivery of a precise amount or volume. Like pesticides, the application of nitrogen will be restricted in the event of impending storms or other adverse weather conditions. Many of the pesticide management guidelines found in Table 9 apply to the use of nitrogen fertilizers as well.

Regarding nutrients other than nitrogen, the quantity applied and the timing of the application will be dictated by both soil testing and plant tissue testing. The testing involves analyzing both soils and turfgrass clippings for nutrient content. Monthly soil and tissue sampling for the first year or two could be considered a reasonable start for establishing a nutrient baseline. Using this approach will save money, provide for optimum plant and soil nutrient concentrations, and prevent excessive nutrient losses due to over application. Such an approach should be considered a critical component of a BMPs scheme.

The area used for storing fertilizer should be well ventilated and dry. There will be containment capabilities in the event of a spill. Fertilizer spilled in the storage area will not be allowed to escape to the outside environment. Should a spill occur, it will be cleaned up immediately and disposed of properly. In addition, the storage area will be away from general work areas and have limited access. It should be large enough to accommodate bulk fertilizer delivery. It will be as fireproof as possible. Like pesticides, keeping a running inventory of fertilizers will be mandatory.

*Turfgrass Irrigation.* Another prime cultural practice related to maintaining turfgrass, and for consideration regarding BMPs, is the application of water via irrigation. Thus, Hokukano will develop a water use plan designed to encourage water conservation. The goal of the plan will be to prevent the waste of irrigation water, and to prevent the subsequent water related movement of sediment, nutrients, and pesticides. The water use plan will encourage conservation of water resources and prevent related water quality problems by:

**1) utilizing a state-of-the-art irrigation system coupled to a computer generated scheduling system and electronic weather station**
**2) designing the system with input from irrigation experts**
**3) utilizing soil moisture indices such as open evaporation pans to help determine irrigation needs**
**4) encouraging use of non-potable water such as wastewater effluent**
**5) implementing an irrigation source with an adequate sustainable yield**
**6) implementing water minimization features where possible**
**7) maintaining a perspective conducive to water conservation**
**8) implementing new irrigation technologies as they develop and become accepted**

These strategies should help to conserve water and promote water quality because they will:

**1) give the turf manager a maximum amount of flexibility in managing water**
**2) help to eliminate guess work regarding irrigation needs**
**3) utilize otherwise non-usable resources**





**4) encourage continuous thought relating to the practice**

The developers will strive to ensure that the strategies are effective and that the goals of the irrigation use plan have been met by continuously:

**1) monitoring actual use against estimated use**
**2) making adjustments to the system**
**3) maintaining the condition of the system**
**4) being aware of new technologies**

Distributing the irrigation water in an efficient fashion will be critical to conserving water, energy, and time. Thus, the irrigations system at Hokukano will likely be of the valve-in-head type. By wiring each head individually to the controller, the turf manager will have the capability to run each sprinkler head individually, as needed.

In addition, controllers will be governed by a scheduling computer. Computer generated data bases compiled with input from electronic weather stations will help to provide accurate, reliable irrigation scheduling information. With computer generated scheduling programs coupled to valve-in-head single-wired irrigation hardware, the turf manager will have the utmost in irrigation system flexibility and control. He or she will be able to control the irrigation system in such a way as to provide the right amount of water for any need. This in turn will help to prevent a waste of water, and also help to prevent nutrient or pesticide related leaching or run-off associated with excess irrigation events.

Another benefit provided by coupling a computer to the irrigation

system is termed flow management. Flow management will allow various portions of the irrigation system to operate simultaneously, thus maintaining an optimum system flow rate. Flow management will help to conserve water, time, and electrical power to the pumping station. It will also help to promote a healthy, vigorous turf by maintaining an adequate flow of water to areas which require it.

The system itself will be designed by a professional irrigation system designer with inputs from water service contractors and professional agronomists. It's design will facilitate delivery of irrigation water within a prescribed irrigation time window. It's design will also be commensurate with site soil types. It will be constructed according to established design criteria.

The need to irrigate will be determined in part by using indices of soil moisture. Several indices include open evaporation pans, soil tensiometers, and computer generated predictive equations. Comparing actual evaporation from the open pan to soil moisture content and calculated Et rates generated by the weather station computer should give an accurate indication of the need for moisture replacement. The use of electronic soil moisture sensors has not yet been sufficiently developed for practical use on golf courses.

Many developments utilize wastewater effluent for irrigation purposes. The use of this water source for irrigation is often coupled with a need for disposal. Effluent water can be an excellent source for irrigation provided that the level of sanitary treatment is sufficient, the nutrient load is acceptable, there are no residual industrial contaminants, and sufficient water is available. If wastewater is considered to be





utilized for irrigation purposes, Hokukano will develop and adhere to a wastewater re-use plan which shall incorporate the Department of Health's Guidelines for the Use of Water Reclamation, and the Twelve Conditions Applicable to All New Golf Course Developments.

Brackish groundwater may be the most feasible source to develop initially, as long as quality in terms of salinity and sodium is not limiting for turfgrass growth. Data developed by hydrogeologists suggests an excellent possibility of developing a well source of brackish water on site.

The selected irrigation source must have sufficient capacity to sustain the peak irrigation demands through the lifetime of the course. Thus, the sustainable yield of the source based on perceived use rates will be calculated and documented. Generally, all warm season grasses require a minimum replacement of 60-70% of measured Et to avoid quality declines. Towards that end it will be important to firmly establish Et rates specific to the site. This will be done by implementing weather monitoring stations and open evaporation pans on site prior to the establishment of turf. Once Et is firmly established soil conditions in terms of physical characteristics will be considered so that a reliable index documenting the need for water use can be implemented specifically for the site.

Water use minimization features to be implemented at Hokukano will include designing the golf course to have less area that requires intensive irrigation. Management will also emphasize maintaining an appropriate turfgrass using appropriate cultural practices with special emphasis on proper mowing height, proper mowing frequency, fertility levels, soil manipulation practices,

the use of wetting agents, and possibly the selective use of plant growth regulators.

Golf Course Maintenance Facility

Best management practices also involve being environmentally responsible in certain areas of the maintenance yard. Thus, a BMP's protocol for the maintenance area will be developed and followed. For example, the equipment wash bay is one area of such responsibility. The area will be equipped with a wash-water recycling station designed to remove contaminants such as oil and grease. This will also allow for continued re-use of the water. Commercial recycling stations set on contained pads are available.

The equipment storage area and the mechanics shop will also be configured in such a way as to prevent the accidental release of oil, grease, hydraulic fluid, gasoline, or coolant directly from the equipment. In addition, the fuel depot and the area selected for storage of any hazardous wastes such as used oil and coolant will be addressed. There are self-contained hazardous waste bins commercially available.

The yard itself will be situated with-in the property in such a way as to minimize associated noise. Shop areas are typically situated with-in the maintenance yard to direct noise in the least objectionable direction. Routine maintenance activities will be conducted at appropriate times to minimize noise disturbance.

Finally, there is solid waste generated on a golf course. The maintenance facility will deal with a portion of this waste by establishing a composting facility. Such would allow clippings



and other organic debris to be recycled into mulch without contributing to landfill problems. Associated mulch would then be used on the property as a soil conditioner or mulching material. Waste not conducive to composting will be disposed of in a manner respecting local codes. No hazardous materials will be included in ordinary waste to be disposed of. The management of solid waste generated on the course will be directed in a manner that does not create a nuisance, and is environmentally compatible, in keeping with the Twelve Conditions Applicable to All New Golf Course Developments.

*ENVIRONMENTAL MONITORING*

Environmental monitoring should be thought of as a tertiary control or final check for maintaining water quality. Proper planning, maintaining an environmentally conscious perspective, designing an environmentally compatible course, and utilizing proper management tools are considered primary controls. Specific strategies outlined for dealing with issues such as erosion control, nutrients, pesticides, and other materials are the secondary controls.

Water Quality Monitoring

In order to assure that groundwater or surfacewater quality is being maintained with reference to erosion, pesticides and nutrients, or other potential contaminants, Hokukano will establish a comprehensive water quality monitoring and mitigation plan. In this plan coastal waters and groundwater as underlying aquifers and drainage water will be sampled on a regular basis for potential contaminants. The goal of the plan will be to ensure that primary and secondary lines of control have been successful in protecting water quality. A secondary goal will be

mitigate any problems the monitoring has detected. Monitoring should be considered a major check system. The success of monitoring will depend in part on:

1) establishing a water sampling plan according to the requirements of the Department of Health and established protocol
2) implementing a routine sampling plan designed specifically for the site using modern, accepted technologies including wells, lysimeters, and other appropriate devices
3) utilizing appropriate analytical techniques with established protocol by qualified laboratory personnel
4) establishing a reliable, valid background index of water quality including the documentation of concentrations of dissolved solids, chlorides, nitrate, phosphorus, and other compounds as mandated by the Department of Health
5) accurately comparing background indices with collected data in a timely fashion
6) reporting valid results and conclusions or recommendations in an expedient manner

The analysis conducted in this manner will help to preserve water quality by:

1) alerting the developers to indications of changes in water quality relative to background indices
2) providing initiative for investigating the potential cause of changes and addressing specific issues which can mitigate the problem if necessary
3) allowing for the mitigation procedure to be instituted in a timely manner
3) documenting that the mitigation procedure has been effective





In following the monitoring plan, drainage water samples from an underground collection system and/or lysimeters will be analyzed for contaminants according to established protocol. Lysimeter wells will be located strategically in association with fairways and greens at the upper and lower elevations of the golf course. Analysis of this water will give the first indication of quality change because contaminants should be most concentrated in drainage water. The next analysis marker would be water from the aquifer, while the final marker would be coastal water.

In order to be successful, a most important aspect of monitoring will be to establish a valid, reliable background index of water quality for all water sources. That index is what all subsequent analyses will be compared to. It will be equally important to obtain representative samples and conduct analysis according to an established, reliable protocol. Hokukano will prepare and adhere to a water quality monitoring and mitigation plan delineating the procedures for monitoring, reporting, and implementation of appropriate mitigation measures should significant changes to baseline conditions be detected.

By using monitoring in this fashion, a change in water quality attributable to management activities can be mitigated. The primary purpose of mitigation would be to prevent the sustained contamination of aquifers or coastal water by changing management practices.

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# II. Engineering Reports

# II - 1 Traffic Impact Study

# FINAL

# TRAFFIC IMPACT STUDY

# THE VILLAGES AT HOKUKANO

North and South Kona, Hawaii

(Revised)

January 1993

Prepared for:

*Oceanside 1250*

Prepared by:

*Parsons Brinckerhoff Quade & Douglas, Inc.*

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## INTRODUCTION

Oceanside 1250 has proposed to develop approximately 1,540 acres in the North Kona/South Kona Districts known as the Villages at Hokukano. The ultimate development will include approximately 1,455 single-family residential dwelling units, a 27-hole golf course, an 85 to 100-room lodge, shoreline conservation area and 2 acres of community parkland. This project will be built in several phases over a 42 year period between 1992 and 2034. Phase I, which is to include the lodge, golf course and approximately 367 occupied single-family residential dwelling units, is estimated to be completed in the year 2005.

The project site is located on the makai (west) side of Mamalahoa Highway near the North Kona District/South Kona District boundary. Initial access to the site will be provided through Halekii Street. A proposed state by-pass road between Holualoa and Papa is being planned which will pass through the Hokukano property. The proposed by-pass road would become the primary access to the Villages at Hokukano once it is completed. A location map which identifies the project site, the existing roadway system and proposed by-pass road is presented in Figure 1.

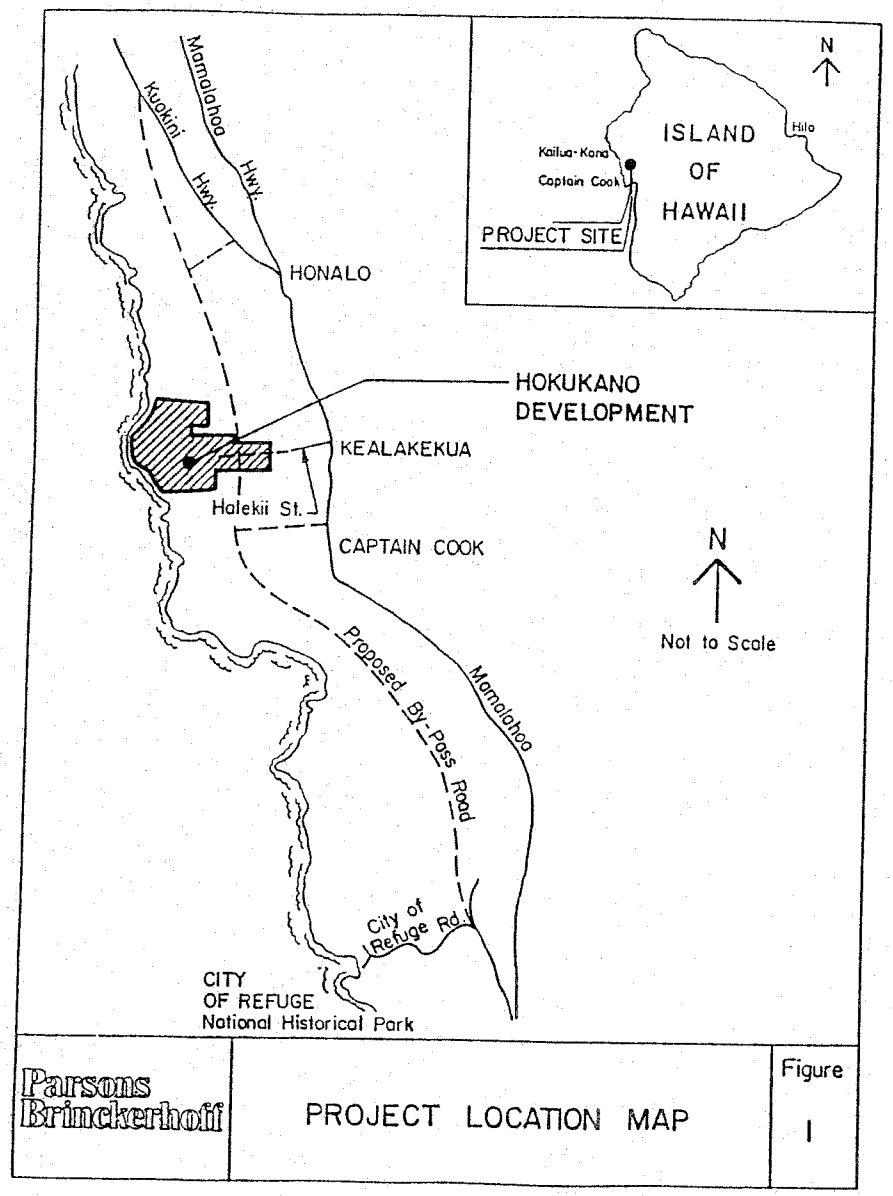
Existing and future roadway conditions along Mamalahoa Highway in the vicinity of the project were evaluated to determine the traffic impacts of the proposed development.

## EXISTING CONDITIONS

The project site is presently undeveloped and located on the makai (west) side of Mamalahoa Highway on the North Kona/South Kona Districts boundary. Existing developments, in the vicinity of the project, include commercial establishments along Mamalahoa Highway and the Kona Scenic Subdivision adjacent to Halekii Street.

### Existing Roadway System

In the vicinity of the proposed project, Mamalahoa Highway is a two-lane arterial roadway that is generally aligned in the north-south direction. It provides regional access between the areas of Kailua-Kona and Kau. The lanes are 10-feet wide with unpaved






shoulders in the vicinity of the project. The posted speed limit on Mamalahoa Highway, in the vicinity of the project, is 30 miles per hour (mph).

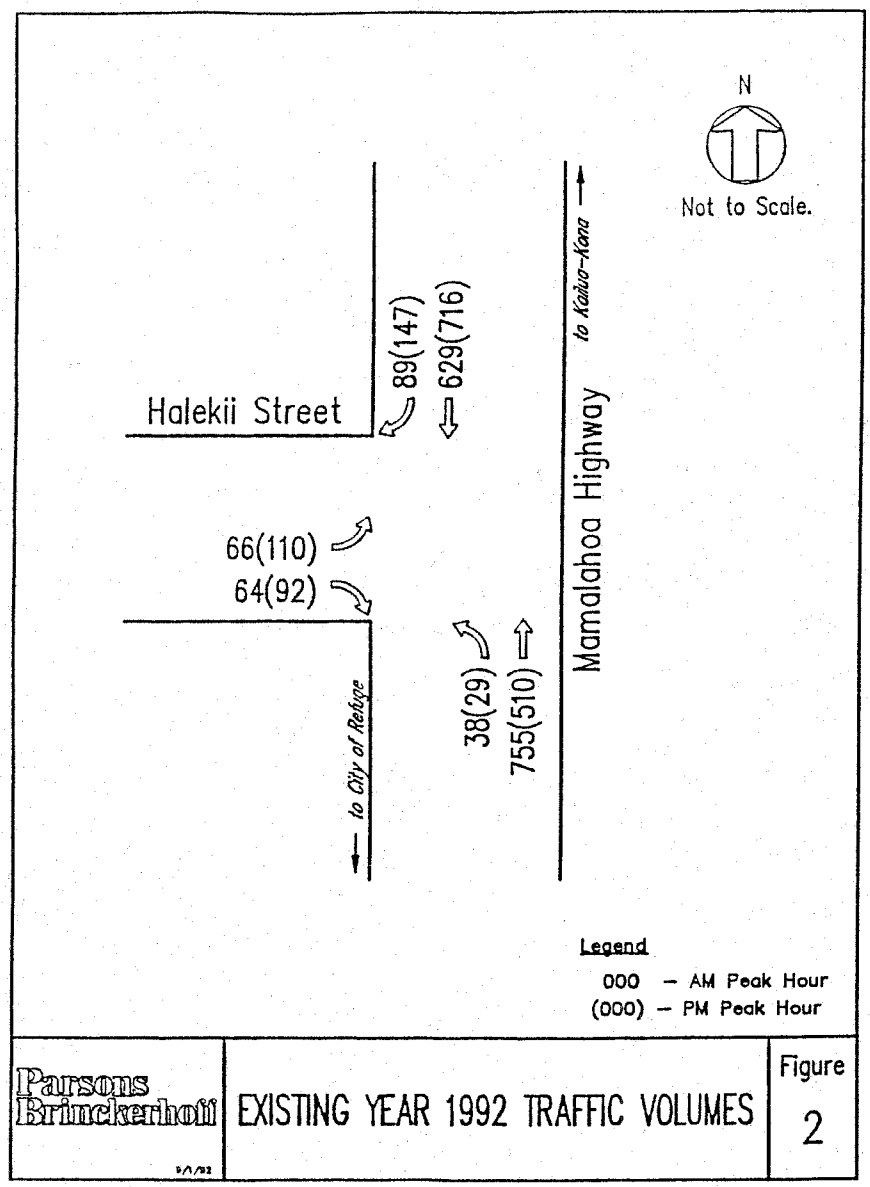
Halekii Street is a two-lane local roadway serving the post office, commercial businesses and the Kona Scenic Subdivision. Halekii Street is generally aligned in the mauka-makai (east-west) direction. Halekii Street is approximately 34 feet wide with 2-foot gutters and sidewalks on both sides. Parking is permitted on both sides of the street. On its mauka end, Halekii Street intersects Mamalahoa Highway forming the stop controlled stem of a T-intersection with dedicated left-turn and right-turn lanes onto Mamalahoa Highway. An acceleration lane is provided for eastbound right-turns onto Mamalahoa Highway. The posted speed limit on Halekii Street is 25 mph.

Existing Traffic Conditions

The description of existing traffic conditions is based on peak hour turning movement counts and field observations taken along Mamalahoa Highway at its intersection with Halekii Street. These peak hour counts were taken between the hours of 3:00 and 6:00 PM on Wednesday, June 24, 1992, and between the hours of 6:00 and 9:00 AM on Thursday, June 25, 1992.

The Mamalahoa Highway/Halekii Street intersection is located north of the Konawaena High, Intermediate, and Elementary Schools. The counts taken on June 25, 1992 were adjusted to reflect traffic volumes during the school year for the AM peak hour. These adjustments were made based on State Department of Transportation (SDOT) counts taken in October 1990 when school was in session. Information obtained from the Traffic Assessment Report for the New Konawaena Elementary School,[1] and telephone conversations with Konawaena School officials were also used in adjusting the turning movement counts.

Counts taken by SDOT in October 1990 indicated that the PM peak hour occurred between 4:15 and 5:15 PM. Since school dismissal is between 2:30 and 2:45 PM, traffic generated by the school minimally affects the PM peak hour traffic volumes on Mamalahoa Highway. For that reason, the June 1992 PM peak hour turning movement counts were not adjusted. These AM and PM peak hour traffic volumes are summarized in Figure 2 and Appendix A.






Intersection capacities usually control overall roadway capacities. Traffic conditions were, therefore, evaluated at the Mamalahoa Highway/Halekii Street intersection using the methodologies for unsignalized intersections as outlined in the 1985 Highway Capacity Manual[2] (HCM). Roadway segments of Mamalahoa Highway north and south of the Halekii Street intersection were also analyzed using HCM procedures for two-lane roadways.

Roadway and intersection operations are expressed as a qualitative measure known as Level-of-Service (LOS). These levels of service are expressed as letter designations from A to F, with LOS A representing the best operating conditions and LOS F the worst. A description of these levels of service is presented in Appendix B.

Unsignalized intersection capacity analyses reveal that the left-turn movement from Halekii Street onto Mamalahoa Highway operates at LOS E during both the AM peak hour and PM peak hour. The right-turn movement operates at LOS A during the AM peak hour and LOS B during PM peak hour. The left-turn movement from Mamalahoa Highway to Halekii Street operates at LOS A during both the AM and PM peak hours. Roadway capacity analyses on segments north and south of Halekii Street reveal that Mamalahoa Highway presently operates at LOS E during both the AM and PM peak hours on segments north and south of Halekii Street.

Traffic signal warrants were evaluated at the Mamalahoa Highway/Halekii Street intersection following criteria outlined in the Manual on Uniform Control Devices[3] (MUTCD). These nationally accepted traffic signal warrants have been established to aid in identifying locations that justify traffic signalization. Traffic signals should only be installed at locations that meet these nationally accepted signal warrants.

Traffic signal warrants were reviewed at the Mamalahoa Highway/Halekii Street intersection for existing year 1992 conditions. Existing traffic volumes marginally meet the peak hour volume traffic signal warrant during the PM peak hour at the Mamalahoa Highway/Halekii Street intersection (Appendix C).

## FUTURE TRAFFIC CONDITIONS

The Future Traffic Conditions section of this report contains information regarding future years 2005 and 2010 traffic forecasts; generation, distribution, and assignment of

trips for the proposed project; and analyses of the effects of the project on the surrounding street system.

Base Year 2005 Conditions

The base year 2005 conditions (no-build) assume future traffic conditions without the Hokukano project. Development in the general area of the project would, however, generate additional traffic causing volumes on Mamalahoa Highway to increase.

Historic traffic count information on Mamalahoa Highway, collected from the State of Hawaii Department of Transportation (SDOT), revealed an average annual growth rate of 8.5 percent per year. However, a review of the information presented in the SDOT's Island of Hawaii Long-Range Highway Plan, Final Report[4] revealed that, with the existing roadway geometrics, traffic volumes on Mamalahoa Highway are projected to be 24,900 vehicles per day in the future year 2010. This future year traffic volume is based on population and employment projections provided by the County of Hawaii, Planning Department, and represents an average annual growth of approximately 3.0 percent per year. The difference between the SDOT historical growth rate and the long-range plan growth rate reflects that as available land in the area is developed, the growth rate which has been relatively high in recent years will taper off. The 3% average annual growth rate was applied to traffic volumes on Mamalahoa Highway for future year analyses in this study to remain consistent with long-range population and employment projections for this area.

In the future year 2005 with existing roadway geometrics, traffic volumes on Mamalahoa Highway would operate at capacity conditions without or with the Hokukano Development. The State Department of Transportation's Hawaii Belt Road from Holualoa to Papa in North and South Kona, Administrative Action/Final Environmental Impact Statement, 1980[5] (FEIS) recommends a by-pass road makai (west) of the existing Mamalahoa Highway from Kamehameha III Road/Kuakini Highway on its northern end to the City of Refuge Road on its southern end. The FEIS also recommends two connector roads; one to Kuakini Highway north of Honalo and one to Mamalahoa Highway south of Kealakekua. The segment of the by-pass road which passes through the Hokukano property is recommended to initially be constructed as a two-lane roadway on 150 feet of right-of-way, and eventually widened to four-lanes. The State Department of Transportation is currently reviewing the 1980 study and planning funds have been appropriated for an updated study of a by-pass road.

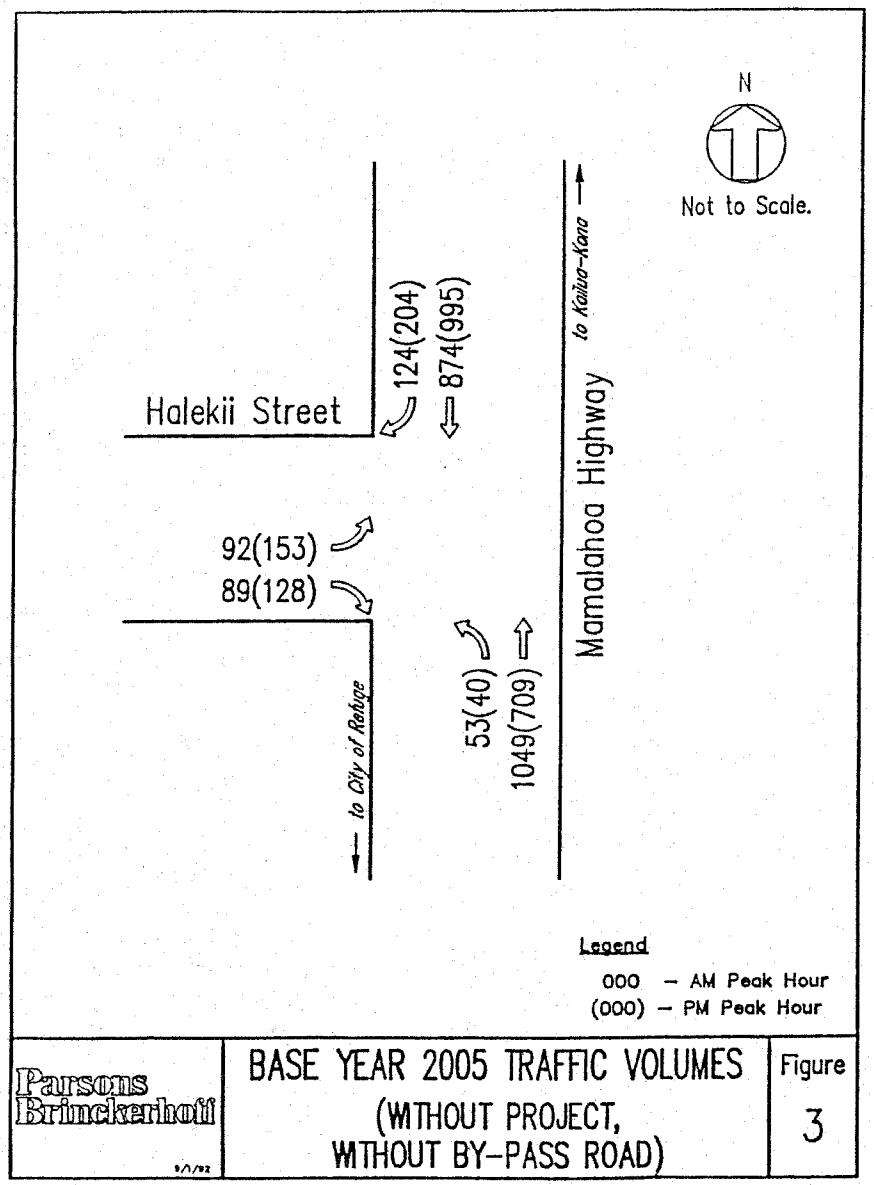


The Island of Hawaii Long-Range Highway Plan, Final Report also recommends a by-pass road along a similar alignment between Kamehameha III Road and Napoopoo Road. The long-range plan recommends the by-pass road be constructed as a four-lane facility to accommodate traffic forecast for the year 2010.

For the purpose of this report, base year 2005 conditions at the Mamalahoa Highway/Halekii Street intersection were analyzed without and with the proposed by-pass road in place. It was assumed that in the year 2005, the by-pass road will be a two-lane facility with connections at Kuakini Highway on the north and Mamalahoa Highway on the south. It was also assumed that without the Hokukano project, Halekii Street would not connect with the by-pass road. Determination of vehicle trips diverted from Mamalahoa Highway to the by-pass road was based on trip diversion volumes presented in the FEIS which indicated approximately sixty percent (60%) of the trips would use the by-pass road and forty percent (40%) of the vehicles would continue to use Mamalahoa Highway. Traffic volumes for the base year 2005 without and with the proposed by-pass road are shown in Figures 3 and 4 respectively.

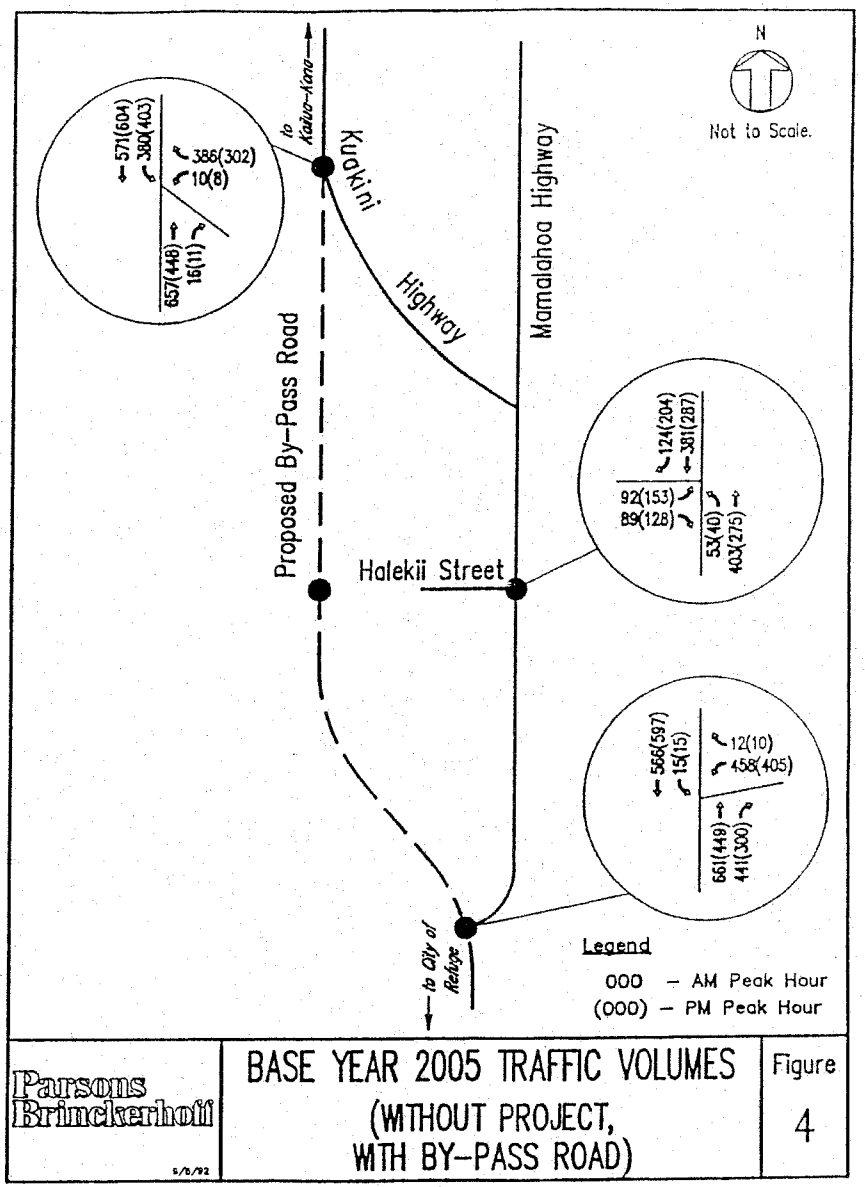
Unsignalized intersection capacity analyses for Mamalahoa Highway/Halekii Street intersection were performed for the base year 2005 without project conditions and without the proposed by-pass road. Analyses reveal that the left-turn movement from Halekii Street onto Mamalahoa Highway would operate at LOS F during both AM and PM peak hours. The right-turn movement would operate at LOS C during the AM peak hour and LOS D during the PM peak hour. The left-turn movement from Mamalahoa Highway onto Halekii Street would operate at LOS B during the AM peak hour and LOS C during the PM peak hour. Roadway capacity analyses reveal that Mamalahoa Highway would operate at LOS F north and south of Halekii Street for base year 2005 conditions without the by-pass road during both AM and PM peak hours. Review of the MUTCD traffic signal warrants indicate that PM peak hour volumes at the Mamalahoa Highway/Halekii Street intersection meet the peak hour volume traffic signal warrant (Appendix C).

Construction of the by-pass road would increase capacity and reduce congestion through the Mamalahoa Highway corridor by providing an alternative route between Kamehameha III Road/Kuakini Highway and the City of Refuge Road. The completion of the by-pass road would also improve operations at the Mamalahoa Highway/Halekii Street intersection.




| Parsons Brinckerhoff | BASE YEAR 2005 TRAFFIC VOLUMES (WITHOUT PROJECT, WITHOUT BY-PASS ROAD) | Figure 3 |
|---|---|---|






| Parsons Brinckerhoff | BASE YEAR 2005 TRAFFIC VOLUMES (WITHOUT PROJECT, WITH BY-PASS ROAD) | Figure 4 |
|---|---|---|

Unsignalized intersection capacity analyses for Mamalahoa Highway/Halekii Street intersection were performed for the base year 2005 with the proposed by-pass road. Analyses reveal that the left-turn movement from Halekii Street onto Mamalahoa Highway would operate at LOS D during both AM and PM peak hours. The right-turn movement would operate at LOS A during both AM and PM peak hours. The northbound left-turn movement from Mamalahoa Highway to Halekii Street would also operate at LOS A during both AM and PM peak hours. Roadway capacity analyses indicate segments on Mamalahoa Highway, north and south of Halekii Street, would operate at LOS D during both AM and PM peak hours for year 2005 conditions with the by-pass road. Upon review, AM and PM peak hour traffic volumes at the Mamalahoa Highway/Halekii Street intersection do not meet the peak hour volume traffic signal warrant for year 2005 conditions with the by-pass road (Appendix C). The diversion of traffic away from Mamalahoa Highway and onto the by-pass road will reduce conflicting traffic volumes at the intersection, therefore, improving intersection operations.

Base year 2005 without project traffic volumes at the by-pass road/Kuakini Highway intersection and by-pass road/Mamalahoa Highway intersection were evaluated following the criteria outlined in the MUTCD. Traffic volumes at these intersections meet the peak hour volume traffic signal warrant during both AM and PM peak hours (Appendix C).

Operating conditions at these intersections were analyzed using HCM planning methodology for signalized intersections. Intersection geometrics for by-pass road intersections were not presented in the FEIS or the long-range plan. It was assumed, however, that the by-pass road/Kuakini Highway intersection would be striped to provide a single through lane in both the northbound and southbound directions. Separate turn lanes would be provided on each approach with a dual left-turn lane on the southbound approach to accommodate the forecast left-turn peak hour volumes. Similarly, the by-pass road/Mamalahoa Highway intersection would have a single through lane on the northbound and southbound approaches. Separate turn lanes would be provided on each approach with a dual left-turn lane on the westbound approach. Signalized intersection analyses reveal that the by-pass road/Kuakini Highway intersection and by-pass road/Mamalahoa Highway intersection would operate under capacity in the year 2005 without project traffic conditions.



Roadway capacity analysis was conducted on a segment of the by-pass road south of Kuakini Highway. Results indicate that the by-pass road would operate at LOS D during both AM and PM peak hours for year 2005 without project traffic conditions as a two-lane roadway.

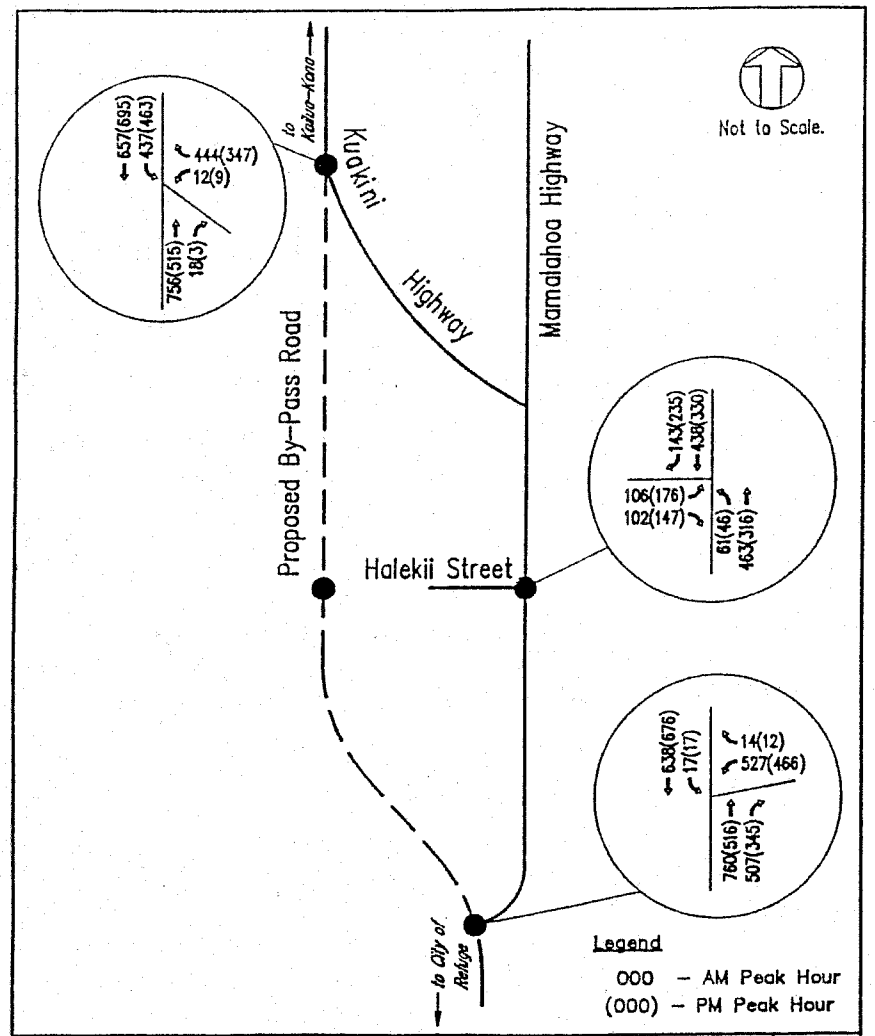
Base Year 2010 Conditions

The proposed Villages at Hokukano project is not expected to reach build-out until approximately the year 2034. Long-range traffic volume forecasts for the North Kona/South Kona area, beyond the year 2010, are not available at this time and would be speculative at best. The year 2010 conditions without project (no-build) were, therefore, used as base for the second level of future year analyses in this report. The average annual growth rate of 3% per year was applied to existing traffic volumes to forecast year 2010 without project traffic. Traffic volumes for base year 2010 conditions are shown in Figure 5.

Unsignalized intersection capacity analyses for the Mamalahoa Highway/Halekii Street intersection were performed for the base year 2010 without project conditions. Analyses reveal that the left-turn movement from Halekii Street onto Mamalahoa Highway would operate at LOS E during both AM and PM peak hours. The right-turn movement would operate at LOS A during both AM and PM peak hours. The left-turn movement from northbound Mamalahoa Highway onto Halekii Street would also operate at LOS A during both AM and PM peak hours. A review of forecast peak hour traffic volumes at the Mamalahoa Highway/Halekii Street intersection reveals that it marginally meets the peak hour volume traffic signal warrant during the PM peak hour (Appendix C).

Roadway capacity analyses indicate that Mamalahoa Highway north of Halekii Street would operate at LOS E during the AM peak hour and LOS D during the PM peak hour with the by-pass road. Mamalahoa Highway south of Halekii Street would operate at LOS D during both the AM and PM peak hours for the year 2010 without project traffic conditions.

Signalized intersection capacity analyses indicate the by-pass road/Kuakini Highway intersection would operate near capacity during the AM peak hour and under capacity during the PM peak hour. Analyses reveal that the by-pass road/Mamalahoa Highway intersection would operate under capacity during both the AM and PM peak hours for year 2010 without project traffic conditions.






Roadway capacity analysis was performed for a two-lane segment of the by-pass road south of Kuakini Highway. Results reveal that the by-pass road would operate at LOS E during the AM peak hour and LOS D during the PM peak hour for year 2010 without project traffic conditions.

## FUTURE CONDITIONS WITH PROJECT TRAFFIC

Proposed for ultimate development within Hokukano are approximately 1,455 single-family residential dwelling units, a 27-hole golf course, 5-acres of parkland, a shoreline conservation area and an 85 to 100-room lodge facility. Initially, Halekii Street will serve as the primary access roadway to the project site. When the proposed by-pass road between Kamehameha III Road/Kuakini Highway and the City of Refuge Road is constructed, it will serve as the primary access to the Hokukano project site.

### Trip Generation

Trip generation is the estimation of vehicular trips attracted or produced by the project. Trip generation rates published by the Institute of Transportation Engineers in the Trip Generation Manual, Fifth Edition[6] were used to estimate the volume of traffic generated by the proposed residential lots, and lodge facility.

Approximately two acres of community parkland are identified in the land use plan. Most trips generated by these parks will be internal trips within the Hokukano project. The Trip Generation Manual states that park traffic generally peaks at times other than the adjacent street traffic. Trips generated by these parks were, therefore, assumed to be internal captures not distributed on to the external roadway network during the AM and PM peak hours.

The appropriate trip rates used to estimate the volume of traffic generated by the proposed project in Phase 1 (year 2005), the year 2010 and build-out are shown in Table 1.

Many of the single family residential lots are expected to be purchased as second homes. The volume of traffic generated by these second homes will be significantly less than if they were primary residences. Specific demographic information of home buyers is not available at this time, therefore, total trips generated by the single family residential units were reduced by twenty percent (20%) when distributed onto the external roadway

TABLE 1

HOKUKANO DEVELOPMENT

TRIP GENERATION

| LAND USE | PEAK HOUR | QTY | UNITS | ENTER RATE | EXIT RATE | PROJECT TRAFFIC IN TRIPS | PROJECT TRAFFIC OUT TRIPS |
|---|---|---|---|---|---|---|---|
| PHASE ONE - YEAR 2005 | | | | | | | |
| SINGLE FAMILY RESIDENTIAL | AM | 367 | UNITS | 0.15 | 0.42 | 55 | 154 |
| | PM | 367 | UNITS | 0.54 | 0.29 | 198 | 106 |
| GOLF COURSE | AM | 1 | COURSE | | | 52 | 8 |
| 1-27 hole | PM | 1 | COURSE | | | 8 | 59 |
| LODGE FACILITY | AM | 85 | ROOMS | 0.20 | 0.13 | 17 | 11 |
| | PM | 85 | ROOMS | 0.18 | 0.30 | 15 | 26 |
| PHASE ONE PROJECT GENERATED TRAFFIC | | | | TOTAL AM | | 124 | 173 |
| | | | | TOTAL PM | | 221 | 191 |
| YEAR 2010 | | | | | | | |
| ADDITIONAL SINGLE FAMILY RESIDENTIAL | AM | 200 | UNITS | 0.15 | 0.42 | 30 | 84 |
| | PM | 200 | UNITS | 0.54 | 0.29 | 108 | 58 |
| YEAR 2010 - TOTAL PROJECT GENERATED TRAFFIC | | | | TOTAL AM | | 154 | 257 |
| | | | | TOTAL PM | | 329 | 249 |
| BUILD-OUT - YEAR 2036 | | | | | | | |
| ADDITIONAL SINGLE FAMILY RESIDENTIAL | AM | 888 | UNITS | 0.15 | 0.42 | 133 | 373 |
| | PM | 888 | UNITS | 0.54 | 0.29 | 480 | 258 |
| YEAR 2036 - TOTAL PROJECT GENERATED TRAFFIC | | | | TOTAL AM | | 287 | 630 |
| | | | | TOTAL PM | | 809 | 507 |



network to account for the part-time residences, and trips between residential and recreational facilities on-site.

A survey of golf courses in Hawaii was conducted to approximate the number of average daily trips and peak hour trips that are generated by a golf course. The golf course survey included contacting various resort and private courses in the State of Hawaii by telephone and requesting information on hours of operation, average number of golfers per day, and number of employees. From this information, the average number of weekday trips each golf course generated was estimated. The amount of vehicles generated during the peak hour was derived by the average number of rounds per day, average group size per round, and starting intervals for the proposed golf courses. The results of this survey are shown in Appendix D. A comparison of survey results and average trip generation rates presented in the Trip Generation Manual revealed that golf courses in Hawaii experience lower trip rates than the published average trip generation rates.

The Hokukano golf course will be private, available to members and their invited guests. Many members will live within Hokukano or be staying at the on-site lodge.

For these reasons, the golf course trip rates derived from the survey results were used to forecast the number of vehicular trips which would be generated by the golf course within the proposed project.

Trip Distribution

Trip distribution is the estimation of the origins and destinations of the project generated traffic. Project-generated trips were distributed in two directions: north towards Kailua-Kona and south towards Kau. Table 2 lists the trip distribution factors used for this project. These distribution factors were based on the location of population and employment centers as well as on the existing traffic distribution patterns observed on Mamalahoa Highway.

Table 2
Distribution of External Project Generated Trips
(vehicles per hour)

| Direction | Percentage AM | PM |
|---|---|---|
| North | 90% | 90% |
| South | 10% | 10% |

Trip Assignment

Project-generated traffic was assigned onto the existing circulation system using the distribution factors presented in Table 2. Project generated trips assigned to the surrounding roadway system reflect a 20% reduction to account for trips internal to the Hokukano project as well as many residences being used as second homes as described under trip generation.

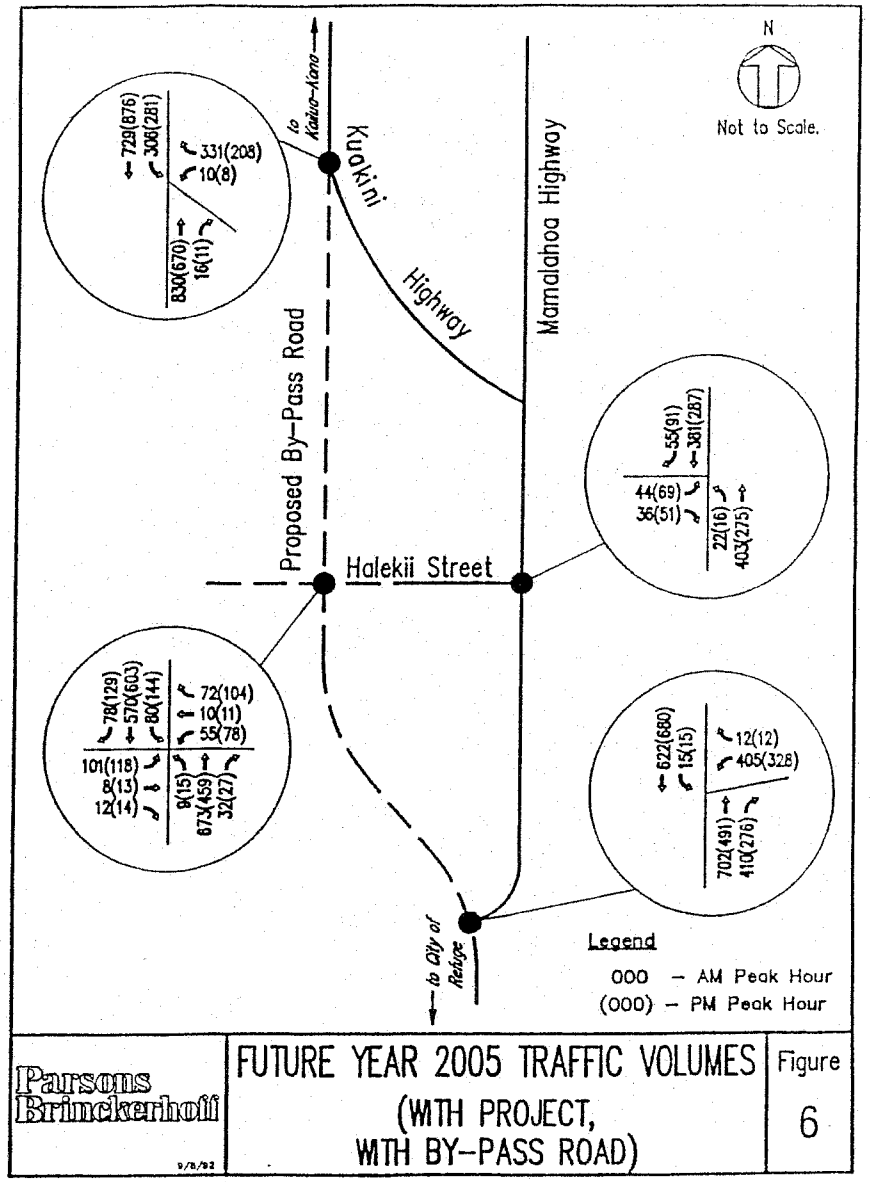
Future Year 2005 With Project

Phase 1 of the proposed Hokukano Development will include a 27-hole golf course, an 85 to 100-room lodge, and approximately 367 occupied single-family residential dwelling units. Phase 1 is expected to be completed in the year 2005.

The future year 2005 with project conditions analysis assumes that the by-pass road is constructed as a two-lane facility. Access to the Hokukano Development is provided through the cross intersection of the by-pass road and Halekii Street. It is also assumed that this intersection will have separate through and turn lanes on each approach.

Phase 1 of the proposed development is projected to generate 297 additional trips during the AM peak hour and 412 additional trips during the PM peak hour. Of the total trips generated, 243 trips are projected to pass through the by-pass road/Halekii Street intersection during the AM peak hour and 337 trips are projected to pass through the intersection during the PM peak hour. Figure 6 illustrates the traffic assignments for the future year 2005 with project traffic conditions.





The traffic impacts of the proposed project in the future year 2005 were assessed by evaluating intersection capacities at the by-pass road/Halekii Street intersection and by re-evaluating intersection capacities at the Mamalahoa Highway/Halekii Street, by-pass road/Kuakini Highway, and by-pass road/Mamalahoa Highway intersections.

At the unsignalized Mamalahoa Highway/Halekii Street intersection, the left-turn movement from Halekii Street would operate at LOS C during the AM peak hour and LOS B during the PM peak hour. The right-turn movement would operate at LOS A during both AM and PM peak hours. The northbound left-turn movement from Mamalahoa Highway onto Halekii Street would also operate at LOS A during both AM and PM peak hours.

Roadway capacity analyses were performed on Mamalahoa Highway north and south of Halekii Street. Results reveal that Mamalahoa Highway would operate at LOS D during both AM and PM peak hours north of Halekii Street. South of Halekii Street, Mamalahoa Highway would operate at LOS D during the AM peak hour and LOS C during the PM peak hour for year 2005 with project traffic conditions.

The by-pass road/Kuakini Highway and by-pass road/Mamalahoa Highway intersections would operate under capacity as signalized intersections in the year 2005 with project traffic conditions.

At the by-pass road/Halekii Street intersection, unsignalized intersection capacity analyses reveal that the eastbound left-turn movement from Halekii Street onto the by-pass road northbound would operate at LOS F during both AM and PM peak hours. The westbound left-turn movement from Halekii Street onto the by-pass road southbound would operate at LOS E during the AM peak hour and LOS F during the PM peak hour. All other movements at the intersection would operate at LOS B or better during both AM and PM peak hours for year 2005 with project traffic conditions.

Traffic volumes at the by-pass road/Halekii Street intersection were evaluated using the MUTCD traffic signal warrant criteria (Appendix C). Year 2005 with project peak hour traffic volumes would marginally meet the peak hour volume traffic signal warrant during the AM peak hour and would meet the warrant during the PM peak hour. As a signalized intersection, analyses reveal that the by-pass road/Halekii Street intersection reveal would operate under capacity during both AM and PM peak hours for year 2005 with project traffic volumes.



Roadway capacity analysis was performed for a two-lane segment of the by-pass road south of Kuakini Highway. Results reveal that the by-pass road would operate at LOS E during both AM and PM peak hours for year 2005 with project traffic conditions.

Future Year 2010 With Project

The proposed Hokukano Development is expected to include an additional 200 single-family residential dwelling units by the year 2010. These additional residential units bring the total number of dwelling units to approximately 567 single-family residential dwelling units in the year 2010.

The future year 2010 with project conditions analysis assumes the by-pass road remains a two-lane facility. Lane configurations at all intersections remain as previously described. The proposed development is projected to generate 411 additional trips during the AM peak hour and 578 additional trips during the PM peak hour. Of the total trips generated, 334 trips are projected to pass through the by-pass road/Halekii Street intersection during the AM peak hour and 470 trips are projected to pass through the intersection during the PM peak hour. Traffic assignments for the future year 2010 with project traffic conditions are shown in Figure 7.

Traffic impacts of the proposed Hokukano Development were assessed by re-evaluating intersection capacities at the critical intersections of Mamalahoa Highway/Halekii Street, by-pass road/Kuakini Highway, by-pass road/Mamalahoa Highway and by-pass road/Halekii Street during both AM and PM peak hours. Table 3 summarizes the results of level of service analyses for existing, future year without project and future year with project traffic conditions..

At the unsignalized Mamalahoa Highway/Halekii Street intersection, the left-turn movement from Halekii Street would operate at LOS D during the AM peak hour and LOS C during the PM peak hour. The right-turn movement would operate at LOS A during both AM and PM peak hours. The northbound left-turn movement from Mamalahoa Highway onto Halekii Street would also operate at LOS A during both AM and PM peak hours.

Roadway capacity analyses were performed on Mamalahoa Highway north and south of Halekii Street. Results reveal that Mamalahoa Highway would operate at LOS D

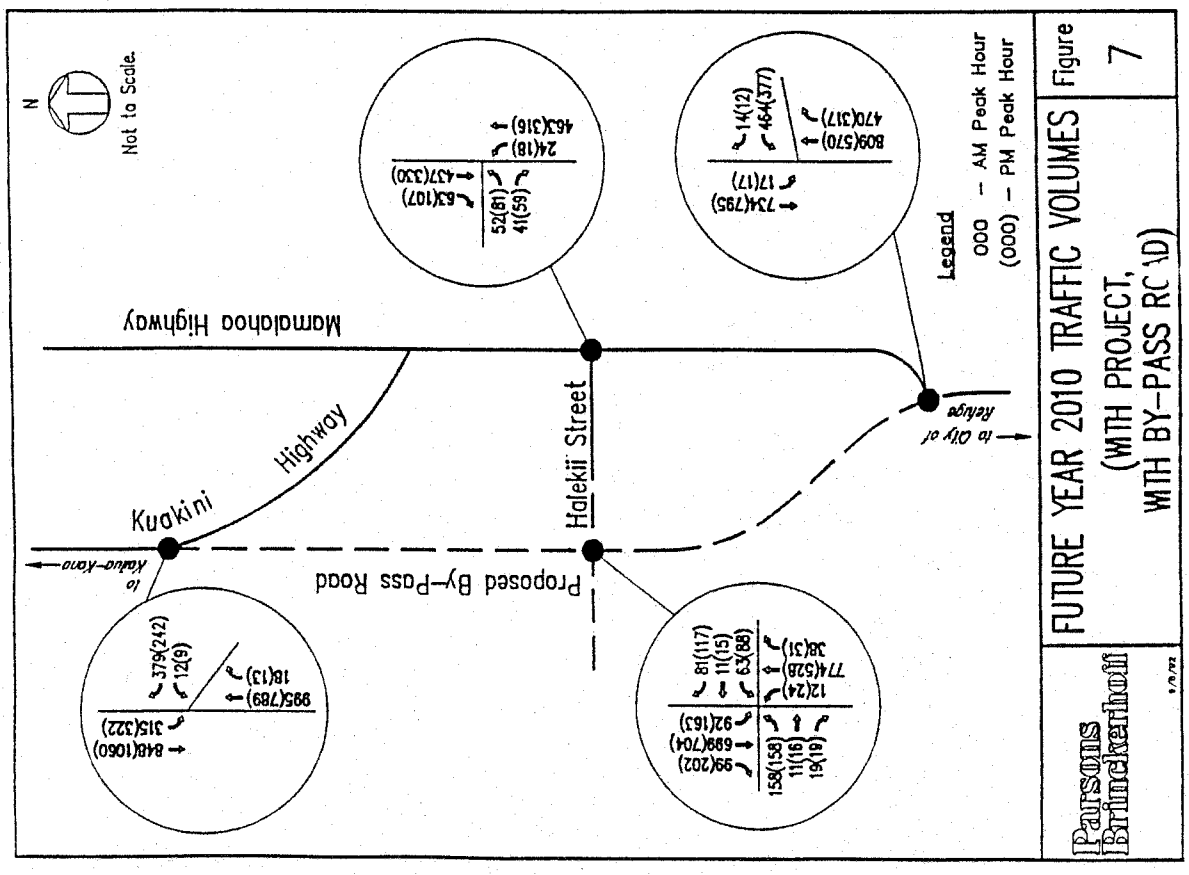
TABLE 3
HOKUKANO DEVELOPMENT
SUMMARY OF PEAK HOUR LEVEL OF SERVICE

| | Existing 1992 | | Year 2005 w/o Proj(1) | | Year 2005 w/o Proj(2) | | Year 2005 w/Proj | | Year 2010 w/o Proj | | Year 2010 w/Proj | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AM | PM | AM | PM | AM | PM | AM | PM | AM | PM | AM | PM |
| **Unsignalized Intersection** | | | | | | | | | | | | |
| Mamalahoa Hwy./Halekii St. | | | | | | | | | | | | |
| NB Left | A | A | B | C | A | A | A | A | A | A | A | A |
| EB Left | E | E | F | F | D | D | C | B | E | E | D | C |
| EB Right | A | B | C | D | A | A | A | A | A | A | A | A |
| by-pass road/Halekii St. | | | | | | | | | | | | |
| NB Left | - | - | - | - | - | - | A | A | - | - | A | B |
| SB Left | - | - | - | - | - | - | B | A | - | - | B | A |
| EB Left | - | - | - | - | - | - | F | F | - | - | F | F |
| EB Right | - | - | - | - | - | - | A | A | - | - | A | A |
| WB Left | - | - | - | - | - | - | E | F | - | - | F | F |
| WB Right | - | - | - | - | - | - | A | A | - | - | B | A |
| **Signalized Intersection (HCM Planning)** | | | | | | | | | | | | |
| by-pass rd/Kuakini Hwy | - | - | - | - | Under | Under | Under | Under | Near | Under | Near | Under |
| by-pass rd/Mamalahoa Hwy | - | - | - | - | Under | Under | Under | Under | Under | Under | Under | Under |
| by-pass rd/Halekii St | - | - | - | - | - | - | Under | Under | - | - | Under | Under |
| **Roadway Segment** | | | | | | | | | | | | |
| Mamalahoa Highway | | | | | | | | | | | | |
| North of Halekii Street | E | E | F | F | D | D | D | D | E | D | D | D |
| South of Halekii Street | E | E | F | F | D | D | D | C | D | D | D | D |
| by-pass road | - | - | - | - | D | D | E | E | E | D | E | E |

Note: (1) without by-pass road
(2) with by-pass road

Abbreviations
NB - northbound (to Kailua-Kona)
SB - southbound (to City of Refuge)
EB - eastbound (mauka)
WB - westbound (makai)





during both AM and PM peak hours north and south of Halekii Street for year 2010 with project traffic conditions.

Signalized intersection capacity analyses reveal that the by-pass road/Kuakini Highway intersection would operate near capacity during the AM peak hour and under capacity during the PM peak hour. Analyses reveal that the by-pass road/Mamalahoa Highway intersection would operate under capacity during both the AM and PM peak hours for year 2010 with project traffic conditions.

Unsignalized intersection capacity analyses were performed at the by-pass road/Halekii Street intersection. Analyses reveal that the eastbound left-turn movement from Halekii Street onto the by-pass road would operate at LOS F during both AM and PM peak hours. The westbound left-turn movement from Halekii Street would also operate at LOS F during both AM and PM peak hours. All other movements at the by-pass road/Halekii Street intersection would operate at LOS B or better during both AM and PM peak hours. As a signalized intersection, analyses reveal that this intersection would operate under capacity during both AM and PM peak hours.

Roadway capacity analysis was performed for a two-lane segment of the by-pass road south of Kuakini Highway. Results reveal the by-pass road would operate at LOS E during both AM and PM peak hours for year 2010 with project traffic conditions.

Beyond Year 2010 With Project Conditions

The Villages at Hokukano is not expected to reach build-out until approximately the year 2034. However, long-range traffic volume forecasts for the project area, beyond the year 2010, are not available at this time and would be speculative at best.

Trips generated by later development phases within the project, between the year 2010 and build-out, are shown in Table 1. It is estimated that the project would generate an additional 506 trips during the AM peak hour and 738 trips during the PM peak hour. Of the additional trips generated, 404 trips are forecast to use the external roadway system during the AM peak hour and 590 trips would be added to the external roadway system during the PM peak hour.



While long-range forecasts beyond the year 2010 are not available, it can generally be assumed that as the North Kona/South Kona area reaches development build-out, the overall increase in regional traffic would taper off with a relatively low annual growth rate. Assuming regional traffic volume increases are minimal, the additional external trips generated by the later phases of the proposed project, up to full build-out, are expected to be accommodated by the reserve capacity of the four-lane by-pass road.

## CONCLUSIONS AND RECOMMENDATIONS

The analyses conducted in this traffic impact study assess the traffic impacts of the Hokukano Development on the surrounding roadway system over the next eighteen years. The proposed Hokukano Development will result in an increase in volumes within the Mamalahoa Highway corridor, primarily north of the project site.

By the future year 2005 without or with project conditions, Mamalahoa Highway would experience at-capacity conditions. The Hawaii Belt Road from Holualoa to Papa in North and South Kona, Administrative Action/Final Environmental Impact Statement and the Island of Hawaii Long-Range Highway Plan, Final Report recommend that a by-pass road be constructed from Kamehameha III Road/Kuakini Highway intersection south to the Napoopoo Road/City of Refuge Road area. The long-range plan recommends construction of this by-pass road by the future year 2010. Presently, the State Department of Transportation has funds appropriated to conduct further planning studies for a by-pass road.

This by-pass road would provide through traffic on Mamalahoa Highway with an alternative route and would also provide access to the Villages at Hokukano. Roadway and intersection capacity operations along Mamalahoa Highway would improve with the diversion of traffic onto the by-pass road. Existing year 1992 two-way traffic volumes on Mamalahoa Highway north of the Halekii Street intersection are 1539 vehicles in the AM peak hour and 1483 vehicles in the PM peak hour. With the by-pass road forecast year 2010 two-way traffic volumes on the same segment of Mamalahoa Highway are estimated to be 1051 vehicles during the AM peak hour and 834 vehicles during the PM peak hour.

A preliminary review of traffic signal warrants as outlined in the MUTCD reveals the unsignalized Mamalahoa Highway/Halekii Street intersection marginally meets the peak hour volume traffic signal warrant during the PM peak hour for existing conditions. Without

the construction of the proposed by-pass road, general growth in the area and the development of the Villages at Hokukano will increase traffic volumes and signalization of this intersection would be warranted. Installation of a traffic signal is recommended when traffic volumes meet the warrants outlined in MUTCD. Installation of a traffic signal would improve the flow of traffic into and out of Halekii Street. The construction of the by-pass road would reduce volumes along Mamalahoa Highway, thereby, improving overall operating conditions at this intersection.

The proposed by-pass road as a two-lane facility will accommodate traffic volumes forecasted for future year 2005 without Hokukano project traffic. If project traffic volumes forecast for the year 2005 are realized, improving the by-pass road to a four-lane roadway is recommended by the year 2005.

At the by-pass road/Halekii Street intersection, the eastbound left-turn movement from Halekii Street onto the by-pass road is forecast to experience LOS F conditions during both AM and PM peak hours in the future year 2005 with the proposed project. The westbound left-turn movement from Halekii Street is forecast to operate at LOS E during the AM peak hour and LOS F during the PM peak hour in the future year 2005 with project traffic. It is not uncommon, however, for left-turn movements to experience LOS F conditions at unsignalized intersections. Capacity analyses and field observations conducted at similar unsignalized intersections indicate that the methodology outlined in the 1985 Highway Capacity Manual is conservative in nature.

A preliminary review of the MUTCD traffic signal warrants reveals that the by-pass road/Halekii Street intersection marginally meets the peak hour volume traffic signal warrant in the future year 2005 with project traffic. If volumes forecast at this intersection for the future year 2005 are realized, signalization is recommended. All approaches to the by-pass road/Halekii Street intersection are recommended to have separate through and turn lanes.

Additional traffic generated by the build-out of the Villages at Hokukano, between the years 2010 and 2034, is expected to be accommodated by the reserve capacity of the proposed four-lane by-pass road.



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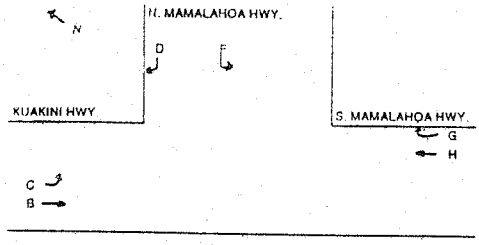
6. Institute of Transportation Engineers, Trip Generation, Fifth Edition, Washington, D.C., 1990.

NAME: HOKUKANO DEVELOPMENT
LOCATION: MAMALAHOA HIGHWAY @ KUAKINI HYW.
DATE: JUNE 24, 1992
BY: MKS

File Name: MAMKUAAM.WK1




COUNT READINGS

| TIME | A | B | C | D | E | F | J | H | G | M | L | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| –6:30 | | 71 | 1 | 6 | | 12 | | 202 | 19 | | | |
| –6:45 | | 117 | 1 | 19 | | 23 | | 336 | 30 | | | |
| –7:00 | | 172 | 3 | 25 | | 36 | | 471 | 45 | | | |
| –7:15 | | 244 | 4 | 39 | | 53 | | 616 | 59 | | | |
| –7:30 | | 349 | 7 | 45 | | 71 | | 781 | 76 | | | |
| –7:45 | | 486 | 10 | 53 | | 94 | | 943 | 95 | | | |
| –8:00 | | 625 | 12 | 60 | | 128 | | 1081 | 124 | | | |
| –8:15 | | 740 | 13 | 63 | | 141 | | 1198 | 145 | | | |
| –8:30 | | 819 | 18 | 66 | | 168 | | 1318 | 169 | | | |
| –8:45 | | 924 | 18 | 75 | | 197 | | 1413 | 188 | | | |
| –9:00 AM | | 1055 | 19 | 80 | | 232 | | 1504 | 215 | | | |

COUNT VOLUMES

| TIME | A | B | C | D | E | F | J | H | G | M | L | K | TOTAL | TOT4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6:00–6:15 AM | | 29 | 0 | 1 | 0 | 2 | 0 | 89 | 6 | 0 | 0 | 0 | 127 | |
| –6:30 | 0 | 42 | 1 | 5 | 0 | 10 | 0 | 113 | 13 | 0 | 0 | 0 | 184 | |
| –6:45 | 0 | 46 | 0 | 13 | 0 | 11 | 0 | 134 | 11 | 0 | 0 | 0 | 215 | |
| –7:00 | 0 | 55 | 2 | 6 | 0 | 13 | 0 | 135 | 15 | 0 | 0 | 0 | 226 | 752 |
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| –9:00 AM | 0 | 131 | 1 | 5 | 0 | 35 | 0 | 91 | 27 | 0 | 0 | 0 | 290 | 1075 |
| 6:00–9:00 TOTAL | 0 | 1055 | 19 | 80 | 0 | 232 | 0 | 1504 | 215 | 0 | 0 | 0 | 3105 | |
| 7:15–8:15 HOUR | 0 | 496 | 9 | 24 | 0 | 88 | 0 | 582 | 86 | 0 | 0 | 0 | 1285 | |

APPROACH/DEPARTURE VOLUMES

| | ABC | DEF | GHJ | KLM | AEJ | BFK | CGL | DHM |
|---|---|---|---|---|---|---|---|---|
| 6:00–6:15 AM | 29 | 3 | 95 | 0 | 0 | 31 | 6 | 90 |
| –6:30 | 43 | 15 | 126 | 0 | 0 | 52 | 14 | 118 |
| –6:45 | 46 | 24 | 145 | 0 | 0 | 57 | 11 | 147 |
| –7:00 | 57 | 19 | 150 | 0 | 0 | 68 | 17 | 141 |
| –7:15 | 73 | 31 | 159 | 0 | 0 | 89 | 15 | 159 |
| –7:30 | 108 | 24 | 182 | 0 | 0 | 123 | 20 | 171 |
| –7:45 | 140 | 31 | 181 | 0 | 0 | 160 | 22 | 170 |
| –8:00 | 141 | 41 | 167 | 0 | 0 | 173 | 31 | 145 |
| –8:15 | 116 | 16 | 138 | 0 | 0 | 128 | 22 | 120 |
| –8:30 | 82 | 30 | 144 | 0 | 0 | 106 | 27 | 123 |
| –8:45 | 107 | 38 | 114 | 0 | 0 | 134 | 21 | 104 |
| –9:00 AM | 132 | 40 | 118 | 0 | 0 | 166 | 28 | 96 |
| 6:00–9:00 TOTAL | 1074 | 312 | 1719 | 0 | 0 | 1287 | 234 | 1584 |
| 7:15–8:15 HOUR | 505 | 112 | 668 | 0 | 0 | 584 | 95 | 606 |



APPENDIX A

SUMMARY OF MANUAL TRAFFIC COUNTS

## APPENDIX B

The Highway Capacity Manual defines six Levels of Service, labelled A through F, from best to worst conditions. Levels of Service for signalized and unsignalized intersections are defined in terms of average user delays. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time.

### Unsignalized Intersections

For unsignalized intersections, the Highway Capacity Manual evaluates gaps in the major street traffic flow and calculates available gaps for left turns across oncoming traffic and for the left and right turns onto the major roadway from the minor street.

| | |
|---|---|
| LEVEL OF SERVICE A: | Little or no delay. |
| LEVEL OF SERVICE B: | Short traffic delays. |
| LEVEL OF SERVICE C: | Average traffic delays. |
| LEVEL OF SERVICE D: | Long traffic delays. |
| LEVEL OF SERVICE E: | Very long traffic delays. |
| LEVEL OF SERVICE F: | Demand volume exceeds capacity, resulting in extreme delays with queuing that may cause severe congestion and affect other movements at the intersection. |

### Signalized Intersections (Planning Analysis)

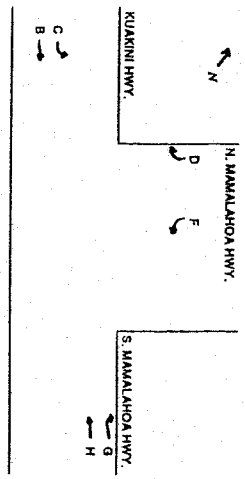
For signalized intersections, the Planning Analysis is a broad evaluation of the capacity of the intersection without considering the details of signalization. The Planning Analysis is often used when an unsignalized intersection is recommended for signalization in the future and information such as phasing and timing are unavailable.

| | |
|---|---|
| UNDER CAPACITY - | Traffic demand is expected to be under the physical capacity of the intersections. Excessive delays are not anticipated. |
| NEAR CAPACITY - | Traffic demand is expected to be near the physical capacity of the intersection. Unstable traffic flow having a wide range of delay is possible. |
| OVER CAPACITY - | Traffic demand is expected to be over the physical capacity of the intersection. Excessive delays are anticipated. |



NAME:HOKUKANO DEVELOPMENT
LOCATION: MAMALAHOA HIGHWAY @ KUAKINI HIGHWAY
DATE: 6/23/92
BY: MKB

File Name: MAMKUAPA.WK1




COUNT READINGS

| TIME | A | B | C | D | E | F | J | H | G | M | L | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3:00-3:15 PM | | 145 | 2 | 6 | | 25 | 99 | 39 | | | | |
| -3:30 | | 248 | 4 | 9 | | 43 | 211 | 64 | | | | |
| -3:45 | | 392 | 7 | 13 | | 65 | 333 | 95 | | | | |
| -4:00 | | 567 | 14 | 22 | | 89 | 422 | 133 | | | | |
| -4:15 | | 730 | 17 | 29 | | 119 | 523 | 163 | | | | |
| -4:30 | | 897 | 24 | 32 | | 147 | 650 | 186 | | | | |
| -4:45 | | 1083 | 29 | 37 | | 172 | 800 | 211 | | | | |
| -5:00 | | 1238 | 44 | 40 | | 200 | 923 | 237 | | | | |
| -5:15 | | 1395 | 51 | 46 | | 224 | 1079 | 267 | | | | |
| -5:30 | | 1558 | 58 | 53 | | 238 | 1194 | 292 | | | | |
| -5:45 | | 1729 | 63 | 57 | | 253 | 1289 | 317 | | | | |
| -6:00 PM | | 1850 | 70 | 60 | | 271 | 1411 | 342 | | | | |

COUNT VOLUMES

| TIME | A | B | C | D | E | F | J | H | G | M | L | K | TOTAL | TOT4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3:00-3:15 PM | 0 | 145 | 2 | 6 | 0 | 25 | 0 | 99 | 39 | 0 | 0 | 0 | 316 | |
| -3:30 | 0 | 101 | 2 | 3 | 0 | 18 | 0 | 112 | 25 | 0 | 0 | 0 | 261 | |
| -3:45 | 0 | 146 | 3 | 4 | 0 | 22 | 0 | 122 | 31 | 0 | 0 | 0 | 328 | |
| -4:00 | 0 | 175 | 7 | 9 | 0 | 24 | 0 | 89 | 38 | 0 | 0 | 0 | 342 | 1247 |
| -4:15 | 0 | 163 | 3 | 7 | 0 | 30 | 0 | 101 | 30 | 0 | 0 | 0 | 334 | 1265 |
| -4:30 | 0 | 157 | 7 | 3 | 0 | 26 | 0 | 127 | 23 | 0 | 0 | 0 | 325 | 1329 |
| -4:45 | 0 | 216 | 5 | 6 | 0 | 25 | 0 | 150 | 25 | 0 | 0 | 0 | 428 | 1427 |
| -5:00 | 0 | 165 | 15 | 3 | 0 | 28 | 0 | 123 | 28 | 0 | 0 | 0 | 350 | 1435 |
| -5:15 | 0 | 157 | 7 | 6 | 0 | 24 | 0 | 156 | 30 | 0 | 0 | 0 | 380 | 1481 |
| -5:30 | 0 | 163 | 7 | 7 | 0 | 12 | 0 | 115 | 25 | 0 | 0 | 0 | 329 | 1485 |
| -5:45 | 0 | 171 | 5 | 4 | 0 | 17 | 0 | 95 | 25 | 0 | 0 | 0 | 317 | 1376 |
| -6:00 PM | 0 | 121 | 7 | 3 | 0 | 18 | 0 | 122 | 25 | 0 | 0 | 0 | 296 | 1322 |
| 3:00-6:00 TOTAL | 0 | 1850 | 70 | 60 | 0 | 271 | 0 | 1411 | 342 | 0 | 0 | 0 | 4004 | |
| 4:30-5:30 HOUR | 0 | 691 | 34 | 21 | 0 | 89 | 0 | 544 | 106 | 0 | 0 | 0 | 1485 | |

APPROACH/DEPARTURE VOLUMES

| | ABC | DEF | GHJ | KLM | AEJ | BFK | CGL | DHM |
|---|---|---|---|---|---|---|---|---|
| 3:00-3:15 PM | 147 | 31 | 138 | 0 | 0 | 170 | 41 | 105 |
| -3:30 | 103 | 21 | 137 | 0 | 0 | 119 | 27 | 115 |
| -3:45 | 140 | 28 | 153 | 0 | 0 | 168 | 34 | 126 |
| -4:00 | 182 | 33 | 127 | 0 | 0 | 199 | 45 | 98 |
| -4:15 | 198 | 37 | 131 | 0 | 0 | 183 | 33 | 108 |
| -4:30 | 144 | 31 | 150 | 0 | 0 | 185 | 30 | 130 |
| -4:45 | 221 | 30 | 175 | 0 | 0 | 241 | 30 | 155 |
| -5:00 | 170 | 31 | 149 | 0 | 0 | 183 | 41 | 128 |
| -5:15 | 164 | 30 | 168 | 0 | 0 | 181 | 37 | 102 |
| -5:30 | 170 | 19 | 140 | 0 | 0 | 175 | 32 | 122 |
| -5:45 | 178 | 21 | 120 | 0 | 0 | 188 | 30 | 99 |
| -6:00 PM | 128 | 21 | 147 | 0 | 0 | 139 | 32 | 125 |
| 3:00-6:00 TOTAL | 1820 | 331 | 1753 | 0 | 0 | 2121 | 412 | 1471 |
| 4:30-5:30 HOUR | 725 | 110 | 650 | | | 780 | 140 | 505 |

## FIGURE 4-6. PEAK HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)




Mamalahoa Highway

*NOTE: 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

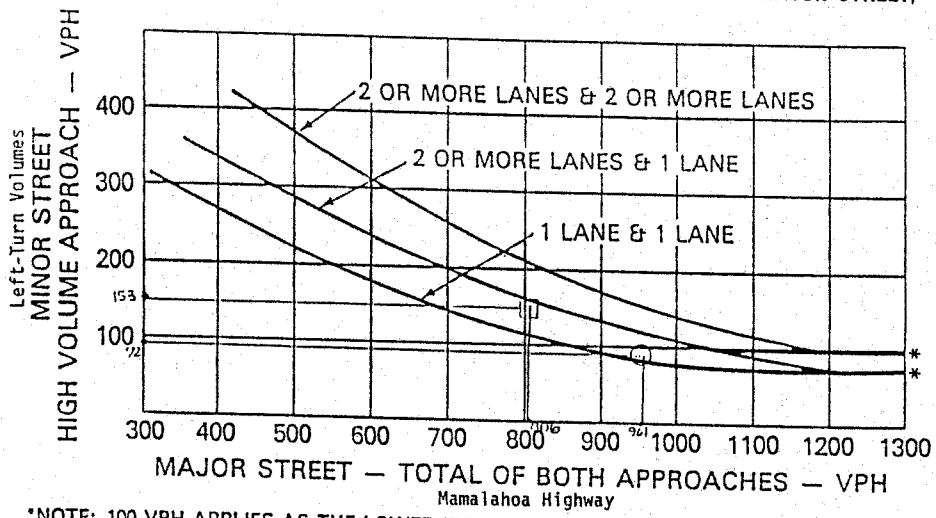
Mamalahoa Highway/Halekii Street
Existing Year 1992

○ AM Peak Hour

□ PM Peak Hour

## FIGURE 4-6. PEAK HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)




*NOTE: 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

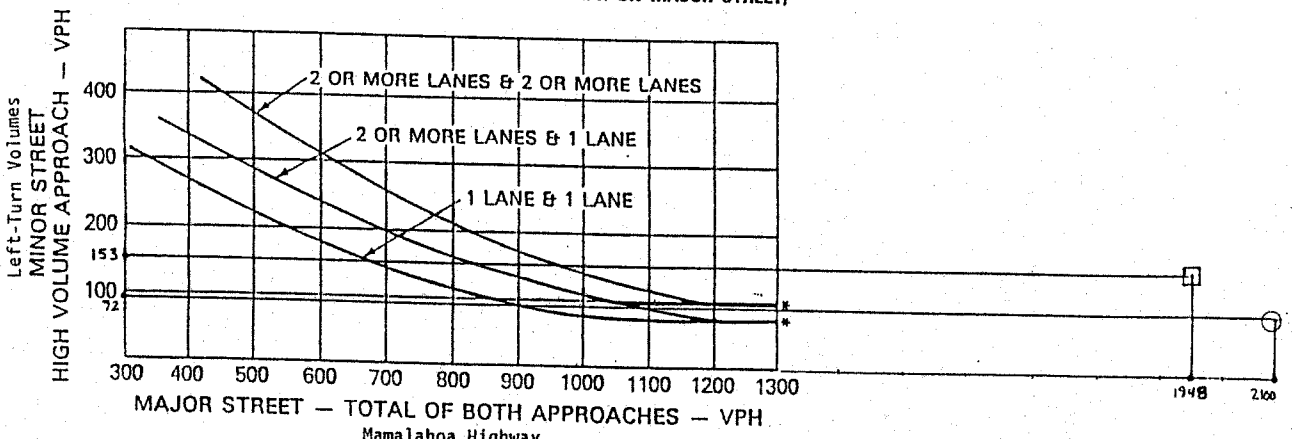
Malalahoa Highway/Halekii Street
Base Year 2005 w/o Project Traffic
With by-pass road

○ AM Peak Hour
□ PM Peak Hour



## FIGURE 4-6. PEAK HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



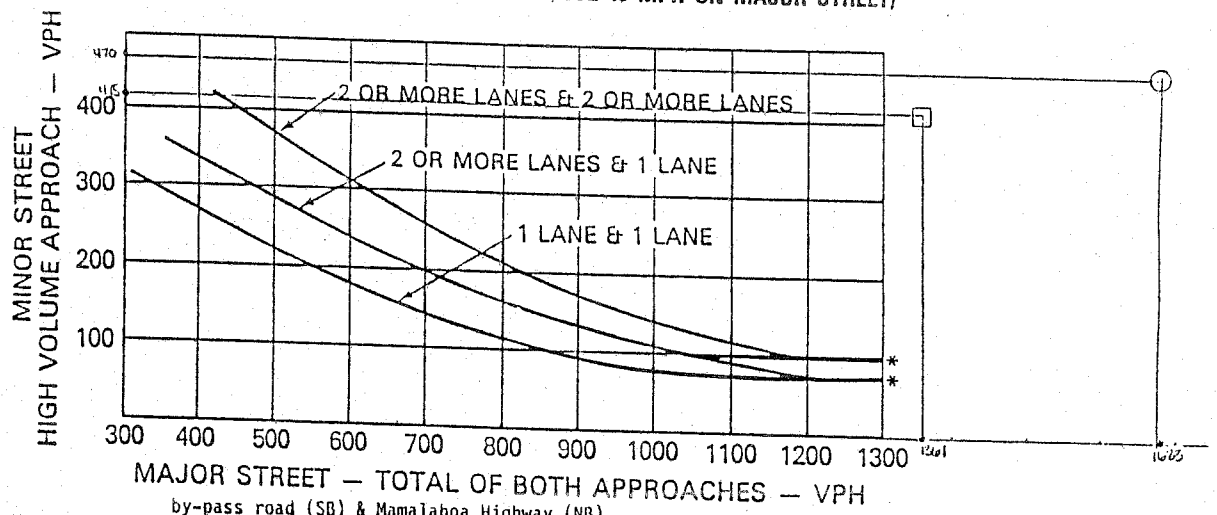

*NOTE: 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Mamalahoa Highway/Halekii Street
Future Year 2005 w/o Project
w/o by-pass road

○ AM Peak Hour
□ PM Peak Hour

## FIGURE 4-6. PEAK HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)




by-pass road (SB) & Mamalahoa Highway (NB)

*NOTE: 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

by-pass road/Mamalahoa Highway
Future Year 2005 w/o Project Traffic

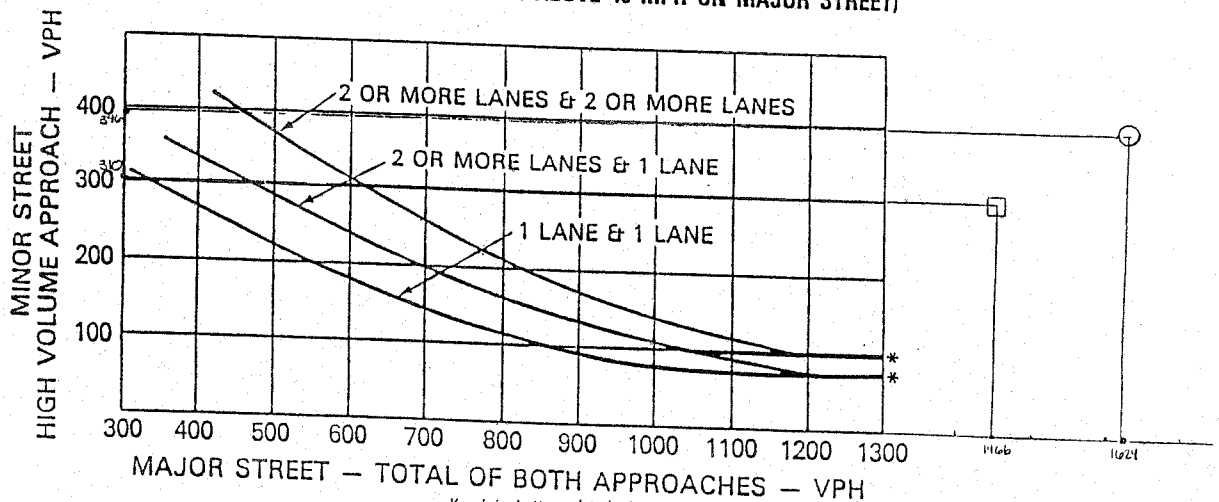
○ AM Peak Hour

□ PM Peak Hour

II-1-36

## FIGURE 4-6. PEAK HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)




Kuakini Hwy (SB) & by-pass road (NB)

*NOTE: 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

by-pass road/Kuakini Highway
Base Year 2005 w/o Project Traffic

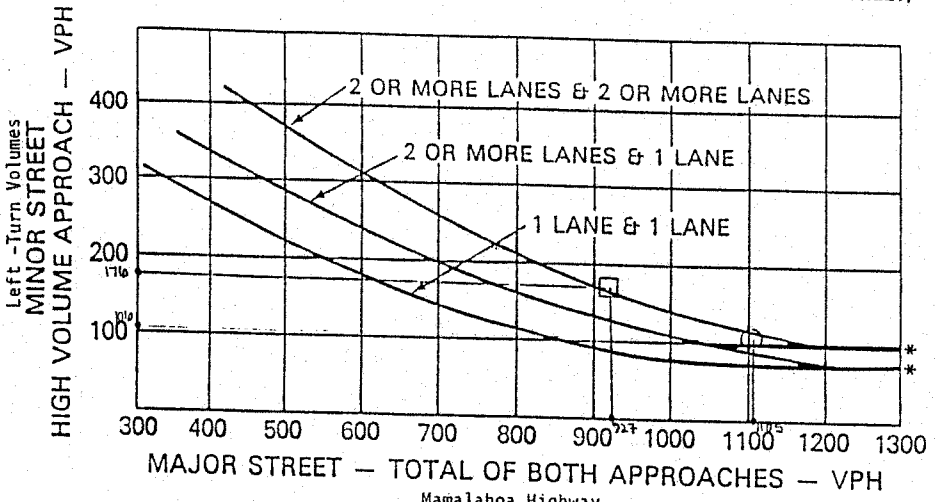
○ AM Peak Hour

□ PM Peak Hour

II-1-37

## FIGURE 4-6. PEAK HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)




Mamalahoa Highway

*NOTE: 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

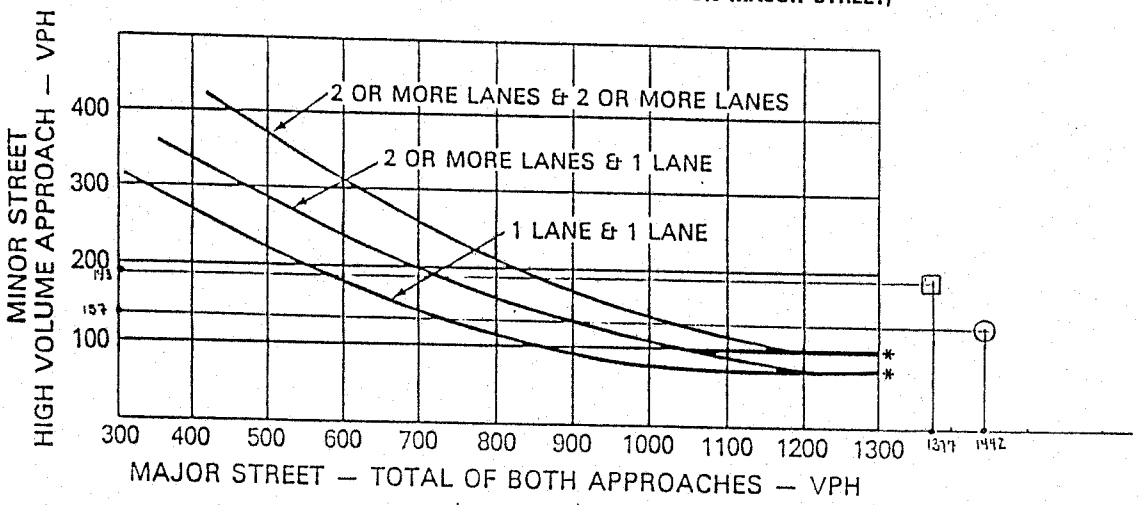
Mamalahoa Highway/Halekii Street
Future Year 2010 w/o Project Traffic

○ AM Peak Hour
□ PM Peak Hour



## FIGURE 4-6. PEAK HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)




by-pass road

*NOTE: 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

by-pass road/Halekii Street
Future Year 2005 - with Project Traffic

○ AM Peak Hour
□ PM Peak Hour

APPENDIX D
WEEKDAY AVERAGE GOLF COURSE USAGE SURVEY

| ISLAND | COURSE NAME | TYPE OF COURSE | PLAYERS PER DAY | TIME/ROUND (HOURS) | PEAK HOURS | # OF EMPLOYEES | | | # HOLES | PERCENT USEAGE | | | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SHOP | GROUND | MISC | | PVT | PUBLIC | HOTEL | |
| HAWAII | SEA MOUNTAIN | RESORT | 110 | 4–4.5 | 7 AM–12 PM | | | | 18 | | 10–20 | 80–90 | |
| | VOLCANO GOLF & COUNTRY CLUB | SEMI-PRIVATE | 100 | 3.5–4 | 8–10 AM | 5 | 6 | 20 (RESTAURANT) | 18 | | 100 | | |
| KAUAI | KIAHUNA GOLF CLUB | RESORT | 185 | 4.5–5 | 8–10:30 AM | 7 | 27 | | 18 | | 50 | 35<br>15 | POIPU AREA<br>OUTSIDE POIPU |
| | PRINCEVILLE MAKAI | RESORT | 100 | 4 | 8–11 AM | 19 | 53 | | 18 | | 85 | 15 | PRINCEVILLE HOTEL CLOSED UNTIL MID-MAY |
| | PRINCEVILLE PRINCE | RESORT | 50 | 4.5 | 8–11 AM | TEMP SHOP, ROTATING EMPLOYEES WITH MAKAI COURSE | | | 36-HOLES | | 70 | 30 | 18-HOLE COURSE CLOSED UNTIL JULY |
| MAUI | KAPALUA GOLF COURSE-BAY | RESORT | 240 | 4.5–5 | 7:30–10:30 AM | 16 | | | 18 | | 60–70 | 30–40 | |
| | KAPALUA GOLF COURSE-VILLAGE | RESORT | 150 | 4–4.5 | 6:30–11:00 AM | 6 | | 18 (GUEST SERVICES) | 18 | | 30 | 20<br>60 | KAPALUA AREA<br>OUTSIDE KAPALUA |
| | KAPALUA GOLF COURSE-NORTH & SOUTH COURSE | RESORT | 130 | 4 | 7–10 AM | 9 | 40 | | 2 18-HOLES | | 25 | 75 | |
| OAHU | KO'OLINA GOLF CLUB | RESORT | 92 | 4.5 | 7–9 AM | 25 | 50 | | 18 | | 100 | | HOTELS NOT OPENED YET |
| | HONOLULU COUNTRY CLUB | PRIVATE | 150 | 4 | 11 AM – 2 PM WED,THURS | 30 | 30 | | 18 | 100 | | <1% | AGREEMENT W/SOME HOTELS TO ALLOW GUESTS TO USE THEIR COURSE |
| | OAHU COUNTRY CLUB | PRIVATE | 120 | 4 | LUNCH TIME | 20 | | | 18 | 100 | | | |
| | WAIALAE COUNTRY CLUB | PRIVATE | 150 | 3.75 | 12–2 PM WED,FRI | | | | 18 | 100 | | | |



APPENDIX D
GOLF COURSE SURVEY

# II - 2 Preliminary Electric & Communication System Analysis

# PRELIMINARY ELECTRIC & COMMUNICATION SYSTEM ANALYSIS

FOR

THE VILLAGES AT HOKUKANO

Prepared By:

Ronald N. S. Ho & Associates, Inc.
2138 Algaroba Street
Honolulu, Hawaii 96826

7 January 1993

Hokukano Preliminary Development Plan
Table of Contents





Preliminary Electric and Communication System Analysis
for The Villages at Hokukano
7 January 1993

## 1. Electric and Communication Systems Overview

Electric and communication improvements necessary to support the requirements of the proposed project can be served from existing utility systems, with some offsite work required. In general, the offsite improvements required for the development is an ongoing activity for the utility companies and should not create an undue hardship for the respective utilities. Furthermore, this development will require that the electric and communication utility systems be constructed and maintained according to approved utility standards.

Existing offsite facilities include 69 KV and 12 KV Hawaii Electric Light Company (HELCo.) overhead lines and structures and Hawaiian Telelphone Company (HTCo.) lines along Mamalahoa Highway. Electric and telephone facilities do not exist on the site and must be extended into the project. Also, cable television facilities do not exist on the site and must be extended from Sun Cablevision trunking cable facilities located mauka of the project site at the Kona Scenic Subdivision.

On-site facilities for the utility systems should have minimal impact on the environment. Noise, aesthetic considerations, safety hazards, and loading impact will be within normally applied guidelines. HELCo. anticipates requiring a substation to serve this project. The 69 KV line along Mamalahoa Highway must be extended to the substation site. Also, HTCo. will require a remote office to serve this project. The on-site electrical and communication systems will be underground facilities with the exception of 69 KV overhead electric lines and structures from Mamalahoa Highway to the proposed substation site, the substation, switching vaults, service transformers, telephone pair-gain unit and cross-connect cabinets, and CATV power supply pedestals. Hawaii Electric Light Company, Hawaiian Telephone Company and Sun Cablevision will cable and maintain the respective underground systems.

It is also anticipated that this development will consider implementation of appropriate items from the "Hawaiian Design Strategies for Energy Efficient Architecture" published by the Energy Division of the State of Hawaii Department of Business, Economic Development and Tourism, in an effort to minimize energy consumption.

2. Hokukano Preliminary Development Plan

a. Summary

Electric and communication improvements necessary to support the requirements of the Hokukano Preliminary Development Plan prepared by Gage Davis Associates, dated September 1992 (see appendix), can be served from the existing utility systems, with some offsite work required. In general, the offsite improvements necessary to serve this development is an ongoing activity for the respective utility companies and should not create an undue hardship for them. Furthermore, this development will require that the electric and communication utility systems be constructed and maintained according to approved utility standards.

On-site facilities for the utility systems will have minimal impact on the environment. Noise, aesthetic considerations, safety hazards, and loading impact will be within normally applied guidelines.

b. Existing Conditions

Electric and telephone facilities do not exist on the site and must be extended into the project. Offsite facilities include existing Hawaii Electric Light Company (HELCo.) 69 KV and 12 KV overhead lines and Hawaiian Telephone Company (HTCo.) and Sun Cablevision overhead lines along Mamalahoa Highway, and existing HELCo. 12 KV, HTCo. and Sun Cablevision overhead lines along Halekii Street.

HELCo's current available generation capacity is approximately 168 MW (megawatts), with a present peak coincident demand of about 146 MW.

c. Future Development Plans

There are no anticipated improvements of public facilities that will be in the project site.

However, HELCo. is presently pursuing obtaining a new power plant site in or adjacent to Kawaihae to meet ever increasing demands on it for the generation of electricity. We understand that the power plant is proposed to generate about 168 megawatts of electricity and that final selection of its site is still on-going. In addition, HELCo. plans to add about 20 megawatts of generation at their Keahole Power Plant in 1994, followed with an additional 36 MW in 1997.

Also, Puna Geothermal Ventures anticipates generating about 25 MW of electricity in March 1993.





d. Proposed Development

(1) Electric

The existing HELCo. overhead 69 KV and 12 KV lines along Mamalahoa Highway may remain.

The projected maximum demand for the proposed project is forecasted to be approximately 13 MW. However, the annual load growth that is anticipated for this project would constitute only .5% of HELCo's projected 1994 generation capacity.

Based on the forecasted loading, HELCo. requires that a new substation be constructed to serve the proposed project. HELCo. anticipates that their substation installation will require a 62,500 square foot lot. In addition, existing 69 KV lines must be extended to the substation site. The necessary land acquisition and equipment procurement processing should be initiated at project inception so that a substation can be in place and ready to serve the project loads as facilities thereat are completed.

The substation will step-down the incoming 69 KV transmission voltage to 12 KV for distribution throughout the development. 12 KV distribution feeders from the substation will be connected to service transformers located adjacent to project facilities via switching vaults provided along the 12 KV distribution feeder routes. The switching vaults will protect the distribution feeders, and allows for isolation of damaged cables and redundancy to protect the development against prolonged outages resulting from the failure of any one section of the underground electrical system. Service transformers will step-down the 12 KV distribution voltage to the utilization voltage required by the project facilities.

The electrical system will be an underground facility with the exception of the substation, the 69 KV overhead lines and structures, the switching vaults and service transformers. A network of underground ducts and handholes will be provided to facilitate cable installation. HELCo. will cable the underground duct system. Cables and ducts will be suitable for underground applications and therefore, are tolerant of both wet and dry conditions.

(2) Communications

The existing HTCo. and Sun Cablevision overhead lines along Mamalahoa Highway and Halekii Street may remain, and will be extended to the project site.

Telephone cross-connect pedestals will be provided by HTCo. at various locations throughout the site to permit access and telephone service to the project facilities. In addition, HTCo. will require a lot approximately 10,000 square feet in area for a Remote Office. The necessary land acquisition and equipment procurement processing should be initiated at project inception so that a switching station can be in place and ready to serve the project as project facilities are completed. The telephone system will be an underground facility with the only exceptions being the Remote Switching Station and cross-connect pedestals. A network of underground ducts and handholes will facilitate the telephone cable installation. HTCo. will cable the underground duct system and make all the necessary arrangements for serving each facility's telephone requirements. Cables and ducts will be suitable for underground applications and therefore, are tolerant of both wet and dry conditions.

Power supply pedestals will be provided by Sun Cablevision at various locations throughout the site to provide CATV service to the project facilities. The CATV system, with the exception of power supply pedestals, will be an underground facility consisting of a network of underground ducts, handholes and cables. Sun Cablevision will provide and maintain the underground CATV system. Cables and ducts will be suitable for underground applications and therefore, are tolerant of both wet and dry conditions.

3. Potential Impacts

Facilities provided by HELCo., HTCo. and Sun Cablevision to serve this development should have minimal negative impact on the surrounding communities. The extension of off-site overhead electric and communication lines to the project site will be constructed following standard utility company practices and will be similar to the existing facilites that are presently serving areas adjacent to this development. In addition, underground electric and communication distribution systems will be constructed and maintained according to approved utility standards and construction methods, and will be planned to coincide with the project development. Furthermore, the utility companies are mandated by their





respective tariff rules to exercise reasonable diligence and care in maintaining their lines and structures to be able to provide continuous service to their customers.

While the forecasted maximum demand load for the proposed project is about 13 MW, the peak coincident demand of all individual loads islandwide is a function of the applicable diversity factors for homogeneous loads and the individual maximum demands of each load comprising that respective islandwide group. Unfortunately, residential load cycles are not precisely recurrent, and therefore, it is not practical to determine the diversity factors for the numerous possible combinations of similar and dissimilar loads. Thus, the actual impact of this project's electrical demand on HELCo's generation system is not known at this time, except that it is expected to have minimal negative impact since the anticipated annual load growth for the proposed project is very gradual. The forecasted annual load increase would constitute only .5% of HELCo's projected 1994 generation capacity and it would only comprise about 4.0% of HELCo's present yearly load growth projection for the County of Hawaii, from 1995 to 2010.

Furthermore, based on the project's buildout schedule (see appendix), by the year 2008, when the project load is anticipated to be about 5 MW, HELCo. plans to add about 56 MW of generation at their Keahole Power Plant. Also, Puna Geothermal Ventures anticipates generating about 25 MW of electricity in March 1993. By 2020, when the anticipated load for this project would be about 8.4 MW, HELCo. plans to add about 168 MW of generation.

4. Mitigative Measures

Energy efficient and conservation measures to reduce the maximum electrical demand will be considered for implementation into the project where feasible. These will include power factor correction, the use of energy efficient pumps and scheduling those types of loads to run during off-peak hours whenever practical. Furthermore, it is anticipated that this development will consider implementation of appropriate items from the "Hawaiian Design Strategies for Energy Efficient Architecture" published by the Energy Division of the State of Hawaii Department of Business, Economic Development and Tourism, in an effort to minimize energy consumption.

While it is not known at this time what types of energy conservation measures or renewable energy sources will be incorporated by the individual building owners, measures that could be considered include:

a. Siting buildings to minimize the heat loads and to effectively utilize trade winds for indoor and outdoor living and recreational spaces.

b. Use of high-efficiency light sources and ballasts for indoor and outdoor lighting purposes.

c. Use of high-efficiency refrigerators, washers and dryers, and ranges.

d. Use of high-efficiency air conditioners.

e. Use of heat pump and solar water heating systems.

f. Facilitating energy-saving opportunities through innovative architectural design of the building(s).

g. Use of occupant-sensing or time switch type light and air conditioner controls.

5. Electrical Load Forecasts

Forecast of the anticipated maximum electrical demand for the proposed project is included in the appendix.

The demand factors used to forecast the peak load for this development are based on empirical units used by HELCo. for exclusive residential property (i.e. large, luxury type air-conditioned homes similar to those at Mauna Kea Resort, Mauna Lani Resort and Kohala Ranch) and other similar facilities, multiplied by the number of units or the facilities' area as shown in the Preliminary Development Plan and Land Use Summary prepared by Gage Davis Associates, dated September 1992.

These demand units, used by the local utility company to forecast the electrical loads for proposed facilities, have been derived from their records on the electrical consumption for other similar facilities. In addition, we understand that the utility company periodically checks their records to review whether these demand units are still appropriate.

Electrical requirements for the various roadway improvements to Mamalahoa Highway were not available and therefore, they are not included (i.e. street lights, traffic signal systems, etc.).





Note that the forecasted maximum demand load for the proposed project should not be compared directly to the HELCo. System peak coincident demand for the island. The peak coincident demand of all individual loads islandwide is a function of the applicable diversity factors for homogeneous loads and the individual maximum demands of each load comprising that particular islandwide group, respectively.

Also, forecasts of the anticipated maximum electrical demand for the years 2008, 2020 and 2032 are included in the appendix. These forecasts are based on the project buildout schedule prepared by KPMG Peat Marwick and on the distribution breakdown of the types of residences that would be occupied, provided by PBR Hawaii.

6. Budget Electrical Estimate

Preliminary budget estimate of the electrical costs to construct the off-site infrastructure for the Villages at Hokukano, based on the Preliminary Development Plan prepared by Gage Davis Associates, dated September 1992, is included in the appendix.

Budget estimates are based on present day costs for similar electric/signal systems provided by the utility companies; no price adjustments have been included for yearly cost escalations and for phasing the construction of the project. Costs for transmission lines are based on wood utility poles. Also, these estimates assume that the costs for services to each individual residence and commercial/industrial facility are by others (i.e. costs for on-site electrical systems for each development parcel, for the wastewater treatment plant, extension of lines from property line to each house, etc. are not included).

By direction, the budget estimates are based on a proposed HELCo. substation which is to be located outside of the development, adjacent to Mamalahoa Highway. Costs for the land acquisition and access roads are not included.

Also, by direction, costs for roadway improvements to Mamalahoa Highway and Halekii Street due to increased traffic are not included (i.e. street lighting, traffic signal systems, etc.), and only costs for street lighting the By-Pass Highway have been included.

APPENDIX

Hokukano Preliminary Development Plan

Projected Sales/Buildout Rate for Hokukano

KPMG Peat Marwick Project Buildout Schedule (Draft)
(Exhibits 3-A, 3-B, & 3-C)

Electrical Load Forecasts

Budget Electrical Estimate

Sun Cablevision Letter dated 29 August 1992

HELCo. "Will Serve" Letter dated 22 September 1992


PARCEL A
PARCEL B
PARCEL C
PARCEL D
PARCEL E
PARCEL F
PARCEL G
PARCEL H
PARCEL I
PARCEL J
PARCEL K
PARCEL L
PARCEL M
PARCEL N
PARCEL O
PARCEL P
PARCEL Q

## LAND USE SUMMARY

| Parcel | Area | Yield | Use | Gross Density |
|---|---|---|---|---|
| A | 118.0 | 60 | Residential/Agriculture | .5 du/ac |
| C | 47.3 | 95 | Residential | 2.0 du/ac |
| D | 226.0 | 154 | Residential/Agriculture | .5 du/ac |
| E | 45.5 | 140 | Residential | 3.0 du/ac |
| F | 8.5 | 35 | Residential | 4.0 du/ac |
| G | 12.0 | 50 | Residential | 4.0 du/ac |
| H | 20.0 | 40 | Residential | 2.0 du/ac |
| I | 123.5 | 65 | Residential/Agriculture | .5 du/ac |
| J | 170.0 | 88 | Residential/Agriculture | .5 du/ac |
| K | 46.0 | 100 | Residential | 2.1 du/ac |
| L | 15.0 | 50 | Residential | 3.1 du/ac |
| N | 66.0 | 139 | Residential | 2.1 du/ac |
| O | 35.0 | 140 | Residential | 4.0 du/ac |
| P | 17.0 | 68 | Residential | 4.0 du/ac |
| Q | 42.5 | 200 | Residential | 4.7 du/ac |
| R | 7.5 | 16 | Residential | 2.1 du/ac |
| **Subtotal** | **1000.0 Acres** | **1440 Units** | | |
| S | 4.0 | -- | Golf Clubhouse | -- |
| T | 14.0 | 100 | Lodge | -- |
| V | 2.0 | -- | Historic Park | -- |
| W | 140.0 | -- | Conservation District | -- |
| X | 349.0 | -- | Golf Course | -- |
| Y | 17.0 | -- | By-Pass | -- |
| Z | 14.0 | -- | Roads | -- |
| **Subtotal** | **540.0 Acres** | **100 Units** | | |
| **TOTAL** | **1540 Acres** | **1540 Units** | | |





DRAFT

Exhibit 2-3

# Hokukano is expected to have a 38-year project period

## HOKUKANO DEVELOPMENT AND OPERATIONAL ASSUMPTIONS

| | Presales/ opening date(1) | Project period 1996 | 2008 | 2020 | 2032 |
|---|---|---|---|---|---|
| Single-family lot sales and home development (cumulative)(2): | 1995 | | | | |
| Homes completed(3) | | 5 | 420 | 840 | 1,240 |
| Unbuilt, sold lots | | 75 | 295 | 235 | 215 |
| Total sold lots | | 80 | 715 | 1,075 | 1,455 |
| Golf course holes completed | 1996 | 18 | 27 | 27 | 27 |
| Hokukano non-lot owner club memberships (cumulative number sold)(2) | 1995 | 25 | 225 | 330 | 435 |
| Average daily golf rounds(4): | 1996 | | | | |
| Hokukano residents and club members | | 20 | 180 | 180 | 180 |
| Resident and club member guests(5) | | 10 | 40 | 40 | 40 |
| Total rounds | | 30 | 220 | 220 | 220 |
| Club members' lodge(2): | 1996 | | | | |
| Available rooms | | 30 | 50 | 50 | 75 |
| Projected average achieved occupancy | | 15% | 55% | 70% | 60% |
| Daily occupied rooms | | 5 | 28 | 35 | 45 |

(1) Assumes that the approval process is completed during 1993 with construction begining in 1994.
(2) Based on data presented in market study, Exhibit 7-E, rounded.
(3) Based on 12% of sold lots being improved per year.
(4) Based on data presented in market study, page 7-3
(5) Estimated at 20% of total play.

Source: Discussions with representatives from Lyle Anderson and PBR Hawaii; information in the report entitled "Market Assessment for the Hokukano Residential Golf Project," October 1992.

Exhibit 3-B

## Average occupancy is estimated at 70% for single-family homes

UNIT USAGE ASSUMPTIONS FOR ON-SITE POPULATION PROJECTIONS

| Source of population impact | Percent distribution | Projected occupancy rate | Persons per unit |
|---|---|---|---|
| Completed single-family homes: | | | |
| Full-time residences | 50% | 95% | 2.2 |
| Part-time residences | 30% | 40% | 2.5 |
| Dedicated visitor rentals | 20% | 50% | 2.5 |
| Total/ average per unit | 100% | 70% | 1.6 |
| Club members' lodge guests: | 100% | 10% to 70% | 2.0 |



Exhibit 3-C

## Total daily population could average over 2,000 people

PROJECTED AVERAGE DAILY RESIDENT AND VISITOR POPULATION AT HOKUKANO

| | Project year | | | | Distribution |
|---|---|---|---|---|---|
| | 1996 | 2008 | 2020 | 2032 | (2032) |
| Single-family lot resident households: | | | | | |
| Full-time | 3 | 210 | 420 | 620 | 50% |
| Part-time | 2 | 130 | 250 | 370 | 30% |
| Dedicated visitor rentals | 0 | 80 | 170 | 250 | 20% |
| Total households | 5 | 420 | 840 | 1,240 | 100% |
| Daily population: | | | | | |
| Single-family lot residents- | | | | | |
| Full-time | 5 | 440 | 880 | 1,300 | 63% |
| Part-time | 2 | 130 | 250 | 370 | 18% |
| Subtotal, daily residents | 7 | 570 | 1,130 | 1,670 | 80% |
| Hokukano visitors- | | | | | |
| Single-family renters | 1 | 110 | 210 | 310 | 15% |
| Club members' lodge | 10 | 60 | 70 | 90 | 4% |
| Subtotal, daily visitors | 11 | 170 | 280 | 400 | 20% |
| Total daily population | 18 | 740 | 1,410 | 2,070 | 100% |

[redacted] A and 3-B.

HOKUKANO DEVELOPMENT MASTER PLAN
Forecasted Electric Loads (Maximum)
7 January 1993

| Description | Quantity | Unit | KW/Unit | Forecasted Load (KW) |
|---|---|---|---|---|
| PRELIMINARY DEVELOPMENT PLAN | | | | |
| Parcel A - Res (1 AC Min) | 60 | EA | 14.4 | 864 |
| Parcel B - Res (LD) | 0 | EA | 6.8 | 0 |
| Parcel C - Res (LD) | 95 | EA | 6.8 | 646 |
| Parcel D - Res (1 AC Min) | 154 | EA | 14.4 | 2,218 |
| Parcel E - Res (MD) | 140 | EA | 4.6 | 644 |
| Parcel F - Res (MD) | 35 | EA | 4.6 | 161 |
| Parcel G - Res (MD) | 50 | EA | 4.6 | 230 |
| Parcel H - Res (LD) | 40 | EA | 6.8 | 272 |
| Parcel I - Res (1 AC Min) | 65 | EA | 14.4 | 936 |
| Parcel J - Res (1 AC Min) | 88 | EA | 14.4 | 1,267 |
| Parcel K - Res (LD) | 100 | EA | 6.8 | 680 |
| Parcel L - Res (MD) | 50 | EA | 4.6 | 230 |
| Parcel N - Res (LD) | 139 | EA | 6.8 | 945 |
| Parcel O - Res (MD) | 140 | EA | 4.6 | 644 |
| Parcel P - Res (MD) | 68 | EA | 4.6 | 313 |
| Parcel Q - Res (MD) | 200 | EA | 4.6 | 920 |
| Parcel R - Res (LD) | 16 | EA | 6.8 | 109 |
| Golf Clubhouse | 1 | EA | 400.0 | 400 |
| Parcel T - Lodge | 100 | EA | 5.0 | 500 |
| By-Pass Highway Ltg. | 2,600 | LF | 0.002 | 5 |
| Roadway Ltg. | 28,800 | LF | 0.001 | 29 |
| Water Pump Station | 1 | EA | 300.0 | 300 |
| Irrig. Pump Station | 1 | EA | 400.0 | 400 |
| Sewer Pump Station | 2 | EA | 88.0 | 176 |
| Sewer Pump Station | 1 | EA | 10.0 | 10 |
| Wastewater Treatment Plant | 1 | EA | 125.0 | 125 |
| Golf Course Pumps | | LS | | 203 |
| Forecasted Electric Loads (Maximum) | | | | 13,227 |

Notes:
1. Load forecasts are based on the Preliminary Development Plan and Land Use Summary prepared by Gage Davis Associates, dated September 1992.



HOKUKANO DEVELOPMENT MASTER PLAN
Forecasted Electric Loads (Maximum) For Year 2008
7 January 1993
Page - 1 -

| Description | Quantity | Unit | KW/Unit | Forecasted Load (KW) |
|---|---|---|---|---|
| PRELIMINARY DEVELOPMENT PLAN (Year 2008) | | | | |
| Res (1 AC Min) | 110 | EA | 14.4 | 1,584 |
| Res (LD) | 113 | EA | 6.8 | 768 |
| Res (MD) | 197 | EA | 4.6 | 906 |
| Golf Clubhouse | 1 | EA | 400.0 | 400 |
| Parcel T - Lodge | 28 | EA | 5.0 | 140 |
| By-Pass Highway Ltg. | 2,600 | LF | 0.002 | 5 |
| Roadway Ltg. | 28,800 | LF | 0.001 | 29 |
| Water Pump Station | 1 | EA | 300.0 | 300 |
| Irrig. Pump Station | 1 | EA | 400.0 | 400 |
| Sewer Pump Station | 2 | EA | 88.0 | 176 |
| Sewer Pump Station | 1 | EA | 10.0 | 10 |
| Wastewater Treatment Plant | 1 | EA | 125.0 | 125 |
| Golf Course Pumps | | LS | | 203 |
| Forecasted Electric Loads (Maximum) For Year 2008 | | | | 5,047 |

Notes:
1. Load forecasts are based on the Preliminary Development Plan and Land Use Summary prepared by Gage Davis Associates, dated September 1992.
2. Development schedule is based on the KPMG Peat Marwick Project Buildout Schedule and on the distribution breakdown, provided by PBR Hawaii, of the types of residences that would be occupied; occupancy is as follows: 26% will be Residences (1 AC Min.), 27% will be Residences (LD), and 47% will be Residences (MD).

HOKUKANO DEVELOPMENT MASTER PLAN
Forecasted Electric Loads (Maximum) For Year 2020
7 January 1993
Page - 2 -

| Description | Quantity | Unit | KW/Unit | Forecasted Load (KW) |
|---|---|---|---|---|
| PRELIMINARY DEVELOPMENT PLAN (Year 2020) | | | | |
| Res (1 AC Min) | 219 | EA | 14.4 | 3,154 |
| Res (LD) | 227 | EA | 6.8 | 1,544 |
| Res (MD) | 395 | EA | 4.6 | 1,817 |
| Golf Clubhouse | 1 | EA | 400.0 | 400 |
| Parcel T - Lodge | 35 | EA | 5.0 | 175 |
| By-Pass Highway Ltg. | 2,600 | LF | 0.002 | 5 |
| Roadway Ltg. | 28,800 | LF | 0.001 | 29 |
| Water Pump Station | 1 | EA | 300.0 | 300 |
| Irrig. Pump Station | 1 | EA | 400.0 | 400 |
| Sewer Pump Station | 2 | EA | 88.0 | 176 |
| Sewer Pump Station | 1 | EA | 10.0 | 10 |
| Wastewater Treatment Plant | 1 | EA | 125.0 | 125 |
| Golf Course Pumps | | LS | | 203 |
| Forecasted Electric Loads (Maximum) For Year 2020 | | | | 8,337 |

Notes:
1. Load forecasts are based on the Preliminary Development Plan and Land Use Summary prepared by Gage Davis Associates, dated September 1992.
2. Development schedule is based on the KPMG Peat Marwick Project Buildout Schedule and on the distribution breakdown, provided by PBR Hawaii, of the types of residences that would be occupied; occupancy is as follows: 26% will be Residences (1 AC Min.), 27% will be Residences (LD), and 47% will be Residences (MD).



HOKUKANO DEVELOPMENT MASTER PLAN
Forecasted Electric Loads (Maximum) For Year 2032
7 January 1993
Page - 3 -

| Description | Quantity | Unit | KW/Unit | Forecasted Load (KW) |
|---|---|---|---|---|
| PRELIMINARY DEVELOPMENT PLAN (Year 2032) | | | | |
| Res (1 AC Min) | 323 | EA | 14.4 | 4,651 |
| Res (LD) | 335 | EA | 6.8 | 2,278 |
| Res (MD) | 583 | EA | 4.6 | 2,682 |
| Golf Clubhouse | 1 | EA | 400.0 | 400 |
| Parcel T - Lodge | 45 | EA | 5.0 | 225 |
| By-Pass Highway Ltg. | 2,600 | LF | 0.002 | 5 |
| Roadway Ltg. | 28,800 | LF | 0.001 | 29 |
| Water Pump Station | 1 | EA | 300.0 | 300 |
| Irrig. Pump Station | 1 | EA | 400.0 | 400 |
| Sewer Pump Station | 2 | EA | 88.0 | 176 |
| Sewer Pump Station | 1 | EA | 10.0 | 10 |
| Wastewater Treatment Plant | 1 | EA | 125.0 | 125 |
| Golf Course Pumps | | LS | | 203 |
| Forecasted Electric Loads (Maximum) For Year 2032 | | | | 11,484 |

Notes:
1. Load forecasts are based on the Preliminary Development Plan and Land Use Summary prepared by Gage Davis Associates, dated September 1992.
2. Development schedule is based on the KPMG Peat Marwick Project Buildout Schedule and on the distribution breakdown, provided by PBR Hawaii, of the types of residences that would be occupied; occupancy is as follows: 26% will be Residences (1 AC Min.), 27% will be Residences (LD), and 47% will be Residences (MD).

PRELIMINARY BUDGET ELECTRICAL ESTIMATE FOR
THE VILLAGES AT HOKUKANO INFRASTRUCTURE
7 January 1993

| ITEM | QTY | UNIT MULT | UNIT COST | TOTAL COST |
|---|---|---|---|---|
| Halekii St. Ext. (Par. A) | 4,800 | LF | 370.00 | $1,776,000 |
| Main Spine Rd. (I/J/K) | 4,000 | LF | 370.00 | 1,480,000 |
| North-South Rd. (H/C/D/E) | 5,400 | LF | 280.00 | 1,512,000 |
| North-South Rd. (K/N/J) | 4,800 | LF | 280.00 | 1,344,000 |
| Parcel T Collector Rd. | 2,800 | LF | 280.00 | 784,000 |
| Parcel Q Collector Rd. | 2,800 | LF | 280.00 | 784,000 |
| Parcel O/P Collector Rd. | 1,200 | LF | 280.00 | 336,000 |
| Highway Bypass Rd. Ltg. | 2,800 | LF | 80.00 | 224,000 |
| HELCo. Substa. (Land N.I.C.) | | LS | | 850,000 |
| OH Line to Substa. Site | 1,200 | LF | 130.00 | 156,000 |
| UG Line to Substa. Site | 7,600 | LF | 275.00 | 2,090,000 |
| Preliminary Budget Electrical Estimate | | | | $11,336,000 |

Notes:
1. Budget estimates are based on the September 1992 Preliminary Development Plan prepared by Gage Davis Associates.
2. Costs are present day estimates; no price adjustments have been included for yearly escalations.
3. Costs to upgrade the existing off-site electric/signal facilities, if any, to serve this project are not included. Also, costs to improve Mamalahoa Highway and Halekii Street are not included.
4. Budget estimate assumes proposed HELCo. substation to be outside the project site, adjacent to Mamalahoa Highway, about 3,000 l.f. north of Halekii Street. Costs for the land and access roads, if required, are not included.
5. Costs for water and sewer pump stations are not included. Also, costs for line extensions to each respective pump station building are not included.
6. Costs for temporary line extension to proposed Well Site are not included.
7. Costs for landscape lighting and irrigation systems are not included.
8. Costs for distribution systems within each parcel of the development are not included. Also, costs for line extensions to each dwelling/facility are not included.
9. Assume infrastructure work will be completed before the first occupancy.
10. Assume roadways to be illuminated per I.E.S. recommendations, using "shoebox" type high-pressure sodium luminaires mounted on 30'-0" round tapered poles.



**Sun Cablevision**
74-5605 Luhia Street
Kailua-Kona, Hawaii 96740
Tel: (808) 329-2418
Fax: (808) 329-9459

RECEIVED
AUG 31 1992
RONALD N. S. HO & ASSOC., INC.

CableVision

August 29, 1992

Ronald N.S.Ho and Associates,Inc.
Electrical Engineers
2138 Algaroba St. Suite A
Honoluu HI 96826-2737

**Attention: Gary Funasaki**

Dear Gary,

Thank you for your request on preliminary information for the CATV requirements for our systems construction in the planned Hokukano Development.

We have just upgraded our requested trunking duct size to a 4" on any major thoroughfare. We feel this change is very necessary considering the problems we have had pulling our fragile coaxial cables thru newly constructed ducts on some other new projects. The standard duct used for residential areas and fairly short avenues would be a 2"duct with 2'x4'pullboxes.

Our box is normally offset from HELCO and HTCO vaults. This requires contractors to put lots of curves in our ducts to bring them around the large vaults of other utilities. We normally pull trunk runs of about 2000' and these bends cause to much friction to be added to our coaxial cables. I think locating our boxes slightly farther away from other utility's vaults would help with eliminating some of the bends required to get around their facilities.

We feel that this increased size will greatly ease this pulling tension. There are also plans to pull in fiber cable links to upgrade most of our systems trunking design over the next few years. The possibilities of additional cables will also increase the need for larger ducts.

We have been trying to make preliminary designs for the large new projects and want to add the use of a 3'x 5' pullbox in specific locations to accomodate our Trunk Amplifier equipment which barely fits in the standard 2'x 4' pullbox used now on most projects. When you have more specific plans for Hokukano Development's roadways we would like to use the larger 3'x 5' boxes in a few locations where the trunk stations will be located.

Sun Cablevision
74-5605 Luhia Street
Kailua-Kona, Hawaii 96740
Tel (808) 329-2418
Fax (808) 329-9459

CableVision

On a project of this size there will also be a requirement for CATV power supply easements included at a few locations. This especially where the system is of underground construction. These locations can be picked out as futher plans arise.

There are no CATV facilities in this area. Our service ends at the base of Kona Scenic subdivision which appears from your drawings to be directly mauka of this development. Offsite requirements here would probably consist of construction of Trunk lines to bring service into the development area.

Our system costs approximately $14,000 per mile to construct. These costs may or may not be born by the developer. This would be determined by the amount of homes serviceable within the area and how much cable is required to reach these homes. We cannot give more accurate costing data without more information about distances and homes passed.

We are quite interested in this project and would be happy to check any available plans to insure the CATV system constructed would be of the highest quality. Please call me at 329-3240 if you have more questions about this information of these requests.

Yours truly,

Robert W. Moeller

Robert W. Moeller
Construction Manager



Hawaii Electric Light Company, Inc. • P.O. Box 1027 • Hilo, Hawaii



September 22, 1992

Ronald N. S. Ho & Associates, Inc.
2138 Algaroba Street, Suite A
Honolulu, Hawaii 96826

Attention: Gary I. Funasaki

Subject: Electric Service for the Hokukano Development

This letter will confirm that the Hawaii Electric Light Company has agreed to provide electric service to the Hokukano Development pursuant to the tariffs, and rules and regulations on file with the Public Utilities Commission of the State of Hawaii.

Sincerely,

HAWAII ELECTRIC LIGHT COMPANY, INC.

By Melvin S. Yamada
Its

# II - 3 Onsite Roadway & Water Systems

# THE VILLAGES AT HOKUKANO

## ON-SITE ROADWAY SYSTEM

NOVEMBER 30, 1992

PREPARED FOR:

OCEANSIDE 1250

PREPARED BY:

OKAHARA & ASSOCIATES, INC.

## VILLAGES AT HOKUKANO ON-SITE ROADWAY SYSTEM

### Introduction

The Hokukano parcel consists of approximately 1,540 acres. The site is located partially in the North Kona and partially in the South Kona Districts, makai of the Hawaii Belt Road and bordered on the west by the Pacific Ocean. Site elevations range from sea level to approximately 1,250 feet.

The proposed development consists of residential, golf course, and possibly agricultural uses. The overall development plan calls for 1440 residential units, a 100 unit members lodge, and a 27 hole golf course. The first phase of the project is to include 367 residential/agricultural lots ranging in size from one to five acres and a 27 hole golf course and clubhouse. Subsequent phases will include approximately 1073 residential lots ranging in density from 0.5 to 4.7 units per acre.

### Site Access

Access to the site is currently from Halekii Street which forms a T-intersection with the Mamalahoa Highway (see Figure 1). Halekii Street is a two lane roadway which has been constructed within an 80 foot right-of-way. The developer plans to use Halekii Street as the site access road for a limited time only. Future site access is anticipated to be from a by-pass highway west of the Hawaii Belt Road which will pass through the upper portion of the site (see Figure 2).

According to the Final Traffic Impact Study for The Villages at Hokukano dated October, 1992 prepared by Parsons Brinkerhoff Quade & Douglas, Inc., existing traffic volumes at the Halekii Street / Mamalahoa Highway intersection marginally meet the peak hour volume traffic signal warrant during the PM peak hour. Signalization would be required by the year 2005 if the by-pass highway is not constructed even without the Villages at Hokukano project. If the by-pass highway is constructed prior to 2005, signalization of the Halekii Street / Mamalahoa Highway intersection may not be required.

### Hawaii County General Plan

The Hawaii County General Plan shows a north-south highway alignment which crosses the project site in the upper portion at approximately the 800 foot elevation. The alignment has been studied by the State Department of Transportation (DOT) for a proposed highway. This highway is to be designed to accommodate four lanes of traffic within a minimum 150 foot right-of-way. The proposed basic design criteria recommendations include a design speed of 60 mph, partial access control and a principal



rural arterial highway classification. The exact location of the proposed State highway alignment has not been finalized.

### Internal Roadway Design

The project roadways will be designed according to County of Hawaii subdivision standards and will meet County dedicable roadway criteria to the extent possible. The roadways will be laid out to facilitate grading, utility, and lot design. Particular care will be exercised in the roadway layout in order to preserve significant archaeological and historical features and to minimize potential impacts to natural topographic conditions. Figure 2 shows the conceptual roadway layout.

The site designers will coordinate closely with the County to ensure that the roadways are adequate to accommodate traffic generated by the project as well as any off-site traffic that may enter the site. Roadways will be stubbed out to adjacent parcels if required by the County to allow for the future traffic needs of the area.

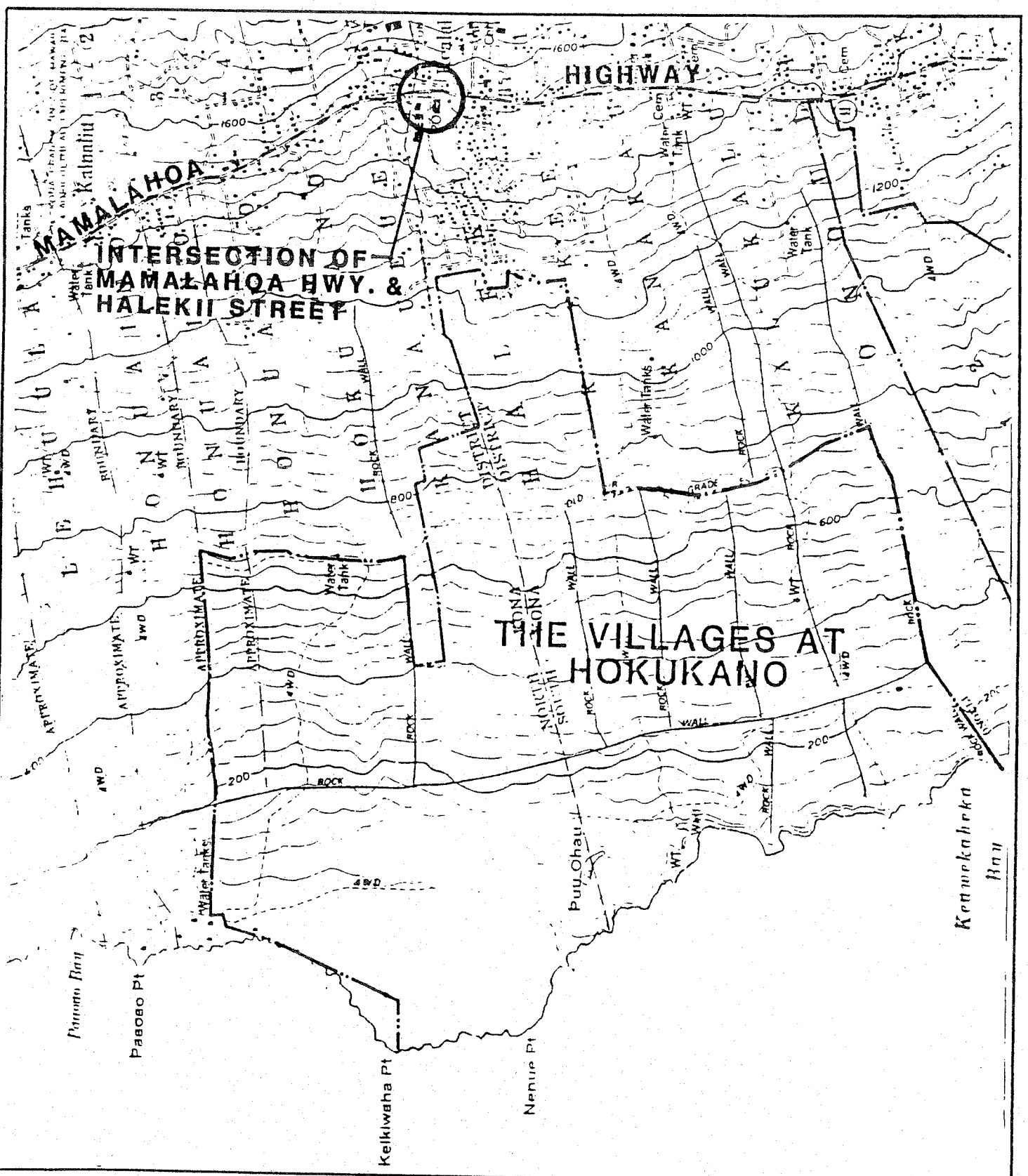
The main collector roadways will be constructed within 60 foot right-of-ways. While meeting County standards for paving and right-of-way width, the developer will explore with the County, roadway features designed to maintain the rural character of the area and aesthetic theme of the development. The minor streets will also be designed using County of Hawaii paving design criteria and will be constructed within 50 foot right-of-ways.

### Roadway Infrastructure Costs

The cost to construct the main internal roadways including the shoreline access parking facility is estimated to be $14,500,000 including design and contingencies, excluding drainage and utilities. The cost to design and construct a two lane by-pass highway is estimated to be approximately $14,800,000. This figure may be revised once a route study is completed and the highway corridor is selected. The cost to signalize the Halekii Street / Mamalahoa Highway intersection is estimated to be $1,000,000 including design and contingencies.

Table I
Summary of Roadway Infrastructure Order of Magnitude Costs

| | |
|---|---|
| Internal Roadways | $14,500,000.00 |
| By-Pass | $14,800,000.00 |
| Signals at Halekii St./Mamalahoa Hwy. | $1,000,000.00 |
| Total | $30,300,000.00 |



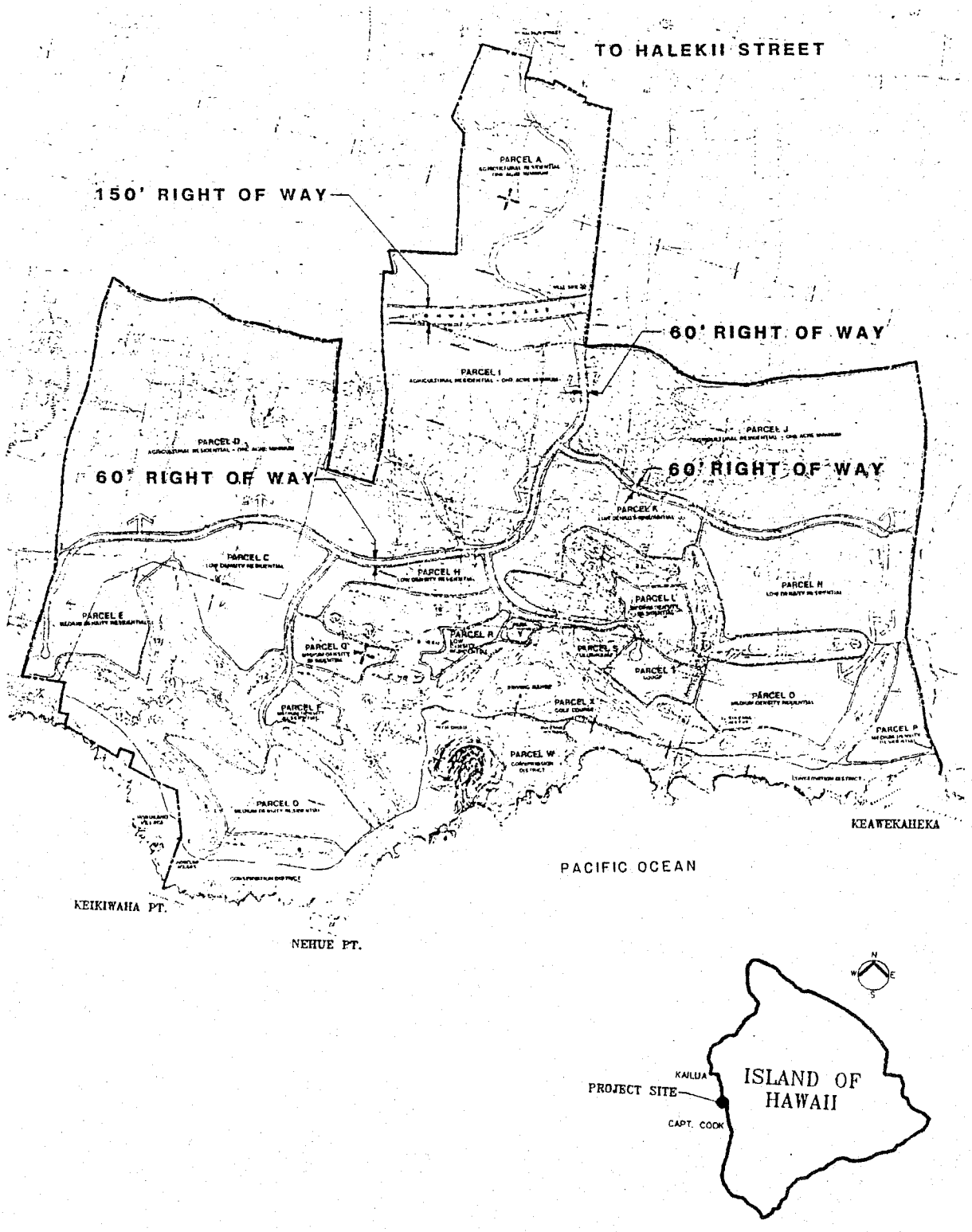

# THE VILLAGES AT HOKUKANO

## INTERSECTION OF MAMALAHOA HIGHWAY & HALEKII STREET

NORTH

| FIGURE 1 | DATE: NOVEMBER 1992 | SCALE: N.T.S. |
|---|---|---|

Okahara & Associates Inc.
CONSULTING ENGINEERS
200 KOHOLA STREET HILO, HAWAII 96720




# THE VILLAGES AT HOKUKANO

## CONCEPTUAL ROADWAY LAYOUT

NORTH

| FIGURE 2 | DATE: NOVEMBER 18, 1992 | SCALE: N.T.S. |
|---|---|---|

GAGE DAVIS ASSOC.
PLANNING LANDSCAPE ARCHITECTURE AND ARCHITECTURE
1007 PEARL STREET, SUITE 200 BOULDER COL. 80302
TEL (303) 449-1166 FAX (303) 449-1751

Okahara & Associates Inc.
CONSULTING ENGINEERS
200 KOHOLA STREET HILO, HAWAII 96720

# THE VILLAGES AT HOKUKANO

# ON-SITE WATER SYSTEM

NOVEMBER 30, 1992

PREPARED FOR:
OCEANSIDE 1250

PREPARED BY:
OKAHARA & ASSOCIATES, INC.



## THE VILLAGES AT HOKUKANO ON-SITE WATER SYSTEM

### Introduction

The Hokukano parcel consists of approximately 1,540 acres. The site is located partially in the North Kona and partially in the South Kona Districts, makai of the Hawaii Belt Road and bordered on the west by the Pacific Ocean. Site elevations range from sea level to approximately 1,250 feet.

The proposed development consists of residential, golf course, and possibly agricultural uses. The overall development plan calls for 1440 residential units, a 100 unit members lodge, and a 27 hole golf course. The first phase of the project is to include 367 residential/agricultural lots ranging in size from one to five acres and a 27 hole golf course and clubhouse. Subsequent phases will include approximately 1073 residential lots ranging in density from 0.5 to 4.7 units per acre.

The purpose of this report is provide an overview of the existing County of Hawaii water system in the vicinity of the project and to evaluate the on-site water system requirements.

### Existing Water System

There are currently no existing on-site County water lines. The nearest County water line is an 8" line in Halekii Street which is adjacent to and east of the site. This 8" line is fed by an 8" line in the Hawaii Belt Road. The closest existing storage tank is the 0.25 million gallon Halekii tank located mauka of the Hawaii Belt Road. The spillway elevation of this tank is at 1763.2 feet (see Figure 1. for the Halekii tank location).

Although the lack of County infrastructure development had limited the availability of potable water to the project site up to now, the Department of Water Supply has plans to develop additional wells in the area. An exploratory well is currently under construction mauka of the Hawaii Belt Road in the vicinity of the Kona Hospital. The projected completion date for this well is June 12, 1993. The quantity and quality of water which may be available from this well is unknown.

The developers of the Hokukano property possess 499 units of County Water Rights assigned to them through Kealakekua Water Resource Agreement. Each Water Right is for one unit or 600 gallons per day. These water rights are not a guarantee that the water is available at the present time but only that the developer will have access to the water as it becomes available. The developer may be required to contribute to off-site improvements that may be needed for transmission lines to the property or for water storage facilities.

**Estimated Potable Water Demand**

The following table is an estimate of the average daily water demand required for the project. The domestic consumption guideline for residential units given in Table 15 of the State of Hawaii Water System Standards - Volume I (1985), is 400 gallons per day (gpd) per unit. Actual water usage for this project may be higher depending on such variables as the extent of potable water used for landscaping and irrigation as well as the size of the residential units. Since these variables are difficult to quantify at this time the 400 gpd/unit is used to estimate residential consumption. There are no guidelines given in the Water System Standards for golf clubhouse and maintenance facilities and for sewage treatment facilities, therefore estimates given are based on usage by similar facilities on other projects.

Table I
Estimated Potable Water Average Daily Demand

| | |
|---|---|
| 1440 Housing Units x 400 GPD = | 576,000 GPD |
| Golf Clubhouse & Maintenance Facility = | 22,000 GPD |
| 100 Lodge Units x 400 GPD = | 40,000 GPD |
| Sewage Treatment Facility = | 5,000 GPD |
| TOTAL = | 643,000 GPD |

Maximum daily demand for Hawaii County is calculated by multiplying average daily demand by a factor of 1.5. The estimated maximum daily demand for the project is as follows:

1.5 x 643,000 GPD = 964,500 GPD

In addition to domestic consumption the water system must be sized to accommodate fire flow. According to Table 16 of the Water System Standards, fire flow requirements for residential units vary from 500 gallons per minute (gpm) for a 30 minute duration (agricultural lots) to 1500 gpm for a duration of one hour (duplex and Townhouse type units). Fire flow demand for the clubhouse and members lodge may be as high as 2000 gpm for a 2 hour duration depending on the type of construction used.

**Water Mains**

Water lines must be sized to accommodate maximum daily flow plus fire flow with a residual pressure of 20 psi at the critical hydrant. The maximum velocity in a water main is limited to 6 feet per second without fire flow and 10 feet per second with fire flow. The Water mains for the project will vary in size



from 6 inches to 12 inches in diameter depending on fire flow and maximum daily demands.

**Reservoirs**

It is anticipated that one or more potable water reservoirs will be required to service the development. It is the developer's intention to design the water system to be dedicable to the County of Hawaii Department of Water Supply if practical. In order to ensure that the water system will be acceptable to the County, the tanks must be located at the proper elevations above and within the project limits. Pressure zones will be identified and the subdivision roadway and water system layout will be designed to accommodate the pressure zones.

There will be a need for pressure reducing valves (PRV's) and/or pressure breaker tanks due to the 1250 foot difference in site elevations. The maximum allowable static pressure is 125psi which translates to a difference in elevation of approximately 288 feet, thus several breaker tanks or PRV units will be required depending on actual tank locations and the actual service area elevations. Spillway elevations of the existing Kahaluu water system reservoirs north of the site are 324.50 ft, 601.00 feet and 853.50 feet. It can be anticipated that the tank spillway elevations for the Hokukano site may be required to be at or near these elevations.

The reservoirs will be sized in accordance with the 1985 County of Hawaii Water System Standards, Volume I as follows:

a) Meet maximum day consumption. Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

b) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

Where there are two or more reservoirs serving the same system, the design will be made on the basis of combined protection provided by all facilities available.

Thus, the storage tanks must be sized to provide a minimum of approximately 964,000 GPD plus any fire flow required depending on the system design.

**Potable Water Supply Infrastructure Costs**

It is estimated that the cost of the water system including the main distribution lines and storage tanks will be $5,580,000.00 including design and surveying, excluding well

development or any off-site costs. The cost is based on the conceptual potable water system layout shown in Figure 2.

Table II
Order of Magnitude Costs
On-Site Potable Water System

| | |
|---|---|
| 2-0.25 MG Reservoirs | $800,000.00 |
| 1-0.50 MG Reservoir | $765,000.00 |
| Ductile Iron Water Mains | $3,000,000.00 |
| 4 Pressure Reducing Valve Units | $85,000.00 |
| SUB-TOTAL = | $4,650,000.00 |
| DESIGN & CONTINGENCY (20%)= | $930,000.00 |
| TOTAL = | $5,580,000.00 |

**Irrigation System**

It is anticipated that irrigation water for agricultural and golf uses will be developed and distributed in a separate system from the potable water supply. Separate wells, storage facilities and distribution lines will be required to supply the irrigation water. The storage and transmission mains for the irrigation water for the golf course will be incorporated into the design of the golf course. Irrigation wells will be developed on-site. The size and location of the irrigation reservoirs will depend on the water requirements of the possible agricultural uses. The estimated order of magnitude cost for the irrigation system infrastructure excluding the golf course is show in Table III. The cost will vary depending on the size of the storage reservoirs required.

Table III
Order of Magnitude Costs
Irrigation Water System

| | |
|---|---|
| 1-0.25 MG Reservoirs | $400,000.00 |
| Ductile Iron Water Mains | $1,782,000.00 |
| 4 Pressure Reducing Valve Units | $85,000.00 |
| SUB-TOTAL = | $2,267,000.00 |
| DESIGN & CONTINGENCY (20%)= | $453,400.00 |
| TOTAL = | $2,720,400.00 |

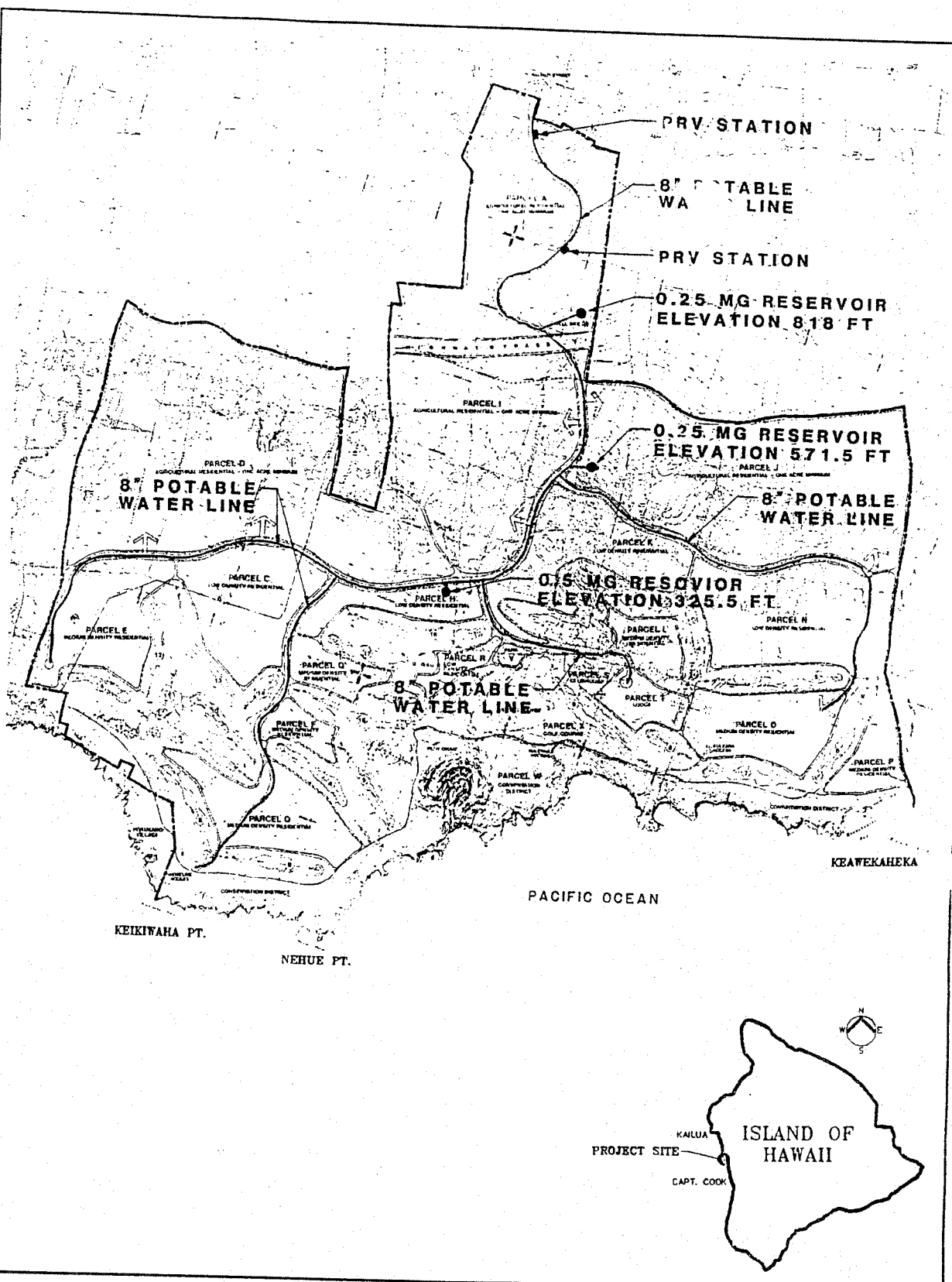


**Summary and Recommendations**

The existing off-site storage reservoirs and transmission mains will be adequate to service only a portion of the ultimate development of the site. The County of Hawaii Department of Water Supply has plans to develop wells in the area. It is not known exactly when additional County water will be available.

The County of Hawaii Department of Water Supply should be consulted before the Hokukano water system design is finalized in order to ensure compatibility with existing pressure zones. If the Hokukano system is not compatible with the County's system it may not be accepted by the County and thus would have to be maintained by the developer.

Once pressure zones have been established and agreed upon by the County, the subdivision should be carefully laid out so that the lots are adequately serviced within the various pressure zones.




# THE VILLAGES AT HOKUKANO

## CONCEPTUAL WATER SYSTEM LAYOUT

NORTH

| FIGURE 2 | DATE: NOVEMBER 18, 1992 | SCALE: N.T.S. |
|---|---|---|

GAGE DAVIS ASSOC.
PLANNING LANDSCAPE ARCHITECTURE AND ARCHITECTURE
1007 PEARL STREET, SUITE 200 BOULDER COL. 80302
TEL (303) 449-1166 FAX (303) 449-1751

Okahara & Associates inc.
CONSULTING ENGINEERS
200 KOHOLA STREET HILO, HAWAII 96720


# THE VILLAGES AT HOKUKANO

## EXISTING WATER PLAN

FIGURE 1 | DATE: NOVEMBER 1992 | SCALE: N.T.S.

SOURCE: DEPT. OF WATER SUPPLY
COUNTY OF HAWAII

Dickhara & Associates Inc.
CONSULTING ENGINEERS
200 KOHOLA STREET HILO, HAWAII 96720

NORTH

# II - 4 Preliminary Engineering Study for Sewage & Drainage Infrastructure System

# VILLAGES AT HOKUKANO
# PRELIMINARY ENGINEERING STUDY
# FOR SEWAGE AND DRAINAGE INFRASTRUCTURE SYSTEM

KEALAKEKUA, HAWAII

Prepared For:

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74-5620A Palani Road
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JANUARY 1993

Prepared By:

R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

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SECTION 1

PURPOSE AND SCOPE

The scope of this report is to determine the sewer and drainage infrastructure requirements for the Villages at Hokukano to be developed by Oceanside 1250. The study area is approximately 1,540 acres.

The scope of this report is as follows:

1. Determine sewage generation rates and volumes for the proposed development.

2. Determine preliminary onsite sewer and drainage improvements required to service the proposed development.

3. Determine preliminary offsite sewer improvements required to service the proposed development.

4. Layout preliminary onsite sewer and drainage systems.

5. Determine budgetary construction cost estimates for the required onsite and offsite infrastructure improvements.

## SECTION 2
## BACKGROUND INFORMATION

The proposed development is located on the North and South Kona district boundary on the Island of Hawaii. It is west of the Kona Hospital and Konawaena High School.

The development concept envisioned for the 1,540-acre site consists of 1,440 single-family residential lots, a 27-hole golf course, clubhouse and maintenance facility, lodge, shoreline access with parking, hiking trails, utilities and conservation area.



## SECTION 3
## ONSITE INFRASTRUCTURE

Onsite infrastructure consists of all infrastructure located within the development site. Onsite drainage improvements also consists of the necessary improvements to convey offsite runoff through the development site.

### 3.1 Existing Sewage Infrastructure

Presently the project site is undeveloped and no sewer system exists. The nearby residences in the area have cesspools. The nearest wastewater treatment plant is the Heeia Wastewater Treatment Plant in Keauhou. There are no infrastructure improvements planned for the area by the County of Hawaii.

### 3.2 Sewage System Improvements

#### 3.2.1 Generation Rates and Volumes

The sewage generation rates and volumes for the proposed development are summarized on Table 1. The sewage collection and conveyance system (sewer lines and pump station) will be designed to accommodate peak flows and the sewage treatment facility designed to accommodate average design flow. The average design flow for the project is 0.56 mgd and the peak flow is 2.09 mgd.

#### 3.2.2 Alternative Treatment, Disposal and Collection Systems

Alternative 1 consists of a collection system confined onsite with treatment onsite and disposal of effluent by golf course irrigation. The collection system will consist of gravity sewer ranging from 8 to 15 inches, three (3) pump stations and force main ranging from 6 to 8 inches. The treatment plant will consist of a sequencing batch reactor (SBR) facility (providing secondary treatment) and a tertiary treatment to achieve Class A reclaimed effluent for use as irrigation water in accordance with DOH guidelines (see Appendix A). The sewer system for this alternate is shown on Figure 1. In accordance with DOH guidelines the owner/developer shall establish a DOH approved irrigation plan and groundwater monitoring plan and system.

fn: hokupsg.wk3
date: 1/6/93

TABLE 1

VILLAGES AT HOKUKANO
PROJECTED SEWER GENERATION

| PARCEL | UNITS | EFFECTIVE ACRES | AVE. FLOW (GAL/DAY) | MAX. FLOW (GAL/DAY) | DRY WEATHER INFILTRATION (GAL/DAY) | WET WEATHER INFILTRATION (GAL/DAY) | DESIGN FLOWS AVERAGE (GAL/DAY) | DESIGN FLOWS PEAK (GAL/DAY) | DESIGN FLOWS MAX. FLOW (GAL/DAY) |
|---|---|---|---|---|---|---|---|---|---|
| A | 60 | 13.43 | 19,200 | | 1,200 | 16,788 | 20,400 | | |
| C | 95 | 4.82 | 30,400 | | 1,900 | 6,025 | 32,300 | | |
| D | 154 | 22.38 | 49,280 | | 3,080 | 27,975 | 52,360 | | |
| E | 140 | 6.89 | 44,800 | | 2,800 | 8,613 | 47,600 | | |
| F | 35 | 2.75 | 11,200 | | 700 | 3,438 | 11,900 | | |
| G | 50 | 2.07 | 16,000 | | 1,000 | 2,588 | 17,000 | | |
| H | 40 | 5.17 | 12,800 | | 800 | 6,463 | 13,600 | | |
| I | 65 | 13.09 | 20,800 | | 1,300 | 16,363 | 22,100 | | |
| J | 88 | 13.43 | 28,160 | | 1,760 | 16,788 | 29,920 | | |
| K | 100 | 3.10 | 32,000 | | 2,000 | 3,875 | 34,000 | | |
| L | 50 | 2.07 | 16,000 | | 1,000 | 2,588 | 17,000 | | |
| N | 139 | 5.85 | 44,480 | | 2,780 | 7,313 | 47,260 | | |
| O | 140 | 5.51 | 44,800 | | 2,800 | 6,888 | 47,600 | | |
| P | 68 | 1.38 | 21,760 | | 1,360 | 1,725 | 23,120 | | |
| Q | 200 | 4.13 | 64,000 | | 4,000 | 5,163 | 68,000 | | |
| R | 16 | 2.07 | 5,120 | | 320 | 2,588 | 5,440 | | |
| S (CLUBHOUSE) | 1 | 3.10 | 40,000 | | NA | NA | 40,000 | | |
| T (LODGE) | 100 | 2.07 | 32,000 | | 2,000 | 2,588 | 34,000 | | |
| TOTAL | | | 532,800 | 1,918,080 | 30,800 | 137,763 | 563,600 | 2,086,643 | 1,948,880 |

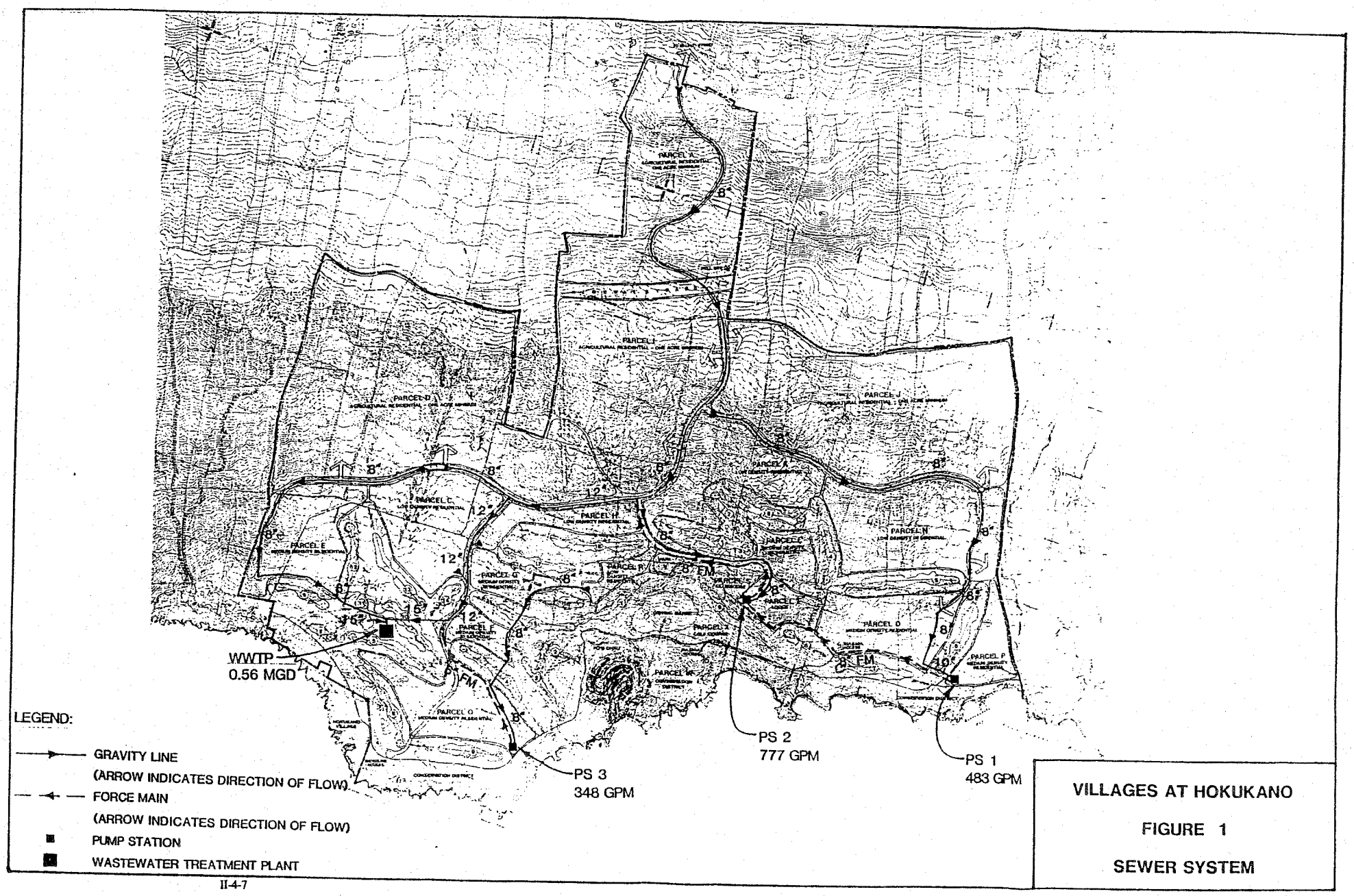


SEWAGE GENERATION CRITERIA

| | |
|---|---|
| 80 | GAL/DAY/CAPITA |
| 4 | PERSONS/HOME (SINGLE FAMILY) |
| 40,000 | GPD CLUBHOUSE (INCLUDING INFILTRATION) |
| 5 | GCD DRY WEATHER I/I |
| 1,250 | GAD WET WEATHER I/I |

GPD = GALLONS PER DAY
GCD = GALLONS PER CAPITA PER DAY
GAD = GALLONS PER ACRE PER DAY

BASED ON DESIGN STANDARDS OF THE DIVISION OF WASTEWATER MANAGEMENT, VOLUME 1, DEPARTMENT OF PUBLIC WORKS, CITY & COUNTY OF HONOLULU, FEBRUARY 1984.




VILLAGES AT HOKUKANO

FIGURE 1

SEWER SYSTEM

Effluent holding ponds shall be made impervious and periodically monitored for leakage into the subsurface. Signage indicating "non-potable water" will be placed at appropriate locations around holding ponds.

It is estimated that 100 percent of the Class A reclaimed water can be utilized to irrigate the golf course. The projected sewage generated by this development is 0.56 mgd and the estimated golf course irrigation use is approximately 0.90 mgd. The difference may be made up using fresh, brackish or or non-potable water.

The SBR system is recommended for wastewater treatment because of its ability to be installed in increments. The project buildout schedule favors a system that can be constructed in phases. Aerated lagoons were also considered, however, was not selected because of the area requirements and visual impacts on the project. Other suitable alternatives can be studied in the design phase of the project.

The alignment of effluent force main has not been set at this time. Size and alignment will be developed in conjunction with the golf course irrigation system design. The cost listed on Table 2 for the effluent pump station and effluent force main may change due to the location of the holding ponds.

Alternative 2 consists of a collection system onsite with treatment offsite at the existing Heeia Wastewater Treatment Plant (HWWTP) located at Keauhou. The collection system would be similar to Alternative 1 with the addition of five (5) pump stations, for a total of eight (8) pump stations, and a force main to the HWWTP. This alternative would require offsite sewage system improvements that will be discussed in Section 4 of this report. The feasibility of this alternate is dependent on availability of the transmission line alignment and the excess capacity at the HWWTP.

The most feasible alternative should be selected at a later date as more information becomes available.



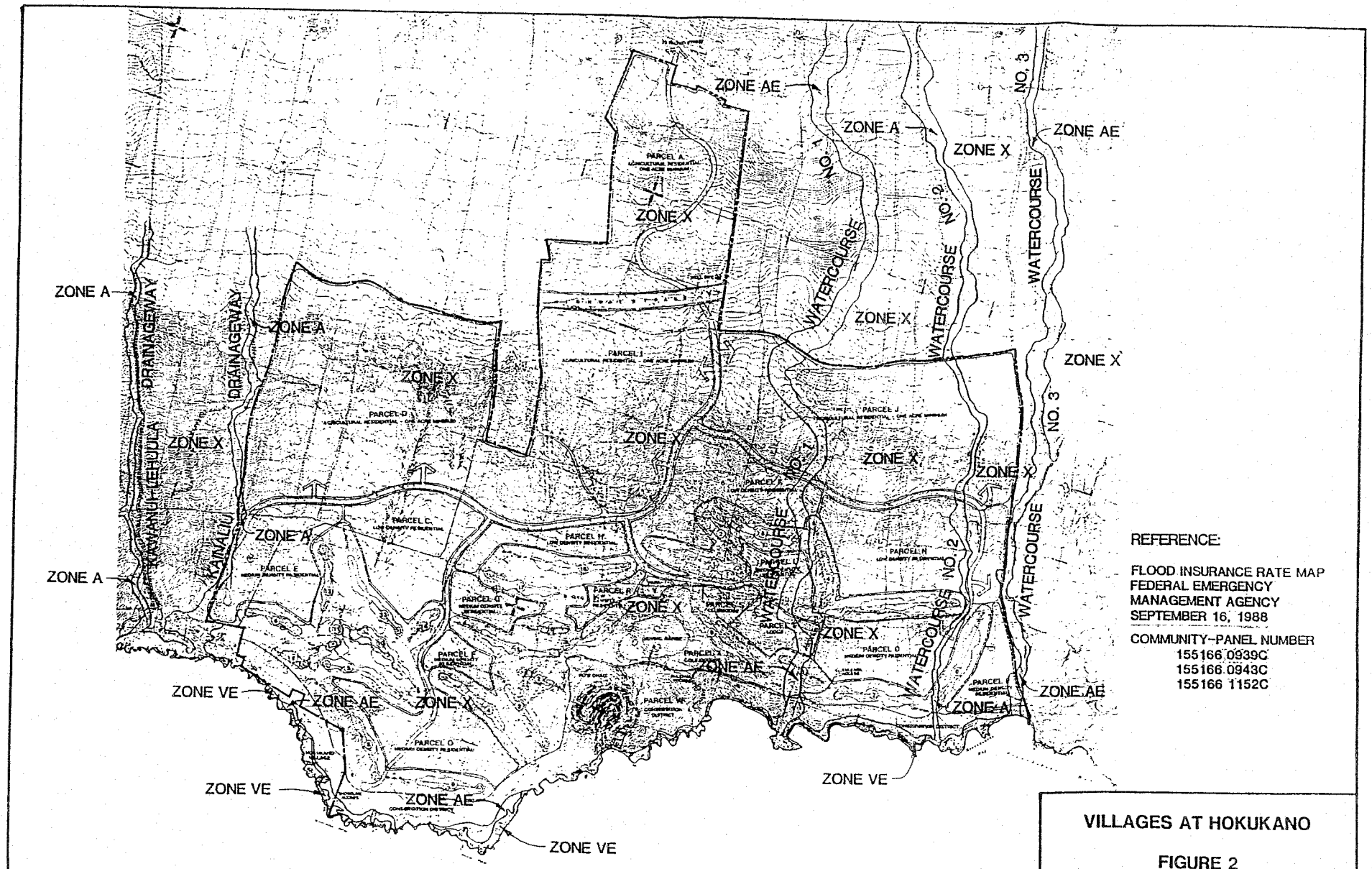
3.3 Drainage System Improvements

Figure 2 shows two (2) existing drainageways that pass through the project site and two (2) that run along the northern and southern boundaries of the site. All of these drainageways discharge into the ocean.

The onsite drainage system will consist primarily of drywells to dispose of runoff generated from the roads and golf course retention/infiltration basins. The lots whenever practical will drain to the golf course or existing watercourses. Siltation basins will be constructed as required to control runoff water quality. These basins may be incorporated into the golf course or created within the existing drainageways. Runoff generated from rainfall on the golf course should be retained and used to supplement the treated effluent and brackish water used to irrigate the golf course. No offsite drainage improvements are anticipated.

Drainage resulting from golf course runoff will be collected by the turf areas being bowl shaped and a carry-off tile system into the irrigation holding ponds. The water can then be used for irrigation.

The two drainageways that pass through the development are on the southern half of the project site. The parcels affected are J, K, L, N, O P, and T (Lodge). Some modifications to these drainageways or development areas may be necessary to keep the lots out of the flood plain.


ZONE AE
ZONE A
ZONE X
NO. 3
WATERCOURSE
NO. 2
NO. 1
ZONE A
ZONE X
DRAINAGEWAY
KAWANUI-EHUULA
KANALIU
ZONE VE
ZONE AE
PARCEL A
PARCEL I
PARCEL J
PARCEL D
PARCEL C
PARCEL E
PARCEL H
PARCEL G
PARCEL F
PARCEL O
PARCEL N
PARCEL M
REFERENCE:
FLOOD INSURANCE RATE MAP
FEDERAL EMERGENCY
MANAGEMENT AGENCY
SEPTEMBER 16, 1988
COMMUNITY–PANEL NUMBER
155166 0939C
155166 0943C
155166 1152C
VILLAGES AT HOKUKANO
FIGURE 2
DRAINAGE SYSTEM

## SECTION 4
## OFFSITE INFRASTRUCTURE

Offsite infrastructure is defined as all infrastructure located outside the development area that directly or indirectly services the development area.

### 4.1 Sewage System

Offsite sewage system improvements are needed for Alternative 2 (see Section 3.2.2). The existing Heeia Wastewater Treatment Plant (HWWTP) at Keauhou is presently being expanded. The ultimate capacity of the plant is 7.2 mgd and current flow is 0.4 mgd. Approximately 24,000 linear feet of pipe and five (5) pump stations will be needed to convey the sewage from the project site to the treatment plant. Depending on alignment of the force main, an easement may need to be obtained from the property owners along the route of the sewer line (see Figure 3). The alignment on Figure 3 is shown for informational purposes and is subject to change due to many factors unknown at this time. These factors include property ownership, existing land usage and developments, and archaeological sites.

The feasibility of this alternative will depend on agreements between Kamehameha Investment Corporation (HWWTP) and Oceanside 1250. The cost estimate for "Offsite Infrastructure - Table 2" does not include any land acquisition costs, facilities charge (usually assessed on a per gallon basis), and cost sharing assessment (should part of the facility be utilized by others). The transmission system cost includes construction of a 20-foot wide road to facilitate maintenance of the system. (A 10-foot wide easement is needed for the force main). The construction of the "Bypass Road" may reduce the amount of service road necessary to provide service access to the sewer line.



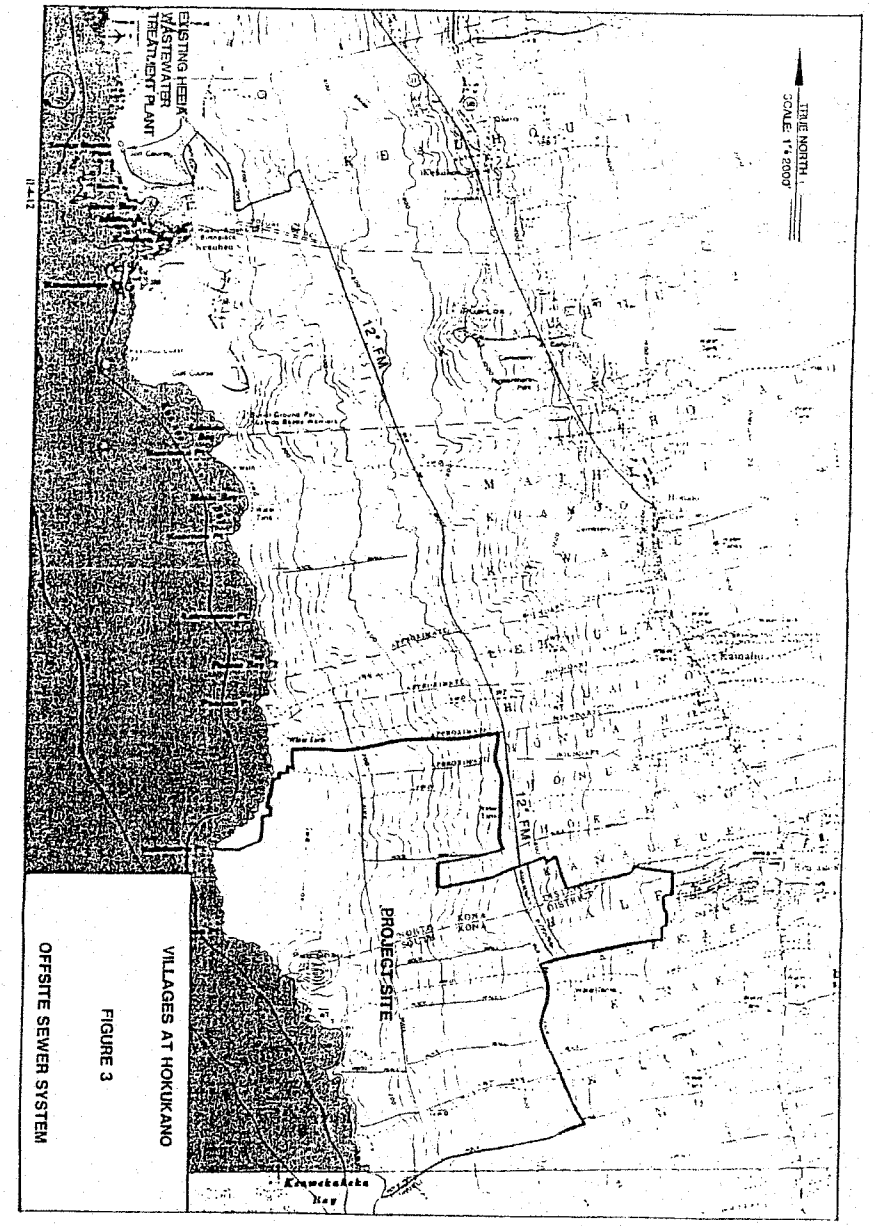



FIGURE 3
OFFSITE SEWER SYSTEM
VILLAGES AT HOKUKANO

## SECTION 5

## COST ESTIMATE

The budgetary cost estimates for the onsite and offsite infrastructure are shown on Table 2. The estimates are based on County of Hawaii dedicable infrastructure systems. The unit costs used in the estimate are based on recent projects in the State of Hawaii adjusted for the development area.



**Table 2**
**VILLAGES AT HOKUKANO**
**ORDER OF MAGNITUDE ESTIMATE**

JANUARY
1993

ONSITE INFRASTRUCTURE

| | Quantity | Units | Unit Cost | Cost X$1,000 | Total X$1,000 |
|---|---|---|---|---|---|
| SEWER SYSTEM | | | | | |
| 1. 8" Gravity Line | 27,600 | lf. | $60 | $1,656 | |
| 2. 10" Gravity Line | 400 | lf. | $75 | $30 | |
| 3. 12" Gravity Line | 4,100 | lf. | $80 | $328 | |
| 4. 15" Gravity Line | 900 | lf. | $85 | $77 | |
| 5. Manholes | 95 | ea. | $5,800 | $551 | |
| 6. 6" Force Main | 2,400 | lf. | $55 | $132 | |
| 7. 8" Force Main | 6,400 | lf. | $60 | $384 | |
| 8. Treatment Plant | 1 | ea. | $5,000,000 | $5,000 | |
| 9. Pump Station 1 | 1 | ea. | $322,000 | $322 | |
| 10. Pump Station 2 | 1 | ea. | $518,000 | $518 | |
| 11. Pump Station 3 | 1 | ea. | $232,000 | $232 | |
| 12. Effluent Pump Station | 1 | ea. | $600,000 | $600 | |
| 13. Effluent Force Main | 2,000 | lf. | $56 | $112 | |
| TOTAL | | | | | $9,942 |
| DRAINAGE SYSTEM | | | | | |
| 1. Drywells | 142 | ea. | $20,000 | $2,840 | |
| 2. Culverts (10'x24') | 150 | lf. | $4,000 | $600 | |
| 3. Retention Basins | 2 | ea. | (to be determined) | | |
| TOTAL | | | | | $3,440 |
| | | | SUB–TOTAL COST | | $13,382 |
| | | | CONTINGENCY (20%) | | $2,676 |
| | | | TOTAL COST | | $16,058 |

Table 2
VILLAGES AT HOKUKANO
ORDER OF MAGNITUDE ESTIMATE*

JANUARY
1993

OFFSITE INFRASTRUCTURE

| | Quantity | Units | Unit Cost | Cost X$1,000 | Total X$1,000 |
|---|---|---|---|---|---|
| SEWER SYSTEM | | | | | |
| 1. Roadway | 18,500 | lf. | $110 | $2,035 | |
| 2. 12" Force Main | 25,000 | lf. | $75 | $1,875 | |
| 3. Pump Station | 5 | ea. | $1,500,000 | $7,500 | |
| TOTAL | | | | | $11,410 |
| | | | SUB-TOTAL COST | | $11,410 |
| | | | CONTINGENCY (20%) | | $2,282 |
| | | | TOTAL COST | | $13,692 |

*This estimate does not include land acquisition costs, facilities charge and cost sharing assessment.

**Should effluent from Heeia Wastewater Treatment Plant be used for irrigation, a return main and pump stations will be needed at an approximate cost of $3-5 million.

# APPENDIX A





TABLE OF CONTINENT

BACKGROUND

Increase safe use of water reclaimed from municipal wastewater can greatly assist meeting water requirements of the State, enhance the environment, and benefit public health by preserving economies upon which public health protection is based.

The time has come for the State Department of Health (DOH) to do more than continue to provide project-specific consultation, to support undertaking of water reclaimed from municipal wastewater. The following wastewater effluent use criteria were adopted by DOH in Chapter 62 of Title 11, Hawaii Administrative Rules, entitled "Wastewater Systems" Section 11-62-25 Wastewater effluent disposal systems:

(a) Effluent irrigation systems.

(1) The owner(s) of an effluent irrigation system shall submit to the director the following information:

(A) Details of the area, type of vegetation to be irrigated and an assessment on the impact to the adjacent areas;

(B) Method and controls to be used in the irrigation system such that no runoff or ponding will occur;

(C) Method of controlling the public accessibility to the system and area to minimize the public contact with the effluent;

(D) Plan of action to adequately warn the public that effluent is being used for irrigation and that the water is unfit for human consumption; and

(E) How the piping and appurtenances are to properly marked to distinguish potable water and sewage effluent.

(2) The owner of an effluent irrigation system shall provide adequate storage basin(s) or a backup disposal system to prevent any overflows or discharges from the system when the irrigation system is not in operation or when wastewater effluent quantities exceed the irrigation requirements.

(b) All Wastewater effluent disposal systems shall include provisions to facilitate operation, maintenance and inspection.

In addition, a three page policy was prepared in April 1989 entitled "EIGHT (8) CONDITIONS APPLICABLE TO THIS NEW GOLF COURSE





DEVELOPMENT" See Appendix A for text.

The above cite only bare essentials of project features and thus inspire numerous requests for consultations regarding adequacy of measures to assure safe use of reclaimed water. DOH proposes to add more specificity to the above criteria in the form of guidelines in order to:

1. Delineate specific reclaimed water application with reclaimed water quality treatment;

2. Facilitate acceleration of planning, design, permitting, and implementation of water reclamation projects;

3. Facilitate use of reclaimed water in greater amounts, by more readily available knowledge of the conditions under which DOH can attest to safety of uses of reclaimed water;

4. Protect public health and repute and public acceptance of water reclamation projects.

In the preparation and presentation of these guideline, acknowledgement is given to numerous federal, state and local agencies, in their contributions to research, evaluation and regulations pertaining to water reclaimed from municipal wastewater. Special recognition is given to the California Department of Health Services and the Florida Department of Environmental Regulations for their publications and regulations regarding water reclamation.

In order to assist the reader, the definition of terms is presented prior to the body of the guidelines.

Definitions:

"Aerosol" means an airborne solid suspended in air with or without preceding evaporation of surrounding water of a mist droplet.

"Alarm" means an instrument or device which continuously monitors a specific function of a treatment process and automatically gives warning of an unsafe or undesirable condition by means of visual and audible signals.

"Approved Laboratory Methods" means analytical procedures specified in the latest edition of "Standard Methods for the Examination of Water and Wastewater", prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution

Control Federation and which are conducted in approved laboratories.

"Biological treatment" means methods of wastewater treatment in which bacterial or biochemical action is intensified as a means of producing an oxidized wastewater.

"Class A reclaimed water" means reclaimed water that is at all times:

a. Oxidized, then coagulated, then clarified, then filtered, and then disinfected so that at some location in the treatment process the median number of total coliform bacteria determined by multiple-tube fermentation does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed 23 per 100 milliliters in more than one sample within any 30-day period;

b. Treated under process conditions that have been demonstrated to the satisfaction of the DOH to consistently provide a degree of treatment as defined above in paragraph "a" and so that the number of detectable enteric animal viruses is less than one per 40 liters; and

c. Treated under process conditions that have been demonstrated to the satisfaction of the DOH to consistently provide a degree of treatment sufficient to make effluent free of a detectable, viable oocyst or cyst of Cryptosporidium, Giardia, and Entamoeba in 40 liter samples.

"Class B reclaimed water" means reclaimed water that is at all times:

a. Oxidized, then coagulated, then clarified, then filtered, and then disinfected so that at some location in the treatment process the median number of total coliform bacteria determined by multiple-tube fermentation does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed 23 per 100 milliliters in more than one sample within any 30-day period; and





b. Treated under process conditions that have been demonstrated to the satisfaction of the DOH to consistently provide a degree of treatment as defined above in paragraph "a" and so that the number of detectable enteric animal viruses is less than one per 40 liters.

"Class C reclaimed water" means reclaimed water that is at all times oxidized, and chlorinated so that at some location in the treatment process the median number of total coliform bacteria determined by multiple-tube fermentation does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed 23 per 100 milliliters in more than one sample within any 30-day period.

"Class D reclaimed water" means reclaimed water that is at all times oxidized and chlorinated so that at some location in the treatment process the median number of total coliform bacteria determined by multiple-tube fermentation does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed 240 per 100 milliliters in any two consecutive samples.

"Coagulated wastewater" means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated by the addition of suitable floc-forming chemicals or by an equally effective method.

"Direct beneficial use" means the use of reclaimed water which has been transported from the point of production to the point of use without an intervening discharge to waters of the state.

"Direct filtration" means treatment which makes wastewater an oxidized, coagulated, filtered wastewater.

"Disinfected wastewater" means wastewater in which the pathogenic organisms have been destroyed by chemical, physical or biological means.

"Domestic wastewater" means the wastewater derived from ordinary human habitation or human activities including, but not limited to, wastewater from dwellings, hotels, hospitals, and comfort stations.

"Filtered, oxidized wastewater" is an oxidized wastewater which has been passed through natural undisturbed solids or

filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and does not exceed 5 turbidity units more than 5 percent of the time during any 24-hour period.

"Filtered Wastewater" means an oxidized, coagulated, clarified wastewater which has been passed through natural undisturbed solids or filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and does not exceed 5 turbidity units more than 5 percent of the time during any 24-hour period.

"Food crop" means any crop intended for human consumption.

"Graywater" means liquid waste from a dwelling or other establishment produced by bathing, washdown, minor laundry and minor culinary operations, and specifically excluding toilet waste.

"Landscape impoundment" is a body of reclaimed water which is used for aesthetic enjoyment or which otherwise serves a function not intended to include public contact.

"Mist" means a suspension of droplets in air.

"Multiple point chlorination" means that chlorine will be applied simultaneously at the reclamation plant and at subsequent chlorination stations located at the use area and for some intermediate point. It does not include chlorine application for odor control purposes.

"Multiple unit" means two or more units of a treatment process which operate in parallel and serve the same function.

"Municipal wastewater" means waste discharged from a community sewerage system, that is comprised of domestic wastewater or a mixture of domestic wastewater and waste from industry or other activity and/or waste or water from other sources.

"Native enteric animal virus" means a virus that infects the intestine of humans, which is presented in wastewater as a result of discharge of sewage into the sewer system.

"Nonrestricted recreation impoundment" is an impoundment of water in which activities that is allowed includes swimming, other activities involving immersion of the face, dunking or drenching during which water is likely to be swallowed, or wading.





"Oxidized wastewater" means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

"Person" has the same meaning as defined in section 342D-1, HRS.

"Power Source" means a source of supplying energy to operate unit processes.

"Primary effluent" is the effluent from a wastewater treatment process which provides removal of sewage solids so that it contains not more than 0.5 milliliter per liter per hour of settleable solids as determined by an approved laboratory method.

"Reclaimed water" means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

"Reclamation plant" means an arrangement of devices, structures, equipment, processes and controls which produce a reclaimed water suitable for the intended reuse.

"Residence" means a home and the land surrounding the home with the property line of land owned by the owner of the home; and includes a dwelling, yard area of dwelling, and other place resided in the frequented by children (e.g., day care center, school, park, playground, school yard); and includes a dwelling, yard area of a dwelling, and other place intended especially for persons who are physiologically infirm, ill, or attempting to recuperate from illness (e.g., a hospital, rest home, convalescent center.

"Restricted recreational impoundment" is a body of reclaimed water in which recreation is limited to fishing, boating and other non-body-contact water recreation activity.

"Secondary sedimentation" means the removal by gravity of settleable solids remaining in the effluent after the biological treatment process.

"Spray irrigation" means application of reclaimed water to crops by spraying it from orifices.

"Standby chlorinator" means a duplicate chlorinator for reclamation plants having one chlorinator and a duplicate of largest unit for plants having multiple chlorinator units.

"Standby power source" means an automatically actuated self-

starting alternate energy source maintained in immediately operable condition and of sufficient capacity to provide necessary service during failure of the normal power supply.

"Standby replacement equipment" means reserved parts and equipment to replace broken down or worn-out units which can be placed in operation within a 24-hour period.

"Standby unit process" is an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment for the entire design flow of the unit for which it is a substitute.

"Surface Irrigation" means application of reclaimed water by means other than spraying and drip such that contact between the edible portion of the food crop and reclaimed water is prevented.

"Unit Process" means an individual stage in the wastewater treatment sequence which performs a major single treatment operation.

"Vector Control" means the prevention and control of vectors and pests (mosquitoes, flies, rats etc.) of public health significance.

"Wetland" means a lowland area containing impounded surface water adjacent soil that is saturated with moisture, such as a marsh, that is regarded as a habitat of or for wildlife, rather than for domesticated animals.

The following water reclamation guidelines uses Section 11-62-25 Wastewater effluent disposal systems as an outline in which details are than embedded.

I. Details of the area, type of vegetation to be irrigated and an assessment on the impact to the adjacent areas;

A. Details of the area:

1. LAND USE REQUIREMENTS.

a. The exact boundaries of the land application project, with buffer zones shown, shall be located on a base map. These base maps shall show present land uses and anticipated land uses for the next ten years within one mile of the site boundaries. The land use information shall be based on the approved county comprehensive land





use plan.

b. All water supply and monitoring wells within a 0.5 mile radius of the land application site shall be located on the base maps and identified as to use (e.g., potable) and ownership (e.g., private)

c. If expansion of the proposed facility is anticipated, the area likely to be used in the expansion shall be shown on the base maps.

d. Surface waters and groundwater classifications pursuant to Title 11 Chapter 54 and 23, within one mile of the project area, shall be located on the base maps and shall be described, with respect to the classification, uses, and approximate distance from the site.

2. SOILS INFORMATION.

a. A soils map of the land application site shall be provided. The soils shall be named and described in accordance with the standard criteria (e.g., soil surveys) of the Soil Conservation Service (SCS).

b. Physical characteristics of each significant soil, subsoil, or substratum layer to a depth of 10 feet below the average water table or to a 20-foot depth measured below the lowest point on the site, if no water table is encountered, shall be provided. Representative soil profiles of the site shall be provided and characteristics such as texture, hydraulic conductivity, available water capacity, organic matter content, Ph, sodium adsorption ratio, and cation exchange capacity should also be investigated; appropriate chemical characteristics shall be determined for soil profile horizons active in the chemical and biological renovation of reclaimed water. Specific sites used for determining hydraulic conductivity shall be shown to the soils maps, and data shall be submitted to substantiated that the proposed site is hydrologically capable of accommodating the design loading and application rate.

3. HYDROGEOLOGIC SURVEY.

a. Hydrogeologic data necessary to evaluate the capability of the proposed project to perform successfully at the site on a long-term basis shall be provided. A proposed ground water monitoring plan meeting the requirements of paragraph C of this section shall be provided. This information shall include, but not be limited to, the

identification, with applicable geologic sections, extent or continuity, and hydrologic characterization of aquifers and confining zones underlining the site (i.e., horizontal and vertical hydraulic conductivity, porosity, thickness); head relationships between aquifer systems; and information on the annual range of ground water elevations at the proposed site.

b. The direction and rate of existing ground water movement and the points of discharge shall be shown on the base maps of the area. Similar information regarding conditions anticipated as a result of the project shall be provided.

c. Information on water supply wells, and monitoring wells including the depth, length of casing, cone of depression and geophysical surveys of the wells (if available) shall be provided.

d. The proposed ground water monitoring system shall also be described and displayed on a base map.

4. HYDROLOGIC SURVEY.

a. Hydrologic data necessary to prepare a water budget to determine the initial irrigation application rate of reclaimed water.

b. In those areas above the underground injection control (UIC) line where reclaimed water is intended to used, the irrigation application rate shall not exceed the ten year monthly average evapotranspiration rate.

c. Flood prone areas on the proposed site and within 0.5 miles of the site shall be located on a base map. Flood frequency and elevation shall be presented.

5. MONITORING PLAN.

a. The owner/developer and all subsequent owners shall establish a groundwater monitoring plan and system which shall be presented to the DOH for approval. The groundwater monitoring plan and system shall minimally describe the following components:

(1) A system of monitoring wells constructed throughout the site. These monitoring wells shall extend approximately ten feet below the water table.





(2) A routine groundwater monitoring schedule of at least once every six months and more frequently, as required by the DOH, in the event that the monitoring data indicates a need for more frequent monitoring.

(3) A list of compounds shall be tested as approved by the DOH. This list may include, but not be limited to, the following:

(a) Total dissolved solids (TDS);

(b) Chlorides;

(c) Ph;

(d) Nitrogen;

(f) Phosphorus;

(g) or any other compounds associated with fertilizers, biocides or effluent irrigation.

b. A baseline groundwater data shall be established as described in this paragraph. Once the test well sites and list of compounds to be monitored have been determined and approved by the DOH, the owner/developer shall contract with an independent third-party professional to have the groundwater sampled and its data reported to the DOH. Testing of the groundwater shall be done by a approved laboratory.

c. If the data from the monitoring wells indicate the presence of the measured compound and/or the increased level of such compound, the DOH may require the owner/developer or subsequent owner to take immediate mitigating action to stop the cause of the contamination.

B. Type of vegetation to be irrigated

1. IRRIGATION OF FOOD CROPS

a. Water used for spray irrigation of land bearing food shall be Class A reclaimed water at all times.

b. Reclaimed water used for surface irrigation or drip irrigation of land bearing a food crop, that is not a

root crop nor does it have an edible portion that touches reclaimed water or the ground nor does it have an edible portion that is within two feet of the ground, shall be Class A, B, or C reclaimed water at all times.

c. Reclaimed water used for spray irrigation less than 30 days before the expected time of fruit formation, or after fruit formation, in an orchard or vineyard for a food crop shall be Class A reclaimed water at all times.

d. Reclaimed water used for spray irrigation less than 30 days or more before the expected time of fruit formation in an orchard or vineyard for a food crop shall be Class A, B, C, or D reclaimed water at all times.

e. Surface irrigation or drip irrigation of orchards and vineyards shall use Class A, B, C, or D reclaimed water.

f. Irrigation of land bearing a food crop that is a root crop (e.g., taro, turnips, sweet potatoes, etc.), or a food crop with an above-ground edible part that touches the ground (including but into limited to macadamia nut, lychee, mangoes, etc.) or touches reclaimed water (e.g., watercress, etc.) or is within two feet of the ground surface (e.g., pineapple, mellon, tomato, etc.) shall be Class A reclaimed water at all times.

g. At least 10 days will elapse between the last irrigation with reclaimed water and harvest of a food crop that is a root crop with above-ground edible part that touches the ground or is within one foot of the ground.

h. At least 10 days will elapse between the last spray irrigation with reclaimed water and harvest of a food crop that is a root crop, or a food crop with above-ground edible part that touches the ground or is within one foot of the ground.

i. Surface, subsurface or spray irrigation of land can be used with sugar cane.

2. IRRIGATION OF FODDER, FIBER AND SEED CROPS.

a. Surface or spray irrigation at a sod farm furnishing sod for installation by the general public shall be Class A, B, or C reclaimed water at all times.

b. Surface or spray irrigation for ornamental nursery stock





shall be Class A, B, or C reclaimed water at all times.

c. Surface or spray irrigation for farms of trees or other non-edible crops shall be Class A, B, C, or D reclaimed water at all times.

d. Surface or spray irrigation for fodder and seed crops not consumed by humans shall be Class A, B, C, or D reclaimed water at all times.

e. Surface or spray irrigation of pasture shall be Class A, B, C, or D reclaimed water at all times.

f. Potable water shall be supplied for the growth of all material used in the production of leis to avoid public use of reclaimed water.

3. LANDSCAPE IRRIGATION

a. Irrigation of golf courses, cemeteries, freeway landscapes, and landscapes in other areas for which it is shown to the satisfaction of the DOH that where the public has no greater access or exposure shall be Class A, B, C, or D reclaimed water.

b. The following apply at golf courses, cemeteries, and other areas with similar access or exposure:

(1) Adequate signs shall be posted indicating pictorially for English illiterates and in writing, that reclaimed wastewater is used for irrigation and it is not safe for drinking i.e., (ATTENTION: RECLAIMED WATER -- DO NOT DRINK). Additional supportive language may also be in the sign.

(2) Potable water shall be supplied for flower containers to avoid public use of reclaimed water.

c. The following apply at golf courses, cemeteries, and other areas with similar access or exposure, if the reclaimed water is not Class A reclaimed water:

(1) Adequate signs shall be posted indicating pictorially for English illiterates and in writing, that reclaimed wastewater in used for irrigation and it is not safe for drinking i.e., (ATTENTION: RECLAIMED WATER -- AVOID CONTACT -- DO NOT DRINK). Additional supportive language may also be in the

sign.

(2) Reclaimed water shall be applied only in evening or night hours when the area is not in use.

(3) Reclaimed water shall be allowed to dry on vegetation and infiltrate into soil before the area is used again so reclaimed water will not be the cause of any wetness remaining on vegetation at the start of the next use.

(4) Score cards shall indicate that reclaimed wastewater is used and saliva shall not be used to clean balls.

d. Irrigation of parks, playgrounds, school yards, and other areas where the public has similar access or exposure shall be Class A or B reclaimed water at all times.

(1) Adequate signs shall be posted indicating pictorially for English illiterates and in writing, that reclaimed wastewater is used for irrigation and it is not safe for drinking i.e., (ATTENTION: RECLAIMED WATER -- DO NOT DRINK). Additional supportive language may also be in the sign.

C. Assessment on the impact to the adjacent area:

1. PROJECT EVALUATION.

a. An evaluation of the overall long-term effects of the proposed project on environmental resources in the area shall be provided. The evaluation shall include aspects such as changes in water table elevations due to natural fluctuations and the application of reclaimed water, prediction of the rate and direction of movement of applied reclaimed water, change in the area associated with the project, and similar information.

b. Justification and documentation for using hydraulic loading rates, and application and resting cycles.

II Method and controls to be used in the irrigation system such that no runoff or ponding will occur;

A. Method and Control.





1. IRRIGATION PLAN.

a The owner/developer and all subsequent owners shall establish an irrigation plan and system which shall be presented to the DOH for its approval. The irrigation plan and system shall minimally describe the following components:

(1) A detailed description of the irrigation system and its uniformity coefficient of irrigation application.

(2) There must be a record of the amount of water applied at each irrigation cycle. This could be a meter reading of flow per irrigation cycle.

(3) A system of subsurface infiltration catchments shall be constructed throughout the site. The top of these subsurface infiltration catchments shall extend approximately three feet below the finished grade. In areas where the depth of the soil horizon is less three feet, the top of the subsurface infiltration catchment shall be placed below the soil horizon.

(4) A routine subsurface infiltration catchment monitoring schedule of at least once every week and more frequently, as required by the DOH, in the event that the monitoring data indicates a need for more frequent monitoring.

(5) A list of compounds shall be tested as agreed to by the DOH. This list may include, but not be limited to the following:

(a) Volume of water

(b) Total dissolved solids (TDS);

(c) Chlorides;

(d) Ph;

(e) Nitrogen;

(f) Phosphorus;

(g) or any other compounds associated with fertilizers, biocides or effluent irrigation.

b. A baseline infiltration data shall be established as described in this paragraph. Once the test subsurface infiltration sites and list of compounds to be monitored have been determined and approved by the DOH, the owner/developer shall contract with an independent third-party professional to have the groundwater sampled and its data reported to the DOH. Testing of the groundwater shall be done by a approved laboratory.

c. If the data from the subsurface infiltration catchments indicate the presence of the measured compound and/or the increased level of such compound, the DOH may require the owner/developer or subsequent owner to take immediate mitigating action to stop the cause of the contamination.

2. Adequate measure shall be taken to prevent ponding and runoff of reclaimed water.

3. Adequate measures shall be taken to prevent ponding and runoff of reclaimed water unless it is specifically allowed by waste discharge requirements. Ponding shall be allowed under circumstances that will prevent the breeding of insects and other vectors of health significance and the creation of nuisance, odors, slimes, or unsightly deposits.

III Method of controlling the public accessibility to the system and area to minimize the public contact with the effluent;

A. Irrigation Methods

1. SPRAY IRRIGATION

a. Reclaimed water used for spray irrigation shall be Class A, B, C, or D reclaimed water at all times.

b. If reclaimed water that is not Class A or B reclaimed water is applied to land by spray irrigation within 500 feet of a residence, or within 500 feet of the property line, all irrigation that wets land within 500 feet of such area shall be performed between the hours of 9:00 p.m. and 5:00 a.m..

c. Reclaimed water used for spray irrigation shall be Class A or B reclaimed water at all times if such use can cause spray or visible mist to reach a residence or open land with a water use that would require Class A or B





reclaimed waster if reclaimed water is used or were to be substituted for water that is used.

d. Reclaimed water shall not be used for spay irrigation, or other uses where spray is formed, if spray can reach an area where there is an outdoor food establishment or an unprotected drinking faucet.

e. Class C and D reclaimed water shall be controlled so that direct or windblown spray and mist will not travel beyond the area designated and approved by the Wastewater Branch DOH as an intended recipient of reclaimed water.

f. Class C and D reclaimed water shall be controlled so that reclaimed water spray or mist will not contact or enter a passing vehicle, building, domestic water facility, food handling facility, or any facility or area not designated by the DOH as an intended recipient of reclaimed water.

g. Except as provided in this policy for specified use of Class A and B reclaimed water, public contact with reclaimed water shall be minimized except where specifically approved by the DOH.

h. No person shall be allowed in a stall, booth, screened or walled area where reclaimed water is sprayed.

i. External drinking water facilities shall be protected from direct or windblown reclaimed water spray.

2 DRIP IRRIGATION

a. Reclaimed water used for drip irrigation shall be Class A, B, C, or D reclaimed water at all times.

b. If reclaimed water that is not Class A or B reclaimed water is applied to land by drip irrigation within 5 feet of a residence, or within 5 feet the property line, all irrigation that wets land within 5 feet of such area shall be performed between the hours of 9:00 p.m. and 5:00 a.m.. All irrigation using subsurface application within 5 feet of such area shall be performed any time, day or night.

3 SURFACE IRRIGATION

a. Reclaimed water used for surface irrigation shall be

Class A, B, C, or D reclaimed water at all times.

b. If reclaimed water that is not Class A or B reclaimed water is applied to land by surface irrigation within 5 feet of a residence, or within 5 feet of the property line, all irrigation within 5 feet of such area shall be performed any time, day or night.

4 OTHER SUITABLE USES FOR RECLAIMED WATER

a. The following are suitable uses for Class B reclaimed water:

(1) Outdoor fire fighting;

(2) Corporate washing of vehicles (e.g., buses, cars) and vessels (e.g., airplanes, boats);

(3) Wash down of corporation yards;

(4) Flushing toilets and urinals where reclaimed water pipe is not hidden behind a wall;

(5) Watering non-dairy livestock;

(6) Decorative fountains; and

(7) Cooling.

(a) Reclaimed water used for cooling, reclaimed water shall be treated by addition of a biocide or application of other disinfection agent sufficient to prevent viability of Legionella and Klebsiella that could enter reclaimed water from the environment surrounding the cooling tower.

(8) Water reclaimed from spent water that was used to wash garments worn by a person shall be treated to make it Class A or B reclaimed water before it is used to wash garments to be worn by a person.

c. The following are suitable uses for Class C reclaimed water:

(1) Washing non-dairy livestock.

d. The following are suitable uses for Class D reclaimed





water:

(1) Industrial process use not for incorporation into food or drink for humans; and

(2) Street cleaning; and

(3) Construction use ( e.g., making concrete, compacting soil, dust control, aggregate washing).

5 GROUNDWATER RECHARGE

a. Case I, reclaimed water used for groundwater recharge of non-potable water supply aquifers below the underground injection control line by surface spreading shall be at all times of a quality that fully protects public health. The DOH evaluation of proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.

1. The DOH evaluation will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operation; soil characteristics; hydrogeology; resident time; and distance to withdrawal.

2. This section is applicable to all waste, wastewater, or reclaimed water put in an impoundment lacking a liner impervious to water or entering a groundwater recharge of domestic water supply aquifers.

b. Case II, reclaimed water used for groundwater recharge of potable water supply aquifers above the underground injection control line by surface spreading shall be at all times of a quality that fully protects public health. The DOH evaluation of proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.

1. The DOH evaluation will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operation; soil characteristics; hydrogeology; resident time; and

distance to withdrawal.

2. This section is applicable to all waste, wastewater, or reclaimed water put in an impoundment lacking a liner impervious to water or entering a groundwater recharge of domestic water supply aquifers.

3. The DOH will hold a public hearing prior to approval.

5 INAPPROPRIATE USES AND PROHIBITED CIRCUMSTANCES

a. Uses of reclaimed water not cited in this guideline shall be considered inappropriate.

IV Plan of action to adequately warn the public that effluent is being used for irrigation and that the water is unfit for human consumption; and

A. PUBLIC EDUCATION PLAN

1. Notification shall be provided to inform the public that reclaimed wastewater is being used. The notification shall include the posting of conspicuous warning signs with proper wording of sufficient size to be clearly read.

2. When Class C or D reclaimed waste is used for irrigation or agricultural land, the owner or lessee shall grade the perimeter of the reclaimed water use area to prevent ponding of reclaimed water along public roads or other public areas and may do the following if they wish to limit their liability related to health hazards associated with illicit use of or exposure to reclaimed water by another party:

a. Post warning signs indicating pictorially for english illiterates and in writing, that reclaimed wastewater is used for irrigation and it is not safe for drinking (ATTENTION: RECLAIMED WATER -- DO NOT DRINK); and

b. Install fencing or other barriers to restrict public access.





3. When Class C or D reclaimed waste is used for irrigation or agricultural land, the owner or lessee wishing to limit their liability related to health hazards associated with illicit use of or exposure to reclaimed water by another party may post warning signs indicating pictorially for english illiterates and in writing, that reclaimed wastewater is used for irrigation and it is not safe for drinking (ATTENTION: RECLAIMED WATER -- DO NOT DRINK); and

4. Tank trucks and other equipment used to distribute reclaimed water shall be clearly identified with warning signs.

B. EMPLOYEE EDUCATION PLAN

1. Employees should be warned that the ingesting of reclaimed water is unsafe

2. Employees should be protected from direct contact of the reclaimed water. If necessary, protective clothing should be provided.

3. Employee should be informed that irrigation water is unsafe for drinking or washing.

4. Employee should be told to protect open cuts or wounds from both irrigation water and irrigated soil.

5. Employee should be warned to avoid touching the mouth, nose, ear or eyes with soiled hands, clothes or any other contaminated objects.

6. Employee should be informed that inanimate objects such as clothes or tools can transport pathogenic organisms.

7. Employee should be required to always wear shoes or boots to protect their feet from pathogenic organisms in the soil or irrigation water.

V How the piping and appurtenances are to be properly marked to distinguish potable water and sewage effluent.

A. Piping and Appurtenances. The criteria specified in this section apply to all uses of reclaimed water in these guidelines.

1. A backflow prevention assembly shall be provided at all

potable water service connections to reclaimed water use areas.

2. There shall be no connection between the potable water supply and piping containing reclaimed water. Supplementing reclaimed water, for a use of reclaimed water specified in these guidelines, with water used for potable supply shall not be allowed except through a reduced pressure principal backflow prevention assembly. Air gaps are not permitted because they can be modified.

3. Below grade, there shall be at least a six-foot horizontal and one-foot vertical separation (with the potable water pipeline above the reclaimed water pipeline) between all pipelines transporting reclaimed water and those transporting potable water.

4. Below grade, whenever a reclaimed water pipeline crosses water mains, the reclaimed water pipeline must be jacketed with reinforced concrete for a minimum of 5 feet on both sides of the point of crossing if the reclaimed water pipeline is above the water main and for 3 feet on both sides if the reclaimed water pipeline is below the water main. However, jacketing may be eliminated if the reclaimed water pipeline is below the water main and the separation is greater than 18 inches and structural requirements are met. The separation distance between the jacket and the water main shall conform to the table on page 2 of the "Water System Standards" Department of Water, county of Kauai; Board of Water Supply, City and County of Honolulu; Department of Water Supply, County of Maui; Department of Water Supply, County of Hawaii; 1985 Volume 1.

5. Adequate controls shall be provided to prevent alterations of plumbing which would result in people drinking reclaimed water and to prevent significant contamination of reclaimed water before use.

6. After 1/1/92 reclaimed water shall only be transmitted in piping, that is not violet in color and permanently labelled "Reclaimed water-do not drink."

7. Supplementing reclaimed water with water from irrigation or industrial wells shall not be allowed except through a reduced pressure principal backflow prevention assembly.

8. There shall be no irrigation or impoundment of reclaimed water within 500 feet of any well used for potable supply





or 100 feet of any irrigation well unless it can be demonstrated that special circumstances justify lesser distance to be acceptable.

9. All piping, valves, and outlets shall be marked to differentiate reclaimed water from potable or other water.

10. All reclaimed water controllers, valves, etc., shall be affixed with reclaimed water warning signs.

11. Use or installation of hose bibs on any irrigation system presently operating or designated to operate with reclaimed water, regardless of the hose bib construction or identification, shall not be permitted.

12. All reclaimed water valves, outlets, quick couplers, and sprinkler heads shall be of a type or secured in a manner that only permits operation by personnel authorized by the user.

VI The owner of an effluent irrigation system shall provide adequate storage basin(s) or a backup disposal system to prevent any overflows or discharges from the system when the irrigation system is not in operation or when wastewater effluent quantities exceed the irrigation requirements.

A. Storage Basins

1. The following apply where reclaimed water is put in any impoundment used as a restricted recreational impoundment or landscape impoundment:

   a. Runoff shall be prevented from entering the pond unless the impoundments is sized to accept the runoff without discharge or an NPDES permit has been issued for the discharge.

   b. There shall be no discharge of reclaimed water to any pond with less than one foot of freeboard.

   c. Impoundment shall have liners impervious to water to retain its contents.

   d. Where reclaimed water is put in a restricted recreational impoundment or landscape impoundment, the impoundment shall have perimeter signs indicating pictorially for English illiterates, and in writing, that the wastewater stored is not safe

for drinking or body contact i.e., (ATTENTION: RECLAIMED WATER --NO SWIMMING OR OTHER ACTIVITY INVOLVING IMMERSION OF THE FACE -- NO WADING --DO NOT DRINK).

3. Reclaimed water used as a source of supply for a restricted recreational impoundment shall be Class A, B, or C reclaimed water at all times.

4. Reclaimed water used as a source of supply for a landscape impoundment shall be Class A, B, C, or D reclaimed water at all times.

5. The time period of 20 days related to emergency storage, is subject to reduction, expansion, or elimination if the project proponent demonstrates to the satisfaction of the DOH through redundant systems, standby equipment, or other provisions that another time period is adequate or that no storage is needed.

6. The design of system storage capacity shall be sufficient to assure the retention of the reclaimed water under adverse weather conditions, harvesting conditions, maintenance of irrigation equipment, or other conditions which preclude land application. The adverse wet weather conditions shall be based on a 50 year recurrence interval using weather data that is available from, or is representative of, the area encompassing the design project.

B. Backup Disposal Systems.

Reclaimed water produced at the treatment facility that fails to meet the criteria established in the operating protocol shall not be discharged into the system storage or to the reuse system. Such substandard reclaimed water (reject water) shall be either stored for subsequent additional treatment or shall be discharged to another reuse system requiring lower levels of pretreatment or to a permitted effluent disposal system.

1. System storage shall not be required where another permitted reuse system or effluent disposal system is incorporated into the system design to ensure continuous facility operation in accordance with the requirements of Chapter 62 of Title 11 HAR. If flow is not required, provisions of flow equalization or storage should be evaluated in the engineering report to ensure that reclaimed water flows will match the demand pattern a diurnal cycle.





2. A separate, off-line system for storage of reject water shall be provided be provided, unless another permitted reuse system or effluent disposal system is capable of discharging the reject water in accordance with these guidelines. Reject water storage shall have sufficient capacity to ensure the retention of reclaimed water of unacceptable quality, At a minimum, this capacity shall be the volume equal to one day flow at the average daily design flow of the reclamation facility or the aver daily permitted flow of the reuse system whichever is less. Provisions for recirculating this reject water to other parts of the reclamation facility for additional treatment shall be incorporated into the design.

VII All Wastewater effluent disposal systems shall include provisions to facilitate operation, maintenance and inspection.

A. Operations

1. MANAGEMENT PLAN: If effluent reuse becomes the choice for wastewater disposal, then the owner/developer and all subsequent owners shall develop and adhere to a Wastewater Reuse Plan which shall address as a minimum, the following items:

a. Management Responsibility. The managers of the irrigation system using reclaimed wastewater shall be aware of the possible hazards and shall evaluate their system for public health, safety, and efficiency. They must recognize that contact with the reclaimed wastewater from treated domestic sewage posed potential exposure to pathogenic organisms (bacteria, viruses, protozoa, and helminths or worms) which commonly cause infectious diseases (salmonella, paratyphoid fever, shigellosis, Diarrhea caused by escherichia coli, legionellosis klebsiella pneumonia, hepatitis A, viral gastroenteritis, viral meningitis, cryptosporidosis, giardiasis, and amebiasis).

b. A reclaimed water user supervisor shall be appointed by the user. The user supervisor shall be responsible for installation, operation, and maintenance of the reclaimed system, prevention of potential hazards, implementing these guidelines, and coordination with the cross-connection control program of the water purveyor or DOH.

c. Inspection, supervision and employee training shall be

provided by the user to assure proper operation of the reclaimed water system. Records of inspection and training shall be maintained by the user.

d. The producer and/or user shall submit an annual report to the DOH describing:

(1) The quality and quantity of water reclaimed;

(2) The method of irrigation and the crop(s) and area(s) irrigated;

(3) Records should include date of application, location, rate of application, total application and climatic conditions; and

(4) Occurrence of noncompliance with policy criteria and corrective action taken. Monitoring reports required by the DOH;

e. The purveyor of reclaimed water is responsible for quality of the reclaimed water.

f. The purveyor of reclaimed water shall provide a copy a current version of this policy to all property owners and lessees of areas where reclaimed water is to be used.

g. The user shall maintain as-built plans of the use area showing all buildings, domestic and reclaimed water facilities, sewage collection system, and potable water systems. Plans shall be updated as modifications are made.

h. A contingency plan including immediate notification of the Branch DOH shall be developed outlining the action to be taken in the event effluent quality fails to meet required standards.

2. OTHER METHODS OF TREATMENT.

a. Methods of treatment other than those included in this section and their reliability features may be accepted if the applicant demonstrates to the satisfactions of the DOH that operation of the reclamation plant with the methods of treatment and reliability features will assure an equal degree of treatment and reliability.

b. Methods of treatment shall be evaluated regarding degree of treatment equivalent to treatment producing Class B





reclaimed water, pursuant to the following section. Methods of treatment shall be evaluated regarding degree of treatment equivalent to treatment producing Class C or D reclaimed water, on the basis of capability to limit concentrations of total coliform bacteria and enteric animal viruses to concentrations achievable by chlorination of oxidized wastewater that produces Class C or D reclaimed water.

3. DEMONSTRATION OF THE DEGREE OF TREATMENT EQUIVALENT TO THAT PRODUCING CLASS B RECLAIMED WATER.

a. Methods of treatment other than that cited in other sections of these guidelines specifying like treatment, shall be evaluated with respect to equivalency of degree of treatment on the basis of capability of operation of the treatment process to reliably produce effluent containing no more than one native enteric animal virus per 40 liters when applied to wastewater containing concentration of native enteric animal viruses considered by the DOH to be sufficient to demonstrate capability of the treatment process, and to reliably produce effluent for which the median number of total coliform bacteria determined by multiple-tube fermentation does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed 23 per 100 milliliters in more than one sample within any 30-day period.

b. The DOH shall consider both treatment effectiveness and reliability during evaluation of alternative treatment methods. If, the DOH deems that adequate data are not available to determine equivalency, studies will be required, the DOH may specify that data shall be developed by investigators independent of the project proponent, from studies conducted in Hawaii subject to oversight by the DOH, by qualified researchers, consulting engineers, or others.

c. If chlorine contact time less than specified in the paragraph 4 of this section is proposed, or a different minimum chlorine residual or different disinfecting agent is proposed, a study shall be required to demonstrate that an equivalent degree of disinfection will be provided. This will include monitoring of native enteric animal viruses in influent and effluent to determine whether it can be assured that concentration of native enteric virus will not exceed one per 40 liters in reclaimed water when significant concentrations of native

enteric animal virus occur in influent to the process, and monitoring to determine whether the median number of total coliform bacteria determined by the multiple-tube fermentation does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed 23 per 100 milliliters in more than one sample within any 30-day period.

4. DIRECT FILTRATION AND CHLORINATION.

a. When all conditions specified in this section are met, direct filtration and disinfection by chlorination shall be considered as capable of limiting the concentration of native enteric animal virus to one virus unit per 40 liters as treatment which makes wastewater disinfected so that the median number of coliform organisms in the effluent does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed 23 per 100 milliliters in any sample.

b. Prior to chemical addition, the wastewater shall have received at least secondary treatment to make it an oxidized wastewater with secondary effluent turbidity less than ten turbidity units at least 95 percent of the time. It may be required to have continuous turbidity monitoring of the secondary effluent such that the subsequent coagulant addition can be automatically adjusted to provide coagulant dosages under varying conditions.

c. Chemical pretreatment facilities shall be provided to assure conformity with provisions of this section under all operating conditions, whether or not a filtered effluent can meet the turbidity requirements specified in the definition of filtered water under normal operating conditions without coagulant addition.

d. Chemical coagulant that is effective for turbidity removal and does not adversely affect filtration shall be added prior to filtration unless all of the following conditions are met:

(1) The secondary effluent turbidity is five turbidity units or less;





(2) The filtered effluent turbidity does not exceed two turbidity units;

(3) There is continuous turbidity measurement of the secondary effluent; and

(4) Chemical addition is automatically actuated or the wastewater is diverted prior to disinfection when the secondary effluent turbidity exceeds five turbidity units.

e. Adequate initial rapid mixing shall be provided to assure effective dispersion of the coagulant into the wastewater.

f. Low energy mixing shall be provided after coagulant is added and residence time shall be provided between the addition of coagulant and filtration to assure that floc forms prior to filtration and does not form after filtration. Residence time required to accomplish that shall be determined by experiment. Flow turbulence and/or mixing shall be controlled to prevent breakup of floc.

g. A maximum filtration rate of 5 gpm/ft$^2$ shall not be exceeded. Compliance with the filtration rate requirement shall be based on the highest flow rates that occur in the diurnal period, averaged over an hour. If wet weather inflows significantly increase peak flow rate during the season when DOH requires conformity with provisions of this chapter for an adequately disinfected, oxidized, clarified, filtered wastewater, the peak wet weather flow rate over an hour shall be the basis for compliance with the filtration rate requirement.

h. Determination of the number of filters to be constructed at a reclamation plant shall be based on operation under the most stressful expected conditions, such as maximum flow rate with one or more filters in the backwash mode or otherwise out of service.

i The turbidity requirement specified in the definition of filtered wastewater shall be met prior to the disinfection process.

j. A continuous recording turbidimeter shall be provided for monitoring the filtered water. Each filter shall be monitored for turbidity to ensure that they are all producing water that meets the turbidity standards.

Continuous monitoring of each filter may not be necessary if it is shown that periodic monitoring is adequate to indicate reliable operation of each filter.

k. A theoretical chlorine contact time in a well-baffled contact basin or pipeline of at least 2.0 hours and an actual modal contact time of at least 90 minutes is required. Compliance with the disinfection contact time requirement is based on the actual maximum flow rate. In some cases, storage facilities can be used to help meet the required contact time. If pipelines or other facilities are used to meet the required chlorine contact time, such facilities are considered to be part of the treatment process and are subject to regulatory controls.

l. Automatic control of chlorine dosage and automatic measuring and recording of chlorine residual shall be provided. The chlorination facilities shall have adequate capacity to maintain a residual of 10 mg/l.

m. The chlorine residual after the required contact time shall be at least 5 mg/l, and shall also be no less than required to consistently meet the coliform requirements.

n. A high energy rapid mix of chlorine shall be provided at the point of application.

o. The chlorine contact tank shall be designed to closely approximate plug flow hydraulic regime, as achievable with a length-to-width and a length-to-depth ration to 40 to one, with minimal short-circuiting.

B. Maintenance.

1. SURETY.

a. The DOH may require that a letter of credit or other surety be provided by the owner or operator of the reclamation plant to assure that the plant will be operated and maintained to consistently produce the quality of reclaimed water required by the DOH at all times of use of effluent.

b. A preventive maintenance program shall be provided at each reclamation plant to ensure that all equipment is kept in a reliable operating condition.

C. Inspection.

1. SAMPLING AND ANALYSIS.





a. Samples for settleable solids and coliform bacteria, where required, shall be collected at least daily and at a time when wastewater characteristics are most demanding on the treatment facilities and disinfection procedures. Turbidity analysis, where required, shall be performed by a continuous recording turbidimeter.

b. For uses requiring an adequately disinfected, oxidized wastewater, samples shall be analyzed by an approved laboratory method for coliform bacteria content.

c. For uses requiring an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater, samples shall be analyzed by an approved laboratory method for turbidity and coliform bacteria content.

d. Samples for enteric viruses and other microorganisms, where required by the regulatory agency to indicate treatment efficacy during a pilot plant study or demonstration phase of operation, shall be collected at the frequency specified by the DOH and at a time when wastewater characteristics are most demanding on the treatment facilities and disinfection procedures, and shall be analyzed in accordance with a protocol approved by the Department of Health.

VIII. Suggested Format of Engineering Report

A. No person shall produce or supply reclaimed water for direct reuse from a proposed water reclamation plant unless an engineering report is submitted to the Department of Health.

B. The report shall be prepared by a properly qualified engineer registered in the State of Hawaii and experience int he field of wastewater treatment, and shall contain a description of the design of the proposed reclamation system. The report shall clearly indicate the means for compliance with the regulations in Chapter 62 and with these guidelines.

C. The report shall contain a contingency plan which will assure that no untreated or inadequately-treated wastewater will be delivered to the user.

D. The report shall be amended prior to any modification to the project.

E. The report shall contain sufficient information to assure the

State Department of Health that the degree of treatment and reliability is commensurate with the proposed use, and that the distribution and use of the reclaimed water will not create a health hazard or nuisance.

F. For new reclamation projects all the data specified below shall be presented in the report. For expansion of an existing project the report need not present information already submitted to the State Department of Health in the application for an NPDES discharge (or wastewater reclamation permit) e.g., discussions of water quality, treatment process, plant reliability, contingency plans, and monitoring). The report shall present descriptions of new treatment and other new features and procedures and or proposed use areas and new distribution system.

1. Producer. The producer is the public or private entity that will treat the wastewater used in the project. Where more than one agency or party is involved in the treatment, the responsibilities of each party shall be described in a contract or memorandum of agreement.

2. Reclaimed Water. State the treatment processes and quality of water that are required and will be provided for each use.

3. Raw Wastewater. State the wastewater chemical quality, the proportion and type of industrial waste.

4. Treatment Processes. Provide a schematic of the treatment train. Describe the treatment processes and the loading rates and/or contact times. All filtration design criteria shall be provided (filtration and backwash rates, filter depth, and media specifications). The expected turbidities of the filter influent (prior to the addition of chemicals) and the filter effluent must be stated. State the chemicals that will be used, the method of mixing, the point of application, and the dosages.

5. Plant Reliability Features. The plant reliability features proposed to comply with the "general requirement of design" shall be described in detail. The discussion of each reliability feature must state under what conditions it will be actuated. When alarms are used to indicate system failure, the report must state where the alarm will be received, how the location is monitored by personnel, and who will be notified. The report shall state the hours the plant will be attended by qualified





personnel.

6. Supplemental Water Supply. The report shall describe all supplemental water supplies. The description shall include:

   a. Source;

   b. Chemical Water Quality;

   c. Cross-connection control measures; and

   d. Quantity available.

7. Monitoring. The report shall describe a monitoring program that complies with Chapter 62 and these guidelines, and includes the frequency and location of sampling. Where continuous analyses and recording equipment is used, the method and frequency of calibration shall be stated. All Analyses shall be performed by a laboratory approved by the State Department of Health.

8. Contingency Plan. Paragraph "C" of this section requires that the engineering report contain a contingency plan designed to prevent inadequately treated wastewater from being delivered to the user. The "Contingency Plan" shall include:

   a. A list of conditions which would require an immediate diversion to take place;

   b. A description of the diversion procedures;

   c. Designation of the diversion area;

   d. A plan for the disposal of treatment of any inadequately treated effluent;

   e. A plan for notifying the reclaimed water user, the State Department of Health, and other agencies as appropriate of any treatment failures that could result in the delivery of inadequately treated wastewater to the use area.

9. Transmission and Distribution Systems. Maps showing the location of the transmission facilities and the distribution system layout shall be provided. The plans shall include the location of all water and sewer lines. The report shall describe how the transmission and

distribution systems will comply with the following documents:

a. Cross-Connection and Backflow Control, Chapter 21 of Title 11 Administrative Rules;

b. Backflow Prevention Devices, Water System Standards, Vol I 1985, Department of Water, County of Kauai; Board of Water Supply, City and County of Honolulu; Department of Water Supply, County of Maui; and the Department of Water Supply, County of Hawaii.

Any deviation form the above, and the necessity therefore, shall be discussed in the report.

10. Use Area Description. The description of each area shall include:

a. Use Areas

b. Use Area Description

(1) The land use.

(2) The type of reuse proposed.

(3) The party responsible for the distribution and use of the reclaimed water at the site.

(4) Map showing:

(a) Specific areas of use.

(b) Areas of public access.

(c) Surrounding land use.

(d) The location of wells in or near the use area,

11. Use Area Design. The report shall discuss how the facilities will be design to minimize the chance to reclaimed water leaving the designated use area. The design shall conform with the Water Reclamation Guidelines. Any proposed deviation from the Guidelines and the necessity, therefore, must be discussed in the report. Any public water distribution system shall be protected from the reclaimed water in accordance with the





Regulations Relating to Cross-Connections.

12. Use Area Inspections and Monitoring. Identify the locations at the use area where problems are most likely to occur (e.g., ponding, runoff, overspray) and propose a program of inspection and reporting.

13. Contingency Plan. The report shall identify the actions and precautions to be taken to protect the public health in the event inadequately treated water is delivered. The plan must include notification of the appropriate regulatory agencies and the exposed public. The plan must discuss the provisions for a backup water supply.

14. Employee Training. The shall describe the training that the employees will receive to ensure compliance with the Water Reclamation Guidelines. The report shall identify the entity that will provide the training and the frequency of the training.

15. Rules and Regulations. The procedures, restrictions, and other requirements that are to be followed by the distributor and/or user must be described. The requirements and restrictions shall be codified into a set of rules and regulations. The "Rules and Regulations" shall be developed in accordance with Water Reclamation Guidelines. The Rules and Regulations shall include measures to be used to protect the public health and prevent cross-connections. Describe in the report the feasibility of the adoption of enforceable regulations to cover all the distributions systems and use areas, and identify the agency or agencies that would adopt them.

## IX. GENERAL TECHNICAL GUIDANCE

A. Technical standards and criteria contained in the following standard manuals and technical publications are hereby incorporated by reference and shall be applied to supplement this guideline, if applicable, in determining whether permits to construct or modify water reclamation facilities or land application facilities shall be issued or denied:

U.S. Environmental Protection Agency, 1981. Land Treatment of Municipal Wastewater-Process design Manual. EPA Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268.

U.S. Environmental Protection Agency, 1984. Land Treatment of Municipal Wastewater-Process design Manual.

Supplement on Rapid Infiltration and Overland Flow. EPA Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268.

Water Pollution Control Federation, 1983. Manual of Practice SM-3. Water Reuse. W.P.C.F., 601 Wythe Street, Alexandria, Virginia 22314-1994.

American Water Works Association, 1985. Dual Water System. A.W.W.A., 6666 West Quincy Avenue, Denver, Colorado 80235.

file: reuse3 Reclamation



# STATE OF HAWAII
# DEPARTMENT OF HEALTH

January, 1992 (Version 4)

## TWELVE (12) CONDITIONS APPLICABLE TO ALL NEW GOLF COURSE DEVELOPMENT

The following conditions are recommended for all new golf course development in Hawaii to assure that environmental quality is preserved and enhanced as it relates to human health and the protection of sensitive ecosystems. Additional conditions may be imposed based on site-specific considerations.

1. Baseline groundwater/vadose zone and/or, if appropriate, coastal water quality shall be established. Once the sampling plan has been determined and approved by the State Department of Health, the owner/developer shall establish the baseline groundwater/vadose zone water quality, and, if appropriate, nearshore water quality, and report the findings to the State Department of Health. Analyses shall be done by a laboratory approved by the Department of Health.

2. The owner/developer and all subsequent owners shall establish a groundwater monitoring plan and system which shall be presented to the State Department of Health for its approval. The groundwater monitoring plan and system shall minimally describe the following components:

   a. A monitoring system tailored to fit site conditions and circumstances. The system shall include, and not be limited to, the use of monitoring wells, lysimeters, and vadose zone monitoring technologies. If monitoring wells are used, the monitoring wells shall generally extend 10 to 15 feet below the water table.

   b. A routine groundwater monitoring schedule of at least once every six (6) months, or more frequently, if required by the State Department of Health in the event that the monitoring data indicates a need for more frequent monitoring.

   c. A list of compounds which shall be tested for as agreed to by the State Department of Health. This list shall include, but not be limited to the following: total dissolved solids; chlorides; PH; nitrogen; phosphorus; and other compounds associated with fertilizers, biocides, or effluent irrigation.

3. If the data from the monitoring system indicate increased levels of a contaminate that poses, or may pose, a threat to public health and the environment, the State Department of Health shall require the owner to take immediate action to stop the source of contamination. Subsequently, the owner shall mitigate any adverse effects caused by the contamination.

4. Owner/developer shall provide sewage disposal for the clubhouse and other facilities by connecting to the public sewer system or by means of a treatment individual wastewater system approved by the Department of Health in conformance with Administrative Rules, Title 11, Chapter 62, Wastewater Treatment Systems. The use of wastewater for irrigation will be generally encouraged, with appropriate controls (see Condition 5).

5. If a wastewater treatment works with effluent reuse becomes the choice of wastewater disposal, then the owner/developer, and all subsequent owners, shall develop and adhere to a Wastewater Reuse Plan which shall incorporate the provisions of the Department of Health's Guidelines for the Use of Reclaimed Water which includes:

   a. An Irrigation Plan encompassing buffer distances, pipe and appurtenance placement, and labeling.

   b. An Engineering Report encompassing treatment options and treatment levels.

   c. Hydro-geologic and hydrologic surveys to determine application rates, sizing and storage needs.

   d. A monitoring plan.

   e. A management plan.

   f. Public and employee education plans.

6. Underground storage tanks (USTs) used to store petroleum products for fueling golf carts, maintenance vehicles, and emergency power generators that pose potential risk to groundwater shall be discouraged. Use of electric golf carts and above-ground storage tanks for emergency power generators shall be encouraged.

   Should the owner/developer/operator plan to install USTs that contain or other regulated substances, the owner/developer/operator must comply with the federal UST technical and financial responsibility requirements setforth in Title 40 of the Code of Federal Regulations Part 280. These federal rules require, among other things, owners and operators of USTs to meet specific requirements in release detection and response, and subsequent corrective action. Also, the owner/developer/operator must comply with all State UST rules and regulations pursuant to the Hawaii Revised Statutes, Chapter 342-L, Underground Storage Tanks.





7. Buildings designed to house the fertilizer and biocides shall be bermed to a height sufficient to contain a catastrophic leak of all fluid containers. It is also recommended that the floor of this room be made waterproof so that all leaks can be contained within the structure for cleanup.

8. A golf course maintenance plan and program will be established based on "Best Management Practices (BMP)" in regards to utilization of fertilizers and biocides as well as the irrigation schedule. BMP's will be reviewed by the State Department of Health prior to implementation.

9. Every effort shall be made to minimize the amount of noise from golf course maintenance activities. Essential maintenance activities (e.g., mowing of greens and fairways) shall be conducted at times that do not disturb nearby residents.

10. Solid waste shall be managed in a manner that does not create a nuisance. Whenever possible, composting of green wastes for subsequent use as a soil conditioner or mulching material is encouraged. The composting and reuse should be confined to the golf course property to eliminate the necessity for offsite transport of the raw or processed material.
    In addition, during construction, the developer should utilize locally-produced compost and soil amendments whenever available.

11. Fugitive dust shall be controlled during construction in accordance with Hawaii Administrative Rules, Title 11, Chapter 60, Air Pollution Control. Pesticides and other agricultural chemicals should be applied in a manner that precludes the offsite drift of spray material. The State Department of Agriculture should be consulted in this regard.

12. To avoid soil runoff during construction, the developer should consult with the U.S. Department of Agriculture, Soil Conservation Service to assure that best management practices are utilized. If the total project area is five (5) acres or more and the development activities include clearing, grading, and excavation, a National Pollutant Discharge Elimination System (NPDES) stormwater permit application shall be submitted to the Department of Health in accordance with the Federal Clean Water Act requirements.

If there are any questions regarding the twelve (12) conditions mentioned here, please contact the Environmental Planning Office at 586-4337. We appreciate your cooperation in preserving and protecting environmental quality in Hawaii.

# II - 5 Evaluation of Water Resources

# EVALUATION OF

# WATER RESOURCES

# FOR

# HOKUKANO PROJECT

FOR:

OCEANSIDE 1250 PARTNERS
74-5620 A PALANI ROAD, SUITE 200
KAILUA-KONA, HI 96750

PREPARED BY:

WAIMEA WATER SERVICES INC.
POB 326
KAMUELA, HI 96743

12/92

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EVALUATION OF

VILLAGES AT HOKUKANO WATER RESOURCES

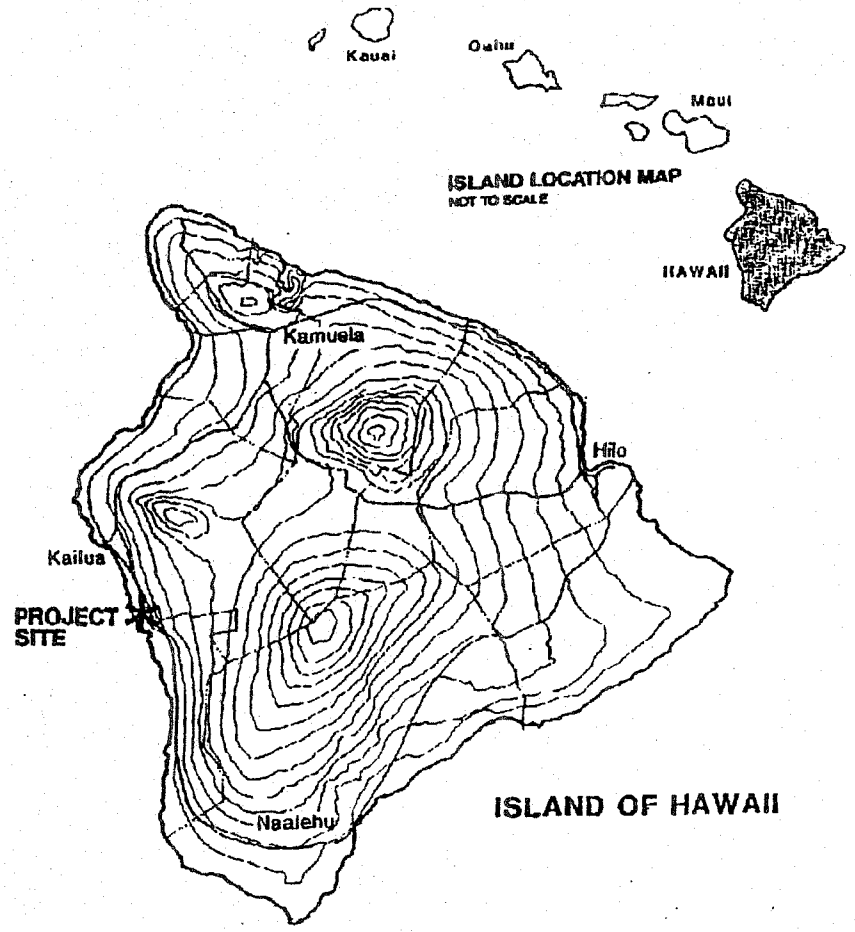
## 1.0 INTRODUCTION

The 1540 acre Villages at Hokukano project will be developed in several phases south of Kailua-Kona on the island of Hawaii (Exhibit A1 and A2). The maximum build out is expected to be 1440 residential units and 100 lodge units and a 27 hole golf course. There is also expected to be approximately 75 acres of agricultural lands within the project.

The first phase of development will include approximately 367 residential units on lots of one acre or greater, a 27 hole golf course with golf clubhouse, and a 100 unit member lodge. The plans call for a clubhouse of 24,000 square feet and a main lodge facility of approximately 24,000 square feet. See Exhibit A3 for the general development site plan.

Subsequent phases of residential development will include various residential neighborhoods ranging from densities of 0.5 to 4.7 units per acre. Although predominantly single family, the higher density residential areas may include some attached units and/or cluster developments.

Development of the golf course, golf clubhouse and members lodge is anticipated to begin in 1995 and be completed by the year 2000.



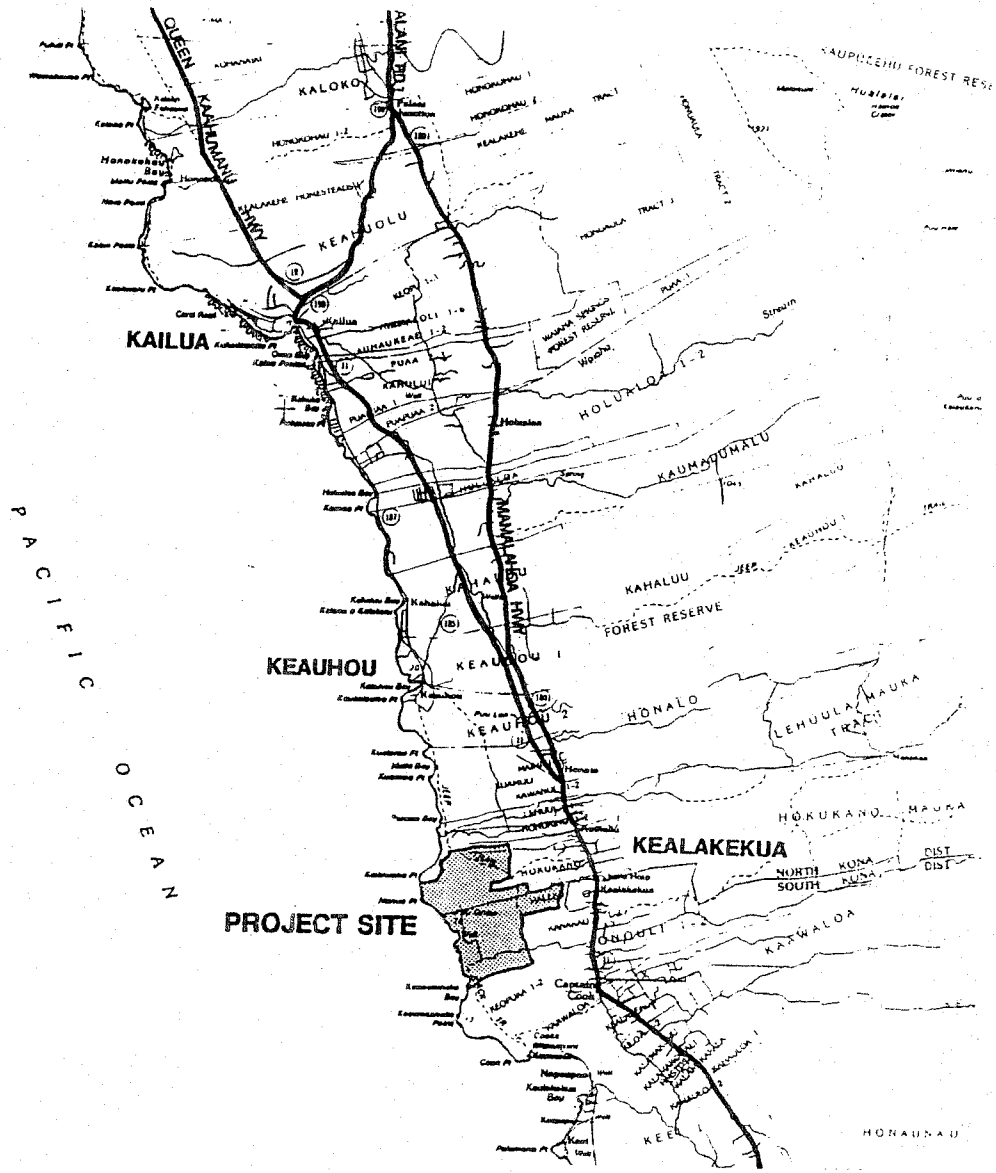




EXHIBIT A2

REGIONAL CONTEXT
HOKUKANO



EXHIBIT A1

source: USGS, 1980

EXHIBIT A3

GENERAL DEVELOPMENT PLAN

II-5-6

LAND USE SUMMARY

| Parcel | Area | Yield | Use | Gross Density |
|---|---|---|---|---|
| A | 118.0 | 60 | Residential/Agriculture | .5 du/ac |
| C | 47.3 | 95 | Residential | 2.0 du/ac |
| D | 226.0 | 154 | Residential/Agriculture | .5 du/ac |
| E | 45.5 | 140 | Residential | 3.0 du/ac |
| F | 8.5 | 35 | Residential | 4.0 du/ac |
| G | 12.0 | 50 | Residential | 4.0 du/ac |
| H | 20.0 | 40 | Residential | 2.0 du/ac |
| I | 123.5 | 65 | Residential/Agriculture | .5 du/ac |
| J | 170.0 | 88 | Residential/Agriculture | .5 du/ac |
| K | 46.0 | 100 | Residential | 2.1 du/ac |
| L | 15.0 | 50 | Residential | 3.1 du/ac |
| N | 66.0 | 139 | Residential | 2.1 du/ac |
| O | 35.0 | 140 | Residential | 4.0 du/ac |
| P | 17.0 | 68 | Residential | 4.0 du/ac |
| Q | 42.5 | 200 | Residential | 4.7 du/ac |
| R | 7.5 | 16 | Residential | 2.1 du/ac |
| Subtotal | 1000.0 | 1440 | Units | |
| | Acres | | | |
| S | 4.0 | -- | Golf Clubhouse | -- |
| T | 14.0 | 100 | Lodge | -- |
| V | 2.0 | -- | Historic Park | -- |
| W | 140.0 | -- | Conservation District | -- |
| X | 349.0 | -- | Golf Course | -- |
| Y | 17.0 | -- | By-Pass | -- |
| Z | 14.0 | -- | Roads | -- |
| Subtotal | 540.0 | 100 | Units | |
| | Acres | | | |
| TOTAL | 1540 | 1540 | Units | |
| | Acres | | | |

1.1 **RECOMMENDATIONS: (Summary)**

1. An exploration well has been drilled at about elevation 800 feet on the mauka portion of the property. The pilot hole was pump tested. The water will be used for irrigation water for the golf course and agricultural areas. The exploration well has provided a basis to determine the feasibility of developing the potable (on-site) water resources. The water quality showed a chloride level of about 340 mg/l, exceeding the desirable 250 mg/l maximum chloride level for potable water.

2. A second irrigation well as noted in Exhibit G, Section 3.1, Irrigation Water, will be needed. A site for this well is shown near the north-west boundary of the property.

3. Discussions with Hawaii County, Dept. of Water, on possible potable water resources and transmission from the County mauka water system for the initial phases of the project were started on 11 Dec 92. Bill Sewake indicates that he can meet the 499 commitments to the project by the expected sales date of 1 January 1993.

4. Construct a second potable well (the first potable well provided in previous agreements with the County to secure 499 water commitments) to be turned over to the County of Hawaii for operation. This well will meet balance of potable water demand for project. This well will need to be located off property above the 1400' elevation. A site must be located and secured.

5. Use Waste Water Treatment Plant effluent for blending with golf course irrigation water if available.

6. Start ground water monitoring program with the new production well and near-shore monitor wells.





## 1.2 SITE DESCRIPTION

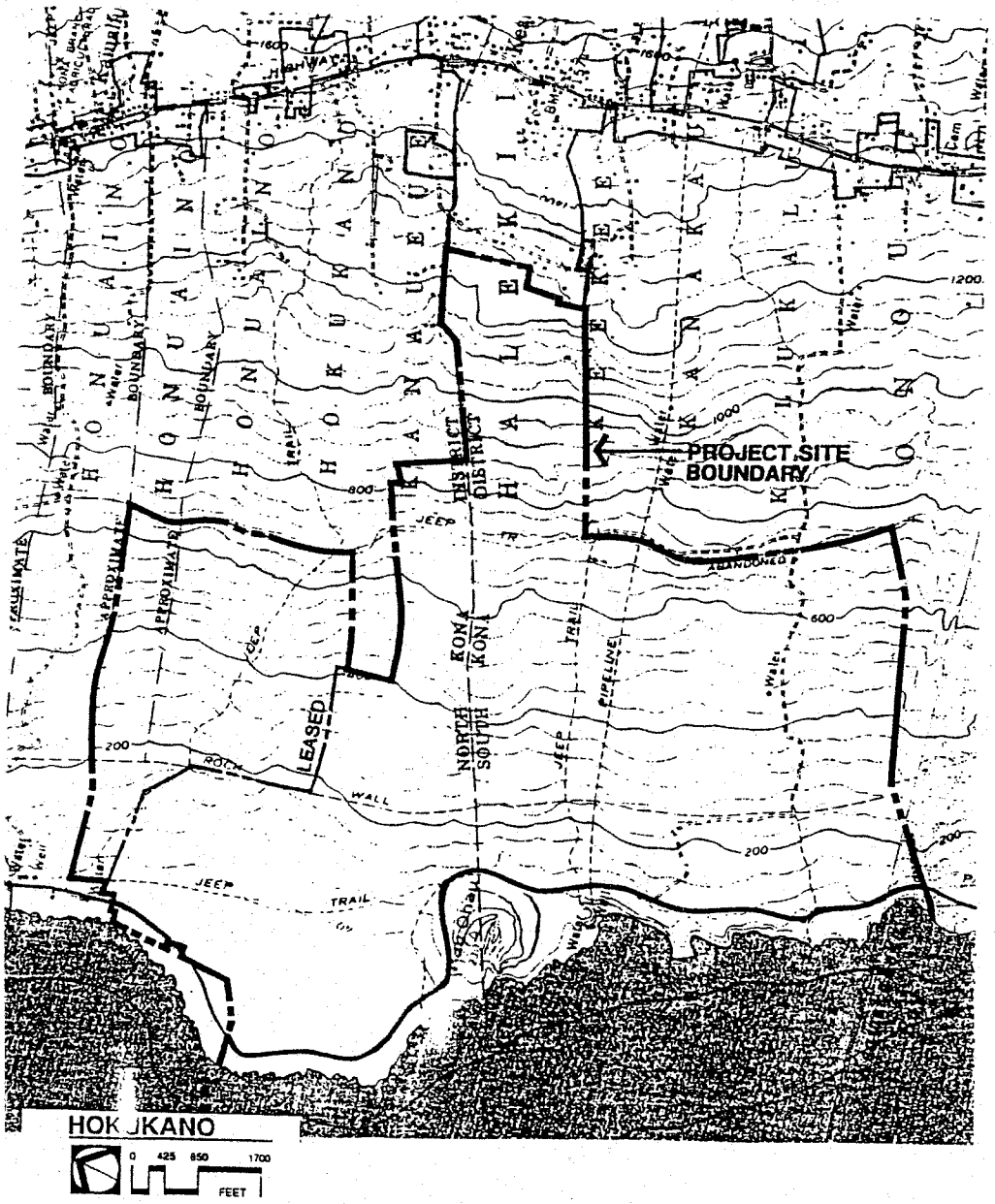
The proposed 1540 acre project site is south of Keauhou and makai of Hawaii Belt Road (see exhibit B) in the area called Red Hill (Puu Ohau) and Keawekaheka Point. The lands are sloping from mauka (elevation 1230') to makai (elevation 0').

## 1.3 WATER DEMAND

The estimated water demand for the project is outlined in Table 1 based upon the expected development units. The estimated water demand for this project is based on **the County standards of 400 gpd (gallons per day) per housing unit**. The other unit numbers used are based on previous uses from similar facilities and activities.

For the purposes of this report, the figures in Table 1 will be used as the reference amounts for the estimated water demands. For definition purposes, **(gpd)** is gallons per day, **(gpad)** is gallons per acre daily, and **(mg/l)** is milligrams per liter.

For this report we will be using the county standards of 400 gpd per housing unit. Existing agreements between the Department of Water, Hawaii County and the Owner are based on **600 gpd per water unit for well design purposes**. The owner plans on using many water conservation practices at the project such as reduced landscaping areas and indigenous plants.




II-5-10
PROJECT SITE MAP

EXHIBIT B



ESTIMATED AVERAGE DAILY WATER DEMANDS AT BUILDOUT- TABLE 1

| POTABLE WATER | UNITS (average) | TOTAL |
|---|---|---|
| 1440 HOUSING UNITS | 400 GPD * | 576,000 GPD |
| 1 GOLF CLUB HOUSE | 20,000 GPD | 20,000 GPD |
| 1 GOLF MAINT. BLDG. | 2,000 GPD | 2,000 GPD |
| 1 SEWAGE TREAT. BLDG. | 5,000 GPD | 5,000 GPD |
| 100 LODGE UNITS | 400 GPD * | 40,000 GPD |
| SUB-TOTAL | | 643,000 GPD |
| **IRRIGATION WATER** | | |
| 150 ACRES GOLF COURSE | 6,000 GPAD ** | 900,000 GPD |
| 20 ACRES COMMON LANDSCAPE | 4,000 GPAD | 80,000 GPD |
| 75 ACRES AGRICULTURAL | 2,000 GPAD *** | 150,000 GPD |
| SUB-TOTAL | | 1,130,000 GPD |
| **TOTAL WATER DEMAND (DAILY)** | | 1,773,000 GPD |
| TREATED EFFLUENT (70% estimated recovery) | | 450,000 GPD |
| TOTAL IRRIGATION WATER DEMAND | | 1,130,000 GPD |
| IRRIGATION WATER DEMAND IF EFFLUENT USED | | 680,000 GPD |

gpm - gallons per minute

gpd - gallons per day

gpad - gallons per acre daily

*County Design Standard

** - 30% higher during grow-in

*** - assuming drip irrigation crops

TABLE 1

The maximum daily demand for potable water, which is based on the average daily demand times 1.5, dictates the needed installed pumping capacity for potable wells. An amount of about 600 gpd for one housing unit is the maximum day amount used (400 gpd ave. daily use times 1.5).

MAXIMUM DAY POTABLE DEMAND — TABLE 2

| POTABLE WATER | TOTAL AVE.* | Multiplier | TOTAL |
|---|---|---|---|
| 1440 HOUSING UNITS | 576,000 GPD | 1.5 | 864,000 GPD |
| 1 GOLF CLUB HOUSE | 20,000 GPD | 1.5 | 30,000 GPD |
| 1 GOLF MAINT. BLDG. | 2,000 GPD | 1.5 | 3,000 GPD |
| 1 SEWAGE TREAT. BLDG. | 5,000 GPD | 1.5 | 7,500 GPD |
| 100 LODGE UNITS | 40,000 GPD | 1.5 | 60,000 GPD |
| SUB-TOTAL | **643,000 GPD** | | **964,500 GPD** |

* Totals from Table 1.

TABLE 2

As described in Section 2.2, and based on DOW/Owner agreements dated September 1988, March, 1986, and December 1984, 499 water units at 600 gpd per unit are presently available from the County water system at the top of the project.





## 1.4 GEOLOGY AND HYDROLOGY (by Stephen P. Bowles, Island Resources Ltd.)

Water supply along the Kona coast is derived from two sources: direct rainfall catchment and by well tapping the groundwater lens. At the higher elevations above 1500', the rainfall is normally adequate to furnish a limited catchment supply. The only reliable water supply is from groundwater. There are no perennial streams in the project area.

A hydrologic budget prepared in conjunction with this report indicates that the groundwater recharge for the study area (bounded by the ocean, the 5000' elevation, and lines drawn parallel to the District boundary 1 mile to the south and 2.75 miles to the north; see Exhibit C1, may total approximately 60 mgd (million gallons per day). This recharge percolates downward into the high level aquifer(s) mauka of the project, into the basal lens at sea level and thence to the sea (see Exhibit C2). Fresh groundwater floats on the underlying salt water in a ratio of about 1 to 40, i.e., for every one foot of fresh water head above sea level, there is approximately 40 feet of fresh water below sea level. The equation is modified by tidal and recharge fluctuations, which produce a thick brackish or transition zone between the fresh water and salt water (see Exhibit D). The head or water level of the lens slopes upward away from the shore (inland) at rates normally from 1 to 2 feet per mile. Near the shore, the lens is brackish, due to oscillations of the tide and seasonal variations in recharge rate of flow.

Recent (since 1990) discoveries of high level groundwater have been made mauka of Mamalahoa Highway. Water levels have been verified in several wells scattered from Kalaoa in north Kona to Kealakekua Bay in South Kona. Water levels in excess of

elevation 350' have been verified by pumping at wells at Keei mauka and above Higashihara Park at Honalo (Exhibit C3). At the observation well mauka of the Kona Hospital, a water level of 490 feet was reported. A production well is now under construction at that site and the water level has been confirmed at elevation 494 feet (10/92).

Based on the estimated recharge, the seaward flow of groundwater should be approximately 11 mgd per mile of shoreline. This value was used originally to estimate the possible existence of fresh water in the basal lens. Hypothetically, the subject property should have a groundwater flow of 23 mgd (2.25 miles of shoreline).

Discoveries made recently by the exploration well indicate that this groundwater flow value is greatly exaggerated. Based on general estimates from the exploration well water level of 3.8 feet and on preliminary water quality data showing total chlorides of about 340 mg/l, it must now be assumed that the groundwater flow through the property to the sea most probably does not exceed 4 to 6 mgd. The estimated groundwater flow appears to be more than adequate to support the irrigation water needs of the project.

Drilling of the exploration well has confirmed the existence of a major hydrogeologic boundary between the Hokukano exploration well at elevation 810 feet and the D.W.S. production well at elevation 1,780 feet near the Kona Hospital. Based on the water quality and water level data, it appears that the majority of the groundwater recharge is diverted away from the subject property. The high water level differential between the two wells in a distance of 1.5 miles indicates a geologic





structure(s) of relatively low permeability.

Recent offshore bottom surveys along the Kona coast (J.G. Moore, et al, 1989) have indicated that massive submarine landslides are in evidence along the Kona coast. Continuing studies of the landslides imply that on shore faulting is associated with the slides labelled Alika 1, and Alika 2 (in Exhibit C4). With the completion of the Hokukano well and the DWS Kealakekua well in 1992, it now appears that not only does on shore faulting exist, more than likely these faults in some way impede or divert the groundwater flow. Such a boundary is likely to be abrupt. Rarely are fault systems in Hawaii found to be boundaries in themselves. Most probably such faulting has caused either a major vertical displacement or tilting which results in subsequent lava flows having a steeper dip.

Exhibit C5 is a slope projection based on the U.S. Geological Survey topographic map of the area. As indicated both from the data and in field observations, there is a transition zone between elevations 1100 feet and 1400 feet which may represent a slope change caused by a buried pali such as that around Kealakekua Bay or at Hilina on Kilauea. It seems probable that the hydrogeologic boundary is caused by steeply dipping younger lavas cascading over and veneering a fault scarp. There is no other evidence such as dikes, sills or other intrusives, even implied, which might cause a structural boundary. While the presentation above seems logical and certain, there is no conclusive evidence to support this hypothesis other than the fact that an abrupt hydrogeologic boundary occurs between the two wells.

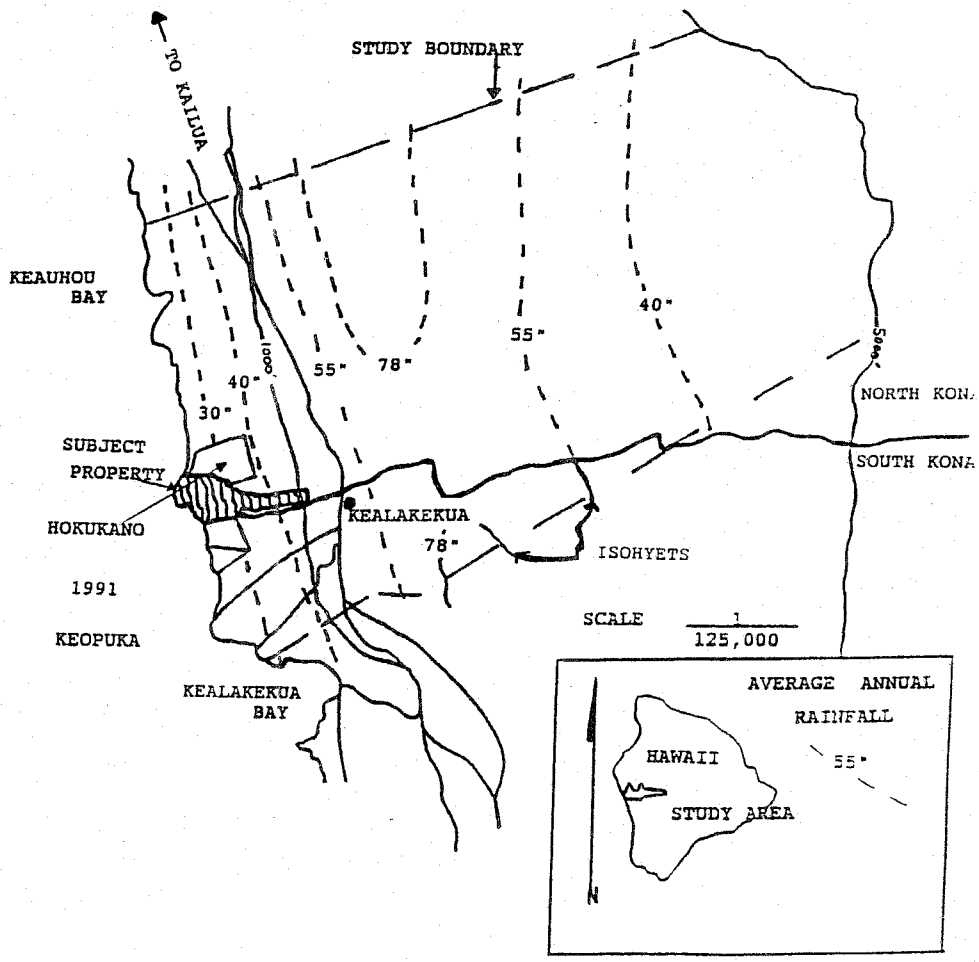
On the project lands, the only possible site for a fresh water well is at an elevation of 1200 feet or approximately 1.75 miles from the shore. At this location, the basal water level should stand at an elevation in excess of 4 feet above sea level. Based on the new information, there is also a possibility that the high level groundwater extends makai of Mamalahoa highway in the upper reaches of the project.

The very high permeability of the basalt lavas in Kona area makes salt water encroachment very rapid, thus well spacing, depth below sea level, and pumping rate are critical items to sustaining high quality production wells. The subject property is very narrow at the 1200' elevation and may preclude the development of more than one continuously operating well (up to 700 gpm or 1 mgd). To obtain more fresh water, it probably will be necessary to place additional wells outside the property boundaries.



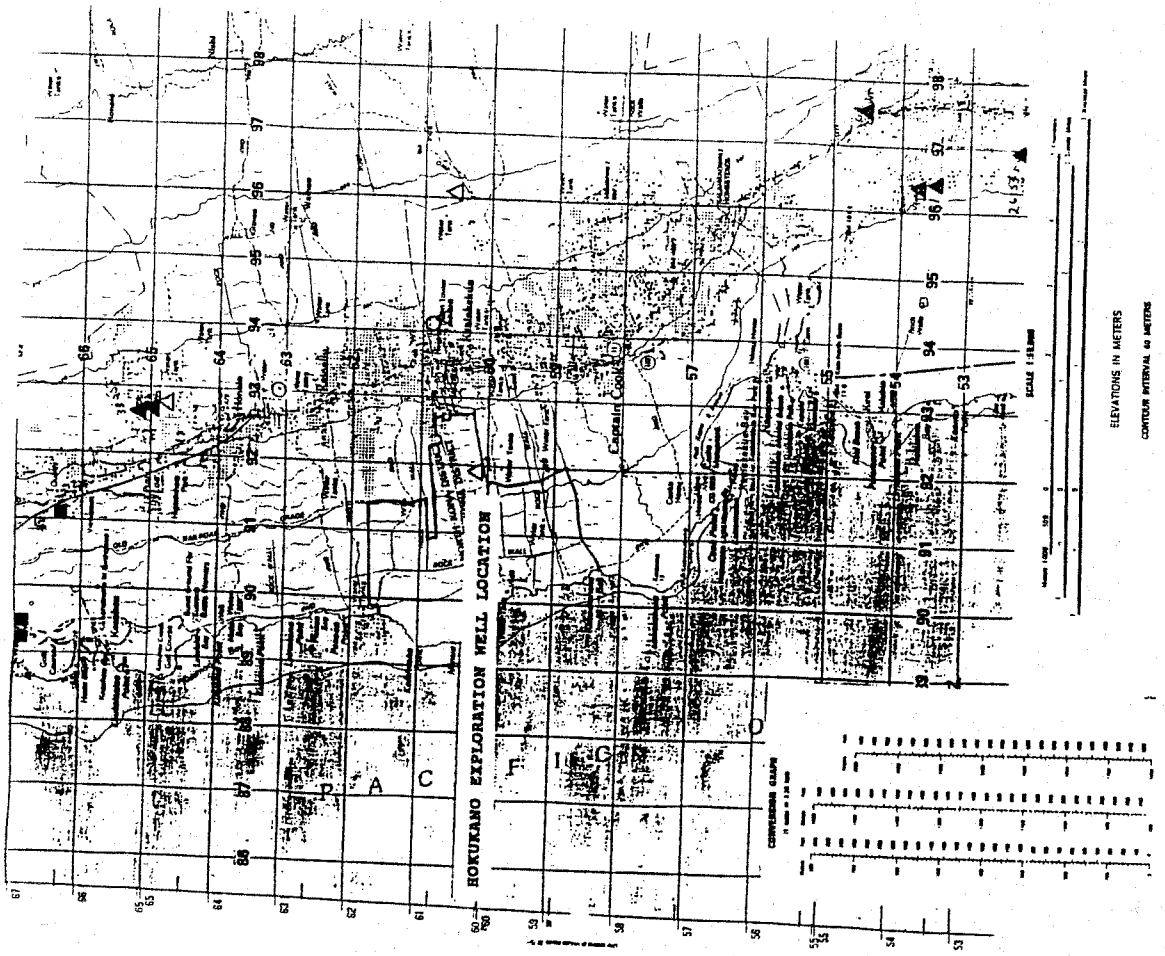
HYDROLOGIC STUDY AREA

KONA, HAWAII




RAIN FALL IN PROJECT AREA (From S. Bowles study; August 14, 1990)

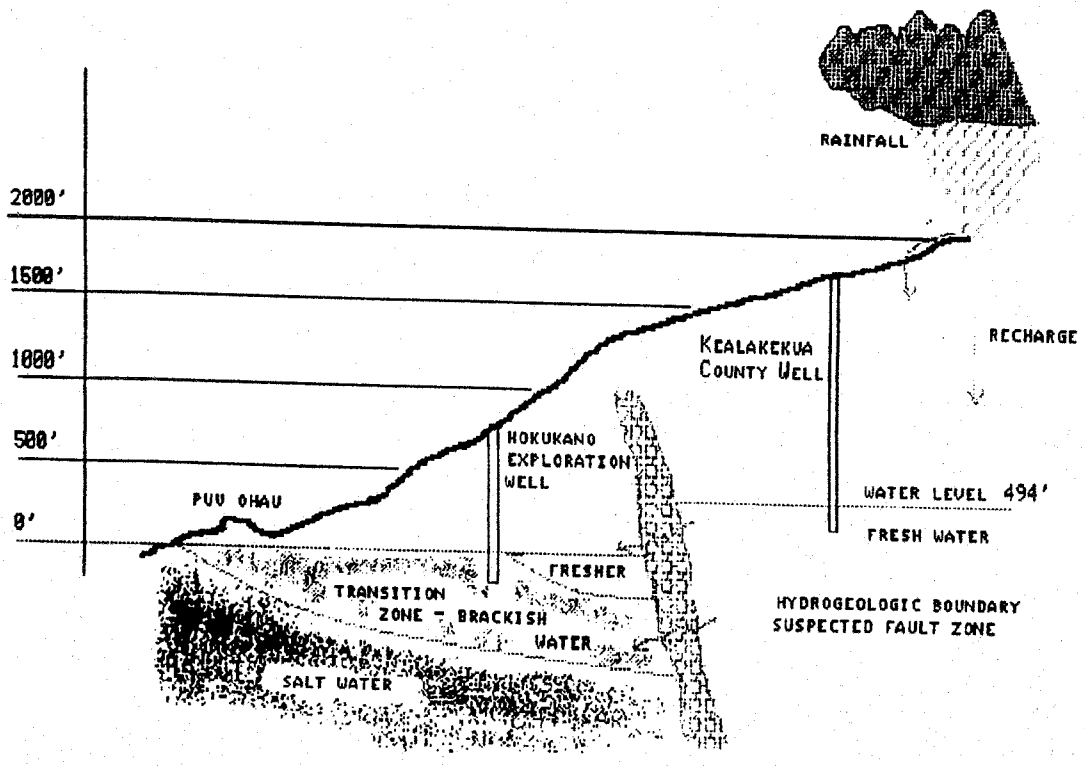
EXHIBIT C1




◀◁10■

HOKUKANO PROJECT AREA
PROBABLE HYDROGEOLOGIC SECTION

WWS
12/92




II-5-18

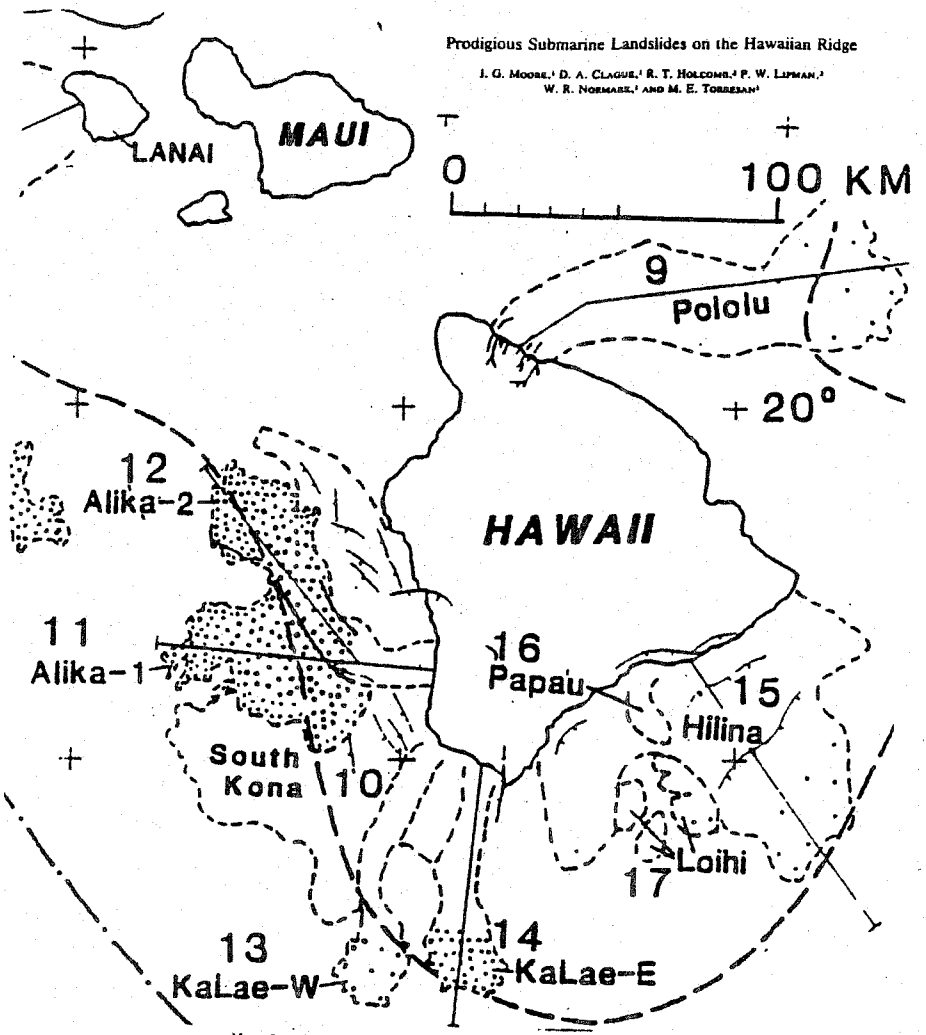
PROBABLE HYDOGEOLOGIC SECTION OF PROJECT AREA

EXHIBIT C2

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 94, NO. B12, PAGES 17,443–17,484, DECEMBER 10, 1989

## Prodigious Submarine Landslides on the Hawaiian Ridge

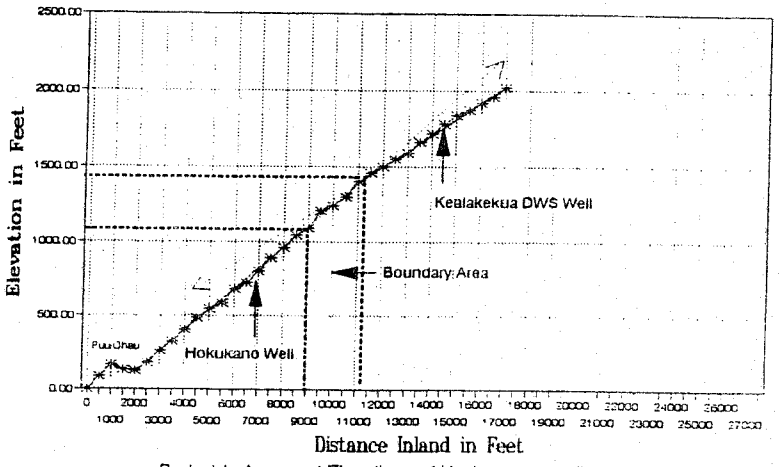
J. G. Moore,[1] D. A. Clague,[1] R. T. Holcomb,[2] P. W. Lipman,[2]
W. R. Normark,[3] and M. E. Torresan[1]




Map of southeastern Hawaiian Ridge showing major slides bounded by dashed lines identified by number in text and Table 1; compare with Figure 1. Dotted area, hummocky ground (widely spaced where subdued); hachured lines, scarps; thin, downslope-directed lines, submarine canyons and their subaerial counterparts; heavy dashed line, axis of the Hawaiian Deep; dash-dotted line, crest of the Hawaiian Arch.



## Hokukano Village
## Slope Analysis




Probable Area and Elevations of Hydrogeologic Boundary

Elevation

Topography from U.S.G.S. [illegible]

## 2.0 POTABLE WATER

### 2.1 REGIONAL WATER SYSTEM DESCRIPTION

**COUNTY OF HAWAII**

The County of Hawaii has a water system above the properties along Mamalahoa Highway and are identified as System 78 & 80 on the attached County map (Exhibit D). The pressure feed for this system is identified at the tank sites of 1763' elevation.

### 2.2 WATER COMMITMENTS

The project has some water commitments from the County as listed:

**HOKUKANO PARCEL (TMK 7-9-12:3) - 1540 acres**

Kealakekua Water Source Agreement provided 2000 unit commitments of County water; 499 of these County Water Rights are now available through the "Assignment of Rights to Water Commitment Units - Kealakekua Water Source Agreement". Agreements also include 2 acres of land already assigned to the County for a well site.

**AGREEMENTS**

The developer has secured an agreement with Norman Greenwell for the purchase of any surplus water developed on the property owned by Greenwell and adjacent to the project property. This may afford options for co-development of a well on the N. Greenwell property. (See Exhibit E for locations of this and other well site properties)

The developer has secured additional well site options from:

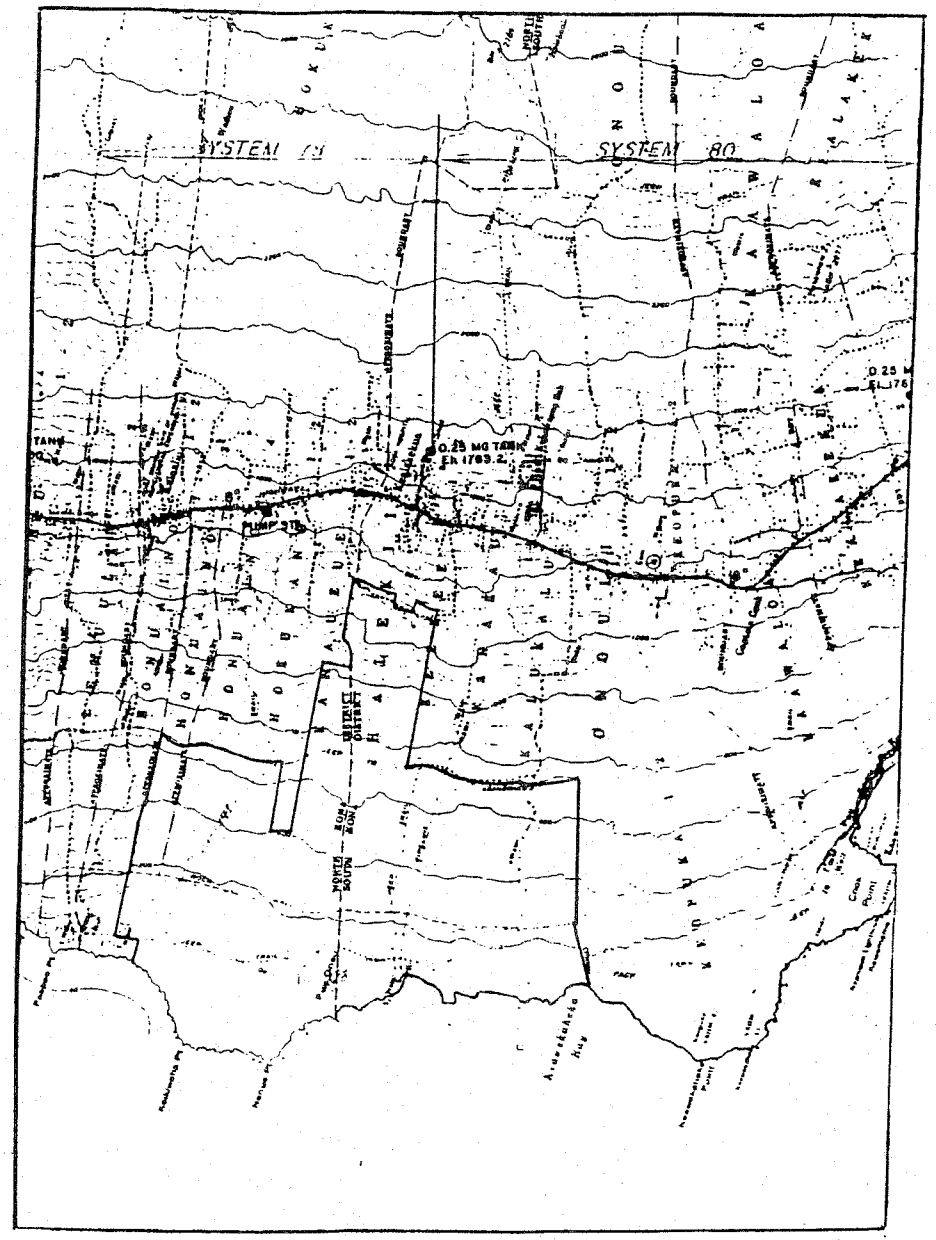
* Ackerman Well Site - 20,000 sq.ft. site on mauka property between 900' and 1200' elevation.



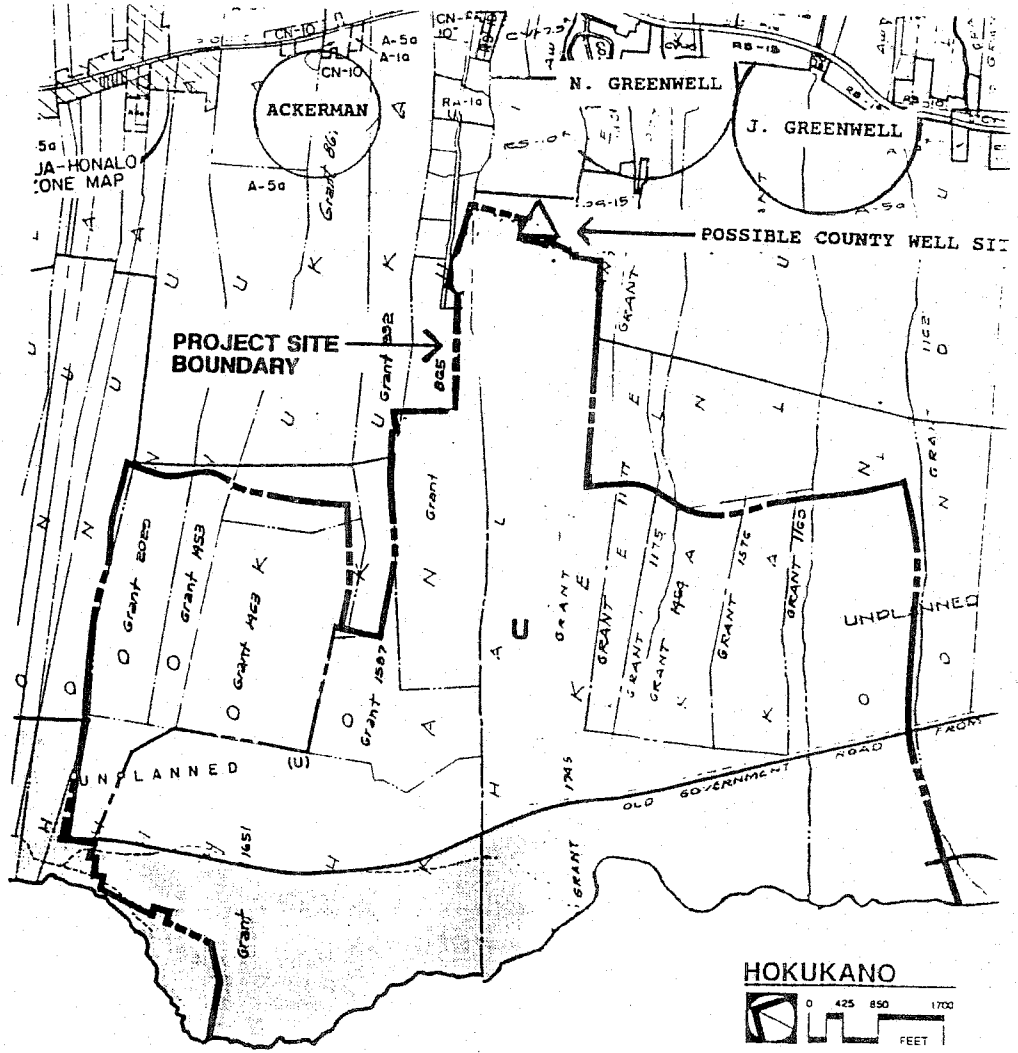


* Jack Greenwell Site - 20,000 sq.ft. site on mauka property at approximately 1200' elevation.

These agreements reached with adjacent land owners are below the probable elevation to successfully develop potable water. The most likely areas are above the highway as described in Section 1.4: Geology and Hydrology.




II-5-24
D.O.W. SYSTEM - LOCATION MAP EXHIBIT D




WATER AGREEMENTS - LOCATION MAP
POSSIBLE COUNTY WELL SITE
II-5-25
EXHIBIT E

## 2.3 POTABLE WATER; Wells both on site and off site.

EVALUATION FOR SOURCES: in the review process for defining water sources the following criteria is used for setting parameters:

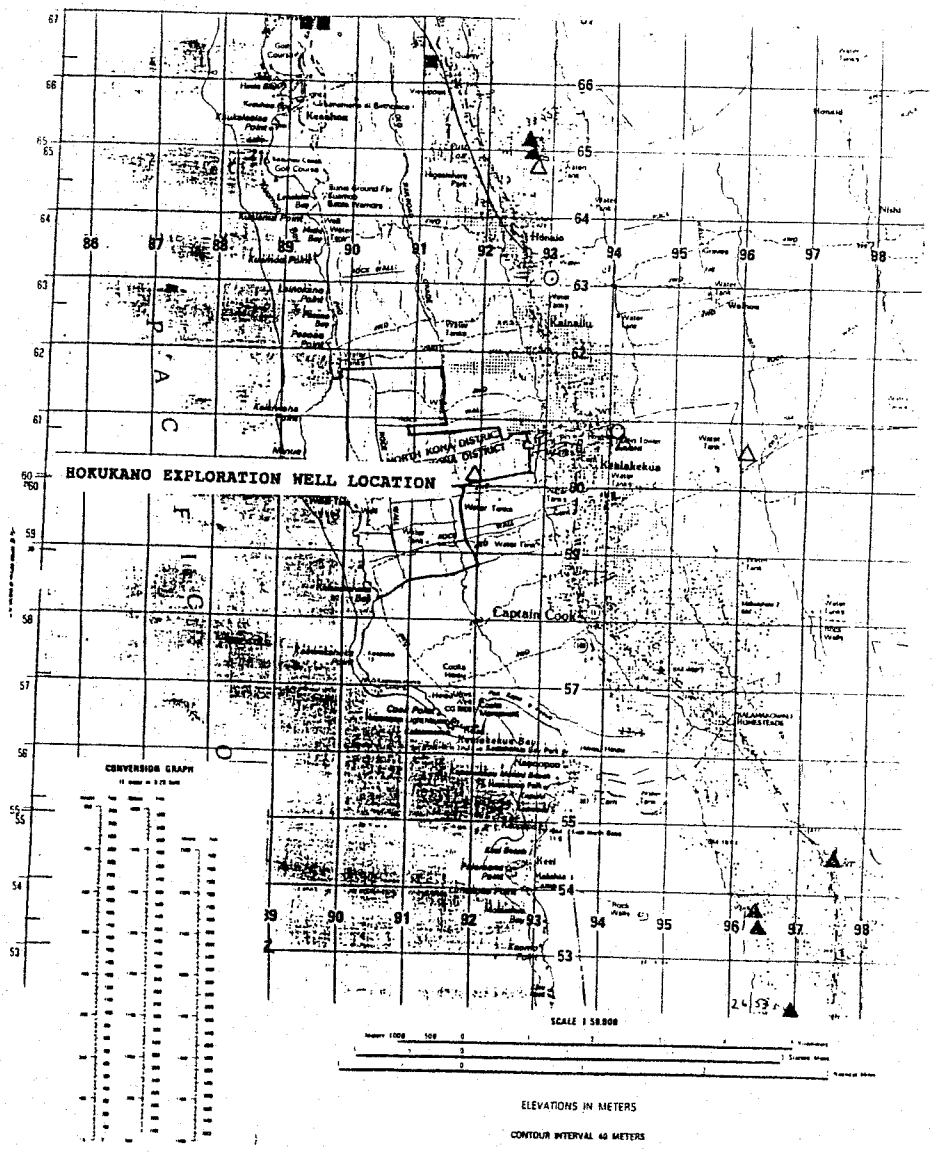
1. Resources
2. Land use and ownership as related to demands in the area, pollution potential and quality and quantity potential.
3. Infrastructure including power, road access, and water system access.
4. Design and regulation standards for water systems.

Based on Water resource studies by Island Resources Ltd., off site potable water wells in south Kona may be located between the elevations of 1500' to 1800 feet. Wells will need to be properly located to integrate with the County water system for future cross connections.

Exhibit (F) indicates locations of drilled, planned or permitted wells as recorded with the State Water Commission, the County or known development plans. This exhibit includes existing potable wells, existing non-potable wells, existing test or observation wells and those wells known to be applied for, or under construction.

Well sites are not readily available as they will need to be properly oriented to the County water system (Exhibit D) as noted above.






▲ Potable Wells
△ Applied For or Under Construction Wells
○ Test / Observation Wells (USGS)
■ Non-potable Wells



WATER WELLS DRILLED OR PROPOSED
IN PROJECT AREA

EXHIBIT F

Each well site will require a well, pump, piping, power connection, controls, fencing, access, and, depending on location, storage tanks. Development costs must include these components.

Based on previous agreements by other developers with the Department of Water, sources to be developed with the County of Hawaii as stand alone wells which are to be turned over to the County for operation and which use D.O.W. transmission lines to transmit the water to the project site. 60% of the water will be dedicated for the County's use and 40% will be allocated to the project. Additional well provided the County would require only 10% of the wells production. This type of source development must be considered as part of this project. The water developed from the potable well sources to meet the demands noted in Table 1 will need to include the above ratio divisions.

The developer has already contributed to the development of one well to secure the 499 water commitments. A second well put on the County system will produce a usable percentage of 90% of production.





**DEMAND**

Using the maximum daily demand per unit of 600 gallons per day for pump design purposes the demand balance for Hokukano village is as follows:

| | |
|---|---|
| Hokukano Demand (Table 2) | 964,500 gpd |
| County to Provide (499 units) | 299,400 gpd |
| **Balance Required** | **665,100** gpd |

**SUPPLY**

The following table of rates or pumpage and hours of operation show that a 600 gpm pump will provide the needed **installed capacity** to meet the balance of the potable water demands.

| OPERATIONS: | 16 HOURS | 24 HOURS |
|---|---|---|
| 500 GPM | 480,000 GPD | 720,000 GPD |
| 600 GPM | 576,000 GPD | 864,000 GPD |
| 700 GPM | 672,000 GPD | 1,008,000 GPD |

Assumptions: Well to pump to 1780' pressure Zone tank
Water level +400'
Elevation of well - 1600'
TDH - 1400' lift

## 2.4 TRANSMISSION LINES AND STORAGE

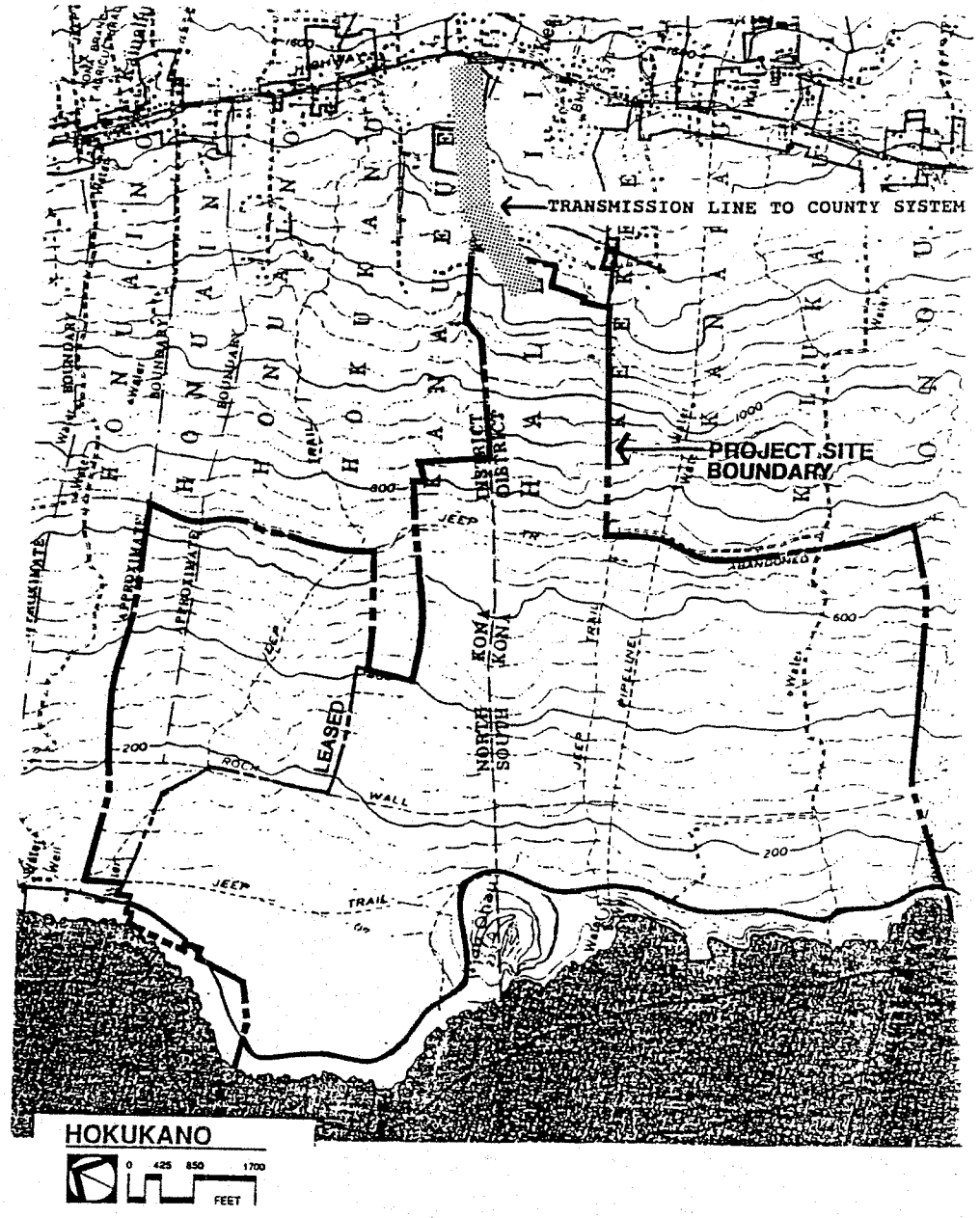
Improvements to the existing or planned transmission system may be required to support the project. Potential and existing transmission corridors are noted in Exhibit (G).

The developer will likely be required to participate in the water system improvements along with other developers. In addition to potential source costs outlined in paragraph 2.3, investment in the transmission system from the source to the project may be required.

Potable water wells may be located in the areas previously mentioned and the DOW may not have existing transmission capability to deliver the water from potential sources to the project. The timing of proposed water demands will be important in determining appropriate transmission improvements and investment. Adequate maximum day and peak hour storage may be required, both on site and off site, depending on the systems designs.

Fire flow for the project will also need to be included in the water system design. The needed storage to supply the required flow will be a factor in tank sizing and related land and construction costs. The land and tanks must be located above and within the project on lands with the proper elevations. The actual siting of tanks within the project will be based on hydraulic service zones in order to meet the County standards and those of insurance underwriters.






NEEDED TRANSMISSION LINES - OFF SITE EXHIBIT G

## 2.5 CONCLUSION:

Based on new county wells north and south of the project site, the 499 water commitments (299,400 gpd) described in section 2.2 can be satisfied.

Additional water development to satisfy the remaining maximum day demand of 665,100 gallons per day potable water will need to be developed with the cooperation of the County Department of Water. This well site most probably will be located above elevation 1400'.

The proposed second well would require negotiations with the land owner of the site.

The proposed pumpage rate would be 600 gpm.





## 2.6 POTABLE WATER from Brackish wells on-site

Wells drilled on-site at elevations of 800 feet or more may produce water with salinities ranging from 300 to 400 mg/l chlorides. This water would need to be treated or blended to remove or decrease the salt for potable use. The developer may need to put in a treatment facility to demonstrate the reliability to the State and County if potable water was to be produced. Well costs would be much less than wells at higher elevations.

The water from on site brackish wells could be developed independent of the off site options as the water is available and can be desalted immediately. This could be a phasing opportunity if other water sources and system improvements do not meet the project water demand in a timely manner.

The desalting process most commonly used in the United States and other parts of the world is Reverse Osmosis (RO). Kona Village Resort on the Kona coast has been using a different type of desalting treatment plant, electro dialysis reversal (EDR), for production of their potable water supply for more than 20 years. The state of Florida and the Caribbean islands use R.O. water extensively for fresh water production. The process is approved by the E.P.A. By starting with an irrigation water production plant, proper testing would demonstrate the use of the water as a potable supply such that the process can receive State Department of Health approval for drinking water.

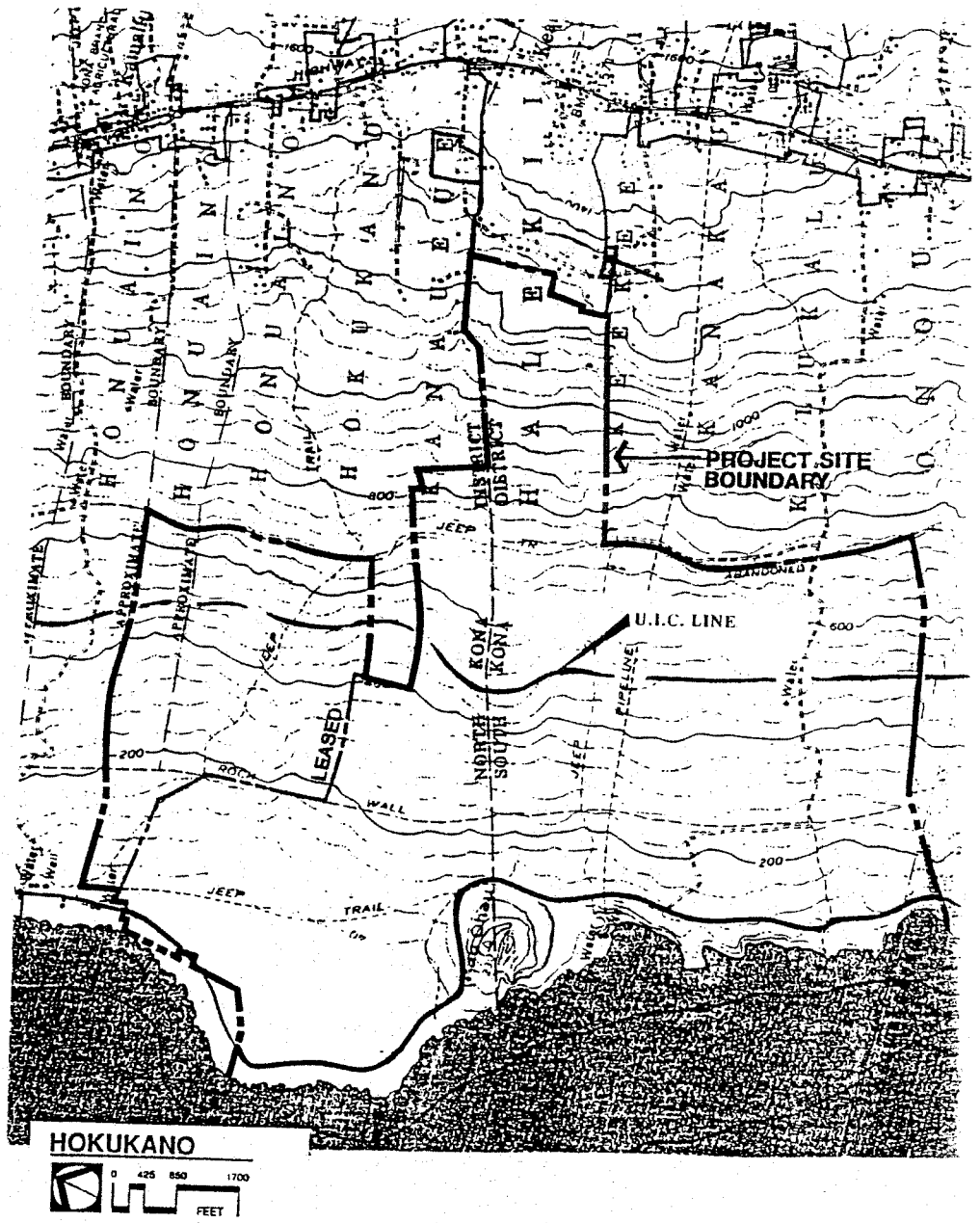
Capital costs for a 1.2 million gallon per day plant producing a 70% recovery or 840,000 gallons per day of product water (100 mg/l chloride) from 1,000 mg/l chloride source water, is approximately $1.8 million dollars. Costs could be between $3 to $5 per 1,000

gallons of potable product water at the location of the R.O. facility.

Another consideration will be the use of water extracted below the Under Ground Injection (UIC) line shown in exhibit (H). The State Department of Health has expressed caution in the extraction of water for potable use below this line. If desalting treatment of on site water of potable use is to be considered, then a pilot plant needs to be installed and tested in conjunction with the Health Department. The water could be used for irrigation purposes during this demonstration period.

Use of desalting is not recommended as the construction of a second potable well as described in Section 2.5 is more viable.






FOCUS ZONES FOR BRACKISH WATER WELLS AND UIC LINE LOCATION

EXHIBIT H

## 3.0 IRRIGATION WATER

### 3.1 IRRIGATION WATER; WELLS; ON SITE

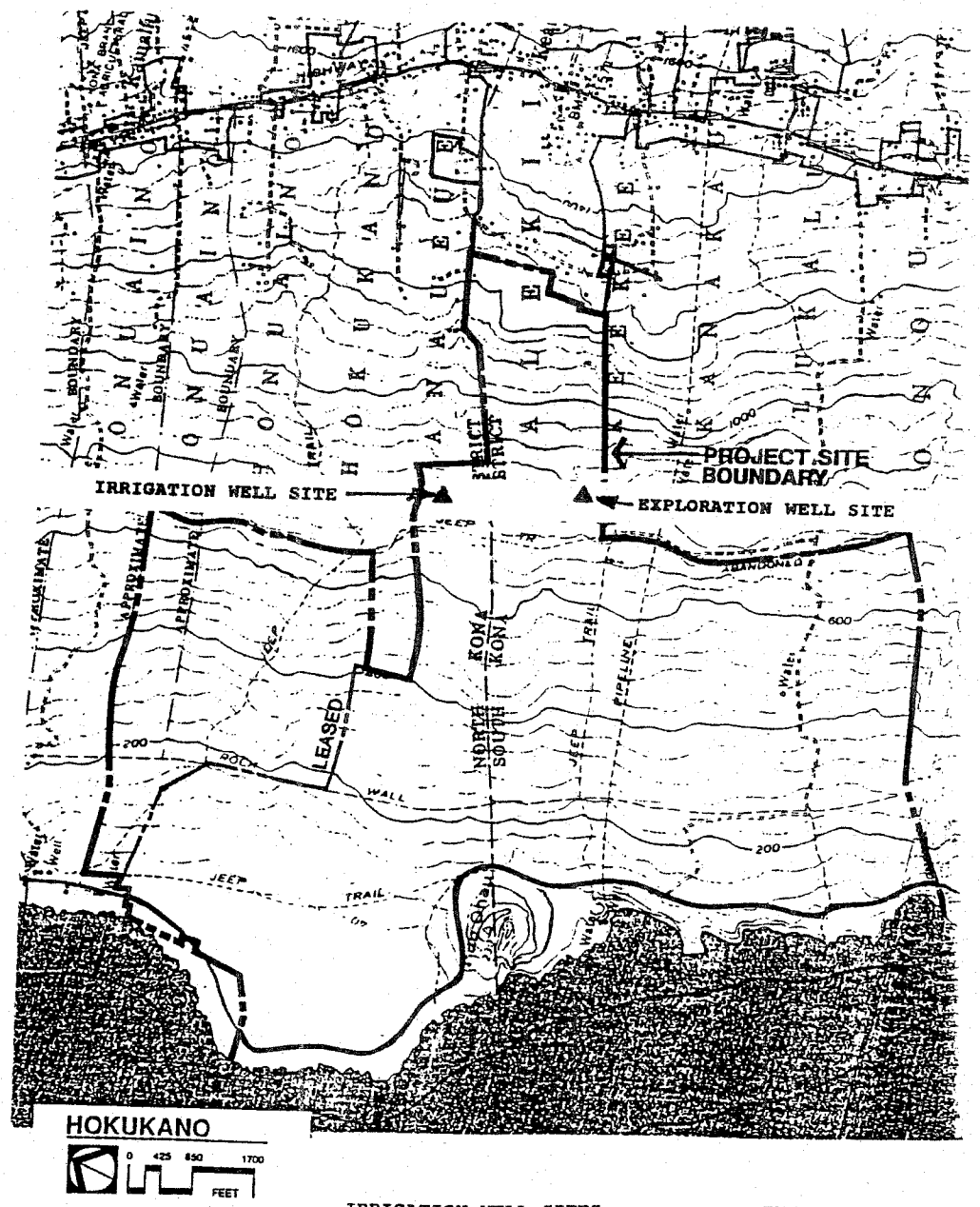
On site golf course irrigation wells will be expected to produce water with chlorides ranging from 250 to 1,000 mg/l. The exploration well identified in section 2.3 further identified the water quality expected on the property. Water quality will also be effected by the elevation of well sites. The water quality from the exploration well pilot hole located at 800' elevation produced about 340 mg/l chloride water.

An additional well will be located as a result of the findings at the exploration well. This well location is noted in Exhibit I.

Table 3 expresses the chemical breakdown of two wells which may have similar characteristics to irrigation wells developed on the project property. Further water quality testing will be provided when the well is pump tested.

Plant types used on the project may be effected by the water quality used for irrigation. High salinity water cannot be used directly on bermuda grass. There are certain types of turf grass, which may be acceptable and are more salt tolerant. More exotic plantings will require fresher water. Water demands for plants requiring chlorides of 250 mg/l or less (fresh water) should be developed. Where feasible, landscaping with native or salt tolerant plants should be used.






IRRIGATION WELL SITES EXHIBIT I



source: S.O.H., Dept. of Planning & Urban Development
State Land Use Commission; STATE LAND USE
DISTRICT MAPS - COUNTY OF HAWAII; printed Feb. 1992

With the information from the exploration well, quality data can further be defined. The developer may want to plant test plots of turf and other plant types on the property to determine the best use of grasses, plants and soil blends. A reduction in irrigation requirements might be achieved through the use of appropriate soils and soil additives.

**TYPICAL BRACKISH BASAL LENS WATER QUALITY**

**TABLE 3**

| ITEM | UNIT | HUALALAI WELL #3758-01 * | WAILEA WELL #9 ** | HOKUKANO #3056-01*** |
|---|---|---|---|---|
| Silicate | mg/l | 68 | 30 | |
| Calcium | mg/l | 16 | 18 | |
| Magnesium | mg/l | 28 | 44.3 | |
| Sodium | mg/l | 261 | 790 | |
| Potassium | mg/l | | 34.3 | |
| Bicarbonate | mg/l | 58 | | |
| Carbonate | mg/l | 0 | | |
| Sulfate | mg/l | 79 | 100 | |
| Chloride | mg/l | 460 | 850 | 340 |
| Fluoride | mg/l | 0.1 | | |
| Nitrate | mg/l | 1.3 | 2.1 | |
| TDS | mg/l | 943 | 1790 | 650 |
| Conductivity | | | 2950 | 1270 |
| pH | | 7.8 | 8.1 | |

* Chemical Quality of Ground Water in Hawaii, Report R48, USGS
** Brewer Analytical Laboratories, 11-17-89,Wailea Resort Company, Ltd.
*** Pilot hole test only, field tests

TABLE 3





Lake storage and transmission lines to the golf course from irrigation wells will need to identified and planned for. Efficient use of gravity irrigation could significantly reduce energy consumption and operating costs. Fire flow might also be incorporated into the storage and line sizing using irrigation water.

## 3.2 WWTP EFFLUENT

Waste Water Treatment Plant (WWTP) effluent may be a valuable source of irrigation water for this property and could enhance resource conservation practices. Effluent is usually of sufficiently low salinity to be used for irrigation. The cost to bring water to the site will have been incurred in the drinking water supply making the use of effluent water as an irrigation resource economically viable.

WWTP effluent can also be used for irrigation of exotic plants.

All WWTP water produced on the site should be re-used on the site if possible, or if regional development WWTP is used, processed effluent could be transmitted back to the project site for use. This water can be used directly or to blend with brackish water sources for irrigation.

# III. Archaeological Reports

# III - 1 Archaeological Inventory (Volume I)

This report has been organized into two separate volumes to facilitate perusal of the substantial amount of material generated during the course of the present study at Hokukano. Volume one contains general background information, archival research, and analysis. Volume Two contains site descriptions and selected site maps.

# Archaeological Inventory Survey and Limited Subsurface Testing of a 1540-Acre Parcel in the *Ahupua'a* of Honuaino 3-4, Hokukano, Kanaueue, Haleki'i, Ke'eke'e, 'Ilikahi, Kanakau, Kalukalu, and Onouli 1, Districts of North and South Kona Island of Hawai'i

## Volume I


by

Brian L. Colin
Ian Masterson
Jennifer J. Robins, B.A.
Victoria Creed, Ph.D
Douglas F. Borthwick, B.A.
and
Hallett H. Hammatt, Ph.D

with

Historical Documentary Research
by
Helen Wong-Smith, B.A.


Prepared for

1250 Oceanside Partners


Cultural Surveys Hawaii
July 1992
Revised January 1993

*Kahokukano - Kona, Hawaii.* Wash drawing by Paul Emmert,*ca.* 1850. (Honolulu Academy of Arts, Gift of Bruce Cartwright, 1938)




## ABSTRACT

From August 20, 1991 to January 17, 1992, Cultural Surveys Hawaii performed an archaeological inventory survey of a 1540-acre parcel which straddles the North/South Kona District boundary, Hawai'i Island. The project area includes portions of 13 *ahupua'a*: Honuaino 3, Honuaino 4, Hokukano 1, Hokukano 2, Kanaueue 1, Kanaueue 2, Haleki'i, Ke'eke'e 1, Ke'eke'e 2, 'Ilikahi, Kanakau, Kalukalu, and Onouli 1. Subsequently, subsurface testing of ten sites was accomplished during the week of February 17 to 21, 1992 and two more sites during the weekend of July 11 and 12, 1992.

Within the 1540-acre parcel 473 archaeological sites and site complexes were identified. Of this total, 469 sites are considered significant. 162 of these significant sites are recommended for preservation, 18 sites are recommended for selective preservation, and 289 are recommended for data recovery.

Limited subsurface testing was conducted at nine probable and possible burial sites, one agricultural mound complex, and within two of the extensive lava tube systems.

## ACKNOWLEDGEMENTS

Fieldwork was performed at various times by Kaleo Ahina, Richard Ballesteros, Timothy Barr, Dennis Bauer, Julie Bertles, Julie Borra, Brett Bronson, Richard Campbell, Ingrid Carlson, Edward Duncan, Paul Kim, Ian Masterson, Matt McDermott, Bryce Myers, Scott Olival, Michael Pfeffer, Jennifer J. Robins, Mark Stride, Aron Suzuki, Stephanie Sanger, and Steven Whitworth. The authors wish to thank these individuals for their hard work.

Lab work carried out under the direct supervision of John Winieski with the aid of Susan Crotty. Field maps were drafted by Bryce Myers and Julie Borra.

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## LIST OF FIGURES



APPENDIX B - PROJECT PHOTOGRAPHS

## LIST OF TABLES

# I. INTRODUCTION

## A. Project Background

An archeological inventory survey with limited subsurface testing was accomplished by Cultural Surveys Hawaii within the approximately 1540-acre Hokukano Project area for 1250 Oceanside Partners (Figures 1-4). The survey was conducted in the *ahupua'a* of Onouli 1, Kalukalu, Kanakau, 'Ilikahi, Ke'eke'e 1, and Ke'eke'e 2 in South Kona, and Halekii, Kanaueue, Hokukano 1, Hokukano 2, Honuaino 3, and Honuaino 4 in North Kona.

The field work was carried out during a period between August 20, 1991 and January 17, 1991 under the direct supervision of Douglas K. Borthwick and Brian L. Colin, and the overall guidance of Dr. Hallett H. Hammatt.

The project area is located in lands between Kealakekua Bay to the south and Keauhou Bay to the north. The property extends from sea level to approximately 1200 ft. (364 m.) a.m.s.l. The actual boundaries of the project area are delineated by the coastline to the west, a *mauka/makai* (east/west) trending boulder wall (marking the *ahupua'a* division of Honuaino 3 and Honuaino 4) to the north (State site 50-10-37-16787), and a *mauka/makai* (east/west) trending boulder wall (marking the *ahupua'a* division of Onouli 1 and Onouli 2) to the south (State site 50-10-37-16800). The majority of the eastern project boundary is demarcated by an old railroad grade (State site 50-10-37-10302) except the central portion which extends eastward to a subdivision, approximately 3650 ft. (1106 m.) *mauka* or east of the railroad bed (State site 50-10-37-10302).

## B. Scope of Work

The primary goal of the inventory survey was the identification of any and all cultural resources within the total project area. The survey was designed to meet the requirements of



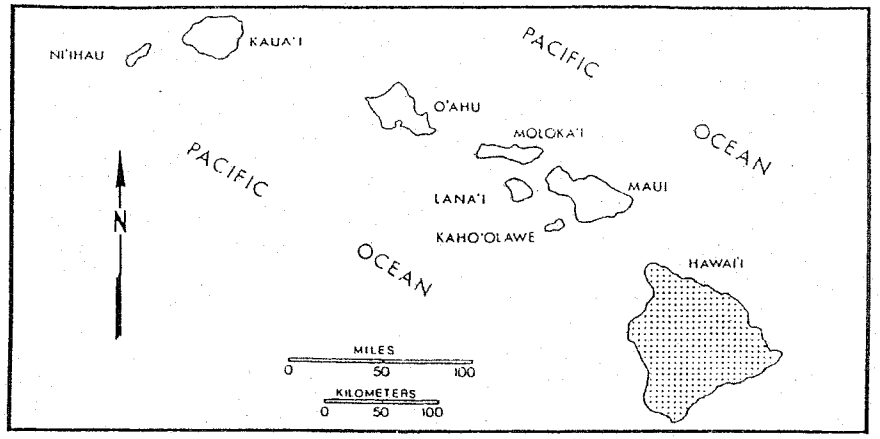



Fig. 1 State of Hawai'i

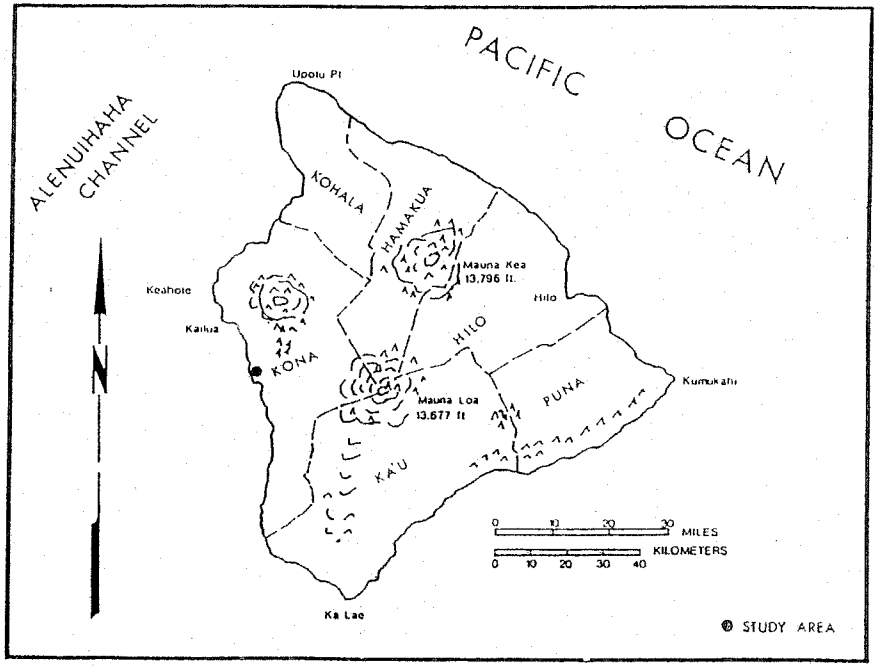



Fig. 2 Hawai'i Island Location Map

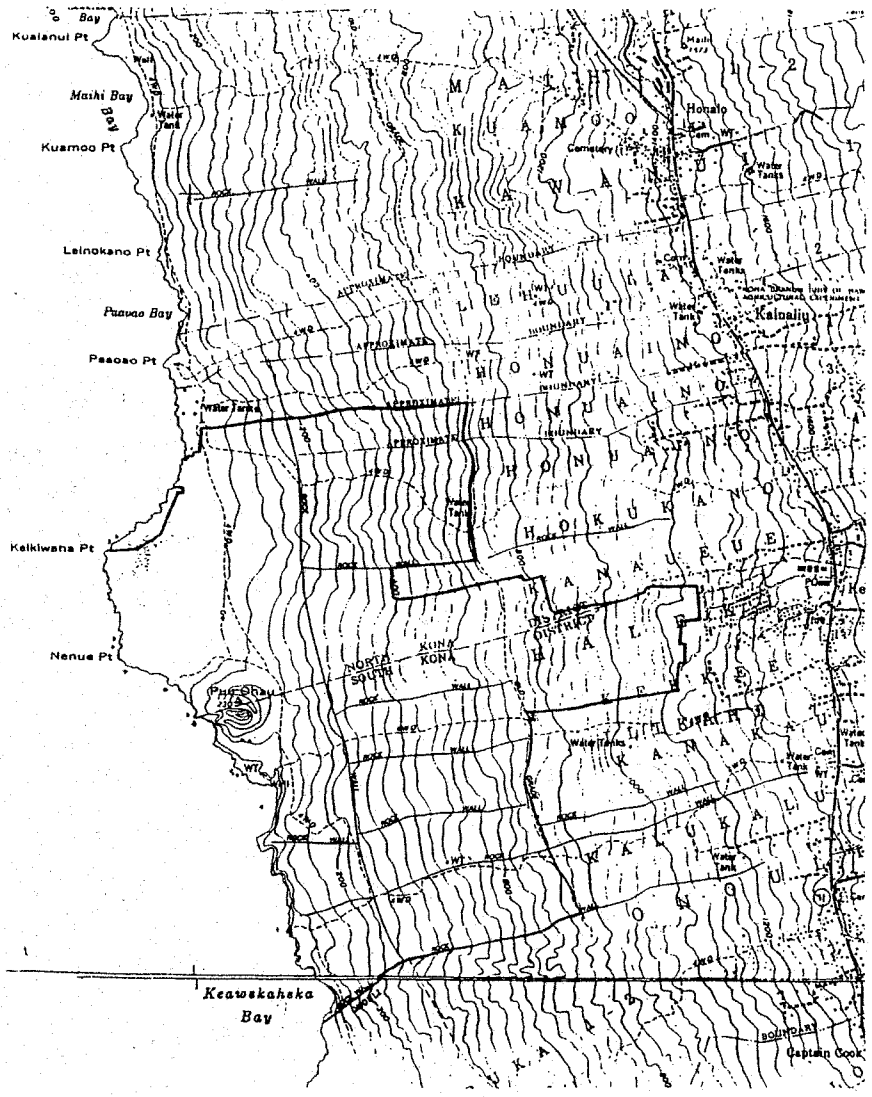



Figure 3 Portion of USGS 7.5 Minute Series Topographical Map, Kealakekua Quadrangle, showing project area location (outlined)

IN THE INTEREST OF PROTECTING POTENTIALLY SENSITIVE ARCHAEOLOGICAL SITES SUCH AS BURIAL MOUNDS AND CAVES, A COPY OF THE ARCHAEOLOGICAL SITE LOCATION MAP IS NOT INCLUDED WITH THIS DOCUMENT. A COPY IS ON FILE WITH THE DEPARTMENT OF LAND AND NATURAL RESOURCES HISTORIC PRESERVATION DIVISION.

the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD). Survey procedures included:

1) A complete (100%) ground survey within the 1540-acre project area. All archaeological sites would be located, described, and mapped. Field documentation will include photographs and scale drawings of the majority of the sites. All sites will be assigned state site numbers. Interpretive evaluations including the archaeological significance and recommended treatment of each site will be presented.

2) Limited subsurface testing to ascertain the presence or absence of human remains and intact cultural deposits, and to obtain datable samples for chronological information.

3) Research on historic and archaeological background, including investigation of historic maps, written records, and Land Commission Award documents.

4) Laboratory analysis of all collected artifacts and midden. Artifacts would remain curated at Cultural Surveys Hawaii until a location is chosen for permanent curation by 1250 Oceanside Partners in agreement with the DLNR-SHPD.

5) Preparation of a survey report.

Approximately two hundred acres of the project area were previously studied by Paul H. Rosendahl Inc. (PHRI) in "Pu'u Ehu Estates" (Kaschko 1984). Upon review of that document by the DLNR-SHPD, it was agreed (Dr. Ross Cordy, personal communication 1991) that a section of the Pu'u Ehu Estates Project area - "Hokukano Flats" - had been subjected to an inventory level survey, and there was no need for inclusion of that particular area in our present study. (A list of these sites with summaries of there functions - based upon the PHRI report - is included in Appendix A of this report.) However, sites outside of the "Hokukano Flats" area which had been previously described were resurveyed and are described in detail in Volume II of this report.

**C. Methods**

The field work was conducted by a crew of five to seven archaeologists. Complete ground coverage of the project area was achieved by pedestrian sweeps which were spaced at



equal intervals ranging from 10.0 m. to 30.0 m. (33.0 to 100.0 ft.) - depending on ground visibility. The survey sweeps were typically oriented in a *mauka/makai* (east/west) direction, so that parallel-running cattle walls could be utilized to define the outer edges and general compass bearing of a sweep. To ensure complete survey coverage of the project area, the outer sweep lines - which were not delineated by cattle walls - followed specific compass bearings which were marked with red flagging tape so as to be clearly visible for any adjoining sweeps.

All readily accessible lava tube chambers were examined throughout their full extent. Main activity areas, typically located in or near the light zone, of all tubes were documented. In some instances individual features within extensive lava tube systems were not fully mapped to scaled dimensions though their locations were noted.

All of the archaeological sites were plotted on a 1 inch = 200 ft. (5 ft.contour) project area map. Sites were located on the contour map by using (in combination) a black and white aerial photograph, distinct topographical contours, and tape and compass to known landmarks present on the project map.

Each site was described in detail and either sketched or mapped to scale, depending on site complexity and condition. The majority of the sites were photographed. (A selection of photographs taken during archaeological field work is included in Appendix B of this report.) Temporary site numbers (prefixed by CSH) and feature designations, if necessary, were assigned to each site or site complex. Yellow flagging tape labelled with the site's temporary site number and other pertinent information was tied above the site and another was placed directly onto the structure. Each site or individual feature was recorded by formal site type using descriptive categories presented in the SURVEY RESULTS section of this report. Functional interpretation of a site was established on the basis of structural characteristics and in some cases associated artifacts, in conjunction with external correlations with other archaeological studies and interpretations in the general region. Significance and

recommended treatment of each site were determined on the basis of site complexity, configuration, and apparent function (Table 1).

During the fieldwork an attempt was made to consolidate related features into site complexes. Feature associations were typically based on the following considerations: proximity, similarity in architecture and preservation, interrelated functions and inclusion within a larger enclosure wall. In areas where a high site density was observed (specifically along the coast) feature associations were less obvious and proximity became the main factor for determining such associations.

Limited subsurface testing was conducted at 12 sites in the overall project area. The testing was carried out at a representative sample of possible and probable burial platforms and terraces (State sites 50-10-37-16354, 50-10-37-16376, 50-10-37-16377, 50-10-37-16386, 50-10-37-16465, 50-10-37-16664, 50-10-37-16665, 50-10-37-16741, and 50-10-37-16743), two lava tube sites (State sites 50-10-37-16677 and 50-10-37-10300) and one agricultural mound complex (State site 50-10-37-16629). Stone structures were tested using controlled excavation to the base of construction. Where soil was present, controlled excavation was extended to bedrock or culturally sterile soil layers with contents screened through 1/8-inch mesh screens. Upon encountering human remains, excavation was terminated and the site was reconstructed to its original form. Results of the subsurface testing are included with the individual site descriptions of this report. A summary of these results is presented in the Testing Results section of this report.



TABLE 1 - SITE SUMMARY OF THE HOKUKANO PROJECT AREA

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance | Prob Age | Recommended Treatment |
|---|---|---|---|---|---|---|---|
| 6601 | | | Kona Field System | Ag. | C,D | PH | Preserve (S) |
| 7276 | | K-4 | Wall (Kuakini) | Boundary/Ag. | A,B,C,D | PH | Preserve (S) |
| 10278 | | W-10 | See Appendix | | | | |
| 10279 | | W-9 | See Appendix | | | | |
| 10280 | | W-8 | See Appendix | | | | |
| 10281 | | W-7 | See Appendix | | | | |
| 10282 | | W-11 | See Appendix | | | | |
| 10283 | 414 | W-6 | Lava Blister | Pen | D | P | Data Recovery |
| 10284 | | K-7 | Wall | Boundary/Ag. | D | PH | Data Recovery |
| 10285 | | W-5 | See Appendix | | | | |
| 10286 | 400 | W-4 | Site Complex | Burial (poss.) | D,E* | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 10287 | 405 | W-3 | Site Complex | Burial (poss.) | D,E* | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 10288 | 399 | W-2 | Platform | Burial (prob.) | D,E* | P | Preserve |
| 10289 | | W-1 | Site Complex | Burial (poss.) | D, E* | P | Preserve |
| 10290 | | K-6 | King's Trail | Trial | A,C,D | PH | Preserve (S) |
| 10291 | 358 | W-19 | Terrace | Burial (poss.) | D,E* | P | Preserve |
| 10292 | | W-20 | Site Complex | Multi-function | D,E* | | Preserve |
| | 365/A | | Mound | Burial (poss.) | | P | |
| | 366/B | | Enclosure | Pen | | PH | |
| | 367/C | | Platform | Hab. (P) | | P | |
| | 368/D | | Enclosure | Hab. (T) | | P | |
| 10293 | 370 | W-14 | Lava Tube | Burial (poss.) | D,E* | P | Preserve |
| 10294 | 227 | K-7a | Lava Tube | Burial | D,E | P | Preserve |
| 10295 | 230 | W-17 | Platform | Burial (prob.) | D,E* | P | Preserve |
| 10296 | | K-3 | Site Complex | Multi-function | C,D,E* | P | Preserve |
| | 238/A | | Platform | Hab. (P) | | | |
| | 239/B | | Platform | Burial (poss.) | | | |
| | 240/C | | Modified Outcrop | Hab. (T) | | | |
| 10297 | 277 | K-5 | Site Complex | Multi-function | C,D,E | P | Preserve |
| | A | | Platforms | Hab. (P) | | | |
| | B | | Lava Tube | Burial | | | |
| | C | | Lava Tube/Petroglyph | Hab. (P) | | | |
| | D | | Lava Tube | Burial | | | |
| | E | | Enclosure | Ag. | | | |
| | F | | Terrace | Burial (poss.) | | | |
| | G | | Enclosure | Boundary | | | |
| | H | | Terrace | Burial (poss.) | | | |
| | I | | Ahu | Indeterminate | | | |
| | J | | Platform | Hab. (P) | | | |
| | K | | Lava Tube | Burial | | | |
| 10298 | 272 | W-16 | Site Complex | Multi-function | A,C,D,E | P | Preserve |
| | A | | Platform | Hab. (P) | | | |
| | B | | Lava Tube | Burial/Refuge | | | |
| | C | | Modified Outcrop | Hab. (P) | | | |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| | D | | Platform | Hab. (P) | | | |
| | E | | Enclosure | Hab. (P) | | | |
| | F | | Terrace | Hab. (P) | | | |
| | G | | Modified Outcrop | Hab. (P) | | | |
| 10299 | | W-15 | Site Complex | Ag. | D | P | Data Recovery |
| 10300 | | W-13 | Lava Tube | Multi-function | A,C,D,E | P | Preserve |
| 10301 | 217 | K-2a | Lava Blister | Hab. (T) | D | P | Data Recovery |
| 10302 | | K-2 | Berm | Railroad Bed | A,C,D | PH | Preserve (S) |
| 10303 | | W-12 | Wall | Boundary/Ag. | D | PH | Data Recovery |
| 10304 | | W-11 | Wall | Boundary/Ag. | D | PH | Data Recovery |
| 10305 | | K-1 | Site Complex | Multi-function | D | P | Data Recovery |
| | 320/A | | Platform | Ag. | | | |
| | 321/B | | Terrace | Ag. | | | |
| | 322/C | | Platform | Hab. (P) | | | |
| | 322/D | | Platform-Enclosure | Hab. (P) | | | |
| 15248 | | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 15257 | | | Burial Deposit | Burials | D,E | P | Preserve |
| 16354 | 1 | | Platform | Burial | D,E | P | Preserve |
| 16355 | 2 | | Site Complex | Hab. (P) | A,D | P | Preserve |
| | A | | Lava Tube | | | | |
| | B | | Lava Tube | | | | |
| 16356 | 3 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16357 | 4 | | Modified Outcrop | Ag. | D | P | Data Recovery |
| 16358 | 5 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Platform | | | | |
| | B | | Papamu | Gameboard | | | |
| | C | | Terrace | | | | |
| | D | | Modified Outcrop | | | | |
| 16359 | 6 | | Wall | Ag. | D | P | Data Recovery |
| 16360 | 7 | | Site Complex | Heiau | D,E | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16361 | 8 | | Papamu | Gameboard | C,D | P | Preserve |
| 16362 | 9 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16363 | 10 | | Site Complex | Ag. | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16364 | 11 | | Wall | Indeterminate | D | P | Data Recovery |
| 16365 | 12 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16366 | 13 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16367 | 14 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16368 | 15 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16369 | 16 | | Modified Outcrop | Ag. | D | P | Data Recovery |
| 16370 | 17 | | Mound | Ag. | NLS | P | None |
| 16371 | 18 | | Walls | Trail (poss.) | D | P | Data Recovery |
| 16372 | 19 | | Site Complex | Burial (poss.) | D,E* | P | Preserve |



TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| | C | | Platform | | | | |
| 16373 | 20 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16374 | 21 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16375 | 22 | | Platform | Shrine | D,E | P | Preserve |
| 16376 | 23 | | Platform | Burial | D,E | P | Preserve |
| 16377 | 24 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16378 | 25 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16379 | 26 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16380 | 27 | | Terrace | Ag. | D | P | Data Recovery |
| 16381 | 28 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16382 | 29 | | Terrace | Burial (poss.) | D,E* | P | Preserve |
| 16383 | 30 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16384 | 31 | | Site Complex | Heiau (poss.) | D,E* | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16385 | 32 | | Terraces | Ag. | D | P | Data Recovery |
| 16386 | 33 | | Platform | Burial | D,E | P | Preserve |
| 16387 | 34 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Terrace | | | | |
| | B | | Platform | | | | |
| 16388 | 35 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16389 | 36 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16390 | 37 | | Site Complex | Ag. | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16391 | 38 | | Wall Remnant | Indeterminate | NLS | P | None |
| 16392 | 39 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16393 | 40 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16394 | 41 | | Mound | Burial (poss.) | D,E* | P | Preserve |
| 16395 | 42 | | Site Complex | Heiau | C,D,E | P | Preserve |
| | A | | Platform | | | | |
| | B | | Terrace | | | | |
| 16396 | 43 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16397 | 44 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16398 | 45 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16399 | 46 | | Site Complex | Burial (prob.) | D,E* | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16400 | 47 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16401 | 48 | | C-Shape | Ag. | D | P | Data Recovery |
| 16402 | 49 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Terrace | | | | |
| | B | | Terrace | | | | |
| | C | | Terrace | | | | |
| 16403 | 50 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16404 | 51 | | Terrace | Ag. | D | P | Data Recovery |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance | Prob. Age | Recommended Treatment |
|---|---|---|---|---|---|---|---|
| 16405 | 52 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16406 | 53 | | Site Complex | Multi-function | D,E* | P | Preserve |
| | A | | Platform | Hab. (P) | | | |
| | B | | Platform | Hab. (P) | | | |
| | C | | Platform | Burial (poss.) | | | |
| | D | | Wall | Hab. (P) | | | |
| 16407 | 54 | | Terrace | Burial (poss.) | D,E* | P | Preserve |
| 16408 | 55 | | Site Complex | Ag. | D | P | Data Recovery |
| 16409 | 56 | | C-Shape Remnant | Indeterminate | D | P | Data Recovery |
| 16410 | 57 | | Site Complex | Ag. | D | P | Data Recovery |
| | A | | Terrace | | | | |
| | B | | Platform | | | | |
| 16411 | 58 | | Enclosure | Pen | D | P | Data Recovery |
| 16412 | 59 | | Platform | Burial (prob.) | D,E* | P | Preserve |
| 16413 | 60 | | Enclosure | Ag. | D | P | Data Recovery |
| 16414 | 61 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Terrace | | | | |
| | C | | Wall | | | | |
| 16415 | 62 | | Site Complex | Hab. (P) | C,D | H | Preserve |
| | A | | Enclosure | | | | |
| | B | | Wall | | | | |
| 16416 | 63 | | Modified Outcrop | Ag. | D | P | Data Recovery |
| 16417 | 64 | | Modified Outcrop | Ag. | D | P | Data Recovery |
| 16418 | 65 | | Enclosure Remnant | Indeterminate | D | P | Data Recovery |
| 16419 | 66 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16420 | 67 | | Enclosure | Ag. | D | P | Data Recovery |
| 16421 | 68 | | Terrace | Ag. | D | P | Data Recovery |
| 16422 | 69 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| | C | | Platform | | | | |
| | D | | Paved Depression | | | | |
| 16423 | 70 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16424 | 71 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| | C | | Platform | | | | |
| | D | | Platform | | | | |
| 16425 | 72 | | Lava Tube/Petroglyphs | Burial;Refuge | C,D,E | P | Preserve |
| 16426 | 73 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16427 | 74 | | L-Shape | Ag. | D | P | Data Recovery |
| 16428 | 75 | | Platform | Burial (poss.) | C,D,E* | P | Preserve |
| 16429 | 76 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16430 | 77 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16431 | 78 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16432 | 79 | | Modified Outcrop | Hab. (P) | C,D | P | Preserve |
| 16433 | 80 | | Platform | Burial (poss.) | D,E* | P | Preserve |



TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance | Prob. Age | Recommended Treatment |
|---|---|---|---|---|---|---|---|
| 16434 | 81 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | | | Platform | | | | |
| | | | Platform | | | | |
| 16435 | 82 | | Platform | Burial (prob.) | C,D,E* | P | Preserve |
| 16436 | 83 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16437 | 84 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16438 | 85 | | Site Complex | Heiau (poss.) | D,E* | P | Preserve |
| | A | | Platform | | | | |
| | B | | Terrace | | | | |
| 16439 | 86 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16440 | 87 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16441 | 88 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16442 | 89 | | Site Complex | Multi-function | D,E* | P | Preserve |
| | A | | Platform | Burial (poss.) | | | |
| | B | | Mound | Burial (prob.) | | | |
| | C | | Platform | Burial (poss.) | | | |
| 16443 | 90 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16444 | 91 | | Platform | Ag. | D | P | Data Recovery |
| 16445 | 92 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16446 | 93 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16447 | 94 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16448 | 95 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16449 | 96 | | Platform | Ag. | D | P | Data Recovery |
| 16450 | 97 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16451 | 98 | | Platform | Burial (prob.) | D,E* | P | Preserve |
| 16452 | 99 | | Platform | Burial (prob.) | D,E* | P | Preserve |
| 16453 | 100 | | Modified Outcrop | Hab. (P) | D | P | Data Recovery |
| 16454 | 101 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16455 | 102 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16456 | 103 | | Enclosure | Ag. | D | P | Data Recovery |
| 16457 | 104 | | Platform | Heiau (poss.) | C,D,E* | P | Preserve |
| 16458 | 105 | | Platform Remnant | Indeterminate | NLS | P | Preserve |
| 16459 | 106 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16460 | 107 | | Enclosure | Ag. | D | P | Data Recovery |
| 16461 | 108 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16462 | 109 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16463 | 110 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16464 | 111 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16465 | 112 | | Site Complex | Burial | D,E | P | Preserve |
| | A | | Platform | Burial | | | |
| | B | | Platform | Burial (prob.) | | | |
| 16466 | 113 | | C-Shape | Ag. | D | P | Data Recovery |
| 16467 | 114 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16468 | 115 | | Lava Tube | Hab. (P) | D | P | Data Recovery |
| 16469 | 116 | | Terrace | Ag. | D | H | Data Recovery |
| 16470 | 117 | | Terrace | Hab. (P) | D | P | Data Recovery |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance | Prob. Age | Recommended Treatment |
|---|---|---|---|---|---|---|---|
| 16471 | 118 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16472 | 119 | | L-Shape | Ag. | D | P | Data Recovery |
| 16473 | 120 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16474 | 121 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16475 | 122 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16476 | 123 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Terrace | | | | |
| | B | | Platform | | | | |
| | C | | Enclosure | | | | |
| | D | | Enclosure | | | | |
| | E | | Platform | | | | |
| | F | | Wall | | | | |
| | G | | L-Shape | | | | |
| | H | | Terrace | | | | |
| 16477 | 124 | | C-Shape | Hab. (T) | D | P | Data Recovery |
| 16478 | 125 | | Lava Tube | Hab. (P) | A,C,D,E | P | Preserve |
| 16479 | 126 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16480 | 127 | | Site Complex | Ag. | D | PH | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Enclosure | | | | |
| 16481 | 128 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16482 | 129 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16483 | 130 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16484 | 131 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16485 | 132 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16486 | 133 | | C-Shape | Hab. (T) | D | P | Data Recovery |
| 16487 | 134 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Enclosure | | | | |
| | C | | Platform | | | | |
| 16488 | 135 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Terrace | | | | |
| | B | | Terrace | | | | |
| | C | | Enclosure | | | | |
| 16489 | 136 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16490 | 137 | | Terrace | Ag. | D | P | Data Recovery |
| 16491 | 138 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16492 | 139 | | Site Complex | Hab. (T) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| | C | | Terrace | | | | |
| | D | | Platform | | | | |
| 16493 | 140 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Terrace | | | | |
| | B | | Platform | | | | |
| | C | | Wall | | | | |



TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance | Prob. Age | Recommended Treatment |
|---|---|---|---|---|---|---|---|
| 16494 | 141 | | Site Complex | Ag | D | P | Data Recovery |
| | A | | L-Shape | | | | |
| | B | | L-Shape | | | | |
| 16495 | 142 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16496 | 143 | | Platform | Hab. (P) | C,D | P | Preserve |
| 16497 | 144 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16498 | 145 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16499 | 146 | | Enclosure | Ag. | D | P | Data Recovery |
| 16500 | 147 | | Enclosure | Ag. | D | P | Data Recovery |
| 16501 | 148 | | C-Shape | Hab. (T) | D | P | Data Recovery |
| 16502 | 149 | | Platform | Ag. | D | P | Data Recovery |
| 16503 | 150 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16504 | 151 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16505 | 152 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16506 | 153 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Terrace | | | | |
| | B | | Platforms | | | | |
| 16507 | 154 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16508 | 155 | | L-Shape | Ag. | D | P | Data Recovery |
| 16509 | 156 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | L-Shape | | | | |
| 16510 | 157 | | Site Complex | Hab. (T) | D | P | Data Recovery |
| | A | | Terrace | | | | |
| | B | | Platform | | | | |
| | C | | Wall | | | | |
| 16511 | 158 | | Site Complex | Heiau | C,D,E | P | Preserve |
| | A | | Platform | | | | |
| | B | | Enclosure | | | | |
| | C | | Platform | | | | |
| 16512 | 159 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16513 | 160 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16514 | 161 | | Lava Blister | Hab. (T) | D | P | Data Recovery |
| 16515 | 162 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16516 | 163 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16517 | 164 | | Modified Outcrop | Hab. (P) | D | P | Data Recovery |
| 16518 | 165 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16519 | 166 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Platform | | | | |
| 16520 | 167 | | Terrace | Burial (poss.) | D,E* | P | Preserve |
| 16521 | 168 | | Lava Blister | Hab. (T) | D | P | Data Recovery |
| 16522 | 169 | | Lava Blister | Hab. (T) | D | P | Data Recovery |
| 16523 | 170 | | C-Shape | Hab. (T) | D | P | Data Recovery |
| 16524 | 171 | | Platform-Blister | Hab. (P) | D | P | Data Recovery |
| 16525 | 172 | | Platform-Enclosure | Hab. (T) | D | P | Data Recovery |
| 16526 | 173 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16527 | 174 | | Site Complex | Multi-function | D | P | Data Recovery |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| | A | | Enclosure | Ag. | | | |
| | B | | Platform | Hab. (P) | | | |
| 16528 | 175 | | Site Complex | Hab. (T) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Terrace | | | | |
| 16529 | 176 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Enclosure | | | | |
| | B | | Terrace | | | | |
| | C | | Platform | | | | |
| | D | | Modified Outcrop | | | | |
| 16530 | 177 | | Site Complex | Ag. | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16531 | 178 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16532 | 179 | | Platform | Ag. | D | P | Data Recovery |
| 16533 | 180 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16534 | 181 | | L-Shape | Ag. | D | P | Data Recovery |
| 16535 | 182 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16536 | 183 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16537 | 184 | | Mounds | Ag. | D | P | Data Recovery |
| 16538 | 185 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16539 | 186 | | Site Complex | Burial (poss.) | D,E* | P | Preserve |
| | A | | Mound | | | | |
| | B | | Mound | | | | |
| 16540 | 187 | | Platform-Blister | Hab. (P) | D | P | Data Recovery |
| 16541 | 188 | | C-Shape Remnant | Indeterminate | NLS | P | None |
| 16542 | 189 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16543 | 190 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16544 | 191 | | Platform | Hab. (P) | C,D | P | Preserve |
| 16545 | 192 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16546 | 193 | | Site Complex | Multi-function | C,D | P | Preserve |
| | A | | Platform | Hab. (P) | | | |
| | B | | Mound | Ag. | | | |
| 16547 | 194 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16548 | 195 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16549 | 197 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16550 | 198 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform-Enclosure | | | | |
| | C | | C-Shape | | | | |
| | D | | C-Shape | | | | |
| 16551 | 199 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16552 | 200 | | Modified Outcrop | Ag. | D | P | Data Recovery |
| 16553 | 201 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Terrace | | | | |



TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| 16554 | 202 | | Site Complex | Multi-function | D | P | Data Recovery |
| | A | | Mound | Ag. | | | |
| | B | | Mound | Ag. | | | |
| | C | | Platform | Hab. (T) | | | |
| | D | | Modified Outcrop | Ag. | | | |
| 16555 | 203 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Enclosure | | | | |
| | C | | Modified Outcrop | | | | |
| 16556 | 204 | | Site Complex | Hab. (P) | D | H | Data Recovery |
| | A | | Terrace | | | | |
| | B | | Enclosure | | | | |
| | C | | Wall | | | | |
| 16557 | 205 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16558 | 206 | | Platform | Ag. | D | P | Data Recovery |
| 16559 | 207 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16560 | 208 | | Site Complex | Multi-function | D | P | Data Recovery |
| | A | | Platform | Hab. (T) | | | |
| | B | | Wall | Ag. | | | |
| | C | | Terrace | Ag. | | | |
| | D | | Modified Outcrop | Ag. | | | |
| | E | | Modified Outcrop | Ag. | | | |
| | F | | Platform | Hab. (T) | | | |
| 16561 | 209 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16562 | 210 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16563 | 211 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16564 | 212 | | Site Complex | Ag. | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Enclosure | | | | |
| 16565 | 213 | | C-Shape | Ag. | D | P | Data Recovery |
| 16566 | 214 | | Site Complex | Ag. | NLS | P | None |
| 16567 | 215 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16568 | 216 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16569 | 218 | | Site Complex | Multi-function | D,E | P | Preserve |
| | A | | Modified Blister | Hab. (T) | | | |
| | B | | Lava Blister | Hab. (T) | | | |
| | C | | Modified Blister | Hab. (T) | | | |
| | D | | Lava Blister | Burial | | | |
| 16570 | 219 | | Lava Tube/Petroglyphs | Burial | C,D,E | P | Preserve |
| 16571 | 220 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16572 | 221 | | Modified Outcrop | Ag. | D | P | Data Recovery |
| 16573 | 222 | | Lava Tube | Hab. (T) | D | P | Data Recovery |
| 16574 | 223 | | Platform | Hab. (P) | C,D | P | Preserve |
| 16575 | 224 | | Site Complex | Multi-function | D | P | Data Recovery |
| | A | | Platform-Enclosure | Hab. (P) | | | |
| | B | | Enclosure | Ag. | | | |
| 16576 | 225 | | Modified Outcrop | Ag. | D | P | Data Recovery |
| 16577 | 226 | | Pavement | Trail | D | P | Data Recovery |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance | Prob. Age | Recommended Treatment |
|---|---|---|---|---|---|---|---|
| 16578 | 228 | | Site Complex | Multi-function | D | P | Data Recovery |
| | A | | Terrace | Hab. (P) | | | |
| | B | | Enclosure | Pen | | | |
| 16579 | 229 | | Pahoehoe Basins | Salt Bowls | C,D | P | Preserve |
| 16580 | 231 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16581 | 232 | | Site Complex | Multi-function | D | P | Data Recovery |
| | A | | Terrace | Ag. | | | |
| | B | | C-Shape | Hab. (T) | | | |
| 16582 | 233 | | Lava Tube | Hab. (T) | D | P | Data Recovery |
| 16583 | 234 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16584 | 235 | | Modified Sink | Ag. | D | P | Data Recovery |
| 16585 | 236 | | Lava Tube | Burial | D,E | P | Preserve |
| 16586 | 237 | | Site Complex | Hab. (T) | D | P | Data Recovery |
| | A | | Modified Outcrop | | | | |
| | B | | Enclosure | | | | |
| 16587 | 241 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16588 | 242 | | Mound | Ag. | D | P | Data Recovery |
| 16589 | 243 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Lava Tube | | | | |
| | B | | Terrace | | | | |
| 16590 | 244 | | Modified Outcrop | Ag. | D | P | Data Recovery |
| 16591 | 245 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16592 | 246 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16593 | 247 | | Enclosure | Ag. | D | P | Data Recovery |
| 16594 | 248 | | Mound | Ag. | D | P | Data Recovery |
| 16595 | 249 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Platform | | | | |
| | B | | Enclosure | | | | |
| | C | | Enclosure | | | | |
| | D | | Enclosure | | | | |
| | E | | Lava Tube-Enclosure | | | | |
| 16596 | 250 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16597 | 251 | | Enclosure | Ag. | D | P | Data Recovery |
| 16598 | 252 | | Site Complex | Multi-function | C,D,E* | P | Preserve |
| | A | | Platform | Burial (prob.) | | | |
| | B | | Mound | Ag. | | | |
| | C | | Modified Outcrop | Indeterminate | | | |
| | D | | Ahu | Religious | | | |
| | E | | Modified Outcrop | Ag. | | | |
| | F | | Enclosure | Ag. | | | |
| | G | | Modified Outcrop | Ag. | | | |
| | H | | Modified Outcrop | Ag. | | | |
| | I | | Modified Outcrop | Ag. | | | |
| | J | | Enclosure | Ag. | | | |
| | K | | Enclosure | Ag. | | | |
| | L | | Enclosure | Hab. (P) | | | |
| | M | | L-Shape | Hab. (P) | | | |
| | N | | Modified Outcrop | Hab. (P) | | | |



TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance | Prob. Age | Recommended Treatment |
|---|---|---|---|---|---|---|---|
| | O | | L-Shape | Ag. | | | |
| | P | | Modified Outcrop | Ag. | | | |
| | Q | | Enclosure | Ag. | | | |
| 16599 | 253 | | Enclosure | Ag. | D | P | Data Recovery |
| 16600 | 254 | | Lava Tube | Hab. (P) | D | P | Data Recovery |
| 16601 | 255 | | Site Complex | Ag. | D | P | Data Recovery |
| 16602 | 256 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16603 | 257 | | Enclosure | Ag. | D | P | Data Recovery |
| 16604 | 258 | | Lava Blister | Burial | D,E | P | Preserve |
| 16605 | 259 | | Modified Blister | Hab. (T) | D | P | Data Recovery |
| 16606 | 260 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16607 | 261 | | Platform-Enclosure | Hab. (P) | D | P | Data Recovery |
| 16608 | 262 | | Lava Blister | Hab. (T) | D | P | Data Recovery |
| 16609 | 263 | | Lava Blister | Hab. (T) | D | P | Data Recovery |
| 16610 | 264 | | Site Complex | Multi-function | D,E* | P | Preserve |
| | A | | Platform | Burial (poss.) | | | |
| | B | | Modified Blister | Hab. (T) | | | |
| 16611 | 265 | | Site Complex | Multi-function | D,E | P | Preserve |
| | A | | Lava Blister | Burial | | | |
| | B | | Modified Blister | Burial (prob.) | | | |
| 16612 | 266 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16613 | 267 | | Site Complex | Hab. (P) | A,C,D | H | Preserve |
| | A | | Platforms | | | | |
| | B | | Terrace | | | | |
| | C | | Enclosure | | | | |
| | D | | Enclosure | | | | |
| | E | | Lava Blister | | | | |
| | F | | Enclosure | | | | |
| | G | | Lava Blister | | | | |
| | H | | Terrace | | | | |
| | I | | Platform | | | | |
| | J | | Pavement | | | | |
| | K | | Terrace | | | | |
| | L | | Terrace | | | | |
| | M | | Platform | | | | |
| 16614 | 268 | | Site Complex | Foundation | C,D | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16615 | 269 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Platform | | | | |
| | C | | Enclosure | | | | |
| | D | | Wall | | | | |
| | E | | Terrace | | | | |
| 16616 | 270 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16617 | 271 | | Mound | Burial (poss.) | D,E* | P | Preserve |
| 16618 | 273 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16619 | 274 | | Lava Blister | Hab. (T) | D | P | Data Recovery |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| 16620 | 275 | | Modified Outcrop | Burial (poss.) | D,E* | P | Preserve |
| 16621 | 276 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Enclosure | | | | |
| | C | | Platform | | | | |
| | D | | Enclosure | | | | |
| | E | | Enclosure | | | | |
| | F | | Modified Outcrop | | | | |
| 16622 | 279 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16623 | 280 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16624 | 281 | | Enclosure | Ag. | D | P | Data Recovery |
| 16625 | 282 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16626 | 283 | | Modified Outcrop | Ag. | D | P | Data Recovery |
| 16627 | 284 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16628 | 285 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Platform | | | | |
| 16629 | 286 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16630 | 287 | | Lava Tube/Petroglyphs | Burial | C,D,E | P | Preserve |
| 16631 | 288 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Modified Blister | | | | |
| 16632 | 289 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16633 | 290 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16634 | 291 | | Platform Remnant | Indeterminate | D | P | Data Recovery |
| 16635 | 292 | | Mound | Burial (poss.) | D,E* | P | Preserve |
| 16636 | 293 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Modified Outcrop | | | | |
| | B | | Enclosure | | | | |
| | C | | Lava Tube | | | | |
| | D | | Enclosure | | | | |
| | E | | Enclosure | | | | |
| | F | | Enclosure | | | | |
| | G | | Modified Outcrop | | | | |
| | H | | Enclosure | | | | |
| | I | | Platform | | | | |
| | J | | Enclosure | | | | |
| | K | | Modified Outcrop | | | | |
| | L | | Platform | | | | |
| 16637 | 294 | | Papamu | Gameboard | C,D | P | Preserve |
| 16638 | 295 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16639 | 296 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16640 | 297 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16641 | 298 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16642 | 299 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16643 | 300 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Terraces | | | | |



TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| 16644 | 301 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16645 | 302 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16646 | 303 | | C-Shape | Ag. | D | P | Data Recovery |
| 16647 | 304 | | Enclosure | Pen | D | P | Data Recovery |
| 16648 | 305 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16649 | 306 | | Enclosure | Ag. | D | P | Data Recovery |
| 16650 | 307 | | Site Complex | Ag. | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Terrace | | | | |
| 16651 | 308 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16652 | 309 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16653 | 310 | | Enclosure | Ag. | D | P | Data Recovery |
| 16654 | 311 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16655 | 312 | | Site Complex | Hab. (T) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16656 | 313 | | Terrace | Ag. | D | P | Data Recovery |
| 16657 | 314 | | Site Complex | Hab. (T) | D | P | Data Recovery |
| | A | | Terrace | | | | |
| | B | | Terrace | | | | |
| 16658 | 315 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16659 | 316 | | Enclosure | Pen | D | H | Data Recovery |
| 16660 | 317 | | Terrace | Ag. | D | P | Data Recovery |
| 16661 | 318 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16662 | 319 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16663 | 323 | | Platform | Hab. (P) | C,D | P | Preserve |
| 16664 | 324 | | Terrace | Ag. | D | P | Data Recovery |
| 16665 | 325 | | Terrace | Ag. | D | P | Data Recovery |
| 16666 | 327 | | Enclosure | Pen | D | P | Data Recovery |
| 16667 | 329 | | Site Complex | Ag. | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Modified Outcrop | | | | |
| | C | | Modified Outcrop | | | | |
| 16668 | 330 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16669 | 331 | | Terrace | Ag. | D | P | Data Recovery |
| 16670 | 332 | | Mounds | Ag. | D | H | Data Recovery |
| 16671 | 333 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16672 | 334 | | Terrace | Ag. | D | P | Data Recovery |
| 16673 | 335 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16674 | 336 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16675 | 337 | | Site Complex | Hab. (P) | A,C,D | H | Preserve |
| | A | | Platform | | | | |
| | B | | Enclosures | | | | |
| 16676 | 338 | | Lava Tube | Hab. (T) | D | P | Data Recovery |
| 16677 | 339 | | Lava Tube | Burial;Refuge | A,C,D,E | P | Preserve |
| 16678 | 340 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16679 | 341 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16680 | 342 | | Site Complex | Hab. (P) | D | P | Data Recovery |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| | A | | Platform | | | | |
| | B | | Enclosure | | | | |
| | C | | Platform | | | | |
| 16681 | 343 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Pavement | | | | |
| | B | | Terrace | | | | |
| 16682 | 344 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16683 | 345 | | Lava Tube | Well;Hab. (T) | C,D | PH | Preserve |
| 16684 | 346 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16685 | 347 | | Enclosure | Pen | D | P | Data Recovery |
| 16686 | 348 | | Platform | Ag. | D | P | Data Recovery |
| 16687 | 350 | | Lava Tube | Burial | C,D,E | P | Preserve |
| 16688 | 351 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| | C | | Wall | | | | |
| 16689 | 352 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16690 | 354 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Platform-Wall | | | | |
| | B | | Enclosure | | | | |
| | C | | Platform-Enclosure | | | | |
| | D | | Enclosures | | | | |
| 16691 | 355 | | Lava Tube | Burial;Refuge | D,E | P | Preserve |
| 16692 | 356 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16693 | 357 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16695 | 359 | | Enclosure | Hab. (P) | D | P | Data Recovery |
| 16696 | 360 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16697 | 361 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16698 | 362 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16699 | 364 | | Terraces | Ag. | D | P | Data Recovery |
| 16700 | 369 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16701 | 371 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16702 | 372 | | Site Complex | Multi-function | A,B,D | PH | Preserve |
| | A | | Platform | Store | | | |
| | B | | Platform Remnant | Hab. (P) | | | |
| | C | | Platform | Hab. (P) | | | |
| 16703 | 373 | | Site Complex | Heiau | A,D,E | P | Preserve |
| | A | | Platform | | | | |
| | B | | Terraces | | | | |
| | C | | Platforms | | | | |
| | D | | C-Shape | | | | |
| | E | | Platform | | | | |
| | F | | Platform | | | | |
| | G | | Platform-Wall | | | | |
| 16704 | 374 | | Platform | Hab. (P) | C,D | P | Preserve |
| 16705 | 375 | | Site Complex | Burial (poss.) | D,E* | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |



TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| 16706 | 376 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16707 | 377 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16708 | 378 | | Terrace | Ag. | D | P | Data Recovery |
| 16709 | 379 | | Mound | Burial (poss.) | D,E* | P | Preserve |
| 16710 | 380 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Platform | | | | |
| | B | | Enclosure | | | | |
| | C | | Enclosure | | | | |
| | D | | Platform | | | | |
| | E | | Terrace | | | | |
| | F | | Enclosure | | | | |
| | G | | Platform | | | | |
| | H | | Enclosure | | | | |
| | I | | Platform | | | | |
| | J | | Platform | | | | |
| 16711 | 381 | | Platform | Hab. (P) | D | P | Data Recovery |
| 16712 | 382 | | Platform | Hab. (P) | C,D | P | Preserve |
| 16713 | 383 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Platform | | | | |
| | B | | Wall | | | | |
| | C | | Enclosure | | | | |
| | D | | Pavement | | | | |
| | E | | Platform | | | | |
| | F | | Platform | | | | |
| | G | | Enclosure | | | | |
| 16714 | 384 | | Platform | Hab. (P) | C,D | P | Preserve |
| 16715 | 385 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| | C | | Wall | | | | |
| | D | | Wall | | | | |
| 16716 | 386 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| | C | | Wall | | | | |
| | D | | Terrace | | | | |
| 16717 | 388 | | Enclosures | Hab. (P) | C,D | P | Preserve |
| 16718 | 389 | | Site Complex | Burial (poss.) | D,E* | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| | C | | Platform | | | | |
| 16719 | 390 | | Enclosure | Heiau | D,E | P | Preserve |
| 16720 | 391 | | Enclosure | Ag. | D | P | Data Recovery |
| 16721 | 392 | | Site Complex | Burial (poss.) | D,E* | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16722 | 393 | | Mound | Burial (poss.) | D,E* | P | Preserve |
| 16723 | 394 | | Site Complex | Hab. (P) | D,E* | P | Preserve |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| | A | | Wall | | | | |
| | B | | Pavements | | | | |
| | C | | Enclosure | | | | |
| | D | | Enclosure | | | | |
| | E | | Wall | | | | |
| 16724 | 395 | | Platforms | Burial (prob.) | D,E* | P | Preserve |
| 16725 | 396 | | Site Complex | Burial (prob.) | D,E* | P | Preserve |
| 16726 | 397 | | Platform | Burial (prob.) | D,E* | P | Preserve |
| 16727 | 398 | | Platform | Burial (prob.) | D,E* | P | Preserve |
| 16728 | 401 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Enclosure | | | | |
| | B | | Terrace | | | | |
| | C | | Enclosure | | | | |
| | D | | Wall | | | | |
| | E | | Enclosure | | | | |
| | F | | Terrace | | | | |
| | G | | Platform | | | | |
| | H | | Platform | | | | |
| | I | | Platform | | | | |
| 16729 | 402 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16730 | 403 | | Alignments | Hab. (P) | C,D | P | Preserve |
| 16732 | 406 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16733 | 407 | | Site Complex | Hab. (P) | D | P | Data Recovery |
| | A | | Enclosure | | | | |
| | B | | Platform | | | | |
| | C | | Platform | | | | |
| 16734 | 408 | | Site Complex | Multi-function | D,E* | P | Preserve |
| | A | | Enclosure | Hab. (P) | | | |
| | B | | Platform | Burial (poss.) | | | |
| | C | | Platform | Hab. (P) | | | |
| 16735 | 409 | | Platform Remnant | Indeterminate | D | P | Data Recovery |
| 16736 | 410 | | Mound | Burial (poss.) | D,E* | P | Preserve |
| 16737 | 411 | | Enclosure | Ag. | D | P | Data Recovery |
| 16738 | 412 | | Lava Blisters | Ag. | D | P | Data Recovery |
| 16739 | 413 | | Site Complex | Ag. | D | P | Data Recovery |
| | A | | Lava Blister | | | | |
| | B | | Lava Blister | | | | |
| | C | | Lava Blister | | | | |
| 16740 | 415 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Wall | | | | |
| | B | | Platform | | | | |
| | C | | Platform | | | | |
| 16741 | 416 | | Site Complex | Multi-function | D,E | P | Preserve |
| | A | | Paved Depression | Hab. (P) | | | |
| | B | | Platform | Hab. (P) | | | |
| | C | | Platform | Hab. (P) | | | |
| | D | | Platform | Burial | | | |
| | E | | Modified Sink | Ag. | | | |



TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| | F | | Modified Sink | Ag. | | | |
| | G | | Enclosure | Hab. (P) | | | |
| | H | | Platform | Hab. (P) | | | |
| 16742 | 417 | | Site Complex | Ag. | C,D | P | Preserve |
| | A | | Enclosure | | | | |
| | B | | Enclosure | | | | |
| 16743 | 418 | | Site Complex | Burials | D,E | P | Preserve |
| | A | | Platform | Burial (prob.) | | | |
| | B | | Terrace | Burial (prob.) | | | |
| | C | | Platform | Burial | | | |
| 16744 | 419 | | Lava Blister | Ag. | D | P | Data Recovery |
| 16745 | 420 | | Site Complex | Multi-function | D,E* | P | Preserve |
| | A | | Platform | Hab. (P) | | | |
| | B | | Enclosure | Hab. (P) | | | |
| | C | | Terrace | Burial (prob.) | | | |
| | D | | Enclosure | Hab. (P) | | | |
| | E | | Terrace | Hab. (P) | | | |
| 16746 | 421 | | Site Complex | Multi-function | D,E* | P | Preserve |
| | A | | Enclosure | Hab. (P) | | | |
| | B | | Enclosures | Hab. (P) | | | |
| | C | | Wall | Hab. (P) | | | |
| | D | | Enclosure | Hab. (P) | | | |
| | E | | Modified Sink | Pen | | | |
| | F | | Pavement | Hab. (P) | | | |
| | G | | Alignment | Hab. (P) | | | |
| | H | | Pavement | Burial (poss.) | | | |
| | I | | Terrace | Hab. (P) | | | |
| | J | | Enclosure | Hab. (P) | | | |
| | K | | Terrace | Hab. (P) | | | |
| 16747 | 422 | | Platform | Hab. (P) | C,D | P | Preserve |
| 16748 | 423 | | Lava Blister | Hab. (T) | D | P | Data Recovery |
| 16749 | 424 | | Rock Shelter | Hab. (T) | D | P | Data Recovery |
| 16750 | 425 | | Rock Shelter | Hab. (T) | C,D | P | Preserve |
| 16751 | 426 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Terrace | | | | |
| | B | | Wall | | | | |
| | C | | Enclosure | | | | |
| | D | | Terrace | | | | |
| | E | | Terrace | | | | |
| 16752 | 427 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16753 | 428 | | Site Complex Remnant | Indeterminate | NLS | P | Data Recovery |
| 16754 | 429 | | Modified Outcrop | Hab. (T) | D | P | Data Recovery |
| 16755 | 430 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform-Enclosure | | | | |
| | C | | Platform-Enclosure | | | | |
| | D | | Platform | | | | |
| | E | | Platform | | | | |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| 16756 | 431 | | Site Complex | Multi-function | C,D,E* | P | Preserve |
| | A | | Enclosure | Hab. (P) | | | |
| | B | | Platform | Hab. (P) | | | |
| | C | | Platform | Hab. (P) | | | |
| | D | | Pavement | Hab. (P) | | | |
| | E | | Terrace | Hab. (P) | | | |
| | F | | Lava Tube | Hab. (P) | | | |
| | G | | Platform | Burial (prob.) | | | |
| | H | | C-Shape | Hab. (T) | | | |
| | I | | Pahoehoe Basins | Bait Cups | | | |
| | J | | Platforms | Hab. (P) | | | |
| | K | | Lava Blister | Hab. (T) | | | |
| | L | | Platform | Hab. (P) | | | |
| | M | | Terrace | Hab. (P) | | | |
| | N | | Enclosure | Hab. (P) | | | |
| | O | | Platform | Hab. (P) | | | |
| | P | | Pavement | Hab. (T) | | | |
| | Q | | Enclosure | Hab. (P) | | | |
| | R | | Platform | Hab. (T) | | | |
| 16757 | 432 | | Site Complex | Shrine | C,D,E | P | Preserve |
| | A | | Platform | | | | |
| | B | | Platform | | | | |
| 16758 | 433 | | Site Complex | Multi-function | C,D,E* | P | Preserve |
| | A | | Platform | Burial (poss.) | | | |
| | B | | Platform | Hab. (P) | | | |
| | C | | Platform | Heiau (poss.) | | | |
| | D | | Platform | Hab. (P) | | | |
| | E | | Platform-Enclosure | Hab. (P) | | | |
| | F | | Platforms | Hab. (P) | | | |
| | G | | Modified Sink | Ag. | | | |
| | H | | C-Shape | Hab. (P) | | | |
| | I | | Lava Blister | Hab. (T) | | | |
| | J | | Enclosure | Hab. (P) | | | |
| | K | | Enclosure | Heiau (poss.) | | | |
| 16759 | 434 | | Site Complex | Hab. (T) | D | P | Data Recovery |
| | A | | Terrace | | | | |
| | B | | Wall | | | | |
| 16760 | 435 | | Platform | Burial (poss.) | D,E* | P | Preserve |
| 16761 | 436 | | Site Complex | Multi-function | C,D,E* | P | Preserve |
| | A | | Enclosure | Hab. (P) | | | |
| | B | | Platform | Hab. (P) | | | |
| | C | | Platform | Hab. (P) | | | |
| | D | | Pahoehoe Basins | Salt Bowls | | | |
| | E | | Enclosure | Hab. (T) | | | |
| | F | | Enclosure | Hab. (P) | | | |
| | G | | Terrace | Hab. (P) | | | |
| | H | | Pavement | Hab. (P) | | | |
| | I | | Terrace | Burial (prob.) | | | |



TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| | J | | Terrace | Burial (prob.) | | | |
| | K | | Terrace | Burial (poss.) | | | |
| | L | | Modified Outcrop | Burial (poss.) | | | |
| | M | | Modified Sink | Hab. (T) | | | |
| | N | | Pavement | Hab. (P) | | | |
| | O | | Modified Sink | Hab. (T) | | | |
| | P | | Alignment | Indeterminate | | | |
| 16762 | 437 | | Site Complex | Heiau | C,D,E | P | Preserve |
| | A | | Platform | | | | |
| | B | | Pavement | | | | |
| 16763 | 438 | | Site Complex | Multi-function | D,E* | P | Preserve |
| | A | | Terrace | Burial (poss.) | | | |
| | B | | Wall | Hab. (T) | | | |
| | C | | Platform | Burial (poss.) | | | |
| 16764 | 439 | | Site Complex | Burial (poss.) | D,E* | P | Preserve |
| | A | | Terrace | | | | |
| | B | | Terraces | | | | |
| 16765 | 440 | | Site Complex | Hab. (T) | D | P | Data Recovery |
| | A | | Pavement | | | | |
| | B | | Enclosure | | | | |
| 16766 | 441 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Platform | | | | |
| | B | | Terrace | | | | |
| | C | | Enclosure | | | | |
| 16767 | 442 | | Site Complex | Multi-function | D,E* | P | Preserve |
| | A | | Enclosure | Hab. (P) | | | |
| | B | | Terrace | Burial (poss.) | | | |
| | C | | Platform Remnant | Indeterminate | | | |
| 16768 | 443 | | Site Complex | Multi-function | D,E* | P | Preserve |
| | A | | Enclosure Remnant | Indeterminate | | | |
| | B | | Terrace | Burial (poss.) | | | |
| | C | | Alignment | Hab. (P) | | | |
| 16769 | 444 | | Walls | Ag. | D | P | Data Recovery |
| 16770 | 445 | | Terrace | Hab. (T) | D | P | Data Recovery |
| 16771 | 446 | | Site Complex | Hab. (P) | C,D | P | Preserve |
| | A | | Enclosure | | | | |
| | B | | Platform | | | | |
| 16772 | 447 | | Site Complex | Multi-function | D,E | P | Preserve |
| | A | | Mound | Burial | | | |
| | B | | U-Shape | Hab. (T) | | | |
| 16773 | 448 | | Enclosure | Hearth | NLS | P | Data Recovery |
| 16774 | 449 | | Enclosure | Hab. (T) | D | P | Data Recovery |
| 16775 | 450 | | Enclosure | Hab. (P) | C,D | P | Preserve |
| 16776 | 451 | | Enclosure | Hab. (P) | C,D | P | Preserve |
| 16777 | 452 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16778 | 453 | | Platform | Hab. (T) | D | P | Data Recovery |
| 16779 | 454 | | Rock Shelters | Hab. (T) | C,D | P | Preserve |
| 16780 | 455 | | Platform-Enclosure | Hab. (P) | C,D | P | Preserve |

TABLE 1 (continued)

| State Site # (50-10-37-) | CSH Site #/ Feature | PHRI Site # | Formal Site Type | Functional Interpretation | Significance * | Prob. Age * | Recommended Treatment * |
|---|---|---|---|---|---|---|---|
| 16781 | 456 | | Enclosure | Pen | D | P | Data Recovery |
| 16782 | 457 | | Terrace | Hab. (P) | D | P | Data Recovery |
| 16783 | 458 | | Platform | Hab. (P) | C,D | P | Preserve |
| 16784 | | | Lava Tube | Burial | D,E | PH | Preserve |
| 16785 | | | Lava Tube | Refuge;Hab.(P) | A,C,D | P | Preserve |
| 16786 | | | Platform | Heiau | A,C,D,E | P | Preserve |
| 16787 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16788 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16789 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16790 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16791 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16792 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16793 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16794 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16795 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16796 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16797 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16798 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16799 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16800 | | | Wall | Boundary/Ag. | D | PH | Preserve (S) |
| 16801 | | | Enclosure | Pen | C,D | PH | Preserve |
| 16802 | | | Enclosure | Pen | C,D | PH | Preserve |

KEY

A Site reflects major trends or events in the history of the state or nation.
B Site is associated with the lives of persons significant in our past.
C Site is an excellent example of a site type.
D Site may be likely to yield information important in prehistory or history
E Site has cultural significance; probable religous structures and/or burials present.
E* Site is a possible burial.
NLS Site is no longer significant.
(P) Permanent
(T) Temporary
(S) Selective
Ag. Agricultural
Hab. Habitation
(Poss.) Possible
(Prob.) Probable
P Prehistoric
PH Prehistoric/Historic
CSH Cultural Surveys Hawaii
PHRI Paul H. Rosendahl, Inc.
* Designations within these collumns are assigned by site and not by feature. These designations are a compulation of all feature designations within the site.



## II. PROJECT AREA DESCRIPTION

The overall project area consists of approximately 1,540 acres (3803.8 hectares) in the *ahupua'a* of Onouli 1, Kalukalu, Kanakau, 'Ilikahi, Ke'eke'e 1, Ke'eke'e 2, Halekii, Kanaueue, Hokukano 1, Hokukano 2, Honuaino 3, and Honuaino 4. The project area lies within the boundary districts of both north and south Kona. It is situated on the lower western slope of Mauna Loa between sea level to 1,245 ft. (379.6 m.) above mean sea level. Rainfall averages between 40 and 50 inches a year (Armstrong 1973); prevailing winds are from the southwest.

There are at least two fresh water sources within the project area consisting of one historically constructed well and one subterranean pond within a lava tube.

The terrain is undulating and consists of two classifications of soil: Waiaha extremely stony silt loam (6-12% slopes), representing the Waiaha series of shallow, well-drained silt loams; and Kainaliu very stony silty clay loam (12-20% slopes), representing the Kainaliu series of well-drained silty clay loams (Soil Conservation Service 1973).

Exotic species of vegetation - including koa haole (*Leucaena glauca*), kiawe (*Prosopis pallida*), guinea grass (*Panicum maximum*) and other pasture grasses - dominate the project area. Other less prevalent exotic species include monkey-pod (*Samanea saman*), mango (*Mangifera indica*), papaya (*Carica papaya*), guava (*Psidium guajava*), coffee (*Coffea arabica*), Christmas-berry (*Schinus terebinthifolius*), hibiscus (*Hibiscus* sp), cat's claw (*Macfadyena ungius-cati*), and lantana (*Lantana camara*). Indigenous or Polynesian-introduced species - observed in considerably fewer numbers - include scattered stands of *'ilima* (*Sida fallax*), *noni* (*Morinda citrifolia*), kukui (*Aleurites moluccana*), kamani (*Calophyllum inophyllum*), and ti (*Cordyline terminalis*).

Pu'u Ohau, located in the center of the project area, was formed by littoral explosions where lava flows from the southwest rift of Mauna Loa entered the sea. Also called "Red Hill", it is a commonly used landmark for the numerous fishing vessels frequenting the coast.

## III. HISTORICAL DOCUMENTARY RESEARCH

by Helen Wong-Smith

The project area falls within ten separate *ahupua'a* in the North and South Kona districts of the island of Hawai'i. The *ahupua'a* of Hokukano, Honua'ino, Kanaueue are located in North Kona, while the *ahupua'a* of Haleki'i, 'Ilikahi, Kalukalu, Kanakau, Ke'eke'e, Keopuka and Onouli, in South Kona. It is interesting to note that the *ahupua'a* of 'Ilikahi is not distinguished on the most recent USGS map (1982), although it is located on earlier maps between the *ahupua'a* of Ke'eke'e and Kanakau.

A general overview of traditional (mythological) references and early historical accounts of the lands in which the project area is situated will be presented. Information concerning the individual *ahupua'a* will follow, including previous archaeological work, Land Commission Award (LCA) and other land tenure data, with any pertinent information regarding the specific area.

### TRADITIONS

The god Lono is identified with Kona, Hawaii, and is said to have introduced the main food plants - taro, sweet potato, yams, sugar cane, and bananas - to Hawaii, as well as *'awa*. The makahiki festival and the rituals for inducing rainfall and fertility centered in Kona comes out clearly in the following description:

> The most interesting mythological and legendary materials relating to Kona have to do directly or indirectly with Lono....The story of the origin of the Makahiki rain and harvest festival, bring Lono from Kahiki, whither he returns. From Kona we have the written record of a myth of Kumuhonua, [Earth Foundation, 36 generations before Wakea and Papa, who was the first man fashioned by the gods] whose writer says that Lono was a fisherman and yet ends his story by stating that the events related occurred before men peopled the earth. Lono is credited with introducing the main food plants, taro, breadfruit, yams, sugar cane and bananas to Hawaii and also 'awa. Hogs were likewise identified with Lono, but there is no mention of his having brought them to Hawaii. (Handy and Handy 1972:522)

John Papa Ii, historian and a member of the Kamehameha II's court, gives the



following tale of a canoe paddler with super-human strength who lived during the reign of Kamehameha I. Keopuka is referenced in this legend:

> Akalele, a man famous for his paddling strength, is said to have come from Kauai and to have lived with our first king. One night the king left Kawaihae and set forth with his double canoes. Daylight found his company outside of Kekaha, and they rested a little while at Kailua. Akalele was alone on a single canoe about 6 fathoms long and filled with baskets of sweet potatoes, fowls, dogs, and such gifts as people brought who came to see the king on the beach in Kona. When they arrived at Kahaluu, or Keauhou perhaps, the single canoe began to race with the double ones, to see which could first reach their goal, Awili in Kaawaloa. So they raced, the king with his canoe paddlers, Akalele alone. Although the single canoe was loaded with goods, the king desired this race....After they passed Keopuka and reached Kahaemano at Kaawaloa, they again turned shoreward. Near the harbor of Awili, where there is a narrow channel only large enough for a single canoe, the king called out, "O Akalele, turn your canoe into the narrow entrance! Glide in on a wave!" Akalele did as he was told and was first to arrive at Awili. The others took the longer way around and found him there carrying the things ashore. The king helped Akalele because he was a stranger (Ii 1959:131-2).

### EARLY HISTORICAL ACCOUNTS

E.S. Craighill and Elizabeth Handy provide insight into the native agriculture in North Kona. Unfortunately, they focus on the uplands of North Kona, specifically to the north of the subject *ahupua'a*, that of Kamehameha I's plantation:

> In North Kona dry taro flourishes only in the uplands, which are now largely given over to ranching, though some Hawaiians still have taro plantations above Kalaoa...
>
> In the uplands above Kahalu'u, Keauhou, and Kailua, was a vast plantation named Kuahewa (huge), belonging to Kamehameha I. To protect these lands, which were cultivated for his people in the section, Kamehameha established the law that anyone who took one taro or one stalk of sugar cane must plant one cutting of the same in its place. Weary of war in 1812, Kamehameha went to Kuahewa and himself worked as a farmer. "This land that Kamehameha farmed is in the upland of Kailua, in Kaopua...on Honua'ula, on the hill called Paoloa and by the spring Waiakauhi" (*Hoku o Hawaii*, May 3, 1927). (Handy and Handy 1972: 523-524)

In 1849, an article in The Polynesian described the cultivation techniques used by Hawaiians:

> In cultivating the uplands, natives do not generally think of breaking up the whole surface of the soil; but only a spot here and there, where the seed, whether it be potatoes, bananas, cane or any other, is there deposited and [they] leave the

intermediate space to be wrought afterwards. (*An Old Farmer* 1849, in Kelly & Barrere 1980:41).

In the following excerpt, Handy and Handy (1972) describe native Hawaiian agriculture in the South Kona District, with liberal use of citations from early European visitors. Included are elevations of the various cultivated zones:

> In time of intensive native cultivation, South Kona was planted in zones determined by rainfall and moisture. Near the dry seacoast potatoes were grown in quantity, and coconuts where sand or soil among the lava near the shore favored their growth. Up to 1,000 feet grew small bananas which rarely fruited, and poor cane; from 1,000 to 3,000 feet, they prospered increasingly. From approximately 1,000 to 2,000 feet, breadfruit flourished (Handy & Handy 1972:524-5).
>
> Taro was planted dry from an altitude of 1,000 to approximately 3,000 feet. An old method of planted taro in Kona, described to us by Lakalo at Ho'okena, was to plant the cuttings in the lower, warmer zone where they would start to grow quickly and then to transplant them to the higher forest zone where the soil was rich and deep and where moisture was ample for their second period of growth, in which their corms are said to have developed to an average of 25 pounds each (*Ibid*:525).
>
> Above Ka'awaloa [ahupua'a abutting Keopuka to the south] some of Cook's officers saw the plantations in the intermediate zone. Cook (1784, Vol. 3 pp. 106-107) says that their plantations were divided from each other by thick, low walls of lava and that there they found the breadfruit trees, plantains, taro root, sweet potatoes, ginger root, and sugar cane...Ellis, surgeon with Captain Cook in 1778, writes of the country above Kealakekua (Ellis, 1783, Vol. 2 pp. 91-96):
>
> > After ascending part of the hill, which was covered in every direction with plantations of sugar-cane, sweet-potatoes, tarrow, plantains, and breadfruit trees (which were by far the largest they had seen) they arrived at a spot of land entirely uncultivated, and overrun with long grass and ferns...they arrived at a long tract of plantain-trees, which far exceed the cultivated ones in size; they produce fruit like them, but it never arrives at perfection...but they took a different route to their former one, proceeding nearly in a W.N.W. direction, through innumerable plantations of the paper mulberry-tree, breadfruit, and plantain trees, which formed an extensive garden. (*Ibid*: 525)

The same region which includes the subject *ahupua'a* is described in detail by Archibald Menzies, a surgeon and naturalist, who accompanied Captain George Vancouver in 1793. The entry provides insight to coastal terrain:

> The forenoon was spent in arranging and equipping the party before we left the village [Kaawaloa], and as our route lay directly back from it, over a dry barren rocky country, up a steep ascent...The tract which extended along shore, if we might judge from its appearance and our knowledge of that which we had already traveled over, we



> were ready to pronounce a dreary naked barren waste, if we except a few groves of cocoa palms here and there near the villages. But that which stretched higher up along the verge of the woods from the manner it was industriously laid out in little fields, exhibited a more pleasing and fertile appearance...On leaving this station, we soon lost sight of the vessels, and entered their breadfruit plantations, the trees of which were a good distance apart, so as to give room to their boughs to spread out vigorously on all sides, which was not the case in the crowded groves of Tahiti, where we found them always planted on the plains along the sea side. But here the size of the trees, the luxuriance of their crop and foliage, sufficiently show that they thrive equally well on an elevated situation. The space between these trees did not lay idle. It was chiefly planted with sweet potatoes and rows of cloth plant. As we advance beyond the bread-fruit plantation, the country became more and more fertile, being in a high state of cultivation. For several miles round us there was not a spot that would admit of it but what was with great labor and industry cleared of the loose stones and planted with esculent roots or some useful vegetable or other. In clearing the ground, the stones are heaped up in ridges between the little fields and planted on each side, either with a row of sugar cane or the sweet [ti] root of these islands where they afterwards continue to grow in a wild state, so that even these stony, uncultivated banks are by this means made useful to the proprietors, as well as ornamental to the fields they intersect.
>
> The produce of these plantations, besides the above mentioned, are the [*wauke*] cloth plant...taro and sweet potatoes.
>
> The land here is divided into plantations, called ili, which take their rise at the sea side and proceed up the country, preserving a certain breadth without any limitations, or as far as the owner chooses to cultivate them, and without the protection either of high walls or gates (Menzies 1920:74-77).

Traversing the subject *ahupua'a* while traveling from Hualalai toward Kaawaloa, Menzies' party descended out of the forest and he noted:

> ...we found the lower edge of it [the forest] as in other places, adorned with rich plantations of plantains and bananas....We came to a village among the upper plantations, where we took up our residence for the night about nine or ten miles north-east of Kealakekua Bay, and where we were surrounded by the most exuberant fields of the esculent vegetables of these islands, which for industry of cultivation and agricultural improvements could scarcely be exceeded in any country in the world, and we were happy to find their labor here rewarded by such productive crops of these vegetables (*Ibid*: 167-168).

In 1823, Rev. William Ellis toured the island of Hawai'i and kept a journal that is a valuable guide to Hawaiian culture and geographical features. In his comparison of the north and south portions of Kona, then a single district, he writes:

> Kona is the most populous of the six great divisions of Hawaii, and being situated on the leeward side, would probably have been the most fertile and beautiful part of the

island, had it not been overflowed by floods of lava...[It] extends along the western shore between seventy and eighty miles, including the irregularities of the coast.

The northern part, including Kairua, Kearake'kua and Honaunau, contains a dense population, and the sides of the mountain are cultivated to a considerable extent; but the south part presents a most inhospitable aspect. Its population is thin, consisting principally of fishermen, who cultivate but little land, and that at the distance of from five to seven miles from the shore (Ellis 1963:126).

It is interesting that reports of South Kona vary so greatly in respect to land utilization. It is not unlikely that Ellis was commenting on the coastal area of South Kona, an area destitute to the westerner's eye.

In regards to coastal cultivation, Handy and Handy state: "Wherever a little soil could be heaped together along the dry lava coast of North Kona, a few sweet potatoes were planted by fishermen..." (1972:527). Handy and Handy also report that sweet potatoes were the staple in lowland localities where there was sandy soil, as at Kailua, Honaunau, Kelia and Ho'okena (*Ibid*:526).

The plantations spoken of by these early visitors were a part of what would later be known as the Kona Field System. The project area lies within the boundaries established for the Kona Field System (Hawaii Register of Historic Places 50-10-37-6601). T. Stell Newman studied these fields and concluded that the Kona Field System was the most extensive and monumental work of ancient Hawai'i. Newman's reconstruction for the 1778-1823 period and Kelly's (1983) research indicate without a doubt that the Kona Field System continued to function into the mid-1800s, when the Mahele took place.

Newman suggests that this system continued northward from Kealakekua to include the area in back of Kailua town and slightly beyond that. He estimated the overall size of the cultivated lands as approximately 3 miles wide by 18 miles long (Kelly 1983:73). It should be acknowledged that a cultivated area of this magnitude would have a sizable impact on the climate in Kona (Kelly pers. comm. 1/14/92).

Additional evidence of the existence of the field system was given by earlier visitors to



the Kona area. In addition to Menzies, an earlier visitor, John Ledyard, wrote in his journal about the trip into the uplands back of Kealakekua Bay and northward toward Kailua. Going in a northeasterly direction from Kealakekua Bay in 1779, Ledyard described the land as a plain of little enclosures separated from each other by low broad walls. He noticed that most of these fields were planted with sweet potatoes and suggested that they were the principal crop. He also noted many breadfruit forests, and patches of sugar cane along the plains of Kona up to about 3 miles from Kailua town (Kelly 1983:71-72).

The following information was gleaned from the Feature Description Form, for the purpose of nominating the Kona Field System to the Hawaii Register of Historic Places (HRHP), which has also been declared eligible for the National Register of Historic Places. The observations of these early westerners were matched to specific land areas and analyzed according to modern environmental data to determine the characteristics controlling the agriculture. The following subzones for the Kona Field System were developed:

Sweet Potato/Wauke Zone
Elevation: Sea level to about 500 feet
Annual Rainfall: Seasonal; 30 to 50 inches
Crops: Sweet potatoes and wauke grown in very rocky areas.

Breadfruit/Sweet Potato/Wauke Zone
Elevation: 500 to 1,000 feet
Annual Rainfall: 30 to 60 inches
Crops: Breadfruit trees, with sweet potatoes and wauke planted between them.

Sweet Potato/Dry Land Taro Zone
Elevation: 1,000 to 2,500 feet
Annual Rainfall: 60 to 80 inches
Crops: no breadfruit trees; sweet potatoes in the lower part, dry land taro in the upper part; field boundaries planted with ti and sugar cane.

Plantains and Banana Zone
Elevation: 2,000 to 3,000 feet
Annual Rainfall: 80 to 100 inches
Crops: bananas and plantains planted just below and within the forest.

## MAHELE AND SUBSEQUENT LAND SALES

In 1848, during the reign of Kamehameha III, the traditional Hawaiian land ownership system was replaced with a more Western-style system. This radical restructuring was called The Great Mahele (division). The Mahele separated and defined the undivided land interests of the King and the high-ranking chiefs, and the *konohiki*, who were in charge of tracts of land on behalf of the king or chief (Chinen 1958:vii and Chinen 1961:13). More than 240 of the highest ranking chiefs and *konohiki* in the kingdom joined Kamehameha III in this division. The first mahele was signed on Jan. 27, 1848 by Kamehameha III and Princess Victoria Kamamalu, and by her guardians Mataio Kekuanaoa and Ione Ii. The last mahele was signed by the King and E. Enoka on March 7, 1848 (Chinen 1958:16).

The mahele did not convey any title to any land. The chiefs and *konohiki* were required to present their claims to the Land Commission to receive awards for the lands quitclaimed to them by Kamehameha III. They were also required to pay commutations to the government in order to receive royal patents on their awards. Until an award was issued, title remained with the government. Because of the lack of surveyors at the time of the Mahele, the lands were identified by name only, with the understanding that the ancient boundaries would hold until a survey of such lands could be made. This expedited the work of the Land Commission and speeded the transfer. These awarded lands became known as Konohiki Lands (Chinen 1961:13).

During this process all land was placed in one of three categories: King's Land (In 1865, during the reign of Kamehameha V, these were renamed "Crown" land in order to prevent Dowager Queen Emma from retaining lands held by her husband Kamehameha IV, thus making them the property of the occupant of the throne), Government Lands, and Konohiki Lands. These were all "subject to the rights of native tenants," (Laws of Hawaii, 1848:22). Native tenants were the commoners who lived and worked the land for their subsistence.



The Kuleana Act of 1850 permitted the Land Commissioners to issue awards to the farmers for houselots and gardens cultivated by them for their own subsistence only, providing the claimants had fulfilled all other legal requirements, such as making a written application before February 14, 1848, having two witnesses give sworn testimony regarding applicant's past occupation and use of the land for an extended period, and having no counter claims made by others (Kelly 1971:6). The parcels for house and garden purposes became known as *kuleana* (responsibility). Until its dissolution on Mach 31, 1855, the Land Commission issued thousands of awards to native tenants for their *kuleana*; even so, less than 30,000 acres of land were awarded to the native tenants as Kuleana Lands.

The ali'i and commoners had to file a claim to Quiet Land Titles with the Board of Commissioners, usually referred to as the Land Commission. When such a claim was filed, a Land Commission Award, (LCA) was assigned and upon payment of a fee, a Royal Patent was awarded (Erikson 1980:9).

In the *Register* and *Testimony* records for the subject *ahupua'a*, the most often mentioned crop is taro (29 times) followed by potatoes (13) and sweet potatoes (7), coffee (6), gourds (5), hala trees (4), bananas (2) orange trees (2), Loulu (2), Kou tree (1), and Hau tree (1). In view of the predominance of taro and potatoes, it appears that most of the planting was carried on in the Sweet Potato/Dry Land Taro Zone. The elevation of this zone corresponds to the elevation of the inland clusters of awards. Crop walls are a feature of the Kona Field System. This could account for the walls shown on the 1924 USGS maps for the area. Figure 5 is a compilation of an 1891 map by Emerson and modern tax key maps providing the location of various large LCAs and grants, as well as the names for places along the coast including the house sites of prominent individuals.

Tables in Appendix C of this report list the LCAs within the subject *ahupua'a* and note the crops and land use for the parcels.

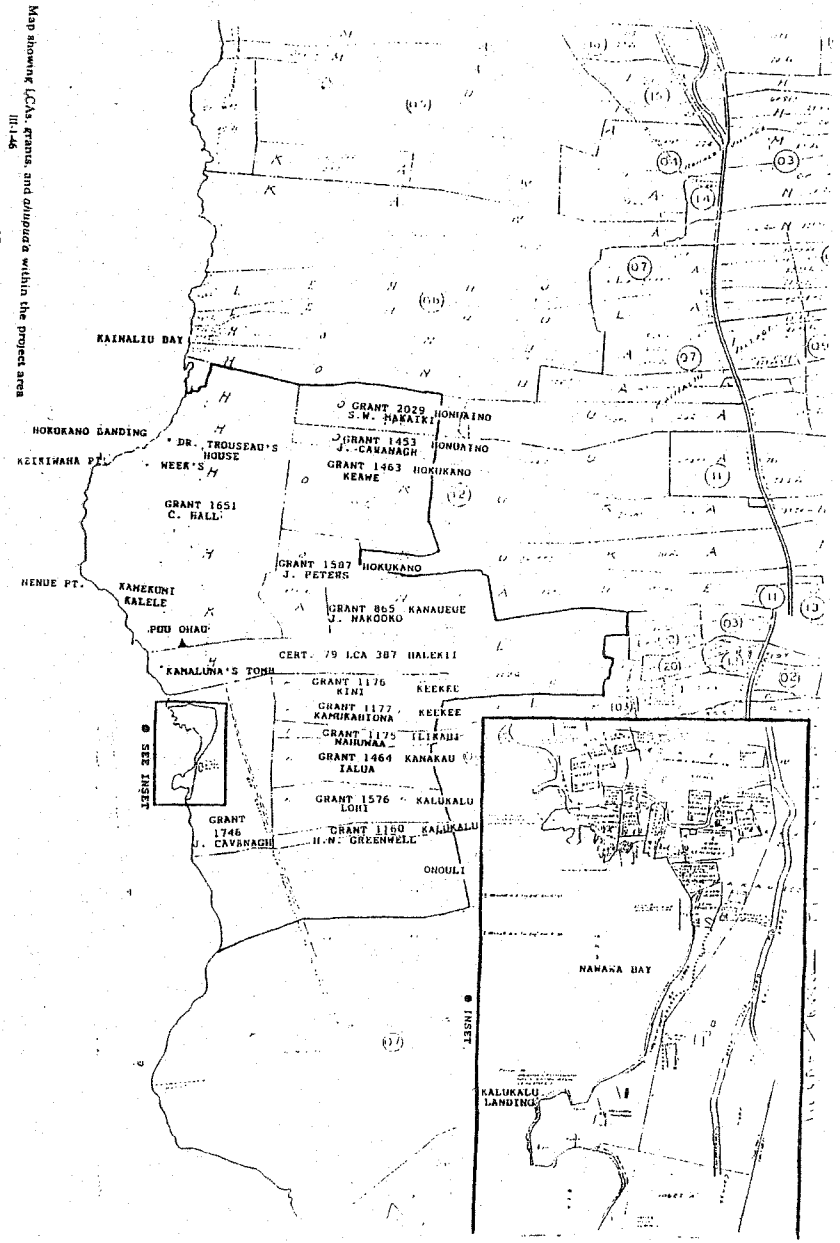



Fig. 5 Map showing LCAs, grants, and *ahupua'a* within the project area



## HISTORY OF INDIVIDUAL *AHUPUA'A*

In addition to the information that can be gleaned from the LCA tables mentioned above, the following information regarding the individual *ahupua'a* was obtained from the Kona Historical Society. The subject *ahupua'a* are presented in geographical order, north to south, starting with Honua'ino 1 to 4. Figure 5 above provides the location of many of the places covered in the following descriptions.

### Honua'ino

The *ahupua'a* of Honua'ino, is divided into four sections. This is most likely a historic, rather than an ancient, division to facilitate granting of parcels during the 19th century. Honua'ino literally means "bad lands," referring to the fact that this was the only place without a canoe landing (Pukui 1974:51). Kona historian Jean Greenwell disagrees, citing that a better translation would be "no good canoe landing," as the inlet called *Awa Kaleopa* was used by the Ho'omanawanui family as recently as the 1930s. A proverb: "Kona Honua-'ino," *Kona, [the] Bad Land.* is said humorously of Kona (Pukui 1983:#1841).

The earliest historic reference to Honua'ino is from native historian Samuel Kamakau who writes: "After the death of Captain Cook, the departure of his ship, Kalaniopu'u moved to Kainaliu near Honuaino" (Kamakau 1961:105). The next reference to Honua'ino is found in Rev. Ellis' journal as he toured the island of Hawai'i in 1824:

> ...where we sat down on the side of a canoe, under the shade of a fine spreading hibiscus and begged a little water of the villagers. We had not remained many minutes, before we were surrounded by about one hundred and fifty people. (Ellis 1963:81-82)

Ellis also noted the location of a *heiau* located inland of a little bay in Honua'ino. for the shark god named Ukanipo.

> On the top of a high mountain, in the neighborhood stood the remains of an old heiau, dedicated to Ukanipo, a shark, to which, we were informed all the people along the coast, for a considerable distance used to repair, at stated times, with abundant

offerings (1963:82).

According to Jean Greenwell there are many Hawaiian remains in this area as there are all along this coast. It has been estimated that around 3,400 people lived along the shore between Keauhou and Ka'awaloa in 1825. The missionary census in 1836 records almost 1,000 people, including children, living between Honalo, and Hokukano. Except for introduced vegetation, such as the kiawe tree and ekoa, this coast line probably appears very much like it did in the mid 1800s.

A well known coastal area is Kainaliu, which falls within the *ahupua'a* of Lehu'ula, Honua'ino and Hokukano. A proverb mentions Kainaliu:

> Ka Hau o Ma'ihi. *The Hau [breeze] of Ma'ihi.*
>
> Refers to Ma'ihi, Kona, Hawai'i. Because this locality was named for Ma'ihi-ala-kapu-o-Lono, daughter of the god Lono-a-ipu, this wind was regarded as sacred and did not blow beyond Kainaliu and Keauhou (Pukui 1983:#1303).

In addition to Ellis' account above, a visitor by the name of S.S. Hill visited Kainaliu in 1850s. He walked from Ka'awaloa and said they were warmly entertained and ate bananas, breadfruit, coconuts and fish in the company of laughing women, wondering children and good natured old folks.

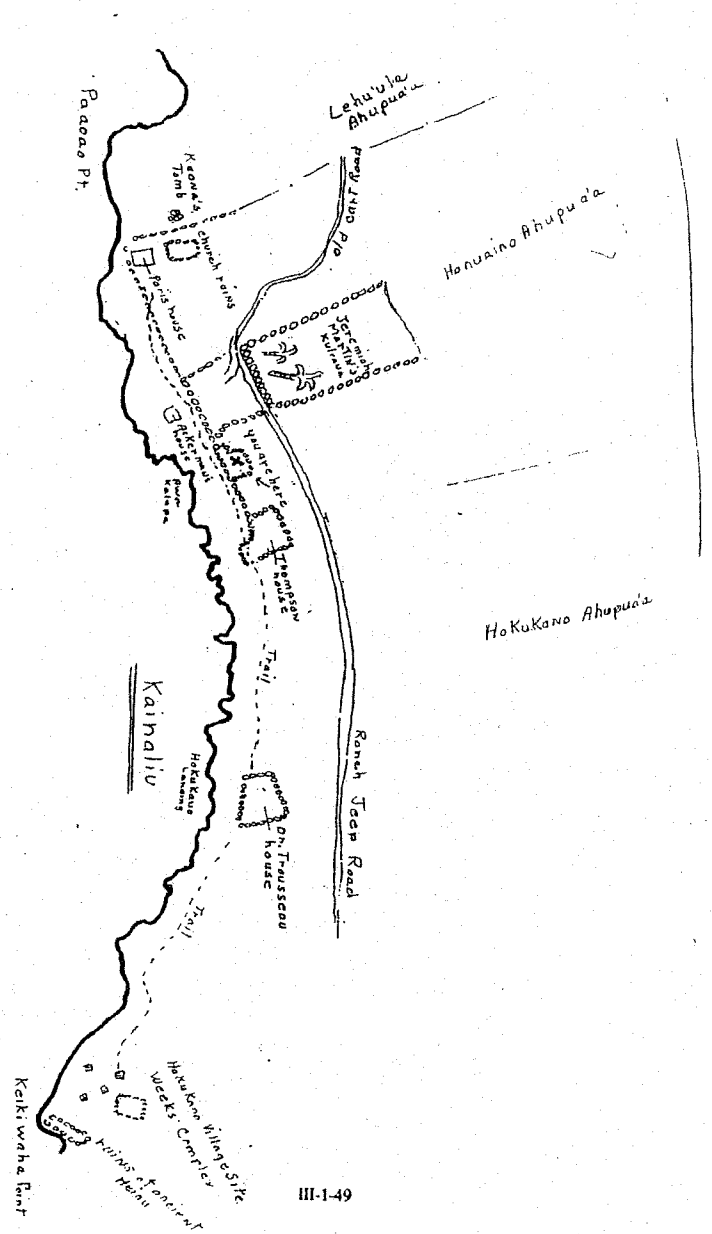
The tax maps (TMK: 7-9-06 and 7-9-12) show a cluster of five awards (LCAs 3659, 5561:1, 5561:2, 5561-BB:2, 5561-C:2, 5592:1) along the seacoast in the Kainaliu Beach area. LCAs 3659 and 5561-BB:2 were house lots. It is difficult to tell from the *Registers* and *Testimonies* if the remaining LCAs had dwellings on them.

The following information on the Kainaliu Beach area is taken from Jean Greenwell's Boat Tour narrative and Kainaliu Beach Historic Tour. Fig. 6 is the map that accompanies the Kainaliu Beach Historic Tour and gives the location of the sites mentioned by Mrs. Greenwell. Sites specific to Honua'ino are presented here:

> This was a sizable village at one time and several *kuleana* awards were made here. The Ackerman house is on the point. Norman and my house is built on an old



Fig. 6 Kainaliu Beach Tour map provided by Jean Greenwell



*kuleana*. The Thompson's house is also built on a *kuleana* that had been in their family for many years.

Kainaliu was probably the name of one particular spot along this bay, but today the bay and village are known as Kainaliu. One meaning of the name, Kainaliu is to bail the bilge Perhaps this bay was a calm place to bail canoes after rounding Keawekaheka Point.

Jeremiah Martin was a well known resident of Kainaliu in the mid 1800s. His home was located *ma uka* of the road behind the old coconut grove. When Chester Lyman visited here in 1846, Jeremiah was the captain of the sailing vessel "Keoua". Lyman considered him a very clever captain and said "...A little beyond Kainaliu we saw our vessel the "Keoua" putting in for passengers, this being the captain's residence." Jeremiah would later build a church at Kainaliu and preached in it himself.

The old Johnson home is still visible. William Johnson was one of the early foreign settlers in Kona. The Paris family have a beach home here. [It was near their home that the previous passage by William Ellis took place.] Behind the Paris' house are the remains of an uncompleted church and an empty tomb. These were built in 1868 by a man name Kaona. Kaona was labeled, "The Rebel", a "Religious Fanatic", The Second Adventist" and by one newspaper of the time "The Crazy Prophet of Kona". Kaona, born in Kona, received a good education at Hilo Boarding School and Lahainaluna and had formerly been a magistrate in Honolulu. At some point he felt himself possessed with miraculous powers. When still in Honolulu he had kept the body of a dead neighbor several days with the intent of bringing it back to life. For this act, he spent some time in an asylum.

When he returned to Kona, he attended the services held by the missionary, Rev. Paris, held in the newly built Lanakila Church located *mauka* in Kainaliu. Around this time there were a series of severe earthquakes in Kona, which may have been the reason Kaona began to preach the immediate second coming of the Lord and soon gathered several hundred followers. He proclaimed that those who stayed in the church building with him would be saved. After being evicted from the building, they set up tents nearby. When the rainy season came they moved down near the beach and built a large foundation for a church and also a large tomb. This was built on land owned by the future King Lunalilo. Before they could secure a lease from Lunalilo, a Mr. Roy, did so and sent the sheriff Neville to evict them. After ten months of dispute, Neville was pulled from his horse, when trying to serve eviction papers, and stoned to death along with one of his deputies. Several individuals, including H.N. Greenwell, made attempts to retrieve the bodies, but were unable to do so.

Eventually, word was sent to Honolulu for help. The Marshal of the Hawaiian Islands, Parke, was awakened at one in the morning and King Kamehameha V called a cabinet meeting at the unusual hour of six in the morning. Two hundred troops along with Governor Dominis of Oahu were dispatched in two sailing vessels to intercept the steamer "Kilauea" at Lahaina. There they were joined by the Maui Governor Nahaolelua and transferred to the faster steamer. In the meantime, the sheriff of Hilo, Coney, heard of the crisis in Kona and marched 200 men from Ka'u to Kona.



Coney managed to arrest Kaona, recover Neville's body and herded together all his followers. The "Kilauea" steamed past Kainaliu as this was taking place, unbeknown to those onshore. The troops had been hidden below deck so as not to alert Kaona's camp.

After their arrival at Kealakekua Bay, the Government forces took over the prisoners. A trial was later held at Mokuaikaua Church in Kailua. Five men including Kaona were charged with murder and about 120 others held as accessories and taken to Honolulu. A few years later Kaona was pardoned by King Kalakaua, returned to Kona and died at Kainaliu in 1883.

**Land Grants**

In a letter to J. Fuller, dated Feb. 23, 1852, instructing him in his role of Land Agent in Kona, it is noted that the lands are already granted in Honuaino 3 and that were all sold for $1 per acre to J.W. Makaike - 100 ac.; Palaau - 50 ac.; and to Makahaohie - 50 ac. According to Boundary commission testimonies, Kamomona is another name for Honuaino 3.

The following grants were awarded in the four *ahupua'a* of Honua'ino in the mid 1800s:

Grant 69 - Cummings, Hokukano and Honuaino 494 acres; Book 1; 1847 sold by Estate of Cummings to John Norton, 8/10/1867; bk.24:199

Grant 1170 - Charles Hall, Honuaino, 375 ac.; book 6; 1853. Sold to Cummings Jan. 4, 1866, including coffee trees, etc. Sold by Cummings estate to John Norton, 8/10/1867; bk.24:199.

Grant 761 in Honuaino to John Cavenagh, 98.6 ac., bk.3; 1852.

Grant 761 Cavenagh deed to Daniel Fredison a portion of #761, Sept. 1, 1856

Grant 761 Lorrin Andrews deed to Asa Thurston 6/1/1859; Bk. 12:28; 7/9/59 a portion of Royal Patent (RP) 761, Honuaino (Release) L. Andrews (grantor) to Henry Weeks, 1/23/62; Bk. 13:165, 1/23/62 portion of RP 761, Honuaino.

An entry dated Dec. 6, 1880 in the journal of Henry N. Greenwell reports that at an auction sale of the Lunalilo lands, W.F Roy bought Honua'ino for $950. An 1891 map shows that two grants were awarded to J. Cavanagh in Honua'ino 4; Grant 1453 and Grant 761, the latter which extends above the road. In Honua'ino 3, S.W. Makaiki had two grants, Grant 2029 and Grant 1462. A large grant above the road in Honua'ino 3 was that of Grant 69 to P. Cummings. Above this is Grant 1170 to Charles Hall.

**Hokukano**

There are two adjoining divisions of Hokukano, Hokukano 1 and 2, with Hokukano 1 being the larger of the two which abuts Honua'ino 4. Hokukano held a sizable village and a well used landing. Pukui credits the star Hoku-pokano as the origin of the *ahupua'a*'s name, whereas Reinecke translates the name to that of "proud stars" (1930:Part 5:1).

While staying at Hokukano, Rev. Ellis made these observations of an earlier religious structure:

**Hokukano Village**

> We now traveled to Hokukano, where we passed a pahu tabu (sacred enclosure) which the natives told us was built by Taraiopu, (Terreoboo in Cook's Voyages), [Kalani'opu'u]...A little further on we examined a buoa (tomb) of a celebrated priest. It was composed of loose stones, neatly laid, about eight feet square and five high. In the center was a small mound of earth, higher than the walls; over this a house formerly had been erected, now fallen to decay, around it were long poles stuck in the earth, about three or four inches apart and united together at the top (Ellis 1963:82).

Another historical reference to Hokukano Village is that there were 70 members present at the village in 1844. Rev. Lyman reported in 1846 that, "Just south of the hill is the village of Nawawa and on the north side of it that of Hokukano..." (Lyman 1924:142).

Hokukano Village (HRHP 50-10-37-1875) is described by archaeologist John Reinecke, who noted two heiau along the beach and stated of the Hokukano Flats, "The shore must have been densely populated." He described house sites of which Site 30, located a little inland, is surmised to be the area called Coconut Beach today according to Jean Greenwell. Reinecke continues, "Among the crevices is a cave, with steps leading to a small pool of brackish water." [At Nenue Point]...a rough wall runs along the point - several house sites." Reinecke provides a sketch of and description of Hoopalahuli, and Pahukapu Heiau located on Nanaiokauhi Pt. Mrs. Greenwell believes this to be a typing error and the name of the point should be Lanai-o-Kauhi, a large flat rock on the Point. According to William Paris, Jr.,



Lanai o Kauhi, a flat rock north of Keikiwaha Point, was named for Kauhi, a chief of the area, who used this rock to watch his fishing canoes come in. Week's landing was called Hanalei Wiki. Reinecke's description follows:

> The interior of Hokukano Flat is apparently almost free from sites of any sort, even small heaps of stones being few in number. The following four sites were the only ones discovered. 1) Platform on pahoehoe knob, more likely heiau than house site. Small high wall pen in gulch below it. 2) Indistinct remains of house site. 3) On pahoehoe pen and house site. 4) Hoopalahuli Heiau located about 350' back of house now used as bee ranch (Reinecke 1930:Part 5:3-5).

Thrum also places Hoopalahuli *heiau* in Hokukano I (1908:45). Unlike Thrum and Reinecke, the HRHP description for Hoopalahuli Heiau places it in the *ahupua'a* of Honua'ino 4. It notes that:

> Nearby to the north is a cluster of holes drilled into the pahoehoe besides the sea that might be *piko* (umbilical cord) holes for they are not arranged like a *papamu*....Pounding areas are found on the pahoehoe near the water.

The description gives the following reason for the *heiau*'s significance: "This heaiu is unusual in being constructed on top of a tumulus and in having the odd holes in the pahoehoe nearby (HRHP #50-10-37-1875).

Another HRHP in the *ahupua'a* is that of the Hokukano Complex (50-10-37-1876). This valuable habitation complex located in the seaward portion between Nenue and Keikiwaha. The bulk of the remains are pre-contact with a total of fourteen sites.

**Land grants**

The largest grant in Hokukano 1 is Grant 864 with an acreage of 235.24 acres which was acquired on Sept. 2, 1852 by Henry J.H. Holdsworth, a British subject. On Dec. 2, 1865 Henry J.H. Holdsworth and his wife Catherine Matilda sold all of the Grant 864 in Hokukano for the sum of $800 to Laurence McCully who was a recent arrival to the islands residing in Hilo (Hawaiian Annual 66th Report:1957:67) . On April 7, 1874, McCully sold to

Charles Wall for the sum of $600 all that part of land described in Royal Patent 864 which lies *ma kai* of the government road from Kealakekua to Keauhou, known as the upper road (the part *ma uka* of the road having been sold by him to Preston Cummings). This came out to be 130 acres more or less and included all the *kuleana* purchased by McCully that were within the Royal Patent as follows: Kauhimahi 9428D; Kuleana of Napela #1044; Kuleana of Naai #9414, RP 3947; Kuleana of Keawekaapali #9428F, RP 3901; Kuleana of Kapaaku #8157 F, RP 4013. And also the following *kuleana* in the strip of Hokukano II adjoining the land as follows: Kuleana of Ukaka #9416; Kuelana of Kuaha #9428 C, and the Kuleana of Kukahi #9427.

On Dec. 26, 1875 Charles and Hannah Wall sold to George Trousseau of Keauhou for the sum of $3,000 the following: all that portion of the land described in Royal Patent 864 which lies *ma kai* of the upper road and all the aforementioned *kuleana*. On Feb. 11, 1879 George Trousseau sold to Henry N. Greenwell of Kona for the sum of $5,000 all that portion of land described in Royal Patent 864 which lies *ma kai* of the government road along with the aforementioned *kuleana* as well as the following: Kuleana of Kama #9428D, RP 3905; Grant 1463 to Keawe; Kuleana 7739 granted to Lupea; Kuleana 7277 C, RP 3903 to Haho. Greenwell reserved a house lot (pahale) on the beach of Hokukano Kuleana #7739, RP 3902 originally granted to Lupea on which he had just built a house, containing .66 acre. On Feb. 3, 1882 Henry Greenwell sold to J.D.Ackerman of Kona for $3,600 all the land described above.

Figure 5 (see above) shows the location of the following Grants: - Grant 1651 to C. Hall (at the shore); Grant 158 Or 1587 to J. Peters; Grant 992 to W. Whitmarsh in Hokukano 2; Grant 210 to W.Whitmarsh (above the road). In Hokukano 1 - Grant 1463 and Grant 1465 to Keawe; Grant 864 to H.L. Holdsworth; *ma uka* of this grant either in Hokukano or Honuaino a large grant 69 to P.Cummings; Hokukano Tract - Grant 3155, certificate 78 to



H.N. Greenwell. H. Weeks house north of Keikiwaha Pt.; Dr. George Trousseau's house at Hokukano Landing.

The survey description map for Grant 1651 indicates Hokukano village had about 16 houses in 1854. A description of Hokukano Village is found in a letter from J.W. Smith to the Minister of the Interior, dated March 25, 1895:

> ...There are a few small fragments of land or lava rocks in what is known as Hokukano Village on the sea shore in North Kona - south of Keauhou on Grant #1651 sold to Charles hall but the village being nearly all native Kuleana and no part of it included in said grant 1651 there a number of small patches still belonging to the government but none suitable for building lots. Mr. W.A. Wall surveyor has examined it and says there are about 9 ac. in it still belonging to the gov. and has advised me to apply for all the government interest in the said piece and as my wife is troubled very much with asthma and myself laid up the greater part of (the time) with my rheumatism- we both feel much better down near the sea than on the hill. I therefore pray you to consider this application for the said bits of land and as it is all covered with ? lava rocks that nothing will grow on I will make an offer of $1.50 per acre for all that belongs to the government on said piece...

The following correspondence between Mr. Smith and the Minister of the Interior provide insight to land value at that time:

> (April 3, 1895) Recommend that the applicant be allowed to occupy any portion of the above remnants to consist of about 2 acres for a term of 10 years with the privilege of 5 years. more at an upset rental of $10 per annum. Sale of lease for 10 years.
>
> (May 6, 1895) Thinks $10 per annum for the remnants of government lands in Hokukano village is rather high - at any rate I'd rather buy than lease.
>
> (May 20, 1895) To send a surveyor to ascertain what Government land is actually remaining in that locality. The surveyor general approves and at the first convenient opportunity steps will be taken to have land surveyed.

Dr. G. Trousseau, who is mentioned above, had his home at Hokukano Landing, located in the area identified as Kainaliu. On her boat tour of the Kona coast, Mrs. Greenwell provides the following for the Hokukano coastline and its early residents. Again, Fig. 6 provides the location of the following sites:

> You can barely see the ruins of an old house on the shore. This was built by Dr. Trousseau. Dr. Trousseau was a Frenchman. Local family tradition says he came to the islands to escape from his wife. However he came from a very prestigious family in France and shortly after his arrival in the islands in 1872 he was appointed by King

Lunalilo to the Board of Health. He also became the King's physician. Besides medicine Dr. Trousseau had a variety of interests including raising sheep in Kona, sugar in Hamakua, and ostriches on Oahu. In 1874 he started his sheep ranch in Kona. This was located in *ma uka* Keauhou on what later became part of the Greenwell ranch. The sheep were sheared and their wool was pressed on the mountain. Then the wool was brought by wagon on the old cart road here to Kainaliu to be shipped. Dr. Trousseau kept his beach *kuleana* at Kainaliu. The *kuelana* had originally been awarded to a man named Lupea. Lupea had probably worked for Dr. Trousseau during his sheep raising days, because way *ma uka* there is an area called Lupea. Often paddocks o ranches acquired the name of the person building stone walls on them. These is not much left of Dr. Trousseau's house, but the stone work around it is in good condition and you can also see a beautiful stone lined well. Later this house was used in connection with raising bees and some of the old crates for storing honey are still there.

Another early resident of this area was Henry Weeks. Weeks used to haul the wool from Keanahaha for H.N. Greenwell, store it here at the beach and ship it at a landing called Ke Awa Hanalei Wiki. He lived on the site of Hokukano Village. [see Frontispiece of this report] The very flat rock you see here was called Lanai o Kauhi. It was probably named for some chief in the area that used that place as an observation post. The point we are passing is called Keikiwaha, which means child's mouth. If you look at it from a certain angle it looks like a child's face with its mouth open. There are the remains of an ancient *heiau* built along side of this out-cropping of rocks (*Ho'opalahuli* 50-10-37-3500).

The large cinder cone we are approaching is called Pu'u Ohau. It is not named for the hau tree but rather for the type of cinder which it produced. This is a soft porous stone used for polishing calabashes and sometimes canoes. The hill serves as a land mark for fishermen who refer to it as Red Hill. There are numerous graves on the hill, some of these graves are in burial caves. Some Hawaiians in the past felt this hill was haunted and they did not like to spend the night on it. Pu'u Ohau marks the boundary between the districts of North and South Kona.

The survey description map for Grant 1651 indicates a "Tomb" on the north rim of Pu'u Ohau crater. The 1891 map by Emerson locates "Kamalama's Tomb" near Pu'u Ohau. This is actually Kumalamu's tomb and is located in the *ahupua'a* of Haleki'i.

**Kanaueue**

There are two divisions of this *ahupua'a* which is said to be named for a chief. Unlike most *ahupua'a*, Kanaueue does not reach the coastline: if it did the south boundary would be at Pu'u Ohau. Lloyd Soehren claims that these lands:

...contain some of the best soil to be found in the district. The high value placed on the



land by the early Hawaiians is attested by the narrow widths of the ahupuaa in this region: the greater productivity in the ancient economy, the more narrowly divided the land for administrative purposes (1981:1).

Pukui gives the translation for Kanueue as "the rotating" (Pukui 1974:84) but Andrews Dictionary of the Hawaiian language says that *naueue* means to vibrate, to shake often or violently; to shake as an earthquake a trembling, as of earth. Reinecke concurs, noting in his Survey of Hawaiian Remains, "Kanaueue means the trembling" (1930:Part 5:1).

During the Mahele, Kanaueue 1 and 2 were designated government land. They were subsequently subdivided and sold in parcels typically from 50 to 150 acres in size. Figure 5 above gives the location of the following Grants and sites in Kanaueue: Grant 865 to J. Nakookoio? (below the road); Grant 146 to G. Thornton; Grant 173 to J. Peters (Thornton and Peters above the road) at the shore - South of Nenue Point is Kamekumi's and Kaelele's houses at what is today called Coconut Beach.

At elevations above 2000 feet, and along the dry shoreline, tracts were sold to cattle ranchers which developed in the late 1800s (Soehren 1981:1).

**Haleki'i**

Haleki'i translates to "image house". Pu'u Ohau marks its boundary to the north with Kanaueue which was discussed previously. The name Haleki'i may refer to a large refuge lava tube with numerous petroglyphs, some in panels, that is located on the border of Haleki'i and Kanaueue.

J.H. Kalaiheana, a land agent, noted on April 25, 1866, that Haleki'i was an *ahupua'a* of the konohiki. In the Indices, the *ahupua'a* is called Halakai, and it is often pronounced this way currently. 315 acres in "Halakii", were awarded to the American Board of Commission of Foreign Ministers in LCA 387 (Indices:893). An 1891 map shows this parcel below the road as being certified to the American Protestant Mission. No mission was actually located here and

it was used to grow crops for subsistence and additional income. Later grants in Haleki'i are: Grantor - John D. Paris & wife to Grantee Henry Smith 11/20/1856 Bk.8:345; 12/15/1856; 315 ac. Halekii; Deed. A deed to H.N. Greenwell from T.H. Martin Smith & wife April 20, 1871; Book 33:11 April 29, 1871; 315 ac. land; and fishing rights. In this last deed, Mr. Greenwell paid $300.

**Ke'eke'e**

A translation or reason for naming this *ahupua'a* is not given in Place Names of Hawaii. However, *ke'e* means crookedness; fault, with *ke'eke'e* being a redup of *ke'e* (Pukui & Elbert 1971:131). This may be a reflection on the boundary that distinguishes the north from the south Kona districts. Nawawa Bay, its canoe landing and village are located in this *ahupua'a*. Puueo Heiau is located at the shore north of Nawawa Bay. In his 1929 survey, Reinecke, notes that the landing at Nawaawaa Bay [sic] "at Keekee" is, "walled on either side, barely large enough to admit one outrigger canoe. Canoe platform built by it." The earliest description of the area is made by Chester Lyman who while walking from Kealakekua to Kailua in 1846, made the following observations:

> ...it gave me an opportunity to pass for a few miles through a new region of country and especially by the old crater on the coast. The road which is most of the way a very fair one for horses, passes just in the rear of this hill...Just south of the hill is the village of Nawawa and on the north side of it that of Hokukano... (Lyman 1924:142).

Undoubtedly, the hill Mr. Lyman refers to is Pu'u Ohau.

A description of a village referred to as "Hauhauha" may very well be Nawawa. This more detailed description come ten years later by Hill:

> Traveling by foot from Kaawaloa to Kailua- At about 3 miles the village of Hauhauha. About half dozen huts. Whole population about 80 men women and children. They ask for water found it to be the greatest of the wants of our hosts, and to procure which they were obliged to send two miles up the elevated county in the rear of them (Hill 1856:188)

Hill also described a conversation with an old woman at the village. The woman said that in



the old days they might have eaten them in time of scarcity. The women also discuss the plight of women in the old days. Their dwelling had been placed at 30 to 40 yards from the point of a piece of land projecting from the bottom of a broad rising vale, lying open to the sea at a distance of about 1/2 a mile (ibid 186:191).

The village probably was associated with the *ahupua'a* of Ke'eke'e, 'Ilikahi, and Kanakau. A cluster of fourteen LCAs (see Figure 5 inset) showing the names of the awardees indicates that vicinity was primarily settled by native Hawaiians. Also supporting this conclusion are the presence of Puueo Heiau, Pali-o-Niu Heiau, the burials at Pu'u Ohau, and a habitation complex (HRHP 50-10-37-1927, 1930, and -1931). It should be noted that south of present day Kealakekua Town, is a cluster of inland awards that correspond, for the most part, to the awards at Nawawa. In four cases it can be determined that the inland plots were the cultivated counterparts of the coastal house lots. In three cases, where the use of the inland plot is uncertain the parcel has a corresponding coastal house lot, so it is presumed that the inland parcels were cultivated.

The coastal village appears to have been a thriving community even in historic times. Rev. Forbes notes in his journal on Oct. 25, 1843, that he preached at Nawawa and that there were 44 church members at Onouli and Nawawa as of 1844. Rev. Paris' Report for South Kona in 1852 mentions the church at Nawawa.

The school at Nawawa is the subject of various letters in the State Archives' Public Instruction file. In a letter to Low from Papa'ula written July 13, 1864; "expenses of the school building at Nawawa have been paid. "The school buildings are fine, likewise at Nawawa, Napoopoo, Keei which are furnished with chairs." A letter to Fornander from the teacher G.W. Kini, dated Nov. 6, 1866 states that there is a population of 71 regular students, 76 students altogether. "The students and I bought a clock for our school. We got a

ringing clock for $10. The students are very happy that they have this. Our school begins at 9:00 a.m. and ends at 1:30 in the afternoon." Kini requested 50 feet of lumber for chairs to be sent to Kaawaloa harbor.

A report on the school while Kini was the teacher shows a decrease in the student body:

> School at Nawawa. Kini is the teacher. There are 36 @students, 24 boys and 12 girls. There are 24 in reading, 6 in arithmetic, 25 in geography, 16 in penmanship and 36 in music. Their reading wasn't good and they're slow in arithmetic. The same for penmanship and geography. I didn't see this school alert. That's the end of my work on the last examine day. Many parents came and they supported me in some encouraging ideas. They didn't complain about their teacher. They have a good school house there. Maybe the government isn't administrating that school.

In 1873 a man by the name of Kapae, testifying to the Land Board Commission on the Kealakekua boundary, said he was a resident of Nawawa.

In a continuation of Mrs. Greenwell's Boat Tour narrative, the sites and history are provided for the Nawawa vicinity:

> Just south of Pu'u Ohau is the small canoe landing of Nawawa. Wawa means roar, din or noisy. I have been here when the surf is high and all the boulders along the rocky beach really make a tremendous noise so the place is aptly named. There was a good size village here...
>
> According to one account Nawawa may have served as Hawaii's first lighthouse. There is a strong wind called *ulu mano* that blows from the south in the night only. Kamehameha and his party were shipwrecked by this wind off Nawawa. The whole village was burned to light them ashore.

The two divisions of Ke'eke'e were listed as Government land at the time of the Mahele, with the exception of the *mauka* lands which were sold. Figure 5 above shows in Ke'eke'e 2: Grant 1177 to Kamakahiona; Grant 2004 to Kuana (above the road and below the radio station); Grant 928 to John Antone (above the road) and Grant 866 to Kapule, for 8.85 acres. In Ke'eke'e 1 - Grant 1176 to Kini; Grant 2963 to Kapule.

A 1912 map shows Grant 977 to Panaunau (This is the land below Popopo'ia Church). This map shows Konawaena School next to Popopoiia Church (about where the library is today) in the land owned by Kapule. On the Ka'u side of the church is a Chinese store, then a



gate on a trail going *ma kai*. Kuinuku's hut *ma kai* of the church, near Kuinuku's hut is 2.32 acres of cane surrounded by a stone wall, Grant 4034 to Pauole. Grant 3883 to Paiwa, cane and coffee. Nagat's house, Kalani's hut. Ke'eke'e 1 portion still further *ma kai* is completely surrounded by a stone wall; 22.9 ac. of cane; 9.03 acres- wild coffee and rocky; 1.39 acres referred to as Koolulo's Kihapai (portion or piece) in coffee.

**'Ilikahi**

According to Reinecke, 'Ilikahi means scraped bark or skin (1930:Part 5:1). In a 1912 map, 'Ilikahi is listed as an *'ili*, the reason for this designation is not known. The entire *ahupua'a* was awarded to Keohokalole, mother of Kalakaua and Lili'uokalani (Indices 1929:465). Only one native tenant received an LCA in 'Ilikahi, Keliiwahanuku, a parcel of one acre (LCA 9428-G). An earlier map (1891) shows Keliiwahanuku's house above Nawawa Bay. Yet in an 1866 report by Kalaiheana, "'Ilikahi; an *ahupua'a* of the government, is absolutely disposed of." This infers that Keohokalole surrender the *ahupua'a* to the government, most likely for commutation of other lands.

Whether government lands or mahele award, a map dated 1852 shows two grants: Grant 866 to Kapule, and Grant 1174 to Kuai. 57 4/10 acres were sold to Kamakahiona, and an application for 50 acres was made by Robert Corney was made. The 1891 Emerson map (figure 5*) shows the following grants awarded in 'Ilikahi: Grant 1175 to Nahuwaa or Nakuwaa; Grant 927 to Issac Vanbrackhau. Although the date of Vanbrackhau's original purchase in not known at this writing, regarding Grant 927, it is known that in 1889 William and Mary Thompson leased to Manuel Goveia this land of 35 acres. In Henry Greenwell's journal, dated March 4, 1884, Mr. Greenwell leased to J.W. Smith the land in the *kula* (about 30 acres) of 'Ilikahi for $10.

**Kanakau**

Reinecke provides the meaning of the name Kanakau as, "to get sight of one's face" (1930:Part 5:1). Kanakau, like 'Ilikahi, was awarded to Keohokalole, but was surrendered back to the government. Numerous LCAs were awarded in this ahupua'a, but the parcels are very small, out of nine awards, only two were over an acre.

H.N. Greenwell obtained Kanakau with Grant 787 in 1852, an area which consisted of 312.88 acres. Figure 5 above also shows Grant 1160 belonging to Mr. Greenwell, which included Kalukalu 1,2 and 3 as well as Kanakau 1 and 2. In his journal, Mr. Greenwell notes on Nov. 30, 1869 that "Atkins had rented the privilege from Kalaehiana (Princess Ruth's agent for Government land) for one year of cutting crooked timber on Kanakau. In 1881, he noted that Kanakau has very good pasturage for cattle and is also used as an orange orchard. An entry for Feb. 5, 1886 states that Grant 1862 was sold to Kapule in 1855. Kapule in turn sold this land to William and Mary Thompson. In 1889 the Thompsons leased to Manuel de Gouveia this land containing 102 acres for 20 years.

**Kalukalu**

Pukui says that the name of this *ahupua'a*, which contains two divisions, is derived from the grass that grows only here (1974:79). The Pukui and Elbert Hawaiian dictionary describes kalukalu as "a fern somewhat like palapalai. 2. a kind of rush or grass like kaluha sedges, famous on Kauai."

Kalukalu, like most of the project area was at sometime the property of Henry N. Greenwell, a short biography of the man is called for. The following is provided from the Kona Historical Society:

> Henry N. Greenwell, founder of the Greenwell store was born in England in 1826 to a landed family in Lanchester, Durham at the Ford, the family home. He graduated from Sandhurst and spent time in Ireland doing Government work. Finding



> the military life insupportable, he sold his military commission in the army at the age of 23. He left for Australia to make a new start where he bought a sheep station. In 1849 he put all his money into a partnership which purchased a ship and goods, and sailed to San Francisco with this shipload of provisions to be sold there during the Gold Rush. The crew deserted in the harbor and because his partner was elderly, Henry had to unload the ship by himself, consequently hurting himself badly. His partner sent him off to Honolulu because the best doctors in the Pacific were held by royalty here. He returned to San Francisco after his R & R only to find that his partner had now taken off with all the profits. Henry then returned to Honolulu and worked on Fort Street with an English import/export company. He was sent to Kona to open a store there. In 1851 King Kamehameha III began selling land to foreigners. He purchased and planted them in oranges. After 15 years, the oranges caught a blight and Henry went on a trip around the world, stopping in the West Indies where he met a lime planters daughter married her and brought her back in 1868, along with a new variety of oranges found in Brazil.
>
> Henry Greenwell is remembered for cultivating oranges, putting "Kona Coffee" on the European Market in the 1870s and for his temper. He raised sheep for wool at the higher elevations of his land after the civil war, dairies in the 1880s and later began extensive cattle ranching. He and his wife had 10 children. Henry N. Greenwell died in 1891 and his eldest son William H. Greenwell, born in 1869, inherited his estate which later became the W.H. Greenwell Ranch.

Continuing Mrs. Greenwell's shoreline narrative, provides us with specific places in which Henry Greenwell conducted business:

> On the point opposite of Nawawa is the site of an old ware house built by Henry Nicholas Greenwell to store wool and goods for his store *ma uka*. Mr. Greenwell arrived in Hawaii in 1850 shortly after the mahele and the act which enabled foreigners to buy land had passed. He was able to purchase several pieces of property along this coast from the government. He later bought Dr. Trousseau's lease on the sheep ranch *ma uka*. When Mr. Greenwell was raising sheep he used the same cart road Dr. Trousseau had made to Kainaloi but continued the road further on to ship his wool from this point. There is a large cave under the point here on the south side. The small boat from the steamer would come in to the cave and the wool would be lowered into it. This of course was a very ticklish operation. The tide had to be high and the sea calm. This point of land acquired the name of Wool's Landing. It is located on the ahupuaa of Kalukalu. The old Greenwell Store which today serves as the Kona Historical Society's headquarters is also on the land of Kalukalu and was one of the first pieces of land purchased by Mr. Greenwell.

The Greenwell's became a stop for visitors as evidenced in Musick's book, Hawaii, Our New Possession:

> Musick and friend stop at Kalukalu in S. Kona at the home of Mrs. H.N Greenwell...(Musick 1898:221).

Prior to Dr. Trousseaus cart road, a road was constructed, probably to exploit the native forests:

> ...in the year 1834 a road was made by the government, by the order of Gov. Adams from the beach at Kalukalu into the forests mauka...and prisoners were employed in the formation of it....(Jarves 1855:21).

This road is the subject of a letter to Messrs. George Sherman, John L. Young, William Thompson and others, from the Interior Department, dated Nov. 18, 1871:

> ...the receipt of your petition concerning the road in Kona leading from Kalukalu makai to the forest mauka, and to say that no disputes between private individuals can have any effect on a Public Road and that the appropriation made by the legislature for roads are intended for the purpose of making new roads, building bridges, and making such repairs as the local road tax is insufficient for. In this case his Ex. is of the opinion that whatever repairs are required should be done by the local road tax....-Charles Guilick

An entry in H.N. Greenwell's journal, dated 1869, mentions a church on the road, "Mr. Paris has commenced services in English at the church makai of the road on Kalukalu."

As previously mentioned Grant 1160 included Kalukalu as well as Kanakau. Other grants in Kalukalu are: Grant 787 to HN Greenwell; Grant 1745 to J. Cavanagh; Grant 1576 to Lohi; Grant 1862 to Kapule (in Kanakau); Grant 1464 to Ialua; and Grant 2910 to John Yates. The property of Grant 2910 was conveyed to Richard Neville (wife Peke) by John and Mary Yates. He in turn mortgaged the property to Charles F. Guillan of Honolulu in 1865. (At that time there were 50 acres of cane planted on land in Kalukalu belonging to C.J. Hart) In 1869 Charles F. Guillan turned over to Theo C. Huck administrator of E.C. (Frank) Kruger's estate. [Bureau of Conveyances - A./M. Guillan by Atty, grantor to Kruger, Frank E.C. Est. of by Adm. Oct. 1, 1869; Bk.21:112, portion of Grant 2910, 2 pieces of land, buildings plus interest in sugar cane on 50 ac. land at Kalukalu.] In 1884 S.Dole, guardian of Kruger's minors released their interest in the property document owned by N.L.Greenwell.

Concerning Grant 1862 to Kapule in 1889, William and Mary Thompson leased this land containing 102 acres to Manuel de Gouveia.



**Onouli**

Although Onouli translates to "the dark ono fish," another interpretation is O-no-Uli, rations for Uli. Uli was the grandmother of Kana, the stretching demigod, whom she reared, and his brother Niheu, (HWN Mythology:464-477 in Pukui 1974:171). Pukui elaborates:

> According to Kalokuokamaile: This land of Onouli (was so named) because Ouli (O Uli) lived on this land. And the reason for naming this land was after the name of this woman Onouli. This was the mother of Hina, the wife of Hakalanileo, and their children were Niheu and Kana. This was the call of Niheu when Kana got hungry while he fought with Kapepeekawila, the chief of the hill of Haupu. Thus the calling; "Stretch to Kona, to Uli, to our grandmother, for food and fish." Therefore, for the name of this woman was bestowed the name of this land adjoining Kaawaloa: O-no-Uli (Uli's food). O is food for travelers had food.

In native testimony for a land award, an *'ili* called Kealaehu is referred to. If this is the correct name of the *'ili*, it may well refer to the following passage in Ruling Chiefs of Hawai'i:

> Ehu, son of Kuaiwa, was another road builder. He was the chief of Kona and built a road from the uplands of Kona into Ka'u which is called "the way of Ehu (Kamakau 1961:429).

In historical times, Kamakau tells us that Palea stole a boat from Captain Cook's ship "conveying it to Onouli, [where] they broke it up in order to get the iron in it." (1961:102).

Onouli, originally classified as Crown Lands, was classed as public lands in the Hawaiian Investigation, which stated, "Onouli, 360 acres, estimated value $500, described as dense forest land." (part 3:149). A description in the same work states that:

> The best portion of this land has been sold. The part unsold lies above the government road and is principally a heavy forest of koa and ohia. The rainfall is very heavy. At the lower end of the forest near the road some good coffee land may be found. Kaawaloa landing is the nearest, distant 4 miles. Area 367 acres. (ibid.:Part 3:1333).

Indicative of how foreigners obtained land is the testimony of a Mr. James Atkins on how he acquired land in Onouli (mauka of the project area), prior to the Mahele:

> I arrived May 1827 from the whale ship Harriot of London as an Englishman. Lived here ever since, employed making shingles, sawing lumber and farming. Native wife. Three children. In 1837 made 100,000 shingles for Gov. Adams. He agreed to pay me

$500. He paid only $400. In 1838 he gave me about 60 ac. in payment for the remaining $100. The land is situated in Koho, known by the name of Nauliuuku. The part given to me is known or called Heleehu. At that time 1838 - the land was uncultivated....(Foreign Register Oct. 20, 1847).

James Atkins attained title to this land with LCA 925 for 113 acres. In support of Atkins' claim the following testimony was given:

Francis Johnson and Kuniola sworn...the claim on James Atkins to consist of a part of the ili Kaalaehu, ahupuaa Onouli 2 called Owaiakau. The gift of Kuakini in the year 1838 in part payment for shingles made for stone church in Kailua, bounded all sides by the land of the konohiki...(Foreign Testimony vol.5:58).

The earliest grant in Onouli (1162) was to Fredrick O. Schulze on August 30, 1853 by Kamehameha III for 189 1/2 acres in Onouli 2 for $284 ($1.50 per acre). The rights of the native tenants (*kuleana*) were reserved. On June 5, 1854, Schulze sold to Alfred Todd, a carpenter, this land for $475. On Jan 1, 1887 Todd mortgaged Onouli Grant 1162 to Henry Weeks. To exemplify the rise in land value, in 1924 Thomas Jagger paid $11,517.07 to the widow and children of Jose Henriques for the land that comprised Grant 1162.

Forest resources were exploited as H. Greenwell notes in November of 1869 that, "...Barett had rented for one year (from Kalaehiana) also the privilege of cutting timber fit for shipbuilders on Onouli..." The following letters show the impact of foresting and further land uses in Onouli:

Letter from H.N.Greenwell to Minister of the Interior Dominis 2/21/1870 - regarding leasing 300 ac. left in Onouli iki, with the privilege of cutting and removing full grown and dead timber. $50 per annum for 20 years.

Letter from C. Hart to W.Webster, Dept. Interior, Nov. 5, 1863 - requesting a lease on Onouli iki which adjoins his land.

Letter from Hart to Dept of Int. Nov. 5, 1863. He had endeavored to find if the land is all covered with wood, but because of the great difficulty in getting to the land he has never found out what is on it. He learned from one old native (Napela) doctor, who lives on his land that it is covered with a type of soil? called "climpens" and aa lava.

Bureau of Conveyances - Release - Grantor Davies to Janion Green & Co. Oct. 27, 1869...2 pc. land, bldgs, machinery, livestock, etc. in Onouli. Janion & Green mortgaged to Theo Davis all that land conveyed to them by Hart, known as Onouli Nui,, also a parcel of cane on Onouli conveyed by C. Hart, also all houses, buildings,



mills, machinery, cattle, horses, mules, and property of every description belonging to our sugar Plantation at Onouli (for $6,600)...

Hawaiian Gazette Wed. Nov. 4, 1868 - Supreme Court in Hawaii vs. Hulu. Indicted for having at Onouli nui, with force and arms, & unlawfully & feloniously broken & entered on night of July 11, 1868 the office of Robert C. Janion & Wm. L. Green to steal books of accounts worth $15 etc.

T.G. Thrum's Hawaiian Annual for 1899 states that A.R. Rowat had 5 acres of newly planted coffee, 15 acres of trees that were between one to three years old and 5 acres that were bearing fruit in Onouli. Barrere (1981) states that Ruggles first planted oranges in Onouli.

The first mention of Onouli Dairy is found in H. Greenwell's journal, "John Bravo worked dairy on shares. Butter to be made..." (March 5, 1880). Further journal entries regarding the dairy; Sept. 12, 1885: foundation laid for new building. May 23, 1886 - Thomas at dairy at Onouli. May 26, 1886 - Thomas Silva cutting down guava and grubbing up the lantana in Onouli calf pen.

## SUMMARY OF HISTORIC LAND USE

For many upland areas, dryland taro gave way to ranching in North Kona. While surveying the land of Honokohau II, Lloyd Soehren reports that it was not until after the introduction of grazing animals, especially goats, that such land became economically productive; until then it served primarily as a source of wild plants having utilitarian value, to be gathered as needed (Soehren 1975:1).

Cattle were introduced by Captain Vancouver in 1793 to Kamehameha I at Kealakekua. These were turned loose to roam the slopes of Hualalai and under Kamehameha's kapu, they were not to be killed for ten years (Henke 1929:9). A photograph by A.S. Baker at the Hawaiian Mission Children's Society Library shows a large wall, *ma uka* of Kainaliu, called "Kamehameha's Corral Wall." It is described as being for cattle landed by

Vancouver in 1793 (Baker 1915:83-84 IN Kelly 1983:75). This wall described by Baker was more of enclosure, encompassing 486 acres, with walls four miles long in 1880 (Baker 1880:550-551). Along with the cattle, Vancouver landed sheep and goats at Kealakekua (Henke 1929:16). Various letters found at the Hawai'i State Archives, indicate that the Hawaiian government was the owner of cattle, horses and sheep through the 1800s (ibid:19).

Walls are the dominating feature in Kona, for cultivated fields; to enclose parcels, either houselots of animal pens; and boundary markers known as *pa 'aina*. These *pa 'aina* in Kona lowlands running across old boundary lines, were built to keep cattle out of the planting areas after they became a pest early in the 19th century (Handy & Handy 1972:526). They fed on the grass of the *kula* and at times on the thatch of Hawaiians' homes and on vegetables in their gardens (Kelly 1983:76).

When the law was passed in 1850 that allowed foreigners to own land privately, many of those who acquired large acreage, began ranching activities. The first ranches were stocked from offspring of Vancouver's cattle. The animals, living wild in the upland forests, and multiplied and became dangerous to humans and capture of wild cattle was encouraged (Kelly 1983:79).

Lands outside the agricultural zone were used for ranching activities and pasture for cattle and goats (Yent 1991:7). In an 1851 address to the Royal Hawaiian Agricultural Society, William Lee commented on the grazing situation:

> "Our high lands are peculiarly well adapted to pasturage; and I doubt if the grazers in any part of the world have been more successful than in these islands. With no winters to contend against, their labors are comparatively light, the increase of their flocks certain and rapid...the raising of cattle, has, thus far, been the most successful pursuit connected with the soil...(Henke 1929:22).

In subsequent years, cattle stock was improved by importing animals. By 1851, it was estimated that Hawai'i Island had 8,000 head of tame cattle and 12,000 head of wild cattle



(Bishop 1852:91 in Kelly 1983:81).

In 1875 Henry Greenwell started the original Greenwell Ranch. The first herds were apparently dairy cattle and beef cattle followed. "By the 1920s the Greenwell holdings had expanded to include three ranches occupying approximately 112,000 acres in North and South Kona (Burgett and Rosendahl 1991:5). The Henry Greenwell Ranch in which the subject *ahupua'a* were included had about 80,000 acres, of which approximately one-fourth was suitable for grazing,an about 3,500 head of cattle (Henke 1929:26).

Coffee replaced taro in the upland agricultural zone, from about the 800 to 1700 foot elevations, and generally did well on the leeward, rocky slopes of Hualalai and Mauna Loa (Goto 1979:5). A report on coffee appearing in the 1854 Royal Hawaiian Agricultural Society Transactions report declared:

> Coffee is cash, and the demand for it the past year has been greatly beyond the supply, and that too at prices ranging from 12 to 18 cents per pound. The call for Kona coffee, which is said to be inferior to none in the world, is much greater than for any other kind, and it is a thousand pities that beautiful district does not send more to market (1854, 2(1):8 IN Kelly & Barrere 1980:42).

The only planters for Kona named in the article were Cummings and Hall, who had their coffee plantation at Kealakekua, South Kona (ibid.). Bowser's Statistical and Commercial Directory for 1880 lists two coffee planters in Kalukalu; C. Kaiaiki with 3 acres cultivated and T.W. Pilipo with 10 acres cultivated (Bowser 1880:334-351). Several LCAs in the subject *ahupua'a* mention coffee (Hokukano 9428-D; Honua'ino 5563, 614; Kalukalu 10750; Onouli 7204). In all but the case of LCA 614, the coffee was cultivated on a relatively small parcel of land (between 1 and 2 acres). LCA 614, belonging to Charles Hall, covered 248.80 acres and is the above mentioned plantation. The first coffee in the area was planted by Rev. Samuel Ruggles at Naole, Onouli in 1828-1829 (Burgett and Rosendahl 1991:4). By 1913 coffee was estimated to bring about $800,000 per year to Hawai'i (Smith 1913:13 IN Kelly 1983:87)). But after a recovery in Brazil's coffee crops in the 1950s, many acres were abandoned (Kelly

1983:87).

A 1901 Hawai'i Territory Survey map shows a sugar plantation extending from Kawanui south through the *ahupua'a* of 'Ilikahi. During the first quarter of this century sugar cane was grown in a 13 mile long belt from Keopu to Keopuka, for the most part the fields lie *ma uka* of Hawaii Belt Road. There is, however, a section *ma kai* of the road extending from Hokukano through 'Ilikahi *ahupua'a*. Some of the best cane land is said to have been here in Konawaena from 1000 to 2200 feet in elevation (Soehren 1981:1). This most likely to furnish the mill of the Kona Sugar Company (incorporated in 1899), located in Waiaha *ahupua'a*, back of Kailua Village. In 1906 the West Hawaii Railway Co, began laying tracks with then intent of becoming a public carrier. However, the ten miles of track that were laid were used only for freight, primarily sugar and *'obi'a* and *koa* that were being forested by the Hawaiian Mahogany Lumber Co (Kelly & Barrere 1980:47). Sugar cane was delivered to the railroad cars by wire cables running from the fields to the railroad track. Some cane was flumed down to the track. The railroad started at Holualoa, the southern terminus in Keopuka, about 11 miles distant (Conde & Best 1973:87-89). The railroad appears on the 1928 USGS maps.

The 1836 missionary census reported Kona's population to by 10,954 (Schmitt 1973:36). The census of 1853 placed the combined populations of North and South Kona at 7,223, making it one of the most populous areas of the island of Hawai'i (Schmitt 1968:71). The decrease in population probably reflects the effects of epidemics in 1848 and 1853. An assessment of settlement patterns, and their changes,in Kona should take into account possible depopulation.

Marion Kelly notes a general settlement pattern in Kona consisting of habitations along the seacoast with another "belt of residence" about two miles inland (Kelly 1983:14). The tax maps for Hokukano/Keopuka area confirm this pattern, locating awards both inland



along the Mamalahoa Highway and on the seacoast.

Clusters of LCAs on the tax maps suggest that, in the period around 1850, these areas of Kona were cultivated and/or had dwellings on them. Absence of LCAs in a area, however, does not mean they were uninhabited; it is possible that the maps do not show all the awards, that land claims were not registered, or that the area suffered depopulation.

In the late 1800s, there was a population shift from the coastal area to the uplands along the present Mamalahoa Highway (Yent 1991:7). Cordy concludes that by the location of land claims, the inland road corresponding to the modern-day Mamalahoa Highway and the predominant inland location of houses, permanent housing largely shifted to the Upland Forest Zone at this time (Cordy 1985:35).

In addition to the upland movement of the populace, many moved to Kailua and Keahou, the centers of port commercial activities and Christianity (Helber, Hastert & Fee 1991:II-6).

Although agriculture and ranching encouraged an increase in the Kona population, people were primarily concentrated in the established communities (Helber, Hastert & Fee 1991:II-6).

Agriculture continued to be the mainstay of Kona economy until the 1970s, when the visitor industry took its hold. In 1960, Kona had a population of 8,743 with 1,449 claiming agricultural employment and only 291 claiming hotel employment (Kona Regional Plan 1982). The 1970 census reported a 1% increase in population but only 333 agricultural employees, compared with 659 in personal services (including hotels) (Helber, Hastert & Fee 1991:II-6). The 1980 census accounted for 19,664 in Kona, an increase of over 120%. This trend intensified during the latter part of the 1980s, with the Kona population reaching 30,900 in 1989 (ibid.).

## IV. PREVIOUS ARCHAEOLOGICAL RESEARCH

The best-known of the previous archaeological studies within the project area focused primarily on coastal sites. The earliest field reconnaissance within the project area was undertaken by John F.G. Stokes in 1906 (Stokes and Dye 1991). Stokes, an associate of the Bishop Museum, conducted a survey of *heiau* sites on the island of Hawaii. Stokes recorded one *heiau* - Ho'opalahuli - located within the Hokukano village exclusion area. The location and description given by Stokes correlate with a *heiau* observed within the Hokukano village during the present study.

Another archaeological study within the project area was conducted by John E. Reinecke (1930) between 1929 to 1930. Reinecke - employed by the Bishop Museum - recorded approximately 45 sites along the coastal region of the present project area and Hokukano village. Reinecke's survey within the present study area was focused along the coast and extended no more than a few hundred feet inland generally within the conservation zone. The sites recorded by Reinecke include a number of habitation structures, *puoa* (burial sites), *heiau*, pens, and agricultural features. Although Reinecke's survey is noteworthy for identifying major sites along the coast, his records and site locations were difficult to correlate during the present survey.

The Hawaiian Register of Historic Places (HRHP 1971) conducted another coastal survey in 1971. The work carried out by the State Historic Preservation Office (SHPO) identified 13 site complexes (Sites 4162, 1875, 1876, 1877, 1927, 1930, 1931, 1932, 1933, 1934, 1935, 1940, and 1942) within the project area (HRHP 1971). The records for these sites are available at the Department of Land and Natural Resources-Historic Preservation Program/State Historic Preservation Office (DLNR-HPP/SHPO). This HRHP survey was the first detailed study of the area following Stokes' and Reinecke's early work.

Paul H. Rosendahl Inc. has conducted a number of archaeological field inspections and



reconnaissance surveys within and adjacent to the project area. In 1984 a reconnaissance survey (Kaschko 1984) was conducted at the proposed Pu'u Ehu Estates subdivision project area, in the *ahupua'a* of Honuaino, Hokukano,and Kanaueue. This survey focused on a "Special Management Area" (S.M.A) located *makai* of the "Old Government Road", and an inland area *mauka* of the "Old Government Road". A brief inspection of the coastal "Conservation District" was also undertaken to check the accuracy and completeness of the HRHP work discussed above. As a result of the survey, twenty-seven sites were identified in the Pu'u Ehu Project area. Recorded sites within the inland survey area include remnant components of the Kona Field system, structural and lava tube habitation sites, the Great Wall of Kuakini, the Old Government Road, and a historic railroad berm. Survey of the *makai* S.M.A identified habitation, agricultural and probable burial sites. A major gap in site distribution is observed within the central portion of the S.M.A survey among the dry, flat pahoehoe terrain presently referred to as the "Hokukano Flats".

In January of 1988 Paul H. Rosendahl Inc. conducted an archaeological field inspection of a South Kona development parcel located in the *ahupua'a* of Keekee 1 and 2, Ilikahi, and Kanakau, South Kona District (Rosendahl 1988a). During the field inspection 16 sites were identified.

In April 1988 Paul H. Rosendahl conducted an archaeological field inspection of the "Ackerman Property" project area, located in the *ahupua'a* of Honuaino 3 and 4, and Hokukano 1 and 2, North Kona District (Rosendahl 1988b). This parcel corresponds to the northern portion of the project area. Six sites were identified through field inspections and background research.

In April 1988 Paul H. Rosendahl Inc. conducted an archaeological survey of the *Hokukano* Village project area, located in the *ahupua'a* of Hokukano 1 and 2, North Kona District (Rosendahl 1988c). Two major site complexes (Sites 1875 and 4162) were identified

by field survey and historical research.

In January 1991 Paul H. Rosendahl Inc. conducted an archaeological inventory survey of the Hokukano Ranch Development located in the *ahupua'a* of Kanaueue, Keekee, Kanakau, and Halekii. Fifty-five (55) sites consisting of 73 features were identified in the project area. The majority of the features were walls (40.8 %) and the most common functional type identified was agricultural (46 %).

The previous research has focused on the immediate coastal zone. Numerous sites and site complexes have been described in varying degrees of detail. Research associated with the inland portion of the project area has been reconnaissance or field inspection level. However even these surveys have reported on major sites (e.g, State site 50-10-37-10300). The previous research, while clearly defining a high site density in the coastal zone, has also noted inland sites beyond the agricultural features associated with the Kona Field System (State site 50-10-37-6601).

Previous research suggested that the present project area would contain evidence of permanent habitation of both pre-historic and historic eras concentrated at the coast; widespread agricultural features associated with and including the classic Kona Field System; numerous lava tubes many with significant features (e.g., petroglyphs and burials); and dispersed habitation sites outside the coastal zone.



## V. SURVEY RESULTS

During the inventory survey, 807 structural and nonstructural features were identified within the project area: these features were subsequently organized into 473 sites or site complexes.

### A. Formal Site Types

Formal site type designations are descriptive - based on physical characteristics - and commonly refer to structural elements of a site. Twenty-one (21) primary site types were identified in the project area. These type categories are defined below:

Ahu: A cairn of stacked or piled stones.

Alignment: A single row of stones one course high.

C-Shape,U-Shape, and L-Shape: A walled structure which partially encloses an area.

Enclosure: A walled structure which completely encloses an area. Enclosures are further categorized by their configurations which are referred to as: *rectangular*, *circular*, or *irregularly-shaped*.

Lava Blister: A small subterranean lava formation. Unlike lava tubes, however, they tend to be circular and do not extend in any direction for a great length.

Lava Tube: Modifications or apparent usage of a subterranean lava formation characteristic of pahoehoe lava flows.

Modified Blister: A subterranean lava formation altered by the placement of stones. Unlike lava tubes, however, they tend to be circular and do not extend in any direction for a great length.

Modified Outcrop: Natural outcrop altered by the placement or removal of stones.

Modified Sink: A natural depression in the terrain which has been humanly altered.

Mound: Linear, circular or amorphous stone pile which typically lacks a vertical face and level surface.

Pahoehoe Basins: Circular depression pecked into a pahoehoe outcrop surface.

Paved Depression: Natural depression in the terrain paved with boulders or cobbles.

Pavement: A stone-filled floor or surface.

Petrogylphs and Papamu: Images or configurations carved or pecked on a rock surface.

Platform: A raised free-standing stone structure with three or more vertical faces; it also refers to circular structures with vertical facing.

Platform-enclosure: A platform with an attached enclosure structure.

Rock Shelter: Varying degrees of construction which modifies a rock shelter (or outcrop overhang). This structure is distinguished by an apparent primary focus on the enhancement of natural features.

Terrace: A raised stone construction partially built against or level to a ground or outcrop surface. These structures commonly resemble platforms. Unlike platforms, however, they are not totally free-standing.

Trail: A trodden lava surface, pavement, or stone alignment set into the ground or outcrop surface.

Wall: A bifaced and free-standing stone structure which is an isolated segment or defines large boundaries (such as land tracts or cattle barriers).

Well: A fresh or brackish water source.

Table 2 tallies the total occurrences of these formal site types in the project area.

**TABLE 2 - OCCURRENCES OF FORMAL SITE TYPES**

| Formal Site Type | Number | % |
|---|---|---|
| *Ahu* | 2 | 0.25 |
| Alignment | 4 | 0.5 |
| Berm | 1 | 0.12 |
| C-, L-, or U-Shape | 27 | 3.35 |
| Enclosure | 142 | 17.6 |
| Kona Field System | undetermined | - |
| Lava Blister | 22 | 2.7 |
| Lava Tube | 29 | 3.6 |
| Modified Lava Blister | 6 | 0.74 |
| Modified Outcrop | 48 | 6 |
| Modified Sink | 7 | 0.87 |
| Mound | 20 | 2.5 |
| Paved Depression | 2 | 0.25 |
| Pavement | 14 | 1.7 |
| Platform | 292 | 36.2 |
| Platform-Lava Blister | 2 | 0.25 |
| Platform-Enclosure | 10 | 1.2 |
| Rock Shelter | 3 | 0.37 |
| Terrace | 116 | 14.4 |
| Wall | 46 | 5.7 |
| Special | 6 | 0.74 |



Any sites which contain multiple features are subsumed under a site complex category. Thus, in these instances, a formal site type refers to feature type. Of the total 471 sites in the project area, 126 are site complexes.

## B. Function Categories

Function interpretation of a site or feature is determined by criteria which include: site construction and complexity; locational context (association with other sites and/or geological determinants); analysis of cultural remains (surface and subsurface); and external correlations with other archaeological sites in Hawai'i.

Eleven primary function categories were identified among the sites within the project area: agriculture; animal containment (pens); habitation; walls (boundary or agricultural); human burial; *heiau* and shrines; railroad; refuge structures; indeterminate; trails and roads; and well structures. The eleventh function category - "special" - is used in the present study to classify isolated features (which are usually associated with habitation complexes) or sites which have an uncommon type of function. These "special" function types include papamu boards, bait cups, and salt bowls.

Since an individual site or site complex may exhibit multiple functions, especially in combination with agricultural activities, in order to avoid confusion, such sites are grouped under their primary function - usually habitation activities.

### Agriculture

The overall project area is within the boundaries of the extensive agricultural complex referred to as the Kona Field System. The majority of the field system, within the project area, is located east (*mauka*) of the Great Wall of Kuakini' (state site 50-10-37-7276).

Evidence of traditional Hawaiian agriculture predominates the project area. The

majority of these features are considered to be part of the Kona Field System (State site 50-10-37-6601). Commercial enterprises of sugarcane and possibly pineapple cultivation during the historic era are also evident within small portions of the project area.

**Kona Field System**

What is presently referred to as the Kona Field System was observed on the early voyages of Captain James Cook and Captain George Vancouver. Archibald Menzies - a surgeon and naturalist on the 1794 voyage of Vancouver - describes the slopes above breadfruit plantations in Kealakekua Bay as being intensively cultivated:

> As we advance beyond the breadfruit plantations, the country became more and more fertile, being in a high state of cultivation. For several miles around us there was not a spot that would admit of it but what was with great labor and industry cleared of the loose stones and planted with exculent roots or some useful vegetables or other (Menzies 1920:75).

A core area of the Kona Field System was documented by Lloyd Soehren and T. Stell Newman in 1968. Soehren of the Bishop Museum and Newman of the University of Hawaii conducted an inventory and evaluation of the archaeological and historic features in a portion of the *ahupua'a* of Kealakekua and Kaawaloa lying immediately above the coastal cliff (Pali-Kapu-o-Keoua) and extending about one-half mile inland (Soehren 1968). During this study a number of agricultural fields were mapped and defined as parallel long and low mounded walls running upslope intersected in places by shorter cross-slope field walls following natural contours. The grid pattern of fields they recorded was of "very narrow and greatly elongated rectangles" oriented on an axis that is both northeast-southwest and "sea-mountain" (*ibid.*:5). They noted "the whole system extends far inland beyond the limits of this map" (*ibid.*). Field dimensions were noted as varying widely in size and configuration from 50 ft. long by 30 ft. wide to over 1,000 ft. long and 150 ft. wide. Newman and Soehren note (*ibid.*:7) that the productivity of their specific study area has been calculated (by H.L. Baker



*et al.*) as "very poor" to "poor" but state that "land productivity in these two *ahupua'a* greatly increases further inland." They suggest that substantial agricultural endeavor took place at higher elevations: "Since the whole land division might be called upon to provide agricultural support for the lower villages of Kealakekua and Kaawaloa, it was not necessary to derive total support from this marginal lower area" (*ibid.*).

Relying on descriptions in the Cook expedition journals, Soehren and Newman suggested that the fields they mapped were largely for sweet potato cultivation and that "further inland one likely would have found a gradual shift to non-irrigated taro" (*ibid.*:9).

Based on his fieldwork and the accounts of early visitors to the upland of Kona, T.Stell Newman (1970, 1971, 1972) suggested that the 1968 project area was part of a large "Kona Field System" approximately 3 miles wide and 18 miles long (Hawaii Register of Historic places, Site 10-37-6601). He suggested that the field system included a number of planting zones, based essentially on elevations. Two of these zones - one between sea level and the 500-foot elevation level, and the other between the 500- and 1000-foot elevation level - are included within the overall project area:

Sweet Potato/*Wauke* Zone

| | |
|---|---|
| Elevation: | Sea level to about 500 feet ( 0 to 150 meters) |
| Annual Rainfall: | Seasonal; 30 to 50 inches (0.8 to 1.2 meters) |
| Crops: | Sweet potatoes and wauke grown in very rocky areas. |

Breadfruit/Sweet Potato/*Wauke* Zone

| | |
|---|---|
| Elevation: | 500 to 1,000 feet (150 to 300 meters) |
| Annual Rainfall: | 30 to 60 inches (0.8 to 1.5 meters) |
| Crops: | Breadfruit trees, with sweet potatoes and wauke planted between them. |

The agriculture features within the overall project area are considered to be components of the Kona Field System (State site 50-10-37-6601) and were treated as such during the survey: several of these features were individually recorded (to enable a more detailed documentation) and were subsequently assigned separate site numbers.

The Kona Field System - observable on the ground and on aerial photos - extends from

the Great Wall of Kuakini at approximately 275 ft. a.m.s.l. to approximately 900 ft. a.m.s.l *mauka* or upslope to the east (Figure 7).

Examples of features associate with the Kona Field System within the project area primarily include rectangular walled fields formed by *kua'iwi* walls (*mauka/makai* trending) intersected at variable points by walls cross-cutting the slope. Other associated features are present among the walled fields and consist of intermittent mound concentrations, terraces and modified outcrops.

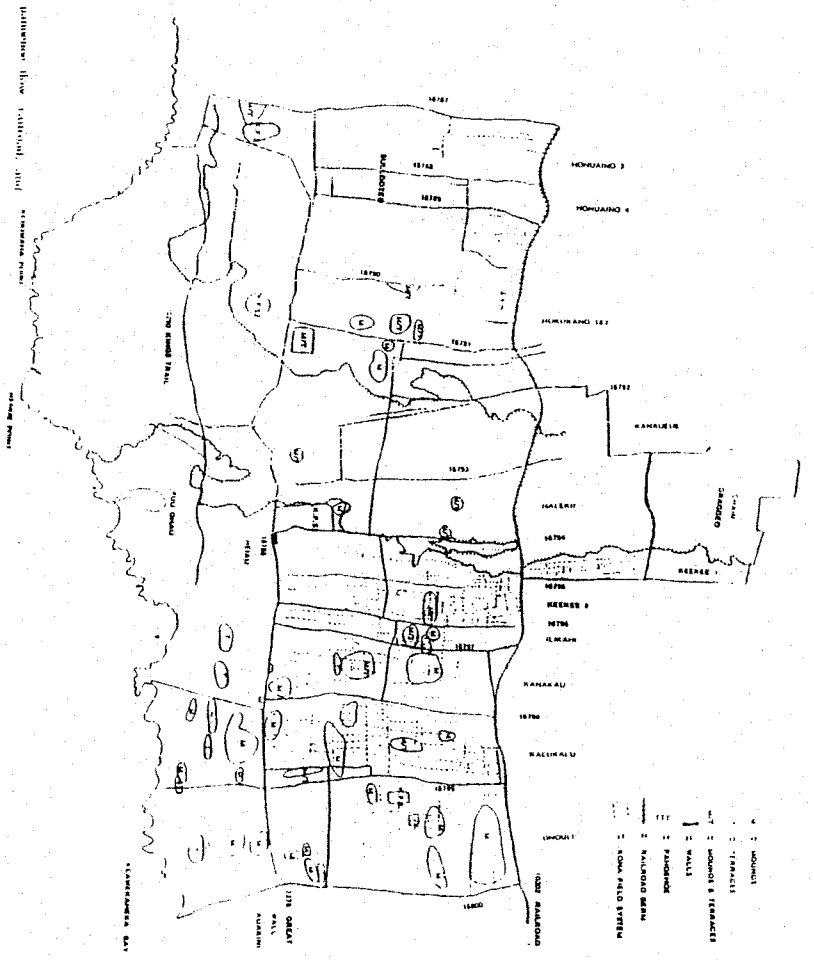
Although the Kona Field System most definitely extended above the 900-ft. elevation and beyond the *mauka* boundary of the project area, various historic and modern land modification have apparently destroyed much of the evidence. This land modification includes "chain-dragging", bulldozing and manual stone clearing - associated with ranching activities and possibly sugarcane cultivation - and urban growth *mauka* of the project area. Distribution of gaps in the field system within the overall project area has been affected by chain dragging, bulldozing, and historic rock clearing, as well as by the natural terrain.

A major pahoehoe lava flow extends *mauka/makai* through the center of the project area. The pahoehoe flow, which is younger with little soil cover,essentially bisects the project area with large soil areas to the north and south. The flow itself contains evidence of agricultural features which - like the rectangular fields in the soil areas, comprise components of the Kona Field System. As described below, the Kona Field System is observed within the project area and is not confined to the rectangular fields within the large soil areas but rather occurred in all types of topography, including the lava flow and steep rocky terrain.

Various modifications were observed along the lava flow and rocky slopes - all indicative of adaptation to apparently less desirable agricultural lands. Such occurrences include terracing along the steep rocky slopes, modifications of natural gullies, modifying and



Figure 7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HONUAINO 4
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WAIAHAU
KEEKEE 1
KEEKEE 2
KEAHA
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KAHAUALEA
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utilizing the edges of lava flows and various other outcrop modifications of which small soil pockets are cleared or depressions excavated in the outcrop for mulch planting.

One "topographic-specific" set of features of particular interest actually resembles a traditional *kua'iwi* wall and rectangular field system in the utilization and modification of the natural *mauka/makai* trending edge of the pahoehoe flow. In this instance, walls are constructed across the slope at the *makai* terminus between parallel pahoehoe "fingers". Thus, the natural configuration of the pahoehoe "fingers" utilized, functioned as, and resembled *kua'iwi* walls.

These features indicate that the *kua'iwi* field system was extended to maximize the utilization of all available soil areas in the project area.

Topographic-specific agricultural features attest to the adaptive qualities of Hawaiian planters in modifying their landscape to maximum agricultural productivity in a varied topographical setting. Thus, beyond confirming Rose Shilt's conclusion (1984:289) that "Hawaiian farmers who landscaped these leeward slopes on a rather monumental scale were well aware of environmental constraints and advantages of each subzone", topographic-specific features indicate that the Hawaiian farmers were also aware of the environmental advantages and constraints within each of the subzones.

**Sugarcane cultivation**

Evidence of commercial sugarcane cultivation is present in three areas within the project area. The evidence includes modification and alteration of the *kua'iwi* walled fields of the Kona Field System for the cultivation of sugarcane. This is suggested by the modification of the *kua'iwi* walls on which stones were added to create a higher and wider wall girth and the removal of walls which traditionally cross-cut the slope to form rectangular fields. It is believed that this alteration - particularly by removing the walls cross-cutting the slope -



allowed the harvested crop to be transported by sled to the railroad located *makai* or downslope of the cane fields. It is also likely that the *kua'iwi* walls were built up as a result of more extensive clearing of the field, necessary for cultivating sugarcane.

The second area of sugarcane cultivation also occurs *mauka* (east) of the railroad berm (State site 50-10-37-10302), immediately *makai* (west) of a historic habitation site (State site 50-10-37-16613) and south of State site 50-10-37-16791 wall. Sugarcane cultivation is evidenced in this area by lack of the field system walls altogether and the presence of unusually large semi-circular mounds. Some of these mounds are formally faced and may have been ramp structures associated with the loading of sugarcane crops onto sleds or other machinery for transportation to the railroad. It is likely that the historic habitation site (State site 50-10-37-16613) was related to the sugarcane cultivation in this area.

The third area of possible sugarcane cultivation lies *makai* (west) of the railroad berm and is evidenced by an open and cleared area and the presence of a historic habitation site (State site 50-10-37-16415). The modification in this area may be more related to homesteading activities than land cultivation. A growth of pineapple exists in this third area, which may indicate that experimental pineapple farming may have taken place here (Jean Greenwell, personal communication). However, precise location of the pineapple experiment is not known at this time.

**Project Area Agriculture Sites**

Eighty-two (82) sites (representing 17.3% of the total 473) within the project area are interpreted as solely agricultural in function. These sites include a section of the Kona Field System along the proposed access road (see Figure 4) and the *makai* edges of the field system within the area *mauka* of the Great Wall of Kuakini. Other agricultural features, typically of topographic-specific types, represent a variety of formal site types including mounds, modified

outcrops, terraces, modified sinks, and excavated outcrop depressions.

## Habitation

Of the total 473 sites recorded in the project area, 253 sites are interpreted as habitation sites. Two specific types of habitation function - temporary and permanent - are used in the present analysis. These function assessments are based in part on Jeffrey Todd Clark's criteria (Clark 1986) for distinguishing domestic unit types.

**Temporary Habitation** (*Single-Use Shelters* and *Recurrent-Use Shelters* - Clark)

*Shape*: C,L,U, Box, Irregular Enclosures, Lava Tubes and Lava Blisters.

*Construction*: Ranging from crude piled rock structures and unmodified to slightly modified lava tubes and blisters to more formally constructed sites with stacked boulders, facing, and modified lava tubes, blisters and sinks.

*Size*: Ranging from 3 $m.^2$ to 30 $m.^2$ approximately.

*Associations*: Usually found in association with agricultural features.

*Cultural Deposit*: Ranging from very little to no artifacts, midden, charcoal, and ash to small quantities of both midden and artifacts, with a clear cultural deposit. Also present might be multiple short-use fireplaces at different horizontal and vertical locations and/or charcoal flecks and possibly ash scattered through deposit.

Ninety-seven (97) of the habitation sites (representing 38.3 % of the total 252), within the project area are determined to be temporary in usage. These include C-shapes, U-shapes, L-shapes, enclosures, lava blisters, lava tubes, modified outcrops, modified sinks, pavements, platforms, rock shelters, and terraces.

In general, temporary habitation sites tend to be small in size, but their construction can range from simple wind blocks to formal, solidly built construction, sometimes similar to permanent habitation sites. Temporary habitation likely occurred primarily during periods of agricultural planting or harvesting when a short-term shelter or a more extended occupation near the agricultural activities was necessary.



Lava tubes which exhibit structural modifications or other evidences of habitation - which are not associated with permanent habitation sites - are also considered to be temporary habitation sites. (A separate summary of function classifications of lava tubes is presented below.)

Some of the structures designated temporary habitations may not be directly associated with habitation activities specified earlier: they may be work or storage areas associated with agriculture, ranching or other activities.

Typically, temporary habitation site designations were given to smaller well-constructed features that were not a part of a large complex. However, some of these features may in fact be smaller permanent habitation sites or, as mentioned previously, separate features of a permanent habitation complexes. Thus, function classifications and spatial associations between temporary and permanent habitation sites will be better clarified during a subsequent data recovery phase of fieldwork when more extensive subsurface testing is conducted.

**Permanent Habitation** (*Permanent Domestic Units* - Clark)

*Shape*: various forms, most commonly terraces, platforms, enclosures, pavings,

*Construction*: Wall structures are well built with thick, high walls, and bifacial or interior surface wall facing likely. Wall cupboard may be present.

*Size*: A very wide range, from 10 $m.^2$ to well over 200 $m.^2$ with commoner's houses smaller than chiefs'. Most range between 20 and 50 $m.^2$.

*Associations*: Chiefs, high-status families and/or religiously devout have multiple structures for each household (huts for various activities, earth ovens, burial monuments, etc.). Houses may occur singly or in neighborhoods with other DUs (domestic units), extended or permanent.

*Geographic Context*: Along the coast, up valleys, and in leeward agricultural zones but seldom, if ever, in Intermediate or Wilderness Zones. That is, they are located wherever people can reasonably secure a living year round.

*Cultural Deposit*: Cultural deposit with highly varied and comparatively abundant midden and artifact assemblages, although quantities may not be large. Multiple abandonment phases absent or separated by long occupation periods. Fireplaces few in number and formal construction.

One hundred fifty six (156) of the habitation sites (representing 61.7% of the total 252) within the project area are considered to be permanent habitation units.

State site 50-10-37-16595 is an excellent example of an inland permanent habitation site. It is situated to the south of the pahoehoe flow and incorporates a platform with attached enclosures, along with multiple possible pig pens. The site displays the prehistoric Hawaiian attention to maximal land utilization: it is constructed on top of a pahoehoe outcrop instead of a soil area that could be utilized for agriculture.

State site 50-10-37-16756 is a classic example of a coastal habitation site, incorporating multiple platforms enclosed within a rectangular enclosure. It is in direct association with sites both to the north and the south comprising a village type setting.

**Lava Tubes**

All twenty-nine (29) lava tubes or lava tube networks identified in the project area display varied evidences of human utilization, exhibiting some degree of external and/or internal modification or containing cultural remains outside the tube. Thus, the discussion of this site type is appropriate within the context of the habitation function category. Lava tube sites which are interpreted primarily as burial sites are summarized in the Burial Sites section of this report.

Lava tubes located within permanent site complexes are considered permanent habitation areas (*e.g.* State sites 50-10-37-10297, 50-10-37-10298 and 50-10-37-16636) which were likely utilized as functionally-specific components similar to the separate house structures found in traditional Hawaiian homesteads or *kau hale*. In a addition, the lava tubes functioned as a family or *ohana* refuge during wartime (*e.g.* State sites 50-10-37-10300,



50-10-37-16425 and 50-10-37-16677).

Almost half (46.7%) of the lava tubes within the project area contain internal and/or external modifications specifically constructed for refuge. These refuge features typically consist of constructions (surface pavements and walls) above or around the entrance of a lava tube which - in effect - conceal the entrance or make it relatively inaccessible.

State sites 50-10-37-10300 and 50-10-37-16677 are the most remarkable refuge caves in the project area, and are comparable to other well-known refuge caves in the Kona District.

State site 50-10-37-10300 refuge cave is characterized by a monumentally altered sink area and massive terrace which blocks its *makai* (west) tube. The site's *mauka* (east) tube is unobstructed and contains the largest concentration of petroglyphs (at least 60 figures) in the project area. The petroglyph figures include numerous human forms, a dog, a centipede and, possibly, a turtle. Because some of the lower petroglyphs are partially covered by deposits, excavation in this area may provide a rare opportunity to date the petroglyphs. A few burials are present within the *makai* tube.

State site -16677 refuge cave is as obscured as State site -10300. It is characterized by a deep sink area - completely filled with stones - through which a well-constructed, faced stone-lined tunnel forms the passage into the underlying lava tube. The presence of numerous internal structures suggests that the lava tube was prepared for refuge, most likely on a long term basis.

Also significant at State site -16677 is the presence of numerous stacks of human bones. These stacks sort the bones by type - long bones, craniums, etc. - and may suggest some type of ritual activity or possible historic or modern disturbance.

The soil areas within the State site -16677 lava tube have been extensively disturbed by previous excavations. This is clearly evidenced by the presence of screens (for sifting soil)

and small plastic containers.

According to Mr. Jack Ackerman, the former property owner, the Ackerman family has an extensive collection of artifacts gathered from State site -16677 over a period of years. The artifacts have been cataloged by the Bernice Pauahi Bishop Museum and are presently located in the Kona area.

### Burial Sites

Twenty-five (25) confirmed burial sites, twelve probable burial sites and 62 possible burial sites were identified within the project area.

Of the 25 confirmed burial sites, 18 are lava tubes and six are monument structures.

Among the confirmed burial sites, State site 50-10-37-16784 lava tube is noteworthy due to the presence of both prehistoric and historic era burials. The historic era burials were observed near the entrance of the tube in a number of stacked lumber coffins. The prehistoric burials were observed in the rear chambers of the tube and were associated with deteriorating ceremonial canoes.

Another notable lava tube burial site - State site 50-10-37-16691 - contains one of the larger concentrations of burials within the project area. The area surrounding the burials contains a large number of grave goods including *he'e* lures and worked wood.

The six confirmed monument burial sites (State sites 50-10-37-16354, 50-10-37-16376, 50-10-37-16386, 50-10-37-16465, 50-10-37-16741, 50-10-37-16743) were identified as the result of subsurface testing. Subsequent to testing, each structural feature was reconstructed to its original configuration.

The nine (9) sites considered probable burials are also surface structures or suspected burial monuments. These sites include platforms, terraces and mounds. All of these sites have similar structural characteristics as the confirmed burial monument sites.



The 62 possible burial sites include mounds, modified outcrops, terraces, platforms, and within stone structures in lava tubes.

### *Heiau* and Other Ritual Sites

Fourteen (14) sites in the project area are interpreted to be *heiau*, possible *heiau*, or shrine structures (State sites 50-10-37-16360, 50-10-37-16375, 50-10-37-16384, 50-10-37-16395, 50-10-37-16438, 50-10-37-16457, 50-10-37-16511, 50-10-37-16703, 50-10-37-16719, 50-10-37-16757, 50-10-37-16758, 50-10-37-16762, and 50-10-37-16786). These sites are considered as *heiau* based on size, presence of formally constructed surface areas, location (*e.g.* positioning on a high point of the terrain), and internal features such as elevated surfaces or altars and deeply-set depressions, possibly for holding idols. Three of the *heiau* are referenced in historical records (State sites 50-10-37-16703, 50-10-37-16719, and 50-10-37-16786).

One major *heiau* - State site 50-10-37-16786 - located within the project area is of particular importance and antiquity. It is believed, based on Rev. William Ellis's accounts in *Polynesian Researches Hawaii*, that this *heiau* was locally known as *Ukanipo*. Ellis describes it in the following passage:

> On top of a high mountain, in the neighborhood, stood the remains of an old *heiau*, dedicated to *Ukanipo*, a shark, to which, we were informed, all the people along the coast, for a considerable distance, used to repair, at stated times, with abundant offerings (Ellis 1825: 129-130).

John Stokes, who surveyed the *heiau* of the island of Hawai'i during the 1920s, while guided by Ellis's narrative, disagrees with Ellis's statement that the *heiau* was located "on top of a high mountain" (Ellis 1825: 129) and suggests that "in reality, he [Ellis] recorded the effect the *heiau* had on him on account of its elevated situation" (Stokes and Dye 1991: 93).

Nonetheless, in accord with Ellis's description, State site 50-10-37-16786 *heiau* - recorded during the present study and believed to be Ukanipo *heiau* - is located on a high bluff above the coast and might well be described as a situated "on top of a high mountain."

Stokes himself locates Ukanipo *heiau* within Lehu'ula *ahupua'a* approximately 4000 feet to the north of the *ahupua'a* of Hokukano. Ellis, however, in his narrative describes his travels as extending in a southerly direction. His last locational reference previous to his description of Ukanipo *heiau* mentions traveling on to Hokukano *ahupua'a*. Ellis's next locational reference is Kaavaroa (Kaawaloa) which - assuming he continued travelling south - would place the Ukanipo *heiau* somewhere between Hokukano and Kaawaloa *ahupua'a*. State site 50-10-37-16677, located in Ke'eke'e *ahupua'a*, is located in the center of this zone and would correspond to Ellis's description. Our observations are tentative and hopefully further research can clarify this issue.

### Animal Pens

Twelve (12) of the recorded sites (representing 2.5% of all sites) within the project area are either isolated animal pens or groups of pens. Sites listed as animal pens are interpreted to be pig pens and are circular or rectangular enclosures which contain high and unusually thick walls: the best examples are State sites 50-10-37-16801 and 50-10-37-16802. Pig pens are distinguishable from similarly constructed habitation enclosures, either by their lack of openings or entrances: if an entrance is present, it is small and roughly constructed. The entrances were constructed large enough to allow outside access to juvenile pigs (for foraging) but small enough to confine adult pigs.

### Railroad

State site 50-10-37-10302 delineates the majority of the *mauka* boundary of the project area.

In 1901 the Kona Sugar Company contracted the firm of Whitehouse and Hawxhurst to build six miles of railroad for the purpose of hauling sugarcane. In 1903 the sugar company failed and the railroad was closed. James B. Castle bought the property and revived



the plantation and railroad in 1906. He extended the line, completing a total of eleven miles of track. The route began above Kailua Town and traveled south to Keopuka. The only known station was at Kona Mill, near the northern end of the railroad. Sugarcane was delivered to the mill in railroad cars.

In April 1906, the West Hawaii Railway Company was formed to build a line of railroad through North and South Kona with an outlet on the seashore at Kealakekua Bay, a total of 30 miles in length. The railway was to be extended at a later date into Kohala and Ka'u. These plans never materialized, and in 1926 the West Hawaii Railway went out of business after having changed hands four times since its original owners.

The railway never carried passengers and was of little use to the general public except to carry freight. (Condé and Best 1973:87-88)

### Trails and Roads

One major trail is located within the project. It is known as the King's Trail and is still discernable along the northern half of the project area. The trail runs from the northern boundary at approximately 20 ft. a.m.s.l. to the *mauka* side of Pu'u Ohau. The trail then turns *mauka* and runs roughly parallel with the "Great Wall of Kuakini" until the southern project boundary where it continues into the *ahupua'a* of Keopuka. The portion of the trail *mauka* of Pu'u Ohau to the south boundary was not observable on the ground; however, its location was obtained on historic maps. The portion of the trail that is distinguishable on the ground follows the general route of the Greenwell Road (built by the Greenwell Family), which at one time connected Keauhou Bay to the north and the Kealakekua Bay settlement at Kaawaloa to the south.

Access to the project area was gained by a dirt and gravel road that extends off of Haleki'i Street south of Kainaliu town. The road runs west (*makai*) until it reaches the

railroad berm at which time it branches off into two roads that extend both to the north and the south and then turn west (*makai*). Both roads run seaward until they connect with the Greenwell Road. Off of the Greenwell Road there are a number of smaller roads that extend toward different destinations including: Nawawa Landing and well, "Cowboy Beach", and "Dr. Trousseau's House" site. There are a number of lesser roads that are still useable that run basically to every section of the project area.

**Walls** (boundary/agricultural)

**The Great Wall of Kuakini**

The Great Wall of Kuakini extends in a north/south direction through the project area between 200 and 275 ft. a.m.s.l. Portions of the wall have been recorded in numerous archaeological projects stretching from Palani Road in Kailua to Keauhou (*e.g.* Kelly [1983:75-76]; Schilt [1984:160-162]).

A wall that may be the Great Wall of Kuakini was recorded by John Papa 'I'i in 1812 at Honua'ula: "A stone wall to protect the food plots stretched back of the village from one end to the other and beyond" (Ii 1959:111). Reverend Albert Baker stated:

> Just a little above [the stone church at Kahalu'u], and continuing all the way to Kailua, is the huge stone wall built in Kuakini's time to keep pigs from the cultivated lands above. A still larger wall may be seen mauka of Kainaliu, built for the cattle landed by Vancouver in 1793. (Baker 1915:83-84)

Marion Kelly in *Na Mala o Kona: Gardens of Kona* (1983:75-76) states:

> It has long been presumed that this wall was built sometime during the governorship of John Adams Kuakini (1820-1844) to protect the cultivated uplands from the depredations of cattle. However, as the wall is at all points less than a mile from the seacoast, only the food plots in the coastal region would have been protected by it. It probably would have only kept cattle and horses grazing on the *kula* away from the houselots and small gardens along the shoreline....
>
> If we are correct in our assumptions, the Kuakini Wall may have been the *pa 'aina* named as the *makai* boundary in several claims to land along its course (Testimony, Native 4: 563, 564, 565). Perhaps the wall was augmented in height and width in later



> years as the necessity arose to protect the coastal residents from horses, cattle, and pigs. Or perhaps it owes its unusual length and height to the need for "busy work" for people who couldn't pay their taxes and other increased money obligations required by the government. (Kelly: 1983:75-76)

Kelly's assumption that the Great Wall of Kuakini may have been the *pa 'aina* coincides with information obtained on the project area. The wall is a major boundary for grants within the project area. Due to the fact that the majority of permanent habitation structures are along the coast, the wall would have served the function of protecting residences and the coastal gardens from pigs, cattle, and horses.

The project area is covered by a network of stone walls that sub-divide it into smaller sections or paddocks. The larger walls tend to run east-west (*mauka/makai*) along the *ahupua'a* boundaries (In addition to these walls serving as *ahupua'a* or grant boundaries they may also represent original Kona Field System walls). The *ahupua'a* are also bisected by north/south running walls that vary in heights and widths. State site numbers were only assigned to the *ahupua'a* division walls with the exception of State site -16790 which runs arbitrarily *mauka/makai* through Hokukano *ahupua'a*.

The presence of the Great Wall within this area of Kona is also indicative of the population center that existed in the project area during the early historic period.

**Wells**

Two (2) sites within the overall project area contain fresh water associated with natural springs. State site 50-10-37-16683 is a lava tube which contains a partially submerged fresh water pond towards its west (*makai*) or downslope end. The pond's size - approximately 20.0 m. (65.6 ft.) E/W by 8.0 m.(26.2 ft.) N/S with an approximate depth of up to 5.0 m. (16.4 ft.) - suggests that it was undoubtedly an invaluable resource in both prehistoric and historic eras. Because of the depth and size of the pond, full exploration was not undertaken, as scuba gear would have been required.

The second water source in the project area is within the conservation zone at Nawawa Landing on the south side of Pu'u Ohau. A well, including a cement tank and pumping station, has been historically modified and is still in use. The presence of the well next to the safest and most accessible landing within the project area explains the large number of historic and prehistoric sites encountered within the area.

## Special

The "special" function category is utilized in this report to categorize sites that did not fit into the standard categories and includes three functional types: bait cups, salt pans, and *papamu* boards which are generally associated with permanent habitation sites or site complexes. However, in certain cases within each functional type, they appear to be independent of direct association with a specific site or site complex.

### Bait Cups

Hawaiian bait cups are small man-made depression (usually pecked and/or ground) in lava pahoehoe used for storing small live bait or grinding bait into "chum") were observed along the coast in clusters near tidal pools and apparent "good" fishing areas. They normally occurred in clusters numbering as small as two or three, or as large as a dozen.

### Salt Bowls

Salt bowls (pans) were observed in association with numerous coastal sites within the project area. They were commonly placed directly onto the outer edges of structures such as enclosures. The salt bowls generally differ from bait cups in that they were usually pecked into large boulders rather than directly into the pahoehoe (*e.g.* State site 50-10-37-16761). State site 50-10-37-16579 contained the only observed salt bowls that were outside of the



coastal area and "conservation district". They did occur, though, just *makai* of the "King's Trail" which might explain there location difference.

### *Papamu*

*Papamu* - a gameboard used in the game *konane* (similar to western checkers) - were observed in association with several habitation sites within the project area. Like the salt bowls the papamu are pecked and ground into both bedrock and boulders. As boulders, they were commonly placed into the walls of sites or they lay within a few feet of a site. However, in a few instances, they appeared isolated and not in association with any site: *i.e.* State sites 50-10-37-16361 and 50-10-37-16637. In these instances, it is felt that these boards were once associated with a site and either the site was destroyed, the association with a site is no longer apparent, or the board had been moved from a site.

## Indeterminate Site Functions

Thirteen (13) of the recorded sites (representing 2.8% of the overall sites) are deemed indeterminate in function, based on lack of observable characteristics. These sites usually are highly disturbed or remnant site structures.

## C. Testing Results

A total of fifteen trenches were excavated at twelve sites during the inventory phase of the present study. These sites include nine (9) possible and probable burials (50-10-37-16354, 50-10-37-16376, 50-10-37-16377, 50-10-37-16386, 50-10-37-16465, 50-10-37-16664, 50-10-37-16665, 50-10-37-16741, and 50-10-37-16743) two (2) lava tubes (50-10-37-10300 and 50-10-37-16677) and one agricultural complex (50-10-37-16629).

The limited testing was conducted primarily to determine the presence or absence of burials. The two lava tube sites were tested to determine whether cultural deposits were present and to collect charcoal samples for radiocarbon dating. Subsequent to the testing all excavated sites were reconstructed to their original form.

Table 3 is a catalog of indigenous artifacts collected within the project area during survey and testing phases. Table 4 is a catalog of historic artifacts collected within the project area during survey and testing phases. Table 5 is a catalog of all midden components collected within the project area during the testing phase. Table 6 is a catalog of charcoal samples collected during testing within the project area. Table 7 lists those charcoal samples from *in situ* contexts or discrete archaeological features that were submitted to Beta-Analytic Inc. of Coral Gables, Florida for radiocarbon dating analysis.





TABLE 3 - INDIGENOUS ARTIFACT CATALOG

| Acc# | State Site 50-10-37 | Trench/feature | Stratum | Depth (cm) | # Pieces | Length (cm) | Width (cm) | Thickness (cm) | Weight (grms) | Material | Function | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10297 | Lava tube | | Surface | 1 | 7.4 | 6.2 | 0.6 | 57.7 | Basalt | polishing stone | |
| 2 | 10300 | | | Surface | 1 | 6.1 | 5.0 | 5.0 | 207.2 | Basalt | poi pounder | mpc |
| 3 | 10300 | | | Surface | 1 | 9.4 | 5.7 | 2 | 217.8 | Basalt | adz | |
| 4 | 10300 | | I | 0-10 | 4 | 1.0/1.3 | 0.8/1.2 | 0.2/0.7 | 2.5 | V-glass | flakes | |
| 5 | 10300 | | I | 0-10 | 2 | 2.0/3.0 | 1.4/1.8 | 0.2/0.7 | 5.1 | Basalt | flakes | |
| 6 | 10300 | | II | 10-20 | 2 | 1.0/1.2 | 0.9/1.1 | 0.1/0.6 | 1.3 | V-glass | flakes | |
| 7 | 10300 | | II | 40-50 | 1 | 3.2 | 0.5 | 0.4 | 0.6 | Urchin | file | |
| 8 | 10300 | 1 | II | 40-50 | 1 | 4.2 | 2.2 | 0.3 | 5.7 | Shell | fish hook | blank |
| 9 | 10300 | 1 | II | 50-60 | 1 | 1.9 | 1.4 | 0.2 | 0.7 | V-glass | flakes | |
| 10 | 10300 | 1 | II | 60-70 | 1 | 1.5 | 1.1 | 0.2 | 0.4 | V-glass | flake | |
| 11 | 10300 | 1 | II | 70-90 | 3 | 1.8/2.1 | 0.8/1.4 | 0.3/0.4 | 2.6 | V-glass | flakes | |
| 12 | 10300 | 1 | II | 70-90 | 2 | 1.1/1.2 | 0.7/1.1 | 0.1/0.2 | 1.0 | Basalt | flakes | |
| 13 | 10300 | 1 | II | 90-100 | 1 | 2.3 | 1.2 | 1 | 0.5 | Urchin | file | |
| 14 | 10300 | 1 | II | 90-105 | 1 | 3.4 | 0.8 | 0.5 | 1.2 | Bone | pendant | dog tooth |
| 15 | 10300 | 1 | II | 90-105 | 1 | 1.7 | 1.4 | 0.4 | 1.3 | V-glass | flake | |
| 16 | 10300 | 1 | II | 90-105 | 2 | 1.6/3.1 | 0.9/1.8 | 1.3/0.3 | 5.7 | Basalt | flakes | |
| 17 | 16354 | 2 | II | 50-90 | 2 | 0.6/1.5 | 0.3/0.9 | 0.1/0.1 | 0.1 | V-glass | flakes | |
| 18 | 16376 | 1, below platform | I | 35-45 | 1 | 1.5 | 1.2 | 0.2 | 0.7 | V-glass | flake | |
| 19 | 16376 | 1, below platform | I | 35-45 | 1 | 1.5 | 1.3 | 0.3 | 0.6 | Basalt | flake | polished |
| 20 | 16376 | 1 | II | 80-90 | 1 | 1.3 | 0.7 | 0.3 | 0.4 | V-glass | flake | |
| 21 | 16376 | 1 | II | 80-90 | 1 | 1.2 | 0.9 | 0.3 | 0.4 | V-glass | flake | |
| 22 | 16376 | 1 | II | 110-150 | 1 | 2.6 | 1.8 | 0.6 | 2.4 | V-glass | flake | |
| 23 | 16376 | 1 | II | 110-150 | 1 | 1.2 | 0.7 | 0.7 | 1.1 | Basalt | manuport | water-rounded pebble |
| 24 | 16376 | 1, below platform | II | 110-150 | 1 | 2.6 | 1.7 | 0.8 | 2.3 | Basalt | flake | |
| 25 | 16376 | 1 | II | 110-150 | 1 | 1.2 | 0.7 | 1 | Basalt | manuport | water-rounded pebble | |
| 26 | 16377 | 2, cobble fill | | | 1 | 4.2 | 3.1 | 0.8 | 12.7 | Basalt | flake | |
| 27 | 16377 | 2, cobble fill | | | 1 | 2.1 | 1.9 | 0.4 | 2.1 | Basalt | flake | |
| 28 | 16377 | 2, cobble fill | | | 1 | 7.3 | 2.4 | 1.4 | 32.6 | Basalt | adze | fragment |
| 29 | 16377 | 2, cobble fill | | | 1 | 4.2 | 3.8 | 2.5 | 38.7 | V-glass | core | |
| 30 | 16377 | 2, cobble fill | | | 1 | 5.2 | 4.8 | 3.8 | 129.1 | Basalt | manuport | fragment |
| 31 | 16377 | 2 | I | 0-10 | 4 | 1.0/2.0 | 1.0/1.3 | 0.8/1.0 | 12.2 | Basalt | manuport | water-rounded |
| 32 | 16377 | 2 | I | 0-10 | 1 | 5.2 | 3.5 | 0.2 | 5.6 | Shell | fish hook | blank |
| 33 | 16377 | 2 | I | 0-10 | 2 | 1.9/2.8 | 1.3/2.7 | 1.0/2.2 | 23.6 | Basalt | core | |
| 34 | 16377 | 2 | I | 0-10 | 6 | 1.0/2.4 | 0.8/1.6 | 0.5/0.9 | 8.2 | V-glass | flakes | |
| 35 | 16377 | 2 | I | 0-10 | 38 | 1.0/3.8 | 0.6/2.4 | 0.8/1.0 | 44.4 | Basalt | flakes | |

TABLE 3 - INDIGENOUS ARTIFACT CATALOG (continued)

| Acc# | State Site 50-10-37 | Trench/Feature | Stratum | Depth (cm) | # Pieces | Length (cm) | Width (cm) | Thickness (cm) | Weight (gms) | Material | Function | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 16377 | 2 | I | 10-20 | 14 | 1.9/3.3 | 0.8/2.8 | 0.2/0.7 | 21.8 | Basalt | flakes | |
| 37 | 16377 | 2 | I | 10-20 | 1 | 1.5 | 1.0 | 0.6 | 0.7 | Bone | human | tooth |
| 38 | 16377 | 2 | I | 10-20 | 2 | 1.2/1.1 | 0.9/1.2 | 0.3/0.9 | 2.1 | V-glass | flakes | |
| 39 | 16377 | 2 | I | 20-35 | 1 | 1.8 | 0.7 | 0.5 | 0.7 | V-glass | flake | |
| 40 | 16377 | 2 | I | 20-35 | 1 | 0.9 | 0.7 | 0.1 | 0.1 | Basalt | flake | |
| 41 | 16377 | 2 | I | 20-35 | 7 | 1.1/3.2 | 0.8/2.1 | 0.2/1.1 | 11.5 | Basalt | flakes | |
| 42 | 16377 | 2 | I | 20-35 | 1 | 2.2 | 1.3 | 1.1 | 3.3 | Basalt | manuport | |
| 43 | 16386 | 3 | I | 0-15 | 6 | 0.9/1.4 | 0.8/0.6 | 0.2/0.2 | 1.9 | V-glass | flakes | |
| 44 | 16386 | 3 | Ib | 25-35 | 4 | 0.9/2.1 | 0.8/1.1 | 0.3 | 3.4 | V-glass | flakes | |
| 45 | 16386 | 3 | II | 45-55 | 1 | 1.1 | 1.0 | 0.4 | 0.4 | Basalt | flake | |
| 46 | 16386 | 3 | II | 45-55 | 1 | 1.2 | 0.7 | 0.1 | 0.1 | V-glass | flake | |
| 47 | 16386 | 3 | II | 45-55 | 1 | 1.6 | 1.6 | 0.6 | 1.4 | Coral | manuport | |
| 48 | 16386 | 3 | II | 45-55 | 1 | 1.9 | 1.5 | 0.9 | 3.1 | Basalt | manuport | |
| 49 | 16386 | 3 | II | 55-65 | 1 | 2.7 | 1.9 | 1.7 | 12.5 | Basalt | manuport | |
| 50 | 16386 | 3 | II | 55-65 | 1 | 0.9 | 0.8 | 0.1 | 0.1 | V-glass | flake | |
| 51 | 16386 | 3 | II | 55-65 | 1 | 1.8 | 1.0 | 1.1 | 1.8 | Basalt | flake | |
| 52 | 16386 | 3 | II | 55-65 | 2 | 2.0/1.4 | 1.7/1.2 | 1.7/0.8 | 7 | Basalt | manuports | |
| 53 | 16386 | 3 | II | 55-65 | 2 | 1.2/2.1 | 0.9/1.2 | 0.1/0.1 | 0.6 | Shell | fragment | pearl |
| 54 | 16386 | 3 | II | 65-75 | 1 | 1.9 | 1 | 0.8 | 2.6 | Basalt | manuport | |
| 55 | 16386 | 3 | II | 65-75 | 2 | 1.7/1.9 | 1.1/1.1 | 0.6/0.7 | 4 | V-glass | flakes | |
| 56 | 16422 | B | | Surface | 1 | 7.9 | 4.5 | 3 | 71.7 | Coral | abrader | |
| 57 | 16422 | B | | Surface | 1 | 8 | 5.7 | 3.7 | 83.3 | Shell | lure | perforated |
| 58 | 16424 | D | | Surface | 1 | 8.4 | 6 | 1.3 | 23 | Bone | boar tusk | fractured |
| 59 | 16425 | | | Surface | 1 | 8.5 | 7.8 | 3 | 232.3 | Coral | abrader | |
| 60 | 16425 | | | Surface | 1 | 9.8 | 3.8 | 3 | 258.7 | Basalt | adz | |
| 61 | 16425 | Lava tube | | Surface | 18 | 1.3/19.3 | 0.8/19.6 | 0.3/0.7 | 54.9 | Gourd | fragments | |
| 62 | 16425 | | | Surface | 1 | 1.5 | 1.2 | 0.3 | 1.1 | Basalt | flake | polished |
| 63 | 16425 | | | Surface | 3 | 1.9/2.4 | 1.7/2.0 | 0.6/1.1 | 20 | Basalt | manuports | water-rounded pebbles |
| 64 | 16465 | 1/A | 1 | 10-20 | 1 | 0.7 | 0.6 | 0.1 | 0.1 | V-glass | flake | |
| 65 | 16478 | | | Surface | 7 | 5.2/22.0 | 1.1/2.0 | 0.5/2.0 | 48.7 | Wood | fire plows | |
| 66 | 16478 | | | Surface | 1 | 36.2 | 3 | 3 | 466 | Wood | tapa beater | |
| 67 | 16478 | | | Surface | 1 | 39.5 | 4.8 | 4.8 | 930.1 | Wood | tapa beater | |
| 68 | 16478 | | | Surface | 1 | 40.5 | 3.7 | 3.7 | 420.4 | Wood | tapa beater | |
| 69 | 16478 | | | Surface | 1 | 35.5 | 4 | 4 | 430.4 | Wood | tapa beater | |
| 70 | 16478 | | | Surface | 1 | 35.5 | 5 | 5 | 370.1 | Wood | tapa beater | |



TABLE 3 - INDIGENOUS ARTIFACT CATALOG (continued)

| Acc# | State Site 50-10-37 | Trench/Feature | Stratum | Depth (cm) | # Pieces | Length (cm) | Width (cm) | Thickness (cm) | Weight (gms) | Material | Function | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 71 | 16478 | | | Surface | 1 | 7.8 | 5.5 | 0.1 | 13.2 | Shell | cut | |
| 72 | 16478 | | | Surface | 1 | 9.1 | 7.9 | 0.3 | 108 | Shell | cut | |
| 73 | 16478 | | | Surface | 1 | 9.2 | 9.6 | 0.5 | 65.9 | Coconut | shell | half |
| 74 | 16478 | | | Surface | 1 | 10.8 | 6.7 | 3.6 | 256.6 | Basalt | abrader/wet stone | |
| 75 | 16478 | | | Surface | 1 | 6.3 | 2.7 | 1.5 | 33.4 | Coral | file | |
| 76 | 16487 | | | Surface | 1 | 20 | 14.5 | 4.7 | 2390.9 | Basalt | polishing stone | |
| 77 | 16509 | | | Surface | 1 | 4 | 3 | 1.3 | 47.2 | Basalt | adz | flake |
| 78 | 16509 | | | Surface | 1 | 6.3 | 4.4 | 4.4 | 225 | Basalt | fragment | polished |
| 79 | 16540 | | | Surface | 1 | 7.3 | 6.4 | 2 | 269.7 | Basalt | hammerstone | |
| 80 | 16553 | | | Surface | 1 | 6.1 | 4.7 | 1.9 | 112 | Basalt | polishing stone | |
| 81 | 16589 | A | | Surface | 1 | 4.4 | 0.8 | 0.6 | 2.7 | Shell | lure | one hole |
| 82 | 16589 | A | | Surface | 1 | 9.3 | 2.2 | 1.5 | 21.5 | Scoria | saw | |
| 83 | 16589 | A | | Surface | 1 | 6.9 | 1.5 | 0.9 | 7.1 | Scoria | file | |
| 84 | 16589 | A | | Surface | 1 | 6.5 | 3.3 | 2.7 | 88.4 | Basalt | sinker | breadloaf |
| 85 | 16589 | A | | Surface | 1 | 4.1 | 0.9 | 0.4 | 1.7 | Shell | fish hook | |
| 86 | 16589 | A | | Surface | 1 | 7.1 | 0.5 | 0.5 | 1.3 | Bone | pick | |
| 87 | 16589 | A | | Surface | 1 | 5.4 | 0.9 | 0.6 | 0.9 | Bone | pick | |
| 88 | 16589 | B | | Surface | 1 | 8.5 | 3.4 | 3.2 | 190.8 | Basalt | adz | |
| 89 | 16613 | I | | Surface | 1 | 6.5 | 6 | 3.3 | 160.4 | Basalt | adz | blade |
| 90 | 16618 | A | | Surface | 1 | 9.7 | 6 | 5.3 | 449 | Basalt | hammerstone | |
| 91 | 16619 | | | Surface | 1 | 6.5 | 5.6 | 3.7 | 167.1 | Coral | hammerstone | |
| 92 | 16619 | | | Surface | 1 | 8.3 | 5.3 | 2.6 | 206.6 | Basalt | octopus lure sinker | |
| 93 | 16630 | | | Surface | 1 | 33.9 | 2.8 | 2.2 | 127.6 | Wood | digging stick | |
| 94 | 16630 | | | Surface | 1 | 60.3 | 2.2 | 2.2 | 156.6 | Wood | worked | tip burned |
| 95 | 16631 | Lava tube | | Surface | 1 | 22.8 | 23.0 | 20.3 | 628.5 | Wood | bowl | bottom rotten |
| 96 | 16631 | | | Surface | 1 | 9.1 | 9.1 | 4.7 | 618.8 | Basalt | ulu maika | |
| 97 | 16676 | A | | Surface | 1 | 16.5 | 1.9 | 0.5 | 12.8 | Wood | worked | |
| 98 | 16677 | 4 | 1 | 0-15 | 2 | 6.5/10.5 | 0.7/0.9 | 0.3/1.0 | 5.8 | Bone | pick | w/ sheath |
| 99 | 16683 | | | Surface | 1 | 12.4 | 8.5 | 2.3 | 143.2 | Coral | file | |
| 100 | 16691 | Lava tube | | Surface | 1 | 39.8 | 1.7 | 1.5 | 19.2 | Wood | worked | broken, 3 pieces |
| 101 | 16702 | | | Surface | 1 | 3.6 | 0.9 | 0.5 | 1.9 | Bone | pendant | dog tooth |
| 102 | 16710 | A | | Surface | 1 | 17 | 12.7 | 5.7 | 1277.5 | Basalt | polishing stone | |
| 103 | 16710 | I | | Surface | 1 | 10.3 | 6.3 | 5.6 | 713.5 | Basalt | hammerstone | |
| 104 | 16710 | G | | Surface | 1 | 6.5 | 5.8 | 4.9 | 400.5 | Basalt | hammerstone | |
| 105 | 16710 | J | | Surface | 1 | 7.8 | 4.4 | 3.8 | 268.5 | Basalt | adz | |

TABLE 3 - INDIGENOUS ARTIFACT CATALOG (continued)

| Acc# | State Site 50-10-37 | Trench/Feature | Stratum | Depth (cm) | # Pieces | Length (cm) | Width (cm) | Thickness (cm) | Weight (gms) | Material | Function | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 106 | 16710 | D | | Surface | 1 | 5 | 1.9 | 1.5 | 12.4 | Basalt | flake | |
| 107 | 16710 | J | | Surface | 1 | 4.6 | 2.9 | 0.7 | 15.5 | Basalt | adz | fragment |
| 108 | 16710 | J | | Surface | 1 | 3.7 | 3.5 | 0.6 | 13.5 | Basalt | polishing stone | |
| 109 | 16710 | I | | Surface | 1 | 4.2 | 2.0 | 0.1 | 2.3 | Shell | fish hook | blank |
| 110 | 16715 | | | Surface | 1 | 4.0 | 2.7 | 0.8 | 17 | Basalt | adz | finishing |
| 111 | 16741 | 1/D | 1 | | 1 | 3.3 | 0.5 | 0.4 | 0.8 | Bone | fish hook | preform |
| 112 | 16741 | 1/D | 1 | | 18 | 1.0/1.7 | 0.5/1.4 | 0.2/0.5 | 10.6 | V-glass | flakes | |
| 113 | 16745 | | | Surface | 1 | 12.2 | 4.7 | 1.7 | 107 | Basalt | knife | fragment |
| 114 | 16785 | | | Surface | 1 | 8.3 | 0.6 | 0.6 | 1.7 | Bone | pick | rail bone |
| 115 | 16785 | | | Surface | 1 | 8.7 | 0.8 | 0.8 | 4.2 | Bone | pick | dog bone |
| 116 | 16785 | | | Surface | 1 | 5.9 | 2.6 | 0.3 | 4.5 | Bone | squid lure toggle | pig vertebra |
| 117 | map | bulldozed road | | Surface | 1 | 6.2 | 6.1 | 3.4 | 255.9 | Basalt | ulu maika | |
| 118 | map | | | Surface | 1 | 7.6 | 4.5 | 2.5 | 120.9 | Basalt | adz | preform fragment |
| 119 | | | | Surface | 1 | 6.6 | 6.5 | 4.9 | 161.8 | Basalt | ulu maika | |
| 120 | map | bulldozed road | | Surface | 1 | 3.3 | 3.2 | 1.4 | 10.5 | Coral | abrader | fragment |
| 121 | map | bulldozed road | | Surface | 1 | 6.7 | 6.3 | 2.2 | 71.3 | Coral | abrader | |
| 122 | map | bulldozed road | | Surface | 1 | 4.3 | 2.1 | 1.3 | 13.8 | V-glass | flake | |
| 123 | | near 156 | | Surface | 1 | 3.7 | 3 | 3 | 23.3 | Coral | net sinker | |
| 124 | | near heiau | | Surface | 1 | 2 | 1.3 | 0.2 | 2.7 | Basalt | adz | fragment |
| 125 | map | | | Surface | 1 | 6 | 6 | 2.5 | 252.9 | Basalt | ulu maika | |
| 126 | | mauka of berm | | Surface | 1 | 5.5 | 3.2 | 3.7 | 85.7 | Basalt | candle holder | |
| 127 | | scatter by landing | | Surface | 1 | 2.2 | 1.7 | 1.2 | 6 | V-glass | flake | |
| 128 | | scatter by landing | | Surface | 1 | 4.2 | 3.1 | 0.7 | 13.3 | Basalt | polishing stone | |
| 129 | | scatter by landing | | Surface | 1 | 8.3 | 4 | 3 | 64.2 | Coral | file | |
| 130 | | road by cowboy beach | | Surface | 1 | 4.9 | 2.8 | 1.8 | 27.3 | Coral | abrader | |

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## TABLE 4 - HISTORIC ARTIFACT CATALOG

| Acc# | State Site 50-10-37 | Trench/Feature | Stratum | Depth (cm) | # Pieces | Length (cm) | Width (cm) | Thickness (cm) | Weight (gms) | Material | Function | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H-1 | 16376 | 1 | II | 140-150 | 3 | 1.2/3.3 | 0.4/0.7 | 0.2/0.6 | 1.6 | Metal | fragments | |
| H-2 | 16386 | 3 | I | 0-15 | 2 | 1.9/2.4 | 0.7/1.8 | 0.5/0.5 | 3.8 | Metal | fish hook | fragments |
| H-3 | 16741 | 1 | I | Surface | 1 | 1.8 | 0.7 | 0.4 | 1.1 | Metal | fragment | |

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## TABLE 5 - MIDDEN CATALOG

| Site # 50-10-37- | 10300 | 10300 | 10300 | 10300 | 10300 | 10300 | 10300 | 10300 |
|---|---|---|---|---|---|---|---|---|
| Trench | I | I | I | I | I | I | I | I |
| Depth(cm)/Stratum | 0-10/I | 10-20/I | 20-40/II | 40-50/II | 50-60/II | 60-70/II | 70-90/II | 90-105/II |
| Class: Gastropoda | | | | | | | | |
| Cellana sp. | 2.5 | | 0.4 | 3.3 | | 1.0 | 0.9 | 2.4 |
| Conus sp. | 4.2 | | | | 12.6 | | 12.6 | |
| Cypraea caputserpentis | 7.7 | 2.8 | 0.6 | 1.8 | 4.4 | 1.9 | 2.8 | 8.2 |
| Cypraea maculifera | 4.5 | 9.3 | | | | | | 15.1 |
| Littorina sp. | | | | | | | | |
| Nerita picea | 1.0 | | 0.4 | 0.3 | 1.7 | | 0.9 | 2.5 |
| Thaididae sp. | 4.9 | 2.8 | 7.6 | 4.2 | 3.1 | 2.4 | 1.6 | 4.4 |
| Trochus intextus | | | | | | | 0.4 | 0.3 |
| Turbo sandwicensis | | 0.1 | | | | | | |
| Class: Pelecypoda | | | | | | | | |
| Isognomon sp. | | | | | | | | |
| Pteriacea sp. | | | | | | | | |
| Unident./Other species | 2.1 | 0.6 | | | 1.4 | | 4.5 | 6.4 |
| Total Mollusca | 26.9 | 15.6 | 9.0 | 9.6 | 23.2 | 5.3 | 23.7 | 39.3 |
| Crustacean | | | | | | 0.6 | | |
| Echinoderm | 1.5 | 0.3 | 0.7 | 1.9 | 0.6 | 1.1 | 1.7 | 1.1 |
| Total Invertebrate Midden | 28.4 | 15.9 | 9.7 | 11.5 | 23.8 | 7.0 | 25.4 | 40.4 |
| Class: Chondrichthyes | | | | | | | | |
| Shark | | 1.6 | | 0.1 | | | | |
| Class: Osteichthyes | | | | | | | | |
| Labrid | | | | 0.1 | | | | |
| Scarid | | | 0.6 | | | | | |
| Acanthurid | | | 0.1 | | | | | |
| Balistid | 0.1 | | | | | | | |
| Deodontid | | | 0.1 | | | | | 0.3 |
| Fish Other or Indeterminate | 0.6 | | 0.3 | 0.6 | 0.8 | 1.8 | 0.7 | 1.0 |
| Total Chordata | 0.7 | 1.6 | 1.1 | 0.8 | 0.8 | 1.8 | 0.7 | 1.3 |
| Total Marine Midden | 29.1 | 17.5 | 10.8 | 12.3 | 24.6 | 8.8 | 26.1 | 41.7 |
| Class Aves | | | | | | | | |
| Gallus gallus | | 0.5 | | | | | | |
| Columba livia | | | | | | | | |
| Birds Other or Indeterminate | | | | | | | 0.4 | |
| Medium bird | | | | | | | | 0.1 |
| Total Aves | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.1 |



## TABLE 5 - MIDDEN CATALOG (continued)

| Site # 50-10-37- | 10300 | 10300 | 10300 | 10300 | 10300 | 10300 | 10300 | 10300 |
|---|---|---|---|---|---|---|---|---|
| Trench | I | I | I | I | I | I | I | I |
| Depth(cm)/Stratum | 0-10/I | 10-20/I | 20-40/II | 40-50/II | 50-60/II | 60-70/II | 70-90/II | 90-105/II |
| Class Mammalia | | | | | | | | |
| Rattus exulans | 0.1 | 0.1 | | | | | 0.1 | 0.2 |
| Rattus nor. &/or R. rattus | 0.4 | | | | | | | 0.1 |
| Mus musculus | | | | | | | | |
| Canis familiaris | | | | | | | 1.4 | |
| Sus scrofa | 0.8 | | | | | 1.6 | | 8.9 |
| Capra hircus/Ovis sp. | | | | | | | | |
| Small-to-medium mammal | 0.8 | 1.3 | | | | | | |
| Medium mammal | | | | | | | | 9.2 |
| Total Mammalia | 2.1 | 1.4 | 0.0 | 0.0 | 0.0 | 1.6 | 1.5 | 18.4 |
| Small vertebrate | | | | | | | | |
| Medium vertebrate | | 0.3 | | | | | | |
| Kukui endocarps | 87.4 | 13.7 | 18.0 | 8.4 | 51.1 | 13.9 | 16.7 | 165.8 |
| Total Terrestrial Midden | 89.5 | 15.9 | 18.0 | 8.4 | 51.1 | 15.5 | 18.6 | 184.3 |
| Total Midden | 118.6 | 33.4 | 28.8 | 20.7 | 75.7 | 24.3 | 44.7 | 226.0 |
| Coral | | | | 0.2 | | | | |
| Land snails | | | | | | | | |
| | | | | | | | | |
| Total Mollusca | 26.9 | 15.6 | 9.0 | 9.6 | 23.2 | 5.3 | 23.7 | 39.3 |
| Total Invertebrate | 28.4 | 15.9 | 9.7 | 11.5 | 23.8 | 7.0 | 25.4 | 40.4 |
| Total Chordata | 0.7 | 1.6 | 1.1 | 0.8 | 0.8 | 1.8 | 0.7 | 1.3 |
| Total Marine Midden | 29.1 | 17.5 | 10.8 | 12.3 | 24.6 | 8.8 | 26.1 | 41.7 |
| Total Aves | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.1 |
| Total Mammalia | 2.1 | 1.4 | 0.0 | 0.0 | 0.0 | 1.6 | 1.5 | 18.4 |
| Total Terrestrial Midden | 89.5 | 15.9 | 18.0 | 8.4 | 51.1 | 15.5 | 18.6 | 184.3 |
| Total Midden | 118.6 | 33.4 | 28.8 | 20.7 | 75.7 | 24.3 | 44.7 | 226.0 |

TABLE 5 - MIDDEN CATALOG (continued)

| Site # 50-10-37- | 16376 | 16376 | 16376 | 16376 | 16376 | 16377 | 16377 | 16377 |
|---|---|---|---|---|---|---|---|---|
| Trench | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| Depth(cm)/Stratum | 35-45/I | 45-80/IB | 80-90/II | 90-100/II | 110-150/III | fill | 0-10/I | 10-20/I |
| **Class: Gastropoda** | | | | | | | | |
| Cellana sp. | 0.6 | 0.7 | | | 0.4 | | 0.2 | 2.5 |
| Conus sp. | | | | | | | | 1.5 |
| Cypraea caputserpentis | 3.0 | | | | 6.2 | | 10.9 | 2.3 |
| Cypraea maculifera | | 8.5 | | | 13.7 | | 8.3 | 10.3 |
| Littorina sp. | | | | | | | | |
| Nerita picea | | | | | 0.8 | | 3.3 | 0.3 |
| Thaididae sp. | | | | | 0.7 | 2.4 | 2.0 | 0.4 |
| Trochus intextus | | | | | | | | |
| Turbo sandwicensis | | | | | | | | |
| **Class: Pelecypoda** | | | | | | | | |
| Isognomon sp. | | | | | 8.1 | | 1.3 | |
| Pteriacea sp. | | | 0.7 | | | | | 0.8 |
| Unident./Other species | 0.9 | | | 2.6 | 4.1 | | 3.8 | 0.2 |
| **Total Mollusca** | 4.5 | 9.2 | 0.7 | 2.6 | 34.0 | 2.4 | 29.8 | 18.3 |
| Crustacean | | | | | | | 0.5 | |
| Echinoderm | 0.8 | 0.2 | | 0.9 | 3.8 | | 5.7 | 1.7 |
| **Total Invertebrate Midden** | 5.3 | 9.4 | 0.7 | 3.5 | 37.8 | 2.4 | 36.0 | 20.0 |
| **Class: Chondrichthyes** | | | | | | | | |
| Shark | | | | | | | | |
| **Class: Osteichthyes** | | | | | | | | |
| Labrid | | | | | | | | |
| Scarid | | | | | | | | |
| Acanthurid | | | | | | | | |
| Balistid | | | | | | | | |
| Deodontid | | | | | | | | |
| Fish Other or Indeterminate | | | | | | 0.6 | | |
| **Total Chordata** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 |
| **Total Marine Midden** | 5.3 | 9.4 | 0.7 | 3.5 | 37.8 | 3.0 | 36.0 | 20.0 |
| **Class Aves** | | | | | | | | |
| Gallus gallus | | | | | | | | |
| Columba livia | | | | | | | | |
| Birds Other or Indeterminate | | | | | | | | |
| Medium bird | | | | | | | | |
| **Total Aves** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



TABLE 5 - MIDDEN CATALOG (continued)

| Site # 50-10-37- | 16376 | 16376 | 16376 | 16376 | 16376 | 16377 | 16377 | 16377 |
|---|---|---|---|---|---|---|---|---|
| Trench | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| Depth(cm)/Stratum | 35-45/I | 45-80/IB | 80-90/II | 90-100/II | 110-150/III | fill | 0-10/I | 10-20/I |
| **Class Mammalia** | | | | | | | | |
| Rattus exulans | | | | | | | | |
| Rattus nor. &/or R. rattus | | | | | | | | |
| Mus musculus | | | | | | | | |
| Canis familiaris | | | | | | | | |
| Sus scrofa | | | | | | | | |
| Capra hircus/Ovis sp. | | | | | | | | |
| Small-to-medium mammal | | | | | | | | |
| Medium mammal | | | | | | | | |
| **Total Mammalia** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Small vertebrate | | | | | 0.2 | | 8.3 | 2.0 |
| Medium vertebrate | | | | | | | | |
| Kukui endocarps | | | | | 1.6 | | 2.9 | |
| **Total Terrestrial Midden** | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 11.2 | 2.0 |
| **Total Midden** | 5.3 | 9.4 | 0.7 | 3.5 | 39.6 | 3.0 | 47.2 | 22.0 |
| Coral | 20.9 | 0.7 | 2.3 | 1.7 | 4.0 | | 2.3 | |
| Land snails | | | 0.1 | | 0.2 | | | |
| | | | | | | | | |
| Total Mollusca | 4.5 | 9.2 | 0.7 | 2.6 | 34.0 | 2.4 | 29.8 | 18.3 |
| Total Invertebrate | 5.3 | 9.4 | 0.7 | 3.5 | 37.8 | 2.4 | 36.0 | 20.0 |
| Total Chordata | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 |
| Total Marine Midden | 5.3 | 9.4 | 0.7 | 3.5 | 37.8 | 3.0 | 36.0 | 20.0 |
| Total Aves | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Mammalia | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Terrestrial Midden | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 11.2 | 2.0 |
| Total Midden | 5.3 | 9.4 | 0.7 | 3.5 | 39.6 | 3.0 | 47.2 | 22.0 |

TABLE 5 - MIDDEN CATALOG (continued)

| Site # 50-10-37- | 16377 | 16386 | 16386 | 16386 | 16386 | 16386 | 16386 | 16386 |
|---|---|---|---|---|---|---|---|---|
| Trench | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Depth(cm)/Stratum | 20-30/I | 0-15/I | 15-25/IB | 25-35/IB | 35-45/II | 45-55/II | 55-65/II | 65-75/II |
| **Class: Gastropoda** | | | | | | | | |
| Cellana sp. | | | | 1.5 | | 0.1 | | 0.2 |
| Conus sp. | | | | 5.3 | | | 11.6 | |
| Cypraea caputserpentis | 2.9 | 8.7 | 0.6 | 4.7 | 0.7 | 2.7 | 5.5 | 1.9 |
| Cypraea maculifera | 10.4 | 15.3 | | 12.6 | | 10.9 | | |
| Littorina sp. | | | | | | | 0.6 | |
| Nerita picea | 0.4 | | 0.1 | 0.7 | | 0.6 | 0.7 | |
| Thaididae sp. | 2.3 | 0.3 | 0.3 | 6.3 | | 2.8 | 4.1 | 3.8 |
| Trochus intextus | | | | | | | | |
| Turbo sandwicensis | | | | | | | | |
| **Class: Pelecypoda** | | | | | | | | |
| Isognomon sp. | | | | | | | | |
| Pteriacea sp. | 0.2 | | | | | | | |
| Unident./Other species | 1.6 | 2.8 | | 0.4 | 1.3 | 6.0 | 4.0 | 4.2 |
| **Total Mollusca** | 17.8 | 27.1 | 1.0 | 31.5 | 2.0 | 23.1 | 26.5 | 10.1 |
| Crustacean | | | | | | 0.1 | | |
| Echinoderm | 1.6 | 1.4 | | 1.0 | 1.1 | 3.0 | 4.9 | 0.6 |
| **Total Invertebrate Midden** | 19.4 | 28.5 | 1.0 | 32.5 | 3.1 | 26.2 | 31.4 | 10.7 |
| **Class: Chondrichthyes** | | | | | | | | |
| Shark | | | 0.1 | | | | | |
| **Class: Osteichthyes** | | | | | | | | |
| Labrid | | | | | | | | |
| Scarid | | | | | | | | |
| Acanthurid | | | | | | | | |
| Balistid | | | | | | | | |
| Deodontid | | | | | | | | |
| Fish Other or Indeterminate | | | | 1.2 | | 1.1 | | |
| **Total Chordata** | 0.0 | 0.0 | 0.1 | 1.2 | 0.0 | 1.1 | 0.0 | 0.0 |
| **Total Marine Midden** | 19.4 | 28.5 | 1.1 | 33.7 | 3.1 | 27.3 | 31.4 | 10.7 |
| **Class Aves** | | | | | | | | |
| Gallus gallus | | | | | | | | |
| Columba livia | | | | | | | | |
| Birds Other or Indeterminate | | | | | | | | |
| Medium bird | | | | | | | | |
| **Total Aves** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



TABLE 5 - MIDDEN CATALOG (continued)

| Site # 50-10-37- | 16377 | 16386 | 16386 | 16386 | 16386 | 16386 | 16386 | 16386 |
|---|---|---|---|---|---|---|---|---|
| Trench | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Depth(cm)/Stratum | 20-30/I | 0-15/I | 15-25/IB | 25-35/IB | 35-45/II | 45-55/II | 55-65/II | 65-75/II |
| **Class Mammalia** | | | | | | | | |
| Rattus exulans | | | | | | | | |
| Rattus nor. &/or R. rattus | | | | | | | | |
| Mus musculus | | | | | | 0.1 | | |
| Canis familiaris | | | | | | | | |
| Sus scrofa | | | | | | | | |
| Capra hircus/Ovis sp. | | | | | | | | |
| Small-to-medium mammal | | | | | | | | |
| Medium mammal | | | | | | | | |
| **Total Mammalia** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Small vertebrate | 4.2 | 3.3 | 2.2 | | 0.1 | 8.2 | 2.9 | 2.2 |
| Medium vertebrate | | | | | | | | |
| Kukui endocarps | | 17.9 | 1.3 | 1.1 | 1.4 | 6.8 | 15.6 | 13.7 |
| **Total Terrestrial Midden** | 4.2 | 21.2 | 3.5 | 1.1 | 1.5 | 15.1 | 18.5 | 15.9 |
| **Total Midden** | 23.6 | 49.7 | 4.6 | 34.8 | 4.6 | 42.4 | 49.9 | 26.6 |
| Coral | | | | | | | 17.7 | |
| Land snails | | | | | | | | 0.2 |
| | | | | | | | | |
| Total Mollusca | 17.8 | 27.1 | 1.0 | 31.5 | 2.0 | 23.1 | 26.5 | 10.1 |
| Total Invertebrate | 19.4 | 28.5 | 1.0 | 32.5 | 3.1 | 26.2 | 31.4 | 10.7 |
| Total Chordata | 0.0 | 0.0 | 0.1 | 1.2 | 0.0 | 1.1 | 0.0 | 0.0 |
| Total Marine Midden | 19.4 | 28.5 | 1.1 | 33.7 | 3.1 | 27.3 | 31.4 | 10.7 |
| Total Aves | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Mammalia | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Total Terrestrial Midden | 4.2 | 21.2 | 3.5 | 1.1 | 1.5 | 15.1 | 18.5 | 15.9 |
| Total Midden | 23.6 | 49.7 | 4.6 | 34.8 | 4.6 | 42.4 | 49.9 | 26.6 |

TABLE 5 - MIDDEN CATALOG (continued)

| Site # 50-10-37- | 16465 | 16465 | 16677 | 16677 | 16677 | 16677 | 16677 | 16677 |
|---|---|---|---|---|---|---|---|---|
| Trench | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 |
| Depth(cm)/Stratum | 10-30/I | 40-50/I | 0-10/I | 10-20/II | 0-10/I | 10-20/II | 0-10/I | 0-15/I |
| **Class: Gastropoda** | | | | | | | | |
| Cellana sp. | | | | | | | | |
| Conus sp. | | | | | | | | |
| Cypraea caputserpentis | | | | | | | | |
| Cypraea maculifera | | | | | | | | |
| Littorina sp. | | | | | | | | |
| Nerita picea | | | | | | | | |
| Thaididae sp. | 0.6 | | | | | | | 2.0 |
| Trochus intextus | | | | | | | | |
| Turbo sandwicensis | | | | | | | | |
| **Class: Pelecypoda** | | | | | | | | |
| Isognomon sp. | | | | | | | | |
| Pteriacea sp. | | | | | | | | |
| Unident./Other species | 3.7 | | | | | | | |
| **Total Mollusca** | 4.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 |
| Crustacean | | | | | | | | |
| Echinoderm | | | 0.2 | | 0.1 | | | |
| **Total Invertebrate Midden** | 4.3 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 2.0 |
| **Class: Chondrichthyes** | | | | | | | | |
| Shark | | | | | | | | |
| **Class: Osteichthyes** | | | | | | | | |
| Labrid | | | | | | | | |
| Scarid | | | | | | | | |
| Acanthurid | | | | | | | | |
| Balistid | | | | | | | | |
| Deodontid | | | | | | | | |
| Fish Other or Indeterminate | | | | | | | 0.1 | |
| **Total Chordata** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
| **Total Marine Midden** | 4.3 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.1 | 2.0 |
| **Class Aves** | | | | | | | | |
| Gallus gallus | | | | | | | | |
| Columba livia | 0.2 | | | | | | | |
| Birds Other or Indeterminate | | | | | | | | |
| Medium bird | | | | | | 0.5 | | |
| **Total Aves** | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 |



TABLE 5 - MIDDEN CATALOG (continued)

| Site # 50-10-37- | 16465 | 16465 | 16677 | 16677 | 16677 | 16677 | 16677 | 16677 |
|---|---|---|---|---|---|---|---|---|
| Trench | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 |
| Depth(cm)/Stratum | 10-30/I | 40-50/I | 0-10/I | 10-20/II | 0-10/I | 10-20/II | 0-10/I | 0-15/I |
| **Class Mammalia** | | | | | | | | |
| Rattus exulans | | | | | | | 0.4 | |
| Rattus nor. &/or R. rattus | 0.1 | | | | 0.1 | | | |
| Mus musculus | | | | | | | | |
| Canis familiaris | | | | | 10.1 | | | |
| Sus scrofa | | | 16.3 | | | | 1.0 | |
| Capra hircus/Ovis sp. | | | | | | | | |
| Small-to-medium mammal | 0.4 | | 4.3 | 0.2 | 0.8 | 0.2 | 1.7 | |
| Medium mammal | | | 5.1 | | | | 2.4 | |
| **Total Mammalia** | 0.5 | 0.0 | 25.7 | 0.2 | 11.0 | 0.2 | 5.5 | 0.0 |
| Small vertebrate | | | | | | | | |
| Medium vertebrate | | | | | | | 0.6 | |
| Kukui endocarps | 1.3 | | 17.5 | | 26.2 | 1.4 | 263.8 | 48.4 |
| **Total Terrestrial Midden** | 2.0 | 0.0 | 43.2 | 0.2 | 37.2 | 2.1 | 269.9 | 48.4 |
| **Total Midden** | 6.3 | 0.0 | 43.4 | 0.2 | 37.3 | 2.1 | 270.0 | 50.4 |
| Coral | | | | | | | | |
| Land snails | | | | | | | | |
| | | | | | | | | |
| Total Mollusca | 4.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 |
| Total Invertebrate | 4.3 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 2.0 |
| Total Chordata | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
| Total Marine Midden | 4.3 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.1 | 2.0 |
| Total Aves | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 |
| Total Mammalia | 0.5 | 0.0 | 25.7 | 0.2 | 11.0 | 0.2 | 5.5 | 0.0 |
| Total Terrestrial Midden | 2.0 | 0.0 | 43.2 | 0.2 | 37.2 | 2.1 | 269.9 | 48.4 |
| Total Midden | 6.3 | 0.0 | 43.4 | 0.2 | 37.3 | 2.1 | 270.0 | 50.4 |

TABLE 5 - MIDDEN CATALOG (continued)

| Site # 50-10-37- | 16741 | 16741 |
|---|---|---|
| Trench | 1/D | 1/D |
| Depth(cm)/Stratum | Surface | 1 |
| Class: Gastropoda | | |
| Cellana sp. | | 8.4 |
| Conus sp. | | 3.0 |
| Cypraea caputserpentis | | 14.4 |
| Cypraea maculifera | 37.2 | 29.6 |
| Littorina sp. | | 0.3 |
| Nerita picea | | 3.0 |
| Thaididae sp. | | 6.5 |
| Trochus intextus | | |
| Turbo sandwicensis | | |
| Class: Pelecypoda | | |
| Isognomon sp. | | |
| Pteriacea sp. | | |
| Unident./Other species | | 12.0 |
| Total Mollusca | 37.2 | 77.2 |
| Crustacean | | |
| Echinoderm | | 5.7 |
| Total Invertebrate Midden | 37.2 | 82.9 |
| Class: Chondrichthyes | | |
| Shark | | |
| Class: Osteichthyes | | |
| Labrid | | |
| Scarid | | |
| Acanthurid | | |
| Balistid | | |
| Deodontid | | |
| Fish Other or Indeterminate | | 0.6 |
| Total Chordata | 0.0 | 0.6 |
| Total Marine Midden | 37.2 | 83.5 |
| Class Aves | | |
| Gallus gallus | | |
| Columba livia | | |
| Birds Other or Indeterminate | | |
| Medium bird | | |
| Total Aves | 0.0 | 0.0 |



TABLE 5 - MIDDEN CATALOG (continued)

| Site # 50-10-37- | 16741 | 16741 |
|---|---|---|
| Trench | 1/D | 1/D |
| Depth(cm)/Stratum | Surface | 1 |
| Class Mammalia | | |
| Rattus exulans | | |
| Rattus nor. &/or R. rattus | | |
| Mus musculus | | |
| Canis familiaris | | 0.9 |
| Sus scrofa | | 4.0 |
| Capra hircus/Ovis sp. | | 0.3 |
| Small-to-medium mammal | | 0.8 |
| Medium mammal | | 2.9 |
| Total Mammalia | 0.0 | 8.9 |
| Small vertebrate | | |
| Medium vertebrate | | |
| Kukui endocarps | | 1.8 |
| Total Terrestrial Midden | 0.0 | 10.7 |
| Total Midden | 37.2 | 94.2 |
| Coral | | |
| Land snails | | 0.2 |
| | | |
| Total Mollusca | 37.2 | 77.2 |
| Total Invertebrate | 37.2 | 82.9 |
| Total Chordata | 0.0 | 0.6 |
| Total Marine Midden | 37.2 | 83.5 |
| Total Aves | 0.0 | 0.0 |
| Total Mammalia | 0.0 | 8.9 |
| Total Terrestrial Midden | 0.0 | 10.7 |
| Total Midden | 37.2 | 94.2 |

TABLE 6 - CHARCOAL CATALOG

| Acc # | State Site 50-10-37 | Trench/Feature | Stratum | Depth (cm) | Weight (gms) | Comments |
|---|---|---|---|---|---|---|
| C-1 | 10300 | Lava tube | | | 22.5 | charcoal |
| *C-2 | 10300 | Makai lava tube | | | 8.2 | charcoal |
| C-3 | 10300 | 1 | I | 0-10 | 36.5 | charcoal |
| C-4 | 10300 | 1 | I | 10-20 | 54.6 | charcoal |
| C-5 | 10300 | 1 | II | 20-40 | 38.0 | charcoal |
| C-6 | 10300 | 1 | II | 40-50 | 28.7 | charcoal |
| C-7 | 10300 | 1 | II | 50-60 | 33.1 | charcoal |
| C-8 | 10300 | 1 | II | 60-70 | 42.1 | charcoal |
| C-9 | 10300 | 1 | II | 70-90 | 36.5 | charcoal |
| C-10 | 10300 | 1 | II | 90-100 | 6.7 | charcoal |
| *C-11 | 10300 | 1 | II | 90-105 | 126.6 | charcoal |
| C-12 | 16354 | 2 | II | 50-90 | 1.0 | charcoal |
| C-13 | 16376 | 1 | I | 35-45 | 0.4 | charcoal |
| C-14 | 16376 | 1 | Ib | 45-80 | 0.4 | charcoal |
| C-15 | 16376 | 1 | II | 80-90 | 0.2 | charcoal |
| C-16 | 16376 | 1 | II | 90-100 | 0.4 | charcoal |
| C-17 | 16376 | 1 | II | 110-150 | 1.2 | charcoal |
| C-18 | 16377 | 1 | I | 0-10 | 0.5 | charcoal |
| C-19 | 16377 | 1 | I | 20-35 | 0.3 | charcoal |
| C-20 | 16386 | 1 | I | 0-15 | 5.4 | charcoal |
| C-21 | 16386 | 1 | Ib | 15-25 | 2.6 | charcoal |
| C-22 | 16386 | 1 | Ib | 25-33 | 2.4 | charcoal |
| C-23 | 16386 | 1 | Ib | 25-35 | 1.0 | charcoal |
| C-24 | 16386 | 1 | II | 35-45 | 0.7 | charcoal |
| C-25 | 16386 | 1 | II | 45-55 | 12.5 | charcoal |
| C-26 | 16386 | 1 | II | 55-65 | 16.2 | charcoal |
| C-27 | 16386 | 1 | II | 55-65 | 17.9 | charcoal |
| *C-28 | 16386 | 1 | | 65-75 | 20.2 | charcoal |
| C-29 | 16465 | 1/A | I | 10-30 | 1.5 | charcoal |
| C-30 | 16465 | 1/A | I | 40-50 | 1.0 | charcoal |
| *C-31 | 16521 | Cave | | Surface | 15.4 | charcoal |
| C-32 | 16589 | A | | Surface | 0.2 | charcoal |
| *C-33 | 16677 | Main lava tube | | | 11.2 | charcoal |
| *C-34 | 16677 | 1 | | 0-10 | 87.4 | charcoal |
| C-35 | 16677 | 1 | | 0-10 | 94.1 | charcoal |
| C-36 | 16677 | 1 | II | 10-20 | 25.7 | charcoal |
| C-37 | 16677 | 2 | I | 0-10 | 18.3 | charcoal |
| C-38 | 16677 | 2 | II | 10-20 | 8.6 | charcoal |
| C-39 | 16677 | 3 | I | 0-10 | 2.8 | charcoal |
| C-40 | 16741 | 1 | I | | 7.0 | charcoal |

*= Samples sent for radio carbon analysis.



TABLE 7 - CHARCOAL SAMPLES ANALYZED BY BETA-ANALYTIC INC.

| CSH Acc.# | Beta Analytic # | State Site # 50-10-37 | C-14 Age Yrs. B.P. | C-13 Adjusted C-14 Age Yrs. B.P. | *Calendric Yrs. A.D. |
|---|---|---|---|---|---|
| C-34 | 52561 | -16677 | 60 +/- 50 | 30 +/- 50 | 1675-1710/ 1805-1930 |
| C-11 | 52562 | -10300 | 150 +/- 50 | 160 +/- 50 | 1645-1950 |
| C-31 | 52563 | -16521 | 270 +/- 50 | 290 +/- 50 | 1435-1665 |
| C-33 | 52564 | -16677 | 160 +/- 60 | 140 +/- 60 | 1650-1950 |
| C-2 | 52565 | -10300 | 600 +/- 120 | 590 +/- 120 | 1250-1430 |
| C-28 | 52566 | -16386 | 150 +/- 50 | 150 +/- 50 | 1645-1950 |

* calibrated according to Klein *et al.* (1982)

State site 50-10-37-10300 lava tube was tested using a 0.5 m.$^2$ test unit (Figure 8) excavated in the light chamber of the tube. Two stratigraphic layers were revealed. Cultural material collected included a total of 15 indigenous artifacts, 572.2 grams of midden, and 402.8 grams of charcoal. A charcoal sample from Stratum II (90 to 105 cm. below the surface) received radiocarbon analysis, producing a date range from AD 1645 to present.

State site 50-10-37-16354 tested positive for human remains. Two 1.0 m.$^2$ trenches were excavated on the platform surface. Human remains were observed within both trenches. Trench 1 contained one stratigraphic layer below the platform construction material.

As the excavation continued into Stratum I, capstones were encountered and removed, revealing a loose fill containing a burial. No cultural material was present.

Trench 2 - at State site -16354 - contained two stratigraphic layers below the construction fill. No cultural material was present in Stratum I. Stratum II contained the burial with no crypt features observed. Stratum II yielded cultural material including a total of two indigenous artifacts (volcanic glass flakes) and 1.0 gram of charcoal.

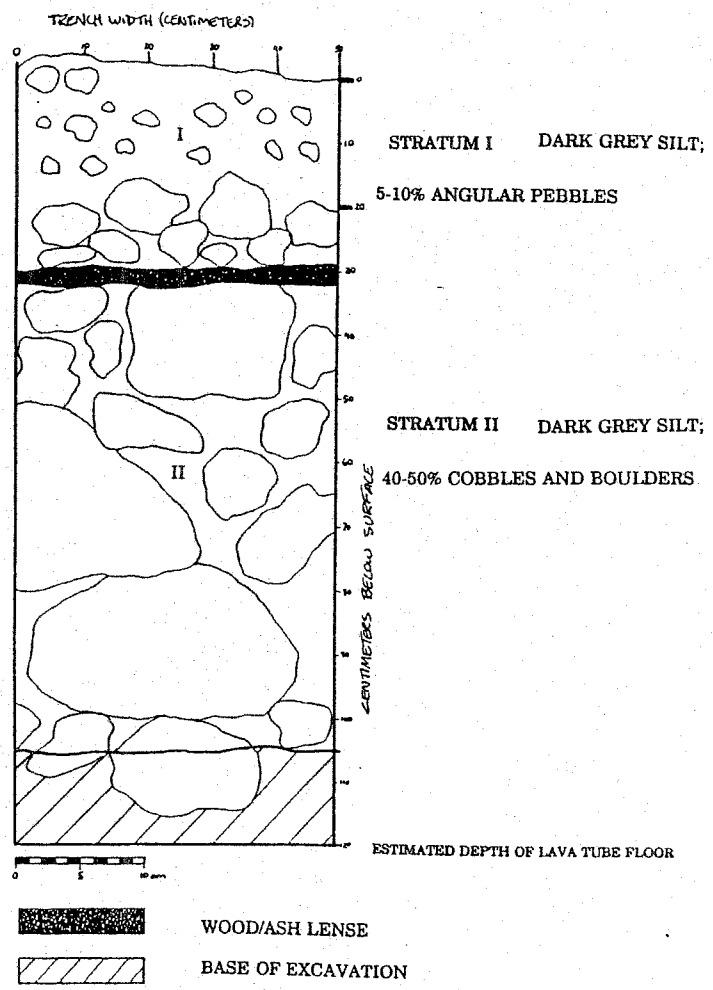



Figure 8 State site 50-10-37-10300 Test trench 1; west profile

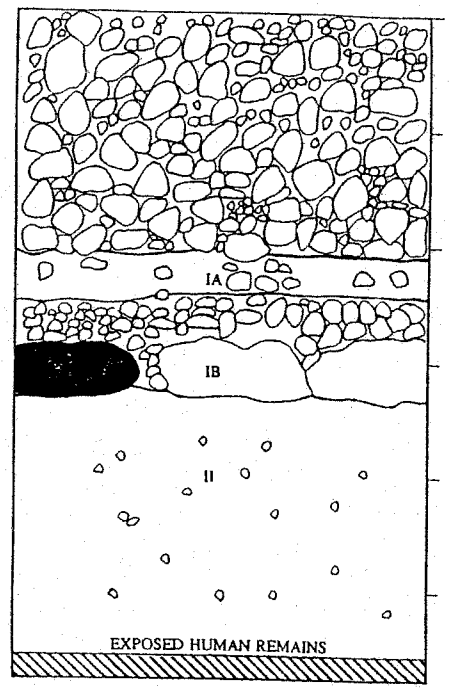


State site 50-10-37-16376 platform tested positive for human remains using a 1.0 m.$^2$ trench (Figure 9). Cultural material was recovered from the trench including a total of two indigenous artifacts (volcanic glass and basalt flakes), 56.7 grams of midden, 29.6 grams of coral and 3.4 grams of charcoal.

State site 50-10-37-16377 terrace tested negative for human remains using a 1.0 m.$^2$ trench (Figure 10). Cultural material was recovered from the trench including a total of 17 indigenous artifacts, one historic artifact (metal fragments), 95.8 grams of midden, 2.3 grams of coral, and 4.2 grams of charcoal. As a indicated by the quantity and types of cultural deposits, State site -16377 is considered a permanent habitation site.

State site 50-10-37-16386 platform tested positive for human remains using a 1.0 m.$^2$ trench (Figure 11). Cultural material was collected from the trench including 13 indigenous artifacts, one historic artifact, 212.6 grams of midden, 17.7 grams of coral, and 70.9 grams of charcoal. A charcoal sample (CSH Acc. #6) was submitted to for radio carbon analysis. The results gave a date range from AD 1645 to 1950 (see Table 7). This site contains a crypt-type burial feature below the platform with one historic artifact.

State site 50-10-37-16465 platform tested positive for human remains. One 1.0 m.$^2$ test unit was excavated on the platform surface, revealing one stratigraphic layer beneath the platform construction material. Cultural material was collected from the underlying stratum including two historic artifacts (bottle fragments and a tin can), one indigenous artifact (a volcanic glass flake), a total of 6.3 grams of midden, and 2.5 grams of charcoal. The site contains a crypt feature characterized by three capstones laid upon large boulders forming the perimeter of the crypt. The capstones were encountered 20 to 30 cm. below the platform

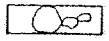


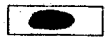


STRATUM IA — FINE RED, LOOSELY COMPACT, SILTY CLAY LOAM.

STRATUM IB — FINE RED, LOOSELY COMPACT, SILTY CLAY LOAM WITH COBBLES AND PAHOEHOE SLABS.

STRATUM II — FINE BROWN SILTY CLAY LOAM. CONTAINS TRADITIONAL HAWAIIAN CULTURAL MATERIAL.

 BOULDERS, COBBLES, AND PEBBLES.

 WATER-WORN BOULDER.

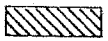
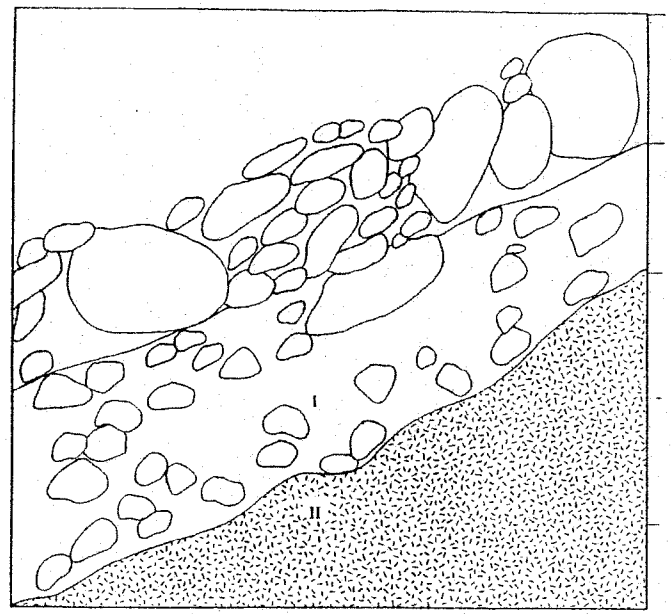
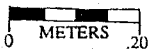
 NOT EXCAVATED.

Figure 9 State site 50-10-37-16376 Test trench 1, east profile






STRATUM I — DARK REDDISH BROWN, LOOSELY COMPACT, SILTY CLAY LOAM WITH SMALL ROOTLETS.

STRATUM II — BASALT BEDROCK.

 BOULDERS, COBBLES, AND PEBBLES.

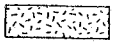
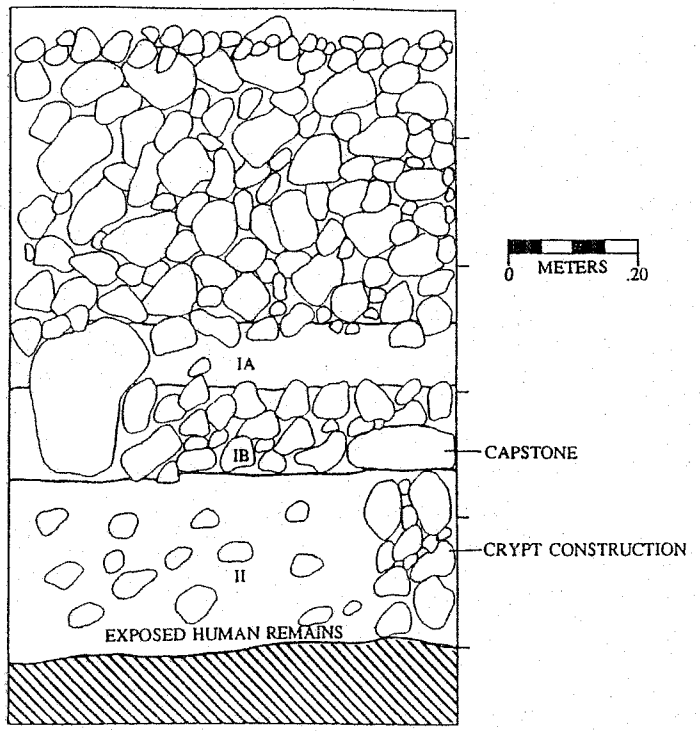
 BASALT BEDROCK.

Figure 10 State site 50-10-37-16377 Test trench 1, north profile




| | |
|---|---|
| STRATUM IA | RED, LOOSELY COMPACT, SILTY CLAY LOAM WITH SMALL ROOTLETS. |
| STRATUM IB | RED, LOOSELY COMPACT, SILTY CLAY LOAM WITH BOULDERS AND COBBLES. |
| STRATUM II | BROWN, VERY LOOSE, SILTY CLAY LOAM WITH SMALL ROOTLETS. CONTAINS TRADITIONAL HAWAIIAN CULTURAL MATERIAL. CRYPT AND CAPSTONE LOCATED IN WEST HALF OF TRENCH. |
| | BOULDERS, COBBLES AND PEBBLES. |
| | NOT EXCAVATED. |

Figure 11 State site 50-10-37-16386 Test trench 1, west profile



surface, at the top of Stratum I. The burial was encountered within the crypt at 80 cm. below the platform surface.

State site 50-10-37-16629 mound complex tested negative for human remains. A total of three trenches (each 1.0 m.$^2$) were excavated in three different mounds within the complex. No cultural material was recovered from the trenches. Excavation was terminated upon reaching bedrock in each of the trenches. Trench 1 contained one stratigraphic layer beneath the mound construction material. Trench 2 contained three stratigraphic layers beneath the mound construction material. In Trench 3 bedrock was reached upon excavating the mound construction material. There was a small soil filled crack in the bedrock but no cultural material was present. State site 50-10-37-16629 is considered an agricultural site.

State site 50-10-37-16664 terrace tested negative for human remains. One test unit (1.0 m.$^2$) was excavated on the surface of the terrace. One stratigraphic layer was present beneath the terrace construction material. The trench proved sterile, no cultural material was present within the terrace fill or Stratum I. Excavation was terminated upon encountering bedrock at 100 cm. below the platform surface. The site is considered an agricultural feature, related by proximity to State site 50-10-37-16665.

State site 50-10-37-16665 terrace tested negative for human remains. One 1.0 m.$^2$ test unit was excavated on the surface of the terrace. One stratigraphic layer was encountered beneath the terrace construction material. No cultural material was present within the trench. Excavation was completed upon reaching bedrock at 40 cm. below the terrace surface. The site is considered an agricultural feature, related by proximity to State site 50-10-37-16664.

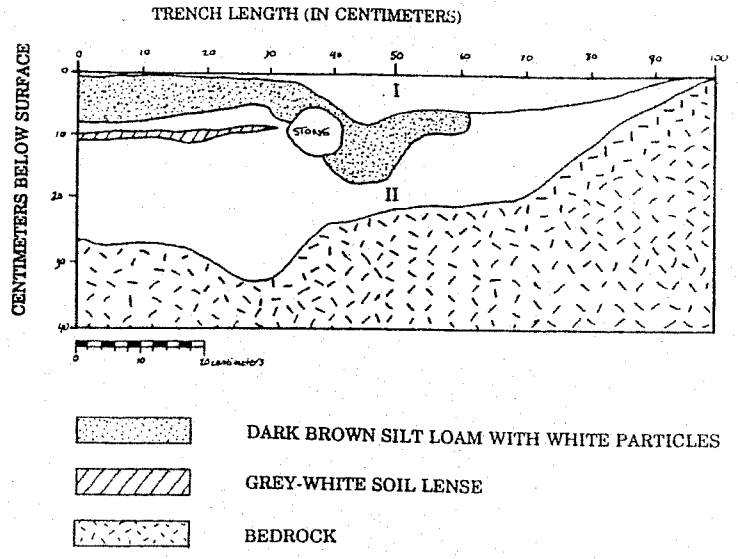
State site 50-10-37-16677 lava tube was tested using three 1.0 m. by 0.5 m. trenches (Trench 1 through 3) and one 0.5 m. X 0.5 m. trench (Trench 4) (Figure 12). Cultural material was collected from the trenches including one indigenous artifact, (a bone pick within a sheath), 403.2 grams of midden, and 236.9 grams of charcoal. Trenches 1 through 3 contained two stratigraphic layers. Trench 4 contained one stratigraphic layer. The indigenous artifact was collected at the top of Stratum I of Trench 4. A charcoal sample (CSH Acc. #4) from Trench 1 (Stratum I) was submitted to Beta Analytic Inc. of Miami, Florida for radiocarbon analysis. The C-14 sample produced a date range of AD 1675 to 1710 and AD 1805 to 1930 (see Table 7).

State site 50-10-37-16741D is a platform which tested positive for human remains using a 1.0 $m.^2$ trench. Cultural material was collected from the trench including two indigenous artifacts (one bone fish hook preform and a volcanic glass flake), historic artifacts (metal fragments), and 131.4 grams of midden.

State site 50-10-37-16743C platform tested positive for human remains using a 1.0 $m.^2$ trench. No artifacts or midden were recovered form the excavation.

As a result of the testing, six (54 percent) of the nine possible and probable burial sites tested positive for human remains. This relatively high occurrence of burials at the representative sample of possible and probable burial sites may also be expected for the remaining unconfirmed burials in the project area.






STRATUM I LIGHT BROWN, LOOSELY COMPACTED, SILT LOAM.

STRATUM II BROWN, SLIGHTLY COMPACTED, SILT LOAM.

Figure 12 State site 50-10-37-16677 Test trench 3, west profile

## VI. SUMMARY

### A. Site Distribution

As displayed on the site location map (see Figure 4), archaeological sites and site complexes are present throughout the entire surveyed area, except in portions which have been heavily impacted historically (i.e. bulldozing and chain-dragging, etc.), and on the pahoehoe flow *makai* of the Greenwell road. There is also a low site density within the area called "Hokukano Flats" because of the low undulating pahoehoe terrain with little soil accumulation. Based on the results of the present study, two main themes of site distribution and land use are indicated: 1) traditional Hawaiian habitation and land usage, and 2) historic utilization and habitation.

Traditional Hawaiian land utilization occurred throughout the entire project area even in areas where bulldozing has obliterated evidence of the usage. Low site density areas do exist, specifically in the area known as "Hokukano Flats, " which is a backshore undulating pahoehoe lava delta associated with the pahoehoe flow that bisects the project area. The dense distribution of permanent habitation complexes along the coast, a less dense distribution on the pahoehoe flow *mauka* of the coastal zone as well as habitation spread throughout the soil areas indicates the presence of a prehistoric and early historic settlement of a presumably large population. The coastal region which was the focal point of habitation prehistorically and into early historic times contains homesteads or *kau hale* which probably represent occupation by high status individuals or *ohana*.

Although habitation sites of varying types are distributed throughout the project area, clustering of permanent habitation complexes or homesteads are concentrated in two main areas, immediately south and north of *Puu Ohau* and along the northern coastal region and along the edges of the pahoehoe flow. Accessibility to the coast has a direct correlation to coastal site density. The southern portion of the project area has high cliffs (approximately



50-100 ft. in height) along the coast. The few southern coastal areas that contain habitation site clusters are somewhat accessible to the ocean. Whereas the northern coastal region of the project is readily accessible almost everywhere and the site distribution is almost continuous.

Within the project area there appears to be no correlation or difference in site distribution in relation to *ahupua'a*. The physical characteristics of the land appear to play the most dominant role the distribution of sites.

Despite historic occupation (i.e. State sites -16415, -16613, and -16702) the majority of the site complexes in the project area appear to represent primary occupation during the prehistoric era. This is evidenced by traditional site construction techniques and by the lack of - or minimal amounts or - historic artifacts. These evidences, along with noticeably similar states of site preservation, suggest contemporaneous usage of most of the traditional sites in the project area during the prehistoric era. However during historic times it appears that the inland areas of the project area are abandoned with coastal sites still being utilized.

### B. Settlement Patterns

This discussion will focus on the overall *ahupua'a* settlement pattern. The discussion attempts an overview of land utilization and population concentrations during different periods.

#### Prehistoric Settlement Pattern

Based on our project area - which extends *mauka* only to the 1000-foot elevation, *makai* of Mamalahoa Highway - it is clear that the pre-contact settlement pattern included a concentrated habitation zone along the shoreline. Though habitation sites, including presumably permanent habitation sites, were observed throughout the project area, concentrations or village-like clustering of these sites were only observed along the coast.

Based on this survey, review of archaeological literature concerning the Kona area, and years of Kona fieldwork, it is apparent that no similar village-like clustering of habitation complexes exist anywhere in the uplands. We suggest that the upland agricultural zones associated with the Kona Field System were in close enough proximity to obviate major upland villages.

Surveys in *mauka* portions of Kealakekua (Kaschko and Rosendahl 1987; Hammatt *et al.* 1992) and in Hokukano *mauka* (Burgett and Rosendahl 1991) did not contain significant numbers of pre-contact habitation sites and, definitely, no village-like clustering.

The survey of Kaschko and Rosendahl (1987) was in an area of the Kona Field System just *mauka* of Pali Kapu-o-Keoua. Of the 85 features recorded, 13 were tentatively identified as permanent habitation units. Additionally, no village-like clustering was observed, but one complex (T-33) did suggest a "prehistoric chiefly residential complex" (*Ibid.*:52). The survey area generally comprised agricultural components of the Kona Field System which the authors suggest supported large prehistoric coastal villages like Kekua and Kaawaloa (*Ibid.*: 50).

The Kealakekua Ranch Development survey (Hammatt *et al.* 1992) at an elevation range of 2200 to 3200 feet did not contain any clear evidence of prehistoric Hawaiian habitation. It was also questioned whether there were any agricultural components of the Kona Field System: only a single feature was tentatively identified as "minor agricultural feature of presumed prehistoric construction" (*Ibid.*: i).

The survey of the 250-acre Hokukano Ranch Development project area (Burgett and Rosendahl 1991) within portions of Kanaueue, Ke'eke'e, Kanakau and Halekii *ahupua'a* contained only 5 (of a total 73) features tentatively identified as having habitation function. The 250 acres are situated *mauka* of Mamalahoa Highway in the 1900 to 2600 foot a.m.s.l. range, which correlates roughly to the two upper zones of the Kona Field System. Excavation



at one of the habitation features (State site 50-10-37-14883) yielded an age range of 1420-1650, clearly indicating prehistoric utilization. However the excavation "yielded no substantial cultural deposits or other evidence that would indicate prolonged periods of occupation. The site appears to be a temporary shelter used either by travelers en route to inland sites or travelers visiting agricultural sites in the upper central region of the project" (*Ibid.*: 20).

The compilation of archaeological data indicates a lack of any village-like site clustering in the *mauka* or inland portions of the *ahupua'a* along the boundary between North and South Kona that are comparable to the large village complexes along the shore.

This is not to suggest that the inland areas were not intensively utilized or that there were no habitation site clustering. However, the focus of land utilization of the inland areas was agriculture which did include dispersed habitation. Habitation in the inland areas included temporary habitation (*e.g.* Site 50-10-37-14883 - Burgett and Rosendahl 1991) and permanent habitation sites. The permanent habitation sites include complexes like Site 50-10-37-16595 located in Kanaueue at roughly the 550-foot elevation which consists of multiple platforms and associated enclosures (pig pens). In the Kealakekua survey (Kaschko and Rosendahl 1987) Site T-33 exhibited characteristics, in terms of "nature, size, and complexity of its constituent features", which "suggested this site may be a prehistoric chiefly residential complex" (*Ibid.*:52). Additionally, the complex included "associated agricultural use area(s)" (*Ibid.*:86). Clearly the inland portions of the *ahupua'a* in the vicinity contained habitation sites but not congregated settlements.

## Chronology and Settlement

In *Subsistence and Conflict in Kona, Hawai'i*, Rose Schilt (1984) has postulated five (5) chronological and associated cultural phases which include: I Pioneer Settlement (*ca.* AD

1050-1400); II Garden Developments (*ca.* AD 1400-1600/1650); III Refuge, Habitation, and Intensive/Extensive Gardening (*ca.* AD 1600/1650-1779); IV Historic Habitation and Gardening (*ca.* AD 1779-1850); and V Historic Ranching (*ca.* AD 1850-Modern Times). During the testing phase of the present survey, five samples of charcoal were collected and subjected to radiocarbon analysis. The results of the analysis include only two date ranges that are entirely within the prehistoric era, with the remaining three having ranges into the historic era (*i.e.*, AD 1675-1710/1805-1930; AD 1645-1950; and AD 1650-1950). The two prehistoric date ranges come from a lava tube, State site 50-10-37-10300 (AD 1250-1430), and a lava blister, State site 50-10-37-16521 (AD 1435-1665).

State site 50-10-37-10300 is a large lava tube with multiple internal features, monumental construction for refuge purposes, and numerous (70+) petroglyphs. The dated sample was obtained at the base of a terrace within the lava tube. The date is presumed to postdate construction of the platform: the charcoal collected in the sample having filtered down throu[illegible]oose matrix of rocks that constitute the terrace. The date range of A.D. 1250-1480, falls generally within the late part of Phase I or the Pioneer Phase (*ca.* A.D. 1050-1400) and is suggestive of early and continue use of this impressive lava tube site. The site is situated at roughly the 600 ft. elevation approximately one mile from the coast and the date may indicate occupation associated with the development of inland agriculture. The date range also is indicative of occupation that probably pre-dates the modification of lava tube Site 10300 for refuge use. The age range appears to coincide well with Schilt's zones of the Kona Field System which may have commenced in the later portion of this phase (*Ibid.*:284).

Site 16521 is similarly situated approximately one mile from the coast, though based on its size and lack of extensive modifications it is presumed to have functioned as a shelter or temporary habitation feature rather than a permanent one. The age range of the recovered charcoal suggests occupation of this blister during Phase II or during the Garden



development Phase (*ca.* A.D. 1400-1600 to 1650). Occupation was probably associated with agricultural pursuits in the general vicinity.

These dates, when combined with the aforementioned date obtained *mauka* of Mamalahoa Highway in the Hokukano Ranch Development parcel (Burgett and Rosendahl, 1991), indicate utilization of all zones, coastal or *kula* to upland jungle or *'ama'u* by the 1400s and probably earlier.

The historic era settlement pattern for the subject *ahupua'a* has changed dramatically with the habitation no longer concentrated along the coast. However, abandonment of the coastal zone was not abrupt, as the coastal villages - Kainaliu, Hokukano, and Nawawa (or Hauhaua) continued to be a focus of activity till the late 1800s or early 1900s.

The pre-Mahele (1835-36) missionary census counted 990 individuals in an area that presumably is inclusive from Honalo to Hokukano (i.e. north of Pu'u Ohau to the southern boundary of Keauhou *ahupua'a*) and 596 at Nawawa and Onouli (i.e., south of Pu'u Ohau to the northern boundary of Keopuka *ahupua'a*). The count of 1586 men, women and children apparently includes all *ahupua'a* in habitants, not those just along the coast. However, coastal concentrations, as evidenced by the setting up of schools and churches along the coast, was still the norm.

The mid 1800s' settlements were still concentrated along the coast. Upland subsistence farming, associated with the coastal settlements, was still prevalent as evidenced by the Land Commission Award (LCA) Testimony and Register information. The general pattern of *kuleana* (LCA) awards was multiple parcels or *apana*, with a house lot (*apana*) at the coast and one or more *apana* at the coast and one or more *apana* inland for subsistence crops. This pattern is best exemplified by Testimony and Register information concerning the *ahupua'a* of Ke'eke'e 1 and 2 (See Appendix C).

The *kuleana* awards included house lots on the coast, at the village of Nawawa or

Haunaua just south of Pu'u Ohau, with garden lots *mauka*. The *mauka* lots were situated close to present day Mamalahoa Highway with a cluster of framing lots just *makai* of the highway at roughly the 1500 foot elevation.

Crops being farmed were for the most part traditional food items of taro and sweet potatoes. Crop information from other *kuleana* include, bananas, *lauhala*, loulu palm, and gourd. Also introduced crops such as coffee and oranges, or fruit trees, are also listed but in much fewer numbers.

Though *kuleana* or LCA awards are a valuable source of information, the largest land transactions involve grants which were actual sales of land. Land use information regarding grants is generally non-existent. However, based on certain specific references as well as size of the grants it can be assumed that the grants are evidence of the emerging market economy that eventually replaces the subsistence based economy.

Examples of market-oriented crops and livestock include coffee, sugar cane, oranges, timber, cattle, sheep and goats. The majority of crop-type enterprises like coffee, sugarcane, and oranges were taking place in the abandoned Kona Field System. Livestock pasturage was also within areas of the Kona Field System but, like timber procurement, the forest zone *mauka* of the formerly cultivated lands were being utilized.

It appears that road building was also a major undertaking during the mid 1800s and it was probably during this time that Mamalahoa Highway, or a cart road predecessor of it, was established.

**Late 1800s**

The market economy was essentially established by the last half of the 19th century. Most of the commercial crops of coffee, cane, and orange were grown within the upper zones of the Kona Field System including the upland forest zone which was rapidly being cleared.



Livestock were grazed on former Kona Field System [illegible] lands as well as in the forest zone.

The need to be integrated into the market-based economy necessitated access to markets. Thus, roadways and ports became essential and population shifted accordingly. In the vicinity of the project area this meant that residential occupation was shifted to a relatively narrow corridor associated with the *mauka* road (i.e., Mamalahoa Highway) as well as to the port areas of Kealakekua, Keauhou and Kailua Bays.

However, this shift did not include total abandonment of the coastal area. Emerson's 1891 map (see Figure 5) shows a few houses remaining on the coast, but no villages as described during the mid 1800s.

Cattle ranching also begins to dominate during the late 1800s as interisland ships large enough to transport live cattle are put in service. Prior to these larger ships, the cattle industry in Kona was mainly focused on butter export which was generally controlled by Portuguese dairy farmers (Per. Comm. Sherwood Greenwell).

The shift to the upland zone is complete with the advent of schools and churches along Mamalahoa Highway. Additionally, demographics clearly planned a major role in not only the population concentration, but in the ethnicity also. The well-documented decline in the native population was a major factor in changes in settlement patterns. Labor specific industries (e.g. cane and coffee) which were established along the Mamalahoa Highway corridor also would have concentrated settlement close to this main access alignment.

**Modern Era**

Presently the coastal zone is totally abandoned, except for a few 'beach houses.' The former agricultural lands of the Kona Field System *makai* of Mamalahoa Highway have been given over totally to cattle grazing. Mamalahoa Highway is clearly the focus of residential occupation, associated service industries and the main artery by which agricultural products

(e.g., coffee) are brought to the market.

The coastal villages sit in quiet abandonment, as do the many sites associated with the once-abundant and thriving communities. Change, which is a constant, is clearly visible in the archaeological record of this project area.



## VII. SIGNIFICANCE AND RECOMMENDATIONS

### A. General Significance

The archaeological complex within the Hokukano project area shows characteristics which are shared with other documented settlement areas along the Kona coast, but it is also different in some aspects. The other major settlement areas at least partially documented include Hōnaunau, Kealakekua, Keauhou, Kaumalumalu-Holualoa and Kailua-Lanihau. It is of interest to note that in the only comprehensive summary of Kona coast archaeology to date (Kirch 1985) the narrative jumps from Kealakekua northward to Keauhou with no mention of the Hokukano area. This shows that the present survey has provided to date the only systematic summary (although preliminary view) of the settlement here. Of the 6 distinct areas these observations are made:

1. Honaunau and Kaumalumalu-Hōlualoa are centered on large ceremonial complexes which are of the late prehistoric-early historic period and although agricultural and dispersed settlement predating these complexes are present in *mauka* areas, the *makai* archaeological sites have the ceremonial structures as their center point and are archaeologically related.
2. Kealakekua, Keauhou and Kailua, as settlement areas, were enhanced and their importance intensified as these places became centers of historic era Euro-American trade and shipping, particularly associated with the sandalwood trade.
3. The Hokukano settlement, from the preliminary survey information available so far, is distinct from the other areas in that a) it did not develop into a major ceremonial center in the late prehistoric-early historic eras of chiefly power consolidation. Although there are *heiau* present in the project area they are

apparently not focal points of interdependent settlement and Hokukano was probably a satellite area to the neighboring ceremonial centers of the north and south. Also, (b) Hokukano was not heavily influenced by post-contact Euro-American trade and commerce although it supported a nineteenth century settlement based on agriculture and later ranching.

The archaeological sites at Hokukano represent the apex of development of a prehistoric Hawaiian community unincumbered with massive early historic modifications. This community was blessed with good agricultural fields in the heartland of the Kona Field System with an excellent coastline with plentiful fishing and adequate but not broad canoe landings with large caves for habitation and later refuge with direct access to the uplands and with a minimum of rough lava wasteland. It became a satellite to other early centers in the historic era because of its lack of a protected anchorage.

**B. Site Significance**

The sites within the project area are evaluated for significance according to the broad criteria established for the National and State Registers (see Table 1). The seven criteria are listed and briefly applied to the archaeological sites in the project area as follows:

A. Site reflects major trends or events in the history of the state or nation (A).

There are certainly major economic trends reflected in the sites, namely prehistoric adaptations in the Kona District and the transformation from a sub-sistence-based traditional agriculture to a commercial plantation economy as well as political upheaval and changing settlement patterns. This criterion seems relevant to the large refuge caves, the Kuakini Wall, the railroad bed and the King's Trail.

B. Site is associated with the lives of persons significant in our past (B).



This would apply in cases in which there is a possibility of associating a feature to a specific individual or important individuals. The Kuakini Wall is the only site which falls into this category.

C. Site is an excellent example of a site type (C).

This criterion addresses quality of construction and design, as well as state of preservation. Many of the habitation features, as well as whole complexes fit into this category.

D. Site may be likely to yield information important in prehistory or history.

Included in this category are sites which contain cultural deposits and therefore have excavation potential or have well defined surface features which could yield information from further study. Included are habitation sites as well as agricultural features whose excavation and further mapping and recording can shed light on chronology, and sequence of prehistoric land development. Prime examples of sites in this category are the lava tube caves and habitation sites.

E. Site has cultural significance to the Hawaiians or other ethnic group (E).

This category includes religious sites - heiau - and sites containing human burials. Other sites whose burial or religious function is uncertain are marked E* in Table 1. If burials are found within other sites during data recovery then these sites would also be placed in this category.

F. Not Significant (NS)

These are sites which do not fit any of the above criteria, but are still listed for recording purposes. Included are minimally modified natural features and modern shelters.

G. No Longer Significant (NLS)

These sites were significant only under Criterion D for their informational content, but all information necessary has been recorded. Included are isolated rock mounds, ahu and sites which are disturbed to the point of bare recognition.

Of the total of 473 archaeological sites in the project area only 4 are deemed "no longer significant". This leaves a total of 469 significant sites.

**C. Recommendations**

Treatment of the 469 significant sites can be undertaken by two possible actions.

1. Preservation of sites in place for future generations, either by simple physical preservation or preservation with interpretation.
2. Further study including subsurface testing and excavation preceding development impact and removal of sites.

Considering the variable significance and the different criteria applied to this significance, as well as a number of practical issues, it is only possible to preserve some sites - those culturally significant and some of the best preserved examples of sites. The scientific and historical significance can be addressed through further study.

By way of preservation within the project area the following recommendations are presented:

1. Preservation of all confirmed burial sites. If testing shows no burials present for sites listed as possible or probable burials, recommended treatment will be re-evaluated.
2. Preservation of all *heiau* and sites listed as probable *heiau*.
3. Preservation of all major lava tube sites (including all tubes containing burials).



4. Preservation of selected examples of multi-component habitation sites *mauka* of the conservation zone (as shown on Table 1).
5. Selective preservation - i.e., preservation of portions - of the Great Wall of Kuakini, the distinguishable portions of the King's Trail, the railroad bed, and the *ahupua'a* boundary walls.
6. Recommended treatment of sites may change as a result of further study through data recovery. For example, burials may be uncovered during excavations. In this case preservation would be the favored alternative. Information on functional associations may also be generated in data recovery which could change the presently recommended treatment.
7. Preservation treatment should be in accordance with a Preservation Plan submitted to the Department of Land and Natural Resources (DLNR) Historic Sites Section and Hawaii County for review and approval. The plans should have two components - short-term preservation and long-term preservation.

With these preservation measures - of the total 469 significant sites within the project area - 162 sites will be preserved and an additional 18 will be selectively preserved. This leaves 289 sites which would be subject to data recovery.

Data recovery of sites within the project will address research significance and should be accomplished in accordance with a data recovery plan. This plan should be submitted to DLNR Historic Sites Section and Hawaii county for review and approval. Additionally we recommend that since this project consists of a large (1540 acre) parcel covering varying environments and large numbers and wide varieties of archaeological sites, data recovery should be on a basis of a well conceived site sampling design using a variety of criteria. Considering that the development of this property will occur over many years, a phased data

recovery program covering parcels in turn as they are slated for development would make the total effort more manageable and could improve the final results by allowing continuous refinement of research goals and data collection from one phase to the next.

Data recovery should also include limited excavations in some sites marked for preservation such as shoreline habitation sites and lava tubes in order to ensure the reconstruction of a complete picture of chronology and range of settlement.



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**APPENDIX A - *HOKUKANO FLATS* Sites**
**from**
**Paul H. Rosendahl Inc. report**
**"PU'U EHU ESTATES" (Kaschko 1984)**

| State Site # | Site Type | Function |
|---|---|---|
| 50-10-37-10278 | Platform and Mounds | Possible Burial |
| 50-10-37-10279 | Wall | none given |
| 50-10-37-10280 | Habitation Enclosures | Habitation |
| 50-10-37-10281 | Mounds and Wall Segment | Possible Burial |
| 50-10-37-10282 | Terrace | Undetermined |
| 50-10-37-10285 | Agricultural Complex | Agricultural |



APPENDIX B - PROJECT PHOTOGRAPHS

Figure 1 State site 50-10-37-10290 Berm portion of King's Trail

Figure 2 State site 50-10-37-10297 Feature B, Entrance to concealed burial chamber



Figure 3 State site 50-10-37-10297 Feature E Enclosure, view south

Figure 4 State site 50-10-37-10298 Feature B lava tube, constructed entrance (exterior)

Figure 5 State site 50-10-37-10298 Feature B lava tube, constructed entrance (interior)

Figure 6 State site 50-10-37-10300 Lava tube sink modification with *mauka* tube in background



Figure 7 State site 50-10-37-10300 Lava tube, southern petroglyph panel

Figure 8 State site 50-10-37-10300 Lava tube, northern petroglyph panel

Figure 9 State site 50-10-37-10300 Lava tube refuge entrance (exterior)

Figure 10 State site 50-10-37-10300 Lava tube refuge entrance (interior)



Figure 11 State site 50-10-37-16360 Feature A *heiau*, view south

Figure 12 State site 50-10-37-16384 Feature A, Possible *heiau*, view northwest

Figure 13 State site 50-10-37-16387 Feature A, Terrace (permanent habitation)

Figure 14 State site 50-10-37-16397 Terrace (permanent habitation)



Figure 15 State site 50-10-37-16529 Feature B, Terrace, view east

Figure 16 State site 50-10-37-16574 Platform (permanent habitation)

Figure 17 State site 50-10-37-16579 Pahoehoe basin, salt bowl

Figure 18 State site 50-10-37-16603 Possible water tank foundation, view northeast



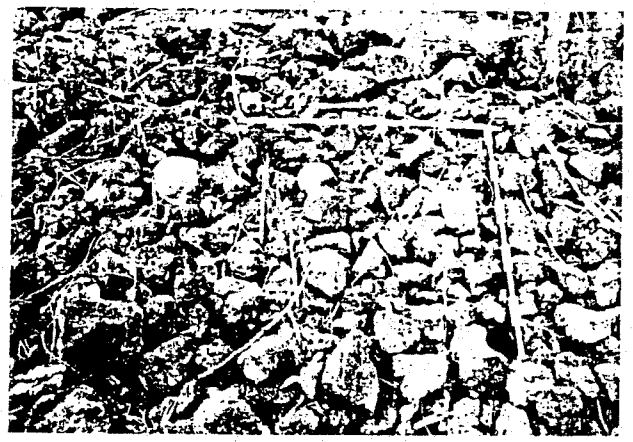

Figure 19 State site 50-10-37-16741 Feature D, pre-excavation

Figure 20 State site 50-10-37-16741 Feature D, post-excavation with crypt uncovered

Figure 21 State site 50-10-37-16743 Feature C, pre-excavation

Figure 22 State site 50-10-37-16743 Feature C, post-excavation with burial exposed



Figure 23 State site 50-10-37-16689 Platform (permanent habitation), view south

Figure 24 State site 50-10-37-16758 Feature C, platform

Figure 25 State site 50-10-37-16758 Feature I Lava blister, view northwest

Figure 26 State site 50-10-37-16785 Lava tube, cliff face entrance in lower left corner



Figure 27 State site 50-10-37-16799 *Ahupua'a* boundary wall

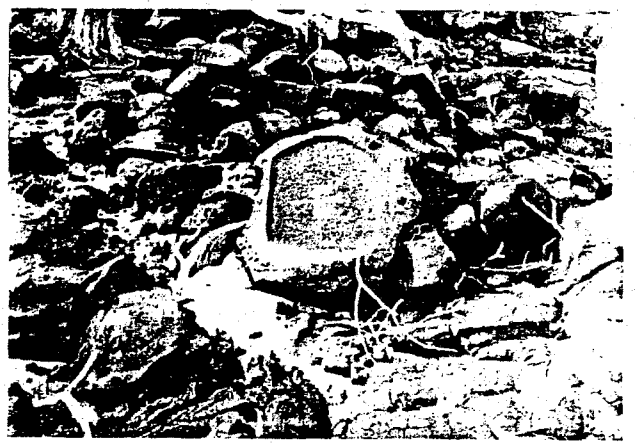

Figure 28 Salt pan along coast in Hokukano Village

LCA TABLES
Arranged by Ahupua'a

| Ahupua'a | Claimant | LCA No. | Area | Nature of Claim | Tenure Justification | Land Use |
|---|---|---|---|---|---|---|
| Halekii | ABCFM | 387 | ~~Ahp~~ 315 Acs. | | From Naihe | |

| Ahupua'a | Claimant | LCA No. | Acres | Nature of Claim | Tenure Justification | Land Use |
|---|---|---|---|---|---|---|
| Hokukano | Kaikuahine | 9425 | 0.40 | House lot in Malou ili. | From parents in 1819. | |
| Hokukano | Kama | 9428-D | 1.40 | Sect 1: 10 Kihapais in Malou ili.<br>Sect 2: Kaopapa ili. | Sect 1: from Haho in 1819.<br>Sect 2: from Kukahi in 1840. | Sect 1: taro, potatoes, coffee. |
| Hokukano | Mamalu | 9421 | 0.14 | House lot in Kaneanau. | From Lupea in 1819. | |
| Hokukano | Paia | 1059-B | 1.50 | Section of Kamuku ili. | From Lupea in 1819. | |
| Hokukano | Ualoko | 9418 | 0.30 | House lot in Kainaliu ili.[1] | From Lupea 1819. | |
| Hokukano 1 | Haho | 7277-C | 1.90 | Ili section of Malou. | From Kaholoaa in 1819. | |
| Hokukano 1 | Hikiaoao | 7740 | 0.50 | Ili section of Piilahi. | From Kanoukapu in 1819. | 10 mala taro, 10 mala sweet potatoes, 2 orange trees. Kihapai (Leleoni cultivator): 1 orange tree, 1 kou tree, 1 loulu tree, 3 hala trees. |
| Hokukano 1 | Kapaaku | 8157-F | 2.00 | Ili section of Kainaliu. | From Wakia in 1840. | |

[1] The indices give Hokukano as the location. *Native Register*, v. 8, p. 626 states, "Kainaliu ili, Kananene ahupuaa."

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| | | | | | | |
|---|---|---|---|---|---|---|
| Hokukano 1 | Kapohaku Kalua[2] | 7731 | 2.65 | Ili section of Puhele and Piiwahine. | From Pohaku and Kahikona in 1830. | 1 orange tree, 1 mala bananas. Kihapai (Umielua cultivator): 3 mala taro. |
| Hokukano 1 | Keawe | 9419 | 1.35 | Sect 1: Piiwahine ili<br>Sect 2: house lot in Kaneanau ili. | Both sections from parents in 1819. | |
| Hokukano 1 | Keawekaapali or Kauhikaapali | 9428-F | 2.40 | Sect 1: Haleoku ili<br>Sect 2: house lot in Haleoku ili. | Sect 1: from Pikanele in 1819<br>Sect 2: 1819. | |
| Hokukano 1 | Kukele | 9423 | 0.65 | Sect 1: 15 kihapais<br>Sect 2: house lot.<br>Both in Malou ili. | Sect 1: from Hako in 1839.<br>Sect 2: from parents in 1819. | Sect 1: taro, potatoes. |
| Hokukano 1 | Lono | 7277-D | 2.30 | Ili section of Malou. | From Pupea in 1840. | |
| Hokukano 1 | Lupea | 7739 | 3.56 | Sect 1: Kaneanau ili.[3]<br>Sect 2: house lot in Kaneanau ili. | Sect 1: from Haluopo.<br>Sect 2: from parents<br>Both in 1819. | 4 mala taro, 4 mala sweet potates, 2 lauhala trees. Kihapai (Kua cultivator): 3 mala taro, 7 mala sweet potates. |
| Hokukano 1 | Naai[4] | 9414 | 1.50 | Sect 1: 11 patches in Kainaliu, Piilai & Puhele ilis.<br>Sect 2: house lot in Kainaliu ili. | Sect 1: from Nuiha.<br>Sect 2: from parents.<br>Both in 1819. | Sect 1: taro, potatoes. |
| Hokukano 1 | Napela | 10444 | 0.94 | Sect 1: Kamuku ili.<br>Sect 2: house lot in Kamalou ili. | Sect 1: from Kaumiumi.<br>Sect 2: from parents.<br>Both in 1819. | A mo'o and a kihapai. |

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[2] The indices list Kapohaku as the awardee. *Native Testimony*, v 8, p 631 gives Kalua as the awardee. *Native Register*, v. 8, p. 508, states, "Kapohaku is above (claimant), Kalua is the konohiki."

[3] *Native Testimony*, v. 8, p. 623 indicates Kaneanau ili. *Native Register*, v. 8, p. 508 states, "Kamuku is the ili."

[4] *Native Testimony*, v. 8, p. 623 states, "Naai deceased, Keopulani, heir."



| | | | | | | |
|---|---|---|---|---|---|---|
| Hokukano 1 | Poka | 9420 | 0.20 | House lot in Kaneanau ili. | From parents in 1819. | |
| Hokukano 2 | Kahana | 9413 | 3.10 | Sect 1: Makahanaloa ili.<br>Sect 2: house lot. | From Kalua in 1846. | |
| Hokukano 2 | Kauhimahi | 9428-E | 1.20 | Ili section of Haleolono. | From Keliikapaole in 1839. | |
| Hokukano 2 | Keawe | 8157-B | 1.10 | Ili section in Kamuku. | From Keliikapaole in 1840. | |
| Hokukano 2 | Keliikapaole[5] | 9428 | 1.20 | Sect 1: ili section of Kamuku.<br>Sect 2: house lot in Malou ili. | Sect 1: from Nawai in 1840.<br>Sect 2: from parents in 1819. | |
| Hokukano 2 | Kuaha | 9428-C | 0.80 | Section in Malou ili. | From Keliikapaole in 1839. | |
| Hokukano 2 | Kuahuia | 9424 | 0.72 | Sect 1: Puhele ili.<br>Sect 2: house lot. | Sect 1: 1847.<br>Sect 2: 1839.<br>Both from Keliikapaole. | |
| Hokukano 2 | Kukahi | 9427 | 1.60 | Sect 1: Kaopapa ili.<br>Sect 2: house lot in Malou ili. | Sect 1: from Keliikapaole in 1839.<br>Sect 2: from parents in 1819. | |
| Hokukano 2 | Nahuewai | 8157-O | 4.80 | Kamuku ili section. | From Keliikapaole in 1844. | |
| Hokukano 2 | Ukaka | 9416 | 1.63 | Sect 1: Manawaihaiki ili.<br>Sect 2: house lot in Palou ili. | Sect 1: from Keliikapaole in 1839.<br>Sect 2: from parents in 1819. | |

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[5] *Native Testimony*, v. 8, p. 628 states, "Keliikapaole, deceased, Kalua, heir."

| Ahupua'a | Claimant | LCA No. | Acres | Nature of Claim | Tenure Justification | Land Use |
|---|---|---|---|---|---|---|
| Honuaino | Kamamalu, V. | 7713 | Ahp Ap 8 | Fee simple title. | Division agreed to by Privy Council August 27, 1850. | |
| Honuaino | Kaoena | 8523-D | 0.45 | Iii section of Kamuku. | From parents in 1819. | |
| Honuaino | Kuula | 5563 | 1.42 | Sect 1: house lot on beach bounded by stone wall.<br>Sect 2: house lot inland. | From ancestors in the days of Kamehameha I. | Kihapais of taro, coffee, and bananas. A loulu palm. |
| Honuaino | Puolo | 6150-C | 1.10 | 10 kihapais in Kukuipalaoa. | From Kaauwaihina in 1840. | Taro and potatoes. |
| Honuaino 1 | Ahia | 6042 | 0.81 | Sect 1: Iliiloa, Lehuula.<br>Sect 2: house lot in Halelani, Honuaino 1. | Sect 1: from Kuahini in 1844.<br>Sect 2: from Nawahine. | |
| Honuaino 1 | Kaaoaokapu | 5561-G | 0.37 | House lot in Kapkiwai ili. | From Kaholua. | |
| Honuaino 1 | Keawe | 7190 | 2.06 | Sect 1: Kapahee ili.<br>Sect 2: house lot in Halelani ili. | Sect 1: from parents in 1819.<br>Sect 2: from wife in 1819. | |
| Honuaino 1 | Keohookahaku | 8523-E | 1.40 | Iii section of Halelani. | From Kaholua in 1844. | |
| Honuaino 1 | Keohokui | 7347-B | 1.25 | Section in Halelani ili. | From Kaholua in 1840. | |
| Honuaino 1 | Naohelo | 5523 | 1.00 | Iii section of Kapahee. | From Kaholua in 1844. | |
| Honuaino 2 | Martin, J. | 3659 | 4.70 | House lot enclosed by stone wall in Kainaliu.[6] | From Samuel Rice in 1828. | |
| Honuaino 3 | Kaawaehina | 5561-C | 1.70 | Section in Kukuipalaoa ili. A mo'o and a house lot. | From Halepahu in 1819. | |

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[6] Jeremiah Martin gives the dimensions of the house lot wall as 360 ft. by 720 ft. He also claimed a parcel in Kainaliu that he described as being within the "wall that was the King Kamehameha's" (*Foreign Register*, v. 2, p. 172). He was apparently not awarded this lot that was sold by the govt. to W. Johnson. It is described in *Foreign Testimony*, v. 8, p. 672 as lying mauka of the "Great Wall."



| | | | | | | |
|---|---|---|---|---|---|---|
| Honuaino 3 | Kekua | 5561 | 1.24 | Sect 1: an ili.<br>Sect 2: house lot. | Both from Kaana in 1840. | Mo'o (inland and seashore) set aside for grazing. |
| Honuaino 3 | Kukaueli | 5561-BB[7] | 2.40 | Sect 1: Kaohe ili.<br>Sect 2: house lot in Kaohe iii. | Both from Kaana:<br>Sect 1: date unspecified<br>Sect 2: in 1845. | |
| Honuaino 3 | Maeoho | 10138 | 0.75 | Section in Kaohe ili. | From Nuuanu in 1840. | 5 taro and potato kihapais. |
| Honuaino 4 | Aheakalani | 5564 | 2.06 | Sect 1: Haleoku ili.<br>Sect 2: Iliiloa.<br>Sect 3: house lot in Iliiloa. | Sect 1: from Keawekaapali in 1847.<br>Sect 2: from Mahiki in 1847.<br>Sect 3: from Kamakolu in 1839. | Sect 1: 3 taro kihapais.<br>Sect 2: 11 taro and potato kihapais. |
| Honuaino 4 | Kanakaole | 7901 | 2.00 | Sect 1: ili of Waipio in Honuaino 1.<br>Sect 2: house lot in Haliipalala ili.<br>Sect 3: Kapahee ili. | Sect 1: from Kaholua in 1844.<br>Sect 2: from parents in 1819.<br>Sect 3: from Keawe in 1847. | Sect 3: 5 potato kihapais. |
| Honuaino 4 | Nohopaa | 6150<br>6180[8] | 1.89 | Sect 1: Kamuku ili of Hokukano.<br>Sect 2: Iliiloa of Honuaino 4.<br>Sect 3: house lot in Iliiloa, Honuaino 4. | Sect 1: from Lono in 1847.<br>Sect 2: from Mahiki in 1840.<br>Sect 3: from Kohi in 1840. | Sect 1: 2 taro and potato kihapais.<br>Sect 2: 10 taro and potato kihapais. |

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[7] Entry in *Native Testimony*, v. 8, p. 638 is probably misnumbered as 5561. The claimnat's name in the same entry is spelled Kukanaili.

[8] Both LCAs are listed in *Native Testimony* v. 8, p. 639. *Native Register*, v. 8, pp. 187-88 places 6150 at Kaluulu and 6180 in Hokukano and Honuaino.

| | | | | | | |
|---|---|---|---|---|---|---|
| Honuaino 4[9] | Lono | 5992 | 3.30 | Sect 1: Haleulupo ili in Honuaino 4. Sect 2: house lot in Iliiloa of Honuaino 4. | Sect 1: from Kamehamena I in 1800. Sect 2: from parents in 1819. | |
| Honuaino iki | Hall, Chas. | 614 | 248.8 | Tract called Honuaino iki I. | From Samuel Rice in 1839. | Coffee plantation, fruit trees. |
| Honuaino nui | Lunalilo, W.C. | 8559-B | 262 | | | |

| Ahupua'a | Claimant | LCA No. | Acres | Nature of Claim | Tenure Justification | Land Use |
|---|---|---|---|---|---|---|
| Iiikahi | Keliiwahanuku | 9428-G | 1.00 | Section in Kanaa ili. | From Nakookoo in 1840. | |
| Iiihahi | Keohokalole | M.A. 2 | By name only | | | |

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| Ahupua'a | Claimant | LCA No. | Acres | Nature of Claim | Tenure Justification | Land Use |
|---|---|---|---|---|---|---|
| Kalukalu | Puki | 10750[10] | 1.00 | Sect 1: Iliiloa ili. Sect 2: Kohekaheia ili and Kamuku. Sect 3: house lot in Makakea ili of Kekkee 2 ahupua'a. | Sect. 2: from Pa in 1844. Sect 3: from Makaihiona in 1841. | Sect 1: 4 taro and coffee kihapai. Sect 2: 3 taro kihapai, 2 taro and coffee kihapai. |
| Kalukalu[11] | Kamaheaiku | 8157-E | 1.15 | Sect 1: Hoolaekukui ili.of Kanakau 1. Sect 2: house lot in Makakea ili of Kekee 2. | Sect 1: from Kanenaole in 1840. Sect 2: from parents in 1819. | |

[9] The *Indices of Awards*, Pt. 2 gives the location simply as Honuaino. *Native Testimony*, v. 8, p. 639 gives Honuaino 4 as the ahupua'a.

[10] Numbered 10700 in *Native Testimony*, v. 8, p. 619. No. 10700 listed as "Not Awarded" in the *Indices of Awards*.

[11] Award 8157-E is also listed under Kanakau, Keekee in the *Indices of Awards*.



| | | | | | | |
|---|---|---|---|---|---|---|
| Kalukalu[12] | Kamahele | 7197 | 0.67 | Sect 1: Hoolaekukui ili in Kanakau. Sect 2: house lot in Pohakea ili of Kekee 2. | Sect 1: from Naihe. Sect 2: from parents Both in 1819. | 1 mala of taro and 1 of sweet potatoes.[13] |
| Kalukalu, Kamuku | Koikua | 9428-H | 1.25 | Section in Kamuku ili. | From Nenene in 1839. | |
| Kalukalu, Kamuku | Lohi | 9650[14] | 1.80 | Sect 1: Kamuku ili Sect 2: Kulou ili. | Sect 1: from Ehu in 1839. Sect 2: from parents in 1819. | Taro, sweet potatoes, gourds. |
| Kalukalu, Kamuku | Pa | 7553-B | 1.10 | Section in ilis of Kamuku, Iliiloa, and Kohekaheia. | From Kaheana in 1840. | |
| Kalukalu, Kulou[15] | Kaiaino | 7212 | 1.20 | Sect 1: Kulou ili. Sect 2: house lot in Waipio ili of Kanakau. | Sect 1: from Kapoi 1847. Sect 2. from parents in 1819. | Sect 1: 2 mala of taro. |

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| Ahupua'a | Claimant | LCA No. | Acres | Nature of Claim | Tenure Justification | Land Use |
|---|---|---|---|---|---|---|
| Kanakau | Kaiaino | 7212 | 1.20 | Sect 1: Kulou ili. Sect 2: house lot in Waipio ili of Kanakau. | Sect 1: from Kapoi 1847. Sect 2. from parents in 1819. | Sect 1: 2 mala of taro. |
| Kanakau | Ialua | 8455-F | 1.30 | Sect 1: ili of Paukauila of Kanakau 2. Sect 2: Kamuku. Sect 3: house lot in Pohakea ili. | Sect 1: from Kuakini in 1840. Sect 2: 1840. Sect 3: from Kaawa in 1819. | Sect 1: 4 taro kihapais. Sect 2: 3 potato and gourd kihapais. |

[12] Award 7197 is also listed under Kanakau, Keekee in the *Indices of Awards*.

[13] Location of mala questionable. Data from *Native Register*, v. 8. p. 249 which gives the location as Kamuku.

[14] Numbered 9652 in *Native Testimony*, v. 8, p. 615. No. 9652 listed as "Not Awarded" in the *Indices of Awards*.

[15] Award 7212 is also listed under Kanakau in the *Indices of Awards*.

| | | | | | | |
|---|---|---|---|---|---|---|
| Kanakau | Paiwa | 9753-B[16] | 0.14 | Sect 1: 3 ilis, Haelua, Haleape, and Pohakea in Kekee 2. Sect 2: house lot in Punanamoa ili of Kanakau 1. | Sect 1: from Haiha in 1844. Sect 2: from parents of Paiwa's wife in 1819. | |
| Kanakau, Keekee | Ialua | 8455-F | 0.45 | Sect 1: Paukauila ili. Sect 2: Kamuku. Sect 3: house lot in Pohakea lli. | Sect 1: from Kuakini in 1840. Sect 2: in 1840. Sect 3: from Kaawa in 1819. | Sect 1: 4 taro kihapais. Sect 2: 3 potato and gourd kihapais. |
| Kanakau, Keekee | Kaiwaiwa | 7035[17] | 0.14 | Sect 1: Waipio ili in Kanakau 2. Sect 2: house lot ili in Kekee 1. | Sect 1: from Kapuai in 1839. Sect 2: from parents in 1819. | Sect 1: 10 taro and potato kihapais. |
| Kanakau, Keekee | Kamaheaiku | 8157-E | 0.10 | Sect 1: Hoolaekukui ili.of Kanakau 1. Sect 2: house lot in Makakea ili of Kekee 2. | Sect 1: from Kanenaole in 1840. Sect 2: from parents in 1819. | |
| Kanakau, Keekee | Kamahele | 7197 | 0.18 | Sect 1: Hoolaekukui ili in Kanakau. Sect 2: house lot in Pohakea ili of Kekee 2. | Sect 1: from Naihe Sect 2: from parents Both in 1819. | 1 mala of taro and 1 of sweet potatoes. |
| Kanakau, Keekee | Kuluiki | 8455-C | 0.25 | Sect 1: Pahakea ili in Kanakau 2. Sect 2: house lot in Mahailua ili, Kekee 2. | From parents in 1819. | |
| Kanakau, Waipio | Kaiwaiwa | 7035 | 1.50 | Sect 1: Waipio ili in Kanakau 2. Sect 2: house lot ili in Kekee 1. | Sect 1: from Kapuai in 1839. Sect 2: from parents in 1819. | Sect 1: 10 taro and potato kihapais. |

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[16] Numbered 9753 in *Native Testimony*, v. 8, p. 615.
[17] Numbered 7635 in *Native Testimony*, v. 8, p. 617. No. 7635 listed as "Not Awarded" in the *Indices of Awards*.



| | | | | | | |
|---|---|---|---|---|---|---|
| Kanakau, Waipio | Makole | 8455-H | 1.80 | Sect 1: Waipio ili at Kanakau. Sect 2: house lot in Pueohale ili of Kanakau 2. | Sect 2: from parents in 1819. | |

| Ahupua'a | Claimant | LCA No. | Acres | Nature of Claim | Tenure Justification | Land Use |
|---|---|---|---|---|---|---|
| Kanaueue | Kaaloakauhi | 9415 | 1.90 | House lot in Kuoi ili. | From parents in 1819. | |
| Kanaueue | Kahananui | 9422 | 0.43 | 2 lots and a house lot in kioi ili. | From Kauhi, but first from parents in 1819. | |
| Kanaueue | Kaheana | 8157-M | 0.75 | House lot in Paepaehaniu ili. | From Kauhi in 1819. | |
| Kanaueue | Kalimakauo | 9426 | 0.16 | Sect 1: Puekahi ili. Sect 2: house lot in Puekahi. | Sect 1: from Kalaluhi in 1839. Sect 2: from Lalaluhi [?] in 1819. | |
| Kanaueue | Kane | 9430[18] | 0.20 | Sect 1: Kamuku ili of Kananene 1. Sect 2: house lot in Pukahi. | Sect 1: from Kauhi in 1819. Sect 2: from Kalimakano 1840. | |
| Kanaueue | Kauhi | 8157-I[19] | 0.20 | House lot in Kioi ili. | From wahine in 1819. | |

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| Ahupua'a | Claimant | LCA No. | Acres | Nature of Claim | Tenure Justification | Land Use |
|---|---|---|---|---|---|---|
| Keekee | Kalamaia | 8157-BB | 0.17 | Sect 1: Halaula 1 ili of Kanakau 2. Sect 2: house lot in Makakea ili of Keekee. | Sect 1: from Uenaole in 1844. Sect 2: from parents in 1819. | |

[18] Numbered 9439 in *Native Testimony*, v. 8, p. 624.
[19] Numbered 8157 in *Native Testimony*, v. 8, p. 624.

| | | | | | | |
|---|---|---|---|---|---|---|
| Keekee | Kini | 7210 | 1.83 | House lot in Makokakea ili. | From parents in 1839. | |
| Keekee | Nawai | 8455-I | 0.20 | House lot in Kukuiula, Kekee 1. | No disputes. | |
| Keekee 1 | Kahue[20] | 7036 | 1.50 | Sect 1: Uo ili in Kohu 1 ahupua'a.<br>Sect 2: house lot in Keekee ahupua'a. | Both sections from parents in 1819. | |
| Keekee 1 | Kuapehu | 8157 | 1.80 | Sect 1: Uo ili in Kekee 1 and Hoolae.<br>Sect 2: house lot in Makakea ili of Kekee 2. | Sect 2: from parents in 1819. | Sect 1: 2 taro mala and 1 gourd mala. |
| Keekee 1 | Pauole | 8455-E[21] | 2.70 | Sect 1: Makakea ili in Keekee 2.<br>Sect 2: house lot in Keekee 2. | Sect 2: from parents in 1819. | |
| Keekee 2 | Kamakahiona | 8157-C | 0.41 | Sect 1: Puunoni ili of Kekee ahupua'a.<br>Sect 2: house lot in Makakea ili of Kekee 2 ahupua'a. | Sect 1 from Kanemaikou.<br>Sect 2: from parents.<br>Both in 1819. | |
| Keekee 2 | Paiwa | 9753-B[22] | 1.60 | Sect 1: 3 ilis, Haelua, Haleape, and Pohakea in Kekee 2.<br>Sect 2: house lot in Punanamoa ili of Kanakau 1. | Sect 1: from Haiha in 1844.<br>Sect 2: from parents of Paiwa's wife in 1819. | |

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[20] *Native Testimony*, v. 8, p. 619 states, "Kahue deceased, Kamakahema, heir."
[21] Numbered 8445-E in *Native Testimony*, v. 8, p. 620.
[22] Numbered 9753 in *Native Testimony*, v. 8, p. 615.



| | | | | | | |
|---|---|---|---|---|---|---|
| Keekee, Punanamoa | Makauwaa | 8455-G | 0.87 | Sect 1: Pohakea ili of Kekee 2.<br>Sect 2: Punanamoa ili in Kanakau 1.<br>Sect 3: house lot in Makakea, Kekee 2. | Sect 1: from Moku in 1819.<br>Sect 2: from Kaawa in 1819.<br>Sect 3: from parents in 1819. | |

| Ahupua'a | Claimant | LCA No. | Acres | Nature of Claim | Tenure Justification | Land Use |
|---|---|---|---|---|---|---|
| Onouli | Atkins, James | 925 | 113.0 | Section of Kealaehu ili. | From Kuakini 1838. | Cutivated. |
| Onouli | Kahananui[23] | 7203 | 0.30 | House lot. | From Kuakini 1839. | |
| Onouli | Keohokalole, A. | 8452 | 1165 | Ahupua'a. | | |
| Onouli | Panaunau | 9776 | 1.40 | | | |
| Onouli | Makaiwi | 9277-F[24] | 0.20 | Sect 1 ilis of Keaweloa and Laulaulahili in Onouli 2.<br>Sect 2: house lot in Laulaulahili ili. | Both from Nihonui in 1839. | |
| Onouli 1 | Kapoi | 7204 | 1.30 | Sect 1: Kapuaapilau ili of Onouli.<br>Sect 2: house lot in Iliiloa of Onouli 2. | Sect 1: from father in 1819.<br>Sect 2: from Kahopuaku 1844. | Sect 1: 2 mala of taro, 1 mala of coffee, 1 mala of hala. |
| Onouli 1, Alapaiki | Kalawaiaaki | 8157-D | 1.42 | Sect 1: ili of Alapaiki, Onouli 1.<br>Sect 2: Kamuku ili and house lot in Keaweloa ili of Onouli 1. | Sect 2: from parents in 1819. | |
| Onouli 1, Kapuaawaha | Kukahuna | 7198 | 0.90 | Sect 1: Kapuaawaha ili.<br>Sect 2: Kukuikupukupu. | Both from Pananau in 1844. | Sect 1: 2 taro kihapais.<br>Sect 2: Taro kihapai. |

III-1-169

[23] *Native Testimony*, v. 8, p. 617 states, "Kahananui deceased, Puhipuhi (w), heir."
[24] Probably the entry numbered 7277-F in *Native Testimony*, v. 8, p. 633.

| | | | | | | |
|---|---|---|---|---|---|---|
| Onouli 1, Nohoau | Kaaua | 8523-B[25] | 1.21 | Ili section in Nohoau and Papuaa ilis. | From Kahanui and Kepaa in 1839. | |
| Onouli Iliola | Kuniola | 6985 | 1.90 | Section of Iliiloa ili.in Onouli 2. | From Puhipuhi in 1839. | |
| Onouli Ohia | Kanapi | 8455 | 0.90 | Ili of Ohia. | From Alapai in 1840. | 2 mala of taro, 3 mala of sweet potatoes, 2 mala of gourd, 1 hala tree, and 1 hau tree. |
| Onouli Ohiki | Naiwiakolea | 5692 | 1.40 | Ili section of Kapuaakilau. | From Kekauhi in 1839. | |



25 Numbered 8523-C in *Native Testimony*, v. 8, p. 632.

# III - 2 Archaeological Inventory (Volume II)

# Archaeological Inventory Survey and Limited Subsurface Testing of a 1540-Acre Parcel in the *Ahupua'a* of Honuaino 3-4, Hokukano, Kanaueue, Haleki'i, Ke'eke'e, 'Ilikahi, Kanakau, Kalukalu, and Onouli 1, Districts of North and South Kona Island of Hawai'i

## Volume II

by

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## INTRODUCTION

Volume Two contains descriptions of all archaeological sites in the project area.

Gaps are present in sequences of both the temporary site numbering and the State Site numbering systems. A few sites that were initially designated by temporary site numbers were removed from the site inventory after they were determined to be elements of larger site complexes. Two sites, after they had been assigned State Site numbers, were later correlated with previously assigned State Site numbers.



## SITE DESCRIPTIONS

**State Site #:** 50-10-37-6601
**Site Type:** Kona Field System
**Function:** Agricultural
**Features (#):** ---
**Site Dimension:** Undetermined
***Ahupua'a:*** All
**Elevation:** 275 ft. to 950 ft. a.m.s.l.

**Description:** State site -6601 refers to features characteristic to the previously recorded Kona Field System. These agricultural features include walled fields and associated mounds and terraces. The field system is present in the project area from 275 ft. a.m.s.l. to approximately 950 ft. a.m.s.l. They are still visible in most areas that have not been affected by bulldozing or lava flows. The actual field walls are constructed of piled small to large boulders. (See figure 7, Vol. I)

**State Site #:** 50-10-37-7276
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** undetermined
***Ahupua'a:*** all within project area
**Elevation:** 225 ft. a.m.s.l. (average)

**Description:** State site -7276 is the Great Wall of Kuakini. The wall runs N/S across the width of the project area. It measures from 1.0 to 2.0 m. (3.28 to 6.6 ft.) wide and high. The wall is constructed of small to large stacked cobbles and boulders. The wall is still well faced along most of its extent. The wall is unique to the project because of its size and length. At different locations along the wall historic and modern alterations (gates) are evident.

**State Site #:** 50-10-37-10283 **CSH Site #:** 414
**Site Type:** Lava blister
**Function:** Pen
**Features (#):** 1
**Site Dimension:** 12.0 $m.^2$ (129.6 $ft.^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -10283 is a lava blister situated in rough terrain within the "Hokukano Flats" area. The site correlates with Paul H. Rosendahl Inc. site W-6.

The blister measures 4.0 m. (13.1 ft.) NW/SE by 3.0 m. (9.8 ft.) NE/SW with a maximum depth of 2.0 m. (6.6 ft.). The southwest portion of the blister has a slight overhang above a soil floor. The northwest portion is paved with small boulders and cobbles and has a wall with an approximate height of 1.0 m. (3.3 ft.) running through the center of the pavement.

Midden includes coral and *Nerita picea*. No artifacts were observed.
State site -10283 is in fair condition and has good excavation potential.

**State site #:** 50-10-37-10284 **PHRI Site #:** K-7
**Site Type:** Wall
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 227.3 m.$^2$ (750.0 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 100 to 200 ft. a.m.s.l.

**Description:** State site -10284 is a *mauka - makai* (east-west) oriented wall that measures approximately 1.0 -2.0 m. (3.3 - 6.6 ft.) wide and 1 - 1.5 m. (3.3 - 4.9 ft.) high. The wall extends between the Great Wall of Kuakini (State site 50-10-37-7276) and the King's Trail (State site 50-10-37-10290). The wall is bifaced with boulders and cobbles.

This site correlates with Paul H. Rosendahl Inc. site K-7.

**State Site #:** 50-10-37-10286 **CSH Site #:** 400
**Site Type:** Site complex
**Function:** Possible burial
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Kanaueue
**Elevation:** 75 ft. a.m.s.l.

**Description:** State site -10286 is a series of small platforms and terraces located north of Pu'u Ohau on a gentle *makai* (west) descending slope. This site correlates with Paul H. Rosendahl Inc. site W-4.

**Feature A** is a platform which measures 4.0 m. by 4.0 m. (13.1 by 13.1 ft.) with a height of 1.1 m. (3.6 ft.). It is constructed of cobbles and boulders and paved with cobbles. It is level and there is facing on all sides.

A coral file fragment was observed at the edge of the outcrop slope; no midden was observed.

Feature A is in good condition.

**Feature B** refers to a complex of platforms and terraces situated on a steep slope *mauka* (east) of the coastal flatlands and about 35.0 m. (114.8 ft.) from the main access road and west/southwest of Feature A. The overall complex measures approximately 20.0 m. (65.6 ft.) N/S by 15.0 m. (49.2 ft.) E/W. The complex features are roughly constructed of small to large pahoehoe boulders. Feature B was mapped and recorded by Paul H. Rosendahl Inc.

No artifacts or midden were observed.

Feature B is in poor condition.



**State Site #:** 50-10-37-10287 **CSH Site #:** 405
**Site Type:** Site complex
**Function:** Possible burials
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Hokukano
**Elevation:** 90 ft. a.m.s.l.

**Description:** State site -10287 comprises two features, both low-level platforms which are designated Features A and B. They are situated in a level grassy area just north of Pu'u Ohau. The surrounding vegetation is ***kiawe, koa haole***, and California grass. This site correlates with Paul H. Rosendahl Inc. site W-3.

**Feature A** is a platform which measures 6.5 m. (21.3 ft.) NE/SW by 4.5 m. (14.8 ft.) NW/SE and is 0.3 m. (1.0 ft.) high. It is constructed of cobbles to small boulders.

No artifacts or midden were observed. Feature A is in fair to poor condition.

**Feature B** platform is located 3.0 m. (9.8 ft.) northwest of Feature A. It measures 7.5 (24.6 ft.) NE/SW by 4.5 (14.8 ft.) NW/SE and it is 0.3 m. (1.0 ft.) high. It is constructed of cobbles to small boulders.

No midden or artifacts were observed.

Feature B is in poor to fair condition.

State site -10287 is interpreted as a possible burial site.

**State site #:** 50-10-37-10288 **CSH Site #:** 399
**Site Type:** Platform
**Function:** Probable burial
**Features (#):** 1
**Site Dimension:** 45.5 m.$^2$ (491.4 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 125 ft. a.m.s.l.

**Description:** State site -10288 was previously recorded by Paul H. Rosendahl Inc. as site W-2.

The site is a large roughly rectangular platform constructed of small to large a'a cobbles and boulders. It is situated on the north eastern edge of the *Pu'u Ohau*. The platform measures 7.0 m. (23.0 ft.) NW/SE by 6.5 m. (21.3 ft.) NE/SW, with a maximum height of 0.3 m. (1.0 ft.) in the southeast corner. The platform surface is roughly paved.

A piece of coral was observed on the platform. There is an old access road located 3.0 m. to the north of the site.

State site -10288 is in fair to poor condition and is interpreted as a probable burial.

**State site #:** 50-10-37-10289 **PHRI Site #:** W-1
**Site Type:** Site complex
**Function:** Possible burials
**Features (#):** 5
**Site Dimension:** Undetermined
***Ahupua'a*:** Kanaueue
**Elevation:** 75 ft. a.m.s.l.

**Description:** State site 50-10-37-10289 is a five-feature complex situated to the north of Pu'u Ohau and to the west of the King's Trail (state site 50-10-37-10290). The features consist of four large rock mounds and a group of small rough terraces. All features are constructed of roughly piled boulders and cobbles. The largest mound measures approximately 20.0 m. (66.0 ft.) long by 8.5 m. (28.0 ft.) wide and 0.35 m (1.1 ft.) high.

A small water-worn basalt cobble was observed atop the largest mound. Although the site is most likely agricultural in function, it is also possible that some of the mounds could represent collapsed burial structures.

This site correlates with Paul H. Rosendahl Inc. site W-1.

**State Site #:** 50-10-37-10290
**Site Type:** Pavement
**Function:** Trail/road
**Features (#):** ---
**Site Dimension:** Undetermined
***Ahupua'a*:** Crosses all project area *ahupua'a*
**Elevation:** 20 ft. to 275 ft. a.m.s.l.

**Description:** State site -10290 consists of what appears to have been a prehistoric foot trail that was converted to a government road. The trail runs through the entire project area. It enters the project area in the north approximately 20.0 m. (66.0 ft.) to the west of main N/S road and exists the project area approximately 30.0 m. (99.0 ft.) to the east of the Great Wall of Kuakini (state site -7276). The trail has an average width of 2.5 m. (8.25 ft.) in the northern half of the project area, with the southern half of the trail being indeterminate in width. The trail is constructed of well stacked basalt boulders with a level cobble paving delinated on either side by an alignment of water rounded boulders. Different portions of the trail range from extensive modifications of "berm" like structures with a maximum height of 3.0 m. (9.9 ft.) to simple alignments of water rounded stones. When the trail extends off the undulating pahoehoe of the northern portion of the project it becomes discontinuous and virtually impossible to follow. The only traces left of the trail (in the southern half of the project) are narrow gateways in the cattle system walls and fences. This site correlates with Paul H. Rosendahl Inc. site K-6.



**State Site #:** 50-10-37-10291 **CSH Site #:** 358
**Site Type:** Terrace
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 26.0 m.$^2$ (280.8 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 80 ft. a.m.s.l.

**Description:** State site -10291 is a terrace built on a very steep-sided ridge of pahoehoe and intermittent soil pockets. The area is surrounded by *kiawe* and *haole koa*. This site was previously recorded by Paul H. Rosendahl, Inc. as site W-19.

The terrace measures 6.2 m. (20.3 ft.) E/W by 4.2 m. (13.8 ft.) N/S by 0.5 m. high. It is constructed of large to medium boulders with some cobbles; there is some remnant facing.

There were no observable midden or artifacts at the site.

State site -10291 is in fair condition.

**State Site #:** 50-10-37-10292 **CSH Site #:** 365-368
**Site Type:** Site complex
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** (see below)
***Ahupua'a*:** Hokukano 1
**Elevation:** 75 ft. a.m.s.l.

**Description:** State site -10292 is a site complex consisting of four features designated A through D. The site complex is situated on a gentle slope near the coast. The site is surrounded by *kiawe* and *koa haole* trees.

Each of the features were originally recorded as separate sites and assigned separate temporary (CSH) site numbers. Subsequently the four sites were combined under the single state site number previously assigned to the general site area by Paul H. Rosendahl Inc. The PHRI site number is W-20.

**Feature A** (CSH Site 365) is a possible burial mound measuring 4.0 m. (13.1 ft.) N/S by 3.0 m. (9.8 ft.) E/W; it has an average height of 0.6 m. (2.0 ft.). It is constructed of medium boulders and cobbles. There is facing on the *makai* (west) side of the mound.

No midden or artifacts were observed.

Feature A is in fair condition. Paul H. Rosendahl Inc. site markers were observed on the site and on a nearby bulldozed road.

**Feature B** (CSH Site 366) is a square enclosure measuring 6.5 m. (21.3 ft.) E/W by 5.5 (18 ft.) N/S. The height ranges from 0.5 m. to 0.8 m. (1.6 ft. to 2.6 ft.). The enclosure is constructed of pahoehoe boulders and cobbles. The interior is level and clear with grass and *koa haole* growing within the enclosure. The internal walls are faced. The external facing averages 1.1 m. (3.6 ft.) high with a maximum of 1.4 m. (4.6 ft.).

The enclosure has distinct corners and remains in good condition with minimal collapse or tumble. Coral was observed in the northeast corner of the enclosure interior.

The enclosure is probably an historic pen or habitation, but may possibly be a prehistoric habitation site.

**Feature C** (CSH Site 367) (Figure 1) consists of 3 mounds and a rough platform with one L-shaped wall segment located 36.6 m. (120 ft.) *mauka* (east) of Feature B on a flat area with *kiawe* and grass covering a soil slope. The platform measures 6.5 m. (21.3 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a maximum height of 0.4 m. (1.3 ft.). The feature area measures roughly 20.0 m. (65.6 ft.) N/S by 15.0 m. (49.2 ft.) E/W. It is constructed of small to large cobbles.

The platform is interpreted as a temporary habitation site surrounded by agricultural mounds. The best mound measures 2.2 m. (7.2 ft.) N/S by 3.4 m. (11.2 ft.) E/W.

No midden or artifacts were observed.

**Feature D** (CSH Site 368) is a small enclosure surrounded by numerous agricultural walls. The mounds and terraces are on an old flat area of slope. The exterior of the enclosure measures 4.0 m. (13.1 ft.) N/S by 3.8 m. (12.5 ft.) E/W with a maximum height 0.5 m. (1.6 ft.) and the interior is 1.8 cm. (5.9 ft.) N/S by 2.2 m. (7.2 ft.) E/W 0.7 m. (2.3 ft.). The construction of this enclosure is of small to large cobble to small boulders stacked 2 to 4 courses high.

There was no midden or artifacts observed.

It is interpreted as a temporary habitation site.

**State Site #:** 50-10-37-10293 **CSH Site #:** 370
**Site Type:** Lava tube
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 96.0 m.$^2$ (1,036.8 ft.$^2$)
***Ahupua'a*:** Hokukano 2
**Elevation:** 175 ft. a.m.s.l.

**Description:** State Site -10293 is a lava tube which was previously recorded by Paul H. Rosendahl Inc. as site W-14. The site is situated amongst *koa haole*, *kiawe* and some grass. The site also contains surface features including a large boulder-filled depression around the tube's entrance and a similar boulder-filled depression located 15.0 m. (49.2 ft.) to the southwest of the entrance.

The tube entrance is open to the east; the tube extends generally toward the west. The tube entrance measures 1.5 m. (4.9 ft.) across with a ceiling height of 0.8 m. (2.6 ft.). A constructed wall section blocks part of the north side of the tube opening. Within the light area is a shallow soil deposit with scattered cobbles and boulders. Some gourd fragments were also observed and some small mammal bone.

A small overhang is located approximately 7.0 m. (23.0 ft.) *mauka* (east) of the lava tube entrance. Although the overhang is part of the lava tube formation, no access into the tube is rendered through the overhang.



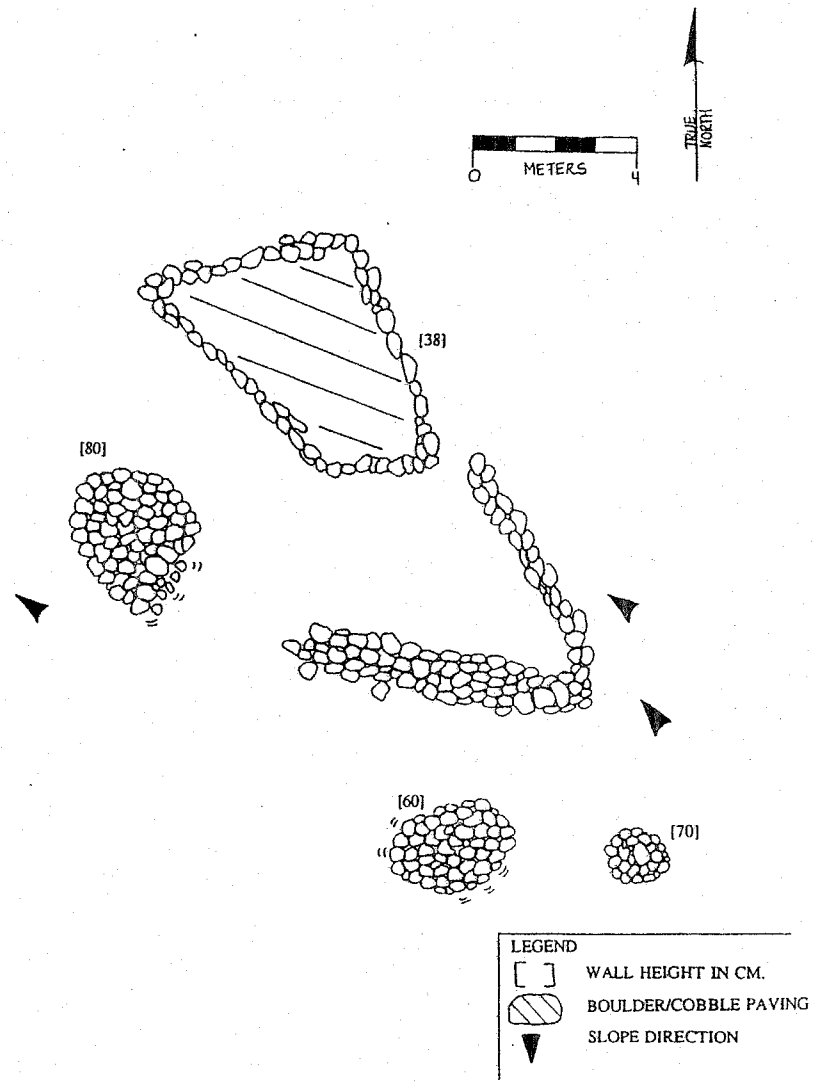



Figure 1 State site 50-10-37-10292, Feature C; plan view

**State Site #:** 50-10-37-10294 **CSH Site #:** 227
**Site Type:** Lava tube
**Function:** Burials
**Features (#):** (see below)
**Site Dimension:** 328.5 m.$^2$ (3,547.8 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 175 ft. a.m.s.l.

**Description:** State site -10294 is a lava tube containing two burials. The site was previously recorded by Paul H. Rosendahl Inc. as site K-7a.

The entrance to the tube consists of a sink located beneath a cattle wall. The sink measures 4.2 m. (13.8 ft.) E/W by 1.5 m. (4.9 ft.) N/S, and extends 1.2 m. (3.9 ft.) deep. There is another entrance - a collapsed ceiling measuring 1.5 m. (4.9 ft.) in diameter - located 1.0 m. (3.3 ft.) south of the main sink.

The tube has two chambers. The first chamber is situated beneath the cattle wall at the south end of the tube. It measures 7.5 m. (24.6 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum ceiling height of 1.0 m. (3.3 ft.). The chamber floor consists of a thin soil deposit. Midden observed includes marine midden (*Cypraea sp.*) and *kukui* nut.

The entrance to the second chamber is located at the north end of the first chamber. It extends 53.0 m. (173.8 ft.) to the north, then curves *mauka* (east) and continues 20.0 m. (65.6 ft.) to the east. The height ranges from 0.4 m. (13.1 ft.) to 1.5 m. (4.9 ft.). The floor consists of a rough lava surface with little or no soil. A fair amount of midden was observed in Chamber 2, including coral, charcoal, and *kukui* nuts.

The first burial - Burial #1 - is located 9.0 m. (29.5 ft.) north of the sink in the first chamber. The remains are in poor condition, and were piled together on the tube floor. Two femurs and two tibia were identified.

Burial #2 is located in the second chamber, approximately 25 meters from the entrance to the chamber. Burial #2 consists of bone fragments - scattered over a 1 m.$^2$ area - that include a possible humerus fragment and a larger fragment from either a tibia or femur. One tooth was observed, but no cranial fragments were located. Along with the human bones, a small mammal skeleton (probable cat) was observed; it did not appear to be associated with the burial.

**State Site #:** 50-10-37-10295 **CSH Site #:** 230
**Site Type:** Platform
**Function:** Probable burial
**Features (#):** 1
**Site Dimension:** 12.0 m.$^2$ (129.6 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 170 ft. a.m.s.l.

**Description:** State site -10295 was previously recorded by Paul H. Rosendahl Inc. (PHRI site W-17). It is situated on a gently sloped pahoehoe outcrop flow. Surrounding this platform is exposed pahoehoe and California grass *kiawe* and *koa haole*.

The platform measures 3.0 m (9.8 ft.) N/S by 3.0 m. (9.8 ft.) E/W with an additional 1.0 m. (3.3 ft.) of tumble present along its *makai* (west) face. It has a maximum height of 0.4 m. (1.3 ft.). The platform is paved with subangular cobbles. Intact facing remains on its



north, south and east sides.

No artifacts or midden were observed.

State site -10295 is in good condition.

**State Site #:** 50-10-37-10296 **CSH Site #:** 238,239,240
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a*:** Haleki'i
**Elevation:** 235 ft. a.m.s.l.

**Description:** State site -10296 (Figure 2) is a site complex comprising three features - designated A to C - surrounded by pasture grass, *koa haole* and *kiawe*. The site is situated on a break in the slope at the top edge of a very steep *makai* (west) slope; it has a good view of the coast and of Pu'u Ohau directly *makai* (west). The site area is *makai* (west) of State site -16786 *heiau* and the Great Wall of Kuakini.

The site was previously recorded by Paul H. Rosendahl Inc. as site K-3. Each of the features was originally recorded as separate sites and assigned separate temporary (CSH) site numbers. Subsequently the three sites were merged under one single state site number previously assigned to the general site area by Paul H. Rosendahl Inc.

**Feature A** (CSH Site 238) is a platform which measures 20.0 m.$^2$ (65.8 ft.$^2$) and is a maximum of 2.5 m. (8.2 ft.) above the surrounding terrain. There is a level soil area *mauka* (east) and to the south.

Numerous possible postholes exist along the platform. There is terracing which surrounds the platform at many different levels.

No artifacts or midden were observed.

The feature is in fair condition and its excavation potential is also fair. It is interpreted as a permanent habitation unit.

**Feature B** (CSH Site 239) is a mounded platform located at the top of a steep slope. The platform has a large upright stone at its *makai* (west) end. It is L-shaped and roughly constructed of large boulders and cobble fill. There are no level areas on the platform surface and the general height is 0.4 m. (1.3 ft.). The upright is 1.0 m. (3.3 ft.) tall and 0.8 m. (2.6 ft.) wide at its base.

No midden or artifacts were observed.

Feature B condition is poor to fair. This platform is interpreted as a possible burial.

**Feature C** (CSH Site 240) consists of a terrace with a small rectangular enclosure on its south central side. It is constructed of medium to small boulders and cobbles stacked upon the existing bedrock. The facing still remains intact along the south *makai* (west) side with the other side fairly tumbled.

Feature C is in fair to good condition.

No artifacts or midden were observed at State site -10296.

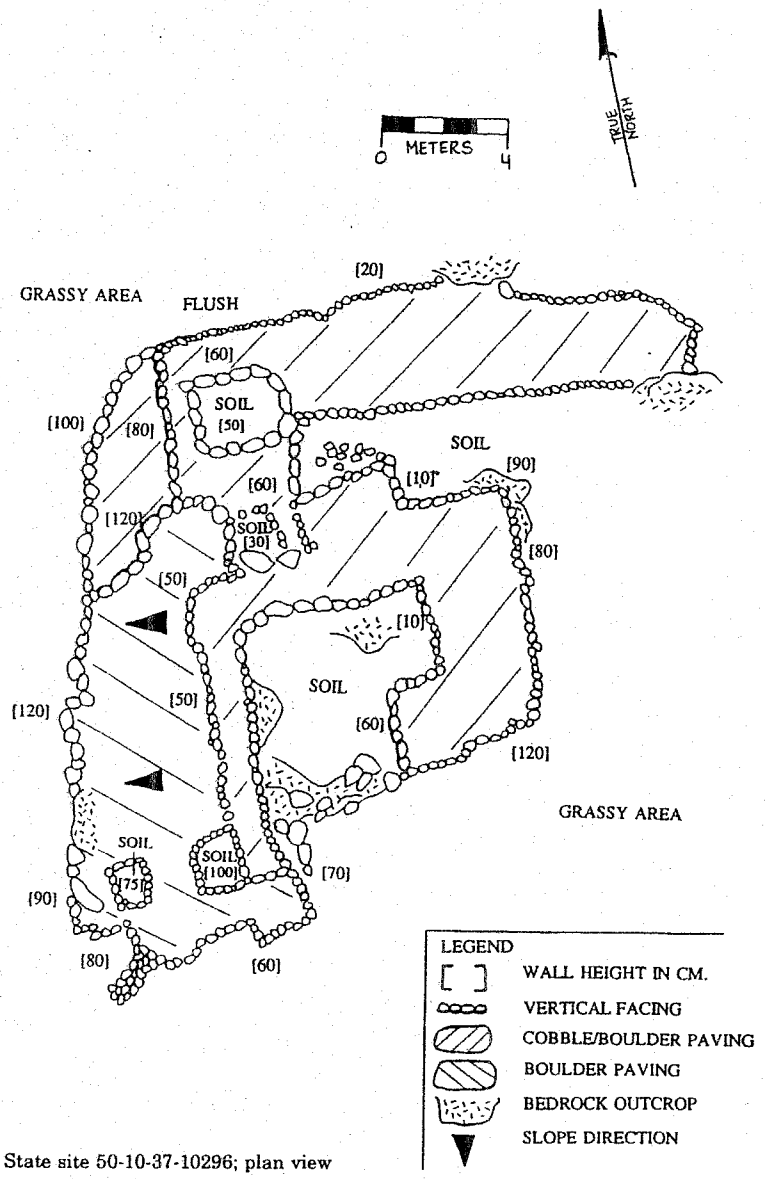



Figure 2 State site 50-10-37-10296; plan view



**State Site #:** 50-10-37-10297 **CSH Site #:** 277
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 11
**Site Dimension:** (see below)
***Ahupua'a:*** Kanaueue
**Elevation:** 330 ft. a.m.s.l.

**Description:** State site -10297 is a large complex with eleven features designated A through K. The site was previously recorded by Paul H. Rosendahl Inc. as site K-5. The complex is located approximately 243.9 m. (800.0 ft) from a north/south running cattle wall. The complex lies on a medium slope surrounded by bedrock outcrop and various modifications. The entire area is surrounded by *koa haole*, *kiawe*, various shrubs and grasses, and pahoehoe outcrop. Features A through F are enclosed by a wall (Feature G).

**Feature A** is a tri-level platform. The three levels are all paved with small to large cobbles to boulders. The bottom level, Level 1, measures approximately 7.5 m. (24.6 ft.) E/W by 3.5 m. (11.5 ft.) N/S. The southeast side descends into Feature D, a tube entrance. This side is well-faced, measuring from 0.4 to 0.9 m. (1.3 to 3.0 ft.) high. There is an alignment of large boulder uprights which forms a pathway from the west side of level one heading east and running south into the opening of Feature D. The pathway is approximately 1.5 m. (4.9 ft.) wide between the alignment and the tier forming Level 2. On the northwest side of Level 1, a pile of rocks measuring approximately 4.0 m. (13.1 ft.) extends to another tube opening, Feature B.

Level 2 measures approximately 3.0 m. (9.8 ft.) E/W by 5.5 m. (18.0 ft.) N/S. This level is also faced, and measures 0.6 to 0.65 m. (2.0 to 2.1 ft.) above the first level. The west side descends upon bedrock outcrop. The north side has a few faced boulders which form the tier leading to level three.

Level 3 is to the north of Levels 1 and 2. It measures 8.5 m. (27.9 ft.) E/W by 6.5 m. (21.3 ft.) N/S. The third level is approximately 0.5 m. (1.6 ft.) above level 2. On its surface a well faced wall with uprights extends from east to the northwest where it intersects Feature G, the complex wall. Other internal features are present on the paved surface of level 3 including a few large slab boulders and a possible cupboard or tube opening on its western portion. On the northeast side of the faced wall, a pavement is present, measuring 5.5 m. (18.0 ft.) E/W by 6.0 m. (19.8 ft.) N/S where it hits bedrock outcrop and another tube opening which possibly connects to the Feature B lava tube.

Approximately 18.0 m. (59.1 ft.) northeast of Feature A is a tamarind tree which is surrounded by outcrop and bulldozing modification.

Pig jaws and bones were observed on level 1 in the pathway on the south side as well as on level 3 in front of a faced wall on its southeast corner.

Feature A is in good condition and offers excellent excavation potential. It is interpreted as a permanent habitation feature.

Features B and C are two tube entrances. These tubes are one in the same yet are blocked off by piled rocks on the inside of both. Feature C is a petroglyph tube with pig bones scattered throughout.

**Feature B** is a lava tube with an entrance which appears to have been blocked off by a constructed wall of medium to large boulders; the wall is presently collapsed. The lava tube opening faces *makai* (southwest). There is also a second opening in the ceiling near the rear

of tube. This tube is in a pahoehoe flow just southwest of bulldozer path. The first chamber measures approximately 6.0 m. (19.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W. The second chamber measures approximately 6.0 m. (19.8 ft.) N/S by 7.0 m. (23.0 ft.) E/W. In the west corner of chamber one, there are several large boulders that seem to be blocking off a tube that runs westward. There may also be another tube that runs westward that's blocked off by the wall blocking the entrance. The floor of chamber 1 is paved except where there's a large slab of lava on the northeast section of the chamber.

Chamber two is paved along the walls and has a small amount of soil its the center, probably deposited through overhead opening. There are two shelves with rocks piled on them on the south side of this chamber. The upper shelf looks to have been blocked off by its rock pile, revealing a small tube behind it. There is a large *koa haole* tree growing from the floor of the tube up through the overhead opening. The paving around the perimeter of chamber is 1.0 m. (3.3 ft.) wide from wall.

In the area where these two chambers connect, there's a wall that blocks off an opening which is designated Feature C lava tube.

In the first chamber two *papamu*, a cowrie shell fragment, a pumice stone fragment, a water rounded stone, and a scraper were observed. In second chamber there were two water rounded manuports, an opihi (*giganticus*) scraper, and a rib fragment (possibly human). A basalt polishing stone (Acc.# 1) was collected.

The modifications within the Feature B lava tube are in fair condition. The feature is considered a burial tube.

**Feature C** is a lava tube which measures 6.5 m. (21.3 ft.) N/S by approximately 2.5 m. (8.2 ft.) E/W. The opening to this tube is about 4.0 m. (13.1 ft.) east of the Feature B lava tube entrance. There is a hearth located just inside of the entrance. The floor is paved with small to medium cobble. The end is blocked off by a wall of stacked boulders. There is a large amount of pig bones on the floor approximately 2.0 to 3.0 m. (6.6 to 9.8 ft.) from the entrance.

The tube contains many petroglyphs on the walls. The southeastern wall has most of the petroglyphs, although there are a few on opposite wall near the floor. Some of the petrogylph appear to extend below the present floor level. The images have been "pecked" and "bruised" into the smooth cave walls. Many of the images are human, although dots and semi-circles are also present.

The modifications within Feature C are in good condition and the excavation potential is considered excellent. This tube is considered a permanent habitation feature.

**Feature D** is another tube which was initially walled up from facing between levels one and two of the Feature A platform. Behind the boulders is a large capstone which previously covered the opening. It measures 0.85 m. wide by 0.7 m. high. The tube entrance slopes open to the south where it hits the southwest wall at approximately 2.0 m. (6.6 ft.). The tube continues west, extending approximately 14.0 m. (45.9 ft.) back with a width ranging from 2.5 m. to 6.0 m. (8.2 to 19.8 ft.) wide. Piled cobbles line the floor of the tube as it slopes to the west for 6.0 m., where the paving continues along the south side reaching approximately 1.5 m. (4.9 ft.) into center of tube.

Along this wall human bones were observed including two sacra, two pelvii, vertebrae, clavicle, phalanges, metacarpals and metatarsals and ribs. At the back of the tube at least two more burials are present; the remains include a large mandible (most likely a large male) vertebrae, ribs, phalanges, metacarpals, metatarsals, and an inarticulated tooth. Molars present within the mandible exhibit heavy wear and dilapidation and the sockets were mostly enclosed suggesting an age of 50 years or more. Two shark vertebra were located beside the



human remains.

Overall, at least two individuals were placed along the wall and two to three individuals were placed at the back of the tube. All long bones were missing.

At the entrance to Feature D, another tube travels west for approximately 6.0 m. (19.8 ft.) where boulders are piled (possibly from the south side of Feature C) and then continues south for unknown distance (at least 20.0 m.). This tube is only 0.65 m. (2.1 ft.) high, 1.0 m. to 1.5 m. (3.3 to 4.9 ft.) wide with a floor of rough lava . A small chamber heads west from this small tube and runs approximately 8.0 m. (26.2 ft.).

Throughout the tube charcoal and kukui were observed.

**Feature E** is a large semi-rectangular enclosure which is attached and partly constructed with Feature G wall (surrounding Features A through F). Feature E measures 12.0 m. (39.4 ft.) E/W by 10.5 m. (34.4 ft.) N/S with maximum height of 0.9 m. (3.0 ft.). The walls are approximately 2.0 m. (6.6 ft.) wide and are constructed of collapsed medium to large cobbles and boulders with no evident facing. The interior of the enclosure is composed of outcrop, collapsed boulders and sparse soil.

No midden or artifacts were observed.

Feature E is in fair condition and offers fair to good excavation potential. It is interpreted as an agricultural feature.

**Feature F** is a semi-rectangular terrace situated on a steep slope descending *makai* (west). The platform measures 8.5 m. (27.9 ft.) N/S by 5.5 m. (18.0 ft.) E/W with maximum height of 1.0 m. (3.3 ft.). The northeast side abuts outcrop. The platform surface is paved with small to large cobbles and boulders. It is constructed of small to large boulders faced on all but the northeast side.

No midden or artifacts were observed.

Feature F is in fair to good condition and is considered a possible burial feature.

**Feature G** is the complex wall. It encloses Features A to F. The walls are mostly collapsed, constructed of small-large cobbles to boulders measuring an average of 0.8 m. high and 1.5 to 2.0 m. (4.9 to 6.6 ft.) wide. The enclosure measures approximately 34.0 m. (111.5 ft.) N/S by 32.0 m. (105.0 ft.) E/W. The enclosure connects to outcrop between Feature A and Features B and C lava tubes where the wall is no longer evident.

No artifacts or midden were observed.

Feature G is in fair to poor condition with fair excavation potential.

**Feature H** is located approximately 22.0 m. (72.2 ft.) west of the west corner of Feature G. Feature H is a roughly square terrace surrounded by piled boulders and bedrock outcrop on a moderate slope descending *makai* (west). It measures 7.0 m. (23.0 ft.) N/S by 7.0 m. (23.0 ft.) E/W with maximum height of 1.7 m. (5.6 ft.) at the southeast corner. The terrace is well faced on the east, west and north sides, and is constructed of small to large boulders. It is paved with small to large cobbles and boulders and utilizes the existing outcrop on its south side along with tumbled cobbles. On its north and east corner boulder piled "legs" extend out forming a possible enclosure with existing outcrop on the north and northwest side.

No artifacts or midden were observed.

Feature H is in good condition and is interpreted as a possible burial terrace.

**Feature I** is an *ahu* situated atop a mound located approximately 5.0 m. (16.4 ft.) west of Feature H. The mound measures approximately 1.5 m. (4.9 ft.) N/S by 2.5 m. (8.2 ft.)

E/W. It is constructed of piled boulders and cobbles. Atop the mound is a pile of small to medium boulders forming an *ahu*. The *ahu* measures approximately 0.6 m. (2.0 ft.) high, 1.0 m. (3.3 ft.) E/W by 0.7 m. (2.3 ft.) N/S.

No artifacts or midden were observed.

Feature I is in fair to good condition and offers fair to poor excavation potential.

**Feature J** is a platform located on the western slope of a small bluff 41.0 m. (134.5 ft.) west of the west corner of Feature H. The platform measures 10.0 m. N/S by 8.0 m. (26.2 ft.) E/W with average height of 1.5 m. (4.9 ft.). From the upper portion it slopes westward 3.0 m. (9.8 ft.) due to the collapse. It is constructed of small to medium boulders with small to large cobbles. There is remnant facing in a few places.

No midden or artifacts observed.

Feature J is in poor condition. The excavation potential is considered fair. It is considered a permanent habitation feature.

**Feature K** is located approximately 41.0 m. (134.5 ft.) east of Feature A. It consists of two small connected lava tubes in an area of an exposed outcrop (pahoehoe) on a moderate slope. The tubes contain modified openings and small probable burial mounds or platforms within.

The *makai* (west) tube measures 17.0 m. (55.8 ft.) E/W by 4.0 m. (13.1 ft.) N/S with a maximum height of 0.6 m. (2.0 ft.). The *makai* (west) tube contains a modified opening and several rock piles that may be burials. One confirmed burial is located in the central floor area of the tube in loose organic soil. The burial includes six to seven vertebra (axis, 2 cervical, several thoracic) several tarsals, metatarsals and phalanges. The distal epiphyses of a radius, several ribs and other fragments. Midden and charcoal also observed.

The *mauka* (east) tube, located 4.0 m. (13.1 ft.) east of the *makai* (west) tube measures 8.0 m. (26.2 ft.) E/W by 4.0 m. (13.1 ft.) N/S with maximum height of 0.5 m. (1.6 ft.). The *mauka* (east) tube contains one possible burial platform; however, no bones were observed.

Midden, charcoal and a highly polished slab of basalt was observed in the *mauka* (east) tube. The polished slab is a possible mirror and measures 8 cm. by 6 cm. by 5 cm. thick.

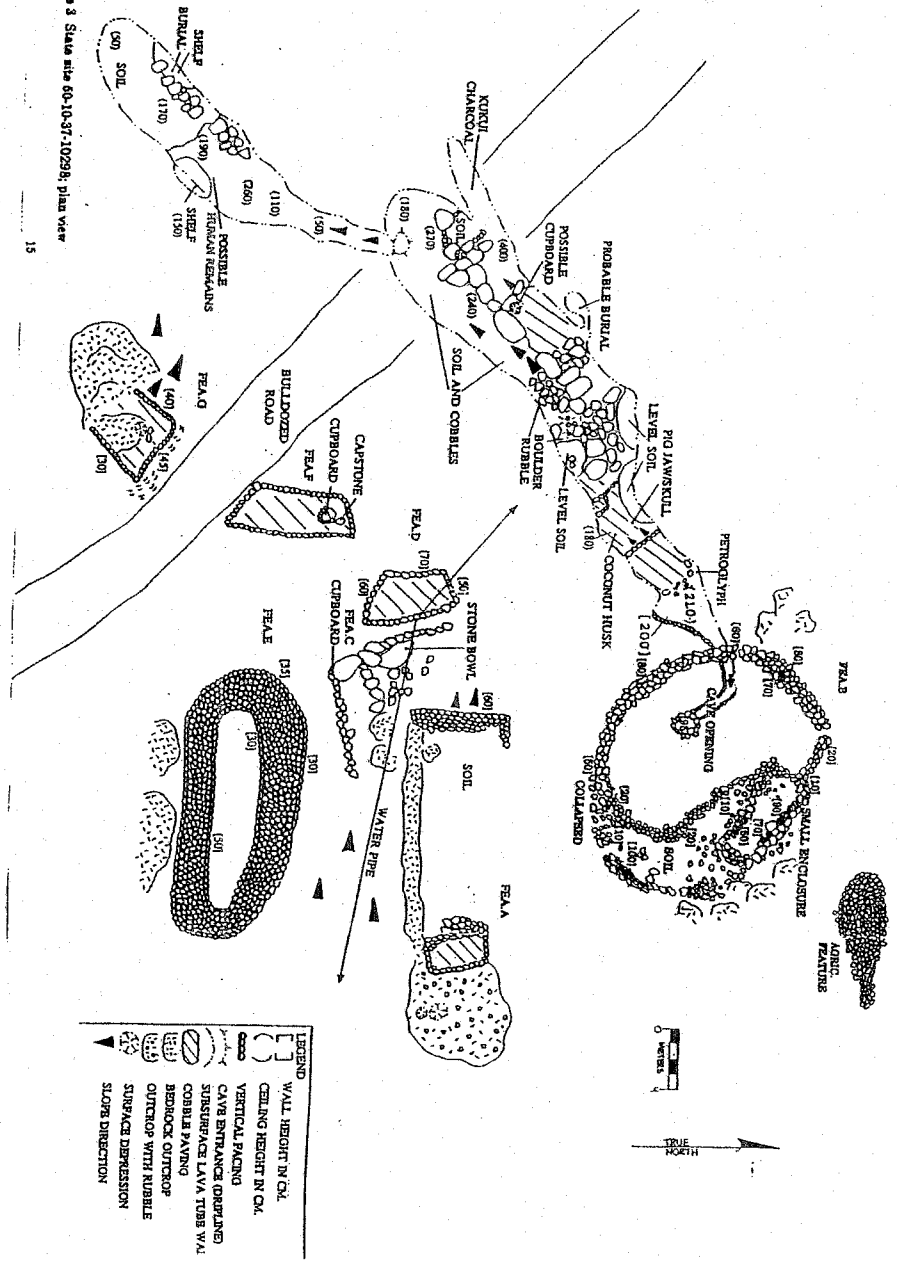
**State Site #:** 50-10-37-10298 **CSH Site #:** 272
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 7
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano 2
**Elevation:** 245 ft. a.m.s.l.

**Description:** State site -10298 (Figure 3) is a site complex comprising seven features designated A to G. The site was previously recorded by Paul H. Rosendahl Inc. as site W-16. The site is situated at the base of a pahoehoe flow in an area covered with California grass, and numerous *koa haole* and *kiawe* trees.

**Feature A** is a platform built of small boulders and a surface of cobble fill. There is a cupboard located at the north end which is 0.9 m. (3.0 ft.) wide. The cover of the cupboard is



Figure 3 State site 50-10-37-10298; plan view



lying at the front side of the hole.

No artifacts or midden were observed at Feature A.

Feature A is interpreted as a permanent habitation unit.

**Feature B** is a lava tube which has been previously recorded by Paul H. Rosendahl, Inc. The entrance is situated in the center of a mounded platform. It is a refuge-type entrance, walled on all sides. Historic trash was observed near the entrance, on the platform.

Inside the entrance is a terrace which is paved wall to wall with small cobbles intermixed with soil. It measures 4.4 m. (14.4 ft.) NE/SW by 3.0 m. (9.8 ft.) NW/SE. The southwest edge of the terrace has a height of 2.0 m. (6.6 ft.). This level has a small petroglyph located 0.34 m. (1.1 ft.) above the floor on the north wall. Some scattered shell midden and small bits of charcoal were observed.

10 m. (32.8 ft.) from the entrance is an enclosure measuring 1.5 m. (4.9 ft.) E/W by 2.0 m. (6.6 ft.) N/S with a maximum height of 1.0 m. (3.3 ft.). It is constructed with stacked boulders, incorporating the south tube wall as part of the enclosure. The floor of the enclosure is stacked with small to large boulders and on the northern side are two small openings which could possibly be cupboards.

The main chamber continues in a southwesterly direction, measuring approximately 6.5 m. (21.3 ft.) wide and 2.5 m. to 3.5 m. (8.2 ft. to 11.5 ft.) high. The floor is mostly rubble on a soil deposit measuring 0.3 m. (1.0 ft.) deep. At 14 m. (45.9 ft.) off the main chamber there is a small tube that extends southwest for 1.75 m. (5.7 ft.). This then opens into a small room which measures 2.2 m. (7.2 ft.) E/W by 2.8 m. (9.2 ft.) N/S. Along the eastern side of the room there is a small cobble pavement 0.75 m. (2.4 ft.). A charred kukui was observed on the pavement. Along the west and south sides and in the southeastern corner there is a piling of small cobbles with soil between the areas of bedrock. Remnants of at least 3 crab claws are observed. This midden, along with the apparently man-made modification leads the archaeologists to believe there is at least one burial here.

Immediately outside the opening to the side tube is a small charcoal deposit, above which is a stick about 0.3 m. long and the end of the stick nearest the charcoal is curved, as a match curves when its burning. It would appear that this stick was used as a torch.

Approximately 29.0 m. (95.1 ft.) from the entrance, in a central location on the floor of the tube is what appears to be a man-made cupboard measuring 1.5 m. (4.9 ft.) by 0.9 m. (3.0 ft.) with a height of 0.8 m. (2.6 ft.). Small amounts of charcoal were observed in the cupboard. There is another small cupboard near the first, measuring approximately 1.0 m. (3.3 ft.) in diameter and 0.4 m. (1.3 ft.) high. The opening to this cupboard is 0.4 m. (1.3 ft.) by 0.2 m. (0.7 ft.). 1.0 m. (3.3 ft.) beyond the cupboards between several large boulders is what appears to be a possible hearth measuring 0.7 m. in diameter by 1.0 m. (3.3 ft.) deep. Coral and kukui were observed in this pit. There is a small side tube near the back of the main chamber measuring approximately 3.0 m. (9.8 ft.) E/W which tapers off.

An opening measuring 0.5 m. (1.6 ft.) wide by 0.3 m. (1.0 ft.) high connects the main chamber with the back portion of the tube. At this opening there is a steep slope measuring 3.0 m. (9.8 ft.) to the floor of the back chamber. Kukui and charcoal are present in this area.

At approximately 10 m. from the rear of the tube a human clavicle was observed along with a highly polished piece of coral. Pieces of crab claw were also observed in this area. Approximately 7.0 m. (23.0 ft.) from the back of the tube is a nice soil layer at least 0.3 m. (1.0 ft.) deep which appears to have been washed down due to the light organic matter which is resting on top of the soil along with the depressions which appear to have been caused by running water. Present among the organic matter kukui nut shells were observed both in fragments and whole along with minute pieces of charcoal.

At the back of the tube is a burial chamber in which human remains were observed on



the eastern shelf closest to the back of the room. The remains include a mandible, numerous scattered teeth, including molars and canines; 9 vertebrae were also present. Small amounts of charcoal were observed on the shelf. all the long bones, the mandible, and 1 or 2 ribs.

Feature B is interpreted as a refuge tube for habitation. It also functions as a burial tube.

**Feature C** consists of a modified outcrop with a cupboard located in the southwest corner of the outcrop. The cupboard measures 0.6 m. (2.0 ft.) high, 0.7 m. (2.3 ft.) wide, and 1.0 m. (3.3 ft.) deep. It is constructed of small pahoehoe boulders with a large slab roof.

No artifacts or midden were observed. The modified outcrop is in fair to poor condition and offers fair excavation potential. It was probably in used for habitation purposes.

**Feature D** is a small habitation platform located 5.0 m. (16.4 ft.) northwest of Feature C. It measures 6.0 m. (2.0 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). It is constructed and roughly paved with cobbles and has a sloping surface. The platform is in fair condition and offers fair to poor excavation potential. It is interpreted as a permanent habitation feature.

**Feature E** is a large rectangular enclosure located 5.0 m. (16.4 ft.) southeast of Feature C. It measures 17.0 m. (55.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.) The walls are constructed of stacked boulders and cobbles which have collapsed in many places.

No artifacts or midden were observed. Feature E is in poor condition and offers fair excavation potential. It is interpreted as a permanent habitation feature.

**Feature F** is a terrace which contains a cupboard in its north end. The terrace is located at the foot of a pahoehoe flow. It measures 6.0 m. (19.8 ft.) N/S by 3.5 m. (11.5 ft.) E/W with a maximum height of 0.4 m. (1.3 ft.). It is constructed of small to large cobbles and boulders with large cobble fill. The cupboard measures 0.4 m. (1.3 ft.) high, 0.8 m. (2.6 ft.) deep, and 0.9 m. (3.0 ft.) in diameter. The capstone is lying adjacent to the cupboard.

No artifacts or midden were observed. The terrace is in fair to poor condition and offers fair excavation potential. It is interpreted as a permanent habitation feature.

**Feature G** is a small faced pahoehoe outcrop measuring 4.5 m. (14.8 ft.) in diameter and 0.4 m. (1.3 ft.) high. It is roughly paved with cobbles and has a small lava blister in its center.

Feature G is partially disturbed by bulldozing. No artifacts or midden were observed. Feature G is in fair condition and offers good excavation potential. It is associated with permanent habitation activities of the site complex.

**State site #:** 50-10-37-10299 **PHRI Site #:** W-15
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** Undetermined
**Site Dimension:** Undetermined
***Ahupua'a:*** Hokukano
**Elevation:** 200 ft. a.m.s.l.

**Description:** State site -10299 is a agricultural complex consisting of at least three terraces. This site was previously recorded by Paul H. Rosendahl Inc. as site W-15. The terrace faces stand up to 1.5 m. (4.9 ft.) high. The terraces are constructed of piled basalt boulders utilized to retain a flat soil surface upslope of the terrace edges.

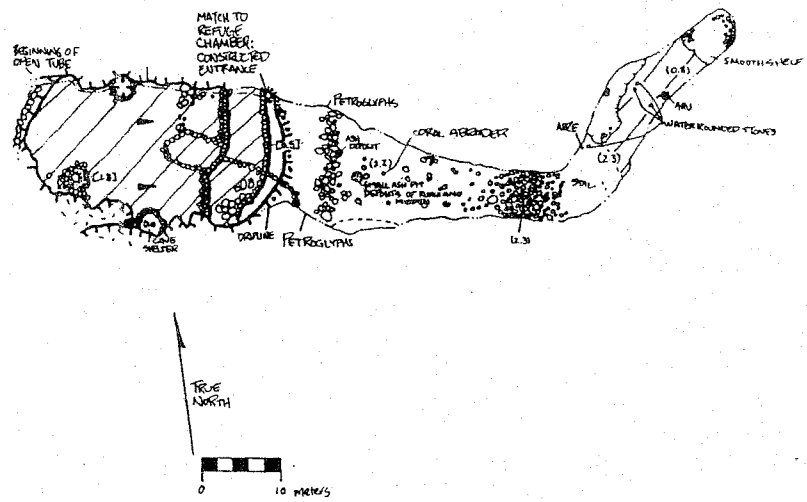
**State Site #:** 50-10-37-10300 **CSH Site #:** none
**Site Type:** Lava tube
**Function:** Multi-function
**Features (#):** 1
**Site Dimension:** 3,300.0 m.$^2$ (35,640.0 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 580 to 620 ft. a.m.s.l.

**Description:** State site -10300 (Figures 4 & 5) is a lava tube consisting of a main tube and several side chambers. The entrance to the tube is situated at the northern edge of the *ahupua'a* of Haleki'i, 50.0 m. (164.0 ft.) *makai* (west) of the access road and historic railroad berm designated State site -10302.

The entrance consists of a large collapsed sink which has been modified extensively with the construction of a massive refuge entrance and surface platforms in excellent condition. The sink measures approximately 16.0 m. (52.5 ft.) E/W by 13.0 m. (42.7 ft.) N/S. It has a maximum depth of 2.8 m. (9.2 ft.). There is a probable entrance located along the northwest edge of the sink. The constructed sink is flush with the surrounding terrain and slopes down to the east, paved roughly with boulders, to the *mauka* (east) tube. It contains a depression and a small shelter. The depression is located next to the probable sink entrance against the sink wall. It is lined with small boulders and measures 3.0 m. (9.8 ft.) in diameter by 1.5 m. (4.9 ft.) wide with a maximum depth of 0.6 m. (2.0 ft.). The shelter is located across from the depression along the south wall of the sink. It measures 4.0 m. (13.1 ft.) wide with a maximum height of 0.8 m. (2.6 ft.).

On the east side of the sink the platform drops down to a lower terrace level that stands a maximum of 1.1 m. (3.6 ft.) above the floor of the *mauka* (east) chamber. It stretches north/south across the sink and measures 3.0 m. (9.8 ft.) wide. The sides of the main sink platform and terrace are well faced with boulders. The refuge entrance which leads to the *makai* (west) chamber is located at the north edge of the *mauka* (east) chamber wall below the terrace.

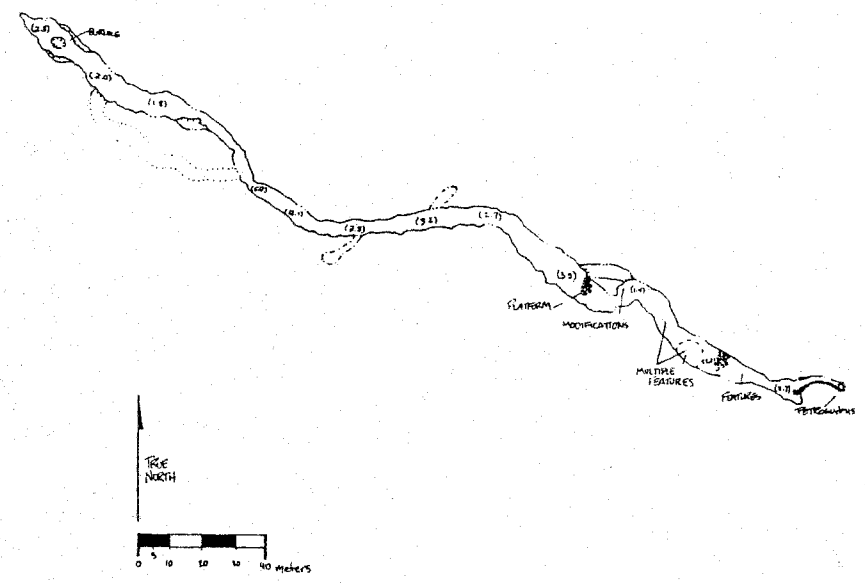





Legend

| | |
|---|---|
| Exposed Bedrock | |
| Drip Line/Tube Entrance | |
| Sink Edge | |
| Boulder Facing | |
| Lava Tube Walls | |
| Surface Feature Height (meters) | (.9) |
| Subsurface/Overhang Height (meters) | (2.8) |
| Surface Depression | |
| Direction of Slope | |

Figure 4 State site 50-10-37-10300 lava tube; plan view of surface and *mauka* chamber




Legend

| | |
|---|---|
| Drip Line/Tube Entrance | |
| Lava Tube Walls | |
| Subsurface/Overhang Height (meters) | (2.8) |
| Surface Depression | |
| Direction of Slope | |

Figure 5 State site 50-10-37-10300 lava tube, *makai* portion; plan view



An extensive panel of petroglyphs are located in the light zone of the *mauka* (east) chamber. These include two panels that contain 30 to 40 petroglyphs per panel. The lower panel is partially covered with a soil deposit which may provide - through excavation - a rare opportunity for dating the petroglyphs. The petroglyph images include human figures with various body and head sizes, a dog figure, a possible turtle figure, and a centipede figure. According to Mrs. Jean Greenwell (personal communication), an unspecified number of large slabs with petroglyphs were removed from the lava tube; one of the slabs is now located at the Kona Historical Society.

Of particular interest is that the *ahupua'a* name of Haleki'i (its northern boundary crosses the tube's entrance) translates as "house of images" and may have been named after this particular lava tube site and its petroglyphs.

The *mauka* (east) chamber of the lava tube measures approximately 75.0 m. (246.1 ft.) E/W and has an average width of 6.0 m. (19.8 ft.) N/S. The height ranges from 3.1 m. (10.2 ft.) near the sink to 0.85 m. (2.8 ft.) at the rear of the chamber. The floor of the tube consists of a soil deposit with scattered ceiling collapse and areas of smooth pahoehoe. There is a rough mounded alignment that extends the width of the tube, located just under the dripline. Two ash deposits were observed beyond the alignment.

Midden including marine shells, bone, and kukui were observed around the ash deposit and scattered around the soil deposit. Artifacts including a coral abrader and a water-rounded stone were also observed, and a basalt adz was collected (Acc.# 3) from the soil area.

About 27.0 m. (88.6 ft.) into the *mauka* (east) chamber is a section of roughly paved cobbles and boulders. This pavement continues for 13.0 m. (47.2 ft.) until another soil deposit begins. Beyond this soil deposit the tube is once again paved with cobbles for a distance of 20.0 m. (65.6 ft.). At the back of the *mauka* (east) tube is a low ledge which has been cleared. It measures 0.1 m. (0.3 ft.) above the pavement surface. At the back of the ledge the *mauka* (east) chamber pinches out.

A possible *ahu* is located on the latter pavement. Several water-rounded stones were observed in the *mauka* (east) chamber and the nape of a basalt poi pounder and a basalt core were found next to the ledge. The poi pounder fragment was collected (Acc.# 2).

The *mauka* (east) chamber is considered a permanent habitation area of the lava tube.

The entrance to the *makai* (west) chamber is a narrow constructed passageway that goes west around the edge of the sink from the northeast sink corner. The passage utilizes the smooth floor and north tube wall up to the ceiling in its construction, and is constructed of a formal boulder facing serving as the south passage wall. There are more petroglyphs located on the wall of the passageway. The constructed portion of the passage is actually the walls of the surface platform present within the sink. The passage measures approximately 17.0 m. (55.8 ft.) E/W long by 1.5 m. (4.9 ft.) wide and has a maximum height of 1.0 m. (3.3 ft.). The well constructed vertical facing of the wall curves to follow the configuration of the sink and dripline of the *makai* (west) chamber (it is of monumental construction and is in excellent condition). At the end of the passage the *makai* (west) chamber begins. The facing extends to the ceiling with a height of 2.7 m. (8.9 ft.). There is a small opening at the south edge of the facing which leads to a small hole located at the southwest corner of the surface platform. It has a diameter of 0.9 m. (3.0 ft.).

The *makai* (west) chamber measures approximately 255.0 m. (836.4 ft.) E/W, has an average width of 8.0 m. (26.2 ft.) and has a height ranging from 1.5 m. (4.9 ft.) near the rear to 3.8 m. (12.5 ft.) along the central portion of the chamber. Several small side chambers are located along the tube. The floor consists of a level soil deposit with scattered ceiling collapse and areas of smooth pahoehoe floor and ledges. This tube is heavily modified with platforms,

terraces, walls, and alignments, situated along the length of the chamber, and it contains human remains in the rear of the chamber.

The rear chamber contains several *ahu* measuring 1.0 m. (3.3 ft.) in diameter with a maximum height of 0.6 m. (2.0 ft.). A probable hearth is located in the center of the chamber. It measures 1.0 m. (3.3 ft.) in diameter and has a maximum depth of 0.3 m. (1.0 ft.). The burial remains are situated on a shelf located along the north chamber wall. It measures 1.3 m. (4.3 ft.) above the tube floor. The remains are in poor condition but appear to be several individuals.

A large amount of midden was observed within this chamber. Midden observed included marine shell, bone (fish and pig), kukui, and charcoal. Several coral and basalt tools were observed.

The *makai* (west) chamber is interpreted as a refuge tube which was later used for burial purposes.

Testing Results:

Limited subsurface testing was conducted at State site -10300 specifically for the purpose of defining the stratigraphy and collecting a charcoal sample to better date the habitation component within the lava tube. The test unit consisted of a 0.5 m. by 0.5 m. (1.6 by 1.6 ft.) trench placed by the north wall of the *mauka* (east) chamber, just beneath the petroglyphs. Two charcoal samples were also collected from within the *mauka* (east) and *makai* (west) chambers for the purpose of C-14 dating. Excavation within the test unit proceeded in 10 cm. levels according to the stratigraphy. The trench revealed two stratigraphic levels, Stratums I and II. Stratum I - 0 to 20 cm. - consisted of dark grey silt (10YR 4/1) with 5 to 10 % angular basalt cobbles present. Stratum II - 20 cm. to 105 cm. - consisted of dark grey silt (10YR 4/1) with 40 to 50 % of the material being cobbles and boulders. At 30 cm. a 3 cm. thick lens of wood ash (white 10YR 8/2) was present. Excavation continued to a depth of 105 cm. Further probing estimated a maximum depth of 130 cm. to the tube floor.

Cultural material, including midden and artifacts, were collected from Stratum I and II. Midden collected from Stratum I included a total of 46.6 grams of marine midden and 105.4 grams of terrestrial midden. A total of 91.1 grams of charcoal (Acc.#'s C-3 and C-4) was collected.

Midden collected from Stratum II included a total of 124.3 grams of marine midden and 295.9 grams of terrestrial midden. A total of 311.7 grams of charcoal (Acc.#'s C-5 through C-11) was collected. A total of 0.2 grams of coral was collected from Stratum II.

Indigenous artifacts were collected from Stratum I and II. Stratum I artifacts included four volcanic glass flakes (Acc.# 4) and two basalt flakes (Acc.# 5).

Artifacts collected from Stratum II included 8 volcanic glass flakes (Acc.#'s 6, 9-11, 15) two urchin files (Acc.#'s 7, 13), one shell fishhook blank (Acc.# 8), four basalt flakes (Acc.#'s 12, 16), and a dog tooth pendant (Acc.# 14).

The two charcoal samples were collected from the tube. The first sample (Acc.# C-11) was collected from the *mauka* (east) chamber. It consisted of 222.5 grams of charcoal, and was submitted for carbon dating analysis. The results provided a date range of 1645-1950 A.D.

The second sample (Acc.# C-2) was collected from the *makai* (west) tube and results provided a pre-historic date range of 1250-1430 A.D.



**State Site #:** 50-10-37-10301 **CSH Site #:** 217
**Site Type:** Lava blister
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 24.0 m.$^2$ (259.2 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 700 ft. a.m.s.l.

**Description:** State site -10301 consists of a small lava blister located along the railroad berm north of a *mauka/makai* (east/west) boundary marker and cattle wall. It has been previously recorded by Paul H. Rosendahl Inc. as site K-2a. The site is surrounded by a pahoehoe flow. Grass and soil are sparse and *koa haole* trees are quite numerous. Surrounding the blister are at least seven kukui-nut trees.. There are also a few papaya trees nearby. The blister is situated on the *makai* (west) end of pahoehoe outcrop.

The tube runs *mauka* (east) for approximately 8.0 m. (26.2 ft.) and the average width of the blister tube is 1.5 to 3.0 m. (4.9 to 6.6 ft.). The average height measures 0.1 m. (0.3 ft.). The floor is mostly soil covered with kukui nut shells literally covering the soil surface.

There are possible mongoose bones near the rear of the tube, in addition to modern and historic debris including two glass jugs, pilsner bottles, pottery, paper, and glass fragments. There is a small opening in the back which measures approximately 1.5 m. (4.9 ft.) N/S by 0.6 m. (2.0 ft.) E/W. The site marker was placed near the main blister entrance.

The area surrounding State site -10301 has been modified. It is very similar to the area *makai* (west) of it. Areas in between the pahoehoe outcrop have been paved or piled. Any sites on the surface are non-existent or remnant. There are numerous lava blisters with some modification around their entrances. A possible *papamu* was observed on the ground surface.

State site -10301 is in poor to remnant condition and offers good excavation potential.

**State Site #:** 50-10-37-10302
**Site Type:** Railroad berm
**Function:** Rail
**Features (#):** 1
**Site Dimension:** Undetermined
***Ahupua'a:*** crosses all *ahupua'a* in project area
**Elevation:** 725 ft. a.m.s.l. (average)

**Description:** State site -10302 is a historic railroad bed which delineates the majority of the *mauka* or east boundary of the project area. The site correlates with Paul H. Rosendahl Inc. site K-2. It is constructed of large fitted boulders with a rock fill. The top surface consists of a layer of small cobbles and/or soil fill. The railbed measures approximately 3.2 m. (10.5 ft.) in width and a maximum of approximately 4.5 m. (14.8 ft.) in height. A number of railroad spikes were observed along with rail ties with spikes still in place (used presently as fence posts). The causeway sections of the berm are in excellent condition and are massively constructed.

**State site #:** 50-10-37-10303 **PHRI Site #:** W-12
**Site Type:** Wall
**Function:** Undetermined
**Features (#):** 1
**Site Dimension:** Undetermined
***Ahupua'a:*** *Kanaueue*
**Elevation:** 650 ft. a.m.s.l.

**Description:** State site 50-10-37-10303 is a north-south running wall with an undetermined total length. The site correlates with Paul H. Rosendahl Inc. site W-12. The wall has an average height of 0.9 m. (3.0 ft.) and an average width of 0.8 m. (2.6 ft.). It is constructed of piled, but collapsing, basalt boulders and cobbles on pahoehoe bedrock. The wall is possibly associated with state site 50-10-37-16601 and probably was connected with state site 50-10-37-10304.

**State site #:** 50-10-37-10304 **PHRI Site #:** W-11
**Site Type:** Wall
**Function:** Undetermined
**Features (#):** 1
**Site Dimension:** Undetermined
***Ahupua'a:*** Kanaueue
**Elevation:** 725 ft. a.m.s.l.

**Description:** State site 50-10-37-10304 is a north-south running wall with an undetermined total length. The site correlates with Paul H. Rosendahl Inc. site W-11. The wall has an average height of 1.1 m. (3.6 ft.) and a average width 0.8 m. (2.6 ft.). It is constructed of well-stacked basalt boulders and cobbles on pahoehoe bedrock. It is probable that the wall connected with state site 50-10-37-10303. Both state sites 50-10-37-10303 and -10304 may be part of a *kuleana* boundary wall.

**State site #:** 50-10-37-10305 **CSH Site #:** 320,321,322
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a:*** Ke'eke'e
**Elevation:** 850 ft. a.m.s.l.

**Description:** State site -10305 is a site complex consisting of four features designated Features A through D. This site was previously recorded by Paul H. Rosendahl Inc. as site K-1. The site is located on a pahoehoe flow just inside the south boundary wall of the project area. The site is surrounded by pasture grass, some lantana, and is shaded by monkeypod trees in certain areas.

**Feature A** is a platform which measures approximately 3.0 m. (9.8 ft.) square, oriented north/south. The height ranges from 0.7 to 0.8 m. (2.3 to 2.6 ft.) high on the *makai*



(west) face, and 0.3 m. to 0.4 m. (1.0 to 1.3 ft.) high in the northeast corner, where the facing is tumbled. It is constructed of small to medium boulders with small to medium cobble fill. No internal features were present.

No artifacts or midden were found.

Feature A is in fair to good condition and its excavation potential is considered fair. It is interpreted as an agricultural feature.

**Feature B** is located approximately 20.0 m. (65.6 ft.) to the north of a gravel-paved access road. The feature is a faced terrace constructed of large to small pahoehoe boulders faced against a pahoehoe bluff. The terrace measures 2.7 m. (8.9 m.) E/W by 5.0 m. (16.4 ft.) N/S. and the maximum height of the faced section of terracing is 1.2 m. (3.9 ft.). From the faced edge, the terrace is paved for 2.7 m. (8.9 ft.) with cobbles and pebbles, and becomes flush with the bluff. The site most likely delineates a planting area which has been cleared and trends slightly downslope. The site is disturbed due to cattle and the terrace is discontinuous as a result of this disturbance.

No artifacts or midden were observed.

Feature B is in fair to poor condition and offers poor excavation potential. It is considered an agricultural feature.

**Feature C** is a platform measuring approximately 3.5 m. (11.5 ft.) N/S by 3.5 m. (11.5 ft.) E/W and is constructed of small to medium boulders as well as a few large boulders on the south end of the site. The platform surface contains a medium to large cobble pavement. The platform is well faced with some areas of collapse. The average height of the platform is 1.0 m. (3.3 ft.).

No artifacts or midden were observed.

The platform is in fair to good condition. The excavation potential is considered fair. The platform is interpreted as a permanent habitation feature.

**Feature D** is located 15.0 m. north of Feature C. It is a small, high faced platform located in and around historic cattle walls. Feature D is surrounded by African violet trees, tulip trees, lawai fern, and situated on a gentle to moderate slope. The platform measures 3.5 m. (11.5 ft.) N/S by 3.5 m. (11.5 ft.) E/W and has an enclosure measuring 5.0 m. (16.4 ft.) N/S by 5.0 m. (16.4 ft.) E/W attached to the south side of the platform. The enclosure is faced on the north wall. Both are constructed with cobbles to small boulders with boulder facing.

No midden or artifacts were observed.

Feature D is in fair condition. The excavation potential is considered good to fair and it is considered a permanent habitation feature.

**State Site #:** 50-10-37-15248 **CSH Site #:** 1
**Site Type:** Platform
**Function:** Burial (Poss.)
**Features (#):** 1
**Site Dimension:** 35.0 $m.^2$ (374.5 $ft.^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 550 ft. a.m.s.l.

**Description:** State site -15248 is a mounded platform situated directly to the north of the southern access road. The surrounding vegitation consists of *kiawe, koa haole,* and grass. The

platform is constructed of medium to small boulders and cobbles with no apparent facing left intact. The platform measures 7.0 m. (23.1 ft.) E/W by 5.0 m. (16.5 ft.) N/S with a maximum height of 0.8 m. (2.6 ft.) in the center of the platform. The southern portion of the site has been disturbed by the construction of the road.
No midden or artifacts were observed. The site is in fair condition.

**State Site #:** 50-10-37-15257 **CSH Site #:**
**Site Type:** Burial deposit
**Function:** Burial
**Features (#):** 1
**Site Dimension:** Indeterminate
***Ahupua'a:*** Hokukano
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -15257 consist of graveyard that was uncovered during Hurricane Iniki on September 12, 1992. The site is located along the coast near Keikiwaha Point in a shallow sand deposit. The deposit is situated on an undulating pahoehoe flow. Approximately 14 individuals were exposed by the high surf of the storm. Mark Smith of DLNR visited the site on December 2, 1992 when the remains were collected. The remains were reinterd at the same location under a stone platform that was constructed in order to stabilize the site area. On January 8, 1992 Kanalei Shun and Mark Smith of DLNR visited the site while on a project tour. Due to the presence of human remains within this sand deposit it is probable that the other coastal sand deposists also contain burials. This should be addressed in the data recovery plan for the project. Due to the late discovery of this site it is not discussed in the summary section of this report.

**State Site #:** 50-10-37-16354 **CSH Site #:** 1
**Site Type:** Platform
**Function:** Burial
**Features (#):** 1
**Site Dimension:** 84.0 m.$^2$ (907.2 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 690 ft. a.m.s.l.

**Description:** State site -16354 (Figure 6) is a roughly rectangular platform situated on open, gently sloping pasture land. It measures 14.0 m. (45.9 ft.) NE/SW by a maximum of 6.0 m.



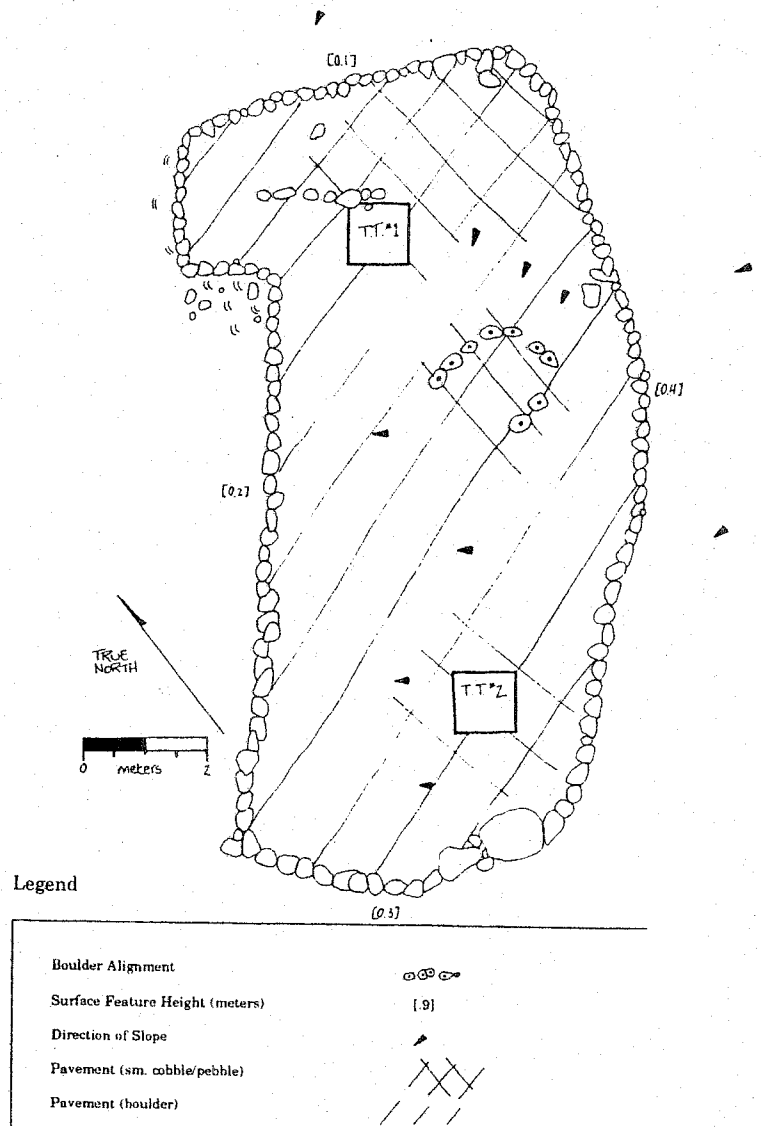



Figure 6 State site 50-10-37-16354; plan view

(19.8 ft.) NW/SE with a maximum height of 0.5 m. (1.6 ft.) at its southwest corner. The platform is constructed of piled boulders and small cobbles, the only intact facing remains at the southwest corner. There are two levels on the platform, the upper (eastern) level is paved with pebbles. The lower level, 0.25 m. (0.8 ft.) below the upper level, is roughly paved with cobbles and boulders.

No midden or artifacts were observed at this site.

State site -16354 is in poor condition. The site marker is located in the southeast corner of the platform.

Testing Results:

Limited subsurface testing was conducted at State site -16354 to determine the presence or absence of human remains. The test units consisted of two 1.0 m. (3.3 ft.) square trenches placed on the surface of the platform: Trench 1 in the northeastern quad, Trench 2 in the southwestern quad. The excavations of both trenches began with the removal of the platform construction to the underlying ground surface. The platform fill within trench 1 extended to a depth of 1.0 m. (3.3 ft.) below the platform surface. The removal of the platform fill revealed one stratigraphic level, Stratum I. Stratum I - 1.0 m. and below - consisted of a loosely compacted, brown (10YR 4/3) silt with interspersed large boulders and cobbles. Several possible capstones were encountered and removed, uncovering pit fill which contained human skeletal remains. Excavation continued to a depth of 1.7 m. (5.6 ft.).

No cultural material was observed within the platform fill and Stratum I of Trench 1.

The platform fill within Trench 2 continued to a maximum depth of approximately 20 cm. below the platform surface. Stratum I - 20 to 50 cm. - consisted of small to medium boulders with a small amount of interspersed soil. The soil matrix was a loosely compacted dark brown (10YR 3/3) silt. Stratum II - 50 cm. and below - consisted of loosely compacted, very dark greyish brown soil (10YR 3/2) with cobbles interspersed. Evidence of human remains were encountered in the south end of the trench at 1.05 m. (3.4 ft.) below the platform surface, within very loosely packed soil. Excavation continued to a maximum depth of 1.15 m. (3.8 ft.).

Cultural material, including charcoal and artifacts, were collected from Stratum II. No cultural material was observed within Stratum I. Stratum II contained a total of 1.0 gram of charcoal (Acc.# C-12). This sample was dated through the C-14 dating process. The results gave date ranges of 1675-1710 and 1805-1930.

Indigenous artifacts were collected from Stratum II. The artifacts include two volcanic glass flakes (Acc.# 17).

**State Site #:** 50-10-37-16355 **CSH Site #:** 2
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 780.0 m.$^2$ (8,424.0 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 640 ft. a.m.s.l.

**Description:** State site-16355 is a lava tube which runs in a *mauka-makai* (east-west) direction. There are two entrances to the tube. The mauka (eastern) tube is designated feature A and the makai (western) tube is designated feature B. On the surface, between the two tube entrances, is a paved area. This area between the entrances is a collapsed section of



the lava tube and measures approximately 12.0 m. (39.4 ft.) long E/W by 5.5 m. (18.0 ft.) wide.

There is an associated agricultural mound located immediately north of the *makai* (west) tube entrance. The site is located in grassy pasture with a surface scatter of pahoehoe cobbles and boulders.

**Feature A** is the *mauka* (east) tube. The tube entrance is located 1.5 m. (4.9 ft.) from the east edge of the pavement. The opening is small, measuring approximately 1.0 m. (3.3 ft.) in diameter. Inside, the tube runs for 34.0 m. (111.5 ft.) at 57° TN. A maximum height of 1.4 m. (4.6 ft.) and a maximum width of 3.0 m. (9.8 ft.) are measured. The interior consists of pahoehoe outcrop with scattered cobbles and intermittent soil deposits.

Charcoal, kukui shell, and marine midden (including urchin spines) were observed within the tube. Also observed were three water-rounded basalt pebbles, located approximately 10.0 m. (32.8 ft.) from the *mauka* (east) entrance.

**Feature B** is the *makai* (west) tube, located approximately 12.5 m. (41.0 ft.) west of Feature A. The tube extends over 176.0 m. (577.3 ft.) in a southwest direction. A maximum width of 12.0 m. (39.4 ft.) and a maximum height of 3.3 m. (10.8 ft.) were measured in the lava tube. The only apparent internal modifications exist near the entrance. The first modification is a wall located 10.0 m. (32.8 ft.) from the entrance. This wall blocks the width of the tube. The wall measures 4.5 m. (14.8 ft.) long by 0.7 m. (2.3 ft.) wide with a maximum height of 0.8 m. (2.6 ft.). The ceiling height over the wall is approximately 1.7 m. (5.6 ft.). The wall is constructed of stacked cobbles and small boulders.

A coral artifact was observed immediately *makai* (west) of the wall. Approximately 12.0 m. (39.4 ft.) beyond the first wall is another smaller wall which only partially blocks the tube. This wall measures 3.0 m. (9.8 ft.) long by 0.7 m. (2.3 ft.) wide with a maximum height of 0.7 m. (2.3 ft.). Construction is of stacked cobbles and small boulders and there are sections of facing.

The tube interior consists of pahoehoe outcrop with scattered ceiling collapse and intermittent soil deposits. Feature B is in fair condition.

The associated mound is located on the surface, approximately 5.0 m. (16.4 ft.) north of Feature B. The mound measures 9.0 m. (29.5 ft.) E/W by 3.0 m. (9.8 ft.) N/S and is constructed of piled cobbles and boulders.

State site -16355 is in fair condition and offers good excavation potential.

**State Site #:** 50-10-37-16356 **CSH Site #:** 3
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 179.0 m.$^2$ (1,933.0 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 620 ft. a.m.s.l.

**Description:** State site -16356 consists of a modified outcrop and platform (designated Features A and B) situated on moderately sloped open pasture land. The site is located approximately 30.0 m. (98.4 ft.) to the southeast of State site -16355 lava tube.

**Feature A** is a modified outcrop. Modifications consist of a terrace and an attached enclosure at the north end of the outcrop. It measures 13.0 m. (42.6 ft.) N/S by a maximum of 8.5 m. (27.9 ft.) E/W. The terrace measures 8.5 m. (27.9 ft.) E/W by 4.0 m. (13.1 ft.) N/S. The maximum height is 1.5 m. (4.9 ft.) on the *makai* side. It is constructed of stacked boulders and cobbles with a cobble pavement which is level with the outcrop surface. Intact facing measures 0.75 m. (2.5 ft.) high on the north side.

The enclosure is attached to the north side of the terrace. It measures 6.0 m. (19.8 ft.) E/W by 1.0 m. (3.3 ft.) N/S. The wall is constructed of cobbles and boulders piled 0.1 m. (0.3 ft.) high. The interior is level soil. Soil also surrounds the terrace.

No artifacts or midden were present at Feature A.

Feature A is in fair condition and offers fair to good excavation potential.

**Feature B** is a rectangular platform located to the south of Feature A. It measures 8.0 m. (26.2 ft.) N/S by 5.5 m. (18.0 ft.) E/W, with a height of approximately 0.8 m. (2.6 ft.). It is constructed of pahoehoe small boulders and cobbles with a roughly level surface. No facing remains.

No artifacts or midden were observed at the site.

Feature B is in poor condition. Excavation potential is considered fair.

**State Site #:** 50-10-37-16357 **CSH Site #:** 4
**Site Type:** Modified outcrop
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 49.8 m.$^2$ (537.8 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 675.0 ft. a.m.s.l.

**Description:** State site-16357 is a modified outcrop located on the southern edge of a pasture. The modifications are situated on the north edge of an a'a flow.

Modifications consist of piled cobbles and boulders measuring 8.3 m. (27.2 ft.) E/W by 6.0 m. (19.8 ft.) N/S. The maximum height is approximately 0.6 m. (2.0 ft.). The north and west sides were probably faced at one time, although they have since collapsed. The south and east sides abut the outcrop.

No midden or artifacts were visible.

State site -16357 is in poor condition and offers poor excavation potential.



**State Site #:** 50-10-37-16358 **CSH Site #:** 5
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 4
**Site Dimension:** 2,268.0 m.$^2$ (24,494.4 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 590 ft. a.m.s.l.

**Description:** State site -16358 (Figure 7) consists of four features (designated Features A to D) situated on a prominent pahoehoe bluff overlooking the ocean. There is pasture to the north of the bluff. The terrain slopes moderately *makai* (west).

**Feature A** is an L-shaped platform located in the northeast corner of the complex. It is built on an outcrop. It measures 7.0 m. (23.0 ft.) N/S by 6.0 m. (19.8 ft.) E/W and has a maximum height of 0.8 m. (2.6 ft.). It is constructed with a level cobble pavement and has cobble to small boulder facing. In the center of the pavement (near the inside corner of the L-shape) is a circular alignment of cobbles measuring 1.0 m. (3.3 ft.) in diameter. It is considered a possible hearth.

No artifacts or midden were observed.

Feature A is in fair condition and is considered to have fair to good excavation potential.

**Feature B** is a *papamu* located approximately 16.0 m. (52.2 ft.) south of Feature A. The gameboard is pecked directly into the pahoehoe outcrop and it measures 0.7 m. (2.3 ft.) square.

No game stones, midden, or other artifacts were observed.

Feature B is in fair condition and offers no excavation potential.

**Feature C** is a rectangular terrace situated on the north side of the bluff, located 12.0 m. (39.4 ft.) northwest of Feature A. It measures 7.0 m. (23.0 ft.) E/W by 2.5 to 3.0m (8.3 ft. to 9.9 ft.) N/S. It is paved with cobbles and constructed with a boulder facing measuring a maximum of 2.2 m. (7.2 ft.) high on the north side. The east face has collapsed. The outcrop rises 0.8 m. (2.6 ft.) above the pavement on the south side.

No artifacts or midden were observed.

Feature C is in good condition and offers fair excavation potential.

**Feature D** is a circular pavement with a boulder alignment extending to the north it is situated on a level area of the bluff. It is located approximately 18.0 m. (59.0 ft.) south west of Feature A. From the north end of the pavement it extends 5.0 m. (16.4 ft.) north. The pavement has a circumferance of 3.0 m. (9.9 ft.).

No artifacts or midden were observed.

Feature D is in poor condition and offers poor excavation potential.

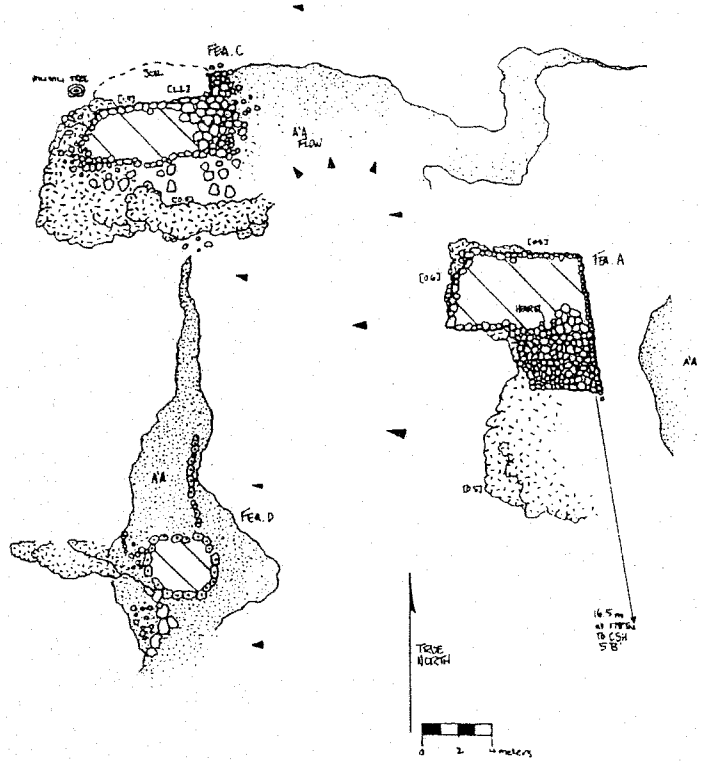



Figure 7 State site 50-10-37-16358; plan view



**State Site #:** 50-10-37-16359 **CSH Site #:** 6
**Site Type:** Wall
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 8 m.$^2$ (26.2 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 2
**Elevation:** 600 ft. a.m.s.l.

**Description:** State site -16359 is a discontinuous wall section situated along the *mauka* (east) edge of a pahoehoe bluff.

The wall measures 8.0 m. (26.2 ft.) long N/S with a width of 0.5 m. (1.6 ft.) and a maximum height of 1.0 m. (3.3 ft.). The wall is constructed of boulders; some facing is preserved.

No artifacts or midden were observed.

State site -16359 is in poor condition and exhibits poor excavation potential.

**State Site #:** 50-10-37-16360 **CSH Site #:** 7
**Site Type:** Site complex
**Function:** Probable *heiau*
**Features (#):** 2
**Site Dimension:** 450 m.$^2$ (4,860 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 500 ft. a.m.s.l.

**Description:** State site -16360 (Figure 8) is a site complex consisting of two platforms designated Features A and B. The site is situated on a large pahoehoe outcrop surrounded by pasture; the terrain slopes gently *makai* (west). A shallow soil pocket is located between the two features.

**Feature A** is a rectangular platform enclosed by a wall along the outer perimeter of its surface. The interior of the platform surface measures 9.3 m. (30.5 ft.) NE/SW by 9.0 m. (29.5 ft.) NW/SE. The enclosing wall encircles the majority of the platform, except along a portion of the southwest side of the platform. The enclosing wall measures 1.0 m. (3.3 ft.) wide and has a maximum height of 2.0 m. (6.6 ft.) on the northeast side; the maximum interior height of the wall on the northeast side is 1.4 m. (4.6 ft.). The wall is well constructed of a pahoehoe boulder facing with cobble fill. The southeast wall is collapsed along the interior.

The platform surface is separated into two areas in the northwest and southwest by a two-tiered construction of differing surface pavements. The upper (northwest) tier is constructed of a boulder pavement with a boulder face rising 0.15 m. (0.4 ft.) above the lower (southeast) tier. The lower (southeast) tier is paved with small cobbles. A faced depression is present along the facing of the upper tier where it abuts the enclosing wall. It measures 0.5 m. (1.6 ft.) in diameter.

The platform surface is level, especially along its lower tier. Two upright boulders (possible godstones) are located at the center of the lower tier, adjacent to the upper tier's facing. These stones measure 0.5 m. (1.6 ft.) high. There is a slight circular depression measuring 1.8 m. (5.9 ft.) in diameter adjacent to the east corner of the upper tier.

An historic bottle was observed in the wall at the north corner of the platform's

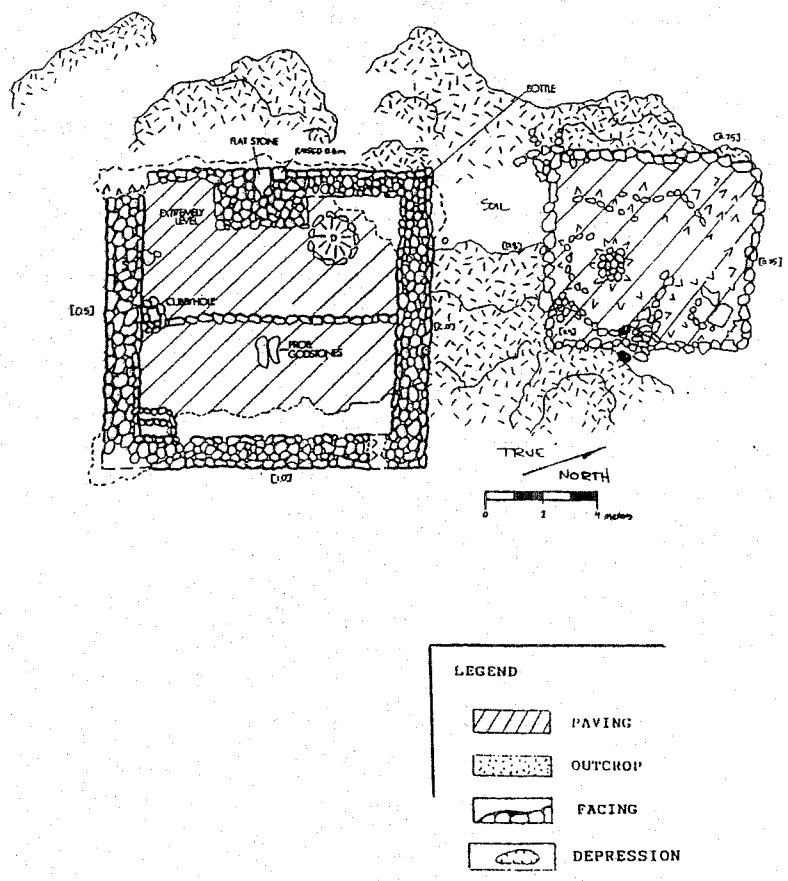



Figure 8 State site 50-10-37-16360; plan view



enclosing wall. The bottle, likely dating to the early 1920's, is a 1-quart, brown glass container with embossing on the sides and bottom.

Feature A is in good condition and offers good excavation potential.

**Feature B** is a rectangular platform located 4.0 m. (13.1 ft.) northeast of Feature A. It measures 10 m. (32.8 ft.) NE/SW by 9.0 m. (29.5 ft.) NW/SE. The maximum platform height measures 0.75 m. (2.5 ft.). It is constructed with a medium boulder and cobble pavement and is faced with boulders. There is a circular pile of cobbles in the south area of the platform, measuring 1.5 m. (4.9 ft.) in diameter.

No artifacts or midden were observed at Feature B. It is in poor condition and offers fair excavation potential.

State site -16360 is interpreted as a probable *heiau* on the basis of its formal construction and presence of possible godstones.

**State Site #:** 50-10-37-16361 **CSH Site #:** 8
**Site Type:** *Papamu*
**Function:** Gameboard
**Features (#):** 1
**Site Dimension:** 1.0 m.$^2$ (10.8 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 500 ft. a.m.s.l.

**Description:** State site -16361 is a *papamu* located adjacent to State site -16360.

The *papamu* measures approximately 0.5 m. (1.6 ft.) in diameter. Its surface is pecked into pahoehoe outcrop and contains a grid of 10 by 14 peg depressions.

The site is in fair condition and provides no excavation potential.

Because of their close proximity, State sites -16361 and -16360 are likely related.

**State Site #:** 50-10-37-16362 **CSH Site #:** 9
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 49.5 m.$^2$ (534.6 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 470 ft. a.m.s.l.

**Description:** State site -16362 is a rectangular platform located 10.0 m. (32.8 ft.) *mauka* (east) of an historic cattle wall in open pasture. It measures 11.0 m. (36.1 ft.) NW/SE by 4.5 m. (14.8 ft.) NE/SW, having a maximum height of 0.2 m. (0.7 ft.). It is constructed with medium to small boulders and cobbles.

No midden or artifacts were observed.

The platform is in poor condition and is interpreted as a possible burial.

**State Site #:** 50-10-37-16363 **CSH Site #:** 10
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 2
**Site Dimension:** 120.0 m.$^2$ (1,296.0 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 570 ft. a.m.s.l.

**Description:** State site -16363 consists of two platforms (designated Features A and B) located on a level break in the slope. The platforms are situated within a large soil deposit which appears to have been cleared for agricultural purposes. Several mounds are located just *mauka* (east) of the site, of which a few have remnant facing. Several water-rounded cobbles and pieces of coral were observed on two of the mounds.

**Feature A** is a semi-rectangular platform measuring 8.5 m. (27.9 ft.) E/W by 5.6 m. (18.4 ft.) N/S. The maximum height is 0.75 m. (2.5 ft.) on the east side. It is roughly paved with large to small boulders and cobbles and has large boulder facing. There appears to have been an exterior wall which has since collapsed. The central portion of the platform is lower than the surrounding portions.

No artifacts or midden were observed.

The platform is in poor condition and offers poor excavation potential.

**Feature B** is a mounded platform located approximately 3.0 m. (9.8 ft.) north of Feature A. It measures 5.0 m. (16.4 ft.) E/W by 2.5 m. (8.2 ft.) N/S and has a maximum height of 0.3 m. (1.0 ft.). It is constructed of mounded small to medium sized boulders.

No artifacts or midden were observed.

Feature B is in poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16364 **CSH Site #:** 11
**Site Type:** Wall
**Function:** Indeterminate
**Features (#):** 1
**Site Dimension:** 6.5 m.$^2$ (70.2 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 540 ft. a.m.s.l.

**Description:** State site -16364 is a discontinuous wall located near a historic cattle corral. The wall is L-shaped, but has been modified. Evidence of bulldozer scarring exists on some of the boulders.

The wall measures 6.5 m. (21.32 ft.) N/S by 5.5 m. (18.0 ft.) E/W with a height of approximately 0.6 m. (2.0 ft.). It is constructed of piled and stacked, large to medium sized boulders. Some of the facing is intact.

No artifacts or midden were observed.

State site -16364 has been disturbed and is in poor condition. It offers poor excavation potential.



**State Site #:** 50-10-37-16365 **CSH Site #:** 12
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 12.0 m.$^2$ (129.6 ft.$^2$)
**Location:** Ke'eke'e 2
**Elevation:** 500 ft. a.m.s.l.

**Description:** State site -16365 is a multi-level terrace situated on a pasture which slopes moderately *makai* (west). The terrace has three levels; the *mauka* (east)-most level is designated as level 1.

The terrace measures 2.0 m. (6.6 ft.) N/S by 2.0 m. (19.8 ft.) E/W. Level 1 is flush with the slope, measuring 2.0 m. (6.6 ft.) E/W. Level 2 is situated 0.3 m. (1.0 ft.) below level 1. It measures 2.0 m. (6.6 ft.) E/W by 6.0 m. (19.8 ft.) N/S. Both levels are constructed of mounded boulders and cobbles and roughly paved. Level 3 is more formally constructed. It measures 2.0 m. (6.6 ft.) long and sits 0.6 m. (2.0 ft.) below level 2. The pavement is level and is delineated by a boulder alignment. It has an approximate height of 0.3 m. (1.0 ft.) on the west side.

No artifacts or midden were observed.

The terrace is in fair to poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16366 **CSH Site #:** 13
**Site Type:** Modified outcrop
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 138 m.$^2$ (1,490.4 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 355 ft. a.m.s.l.

**Description:** State site -16366 is a modified outcrop situated on pahoehoe outcrop, which is slightly than the surrounding terrain. The site is located along grassy pasture which slopes moderately *makai* (west). Vegetation consists of scattered *kiawe* trees.

The outcrop modification forms an enclosure measuring 9.0 m. (29.5 ft.) E/W by 7.0 m. (23 ft.) N/S. The north and east sides of the enclosure are constructed of a boulder facing with cobble core fill. The south and west sides are defined by a rough piling of boulders on outcrop. The enclosure wall is flush with the ground surface on its *mauka* (east) side and has a maximum height of 0.8 m. (2.6 ft.) on its *makai* (west) side. On average the walls measure 1.5 m. (4.9 ft.) wide and have an interior height of 0.3 m. (1 ft.). There is a possible entrance in the south wall of the enclosure measuring 2.5 m. (8.2 ft.) wide. The enclosure interior consists of a shallow, level soil deposit with scattered cobbles.

No artifacts or midden were observed.

State site -16366 is in poor condition but offers fair to good excavation potential.

**State Site #:** 50-10-37-16367 **CSH Site #:** 14
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 33 m.$^2$ (356.4 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 375 ft. a.m.s.l.

**Description:** State site -16367 is an enclosure located on a level break in the slope. The (Kuaiwi) surrounding terrain is grassy pasture which slopes gently *makai* (west). Agricultural walls are present within the site area.

The enclosure interior measures 4.0 m. (13.1 ft.) N/S by 3.5 m. (11.5 ft.) E/W. The enclosure wall is 1.0 m. (3.3 ft.) wide with an approximate height of 0.8 m. (2.6 ft.). The enclosure wall is constructed of stacked boulders and cobbles. Most of the north and south sides of the enclosure are collapsed. The enclosure interior consists of soil with scattered cobbles.

No artifacts or midden were observed.

State site -16367 is in poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16368 **CSH Site #:** 15
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 46.7 m.$^2$ (504.4 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 425 ft. a.m.s.l.

**Description:** State site -16368 is a terrace which extends *makai* (west) from a pahoehoe outcrop. The site is situated in grassy pasture which slopes moderately *makai* (west). The site is located 20.0 m. (65.6 ft.) *makai* (west) of a large historic cattle wall.

The terrace measures 8.5 m. (27.9 ft.) N/S by 5.5 m. (18 ft.) E/W, with a maximum height of 0.85 m. (2.8 ft.) on the *makai* (west) side. It is constructed with medium to small boulders and cobbles, and has a level pavement which is flush with the outcrop surface.

No artifacts or midden were observed.

State site -16368 in good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16369 **CSH Site #:** 16
**Site Type:** Modified outcrop
**Function:** Agriculture
**Features (#):** 2
**Site Dimension:** 640 m.$^2$ (6,912 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 425 ft. a.m.s.l.

**Description:** State site -16369 is a modified pahoehoe outcrop and an associated mound. The site is located near the intersection of two historic cattle walls (State site - #16794).



The modified outcrop measures 10.0 m. (32.8 ft.) N/S by 20.0 m. (65.6 ft.) E/W, with an approximate height of 1.0 m. (3.28 ft.). It is defined by a mounded boulder wall which extensively utilizes the existing outcrop in its construction.

Approximately 12.5 m. (41 ft.) northwest of the outcrop is a large mound measuring 7.0 m. (23 ft.) E/W by 4.5 m. (14.8 ft.) N/S with a maximum height of 2 m. (6.6 ft.). It is constructed of boulders.

Possible evidence of bulldozing disturbance was observed along the modified outcrop.

No artifacts or midden were observed.

State site -16369 is in poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16370 **CSH Site #:** 17
**Site Type:** Mound
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 120.75 m.$^2$ (1,304.1 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 325 ft. a.m.s.l.

**Description:** State site -16370 is a large mound situated on a relatively level break in the sloping pasture. At the *makai* (west) edge of the mound is a level soil area.

The mound is the largest mound in the area. It measures 10.5 m. (34.4 ft.) N/S by 11.5 m. (37.7 ft.) E/W by and has a maximum height of 2.0 m. (6.6 ft.). It consists of boulders and cobbles piled on pahoehoe outcrop.

No artifacts or midden were observed.

State site -16370 is in poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16371 **CSH Site #:** 18
**Site Type:** Walls
**Function:** Possible trail
**Features (#):** 1
**Site Dimension:** Indeterminate
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 325 ft. a.m.s.l.

**Description:** State site -16371 consists of two parallel walls extending in a *mauka/makai* (east/west) direction over an indeterminate distance.

The individual walls are situated approximately 3.5 m. (11.5 ft.) apart (N/S) and 1.75 m. (5.7 ft.) wide and 0.75 m. (2.5 ft.) high. The walls are constructed of large to small boulders and cobbles with no facing present.

No artifacts or midden were observed.

The site is in poor condition and appears to have been disturbed by bulldozing as evidenced by impact scars. The site offers fair to poor excavation potential.

State site -16371 may define a trail used either as a cattle run or as access to settlement along the coast (associated with the landing at Nawawa). The site is evident on the aerial photograph of the project area used during the present survey.

**State Site #:** 50-10-37-16372 **CSH Site #: 19**
**Site Type:** Site complex
**Function:** Possible burials
**Features (#):** 3
**Site Dimension:** 75.9 m.$^2$ (819.7 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 300 ft. a.m.s.l.

**Description:** State site -16372 is a site complex consisting of three platforms designated Features A through C. The site extends in a *mauka/makai* (east/west) direction along moderately sloped pasture.

**Feature A** is the platform located furthest *makai* (west) in the site area. It measures 5.5 m. (18 ft.) N/S by 4.2 m. (13.8 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.). It is constructed of medium to small boulders and is in good condition.

**Feature B** is a platform located *mauka* (east) of feature A. It measures 5.0 m. (16.4 ft.) E/W by 4.5 m. (14.8 ft.) N/S, with a maximum height of 0.6 m. (2.0 ft.). It is constructed of small to medium size boulders and is in fair condition.

**Feature C** - the platform furthest *mauka* (east) in the site area - measures 5.5 m. (18.0 ft.) N/S by 5.5 m. (18.0 ft.) E/W and has a maximum height of 0.8 m. (2.6 ft.). It is in fair condition.

No artifacts or midden were observed at State site -16372.

**State Site #:** 50-10-37-16373 **CSH Site #: 20**
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 52.3 m.$^2$ (564.4 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 425 ft. a.m.s.l.

**Description:** State site -16373 is a rectangular platform located along a level break in the slope of pasture. Vegetation consists predominantly grasses and scattered *kiawe* and *koa haole*.

The platform measures 7.8 m. (25.6 ft.) N/S by 6.7 m. (22.0 m.) E/W with an approximate height of 1.0 m. (3.3 ft.). It is constructed of stacked and piled medium sized pahoehoe boulders. There is an irregularly shaped depression in the eastern central portion of the platform.

No artifacts or midden were observed at State site -16373. It is in poor condition and offers fair excavation potential.



**State Site #:** 50-10-37-16374 **CSH Site #: 21**
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 45.0 m.$^2$ (486.0 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 460 ft. a.m.s.l.

**Description:** State site-16374 is a rectangular platform situated on a relatively level break in the slope surrounded by grasslands and scattered *kiawe* trees. It measures 7.5 m. (24.6 ft.) N/S by 6.5 m. (21.5 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). It is constructed of large cobbles and boulders leveling an underlying pahoehoe outcrop. The interior may have had a soil filled depression which is now filled with rubble.

No artifacts or midden were observed at the site.

The platform is in poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16375 **CSH Site #: 22**
**Site Type:** Platform
**Function:** Shrine
**Features (#):** 1
**Site Dimension:** 308.0 m.$^2$ (3,326.4 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 460 ft. a.m.s.l.

**Description:** State site -16375 (Figure 9) is a rectangular platform surrounded by a wide exterior wall situated on level terrain with a spectacular view of the coast. The platform measures 6.3 m. (20.7 ft.) N/S by 6.7 m. (22.0 ft.) E/W with a maximum height of 0.3 m. (1.0 ft.). It is constructed of small boulders and has a cobble pavement. The platform's sides have a sloped face and become almost flush with the surrounding soil deposit.

There is a water-rounded boulder located in the center of the platform.

The platform is in good condition.

The outer wall is located approximately 6.0 m. (19.8 ft.) from the platform on all but the south side. It measures 17.0 m. (55.8 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.). It is constructed of medium to large boulders with a cobble fill pavement.

Another water-rounded boulder is located at the *makai* (west) edge of the wall.

The wall is in poor condition. The SE portion of the wall appears to have been impacted by bulldozing. No artifacts or midden were observed.

State site -16375 is interpreted as a shrine. It offers excellent excavation potential.

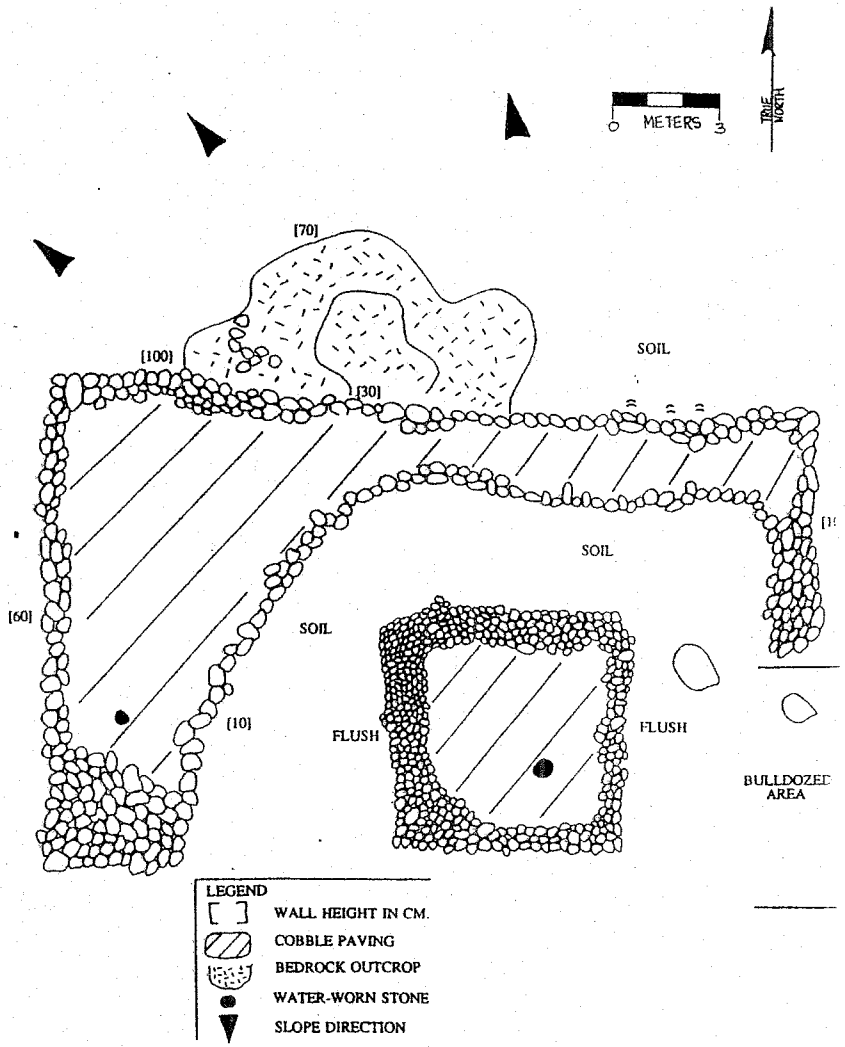



Figure 9 State site 50-10-37-16375; plan view



**State Site #:** 50-10-37-16376 **CSH Site #:** 23
**Site Type:** Platform
**Function:** Burial
**Features (#):** 1
**Site Dimension:** 49.0 m.$^2$ (529.2 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 115 ft. a.m.s.l.

**Description:** State site -16376 (Figure 10) is a rectangular terrace situated along a moderate slope. Vegetation includes grasses and scattered *kiawe* trees. The site is located approximately 20.0 m. (65.6 ft.) north of the southern *mauka/makai* (east/west) jeep access road.

The terrace measures 6.8 m. (22.3 ft.) N/S by a maximum of 5.8 m. (19.0 ft.) E/W; it has a maximum height of 0.7 m. (2.3 ft.). It is constructed of medium boulders and cobbles with a relatively even surface. The sides of the terrace are completely collapsed and its *mauka* (east) side is flush with the ground surface.

As a result of the subsurface testing described below, State site -16376 is designated a confirmed burial.

Testing Results:

Limited subsurface testing was conducted at State site -16376 to ascertain the presence or absence of human remains. A 1.0 m.$^2$ trench (trench 1) was excavated within the terrace and the underlying soil deposits.

After removing the 35 cm. thick terrace fill, the continued excavation revealed three underlying stratigraphic units: Stratum I, IB, and II.

Stratum I extended 35 cm to 45 cm. below the terrace surface; it consisted primarily of organic material Stratum IB, 45 cm. to 80 cm. below the terrace surface, consisted of a rocky layer intermixed with a dark soil matrix. Directly below Stratum IB - at its interface with Stratum II - a crypt-like feature of basalt slabs was encountered. Stratum II extended from 80 cm. to 140 cm below the terrace surface and consisted of a loose dark brown soil (fill). A human burial was identified within Stratum II, between 140 cm. to 150 cm. below the terrace surface.

Cultural material - including midden and indigenous artifacts - was recovered within the strata beneath the terrace fill.

Stratum I yielded one volcanic glass flake (Art. #18), one basalt flake (Art. #19), 5.3 gms. of marine midden, 20.9 gms. of coral and 0.4 gms. of charcoal. Stratum IB yielded three volcanic glass flakes (Art. #20-22), one basalt flake (Art. #24), two water-rounded pebbles (Art. #23, 25), 9.4 gms. of marine midden, 0.7 gms. of coral and 0.3 gms. of charcoal. Stratum II burial fill contained 42.0 gms. of marine midden, 1.8 gms. of terrestrial midden, 8.0 gms. of coral, and 2.2 gms. of charcoal.

Upon encountering the human remains, the excavation was terminated. Trench 1 was back-filled and the crypt and overlying terrace were reconstructed to their original form.

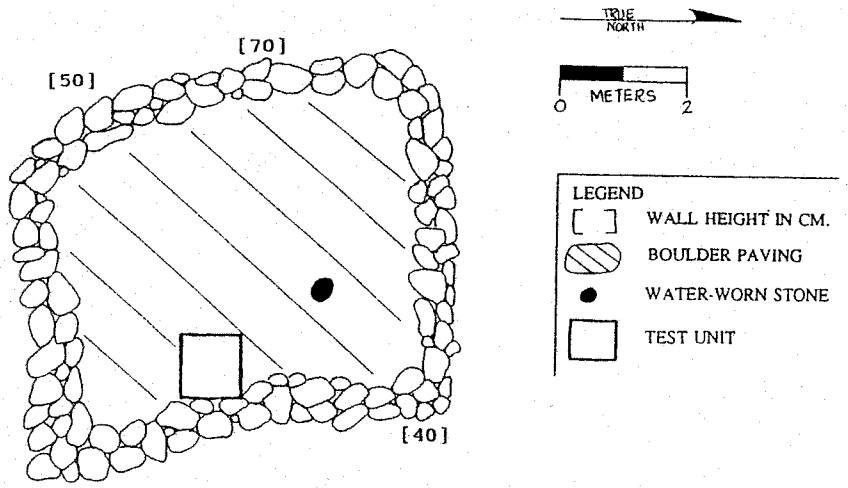



Figure 10 State site 50-10-37-16376; plan view



**State Site #:** 50-10-37-16377 **CSH Site #:** 24
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 48.5 m.$^2$ (523.8 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 125 ft. a.m.s.l.

**Description:** State site -16377 (Figure 11) is a rectangular terrace located approximately 30.0 m. (98.4 ft.) *mauka* (east) of State site -16376. The site is situated on moderately sloped terrain surrounded by grasses and scattered *kiawe* trees.

The terrace measures 9.7 m. (31.8 ft.) N/S by 5.0 m. (16.4 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.) exhibited on the *makai* (west) side. The *mauka* (east) edge of the terrace is constructed flush with the ground surface. It is constructed of small to medium boulders and cobbles with a mounded surface area.

No artifacts or midden were observed at the site.

State site -16377 is in fair condition.

Testing Results:

Limited subsurface testing was conducted at State site -16377 to determine the presence or absence of human remains. One 1.0 m.$^2$ trench was excavated along the central *makai* (west) portion of the terrace.

After removing the 20 cm. thick terrace fill, excavation continued until encountering bedrock at a maximum depth of 55 cm. below the terrace surface. One stratigraphic unit, Stratum I, was revealed below the terrace fill.

The terrace fill consisted of angular to subangular boulders and cobbles. Stratum I - 35 cm. thick - consisted of a loose brown soil containing organic material and overlying bedrock.

Both indigenous artifacts and midden were collected from the terrace fill and underlying Stratum I.

The terrace fill yielded two basalt flakes (Art. #26, 27), one basalt adze fragment (Art. #28), a volcanic glass core (Art. #29), and one basalt manuport (Art. #30). Three (3) gms. of marine midden was also collected from the terrace fill.

Stratum I yielded an abundance of artifacts including 60 basalt flakes (Art. #35, 36, 40, 41), 15 volcanic glass flakes (Art. #34, 38, 39, 43), two basalt cores (Art. #33), five basalt manuports (Art. #31, 42), one shell fishhook blank (Art. #32), and a human tooth (Art. #37). Stratum I midden includes 75.4 gms. of marine midden, 17.4 gms.
terrestrial midden, 2.3 gms. of coral, and 0.3 gms. of charcoal.

Results of the limited testing indicate that the terrace was a habitation unit, likely used on a temporary basis. The presence of the human tooth is not believed to be associated with a human burial but rather a result of incidental or intentional tooth loss of the terrace inhabitant.

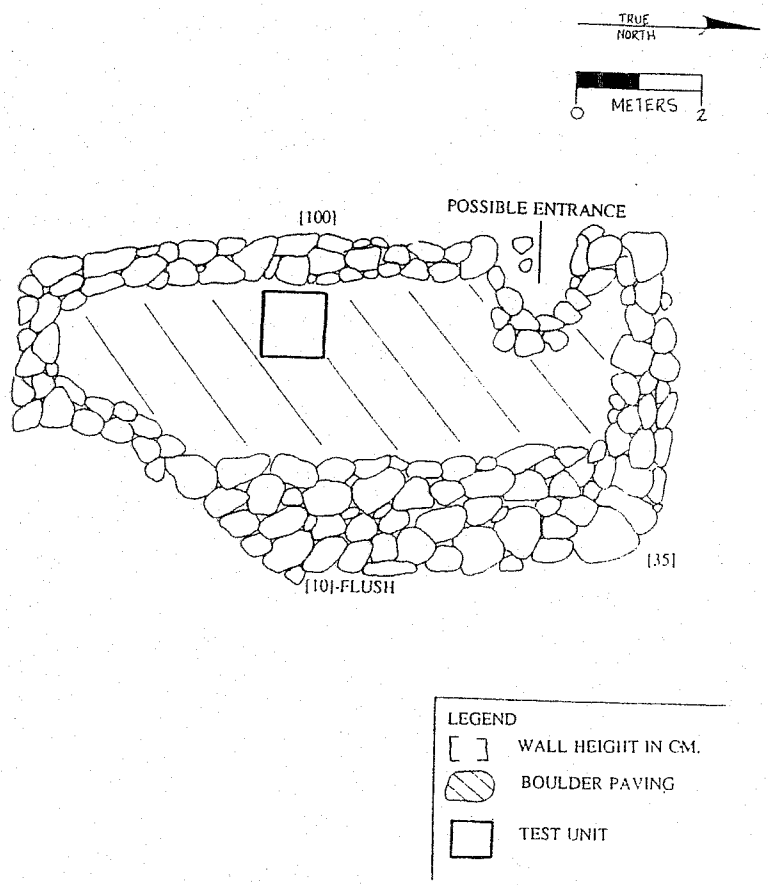



Figure 11 State site 50-10-37-16377; plan view



**State Site #:** 50-10-37-16378 **CSH Site #:** 25
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 32.0 m.$^2$ (345.6 ft.$^2$)
***Ahupua'a*:** Ke'eke'e
**Elevation:** 115 ft. a.m.s.l.

**Description:** State site -16378 is a rectangular platform located approximately 10.0 m. (32.8 ft.) northwest of State site -16377. It is situated along moderately sloped terrain covered by grasses and scattered *kiawe* trees.

The platform measures 4.0 m. (13.1 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.) on its *makai* (west) side. It has a mounded surface of large boulders and cobbles.

One water-rounded cobble was observed on the platform surface.

State site -16378 is in fair condition. No artifacts or midden was observed.

**State Site #:** 50-10-37-16379 **CSH Site #:** 26
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 37.5 m.$^2$ (405 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 2
**Elevation:** 130 ft. a.m.s.l.

**Description:** State site -16379 is a rectangular platform situated on a moderate slope covered by grasses and scattered *kiawe* trees.

The platform measures 5.0 m. (16.4 ft.) N/S by 7.5 m. (24.6 ft.) E/W with a maximum height of 2.0 m. (6.6 ft.) on its *makai* (west) edge. It is constructed with a boulder facing and a cobble and boulder pavement.

A water-rounded stone was observed on the platform surface.

State site -16379 is in fair condition.

**State Site #:** 50-10-37-16380 **CSH Site #:** 27
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 240.0 m.$^2$ (2592.0 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 150 ft. a.m.s.l.

**Description:** State site -16380 is a large agricultural terrace situated at the *makai* (west) edge of a slope. The site area is located adjacent to a level soil which is apparently cleared of stone rubble. The surrounding vegetation consists of grassland, *koa haole* and scattered *kiawe* trees.

The terrace measures 40.0 m. (131.2 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a maximum

height of 1.0 m. (3.3 ft.). Its *mauka* (east) edge is flush with the terrain. It is roughly constructed of piled boulders. The cleared soil area adjacent to the site suggests that the terrace may be the result of clearing.

Numerous water-rounded stones were observed at the site.

State site -16380 is in fair to poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16381 **CSH Site #:** 28
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 14.4 m.$^2$ (155.5 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 145 ft. a.m.s.l.

**Description:** State site -16381 is a rectangular platform. Site vegetation consists of dense California grass and scattered *kiawe* trees.

The platform measures 4.5 m. (14.8 ft.) N/S by 3.2 m. (10.5 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). It is constructed of pahoehoe cobbles and boulders.

One piece of coral was observed on the platform surface.

State site -16381 is in poor condition.

**State Site #:** 50-10-37-16382 **CSH Site #:** 29
**Site Type:** Terrace
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 21.0 m.$^2$ (226.8 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 180 ft. a.m.s.l.

**Description:** State site -16383 is a rectangular terrace located at the edge of a level break in the slope. The surrounding vegetation consists of California grass, *koa haole* and scattered *kiawe* trees.

The terrace measures 7.0 m. (23 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.) on the *makai* (west) edge. The *mauka* (east) edge of the terrace is flush with the slope. It is constructed small boulders and cobbles; its surface is a level pavement.

No artifacts or midden were observed.

State site -16383 is in poor condition.



**State Site #:** 50-10-37-16383 **CSH Site #:** 30
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 56.0 m.$^2$ (604.8 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 210 ft. a.m.s.l.

**Description:** State site -16383 is a rectangular platform situated amongst California grass, *koa haole* and scattered *kiawe* trees.

The platform measures 7.0 m. (23 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). It is constructed with small to medium boulders and the surface is mounded.

A basalt polishing stone and several water-rounded stones were observed on the south side of the platform.

State site -16383 is in good condition and offers fair to good excavation potential.

**State Site #:** 50-10-37-16384 **CSH Site #:** 31
**Site Type:** Site complex
**Function:** Possible *heiau*
**Features (#):** 2
**Dimension:** 292.5 m.$^2$ (3159.0 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 125 ft. a.m.s.l.

**Description:** State site -16384 (Figure 12) is a site complex consisting of two platforms, designated Features A and B. The site is situated on a level break in the slope, surrounded by California grass, *koa haole*, and scattered *kiawe* trees.

**Feature A** is an irregularly-shaped platform located less than 1.0 m. (3.3 ft.) east of Feature B. It measures a maximum 15.0 m. (49.2 ft.) N/S by 8.0 m. (26.2 ft.) E/W. A maximum height of 1.0 m. (3.3 ft.) is exhibited along its *makai* (west) side. It is constructed of small to large boulders and cobbles and contains a level paved surface of small boulders and cobbles at its center. Most of the platform has intact facing except along its *makai* (west) side which is tumbled.

**Feature B** platform is semi-triangular in shape and measures a maximum of 13.0 m. (42.6 ft.) N/S by 10.0 m. (32.8 ft.). It has a maximum height of 2.0 m. (6.6 ft.) along its *makai* (west) side where it fronts Feature A. The platform is constructed of small to large boulders with vertical facing preserved on all sides except along its east side.

There is a collapsed cupboard located on the north side of the Feature B platform. It measures 3.0 m. (9.8 ft.) N/S by 0.6 m. (2.0 ft.) E/W with a depth of 0.75 m. (2.5 ft.). Two upright stones are situated to the east of the cupboard. Also present on the platform surface are two circular depressions; these measure 1.2 m. (3.9 ft.) in diameter with depths of 1.0 m. (3.3 ft.) and 0.5 m. (1.6 ft.), respectively.

Numerous water-rounded cobbles were observed along both features of the site.

State site -16384 is in fair condition and offers good excavation potential.

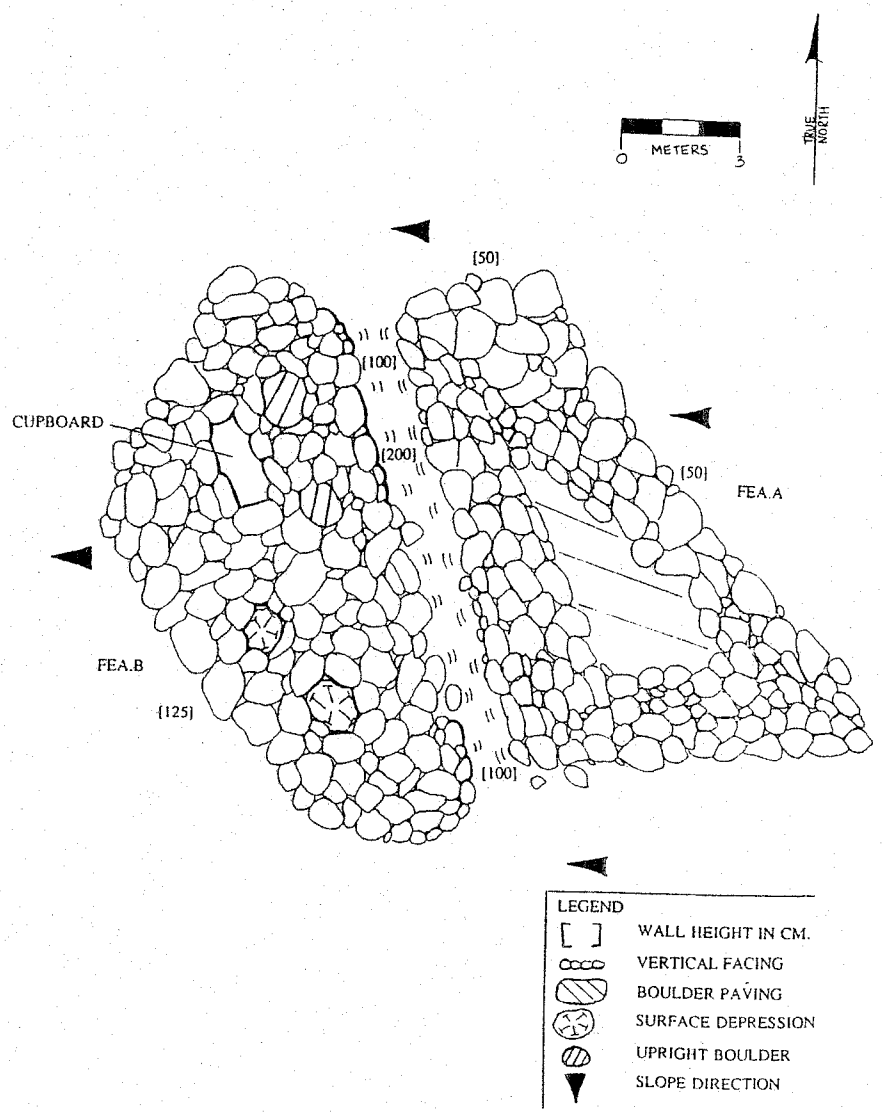



Figure 12 State site 50-10-37-16384; plan view



**State Site #:** 50-10-37-16385 **CSH Site #:** 32
**Site Type:** Terraces
**Function:** Agriculture
**Features (#):** 2
**Dimension:** 78.8 m.$^2$ (842.4 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 155 ft. a.m.s.l.

**Description:** State site -16385 consists of two terraces located on a level break in the slope. Vegetation includes grasses and scattered *kiawe* trees. An extensive soil deposit surrounds the site area.

Both terraces are aligned in a north/south direction.

The north terrace measures 5.5 m. (18.0 ft.) N/S by 4.5 m. (14.8 ft.) E/W with a height of 1.0 m. (3.3 ft.) along its *makai* (west) side. The south terrace measures 6.0 m. (19.8 ft.) N/S by 9.0 m. (29.5 ft.) E/W and has a maximum height of 0.7 m. (2.3 ft.).

Both terraces are constructed with medium to small boulders and cobbles.

No artifacts or midden were observed.

State site -16385 is in poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16386 **CSH Site #:** 33
**Site Type:** Platform
**Function:** Burial
**Features (#):** 1
**Dimension:** 18.2 m.$^2$ (196.6 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 125 ft. a.m.s.l.

**Description:** State site -16386 (Figure 13) is a rectangular platform situated in grass covered land with scattered *kiawe* and *koa haole* trees.

The platform measures 5.0 m. (16.4 ft.) E/W by 4.0 m. (13.1 ft.) N/S with a maximum height of 1.0 m. (3.3 ft.). It is constructed of small boulders and it has a surface pavement of cobbles and boulders. The *makai* (west) portion of this pavement is constructed with pebbles and cobbles.

Several water-rounded boulders were observed in the east face of the platform.

State site -16386 is in fair condition.

Testing Results:

Limited subsurface testing was conducted at State site -16386 to ascertain the presence or absence of human remains. A 1.0 m.$^2$ trench was placed within the pavement of the central portion of the platform.

After removing the 65 cm. thick platform fill, the continued excavation revealed three underlying stratigraphic units: Stratum I, IB, and II.

Stratum I - extended to a depth of 15 cm. below the ground surface (at the base of the platform); it consisted of a loose red silt which contained an abundance of organic material and rootlets. Stratum IB - 20 cm. thick - extending from 15 cm. to 35 cm. below the ground surface; it consisted of a rocky matrix intermixed with a dark brown soil. Directly beneath Stratum IB, at its interface with Stratum II, a crypt-like feature was encountered. The crypt was constructed of upright pahoehoe slabs and interior capstones.

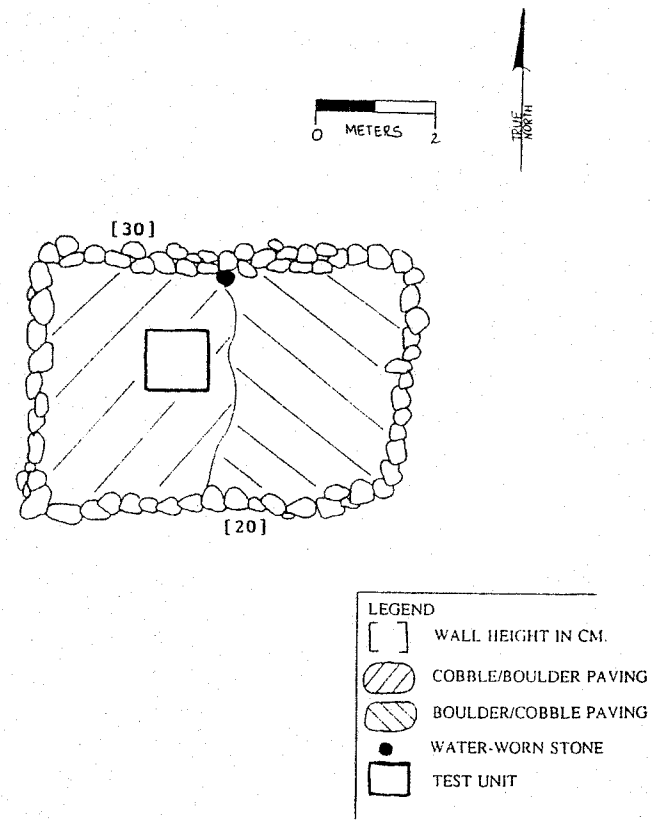



Figure 13 State site 50-10-37-16386; plan view



Stratum II - within the crypt - consisted of a very loose brown silt with large to medium rootlets and some cobbles. Human remains were identified at 70 cm. below the ground surface within Stratum II.

Cultural material - including artifacts, midden and charcoal- was recovered within the strata beneath the terrace fill.

Stratum I yield six volcanic glass flakes (Art. #43), Stratum IB contained four volcanic glass flakes (Art. #44), and Stratum II contained numerous cultural artifacts. Stratum II artifacts include two basalt flakes (Art. #45, 51), four volcanic glass flakes (Art. #46, 50, 55), one coral manuport (Art. #48, 49, 52, 54), and two pearl shell fragments (Art. #53). Stratum I yielded 28.5 gms. of marine midden, 21.2 gms. of terrestrial midden and 5.5 gms. of charcoal. Stratum II burial fill contained 72.5 gms. of marine midden, 51.0 gms. of terrestrial midden, 17.7 gms. of coral, and 59.5 gms. of charcoal.

Upon encountering the human remains, the excavation was terminated. Trench 3 was back-filled and the constructed crypt and overlying platform was reconstructed to its original form.

**State Site #:** 50-10-37-16387 **CSH Site #:** 34
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Dimension:** (see below)
***Ahupua'a*:** Ilikahi
**Elevation:** 175 ft. a.m.s.l.

**Description:** State site -16387 is a site complex comprising two features designated A and B. The site is situated on a moderate to steep slope with grass, *kiawe* and *koa haole* vegetation.

**Feature A** is a multi-level terrace situated on a steep slope. The highest level - Level 1 - is somewhat circular in shape measuring 4.8 m. (15.7 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.) above the surrounding terrain and Level 2.

Level 2 is attached to the north and west sides of Level 1. It measures 5.0 m. (16.4 ft.) N/S by 13.0 m. (42.7 ft.) E/W with a maximum height of 1.4 m. (4.6 ft.) near the southwest corner of the terrace (along its *makai* (west) wall). A depression is present at the eastern edge of Level 2; it extends across the width of the terrace with a depth of 0.2 m. (0.7 ft.) below the surface. It measures 7.5 m. (24.6 ft.) NW/SE by 2.0 m. (6.6 ft.) NE/SW.

Overall the terrace is constructed of large to small boulders and cobbles with mostly intact facing. Collapse exists along the western edge of the terrace.

Two water-rounded stones were observed on Level 2. No other artifacts or midden was present.

Feature A is in good condition and offers good excavation potential.

**Feature B** is a rectangular platform located approximately 5.6 m. (18.4 ft.) southeast of Feature A. It measures 5.0 m. (16.4 ft.) N/S by 3.5 m. (11.5 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). The platform is constructed of small boulders and has a cobble pavement. No intact facing remains. There is a possible alignment running east/west near the north edge of the platform. There is a boulder mound situated just *mauka* (east) of the platform.

Several water-rounded stones were observed on the platform surface. No other artifacts or midden were present.

Feature B is in fair to good condition and offers fair to good excavation potential.

**State Site #:** 50-10-37-16388 **CSH Site #:** 35
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Dimension:** 31.5 m.$^2$ (340.2 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 130 ft. a.m.s.l.

**Description:** State site -16388 is an L-shaped platform located on gently sloped terrain.

The maximum measurements of the platform are 7.0 m. (23 ft.) N/S by 4.5 m. (14.8 ft.) E/W. Its maximum height is 2.0 m. (6.6 ft.). The platform is constructed of medium cobbles and boulders with a level cobble and boulder pavement.

Several water-rounded stones were observed on the platform surface. An upright stone was observed in the center of the platform's *makai* (west) side.

State site -16388 is in good condition.

**State Site #:** 50-10-37-16389 **CSH Site #:** 36
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Dimension:** 20.0 m.$^2$ (216.0 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 155 ft. a.m.s.l.

**Description:** State site -16389 is a platform situated along the *makai* (west) edge of steeply sloped terrain. Vegetation consists of moderately grazed California grass, *koa haole* and scattered *kiawe* trees.

The platform measures 5.0 m. (16.4 ft.) N/S by 4.0 m. (13.1 ft.) E/W. It is constructed of small to medium boulders and has a cobble surface pavement.

A water-rounded pebble was observed in the northeast area of the platform.

State site -16389 is in fair to poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16390 **CSH Site #:** 37
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 2
**Dimension:** 33.8 m.$^2$ (364.5 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 155 ft. a.m.s.l.

**Description:** State site -16390 is a site complex consisting of a platform and a terrace designated Features A and B, respectively. The site is situated on a moderately sloped terrain covered with California grass, *koa haole*, and scattered *kiawe* trees.



**Feature A** is a roughly rectangular platform situated at the top of a 1.2 m. (3.9 ft.) high ledge. It measures 4.5 m. (14.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 0.3 m. (1.0 ft.). It is faced with boulders and has an internal surface of boulders and cobbles.

**Feature B** is a rectangular terrace located 6.0 m. (19.8 ft.) *makai* (west) of Feature A. It measures 4.5 m. (14.8 ft.) N/S by 3.5 m. (10.5 ft.) E/W with a maximum height of 0.3 m. (1.0 ft.). It is similar in construction and composition to Feature A, except that its *mauka* (east) side is constructed flush to outcrop.

No artifacts or midden were observed at the site.

State site -16390 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16391 **CSH Site #:** 38
**Site Type:** Wall remnant
**Function:** Indeterminate
**Features (#):** 1
**Site Dimension:** 60 m.$^2$ (648 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 180 ft. a.m.s.l.

**Description:** State site -16391 is a remnant wall located on level terrain. The site is situated *makai* (west) of a heavily modified (roughly terraced) slope.

The wall extends in a northwest/southeast direction and measures 40.0 m. (131.2 ft.) long and 1.5 m. (4.9 ft.) wide; maximum wall height is 1.5 m. (4.9 ft.). The wall is constructed of stacked and piled small to medium boulders along an outcrop surface.

No artifacts or midden were observed on the site.

State site -16391 is in fair condition and offers poor excavation potential.

**State Site #:** 50-10-37-16392 **CSH Site #:** 39
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 73.5 m.$^2$ (793.8 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 235 ft. a.m.s.l.

**Description:** State site -16391 is a rectangular enclosure situated northwest of a cattle corral. Vegetation includes California grass, *koa haole* and scattered *kiawe* trees.

The enclosure interior measures 10.5 m. (34.4 ft.) N/S by 7.0 m. (23.0 ft.) E/W. Its wall is constructed of medium boulders; it measures a maximum 0.5 m. (1.6 ft.) high. The enclosure interior consists of soil with scattered boulders.

No artifacts or midden were observed at the site.

State site -16392 is in fair to poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16393 **CSH Site #:** 40
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 680.4 m.$^2$ (540 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 240 ft. a.m.s.l.

**Description:** State site -16393 is a rectangular platform situated on a level break in the slope. The site is situated just south of a large *heiau* (State site -16395).

The platform measures 14.0 m. (46.2 ft.) N/S by 4.5 m. (14.8 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). It is constructed with large cobbles and boulders.

One water-rounded stone was observed on the platform surface.

State site -16393 is in poor condition and offers fair excavation potential.

No artifacts or midden were observed.

**State Site #:** 50-10-37-16394 **CSH Site #:** 41
**Site Type:** Mound
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 27 m.$^2$ (291.6 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 245 ft. a.m.s.l.

**Description:** State site -16394 is a mound situated immediately *makai* (west) of a bulldozed road. The mound is larger than other mounds present in the project area.

The mound measures 6.0 m. (19.8 ft.) E/W by 4.5 m. N/S and has a maximum height of 1.5 m. (4.9 ft.). It is constructed of medium boulders and cobbles. A boulder is present at the top of the mound and due to its unusual and seemingly intentional placement may indicate the presence of a burial.

No artifacts or midden were observed.

State site -16394 is in poor condition.

**State Site #:** 50-10-37-16395 **CSH Site #:** 42
**Site Type:** Site complex
**Function:** *Heiau*
**Features (#):** 2
**Site Dimension:** 300.0 m.$^2$ (3,240.0 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 240 ft. a.m.s.l.

**Description:** State site -16395 (Figures 14 & 15) is a site complex comprising a platform and a terrace designated Features A and B, respectively. The site is situated on a grass covered pasture with intermittent pahoehoe outcrops and scattered *kiawe* trees.

**Feature A** is a large rectangular platform containing a soil-filled depression at its center. It measures 27.0 m. (88.6 ft.) N/S by 10.0 m. (32.8 ft.) E/W and has a maximum



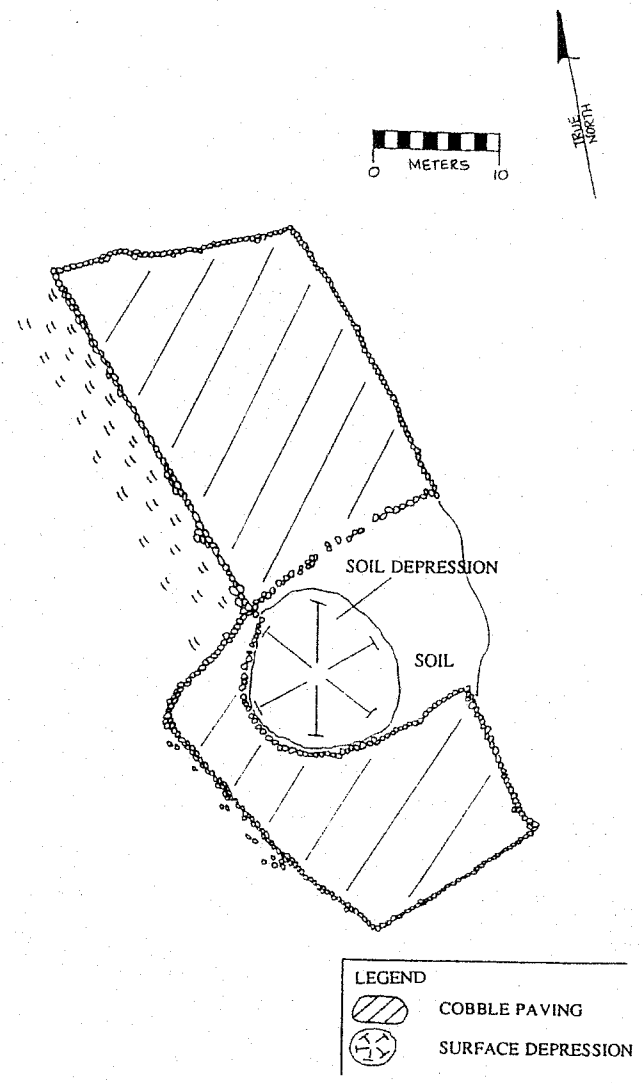



Figure 14 State site 50-10-37-16395, Feature A; plan view

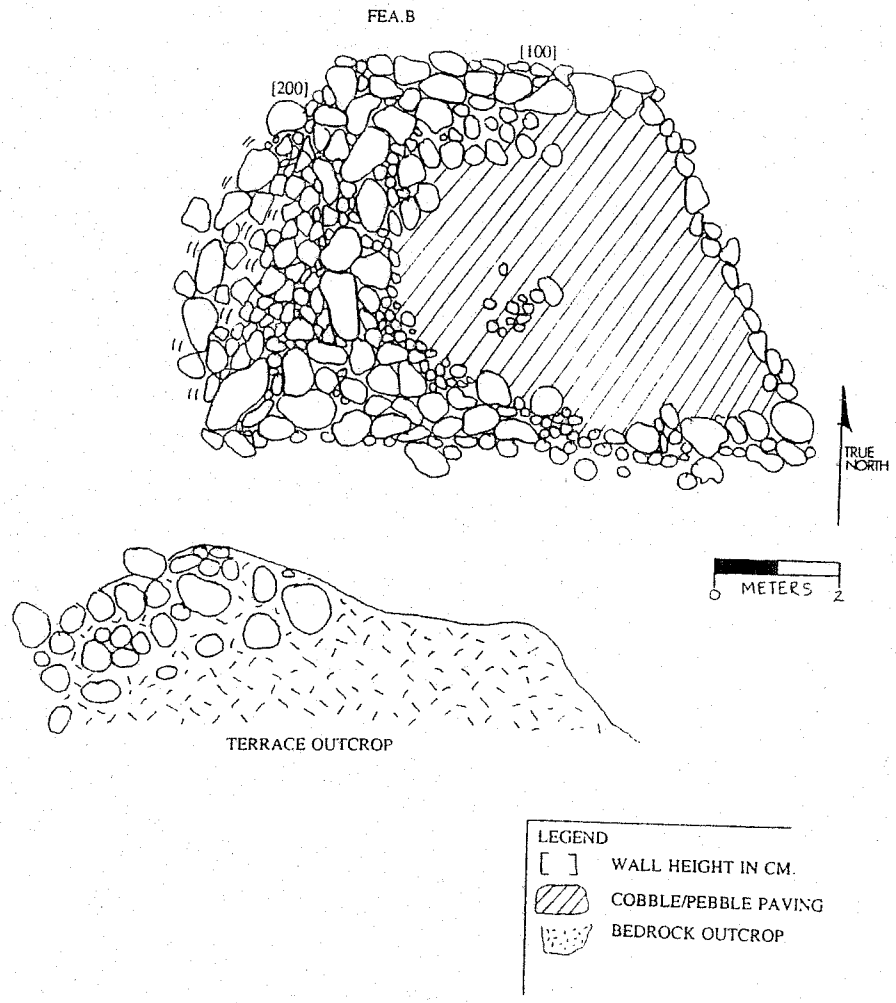



Figure 15 State site 50-10-37-16395, Feature B; plan view



height of 2.0 m. (6.6 ft.) on its *makai* (west) side. Its *mauka* (east) edge measures 1.0 m. (3.3 ft.) high. The platform is constructed and paved with large to small boulders and cobbles and contains intact facing along its west edge.

The soil depression at its center measures approximately 7.0 m. (23.0 ft.) E/W by 5.0 m. (16.4 ft.) N/S. This area of the platform and along the *makai* (west) side of the platform appears to have been excavated.

Numerous water-rounded stones and coral pieces were observed on the surface of the platform. A deteriorated piece of lumber was also observed in the northern portion of the platform.

Feature A is in good condition and offers excellent excavation potential.

**Feature B** is a roughly rectangular terrace located approximately 10.0 m. (32.8 ft.) *makai* (west) of feature A. It is situated on steeply sloped grasslands *makai* (west) of a level plateau. It measures 10.0 m. (32.8 ft.) E/W by 6.0 m. (19.8 ft.) N/S and has a maximum height of 2.0 m. (6.6 ft.). The *mauka* (east) edge is flush with the slope. It is constructed with medium to small boulders and has a level cobble pavement. Intact facing remains on the northwest corner of the platform.

No artifacts or midden were observed at Feature B.

Feature B is in good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16396 **CSH Site #:** 43
**Site Type:** Modified Outcrop
**Function:** Temporary habitation
**Features (#):** 3
**Site Dimension:** 91.9 m.$^2$ (123.9 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 230 ft. a.m.s.l.

**Description:** State site -16396 is a modified outcrop situated atop a pahoehoe outcrop located immediately *makai* (west) of a bulldozed road.

The modification is defined by a mound and an attached L-shaped enclosure, both of which incorporate outcrop into their construction. Overall the modified outcrop measures approximately 16.0 m. (52.8 ft.) N/S by 6.0 m. (19.8 ft.) E/W.

Interior of the L-shape enclosure measures approximately 5.0 m. (16.4 ft.) N/S by 3.5 m. (11.5 ft.) E/W; its walls are approximately 1.0 m. (3.3 ft.) wide by 0.5 m. (1.6 ft.) high. The interior of the enclosure consists of outcrop.

The mound measures 7.7 m. (25.4 ft.) N/S by 5.5 m. (18.5 ft.) E/W. The mound is located directly to the south of the L-shaped with the northern portion (of the mound) directly abutting the L-shaped.

Both modified outcrop features are constructed with loosely piled small to large boulders.

No artifacts or midden were observed at the site.

State site -16396 is in fair condition and offers poor to fair excavation potential.

(*Mauka* (east) of the bulldozed road are two mounded platforms which could be associated with State site -16396. However, this association is difficult to discern because the platforms have been extensively altered by construction of the road.)

**State Site #:** 50-10-37-16397 **CSH Site #:** 44
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 51.0 m.$^2$ (550.8 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 205 ft. a.m.s.l.

**Description:** State site -16397 is a rectangular terrace constructed against moderately sloped terrain. Vegetation consists of grass and scattered *kiawe* trees.

The terrace measures 8.5 m. (27.9 ft.) N/S by 6.0 m. (19.8 ft.) E/W and is divided into two sections. The *mauka* (east) section is a pavement measuring 3.3 m. (10.8 ft.) E/W long by 8.5 m. (27.9 ft.) N/S wide. It is constructed with small boulders and cobbles with a level cobble pavement. The *mauka* (east) edge of the pavement is flush with the terrain. The *makai* (west) section is very tumble and down and sloping. It measures 3.6 m. (11.8 ft.) E/W long by 8.5 m. (27.9 ft.) wide. The terrace has a maximum height of 2.5 m. (8.2 ft.) along the west (*makai*) edge.

No artifacts or midden were observed at the site.

State site -16396 is in good condition and offers good excavation potential.

**State Site #:** 50-10-37-16398 **CSH Site #:** 45
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 49.5 m.$^2$ (534.6 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 230 ft. a.m.s.l.

**Description:** State site -16398 is a platform situated on a grassy, gentle slope, surrounded by *koa haole* and *kiawe* trees.

The platform measures 9.0 m. (29.5 ft.) N/S by 5.5 m. (18 ft.) E/W, and has an approximate height of 0.8 m. (2.6 ft.). It is constructed with medium sized boulders to large cobbles. Its surface is roughly level with remnant facing present along its *makai* (west) edge.

One water-rounded stone was observed on the platform.

State site -16398 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16399 **CSH Site #:** 46
**Site Type:** Site complex
**Function:** Probable burial
**Features (#):** 2
**Site Dimension:** 273.0 m.$^2$ (2,948.4 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 230 ft. a.m.s.l.

**Description:** State site -16399 is a site complex consisting of two platforms designated Features A and B. The site is situated in grassy pasture which slopes moderately *makai*



(west).

**Feature A** is a rectangular platform measuring 14.0 m. (45.9 ft.) E/W by 11.0 m. (36.1 ft.) N/S; it has an average height of 0.5 m. (1.6 ft.). The platform surface is relatively level and paved with small to medium cobbles. An area of the platform around its *makai* (west) side is mostly mounded. The platform is faced with large boulders along its *makai* (west) edge, where a maximum height of 1.0 m. (3.3 ft.) is achieved.

**Feature B** comprises a mound and an attached pavement located 5.5 m. (18 ft.) *makai* (west) of Feature A. The mound measures 8.0 m. (26.2 ft.) E/W by 5.5 m. (18.0 ft.) N/S with an approximate height of 0.5 m. (1.6 ft.). It is constructed of small to medium sized cobbles. The pavement is attached to the *makai* (west) side of the mound. It measures 6.0 m. (19.8 ft.) E/W by 5.5 m. (18 ft.) and is situated on a level break in the slope. It is constructed of medium sized cobbles.

Water-rounded stones were observed on the surfaces of both Feature A and B.

State site -16399 is in fair to poor condition.

**State Site #:** 50-10-37-16400 **CSH Site #:** 47
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 120.8 m.$^2$ (1,304.1 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 190 ft. a.m.s.l.

**Description:** State site -16400 is a circular enclosure located approximately 20.0 m. (65.6 ft.) east of State site -16387. The site is surrounded by tall California grass, *koa haole*, and scattered *kiawe*.

The enclosure exterior measures 11.5 m. (37.7 ft.) N/S by 10.5 m. (34.4 ft.) E/W; its walls have a maximum height of 0.6 m. (2.0 ft.). The walls are constructed with medium boulders and cobbles with facing preserved along its *makai* (west) side.

The interior of the enclosure consists of a soil deposit with scattered cobbles. It measures 4.5 m. (14.8 ft.) N/S by 5.0 m. (16.4 ft.) E/W; the walls have a maximum interior height of 0.3 m. (1.0 ft.).

No artifacts or midden were observed at the site.

State site -16400 is in poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16401 **CSH Site #:** 48
**Site Type:** C-shape
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 23.4 m.$^2$ (252.7 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 2
**Elevation:** 240 ft. a.m.s.l.

**Description:** State site -16401 is a large, roughly C-shaped enclosure. The site is located within close proximity to other agricultural features.

The enclosure measures 5.2 m. (17.1 ft.) N/S by 4.5 m. (14.8 ft.) E/W, with a maximum wall width of 1.5 m.(4.9 ft.). The wall is constructed of piled boulders and cobbles rising a maximum 0.5 m. (1.6 ft.) high.

No artifacts or midden were observed at the site.

State site -16401 is in poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16402 **CSH Site #:** 49
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** Undetermined
***Ahupua'a*:** Ilikahi
**Elevation:** 260 ft. a.m.s.l.

**Description:** State site -16402 consists of three terraces - designated Features A to C - located on a steep slope and surrounded by other terraces and mounds. The terraces are aligned in a *mauka/makai* (east/west) direction.

**Feature A** is a rectangular terrace constructed of small boulders and cobbles. It contains an internal alignment of small boulders.

**Feature B**, a terrace located approximately 14.5 m. (47.5 ft.) from Feature A. It measures 9.5 m. (31.2 ft.) N/S by 3.0 m. (9.8 ft.) E/W. It is constructed of small boulders and cobbles.

**Feature C** terrace is located 7.5 m. (24.6 ft.) southeast of feature B. It measures 4.5 m. (14.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W. Its *mauka* (east) portion has a paved cobble surface while its *makai* (west) portion is roughly constructed of cobbles and boulders and slopes moderately *makai* (west).

No artifacts or midden were observed at the site.

State site -16402 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16403 **CSH Site #:** 50
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 42.0 m.$^2$ (453.6 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 270 ft. a.m.s.l.

**Description:** State site -16403 is a rectangular platform located in grassy pasture which slopes gently *makai* (west).

The platform measures 6.0 m. (19.8 ft.) N/S by 7.0 m. (23 ft.) E/W and has a maximum



height of 0.5 m. (1.6 ft.). It is constructed with large cobbles to medium size boulders and has a roughly level surface. No obvious facing remains.

No artifacts or midden were observed.

State site -16403 is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16404 **CSH Site #:** 51
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 19.4 m.$^2$ (209.0 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 645 ft. a.m.s.l.

**Description:** State site -16404 is a mounded terrace attached to the edge of a pahoehoe outcrop. Outcrop and scattered boulders and cobbles surround the site, which is situated under a canopy of *koa haole* and *kiawe*. A Paul H. Rosendahl Inc. site tag labelled site 3 87-40(5?), was observed on the terrace.

The terrace measures 4.3 m. (14.1 ft.) N/S by 4.5 m. (14.8 ft.) E/W and it has a maximum height of 0.3 m. (1.0 ft.). It is constructed of mounded boulders and cobbles with a roughly level paved surface. The surrounding outcrop has a maximum height of 0.2 m. (0.7 ft.).

No artifacts or midden were observed.

State site -16404 is in fair to poor condition and it offers poor excavation potential.

**State Site #:** 50-10-37-16405 **CSH Site #:** 52
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 28.0 m.$^2$ (302.4 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 635 ft. a.m.s.l.

**Description:** State site -16405 is a roughly rectangular, multi-level platform situated on a level break in a moderate slope. The site densely covered with California grass.

The platform has two levels. The upper level measures 5.0 m. (16.5 ft.) E/W by 4.0 m. (13.2 ft.) N/S; its west face is collapsed. The lower level measures 2.0 m. (6.6 ft.) E/W by 4.0 m. (13.2 ft.) N/S. The height of the platform is approximately 0.8 m. (2.6 ft.). The platform is constructed with small to medium sized cobbles and boulders and its surface is level and cobble paved.

No artifacts or midden were observed.

State site -16405 is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16406 **CSH Site #:** 53
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 4
**Site Dimension:** 1,840.0 m.$^2$ (19,872.0 ft.$^2$)
***Ahupua'a:*** Ilikahi
**Elevation:** 630 ft. a.m.s.l.

**Description:** State site -16406 is a habitation complex comprising three platforms, and an enclosing wall. The complex is situated on a gentle slope. A grass-covered soil area is present within the site's enclosing wall.

**Feature A** is a rectangular platform centrally situated within the site's enclosing wall. It measures 9.0 m. (29.5 ft.) N/S by 6.0 m. (19.8 ft.) E/W and it has a maximum height of 1.5 m. (4.9 ft.). It is constructed with small to medium boulders with a level, paved surface and exterior boulder facing. Two 1.0 m. (3.3 ft.) square depressions are present in the *makai* (west) portion of the platform; these depressions may be the result of previous excavations.

No artifacts or midden were observed at the site.

Feature A is in fair to good condition and is considered to be a permanent habitation feature.

**Feature B** is a rectangular platform located immediately adjacent to the site's outer wall. It measures 10.0 m. (32.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 0.6 m. (2.0 ft.). It is constructed of small to medium sized boulders with intact facing, and has a level pavement of cobbles.

One polished basalt flake was observed on the platform's southeast corner.

The platform is in fair to good condition and is considered to be a permanent habitation feature.

**Feature C** is a platform located 7.0 m. (23.0 ft.) east of Feature A. It measures 2.5 m. (8.2 ft.) N/S by 3.0 m. (9.8 ft.) E/W and it has a maximum height of 0.4 m. (1.3 ft.). It is constructed with medium boulder facing and has a roughly level, small to medium cobble pavement.

No artifacts or midden were observed.

Feature C is in fair to good condition and is interpreted as a possible burial platform.

**Feature D** is the wall which encloses the site complex. It measures approximately 71.0 m. (232.9 ft.) E/W by 38.0 m. (124.6 ft.) N/S and it averages in height from 0.7 m. (2.3 ft.) to 1.0 m. (3.3 ft.). The wall is constructed of a small to large boulder facing with a cobble core fill. The wall is collapsed in a few places along the north wall, but is in good condition overall.

No artifacts or midden were observed.

Feature D offers fair to poor excavation potential and is considered to be a permanent habitation feature.



**State Site #:** 50-10-37-16407 **CSH Site #:** 54
**Site Type:** Terrace
**Function:** Possible burial
**Features (#):** 2
**Site Dimension:** 80.0 m.$^2$ (864.0 ft.$^2$)
***Ahupua'a:*** Ilikahi
**Elevation:** 620 ft. a.m.s.l.

**Description:** State site -16407 comprises a multi-level terrace and an adjacent modified outcrop located on a steep slope surrounded by California grass and covered with vines.

The terrace measures 7.5 m. (24.6 ft.) N/S by 5.0 m. (16.4 ft.) E/W and it has a maximum height of 1.3 m. (4.3 ft.) on its *makai* (west) side. The terrace contains two levels.

The terrace's *mauka* (east) level measures 3.2 m. (10.5 ft.) E/W. It is constructed with a roughly level, boulder and cobble pavement. The *makai* (west) level measures 1.7 m. (5.6 ft.) E/W and is constructed with a level boulder pavement.

Approximately 4.0 m. (13.1 ft.) *mauka* (east) of the terrace is a mound or discontinuous wall situated on a pahoehoe outcrop. It measures 1.5 m. (4.9 ft.) E/W by 1.0 m. (3.3 ft.) N/S. It is constructed with piled cobbles and boulders.

One coral file was observed on the edge of the large pahoehoe bluff. No other artifacts or midden were observed at the site.

State site -16407 is in fair condition and is considered a possible burial site.

**State Site #:** 50-10-37-16408 **CSH Site #:** 55
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 6
**Site Dimension:** 1350 m.$^2$ (14,580 ft.$^2$)
***Ahupua'a:*** Ilikahi
**Elevation:** 580 ft. a.m.s.l.

**Description:** State site -16408 consists of an enclosure, a linear mound, and several circular mounds located on a gentle slope surrounded by tall grass and intermittent pahoehoe outcrops. The circular mounds range from 2.0 m. (6.6 ft.) in diameter with a height of 0.6 m. (2.0 ft.) to 5.0 m. (16.4 ft.) in diameter with a height of 2.5 m. (8.2 ft.). They are constructed of piled cobbles and boulders. The linear mound is L-shaped, measuring 8.0 m. (26.2 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a height of approximately 1.5 m. (4.9 ft.). It is constructed with piled and stacked boulders and cobbles.

No artifacts or midden were observed.

The mounds offer poor excavation potential.

The central feature in the site is an enclosure located *makai* (west) of the mounds. It is situated on the *makai* (west) edge of a pahoehoe bluff. It measures 13.0 m. (42.6 ft.) E/W by 8.0 m. (26.2 ft.) N/S with a maximum height of 1.5 m. (4.9 ft.). The bluff drops off another 1.8 m. (5.9 ft.) right below the west wall of the enclosure. The enclosure wall measures approximately 2.0 m. (6.6 ft.) wide. It is constructed of stacked and faced medium to large sized boulders. The entire east wall has collapsed. The interior consists of a grassy soil deposit with scattered cobbles and boulders. The soil level is raised on the interior giving the walls a maximum interior height of 0.7 m. (2.3 ft.) along its *makai* (west) edge. A soil surface

abuts the exterior of the enclosure wall's *mauka* (east) side.

No artifacts or midden were observed.

The enclosure is in good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16409 **CSH Site #:** 56
**Site Type:** C-Shape remnant
**Function:** Indeterminate
**Features (#):** 1
**Site Dimension:** 50.0 m.$^2$ (540.0 ft.$^2$)
***Ahupua'a:*** Ilikahi
**Elevation:** 510 ft. a.m.s.l.

**Description:** State site -16409 is a remnant C-shaped enclosure and an adjacent agricultural clearing mound located on a gentle slope consisting of grassy soil with intermittent pahoehoe outcrops.

The C-shape measures 3.0 m. (9.8 ft.) N/S by 2.5 m. (8.2 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). It is constructed with medium to large cobbles and small boulders and is in poor condition.

The clearing mound is located 5.0 m. (16.4 ft.) to the east of the enclosure. It measures 8.0 m. (26.2 ft.) N/S by 5.0 m. (16.4 ft.) E/W and has an approximate height of 1.0 m. (3.3 ft.). It has a similar construction as the C-shape and is also in poor condition.

No artifacts or midden were observed.

State site -16409 offers poor excavation potential.

**State Site #:** 50-10-37-16410 **CSH Site #:** 57
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 2
**Site Dimension:** 79.8 m.$^2$ (861.3 ft.$^2$)
***Ahupua'a:*** Ilikahi
**Elevation:** 470 ft. a.m.s.l.

**Description:** State site -16410 comprises an agricultural terrace and platform designated Features A and B, respectively. The site is located on a gentle slope descending *makai* (west). It is surrounded by grasses, *koa haole*, and *kiawe* trees.

**Feature A** is a terrace which measures 13.5 m. (44.3 ft.) NW/SE by 5.0 m. (16.4 ft.) NE/SW and it has an approximate height of 0.8 m. (2.6 ft.). It is constructed with medium cobbles to medium boulders and has a sloped surface.

No artifacts or midden were observed.

The terrace is in fair to poor condition and offers poor excavation potential.

**Feature B** is a platform which measures 3.5 m. (11.5 ft.) in diameter with a maximum height of 1.0 m. (3.3 ft.). It is constructed with boulders and has some cobble fill on



its surface. Remnant facing exists along its east side.

No artifacts or midden were observed.

The platform is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16411 **CSH Site #:** 58
**Site Type:** Enclosure
**Function:** Animal pen
**Features (#):** 1
**Site Dimension:** 60 m.$^2$ (648 ft.$^2$)
***Ahupua'a:*** Ilikahi
**Elevation:** 445 ft. a.m.s.l.

**Description:** State site -16411 is an oval-shaped enclosure located along the edge of a steep slope.

The enclosure interior measures 6.0 m. (19.8 ft.) N/S by 6.0 m. (19.8 ft.) E/W, with a maximum wall height of 0.8 m. (2.6 ft.). The enclosure wall is constructed with large cobbles to small boulders and is well faced on its *makai* (west) side.

No artifacts or midden were observed at the site.

State site -16411 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16412 **CSH Site #:** 59
**Site Type:** Platform
**Function:** Probable burial
**Features (#):** 1
**Site Dimension:** 18.0 m.$^2$ (194.4 ft.$^2$)
***Ahupua'a:*** Ilikahi
**Elevation:** 230 ft. a.m.s.l.

**Description:** State site -16412 is a rectangular platform located on gently sloping terrain surrounded by California grass.

The platform measures 4.5 m. (14.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W and has a maximum height of 1.0 m. (3.3 ft.). It is constructed with small to large cobbles and some boulders with a level surface pavement of pebbles and small cobbles. Upright boulders are incorporated into its north and west sides.

An historic tin can lid was observed on the platform surface.

State site -16412 is in good condition.

**State Site #:** 50-10-37-16413 **CSH Site #:** 60
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 64 m.$^2$ (691.2 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 325 ft. a.m.s.l.

**Description:** State site -16413 is a rectangular enclosure constructed into a steep slope just above a large level landing.

The enclosure measures approximately 8.0 m. (26.2 ft.) in diameter. The walls measure approximately 0.7 m. (2.3 ft.) wide. The *mauka* (east) side of the enclosure is flush with the slope surface and has an internal height of 0.5 m. (1.6 ft.). The enclosure wall is constructed of small to large cobbles. The interior of the enclosure contains ample soil with scattered cobbles.

No artifacts or midden were observed at the site.

State site -16413 is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16414 **CSH Site #:** 61
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** 1,400.0 m.$^2$ (15,120.0 ft.$^2$)
**Ahupua'a:** Kanakau
**Elevation:** 685 ft. a.m.s.l.

**Description:** State site -16414 is a site complex comprising three features designated A through C. The site is situated on a gently sloping terrain covered with grasses and scattered monkeypod trees. There are numerous mounds and agricultural features located in the surrounding area.

**Feature A** is a remnant enclosure partially intact as an L-shaped structure. The enclosure's long axis measures 10.0 m. (32.8 ft.) NE/SW and its short axis is 4.0 m. (13.2 ft.) SE/NW. Its southeast and southwest sides are completely collapsed. A partition wall remnant extends 2.0 m. (6.6 ft.) to the southeast of its long axis wall. The wall is constructed of stacked cobbles and boulders; it is faced to a maximum height of 1.0 m. (3.3 ft.) on the exterior of its northwest wall. It is constructed of medium to small boulders and cobbles.

No artifacts or midden were observed.

Feature A is in fair to remnant condition and offers fair to poor excavation potential.

**Feature B** is a terrace constructed against the south edge of a pahoehoe outcrop. It measures 5.0 m. (16.4 ft.) E/W by 3.5 m. (11.5 ft.) N/S and is faced to a maximum height of 0.6 m. (2.0 ft.). It is constructed with small boulders and has a cobble pavement.

No artifacts or midden was observed.

Feature B is in good condition and it offers fair to good excavation potential.

**Feature C** is a discontinuous wall segment situated at the southeast edge of the site complex. It measures 9.0 m. (29.5 ft.) NE/SW and has a maximum width of 4.0 m. (13.1 ft.).



It is constructed of piled boulders with no visible facing.

No artifacts or midden were observed.

Feature C is in fair condition and offers poor condition.

**State Site #:** 50-10-37-16415 **CSH Site #:** 62
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 70.0 m.$^2$ (756.0 ft.$^2$)
**Ahupua'a:** Kanakau
**Elevation:** 700 ft. a.m.s.l.

**Description:** State site -16415 is a site complex with two features designated A and B. The site is situated on a fairly level break in the slope and surrounded by grasses, scattered Monkeypod trees and several papaya trees.

**Feature A** is an enclosure that measures 5.5 m. (18.0 ft.) N/S by 6.0 m. (19.8 ft.) E/W. It is constructed of stacked and piled boulders with cobble fill. Intact facing exists on the east wall. It measures 1.4 m. (4.6 ft.) above the surrounding terrain. The north wall has collapsed.

No artifacts or midden were observed.

Feature A is in fair condition and offers fair excavation potential.

**Feature B** is a U-shaped wall segment that measures 3.0 m. (9.8 ft.) NE/SW by 2.5 m. (8.2 ft.) NW/SE with a maximum height of 1.0 m (3.3 ft.). It is constructed of piled boulders and cobbles. The enclosure is open to the northwest. There is a depression in the center of the enclosed area. It measures 0.6 m. (2.0 ft.) in diameter by 0.4 m. (1.3 ft.) deep.

No artifacts or midden were observed.

Feature B is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16416 **CSH Site #:** 63
**Site Type:** Modified outcrop
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 70.0 m.$^2$ (756.0 ft.$^2$)
**Ahupua'a:** Kanakau
**Elevation:** 570 ft. a.m.s.l.

**Description:** State site -16416 is a level, modified outcrop located on a break in the slope and surrounded by a well-grazed, grassy soil area; vegetation includes *kiawe*, and *koa haole*.

The modification measures 10.0 m. (32.8 ft.) N/S by 7.0 m. (23.0 ft.) E/W and has a maximum height of 1.0 m. (3.3 ft.). The outcrop is modified with large cobbles creating a roughly level, rectangular surface. The site marker is located in its southeast corner.

No midden or artifacts were observed at the site.

State site -16416 is in fair condition and offers poor excavation potential.

**State Site #:** 50-10-37-16417 **CSH Site #:** 64
**Site Type:** Modified outcrop
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 27.0 m.$^2$ (291.6 ft.$^2$)
***Ahupua'a:*** Kanakau
**Elevation:** 570 ft. a.m.s.l.

**Description:** State site -16417 is a modified outcrop situated on a gentle slope, surrounded by tall California grass and *koa haole*.

The modifications consist of an enclosed area measuring 6.0 m. (19.8 ft.) N/S by 4.5 m. (14.8 ft.) E/W. The facing along the west side measures 0.8 m. (2.6 ft.) in height. The interior consists of the outcrop surface. A wall located immediately to the south of the modification appears to be a historic cattle wall whose length is unknown. It has a maximum height of 0.9 m. (3.0 ft.). Both the modification and cattle wall are constructed of pahoehoe boulders and cobbles.

No artifacts or midden were observed.

State site -16417 is in fair to poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16418 **CSH Site #:** 65
**Site Type:** Enclosure remnant
**Function:** Indeterminate
**Features (#):** 1
**Site Dimension:** 45.0 m.$^2$ (486.0 ft.$^2$)
***Ahupua'a:*** Kanakau
**Elevation:** 570 ft. a.m.s.l.

**Description:** State site -16418 is a remnant enclosure located near State site -16419 on the same break in the slope. It is situated approximately 30.5 ft. *mauka* (east) of a historic cattle wall (State site -16797).

The enclosure exterior measures 7.5 m. (24.6 ft.) E/W by 6.0 m. (19.8 ft.) N/S and its interior measures 5.5 m. (18 ft.) E/W by 3.0 m. (9.8 ft) N/S. Its wall ranges in height from 0.5 m. (1.6 ft.) to 1.5 m. (4.9 ft.). It is constructed of stacked pahoehoe boulders with some cobble fill. Intact facing exists along the south wall. The entire west wall has collapsed.

No artifacts or midden were observed at the site.

State site -16418 is in fair to poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16419 **CSH Site #:** 66
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 12.5 m.$^2$ (135 ft.$^2$)
***Ahupua'a:*** Kanakau
**Elevation:** 580 ft. a.m.s.l.

**Description:** State site -16419 is a rectangular platform situated on a fairly level break in



the slope and covered with *koa haole* and California grass. It is located approximately 30.0 m. (98.4 ft.) *makai* (west) of State site -16417 and 10.0 m. (32.8 ft.) north of the State site -16417 wall. Numerous other historic cattle walls and agricultural clearing mounds surround the platform.

The platform measures 5.0 m. (16.4 ft.) N/S by 2.5 m. (8.2 ft.) E/W with a maximum height of 0.6 m. (2.0 ft.). It is constructed with pahoehoe boulders and has a level boulder pavement. Much of the facing has collapsed.

No artifacts or midden were observed.

State site -16419 is in fair condition and offers fair to good excavation potential.

**State Site #:** 50-10-37-16420 **CSH Site #:** 67
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 112.0 m.$^2$ (1,209.6 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 525 ft. a.m.s.l.

**Description:** State site -16420 is a rectangular C-shaped enclosure situated on a moderate slope surrounded by tall California grass and *koa haole*. A small kukui-nut tree is present within the enclosure.

The enclosure measures 14.0 m. (46.0 ft.) E/W by 8.0 m. (26.2 ft.) N/S and has a maximum height of 0.75 m. (2.5 ft.) in its northwest corner. The *mauka* (east) edge of the enclosure is constructed flush with the slope. The walls are constructed with stacked boulders - much of which has collapsed. The interior consists of a shallow soil deposit and pahoehoe outcrop.

There are several agricultural terraces and a mound located approximately 8.0 m. (26.2 ft.) *mauka* (east) of the enclosure. The terraces measure approximately 3.0 m. (9.8 ft.) N/S. The mound measures 2.0 m. (6.6 ft.) in diameter with a maximum height of 1.5 m. (4.9 ft.). These features are associated with State site -16420 by proximity.

No artifacts or midden were observed at the site.

State site -16420 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16421 **CSH Site #:** 68
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 68.0 m.$^2$ (734.4 ft.$^2$)
***Ahupua'a:*** Kanakau
**Elevation:** 525 ft. a.m.s.l.

**Description:** State site -16421 is a terrace located on a gentle slope and surrounded by *koa haole* and *kiawe* trees.

It measures 8.5 m. (27.9 ft.) N/S by 8.0 m. (26.2 ft.) E/W and has a maximum height of 1.0 m. (3.3 ft.) along its *makai* (west) edge. The *mauka* (east) edge of the terrace is

constructed flush with the slope. It is constructed with medium boulders and cobbles. Remnant facing exists along the north and west walls.

No artifacts or midden were observed.

State site -16421 is in fair condition and offers poor excavation potential.

**State Site #:** 50-10-37-16422 **CSH Site #:** 69
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a*:** Kalukalu
**Elevation:** 400 ft. a.m.s.l.

**Description:** State site -16422 is a site complex consisting of three platforms and a pavement with a stone-lined depression designated Features A through D. The site is situated on a large, grassy, level break in the slope. The surrounding terrain consists of *kiawe*, *koa haole*, and California grass.

**Feature A** is a rectangular platform measuring 5.5 m. (18 ft.) N/S by 6.5 m. (21.3 ft.) E/W, with a maximum height of 1.0 m. (3.3 ft.). It is constructed of large cobbles and small boulders with no intact facing present. Its surface is fairly mounded and contains a depression at its center. A site marker is located in the southwest corner of Feature A.

No artifacts or midden were observed at Feature A.

Feature A is in fair to poor condition but offers good excavation potential.

**Feature B** is a platform located 8.0 m. (26.2 ft.) *makai* (west) of Feature A. It measures 5.5 m. (18 ft.) N/S by 4.5 m. (14.8 ft.) E/W and has a maximum height of 0.5 m. (1.6 ft.) on its east side. It is constructed of small to medium boulders and cobbles. The *makai* (west) side of the platform contains some intact facing. A cowrie shell (Acc.# 57) (*Cypraea* sp.) - with drilled holes at each end - was collected from the west face of the platform. This artifact is interpreted as an octopus lure. Numerous coral pieces - including a coral abrader (Acc.# 56) (collected) were also observed along the surface of the platform.

Feature B is in good condition and offers excellent excavation potential.

**Feature C** is a roughly L-shaped platform located just *mauka* (east) of Feature A. It measures 7.5 m. (24.6 ft.) N/S by 4.5 m. (14.8 ft.) E/W. The platform has a maximum height of 0.8 m. (2.6 ft.) along its *makai* (west) side. It is constructed with boulder facing and surface pavement of cobbles and small boulders.

A water-rounded cobble was observed at the center of the platform.

Feature C is in good condition and offers good excavation potential.

(There is a historic pig pen located 10.0 m. (32.8 ft.) northeast of feature C. It measures 3.8 m. (12.5 ft.) N/S by 4.4 m. (14.4 ft.) E/W. It is constructed with grade wood and it has no apparent entrance. A tag labelled with the number 121 is present on the structure.)

**Feature D** is an oval pavement with a boulder lined depression in its northern section. The feature is located 45.0 m. (147.6 ft.) west of feature C. The pavement measures 7.0 m. (23.0 ft.) N/S by 6.0 m. (19.8 ft.) E/W and is constructed with cobbles and small



boulders placed along a level outcrop surface. The depression measures 2.0 m. (6.6 ft.) N/S by 1.2 m. (3.9 ft.) E/W with a maximum depth of 0.9 m. (3.0 ft.). It is faced with boulders.

An iron strap was observed on the pavement.

Feature D of State site -16422 is interpreted as a possible *lua* (latrine). It is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16423 **CSH Site #:** 70
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 25 m.$^2$ (270 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 325 ft. a.m.s.l.

**Description:** State site -16423 is a two-tiered platform situated on a gentle slope surrounded by *koa haole* and scattered *kiawe* trees. An historic cattle wall measuring 2.0 m. (6.6 ft.) high is located approximately 3.0 m. (9.8 ft.) north of the site. Agricultural mounds were observed approximately 5.0 m. (16.4 ft.) southwest of the site.

The platform is divided into two areas *mauka* (east) and *makai* (west) by a two-tiered construction.

The *mauka* (east) tier of the platform has a paved area measuring 2.6 m. (8.5 ft.) N/S by 2.3 m. (7.5 ft.) E/W. Beyond the pavement the platform exhibits a sloped surface approximately 2.4 m. (7.9 ft.) to the north.

The *makai* (west) tier of the platform is located 0.6 m. (2.0 ft.) below the *mauka* (east) tier and it measures 6.0 m. (19.6 ft.) N/S by 4.0 m. (13.1 ft.) E/W. Its *makai* (west) edge measures 0.4 m. (1.4 ft.) in height.

Overall, the platform is roughly constructed of small boulders to large cobbles of which no vertical facing remaining.

No artifacts or midden were observed at the site.

State site -16423 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16424 **CSH Site #:** 71
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 4
**Site Dimension:** 128.5 m.$^2$ (1,387.8 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 370 ft. a.m.s.l.

**Description:** State site -16424 consists of three platforms and a terrace, designated features A through D. The site is situated on a fairly level break in slope and surrounded by California grass, *koa haole*, and *kiawe* trees.

**Feature A** platform is centrally-located within the site complex, and it lies approximately 8.0 m. (26.2 ft.) south of State site -16422B.

Feature A platform measures 4.0 m. (16.4 ft.) in diameter with an approximate height

of 1.0 m. (3.3 ft.). It is constructed with boulder facing and has a level, small cobble to small boulder pavement.

Feature A is in good condition and offers good excavation potential.

**Feature B** is a rectangular platform located approximately 8.0 m. (26.2 ft.) southwest of feature A. It measures 3.9 m. (12.8 ft.) N/S by 3.1 m. (10.2 ft.) E/W with a maximum height of 1.3 m. (4.3 ft.) on its *makai* (west) side. It is constructed of a small to large boulder and cobble pavement. Intact facing is preserved long the platform's *makai* (west) edge.

Feature B is in good condition and offers fair to good excavation potential.

**Feature C** is a rectangular platform measuring 6.0 m. (19.8 ft.) N/S by 3.0 m. (10.0 ft.). It is constructed of cobbles and boulders; its surface is paved with a pebble-cobble-boulder mix.

[A pig tusk was collected from an unrecorded terrace located approximately 12.0 m. (39.6 ft.) east of Feature C (Artifact #58)]

**Feature D** is a platform which measures 3.0 m. (10.0 ft.) N/S by 4.3 m. (14.2 ft.) E/W. It is constructed of piled boulders and it exhibits a rough surface rising a maximum 0.6 m. (1.9 ft.) high.

**State Site #:** 50-10-37-16425 **CSH Site #:** 72
**Site Type:** Lava Tube; Petroglyphs
**Function:** Burial; Refuge
**Site Dimension:** 482.5 $m.^2$ (5211 $ft.^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 250 ft. a.m.s.l.

**Description:** State site -16425 (Figure 16) is a lava tube whose sink is located 5.0 m. (16.4 ft.) south of a water trough situated within a corral along a *mauka/makai* (east/west) running cattle wall. The area surrounding the sink consists of pasture land with scattered *kiawe*. The sink contains scattered modern trash dating to as recent as the 1970's.

Two chambers extend *mauka* (east) and *makai* (west) from the main sink area, respectively.

The *mauka* (east) chamber measures 28.0 m. long, extending at an approximate azimuth of 56° true north. In the light zone, the *mauka* (east) chamber has a maximum height of 1.8 m. (5.9 ft.) and a maximum width of 5.0 m. (16.4 ft.). Beyond the light zone, the chamber becomes gradually smaller until access is no longer possible.

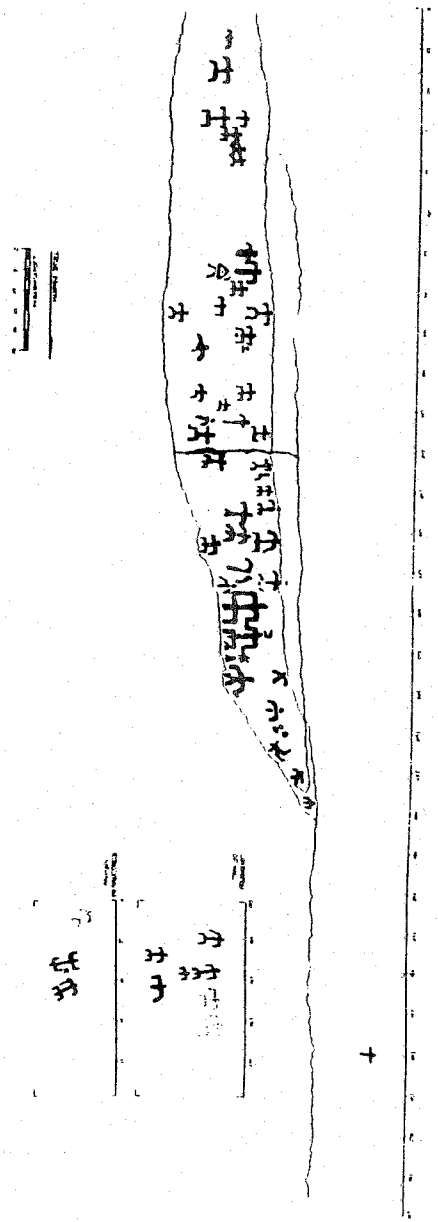
Modifications and cultural material are present throughout the length of the *mauka* (east) chamber. A stacked boulder-cobble wall extends across the width of the chamber approximately 7.0 m. (23 ft.) from the sink area. For a distance of approximately 16.0 m. (52.8 ft.) *mauka* (east) of the constructed wall the chamber floor is cleared and boulders are stacked and piled along the edge of the chamber wall; the chamber floor is eventually covered by rubble with some soil areas exposed. Further exploration approximately 15.0 m. (19.5 ft.) beyond the rubble-covered floor of the chamber was terminated because of a low ceiling height.

Midden including *kukui* nut shells, charcoal, a cowrie (*Cypraea* sp.), and butchered



Figure 16 State site 50-10-37-16425 lava tube petroglyphs: plan view





cattle bone are present in moderate amounts throughout the *mauka* (east) chamber. Artifacts include three water-rounded stone manuport (Art. #63), gourd fragments (Art. #61), and a probable wooden torch fragment (cut at one end) was observed.

The petroglyphs were observed in the light zone. The images have been "pecked" and "bruised" (Cox and Stasack 1970:38) into the smooth cave wall on the northwest side of the sink. There are also several images on the ceiling of the tube. The petroglyphs occur primarily along a 4.0 m. (13.1 ft.) panel of the cave wall. The panel has a maximum thickness of approximately 0.6 m. (2.0 ft.). The images range in size from 0.004 m. (0.013 ft.) in diameter (circular image) to 0.22 m. (0.72 ft.) tall by 0.36 m. (1.2 ft.) long (two connected human figures). Most of the images depict human figures, one of which appears to be a pregnant woman (depicted by a triangle with a dot in the center, two legs, and one arm). There is also a circle, and an image (possibly cryptic) of a semi-circular curve with a dot in line with the center of the curve on either side of it. One of the largest human figures has a crested image atop its head, possibly a helmet. The feet and hands are depicted with fingers and toes, showing more elaborate petroglyph work, possibly representing an important figure. This figure is attached by the hand to another large figure which is not as intricately worked.

Similar to petroglyphs in other areas, these figures probably represent family groupings, possibly related to the burials in the *makai* (west) end of the cave. It would seem that the images depict a family history of the *ohana* (family) whose members were eventually buried there. The small human forms would represent children to the larger forms in the immediate vicinity. The elaborate crested man may show an *ali'i* present in the family.

On the southwest side of the sink is the entrance to the *makai* (west) chamber. The chamber extends 165.0 m. (541.2 ft.) at an approximate azimuth of 274° TN.

The *makai* (west) chamber has an average height of 2.3 m. (7.5 ft.) and an average width of 2.5 m. (8.2 ft.) N/S. The floor consists of pahoehoe bedrock with scattered soil deposits which are located mainly in the rear of the tube. There is a small side chamber located approximately 30.0 m. (98.4 ft.) from the end of the tube. The side chamber has a length of 10.0 m. (32.8 ft.) extending at 292° TN, with a width of approximately 2.0 m. (6.6 ft.). A small pile of stones (ahu) is located in the main tube directly outside the side chamber. It measures approximately 0.4 m. (1.3 ft.). A human skull was observed on the top of the pile along with a large opihi shell.

Human burials were observed at the western end of the *makai* (west) chamber and in the associated side chamber. At the end of the main chamber there are at least three different individuals, evidenced by the presence of three mandibles. One individual is positioned on the floor of the tube in the sediment. The other two individuals are positioned on a large shelf located on the north side of the tube. These remains appear to be undisturbed. In the side chamber, there is evidence of at least seven human burials. Cobbles and boulders have been placed atop the remains. These remains appear to be relatively undisturbed. The makai (west) tube, compared to the mauka (east) tube, has little internal modification. A small wall blocked the entrance to the makai (west) tube. The wall was dismantled, for exploration and mapping, and reconstructed once work was xompleted.



**State Site #:** 50-10-37-16426 **CSH Site #:** 73
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 24 m.$^2$ (259.2 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 250 ft. a.m.s.l.

**Description:** State site -16426 is a two-tiered, mounded platform located approximately 30.5 m. (100 ft.) *makai* (west) of State site -16426.

The upper tier of the platform measures 5.0 m. (16.4 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). The lower tier measures 2.3 m.(7.5 ft.) E/W by 4.0 m. (13.1 ft.) N/S. The platform is constructed of small to medium boulders and large cobbles and has no visible facing.

No artifacts or midden were observed at the site.

State site -16426 is in fair to poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16427 **CSH Site #:** 74
**Site Type:** Modified outcrop
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 204 m.$^2$ (2,203.2 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 265 ft. a.m.s.l.

**Description:** State site -16427 is a modified outcrop located among California grass and scattered *koa haole*.

The outcrop modification is defined by an L-shaped structure constructed of small to medium boulders and a cobble-fill. Its L-shaped axis measures 17.0 m. (55.8 ft.) N/S by 12.0 m. (39.4 ft.) E/W; it has an average height of 0.6 m. (2.0 ft.). The structure has a maximum width of 4.0 m. (13.1 ft.) along its east/west axis. A boulder alignment extends in a north/south direction across its east/west axis.

No artifacts or midden were observed at the site.

State site -16427 is in fair to poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16428 **CSH Site #:** 75
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 92 m.$^2$ (993.6 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 250 ft. a.m.s.l.

**Description:** State site -16428 (Figure 17) is a platform located at the *makai* (west) edge of a large pahoehoe bluff. Vegetation includes California grass, *koa haole*, and scattered *kiawe* trees. The site is located approximately 25.0 m. (82.0 ft.) *makai* (west) of State site -16427.

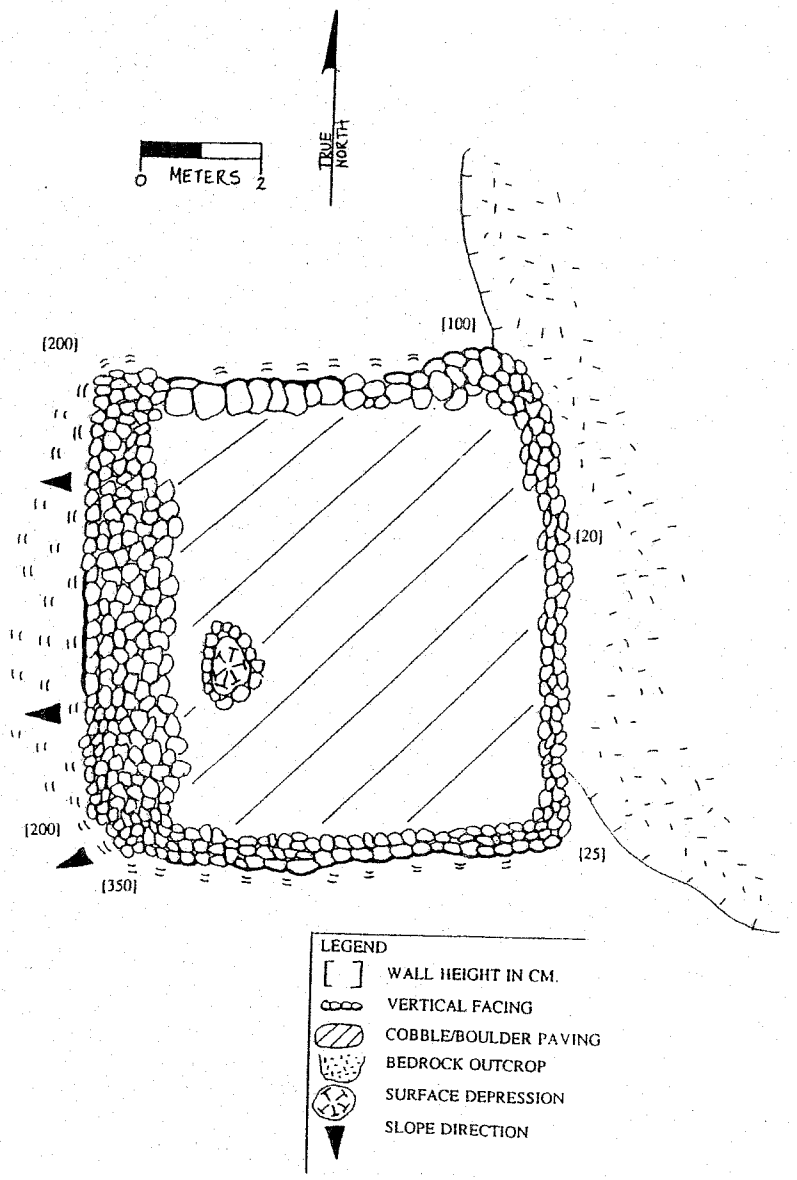



Figure 17 State site 50-10-37-16428; plan view



The platform measures 8.0 m. (26.2 ft.) N/S by 9.0 m. (29.5 ft.) E/W. Its *mauka* (east) face has a height of 0.2 m. (0.7 ft.) where as the *makai* (west) face has a height of approximately 4.0 m. (13.1 ft.). It is constructed of small to large boulders with a cobble-boulder fill. Intermittent facing remains on the north, south, and west sides of the platform. There is a depression near the *makai* (west) edge of the platform measuring 1.5 m. (4.9 ft.) in diameter.

Adjacent to the platform is a linear agricultural mound measuring 10.0 m. (32.8 ft.) N/S by 2.0 m. (6.6 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). Other agricultural mounds are also present *makai* (west) of the site.

State site -16428 is in good condition.

**State Site #:** 50-10-37-16429 **CSH Site #:** 76
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 30 m.$^2$ (98.4 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 230 ft. a.m.s.l.

**Description:** State site -16429 is a two-tiered platform situated on a gentle slope and surrounded by California grass and *koa haole*. The platform is constructed into two tiers.

The *mauka* (east) tier measures 2.6 m. (8.5 ft.) N/S by 2.3 m. (7.5 ft.) E/W. It rises a maximum of 0.6 m. (2.0 ft.) above the *makai* (west) tier of the platform.

The *makai* (west) tier measures 6.0 m. (19.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W with an overall height of 0.4 m. (1.3 ft.). There is a possible boulder alignment located along the west edge of the tier.

Both tiers of the platform are constructed with large cobbles to small boulders with no intact facing remaining.

An agricultural mound is located 1.5 m. (4.9 ft.) SW of the platform.

State site -16429 is in fair to poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16430 **CSH Site #:** 77
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 42.5 m.$^2$ (459 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 200 ft. a.m.s.l.

**Description:** State site -16430 is a rectangular platform situated on a gentle slope.

The platform measures 5.0 m. (16.4 ft.) N/S by 5.5 m. (18 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). It is constructed of large cobbles to small boulders with no visible facing remaining. There is a possible boulder alignment running parallel to the south platform face.

Approximately 15.0 m. (49.2 ft.) to the south of the platform is an agricultural feature measuring 5.0 m. (16.4 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum height of 0.6 m. (2.0 ft.) on the *makai* (west) side. Its *mauka* (east) edge is flush with the slope. No artifacts or midden were observed at the site.

State site -16430 is in fair to poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16431 **CSH Site #:** 78
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 58.5 m.$^2$ (631.8 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 175 ft. a.m.s.l.

**Description:** State site -16431 is a roughly rectangular platform situated amongst California grass and scattered *kiawe*. The site is located 30.0 m. (98.4 ft.) *makai* (west) of State site -16430.

The platform measures 7.5 m. (24.6 ft.) N/S by 6.5 m. (21.3 ft.) E/W and has a maximum height of 0.5 m. (1.6 ft.). It is constructed of small to medium boulders and cobbles and has mounded sides.

There is a north/south running wall crossing the west side of the platform. It measures 9.0 m. (29.5 ft.) N/S and has a maximum height of 0.3 m. (1.0 ft.). It is constructed of one to two courses of stacked and faced boulders.

No artifacts or midden were observed on or around the site.

State site -16431 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16432 **CSH Site #:** 79
**Site Type:** Modified outcrop
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 330.0 m.$^2$ (3564.0 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 100 ft. a.m.s.l.

**Description:** State site -16432 is a modified outcrop situated at the *makai* (west) edge of a pahoehoe outcrop on a gently sloping terrain, approximately 30.0 m. (98.4 ft.) *mauka* (east) of the high cliffs of the coast. Modifications consist of a C-shaped terrace whose main pavement area is located on the north leg. This area measures 15.0 m. (49.2 ft.) E/W by 7.0 m. (23.0 ft.) N/S. Four meters (13.1 ft.) from the *makai* (west) edge of the main area, the pavement extends to the south along the outcrop for 13.0 m. (42.6 ft.) with a width measuring 3.0 m. (9.8 ft.) E/W. The south leg of the terrace measures 6.0 m. (19.8 ft.) E/W by 3.0 m. (9.8 ft.) N/S. The *mauka* (east) terrace edge is flush with the outcrop surface. The *makai* (west) edge has a maximum height of 1.7 m. (5.6 ft.). The terrace is constructed of stacked boulders and cobbles with a fairly level cobble pavement.

Two water-rounded cobbles, coral, and two cowrie shells were observed on the pavement surface.

State site -16432 is in good condition and offers good excavation potential.



**State Site #:** 50-10-37-16433 **CSH Site #:** 80
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 8.0 m.$^2$ (86.4 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 100 ft. a.m.s.l.

**Description:** State site -16433 is a rectangular platform situated on a gentle slope located approximately 10.0 m. (32.8 ft.) *mauka* (east) of a 27.0 m. (90.0 ft.) high ocean cliff. It measures 3.2 m. (10.5 ft.) N/S by 2.5 m. (8.2 ft.) E/W with a maximum height of 0.4 m. (1.3 ft.) on the *makai* (west) side. It is constructed of well stacked pahoehoe boulders with a cobble pavement. Intact facing is present on three sides, the north side is collapsed.

No artifacts of midden were observed.

State site -16433 is in good condition.

**State Site #:** 50-10-37-16434 **CSH Site #:** 81
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 100.0 m.$^2$ (1080.0 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 50 ft. a.m.s.l.

**Description:** State site -16434 is a multi-level platform situated *mauka* (east) of a coastal cliff. The terrain in a steep sloping area of grass, *kiawe*, and *koa haole*.

The platform is constructed of large to small stacked boulders with cobbles. The upper level of the platform (*mauka*) is paved with cobbles and measures 3.0 m. (9.8 ft.) E/W by 5.0 m. (16.4 ft.) N/S. The lower level (*makai*) is 1.2 m. (3.9 ft.) below the upper level. It measures 3.0 m. (9.8 ft.) E/W by 10.0 m. (32.8 ft.) N/S.

Observable midden includes cowrie, *opihi*, and coral.

State site -16434 is in good condition. Excavation potential is considered excellent.

**State Site #:** 50-10-37-16435 **CSH Site #:** 82
**Site Type:** Platform
**Function:** Probable burial
**Features (#):** 1
**Site Dimension:** 26.0 m.$^2$ (280.8 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 55 ft. a.m.s.l.

**Description:** State site -16435 comprises a level platform situated approximately 5.0 m. (16.4 ft.) from the edge of an ocean cliff. It measures approximately 4.0 m. (13.1 ft.) N/S by 6.5 m. (21.3 ft.) E/W with an average height of 0.5 m. (1.6 ft.). The platform is constructed of

small to large cobbles with intermixed small boulders. The northern side is well faced.

No midden or artifacts were observed.

State site -16435 is in fair to good condition and is interpreted as a probable burial.

**State Site #:** 50-10-37-16436 **CSH Site #:** 83
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 80.8 m.$^2$ (265.0 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 130 ft. a.m.s.l.

**Description:** State site -16436 is a rectangular platform situated on terrain covered with grass, *koa haole*, and *kiawe*. The platform measures 8.0 m. (26.2 ft.) N/S by 9.0 m. (29.5 ft.) E/W with a maximum height of 0.2 m.(0.65 ft.). It is constructed of medium to large cobble with a rough paving sloping *makai* (west). Internally there is a possible post-hole located in the southeast corner of the platform.

No midden or artifacts were observed at the site.

State site -16436 is in fair condition and exhibits fair excavation potential.

**State Site #:** 50-10-37-16437 **CSH Site #:** 84
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 16.0 m.$^2$ (172.8 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 150 ft. a.m.s.l.

**Description:** State site -16437 a platform situated on gently sloped pasture land of grass, *kiawe*, and *koa haole*.

The platform measures approximately 4.0 m. (13.1 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a height of approximately 0.6 m. (2.0 ft.). It is constructed of large stacked cobbles and is roughly paves with cobbles.

A wall extends across the middle surface of the platform in a north/south direction for 1.8 m. (5.9 ft.). It is constructed of two to three courses of small to medium boulders and has a maximum height of 0.7 m. (2.2 ft.).

No artifacts or midden were observed at the site.

State site -16437 has a fair excavation potential.



**State Site #:** 50-10-37-16438 **CSH Site #:** 85
**Site Type:** Site complex
**Function:** Possible *heiau*
**Features (#):** 2
**Site Dimension:** 252.0 m.$^2$ (2721.6 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 218 ft. a.m.s.l.

**Description:** State site -16438 (Figure 18) consists of two platforms designated Features A and B. The site is situated on a moderately sloped grassland with scattered *kiawe* and *koa haole*.

**Feature A** is a rectangular platform which measures approximately 11.0 m. (36.1 ft.) N/S by 8.0 m. (26.2 ft.) E/W, with heights of 2.0 m. (6.6 ft.) on the *makai* (west) side and 0.5 m. (1.6 ft.) on the *mauka* (east) side. The platform is constructed with medium to large boulders with cobbles. Its surface is paved with cobbles and pebbles. There is intact facing on all sides of the platform.

The platform contains internal features including two semi-circular depressions on the northern end of the platform and a cupboard at the center of the platform. The cupboard contains two openings approximately 0.4 m. (1.3 ft.) in diameter; one of the openings is capped with a boulder slab.

Feature A is in good condition and exhibits good excavation potential.

**Feature B** is an irregularly-shaped terrace situated approximately 5.0 m. (16.4 ft.) *makai* (west) of Feature A. It measures approximately 8.0 m.(26.2 ft.) N/S by 8.0 m. (26.2 ft.) E/W with the height on the *makai* (west) side 0.75 m.(2.5 ft.). It is constructed with small to medium boulders and paved on its surface with cobbles. There is facing apparent on the *makai* (west) side of the platform; its *mauka* (east) side is flush with the slope.

One piece of coral was observed on the *makai* (west) side of the platform.

State site -16438 has fair to good excavation potential.

**State Site #:** 50-10-37-16439 **CSH Site #:** 86
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 30.0 m.$^2$ (324.0 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 240 ft. a.m.s.l.

**Description:** State site -16439 is a rectangular platform situated on gently sloped terrain covered by grass, *kiawe*, and *koa haole*.

The platform measures 4.0 m. (13.1 ft.) N/S by 5.5 m.(18.0 ft) E/W with a height of 0.4 m.(1.3 ft.). The platform is constructed of small to medium boulders with a cobble surface pavement.

No artifacts or midden were observed at the site.

State site -16439 is in fair condition and offers fair to good excavation potential.

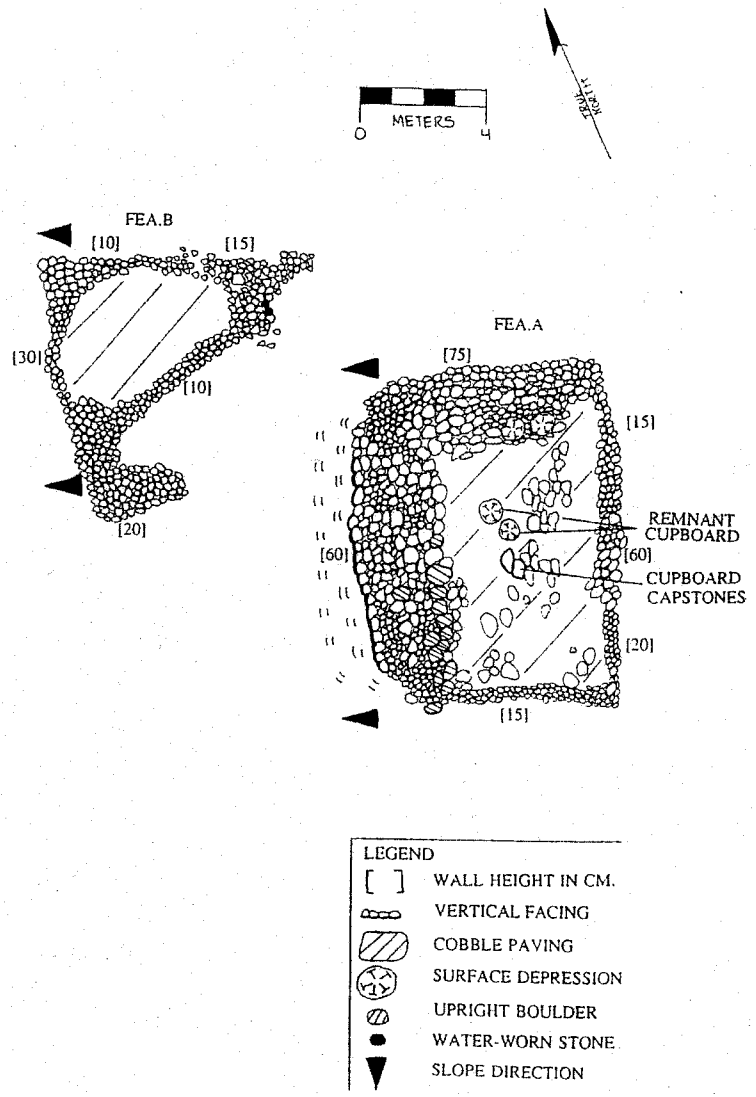



Figure 18 State site 50-10-37-16438; plan view



**State Site #:** 50-10-37-16440 **CSH Site #:** 87
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 24.0 m.$^2$ (259.2 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 250.0 ft. a.m.s.l.

**Description:** State site -16440 is a rectangular platform situated approximately 36.6 m. (120.0 ft.) *makai* (west) of the Great Wall of Kuakini (State site -7276).

The platform measures approximately 4.0 m. (13.1 ft.) E/W by 6.0 m. (19.7 ft.) N/S with a maximum height of 0.25 m. (0.8 ft.). It is constructed of small to medium boulders with a cobble surface pavement. A possible abrader was observed just north of the center of the platform.

State site -16439 is in fair condition and its excavation potential is fair to good.

**State Site #:** 50-10-37-16441 **CSH Site #:** 88
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 60.0 m.$^2$ (648.0 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 235 ft. a.m.s.l.

**Description:** State site -16441 is a roughly rectangular platform situated on a gentle slope. Vegetation includes grass, *kiawe*, and *koa haole*.

The platform measures 6.0 m. (9.7 ft.) E/W by 10.0 m. (32.8 ft.) N/S. It is constructed of small boulders and cobbles. There is a semi-circular 1.0 m. (3.28 ft.) depression in the east central portion of the platform; it measures 0.3 m. (1.0 ft.) in depth.

No midden or artifacts were observed at the site.

State site -16441's excavation potential is considered fair.

**State Site #:** 50-10-37-16442 **CSH Site #:** 89
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 3
**Site Dimension:** 780 m.$^2$ (8424 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 210 ft. a.m.s.l.

**Description:** State site -16442 consists of three features designated A to C. Feature A is considered a possible burial while B and C are considered probable burials. Vegetation includes grass, *kiawe*, and *koa haole*.

**Feature A** is a semi-rectangular platform situated in the *makai* (west) portion of the site complex. It measures 7.5 m. (24.6 ft.) N/S by 5.5 m. (18.0 ft.) with a maximum height of

0.9 m. (3.0 ft.). The platform is constructed of small boulders and cobble, with the *makai* (west) portion being well-faced.

Feature A is in fair condition.

**Feature B** is a semi-circular mound located southeast of Feature A. It measures 5.5 m.(18.0 ft.) N/S by 4.0 m. (13.1 ft.) with a maximum height of 2.5 m.(8.2 ft.). The mound is constructed of small boulders and cobbles. There is a medium-size boulder placed on the top central portion of the mound.

Feature B is in good condition.

**Feature C** is a rectangular platform situated 15.0 m. (49.2 ft.) north of Feature B. It measures 7.0 m. (23.0 ft.) N/S by 3.0 m. (9.8 ft.) with a maximum height of 1.0 m. (3.28 ft.). It is constructed of piled small boulders and cobble. The *makai* (west) portion of the platform is well faced.

No midden or artifacts were observed at State site -16442.

**State Site #:** 50-10-37-16443 **CSH Site #:** 90
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 56 m.$^2$ (604.8 ft.$^2$)
***Ahupua'a*:** Onouli 1
**Elevation:** 190 ft. a.m.s.l.

**Description:** State site -16443 is a rectangular enclosure situated on a moderately level terrain covered with grass, scattered *koa haole*, and *kiawe*.

The enclosure exterior measures 7.0 m. (23.0 ft.) E/W by 8.0 m. (26.2 ft.) N/S and its interior measures 3.7 m. (12.1 ft.) E/W by 4.6 m. (15.1 ft.); maximum wall height is 1.3 m. (4.26 ft.). The enclosure wall is constructed with stacked small boulders and cobble. The interior of the enclosure consists of a soil base with grass.

The *mauka* (east) and *makai* (west) walls are in fair to good condition while the north/south walls are in poor condition.

State site -16443 has fair to good excavation potential.

**State Site #:** 50-10-37-16444 **CSH Site #:** 91
**Site Type:** Platform
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 16.0 m.$^2$ (172.8 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 175 ft. a.m.s.l.

**Description:** State site -16444 is a platform situated on a gently sloping pasture land. The



platform measures 4.0 m. (13.1 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 0.4 m. (1.3 ft.). It is constructed of intermixed small boulders and cobbles.

No midden or artifacts were observed.

State site -16444 is in fair to poor condition. The platform offers fair to poor excavation potential.

**State Site #:** 50-10-37-16445 **CSH Site #:** 92
**Site Type:** Modified outcrop
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 21.0 m.$^2$ (226.8 ft.$^2$)
***Ahupua'a*:** Onouli 1
**Elevation:** 200 ft. a.m.s.l.

**Description:** State site -16445 is a modified outcrop situated on gently sloping grassland with scattered *kiawe* and *koa haole*. Modification consists of an area of rough paving of small boulders and cobbles with pebbles on the surface. There is rough facing along the *makai* (west) side. The area measures 7.0 m. (23.0 ft.) N/S by 3.0 m. (9.8 ft.) E/W. Height along the *mauka* (east) side is 0.2 m. (0.7 ft.); height of the *makai* (west) side is 1.0 m. (3.28 ft.).

No midden or artifacts were observed.

State site -16445 is in fair condition and excavation potential is considered poor.

**State Site #:** 50-10-37-16446 **CSH Site #:** 93
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 135.0 m.$^2$ (1458.0 ft.$^2$)
***Ahupua'a*:** Onouli 1
**Elevation:** 225 ft. a.m.s.l.

**Description:** State site -16446 (Figure 19) consists of two platforms - designated A and B - situated in grassland with scattered *kiawe*.

**Feature A** is an irregularly shaped platform. It measures approximately 8.5 m. (27.9 ft.) N/S by 10.0 m. (32.8 ft.) E/W. Heights range from 0.4 m. (1.3 ft.) along the north and south sides to 0.2 m. (0.7 ft.) and 0.1 m. (0.3 ft.) along the west and east sides respectively. The platform is constructed of medium to small rough, sharp basalt boulders.

A water-rounded stone - which appears to have been deliberately positioned - was observed in the east section of the platform. Also observed were a possible polishing stone and a large flat boulder that was inlaid into the surface of the platform.

**Feature B** is a roughly square platform, situated approximately 8.0 m. (26.2 ft.) south of Feature A, measuring 3.0 m. (9.8 ft.) E/W by 3.5 m. (11.5 ft.) N/S with a maximum height of 0.6 m. (1.9 ft.). It too is constructed of sharp, rough, medium to small boulders.

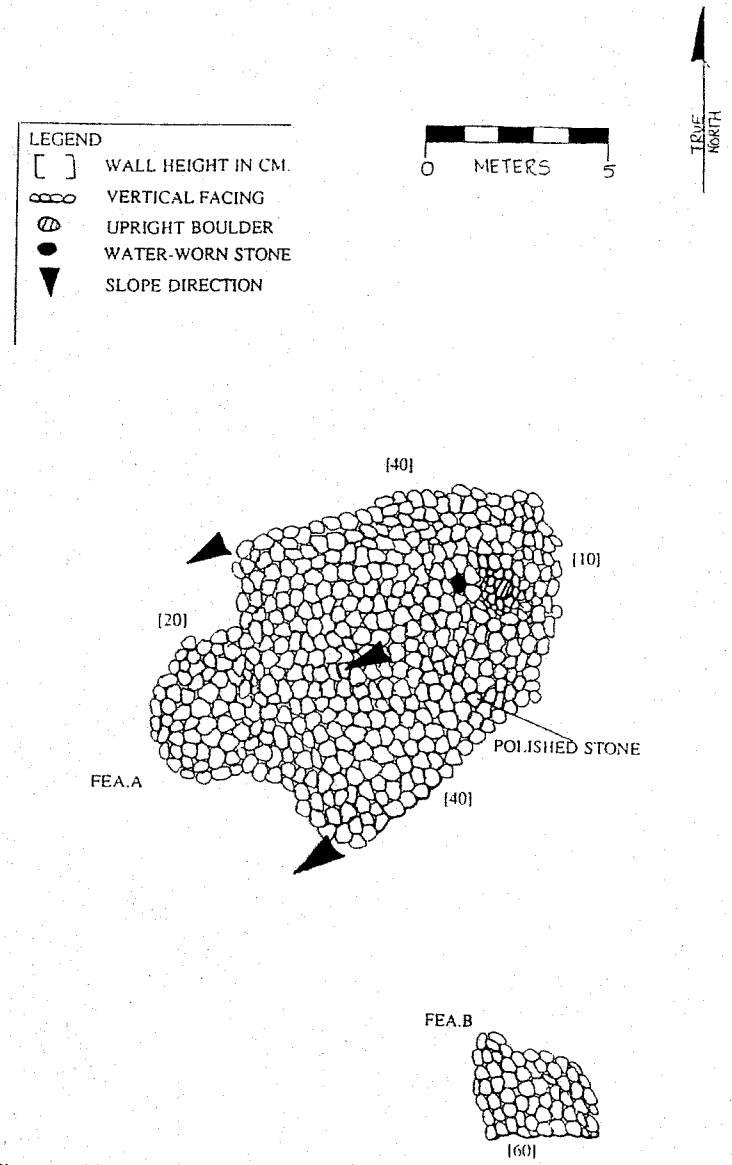



Figure 19 State site 50-10-37-16446; plan view



State site -16446 likely represents a permanent habitation area. Both features are in fair to good condition and excavation potential is considered good.

**State Site #:** 50-10-37-16447 **CSH Site #:** 94
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 104.0 m.$^2$ (1123.3 ft.$^2$)
***Ahupua'a*:** Onouli 1
**Elevation:** 200 ft. a.m.s.l.

**Description:** State site -16447 is a rectangular platform situated *makai* (west) of a moderately sloping area and *mauka* (east) of a level area in the surrounding terrain. Vegetation in the area includes grass, *koa haole*, and *kiawe*.

The platform measures 8.0 m. (26.2 ft.) N/S by 13.0 m. (42.6 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). It is constructed of loosely piled small to large boulders.

State site -16447 is in fair to good condition and excavation potential is considered fair to good.

**State Site #:** 50-10-37-16448 **CSH Site #:** 95
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 93.5 m.$^2$ (1009.8 ft.$^2$)
***Ahupua'a*:** Onouli 1
**Elevation:** 125 ft. a.m.s.l.

**Description:** State site -16448 is an irregularly shaped platform situated on gently sloping grassland covered with scattered *kiawe* and *koa haole*. The platform measures 17.0 m. (55.7 ft.) N/S along its western face, 12.0 m.(39.3 ft.) N/S on its eastern face, 5.0 m. (-16.4 ft.) E/W along its northern face and 2.5 m. (8.2 ft.) E/W on its southern face. It is constructed of small to medium boulders and cobbles with no facing apparent.

No midden or artifacts were observed.

State site -16448 is in fair to poor condition and excavation potential is considered fair to good.

**State Site #:** 50-10-37-16449
**Site Type:** Platform
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 28.0 m.$^2$ (302.4 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 105 ft. a.m.s.l.

**CSH Site #:** 96

**Description:** State site -16449 is an irregularly shaped platform located just *makai* (west) of State site -16449 on a gently sloping grassland with scattered *kiawe* and *koa haole*. The platform measures 8.0 m. (26.2 ft.) E/W by 3.5 m. (11.5 ft) along its *mauka* (east) side and 1.0 m. (3.28 ft.) along its *makai* (west) side; maximum height is 0.4 m. (1.3 ft.). It is constructed of small boulders and cobbles.

No midden or artifacts were observed.

State site -16449 is in poor condition and excavation potential is considered poor.

**State Site #:** 50-10-37-16450
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 12.0 m.$^2$ (129.6 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:**

**CSH Site #:** 97

**Description:** State site -16450 is a rectangular platform situated approximately 25.0 m. (82.0 ft.) from the ocean cliff-face. Vegetation includes grass, *kiawe*, and *koa haole*. It measures 4.0 m. (13.1 ft.) N/S by 3.0 m. (9.8 ft.) E/W. The site is constructed of large to small boulders and cobble paving on the surface. Intact facing remains on the north,south, and east sides. The west side is tumbled.

No midden or artifacts were observed.

State site -16450 is in fair condition. The platform is interpreted as a possible burial site.

**State Site #:** 50-10-37-16451
**Site Type:** Platform
**Function:** Probable burial
**Features (#):** 1
**Site Dimension:** 20.0 m.$^2$ (65.6 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 50 ft. a.m.s.l.

**CSH Site #:** 98

**Description:** State site -16451 is a small oval platform situated 10.0 m. (32.8 ft.) *mauka* (east) of the ocean cliff. It measures 4.0 m. (13.1 ft) N/S by 5.0 m. (16.4 ft.) with an average height of 0.8 m. (2.6 ft). The platform is constructed of small boulders and cobbles with rough facing on its western side.

No midden or artifacts were observed.



**State Site #:** 50-10-37-16452
**Site Type:** Platform
**Function:** Probable burial
**Features (#):** 1
**Site Dimension:** 12.0 m.$^2$ (129.6 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 55 ft. a.m.s.l.

**CSH Site #:** 99

**Description:** State site -16452 is a small rectangular platform situated just *mauka* (east) of the coastal cliff edge. Vegetation includes grass, *kiawe*, and *koa haole*. It measures 4.0 m. (13.1 ft.) E/W by 3.0 m. (9.8 ft.) N/S with an average height of 1.0 m. (3.28 ft.). The platform is constructed of piled medium boulders and cobbles with intermixed water rounded stones.

No midden or artifacts were observed.

State site -16452 is in fair condition.

**State Site #:** 50-10-37-16453
**Site Type:** Modified outcrop
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 35.0 m.$^2$ (378.0 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 95 ft. a.m.s.l.

**CSH Site #:** 100

**Description:** State site -16453 is a bi-level modified outcrop situated in the top portion of a ravine covered with grass, *kiawe*, and *koa haole*. Modification consists of stacking of small to large rough a'a boulders. The *mauka* (east) upper level measures 5.0 m. (-16.4 ft.) N/S by 2.9 m. (9.5 ft.) E/W. The *makai* (west) lower level, 0.8 m. (2.6 ft.) below the upper, measures 7.0 m. (22.9 ft.) N/S by 2.0 m. (6.5 ft.) E/W.

No artifacts were observed. Midden observed included tiger cowrie and *pi'pi'pi*.

State site -16453 is in fair condition and excavation potential is considered fair to good.

**State Site #:** 50-10-37-16454
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 16.0 m.$^2$ (172.8 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 135 ft. a.m.s.l.

**CSH Site #:** 101

**Description:** State site -16454 is a rectangular platform situated along the southern edge of a ravine. The platform measures approximately 4.0 m. (13.1 ft.) N/S by 4.0 m. (13.1 ft.) E/W

with a maximum height of 0.1 m. (0.3 ft.). It is constructed of small boulders and cobbles with level cobble paving on the surface. There is an a'a boulder alignment running north/south along the central surface of the platform.

No artifacts or midden were observed.

State site -16454 is in fair to good condition. Excavation potential is deemed poor.

**State Site #:** 50-10-37-16455 **CSH Site #:** 102
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 16.5 m.$^2$ (178.2 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 145 ft. a.m.s.l.

**Description:** State site -16455 is a rectangular platform situated on the *makai* (west) end of a level soil area covered with grass, *kiawe*, and *koa haole*.

The platform measures 4.7 m.(15.4 ft.) E/W by 3.5 m. (11.5 ft.) N/S with a maximum height of 1.0 m. (3.28 ft.). It is constructed of a'a small boulders and cobbles; a portion at one corner is paved with pebbles.

State site -16455 is in fair to poor condition. Excavation potential is considered fair to poor.

**State Site #:** 50-10-37-16456 **CSH Site #:** 103
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 187.0 m.$^2$ (2019.6 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 260 ft. a.m.s.l.

**Description:** State site -16456 is a large rectangular enclosure situated approximately 5.0 m. (16.4 ft.) *makai* (west) of the Great Wall of Kuakini (State site -7276). The enclosure - constructed of small to medium boulders - measures 11.0 m. (36.0 ft.) E/W by 17.0 (55.7 ft.) N/S (external) and 6.0 m. (19.7 ft.) E/W by 10.0 (32.8 ft.) N/S (internal); maximum wall height is 0.5 m. (1.6 ft.). The floor of the enclosure is soil with grass.

No midden or artifacts were observed.

State site -16456 is in fair condition and excavation potential is considered fair.



**State Site #:** 50-10-37-16457 **CSH Site #:** 104
**Site Type:** Platform
**Function:** Possible *heiau*
**Features (#):** 1
**Site Dimension:** 88.0 m.$^2$ (950.4 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 150 ft. a.m.s.l.

**Description:** State site -16457 (Figure 20) is a large well-constructed platform situated on a steep slope. Vegetation on the site includes grass and lantana; vegetation in the surrounding area includes *koa haole* and *kiawe*. The platform measures 13.0 m. (42.6 ft.) N/S by 9.0 m. (29.5 ft.) E/W. It is constructed of medium to small a'a boulders.

No midden or artifacts were observed. A large water rounded boulder was observed on the site.

State site -16457 is in good condition and is considered to have good excavation potential.

**State Site #:** 50-10-37-16458 **CSH Site #:** 105
**Site Type:** Platform remnant
**Function:** Indeterminate
**Features (#):** Indeterminate
**Site Dimension:** Indeterminate
***Ahupua'a:*** Onouli
**Elevation:** 80 ft. a.m.s.l.

**Description:** State site -16458 is a platform remnant situated on a moderate slope descending upon Keawekaheka Bay. The site is extensively disturbed by a bulldozed road. Artifacts, midden, and coral were observed and collected from adjacent bulldozed rock piles.

**State Site #:** 50-10-37-16459 **CSH Site #:** 106
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 96.0 m.$^2$ (1036.8 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 205 ft. a.m.s.l.

**Description:** State site -16459 comprises two platforms joined by a terrace. The site is situated south of a ravine with vegetation including grass, *koa haole*, and scattered *kiawe*. The southern platform measures 3.0 m. (9.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W. The northern platform measures 6.0 m. (19.6 ft.) N/S by 3.0 m. (9.8 ft.) E/W. The terrace which connects the two platforms measures 4.0 m. (13.1 ft.) by 1.5 m. (4.9 ft.). The southern platform has a rough boulder paving. The platforms are constructed of medium to small a'a boulders with small cobbles intermixed.

No artifacts or midden were observed.

State site -16459 is in poor condition and excavation potential is considered good.

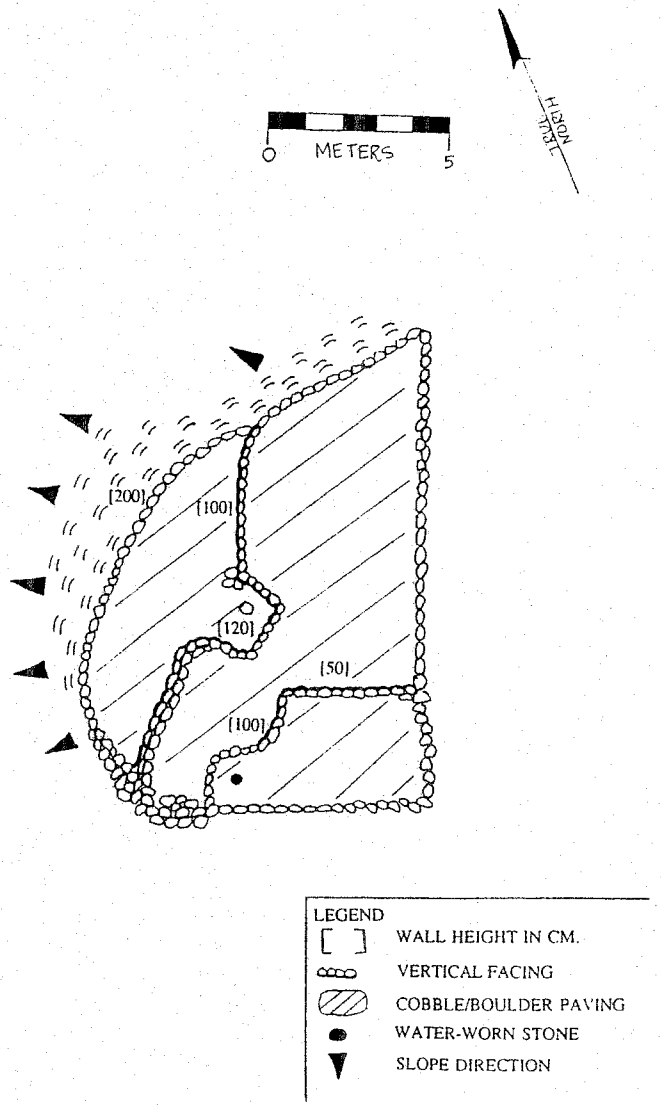



Figure 20 State site 50-10-37-16457; plan view



**State Site #:** 50-10-37-16460 **CSH Site #:** 107
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 30.0 m.$^2$ (324.0 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 135 ft. a.m.s.l.

**Description:** State site -16460 is a rectangular enclosure situated *mauka* (east) of a steep slope - allowing the site an excellent view of the coast. Vegetation includes grass, *kiawe*, and scattered *koa haole*. The enclosure measures 6.0 m. (19.6 ft) N/S by 5.0 m. (16.4 ft.) E/W (external), and 3.0 m. (9.8 ft.) square (internal). It is constructed of loosely stacked small to large a'a boulders. The interior is soil with grass.

No midden or artifacts were observed.

State site -16460 is in poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16461 **CSH Site #:** 108
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 289.0 m.$^2$ (3121.2 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 130 ft. a.m.s.l.

**Description:** State site -16461 comprises a C-shaped enclosure with a remnant platform in the central area. The surrounding vegetation includes grass, *kiawe*, and *koa haole*.

The C-shape measures 17.0 m. (55.7 ft.) N/S by 17.0 m. (55.7 ft.) E/W (external), and approximately 12.0 m. (39.3 ft.) N/S by 12.0 m. (39.3 ft) E/W (internal). The platform, in the central area of the enclosure and 3.0 m. (9.8 ft.) from the west wall, measures 3.2 m. (10.4 ft.) N/S by 3.5 m. (11.4 ft.) E/W. It is constructed of large to small boulders with intermixed cobbles and water-rounded stones.

Midden observed includes cowrie shells. A possible basalt core was observed on the south *mauka* (east) wall.

State site -16461 is in fair to poor condition and excavation potential is considered good.

**State Site #:** 50-10-37-16462 **CSH Site #:** 109
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 8.0 m.$^2$ (26.2 ft.$^2$)
***Ahupua'a:*** Onouli
**elevation:** 50 ft. a.m.s.l.

**Description:** State site -16462 is a terrace located 5.0 m. (16.4 ft.) from the cliff edge of a small bay (Keawehaheka Bay).

The terrace measures 4.0 m. (13.1 ft.) N/S by 2.0 m. (6.6 ft.) E/W and it is constructed of large boulders. It is faced on its *makai* (west) side. The maximum height is 1.0 m. (3.3 ft.) on the *makai* (west) side and the terrace abuts the slope on its *mauka* (east) side.

No artifacts and midden were observed on the site.

State site -16462 is in good condition. The excavation potential is considered poor to fair.

**State Site #:** 50-10-37-16463 **CSH Site #:** 110
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 6.0 m.$^2$ (64.8 ft.$^2$)
***Ahupua'a:*** Onouli
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16463 is a small rectangular platform in a level area with grass, *koa haole*, *kiawe* trees and one plumeria tree.

This platform measures 3.0 m. (9.8 ft.) by 2.0 m. (6.6 ft.) and is constructed of small pebbles and cobbles and surrounded by medium boulders.

There are several water-rounded stones scattered throughout the area. This site contains plentiful midden and numerous historic bottles.

State site -16463 is in fair to good condition and is considered to be a possible burial site.

**State Site #:** 50-10-37-16464 **CSH Site #:** 111
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 74.7 m.2 (806.7 ft.2)
***Ahupua'a:*** Onouli 1
**Elevation:** 20 ft. a.m.s.l.

**Description:** State site -16464 is a rectangular platform with a boulder wall running parallel to the platform. The platform measures 11.0 m. (36.0 ft.) by 4.2 m. (13.7 ft.) with heights ranging from 1.0 m. (3.28 ft.) to 0.6 m. (1.9 ft.). There are approximately 2.0 m. (6.5 ft.) of boulders piled along the west side. The wall is approximately 6.0 m. (19.6 ft.) from the platform and measures 13.0 m. (42.6 ft) N/S with a maximum height of 0.6 m.(1.9 ft.). Both the wall and the platform are constructed of medium to small boulders. The platform is paved with small pebbles and coral.

No artifacts or midden were observed.

State site -16464 is in good condition.



**State Site #:** 50-10-37-16465 **CSH Site #:** 112
**Site Type:** Site complex
**Function:** Burial
**Features (#):** 2
**Site Dimension:** 128.0 m.$^2$ (1382.4 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16465 is a burial complex consisting of two features designated A and B. The site is situated on the edge of the sea cliff. Site vegetation includes grass and scattered *kiawe* trees.

**Feature A** is a rectangular burial platform situated approximately 10.0 m. (32.8 ft.) from the sea cliff. It measures 6.5 m. (21.5 ft.) E/W by 4.0 m. (13.2 ft.) N/S. Heights are uniformly 0.8 m. (2.6 ft.) on all sides of the platform. The platform is constructed of large to small stacked boulders with a level pebble and cobble pavement. Facing is still present on all sides and consists of large flat boulders.

A cement surveyors point is present in the center of the platform. The point is circular with a average width of approximately 0.3 m. (1.0 ft.). Also observed on the surface of the platform was modern trash consisting of beer cans, bottles, and a pepsi bottle.

Feature A is in good to fair condition.

Testing Results:

Limited subsurface testing was conducted at State site -16465 (Feature A) to determine the presence or absence of a human burial. The test unit consisted of a 1.0 m. by 1.0 m. (3.3 by 3.3. ft.) square trench placed in the west central portion of the platform. Excavation began by removing the platform fill. The platform fill extended to a depth of 20 cm. below its surface. Upon removal of the platform fill, a layer of three flat, horizontally placed capstones were observed and removed. The capstones had been placed atop large vertical placed boulders to form a crypt structure. Below the capstones (within the crypt) one stratigraphic layer was revealed and designated stratum I. Stratum I consisted of a fine silty dark brown (10YR 4/3) soil with some root intrusion. At 80 cm. below the platform surface a human cranium was uncovered. Excavation was terminated upon encountering the burial at a maximum depth of 80 cm. below the platform surface. Following the excavation, the platform was reconstructed to its original form.

Cultural material - including artifacts and midden - were collected from the surface and Stratum I. No midden was present on the platform surface. Stratum I midden included 4.3 grams of marine midden and 2.0 grams of terrestrial midden. A total of 2.5 grams of charcoal was also collected from Stratum I.

One volcanic glass flake (Acc.# 64) was recovered form Stratum I. Historic or modern bottles were also present on the platform surface.

**Feature B** is a rectangular platform situated directly on the edge of the sea cliff approximately 10.0 m. (32.8 ft.) to the northwest of Feature A. It measures 2.0 m. (6.6 ft.) N/S by 3.2 m. (10.6 ft.). The northwest face of the platform runs directly along the edge of the cliff. The cliff is approximately 15.2 m. (50 ft.) above the high-tide mark. The platform is constructed of small to medium stacked boulders with a level cobble paving. The platform sides (except the northeast face) is faced to a maximum height of 0.7 m. (2.3 ft.). Water rounded stones were observed within the facing and surface pavement of the platform.

Feature B is in fair condition. The platform is considered a probable burial.

**State Site #:** 50-10-37-16466 **CSH Site #:** 113
**Site Type:** C-Shape
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 65.0 m.$^2$ (702.0 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16466 is a C-shaped enclosure situated on level terrain covered with grass and scattered *koa haole* and *kiawe* trees. This site is 15.0 m. (49.2 ft.) *mauka* (east) of State site -16468.

The C-Shape measures 13.0 m. (42.7 ft.) N/S by 5.0 m. (16.4 ft.) E/W and it is constructed of loosely stacked medium-sized boulders. Midden and charcoal were observed.

The condition of State site -16466 is considered fair to poor. It has good excavation potential.

**State Site #:** 50-10-37-16467 **CSH Site #:** 114
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 120.0 m.$^2$ (1296.0 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16467 is a large rectangular enclosure located 15.0 m. (49.5 ft.) *mauka* (east) of the coast's cliff edge and 10.0 to 20.0 m. (32.8 ft. - 65.6 ft.) north of Site -16464. There is California grass and *kiawe* growing in the interior of the enclosure.

The site exterior measures 15.0 m. (49.2) N/S by 8.0 m. (26.2) E/W with interior measurements of 11.0 m. (36.1 ft.) N/S by 3.5 m. (11.5 ft.) E/W. The enclosure is constructed of large boulders with some water-rounded boulders. It has a maximum height of 1.4 m. (4.6 ft.).

No midden or artifacts were observed.

State site -16467 is in fair condition. Its excavation potential is considered fair to poor.

**State Site #:** 50-10-37-16468 **CSH Site #:** 115
**Site Type:** Lava tube
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 297 m.$^2$ (3,207.6 ft.$^2$)
***Ahupua'a*:** Onouli 1
**Elevation:** 135 ft. a.m.s.l.

**Description:** State site -16468 (Figure 21) is a lava tube located at the edge of Onouli 1 *ahupua'a*. It measures 33.0 m. (356.4 ft.) NE/SW by a maximum 8.0 m. (26.2 ft.) NW/SE



wide. Height ranges from 0.4 m. (1.3 ft.) to 1.8 m. (5.9 ft.).

The entrance is at a collapsed sink - measuring approximately 5.5 m. (18 ft.) in diameter - at the *mauka* (east) end of the tube: it measures 6.0 m. (19.8 ft.) NW/SE and has a height of 1 m. (3.3 ft.).

The floor of the tube contains an extensive soil deposit which has a water-worn ravine down the center exposing the stratigraphy and disturbing sub-surface artifacts and midden.

Evidence of habitation includes scattered surface midden and artifacts as well as several low walls. The light area of the tube is delineated by a boulder and cobble wall - 0.5 m. (1.6 ft.) high - located 3.0 m. (9.8 ft.) from the cave lip. Within this area artifacts including gourd fragments, water-rounded stone manuports, bamboo poles, a scoopnet, and a twisted metal wire (possible *he'e* grasper) were observed. Midden included a pig skeleton, other mammal bones, various marine shells, kukui, and charcoal. *Makai* (west) of the wall three more bamboo poles were observed as well as a gourd, a basalt core, and a water-rounded basalt manuport.

The back of the main chamber displayed a considerable amount of midden including various species of marine shells (*Cypraea sp.*, Thaididae, *Conus sp.*, *Cellana sp.*, Nerita Picea), coral, *kukui* nut, and fish and mammal bones. Artifacts observed in this area include basalt cores and flakes, volcanic glass, water-rounded basalt manuports, and gourd fragments placed on a shelf at the end of the tube.

There is a small side passage 4.0 m. (13.1 ft.) from the wall on the southeast side of the tube which is blocked off by piled boulders and cobbles. It measures 3.5 m. (11.5 ft.) NE/SW long but is impenetrable.

There is a larger side passage on the northwest side of the tube located 11.0 m. (36.1 ft.) from the entrance. It measures 10.0 m. (32.8 ft.) NE/SW, has a maximum width of 3.0 m. (9.8 ft.), and reconnects with the main chamber *makai* (west) of the entrance. No artifacts and sparse midden were observed in this side chamber.

There is a low a'a wall located 1.0 m. (3.3 ft.) from the entrance to the *mauka* (east) side chamber. It extends a short way into the tube, measuring 1.0 m. (3.3 ft.) NE/SW.

The modifications within the tube are in fair condition.

State site -16468 represents a prehistoric permanent habitation site with possible use in historic times as a fisherman's cave. It has excellent excavation potential.

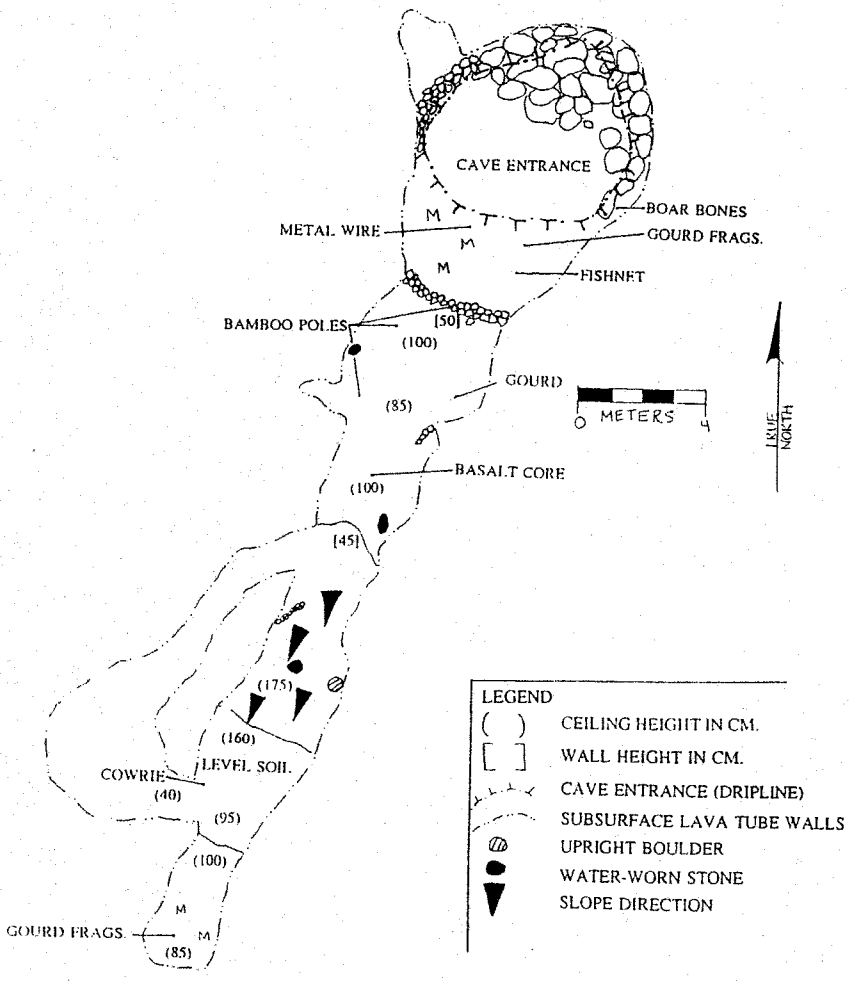



Figure 21 State site 50-10-37-16468 lava tube; plan view



**State Site #:** 50-10-37-16469 **CSH Site #:** 116
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 1.4 m.$^2$ (15.6 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 325 ft. a.m.s.l.

**Description:** State site -16469 is a terrace situated on a break in the slope among short California grass with scattered *kiawe* trees.

The terrace measures 1.2 m. (3.9 ft.) N/S by 1.2 m. (3.9 ft.) E/W and it is constructed of small boulders and a cobble pavement; the pavement contains a small circular pile of rocks with a hollow center. A metal piling beneath the terrace indicates historic-era usage. There are several clearing mounds surrounding a small agricultural wall running *makai* (west) from the site.

No artifacts or midden were observed.

State site -16469 is in fair condition and has fair excavation potential.

**State Site #:** 50-10-37-16470 **CSH Site #:** 117
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 240.0 m.$^2$ (2592.0 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 350 ft. a.m.s.l.

**Description:** State site -16470 is a level terrace with a soil interior and paved areas along the north and south edges. It is located in a grassy area with scattered *koa haole* and *kiawe* surrounding it.

The terrace measures 15.0 m. (49.2 ft.) N/S by 16.0 m. (52.5 ft.). It is constructed flush to outcrop along its southeast side. The majority of its surface is a level soil area retained by a boulder facing along its north and west sides. Two possible postholes are present adjacent to the terrace's north, partially collapsed face. An internal alignment extends in a southeast direction from its north face across the soil surface.

The terrace contains two cobble paved surfaces in the northeast and south end; they measure 6.5 m. (21.3 ft.) N/S by 5.0 m. (16.4 ft.) E/W and 3.2 m. (10.5 ft.) N/S by 6.5 m. (21.3 ft.) E/W, respectively. The paved areas are faced with cobbles and small boulders.

Several water-rounded stones were observed at the site.

The condition of State site -16470 is considered fair, and it offers fair to good excavation potential.

**State Site #:** 50-10-37-16471 **CSH Site #:** 118
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 5.0 m.$^2$ (54.0 ft.$^2$)
***Ahupua'a:*** Onouli
**Elevation:** 325 ft. a.m.s.l.

**Description:** State site -16471 is a terrace which measures 2.5 (8.2 ft.) N/S by 2.0 m. (6.6 ft.) E/W. The terrace is constructed of cobbles and pebbles and is paved with pebbles. It has facing on its *makai* (west) side and is flush to outcrop along its *mauka* (east) side.

Midden was observed on the surface of the outcrop.

State site -16471 is in fair to poor condition. The excavation potential is considered poor to fair.

**State Site #:** 50-10-37-16472 **CSH Site #:** 119
**Site Type:** L-shape enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 13.5 m.$^2$ (145.8 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 280 ft. a.m.s.l.

**Description:** State site -16472 is an L-shaped enclosure situated on level pasture land with scattered *kiawe* and *koa haole.*

The enclosure measures 3.0 m. (9.8 ft.) N/S by 4.5 m. (14.8 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). Its wall is 1.0 m. (3.3 ft.) wide and it is constructed of small boulders and cobbles. No intact facing remains.

No artifacts or midden were observed.

State site -16472 is in fair to poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16473 **CSH Site #:** 120
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 5.1 m.$^2$ (55.1 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 300 ft. a.m.s.l.

**Description:** State site -16473 is a terrace situated on a moderate slope vegetated with grasses and scattered Christmas-berry trees.

The terrace measures 3.4 m. (11.2 ft.) N/S by 1.5 m. (4.9 ft.) E/W. It is constructed of mounded small to large boulders. The terrace is flush with the slope on the *mauka* (east) side and it is 0.5 m. (1.6 ft.) high on the *makai* (west) side. The surface is roughly level.



No artifacts or midden were observed.

State site -16473 is in fair to poor condition and excavation potential is considered poor.

**State Site #:** 50-10-37-16474 **CSH Site #:** 121
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 8.75 m.$^2$ (94.5 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 530 ft. a.m.s.l.

**Description:** State site -16474 is a rectangular platform situated at the edge of a slope with a view the ocean. The surrounding vegetation consists of California grass and scattered *kiawe* trees.

The platform measures 2.5 m. (8.2 ft.) N/S by 3.5 m. (11.5 ft.) E/W and has a maximum height of 0.5 m. (1.6 ft.). It is constructed of faced pahoehoe cobbles and boulders with a rough cobble pavement.

No artifacts or midden were observed.

State site -16474 is in good condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16475 **CSH Site #:** 122
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 30.0 m.$^2$ (98.4 ft.)
***Ahupua'a:*** Onouli 1
**Elevation:** 380 ft. a.m.s.l.

**Description:** State site -16475 is a multi-level platform situated on the edge of a slope at the base of a ravine approximately 20.0 m. (65.6 ft.) *mauka* (east) of a north/south running wall. The surrounding terrain consists of California grass and scattered *kiawe*.

The platform is separated by tiers into three levels, level 1 being the lowest. Level 1 measures 1.5 m. (4.9 ft.) N/S by 6.0 m. (19.8 ft.) E/W. Level 2 measures 1.1 m. (3.6 ft.) N/S by 5.0 m. (16.4 ft.) E/W. Level 3 measures 2.3 m. (7.5 ft.) N/S by 6.0 m. (19.8 ft.) E/W. The platform is constructed of medium boulders to small cobbles. All three levels are roughly paved with cobbles. The site marker is located at the southwest corner of level 3.

No artifacts or midden were observed at the site.

State site -16475 is in fair condition and offers poor excavation potential.

**State Site #:** 50-10-37-16476 **CSH Site #:** 123
**Site Type:** Site Complex
**Function:** Permanent habitation
**Features (#):** 8
**Site Dimension:** 3952 m.$^2$ (42682 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 470 ft. a.m.s.l.

**Description:** State site -16476 is a site complex comprising 8 features, designated A through H. The site features include two platforms, two terraces, one mound, and three enclosures. The site complex is situated on a level soil area, east of a steep slope. The surrounding vegetation includes *kiawe* trees, grass, and *koa haole*.

**Feature A** is a permanent habitation terrace located in the southern portion of the complex. The terrace measures 12.0 m. (39.6 ft.) N/S by 7.5 m. (24.8 ft.) E/W and is L-shaped. It is constructed of large to small stacked boulders with a small cobble level pavement. Facing is still in excellent condition along the east, south and west sides, rising a maximum height of 1.0 m. (3.3 ft.). A possible cupboard was observed in its southern face. No artifacts or midden was observed. The feature is in good condition and excavation potential is considered good.

**Feature B** is a rectangular platform situated approximately 3.0 m. (10.0 ft.) to the northeast of Feature A. The platform measures 6.0 m. (19.8 ft.) E/W by 4.0 m. (13.2 ft.) N/S. It is constructed of medium stacked boulders and cobble. Two walls extend off the northeast and southeast corners of the platform to form a portion of Feature C. No artifacts or midden were observed. Feature B is in fair to good condition and excavation potential is considered good.

**Feature C** is a long and narrow rectangular enclosure. The enclosure measures 17.0 m. (56.1 ft.) E/W with the eastern portion being 7.0 m. (23.1 ft.) and the western portion being 3.0 m. (9.9 ft.). The enclosure is constructed of large to small boulders with the majority of the walls being tumbled. The western portion of the enclosure is not delineated by a wall. The southeastern portion of the enclosure wall is constructed of a large flat stone and three large uprights.

**Feature D** is a extremely large enclosure enclosing a very level soil area. It is located to the north of both Features A and B. It measures 31.0 m. (102.4 ft.) N/S by 13.0 m. (43.0 ft.) and it is constructed of large to small boulders with the majority of the walls being tumbled. The soil area within the enclosure appears to have been artificially leveled.

**Feature E** is a rectangular platform situated on the outside of the west-central portion of Feature D. The platform measures 5.5 m. (18.2 ft.) N/S by 2.0 m. (6.6 ft.) E/W. It is constructed of small to medium boulders; facing is no longer evident on any side.

**Feature F** is a long linear wall which runs in an E/W direction. It measures 101.0 m. (333.3 ft.) long. It is constructed of large to small boulders with the majority of the wall being tumbled. The wall forms the northern portion of Feature C and the southern portion of Feature D. The wall extends for the majority of its extent at 260 degrees TN. Approximately 7.0 m. (23.1 ft.) from the western portion of Feature D, the wall turns to 318 degrees TN to its end.



**Feature G** is an L-shaped enclosure situated in the eastern portion of the complex. It measures 4.0 m. (13.2 ft.) N/S; the southern portion of the L-shape is Feature F. It is constructed of small to medium boulders and the majority of the wall is tumbled.

**Feature H** is a rectangular terrace situated south of Feature A. It measures 2.0 m. (6.6 ft.) in diameter. It is constructed of medium to small boulders and has facing along its southern face with a maximum height of 0.5 m. (1.7 ft.). Midden includes a cowrie shell fragment. Feature H is in fair to good condition.

The site complex is considered to have good excavation potential.

**State Site #:** 50-10-37-16477 **CSH Site #:** 124
**Site Type:** C-Shape
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 34.8 m.$^2$ ( 375.8 ft.$^2$)
***Ahupua'a:*** Onouli
**Elevation:** 385 ft. a.m.s.l.

**Description:** State site -16477 is a C-shaped enclosure located on the edge of a steep gully and surrounded by grass, *kiawe*, lantana, and other shrubs.

It measures 5.8 m. (19 ft.) N/S by 6.0 m. (19.7 ft.) E/W. on the exterior and the interior measures 2.3 m. (7.5 ft.) N/S by 5.0 m. (16.4 ft.)E/W. It is constructed of boulders and cobbles built on top of an outcrop bluff. The interior is soil.

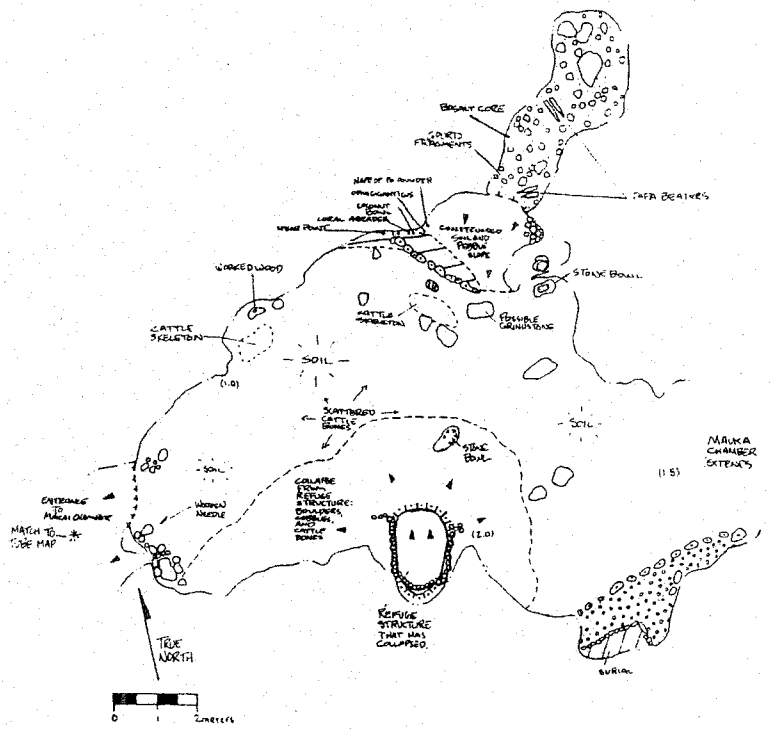
No midden or artifacts were observed.

State site -16477 is in fair condition. The excavation potential is considered poor.

**State Site #:** 50-10-37-16478 **CSH Site #:** 125
**Site Type:** Lava Tube
**Function:** Permanent habitation
**Features (#):** ---
**Site Dimension:** 104.0 m.$^2$ (1118.7 ft.$^2$)
***Ahupua'a:*** Onouli
**Elevation:** 415 ft. a.m.s.l.

**Description:** State site -16478 (Figures 22 & 23) is a lava tube with several chambers designated Chambers A through C. The tube runs *mauka/makai* (east/west) and is located in a well-grazed pasture with scattered *kiawe* and *koa haole*. The main entrance to the tube system is a hole in the ceiling of the tube measuring 1.5 m. (4.9 ft.) in diameter. The light zone below the entrance measures approximately 13.0 m. (42.7 ft.) E/W by 8.0 m. (26.2 ft.) N/S.

The main entrance of the tube is faced on the east and west sides. The north side is a steep slope of boulders that extends to the floor of Chamber A.

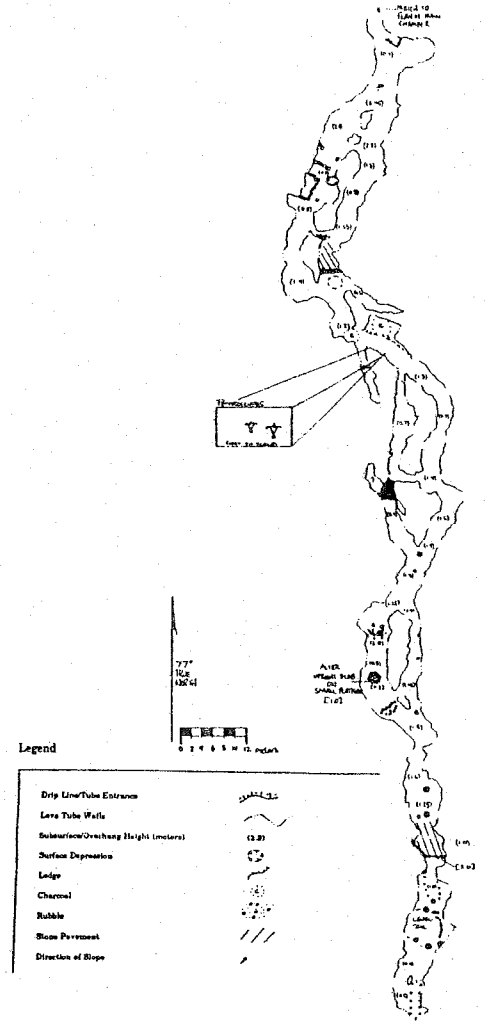



Legend

| | |
|---|---|
| Drip Line/Tube Entrance | |
| Lava Tube Walls | |
| Subsurface/Overhang Height (meters) | (2.8) |
| Rubble | |
| Stone Alignment | |
| Stone Pavement | |
| Pebble Pavement | |
| Direction of Slope | |

Figure 22 State site 50-10-37-16478 lava tube; plan view






Legend

| | |
|---|---|
| Drip Line/Tube Entrance | |
| Lava Tube Walls | |
| Subsurface/Overhang Height (meters) | (2.8) |
| Surface Depression | |
| Ledge | |
| Charcoal | |
| Rubble | |
| Stone Pavement | |
| Direction of Slope | |

Figure 23 State site 50-10-37-16478 lava tube; plan view

**Chamber A** extends 109.0 m. (357.5 ft.) east of the tube's entrance. The ceiling heights in Chamber A range from 3.1 m. to 1.3 m. (10.2 to 4.3 ft.). The average width of the chamber measures 4.5 m. (14.8 ft.). The floor of Chamber A consists of soil (20+ cm.) and scattered cobbles, wood fragments, midden, charcoal, and shells.

Along the north side of Chamber A, cobbles line a circular, soil-filled area near the entrance to a small side chamber. Concentrations of artifacts were observed in this area of Chamber A. But many artifacts were observed and some were collected throughout Chamber A (See figure for exact locations). The following items were collected: a *Cellana giganticus* shell (Acc.# 72); a cut mother-of-pearl fragment (Acc.# 71); a fire plough (Acc.# 65); a coconut bowl (Acc.# 73); a basalt abrader fragment (Acc.# 74), 5 tapa beaters (2 round and 3 square) (Acc.#'s 66-70) and; a coral file (Acc.# 75). Numerous other artifacts and midden were observed in the chamber including: a polished nape of a basalt poi pounder, gourd fragments, two stone bowls, and tapa bark strips. Midden observed included a coconut husk, leopard Cowrie, and *kukui* nut shell fragments.

Two water-rounded stones and an upright stone were also observed. Regarding the observed stone bowls, one was located on a pile of collapsed boulders near the tube's entrance and measures 52 cm. (1.7 ft.) by 22 cm. (0.7 ft.) by 38 cm. (1.2 ft.) high and is 20 cm. (.7 ft.) deep. The second stone bowl was located on the floor in front of this ledge and measures 41 cm. (1.4 ft.) by 26 cm. (.8 ft.) by 16 cm. (.5 ft.) high and is 8 cm. (0.2 ft) deep.

A concentration of small cobbles and boulders is located on the south side of Chamber A and may represent a burial mound.

**Chamber B** is located at the west end of Chamber A and is the *makai* (west) section of this lava tube system. The two chambers are connected by a very small crawl space which measures approximately 1.0 m. (3.3 ft.) wide and 0.7 m. (2.3 ft.) high. Chamber B measures approximately 212.0 m. (695.4 ft.) to the west from the main entrance of the tube. The ceiling height ranges from 2.0 to 2.5 m. (6.6 to 8.2 ft.) at the mouth of the chamber to a minimum height of 0.4 m. (1.3 ft.) near the *makai* (west) end of the tube. An average width of 5.0 m. (16.4 ft.)is measured. The floor of this chamber is mostly bedrock with scattered soil deposits. There are several *ahu* situated along the tube. A stone platform with an upright stone in the center is located approximately 160.0 m. (524.8 ft.) west of the tube's main entrance. This platform may have functioned as an altar.

Included among the midden observed within Chamber B is *kukui*, unidentified bone, marine midden, and charcoal. Also observed in Chamber B were two sets of two petroglyphs. The petroglyphs are paired human forms, one larger than the other, and are characterized by an upside-down triangular body, attached limbs, and a vertical line for a head. The petroglyphs are "pecked" into the tube wall deep within the chamber.

**Chamber C** is the *mauka*-most (easternmost) chamber within the tube system. A ceiling collapse at the *mauka* (east) end of Chamber A separates Chamber A from Chamber C. Chamber C measures 33.0 m. (108.3 ft.) to the east from this ceiling collapse entrance. Ceiling height in Chamber C ranges from 2.0 m. (6.6 ft.) to 1.2 m. (3.9 ft.). The average width of this chamber measures 4.0 m. (13.1 ft.). The floor of the tube is mostly soil with some exposed bedrock areas. There is paving near the entrance measuring 5.0 m. (16.4 ft.) long and it fills the width of the tube. Collapsed ceiling seals Chamber C to the east.

State site -16478 offers excellent excavation potential and is considered a permanent habitation site.

**State Site #:** 50-10-37-16479 **CSH Site #:** 126
**Site Type:** Platform



**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 10.0 m.$^2$ (108.0 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 700 ft. a.m.s.l.

**Description:** State site -16479 is a platform located in a pasture with scattered old *kiawe* and monkeypod trees situated on moderately sloped terrain.

The platform measures 4.0 m. (13.1 ft.) N/S by 2.5 m. (8.2 ft.) E/W and is constructed of small boulders and cobbles. The west wall has a rough facing.

No midden or artifacts were observed.

State site -16479 is in fair condition. The excavation potential is considered fair.

**State Site #:** 50-10-37-16480 **CSH Site #:** 127
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Onouli
**Elevation:** 650 ft. a.m.s.l.

**Description:** State site -16480 consists of two enclosures designated Feature A and B. The site is situated on a mountain slope in a flat grassy area with California grass and scattered *koa haole* and monkeypod trees.

**Feature A** is a large enclosure that measures 12.0 m. (39.4 ft.) E/W by the 16.0 to 17.0 m. (52.5 to 55.8 ft.) N/S walls. There is a 2.0 m. (6.6 ft.) wide entrance in the north wall of this enclosure. The average height of this outer wall is 0.7 m. (2.3 ft.). Feature A is in good condition.

**Feature B** is a small rectangular enclosure located in the SW interior corner of Feature A. It measures 5.5 m. (18.0 ft.) N/S by 4.8 m. (15.7 ft.) E/W and is constructed of large boulders and cobbles. The walls are 1.0 m. (3.3 ft.) high and 1.0 m. (3.3 ft.) wide.

A few broken 1-gallon "screw top jugs" were present on Feature B's wall. No other artifacts or midden were observed. The site is in good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16481 **CSH Site #:** 128
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 49.0 m.$^2$ (160.7 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 625 ft. a.m.s.l.

**Description:** State site -16481 is a small enclosure located on level terrain among California grass and *kiawe*.

This enclosure measures approximately 7.0 m. (23.0 ft.) by 7.0 m. (23.0 ft.) and it is constructed of rough boulders and cobbles; its wall is intermittently faced. The wall height ranges from 0.4 to 0.5 m. (1.3 to 1.6 ft.) and the wall is 1.0 m. (3.3 ft.) wide. The interior of the enclosure is a grass covered soil.

No midden or artifacts were observed.

State site -16481 is in fair to poor condition. The excavation potential is considered poor to fair.

**State Site #:** 50-10-37-16482 **CSH Site #:** 129
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 6.0 m.$^2$ (64.8 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 730 ft. a.m.s.l.

**Description:** State site -16482 is a terrace situated on a moderately steep slope covered by *kiawe*, *koa haole*, and monkeypod trees. The terrace measures approximately 11.0 m. (36.3 ft.) N/S by 4.0 m. (13.2 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.). It is constructed of small boulders and cobbles with its *mauka* (east) edge constructed flush to the outcrop. Small amounts of facing remain on the north and south central edges of the terrace.

No artifacts or midden were observed.

State site -16482 is in fair condition and offers poor excavation potential.

**State Site #:** 50-10-37-16483 **CSH Site #:** 130
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 17.5 m.$^2$ (189.0 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 720 ft. a.m.s.l.

**Description:** State site -16483 is a platform situated on a flat grassy area with some *koa haole*, *kiawe* trees, and a small grove of *kamehame* trees.

The platform measures 3.5 m. (11.5 ft.) N/S by 5.0 m. (16.4 ft.) E/W and is 0.3 m. (0.9 ft.) constructed of rough boulders and cobbles with some facing but no smooth paving.

No artifacts or midden were observed.

State site -16483 is in fair to poor condition and offers fair to poor excavation potential.



**State Site #:** 50-10-37-16484 **CSH Site #:** 131
**Site Type:** Site Complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Onouli
**Elevation:** 700 ft. a.m.s.l.

**Description:** State site -16484 is a site complex comprising two platforms designated Features A and B. The site is located on a gentle slope covered with grasses and large *koa haole* trees.

**Feature** A is a rectangular platform adjoining a U-shaped enclosure. The platform measures 4.0 m. (13.1 ft.) NW/SE by 2.5 m. (8.2 ft.) NE/SW with a maximum height of 0.5 m. (1.6 ft). Walls extend from the corners of its northeast side to form the U-shape enclosure. These walls measure 3.5 m. (11.5 ft.) long (NE/SW) with a height of 1.0 m. (3.3 ft.). Feature A platform is constructed of small to medium boulders stacked with a sloped face on the southwest side.

No midden or artifacts were observed.

Feature A is in good condition and offers fair to good excavation potential.

**Feature B** is a rectangular bi-level platform measuring 6.0 m. (19.4 ft.) NW/SE by 5.5 m. (18.0 ft.) NE/SW with a maximum height of 0.5 m. (1.6 ft.). Its *mauka* (east)level measures 0.4 m. (1.3 ft.) above the main platform level, and it incorporates 1.0 m. (3.3 ft.) of the southeastern platform edge. A second, smaller platform and a rectangular agricultural mound are located just *mauka* (east) of Feature B.

One basalt flake was observed at the feature.

Feature B is in fair to good condition and offers fair to good excavation potential.

**State Site #:** 50-10-37-16485 **CSH Site #:** 132
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 38.5 m.$^2$ (415.8 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 660 ft. a.m.s.l.

**Description:** State site -16485 is a bi-level terrace situated on a break in the slope. Site vegetation includes grasses and scattered monkeypod, *kiawe*, and *koa haole* trees.

The upper level of the terrace is located on its *mauka* (east) side; it measures 3.5 m. (11.5 ft.) E/W by 4.5 m. (14.8 ft.) N/S with a maximum height of 0.5 m. (1.6 ft.) above the lower level *makai* (west). There is remnant facing on the north side of the *mauka* (east) terrace while the rest of the upper level is in tumbled condition.

The *makai* (west) terrace level measures 6.5 m. (21.3 ft.) N/S by 3.5 m. (11.5 ft.) E/W. with a height of 0.5 m. (1.6 ft.) on its *makai* (west) side.

The terrace is constructed of small boulders and medium cobbles. Some facing remains on the *makai* (west) faces of both levels. The *mauka* (east) edge of the terrace is constructed flush with the slope.

No artifacts or midden were observed.

State site -16485 is in fair condition. The excavation potential is considered fair to poor.

**State Site #:** 50-10-37-16486 **CSH Site #:** 133
**Site Type:** C-Shape
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 29.6 m.$^2$ (319.7 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 685 ft. a.m.s.l.

**Description:** State site -16486 is a C-Shaped enclosure situated adjacent to outcrop on a gentle slope covered with grass and some lantana and *kiawe* trees. It measures 7.5 m. (24.6 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.). It is constructed of medium to small boulders and cobbles and its exterior edge is tumbled. The wall is 0.8 m. (2.6 ft.) high.

No artifacts or midden were observed at the site.

The site is in poor condition. The excavation potential is considered poor.

**State Site #:** 50-10-37-16487 **CSH Site #:** 134
**Site Type:** Site Complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a*:** Onouli
**Elevation:** 640 ft. a.m.s.l.

**Description:** State site -16487 is a site complex comprising three features, designated A through C. The surrounding area is grassy with scattered lantana, *koa haole* and *kiawe* trees.

**Feature A** is a rectangular enclosure. The enclosure measures 11.0 m. (36.1 ft.) N/S by 7.5 m. (24.6 ft.) E/W. It is constructed of small to medium boulders with vertical facing measuring a maximum of 1.0 m. (3.3. ft.) high.

A basalt grinding stone (Acc.# 76) was collected from the enclosure's south side.

Feature A is in good to fair condition and offers good excavation potential.

**Feature B** is a square enclosure situated on a gentle slope about 5.0 m. (16.4 ft.) *makai* (west) of Feature A. The enclosure measures 4.2 m. (13.8 ft.) by 5.5 m. (18 ft.) E/W. It is constructed of stacked small to medium boulders with facing still present on all sides.

Feature B is in good condition and offers good excavation potential.

**Feature C** is a square platform measuring 7.0 m. (23.0 ft.) *makai* (west) of Feature B. It measures 2.5 m. (8.2 ft.) by 3.5 m. (11.5 ft.).

Feature C is in poor condition and offers poor excavation potential.



**State Site #:** 50-10-37-16488 **CSH Site #:** 135
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a*:** Onouli
**Elevation:** 630 ft. a.m.s.l.

**Description:** State site -16488 is a site complex comprising a two terraces designated Feature A and B. The site is situated approximately 0.5 m. (1.6 ft.) *makai* (west) of a steep slope.

**Features A** is a bi-level terrace measuring 6.0 m. (19.8 ft.) N/S by 5.0 m. (16.4 ft.) E/W and is constructed of medium boulders and cobbles. The levels have a maximum height of 0.3 m. (1.0 ft.). There is a small soil area between the terrace levels. No facing remains.

No artifacts or midden were observed at the feature.

Feature A is in fair to good condition. Its excavation potential is considered fair.

**Feature B** is a terrace located just *mauka* (east) of Feature A. It measures 5.0 m. (16.4 ft.) N/S by 6.5 m. (21.3 ft.) E/W with a maximum height of 0.4 m. (1.3 ft.). It is constructed of a boulder facing with cobble fill. There is a small pavement just *mauka* (east) of the terrace. A small portion of facing remains intact.

No artifacts or midden were observed.

Feature B is in fair to good condition and offers fair excavation potential.

**Feature C** is an enclosure measuring 8.0 m. (26.2 ft.) E/W by 6.5 m. (20.3 ft.) N/S. The feature is constructed of rough 'a'a boulders and large cobbles. The *mauka* (east) wall is 1.0 m. (3.3 ft.) wide while the north/south walls are 1.5 m. (4.9 ft.) wide. The *makai* (west) wall is mostly collapsed. The enclosure interior is soil with some scattered boulders resulting from the collapsed walls.

No artifacts or midden were observed.

Feature C is in fair condition. The excavation potential is considered poor.

**State Site #:** 50-10-37-16489 **CSH Site #:** 136
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 35.0 m.$^2$ (114.8 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 575 ft. a.m.s.l.

**Description:** State site -16489 is a rectangular terrace located just south of a gully in a grassy area with scattered *koa haole*, *kiawe* and lantana.

The terrace measures 5.0 m. (16.4 ft.) N/S by 7.0 m. (23.0 ft.) E/W with a maximum height of 0.6 m. (2.0 ft.). It is constructed of cobbles to medium boulders stacked against the outcrop. It has a roughly level surface.

No midden or artifacts were observed.

State site -16489 is in poor condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16490 **CSH Site #:** 137
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 105.0 m.$^2$ (1134.0 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 600 ft. a.m.s.l.

**Description:** State site -16490 is a terrace constructed on and against a pahoehoe outcrop surrounded by grass land with scattered *kiawe* and *koa haole*.

The terrace has a bi-level construction and it measures 15.0 m. (49.2 ft.) E/W by 2.0 m. (6.6 ft.) N/S on its *makai* (west) level and 5.0 m. (16.4 ft.) N/S by 1.5 m. (5.0 ft.) E/W on its *mauka* (east) level. The *mauka* (east) level is raised 0.5 m. (1.6 ft.) above the rest of the terrace. The terrace is constructed of medium to small boulders and cobbles.

No artifacts or midden were observed.

State site -16490 is in fair to poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16491 **CSH Site #:** 138
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 23.1 m.$^2$ (249.9 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 575 ft. a.m.s.l.

**Description:** State site -16491 is a terrace situated on a raised area of grass-covered terrain with scattered *koa haole* and *kiawe*.

The terrace has a bi-level terrace which measures 7.7 m. (25.3 ft.) N/S by 3.0 m. (9.8 ft.) E/W on its first level and 3.7 m. (12.1 ft.) E/W by 4.8 m. (15.7 ft.) N/S on its second level. It is constructed of medium to small boulders stacked against pahoehoe outcrop. Some facing remains along the *makai* west portion.

No artifacts or midden were observed at the site.

State site -16491 is in fair condition and the excavation potential is considered poor.

**State Site #:** 50-10-37-16492 **CSH Site #:** 139
**Site Type:** Site complex
**Function:** Temporary habitation
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a*:** Onouli
**Elevation:** 560 ft. a.m.s.l.



**Description:** State site -16492 is a site complex comprising four platforms designated Features A through D. The site is located on both sides of a ravine. The ravine are appears to have been modified to form a level soil surface for agricultural purposes.

**Feature A** is an irregular shaped platform, consisting of three levels which are connected to a linear agricultural mound which extends downslope for 30.0 m. (98.6 ft.). Level 1 - the *mauka* (east) level - measures 6.0 m. (19.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W; it is connected to the north edge of level 2. Level two is the main platform area, measuring 8.0 m. (26.2 ft.) N/S by 14.0 m. (45.9 ft.) E/W. Level three is connected to the west edge of level 2. It consists of the agricultural mound which measures 3.0 m. (9.8 ft.) N/S by 30.0 m. (98.4 ft.) E/W. The platform is constructed of piled and mounded boulders with a boulder/cobble interior.

No midden or artifacts were observed.

Feature A is in poor to fair condition.

**Feature B** is a rectangular platform located east of Feature A. It measures 7.0 m. (23.0 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 0.6 m. (2.0 ft.). It is constructed of small to large boulders and utilizes outcrop along its east edge.

No artifacts or midden were observed.

Feature B is in fair condition and offers fair excavation potential.

**Feature C** is an elongated terrace located north of Feature B. It measures 3.5 m. (11.5 ft.) N/S by 32.0 m. (105.0 ft.) E/W. Outcrop is utilized extensively in its construction. It is constructed of small to large boulders.

No artifacts or midden were observed.

Feature C is in fair to poor condition and offers poor excavation potential.

**Feature D** is an elongated platform located across the gully from Features A through C. It measures 7.5 m. (24.6 ft.) N/S by 22.5 m. (73.8 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). It is constructed of small to large boulders and utilizes outcrop in its construction.

No artifacts or midden were observed.

Feature D is in fair to poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16493 **CSH Site #:** 140
**Site Type:** Site Complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** 784.0 m.$^2$ (2,571.5 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 520 ft. a.m.s.l.

**Description:** State site -16493 is a site complex comprised of 3 features designated A through C.

**Feature A** is a terrace situated on a pahoehoe bluff facing west/northwest and it is surrounded by *kiawe* and California grass. It measures 4.0 m. (13.1 ft.) N/S by 8.5 m. 27.9 (ft.) E/W and is approximately 2.0 m. (6.6 ft.) high on the north side. It is constructed of

medium to large boulders and has a small cobble fill.

No midden or artifacts were observed.

Feature A is in fair condition and offers fair to poor excavation potential.

**Feature B** is a rectangular platform situated on a bluff facing west/southwest. It is located about 10.0 m. (32.8 ft.) south of Feature A. It measures 6.5 (21.3 ft.) N/S by 4.0 m. (13.1 ft.) E/W and it is constructed of medium boulders. The platform is level and well paved with cobbles; boulders serve as corner stones.

Feature B is in good condition and offers fair to good excavation potential.

There is a boulder alignment located between Feature A and B; it measures 12.0 m. (39.4 ft.) long.

**Feature C** is a curved wall located 10.0 m. west/southwest of Feature B. It measures approximately 12.0 m. (39.6 ft.) N/S, at which point it diverts east for a distance of 9.0 m. (29.5 ft.); the wall has a width of 2.0 m. (6.6 ft.). It is roughly constructed of large to medium boulders.

Feature C is in fair condition and offers poor excavation potential.

**State Site #:** 50-10-37-16494 **CSH Site #:** 141
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 63.0 m.$^2$ (206.6 ft.$^2$)
***Ahupua'a:*** Onouli
**Elevation:** 530 ft. a.m.s.l.

**Description:** State site -16494 consists of two L-shaped walls situated on a gentle slope surrounded by grass and scattered *koa haole*, *kiawe* trees and lantana.

**Feature A** is an L-shape wall with its lengths measuring 7.0 m. (23.0 ft.) N/S and 3.0 m. (9.8 ft.) E/W. It is constructed of small to medium piled boulders with a maximum height of 1.0 m. (3.3 ft.) on its *makai* (west) sides. It measures 1.5 m. (4.9 ft.) wide and is constructed flush with the slope on the *mauka* (east) side.

No artifacts or midden were observed.

Feature A is in fair condition and offers fair excavation potential.

**Feature B** an L-shaped wall measuring 5.0 m. (16.4 ft.) N/S and 3.0 m. (9.8 ft.) E/W. It is similar in construction to Feature A. The interior area between Features A and B is mostly soil and scattered boulders and cobbles.

No artifacts or midden were observed.

Feature B is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16495 **CSH Site #:** 142
**Site Type:** Platform
**Function:** Permanent habitation



**Features (#):** 1
**Site Dimension:** 16.8 m.$^2$ (55.1 ft.$^2$)
***Ahupua'a:*** Onouli
**Elevation:** 530 ft. a.m.s.l.

**Description:** State site -16495 is a rectangular platform situated on gently sloped terrain covered with grasses and scattered *koa haole* and *kiawe* trees.

The platform measures 4.0 m. (13.1 ft.) E/W by 4.2 m. (13.8 ft.) N/S. It is constructed of small boulders and cobbles. The top portion if fairly level. Facing remains intact on all sides. In the southwest corner is a stack of stones which may have served as a ramp.

No artifacts or midden were observed at the site.

State site -16495 is in good condition. The excavation potential is considered fair to good.

**State Site #:** 50-10-37-16496 **CSH Site #:** 143
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 143.0 m.$^2$ (1,544.4 ft.$^2$)
***Ahupua'a:*** Onouli
**Elevation:** 460 ft. a.m.s.l.

**Description:** State site -16496 consists of a bi-level platform situated on level terrain surrounded by grasses and scattered *koa haole*, *kiawe* and lantana.

The platform's Level 1 is situated in the north portion of the platform. It measures 13.0 m. (42.7 ft.) E/W by 2.0 m. (6.6 ft.) N/S. Level 2 - located south of Level 1 - measures 5.0 m. (16.4 ft.) N/S by 13.0 m. (42.7 ft.) E/W. Level 1 contains a segment which extends to the south and measures 4.0 m. (13.1 ft.) E/W by 2.0 m. (6.6 ft.) N/S. The platform is constructed of cobbles and small boulders.

No midden or artifacts were observed.

The condition of State site -16496 is fair to good and the excavation potential is considered fair.

**State Site #:** 50-10-37-16497 **CSH Site #:** 144
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 416.0 m.$^2$ (4,492.8 ft.$^2$)
***Ahupua'a:*** Onouli
**Elevation:** 450 ft. a.m.s.l.

**Description:** State site -16497 is an irregularly shaped platform with an attached C-shaped enclosure. The site is situated on a moderate slope. Two agricultural terrace-like mounds are located just *makai* (west) of the site.

The platform measures 8.0 m. (26.2 ft.) N/S by 9.5 m. (31.2 ft.) with a maximum height of 1.0 m. (3.3 ft.) on its *makai* (west) side. It is constructed of a boulder facing with a

boulder and cobble pavement.

The C-shape enclosure is attached to the eastern edge of the platform. The walls of the enclosure measure 6.0 m. (19.8 ft.) N/S by 12.0 m. (39.6 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). There is a maximum width of 3.5 m. (11.5 ft.) at the eastern end of its north wall. The enclosure is open to the east and it has a level soil interior. The walls are constructed of a cobble fill with intact boulder facing.

No midden or artifacts were observed.

State site -16497 is in fair condition and the excavation potential is considered good.

**State Site #:** 50-10-37-16498 **CSH Site #:** 145
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 140.0 m.$^2$ (1,512.0 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 487 ft. a.m.s.l.

**Description:** State site -16498 is a circular three-level platform situated in an area of dense lantana.

The bottom level - Level 1 - measures 9.0 m. (29.5 ft.) E/W by 11.0 m. (36.1 ft.) N/S and it is almost flush with the surrounding terrain. It is constructed of a level boulder pavement. This level has minimal facing.

Level 2 is situated at the north corner of Level 1. It measures 5.0 m. (16.4 ft.) by 5.0 m. (16.4 ft.) with a height of 0.6 m. (1.9 ft.) above Level 1. No facing is apparent on the second level. It is constructed of medium to large boulders with a level medium to large cobble pavement.

Level 3 is a circular platform located on the west edge of Level 1 immediately south of Level 2. It measures 4.0 m. (13.1 ft.) in diameter and stands 1.0 m. (3.3 ft.) above the surrounding terrain. It is faced with boulders and has a perfectly level cobble pavement.

No midden or artifacts were observed.

State site -16498 is in good condition and the excavation potential is considered good to excellent.

**State Site #:** 50-10-37-16499 **CSH Site #:** 146
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 700.0 m.$^2$ (7560.0 ft.$^2$)
***Ahupua'a*:** Onouli
**Elevation:** 475 ft. a.m.s.l.

**Description:** State site -16499 is a rectangular enclosure with two obvious entrances. It is situated on level terrain surrounded by grass with scattered *koa haole*, *kiawe* trees, and lantana.

The site measures 35.0 m. (114.8 ft.) N/S by 20.0 m. (65.6 ft.) E/W. Its wall is



constructed of small to large boulders and is completely bi-faced. The interior consists of soil with scattered rocks.

A basalt core was observed at the site.

State site -16499 is in good condition and offers good excavation potential.

**State Site #:** 50-10-37-16500 **CSH Site #:** 147
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 100.0 m.$^2$ (1080.0 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 680 ft. a.m.s.l.

**Description:** State site -16500 is a rectangular enclosure utilizing outcrop. The site is situated on relatively level terrain covered with California grass, *koa haole*, and monkeypod trees.

The enclosure measures 10.0 m. (32.8 ft.) N/S by 10.0 m. (32.8 ft.) E/W. The *mauka* (east) face of the enclosure measures 1.0 m. (3.3. ft.) in height,while the remaining heights range from 0.5 to 0.8 m. (1.6 to 2.6 ft.). The wall is constructed of cobbles and a boulder mix. The enclosure interior is a level soil.

No artifacts or midden were observed.

State site -16500 is in poor condition. The excavation potential is considered fair.

**State Site #:** 50-10-37-16501 **CSH Site #:** 148
**Site Type:** C-Shape
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 89.3 m.$^2$ (963.9 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 720 ft. a.m.s.l.

**Description:** State site -16501 is a C-shaped enclosure situated on a bluff approximately 35.0 m. (114.8 ft.) to the south of a *mauka/makai* (east/west) running cattle wall (State site -16799). To the west is a 50.0 m. (164 ft.) section of an old agricultural wall.

The enclosure is open *makai* (west). Its south wall measures 8.5 m. (27.9 ft.). The east wall measures 10.5 m. (34.4 ft.) long and contains an entry way. The north wall measures 7.5 m. (24.6 ft.) long. The site is constructed of small to medium boulders with small cobble fill and has a level soil interior.

No artifacts or midden were observed.

State site -16501 is in fair condition and has fair excavation potential.

**State Site #:** 50-10-37-16502 **CSH Site #:** 149
**Site Type:** Platform
**Function:** Agriculture

**Features (#):** 1
**Site Dimension:** 24.8 m.$^2$ (267.8 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 655 ft. a.m.s.l.

**Description:** State site -16502 is a rectangular platform situated on a grass covered field approximately 234 m. (775 ft.) from a cattle wall (State site -16799).

The platform measures 5.4 m. (17.7 ft.) E/W by 4.6 m. (15.1 ft.) N/S. It is constructed of medium to large cobbles. It is 1.0 m. (3.3 ft.) in height. There is no apparent facing.

No midden or artifacts were observed.

State site -16502 is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16503 **CSH Site #:** 150
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 30.0 m.$^2$ (98.4 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 595 ft. a.m.s.l.

**Description:** State site -16503 is a large rectangular platform situated on a break in the slope approximately 700 ft. west of the historic railroad berm (State site -10302). The site is densely covered with lantana.

The platform measures 6.0 m. (19.7 ft.) E/W by 5.0 m. (16.4 ft.) N/S and it has a 1.0 m. extension. It is faced along the north and west sides with a height of 0.5 m. (1.6 ft.). The central area is somewhat raised and is paved with small cobbles.

No artifacts or midden were observed.

State site -16503 is in excellent condition. The excavation potential is considered excellent.

**State Site #:** 50-10-37-16504 **CSH Site #:** 151
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 56.3 m.$^2$ (607.5 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 560 ft. a.m.s.l.

**Description:** State site -16504 is a small, circular, temporary field enclosure situated on a gentle grassy slope surrounded with *koa haole*, *kiawe* lantana, and California grass.

The enclosure measures 7.5 m. (24.6 ft.) in diameter on the exterior and 4.0 m. (13.1 ft.) on the interior. It is constructed of small to medium boulders and has rough facing along its north side. The interior floor is level soil.

No artifacts or midden were observed.

State site -16504 is in fair condition. The excavation potential is considered poor to fair.



**State Site #:** 50-10-37-16505 **CSH Site #:** 152
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 20.25 m.$^2$ (218.7 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 580 ft. a.m.s.l.

**Description:** State site -16505 is a large platform with a mound piled near the center of its surface. The platform is situated on a relatively level grassy area surrounded by scattered *kiawe*.

The platform measures 4.5 (14.8 ft.) N/S by 4.5 m. (14.8 ft.) E/W and ranges in height from 0.5 m. (1.6 ft.) on the *mauka* (east) side to 1.5 m. (4.9 ft.) on the *makai* (west) side. The mounded portion measures 2.6 m. (8.5 ft.) N/S by 1.7 E/W (5.6 ft.). The platform is constructed of small boulders and cobbles. Remnant facing was observed.

A small top portion of a hand-blown, cork-top bottle, approximately 100 years old, was observed.

State site -16505 is in fair condition.

**State Site #:** 50-10-37-16506 **CSH Site #:** 153
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Kalukalu
**Elevation:** 525 ft. a.m.s.l.

**Description:** State site -16506 is a site complex with two features, designated A and B. The complex is surrounded by a grassy slope with scattered *kiawe*.

**Feature A** is a terrace, with an upper and lower level, built on the *makai* (west) edge of a bedrock bluff. The lower level of the terrace measures 10.0 m. (32.8 ft.) N/S by 4.5 m (14.8 ft.) E/W. The upper level measures 10.0 m. (32.8 ft.) N/S by 2.6 m. (8.5 ft.) E/W. This upper level has a *makai* (west) face which is 2.5 m. (8.2 ft.) high and a level surface well-paved with small cobbles. The *mauka* (east) side is flush with the bedrock slope.

A remnant wall, located 12.0 m. (39.4 ft.) southeast of Feature A, measures 10.0 m. (32.8 ft.) long and 1.6 m. (5.2 ft.) high. This wall has good facing in the central portion. South of Feature A by 0.5 m. (1.6 ft.) are two mounds, each measuring 0.5 m. (1.6 ft.) in diameter.

No artifacts or midden were observed.

Feature A is in good condition. The excavation potential is considered to be poor to fair.

**Feature B** is located 11.3 m. (37.1 ft.) south of Feature A. It consists of two platforms situated 1.6 m. (5.2 ft.) apart along an expanse of pahoehoe outcrop. The outcrop measures 8.6 m. (28.2 ft.) NE/SW and 7.3 m. (24.0 ft.) NW/SE. The *mauka* (east) platform is mounded and the *makai* (west) one is level and has clear facing along the west portion. These platforms are constructed of large to small stacked boulders with cobbles. Both platforms are 0.5 m. (1.6 ft.) high.

No artifacts or midden were observed.

Feature B is in poor condition. The excavation potential is considered to be fair to poor.

**State Site #:** 50-10-37-16507 **CSH Site #:** 154
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 10.5 m.$^2$ (113.4 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 510 ft. a.m.s.l.

**Description:** State site -16507 is a semi-circular platform located on a sloping bluff with surrounding vegetation consisting of California grass and *kiawe*.

The platform measures 3.5 m. (11.5 ft.) E/W by 3.0 m. (9.8 ft.) N/S with a maximum height of 1.0 m. (3.3 ft.). It is constructed of small to medium cobbles and small boulders. There is no apparent facing.

No artifacts or midden were observed.

State site -16507 is in poor condition with poor excavation potential.

**State Site #:** 50-10-37-16508 **CSH Site #:** 155
**Site Type:** L-Shape
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 42.5 m.$^2$ (459.0 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 505 ft. a.m.s.l.

**Description:** State site -16508 is an L-shaped enclosure, situated on sloping terrain and is surrounded by California grass and *kiawe*, and numerous agricultural mounds.

The enclosure measures 8.5 m. (27.9 ft.) E/W by 5.0 m. (16.4 ft.) N/S. The walls have an average width of 0.4 m. (1.3 ft.) and an average width of 1.9 m. (6.2 ft.). It is constructed of cobbles and small boulders with remnants facing. The interior of the enclosure is level soil with scattered cobbles.

No midden or artifacts were observed.

State site -16508 is in fair condition with poor excavation potential.



**State Site #:** 50-10-37-16509 **CSH Site #:** 156
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 37.1 m.$^2$ (400.7 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 495 ft. a.m.s.l.

**Description:** State site -16509 is a site complex containing two enclosures which are designated features A and B. The complex is located in a field of level soil which supports California grass and *kiawe*.

**Feature A** is a rectangular enclosure located at the northern edge of the site complex. The enclosed area measures 4.5 m. (14.8 ft.) by 3.5 E/W (11.5 ft.). The interior is soil and scattered boulders. Facing exists on the interior and exterior sides of the enclosure east/west walls. The entire enclosure is constructed of cobbles and small boulders.

Indigenous and historic artifacts, as well as midden, were observed at Feature A. Inside the enclosure, a large polished basalt fragment, large pieces of volcanic glass, a coral file, and coral fragments were observed; the basalt fragment was collected (Acc. #78). Marine midden observed there include cowrie fragments and *opihi*. Historic artifacts observed inside the enclosure include china fragments with a red and purple flower design, ceramic plate ware fragments, and pieces of an old dark green bottle.

Outside the enclosure more artifacts and midden were observed in three different general areas. Coral and *Thaididae* were observed 12.0 m. (39.6 ft) away, as well as an old medicine bottle and assorted glass. A adz fragment (Acc.# 77) and a polished flake (Art. #78) was collected from 25.0 m. (82.0 ft.) southwest of the enclosure. A coral sinker (Acc. #123) was collected from a wall 36.6 m. (120.0 ft.) from the southwest. This site may be associated with state site -16509.

Feature A is in good condition and the excavation potential is considered good.

**Feature B** is an L-shaped enclosure located 15.0 m. (49.2 ft.) south of Feature A. It measures 12.0 m. (39.4 ft.) N/S by 8.5 m. (27.9 ft.) E/W with a maximum wall height of 0.5 m. (1.6 ft.). The wall has an approximate width of 1.5 m. (4.9 ft.). It is constructed of boulders mounded on top of outcrop.

Midden was observed between Features A and B. No artifacts were visible.

Feature B is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16510 **CSH Site #:** 157
**Site Type:** Site Complex
**Function:** Agricultural
**Features (#):** 3
**Site Dimension:** 264 m.2 (2824.8 ft.2)
***Ahupua'a*:** Haleki'i
**Elevation:** 660 ft. a.m.s.l.

**Description:** State site -16510 is a site complex containing three features designated as features A, B, and C. Feature A consists of a terrace, feature B a platform, and feature C a wall structure. The complex is llocated at the top of a slope utilizing a bedrock bluff that has

been bulldozed at the *mauka* (west) end.

**Feature A** is a boulder/cobble terrace constructed at the *makai* (western) end of a bedrock bluff. The terrace measures 8.3 m. E/W by 5.8 m. N/S with the east end of the terrace abbutting the bedrock bluff. The surface of the terrace is level with cobble and pebble paving.

**Feature B** is a small rectangular platform located directly to the northeast of Feature A, terrace. The platform, constructed of boulders and cobbles, measures 4.5 m. N/S by 3.5 E/W. The surface of theplatform is level with cobble and pebble paving. A short wall section, approximately 2 m. long, extends off of the NE corner. The wall is constructed of medium size boulders and is oriented in a roughly east/west direction.

**Feature C** consists of 12.3 m. long wall section that extends off of the SE corner of feature B and is also oriented in a east/west direction. The wall is constructed of medium size boulders and cobbles and is situated on the north end of the bedrock bluff. Feature B and C forms a J-shaped enclosure with a level soil interior.

Vegetation surrounding the site consists of California grass, *koa haole* and a cluster of *kukui* nut trees.

No midden or artifacts were observed on the surface. Excavation potential is poor.

**State Site #:** 50-10-37-16511 **CSH Site #:** 158
**Site Type:** Site complex
**Function:** *Heiau*
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a*:** Haleki'i
**Elevation:** 600 ft. a.m.s.l.

**Description:** State site -16511 is a *heiau* complex comprised of three features, designated A-C. These include a set of platforms (Feature A), an enclosure (Feature B), and another platform (Feature C). The complex is located approximately 30.0 m. (98.4 ft.) from the main project access road on a pahoehoe slope.

**Feature A** is a bi-level platform. Level 1, the upper level, measures 7.5 m. (24.6 ft.) N/S by 11.0 m. (36.1 ft.) E/W on the *makai* (west) edge, and 10.0 m. (32.8 ft.) E/W on the *mauka* (east) edge with heights ranging from 0.8 m. to 1.0 m. (2.6 to 3.3 ft.). Along the edge of this level is a wall 0.8 m. (2.6 ft.) thick with a maximum weight of 1.15 m. (3.8 ft.) above the platform surface. Facing is well-preserved along the exterior and interior of this enclosing wall. The *makai* (west) edge of the platform bears no enclosing wall; this side of the platform is well-faced. The platform has a maximum height of 1.2 m. (3.9 ft.) at the NE corner, including the height of the wall. Level 1 is constructed of small to medium boulders with some cobble chinking. It rises 5 to 6 courses high with stacked small boulders. The interior floor is level with no internal features. The *makai* (west) portion measuring about 3.0 m. (9.8 ft.) wide is tumbled, probably due to cattle grazing. One meter (3.3. ft.) below and south of Level 1 is the lower platform level, Level 2.

Level 2 measures 7.0 m. (23.0 ft.) E/W by 6.5 m. (21.3 ft.) N/S and has an internal hearth feature in the center of the pavement. There is also a boulder alignment running E/W approximately 2.5 m. (8.2 ft.) off the north side. The construction is similar to Level 1, although the surface of Level 2 is more roughly paved.



No midden or artifacts were observed.

Feature A is in good to excellent condition.

**Feature B** is a roughly rectangular enclosure adjacent to the south side of Level 2, Feature A. The enclosed area measures 4.0 m. (13.1 ft.) E/W by 5.0 m. (16.4 ft.) N/S and 2.5 m. (8.2 ft.) E/W. The walls are 0.75 (2.4 ft.) thick and 0.2 m. (2 ft.) high. The interior surface is level soil.

No midden or artifacts were observed.

Feature B is in good condition.

**Feature C** is a platform located 50.0 m. (164 ft.) northwest of Feature A. *Lau'ae* ferns were observed growing on the feature.

The platform measures 2.0 m. (6.6 ft.) N/S by 5.0 m. (16.4 ft.) E/W with an average height of 0.7 m. (2.3 ft.). Some facing was observed along the *makai* (west) face. The platform is constructed of small boulders and a few cobbles.

No artifacts or midden were observed.

Feature C is in good condition.

**State Site #:** 50-10-37-16512 **CSH Site #:** 159
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 46.75 $m.^2$ (504.9 $ft.^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 640 ft. a.m.s.l.

**Description:** State site -16512 is a small platform built on a bedrock slope approximately 35.0 m. northwest of State site -16511. Vegetation at the site is primarily *koa haole*.

The platform measures 8.5 m. (27.9 ft.) N/S by 5.5 m. (18.0 ft.) E/W with a maximum height of 0.3 m. (1.0 ft.). It is defined by a boulder facing with a boulder and cobble pavement. There is a rectangular depression in the center of the platform.

No artifacts or midden were observed.

State site -16,512 is in fair condition and the excavation potential is considered poor.

**State Site #:** 50-10-37-16513 **CSH Site #:** 160
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 28.2 $m.^2$ (304.6 $ft.^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 640 ft. a.m.s.l.

**Description:** State site -16513 is a terrace situated in an old 'a'a flow. Numerous *koa haole* trees surround the site.

The terrace measures 8.8 m. (28.9 ft.) N/S by 3.2 m. (10.5 ft.) E/W and is 1.2 m. (3.9 ft.) high. It is constructed of small boulders and cobbles piled on an outcrop. The surface of the terrace is paved wit cobbles.

No artifacts or midden were observed.

State site -16513 is in good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16514 **CSH Site #:** 161
**Site Type:** Lava Blister
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 11.9 m.$^2$ (128.5 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 630 ft. a.m.s.l.

**Description:** State site -16514 is lava blister situated on a moderately sloping terrain. The surrounding vegitation is mainly *Kiawe*.

The blister measures 3.3 m. (10.8 ft.) E/W by 2.1 m. (6.9 ft.) N/S with a maximum height is 0.5 m. (1.6 ft.). The entrance of the blister measures 0.5 m. (1.6 ft.) in diameter.

Large amounts of marine midden and coral were observed in the interior of the blister.

State site -16514 is in fair condition with fair to good excavation potential.

**State Site #:** 50-10-37-16515 **CSH Site #:** 162
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 38.0 m.$^2$ (410.4 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 610 ft. a.m.s.l.

**Description:** State site -16515 is a terrace with a roughly square depression in the center. The terrace is located approximately 30.0 m. (98.4 ft.) *makai* (west) of state site -16514. The is exposed pahoehoe with little or no soil.

The terrace measures 6.0 m. (19.8 ft.) N/S by 4.2 m. (13.9 ft.) E/W. It is roughly constructed of large angular pahoehoe boulders and cobbles. No facing is evident. Near the south center portion of the terrace surface is a depression which measures 1.0 m. by 1.0 m. (3.3 ft. by 3.3 ft.). Loose pahoehoe boulders fill the depression.

No artifacts or midden were observed.

State site -16515 is in poor condition and offers fair to poor excavation potential.



**State Site #:** 50-10-37-16516 **CSH Site #:** 163
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 600 m.$^2$ (6,480.0 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 600 ft. a.m.s.l.

**Description:** State site -16516 is a terrace located on a pahoehoe flow.

The terrace measures 7.0 m. (23.0 ft.) NE/SW by 4.2 m. (13.8 ft.) NW/SE with a maximum faced height of 1.2 m. (3.9 ft.). The terrace abuts the edge of the pahoehoe flow along its southeastern side. It is constructed with boulders and has a small boulder pavement.

On the surface of the pahoehoe flow 2.5 m. (8.2 ft.) east of the terrace is a small cupboard built into a crack in the outcrop. The cupboard measures 1.5 m. (4.9 ft.) N/S long by 0.9 m. (3.0 ft.) high, by 0.5 m. (1.6 ft.) wide E/W.

A remnant enclosure wall is located 14.5 m. to 25.0 m. (47.6 ft. to 82.0 ft.) south of the terrace. The wall is defined by a few boulders piled in a long L-shape. The north/south segment measures 7.5 m. (24.6 ft.) long. Three meters south of this segment is the western end of a 20.0 m. (65.6 ft.) -long east/west remnant wall segment.

No midden or artifacts were observed.

State site -16516 is in fair condition. It offers fair to good excavation potential.

**State Site #:** 50-10-37-16517 **CSH Site #:** 164
**Site Type:** Modified outcrop
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 600.0 m.$^2$ (1,968.0 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 585 ft. a.m.s.l.

**Description:** State site -16517 consists of a modified outcrop and nearby retaining wall segments. The site is located approximately 10.0 m. (32.8 ft.) north of the *mauka/makai* (east/west) cattle wall and 30 m. (98.4 ft.) to the west of state site -16519. The vegetation consists of California grass and *kiawe* trees.

This general site area measures 50.0 m. (164.0 ft.) E/W by 12.0 m. (39.4 ft.) N/S. The modifications to the outcrop include three small roughly paved areas. The rough pavements consist of boulders roughly stacked to produce a moderately level area. One area is well paved with pahoehoe cobbles.

The retaining wall segments stretch 54.0 (177.2 ft.) N/S and average 2.3 m. (7.5 ft.) wide. They are defined by loosely piled pahoehoe boulders and cobbles.

No artifacts or midden were observed.

State site -16517 is in poor condition.

**State Site #:** 50-10-37-16518 **CSH Site #:** 165
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 14.4 m.$^2$ (155.5 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 585 ft. a.m.s.l.

**Description:** State site -16518 is a rectangular platform located on pahoehoe outcrop and surrounded by agricultural features. Vegetation at this site consists of brush and *kiawe*.

The platform measures 3.8 m. (12.5 ft.) E/W by 3.8 (12.5 ft.) N/S and ranges in height from 0.6 m. (2.0 ft.) on the north to 0.7 m. (2.3 ft.) on the east. The platform is constructed of medium cobbles and boulders. The north and east walls are both well faced. The south and west walls are collapsed and in poor condition.

Located 2.5 m. (8.2 ft.) from the northeast corner of the platform, is a circular alignment, possibly a hearth, measuring 0.8 m. (2.6 ft.) in diameter by 0.8 m. (2.6 ft.) high.

No observable midden or artifacts were observed.

State site -16518 is in fair condition with fair excavation potential.

**State Site #:** 50-10-37-16519 **CSH Site #:** 166
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 105.0 m.$^2$ (1134.0 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 580 ft. a.m.s.l.

**Description:** State site -16519 comprises an enclosure and a platform, designated features A and B respectively. It is located 10.0 m. (32.8 ft.) from a *mauka/makai* (east/west) cattle wall (State site -16794).

**Feature A** is a rectangular enclosure which measures 11.2 (36.7 ft.) N/S by 7.5 m. (24.6 ft.) E/W. It is constructed of large boulders and small cobbles. The *makai* (west) section is faced while the rest is tumbled. The interior measures 3.1 m. (10.2 ft.) N/S by 1.7 m. (5.6 ft.) E/W and is level soil.

No midden or artifacts were observed.

Feature A is in fair condition and offers fair excavation potential.

**Feature B** is a semi-rectangular mounded platform situated 1.3 m. (4.3 ft.) *mauka* (east) from Feature A. It measures 9.2 m. (30.2 ft.) E/W by 6.2 m. (20.3 ft.) N/S with a maximum height of 1.2 m. (3.9 ft.). It is constructed of large boulders and cobbles.

No artifacts or midden are observed.

Feature B is in fair condition and offers fair excavation potential.



**State Site #:** 50-10-37-16520 **CSH Site #:** 167
**Site Type:** Terrace
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 13.5 m.$^2$ (145.8 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 560 ft. a.m.s.l.

**Description:** State site -16520 is a rectangular terrace located on a pahoehoe outcrop. The terrace slopes gently *makai* (west) as does the surrounding terrain.

The terrace measures 4.5 m. (14.8 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum height of 1.5 m. (4.9 ft.) at the southeast corner and 0.9 m. (3 ft.) at the northwest corner. It is constructed of small to medium boulders. The west and south sides are flush with the outcrop while the northeast corner is well faced. In the center of the terrace is an alignment of boulders which measures 1.5 m. (4.9 ft.) E/W.

No midden or artifacts are observed.

State site -16520 is in fair to good condition with a fair excavation potential.

**State Site #:** 50-10-37-16521 **CSH Site #:** 168
**Site Type:** Lava blister
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 20.0 m.$^2$ (216.0 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 575 ft. a.m.s.l.

**Description:** State site -16521 is a lava blister located in a pahoehoe lava field. Vegetation consists primarily of *koa haole*.

The interior of the blister measures 8.0 m. (26.2 ft.) N/S by 2.5 (8.2 ft.) E/W. The entrance is less than a meter in diameter. Along the northeast edge of the blister is an alignment of medium boulders. Below the entrance large chunks of charcoal which were collected for dating. (See Table 7)

No artifacts or midden was observed.

State site -16521 is in remnant condition. The excavation potential is considered poor.

**State Site #:** 50-10-37-16522 **CSH Site #:** 169
**Site Type:** Lava Blister
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 20.25 m.$^2$ (218.7 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 500 ft. a.m.s.l.

**Description:** State site -16522 is a lava blister with an entrance at its top 0.7 m. (2.3 ft.) above the surrounding ground surface. The terrain consists of gentle to moderate undulating

pahoehoe outcrops with many bluffs and small pockets of soil present.

The blister measures 4.5 m. (14.8 ft.) in diameter. The interior soil is covered with occasional cobbles. The soil depth is 0.1 m. (0.3 ft.).

A water-worn pebble is present inside this blister. No other artifacts or midden was observed and no structural modification were present.

**State Site #:** 50-10-37-16523 **CSH Site #:** 170
**Site Type:** C-Shape
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 60.0 m.$^2$ (648.0 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 500 ft. a.m.s.l.

**Description:** State site -16523 is a C-shaped enclosure located 2.5 m. (8.3 ft.) north of a *mauka/makai* (east/west) cattle wall (State site -16793). The surrounding topography consists of undulating pahoehoe.

The C-shaped enclosure measures 10.0 m. (32.8 ft.) N/S by 6.0 m. (19.7 ft.) E/W. The enclosure is constructed of pahoehoe boulders and cobbles piled against and out from a bedrock outcrop. Small segments of facing are still intact.

No surface artifacts or midden were observed.

State site -16523 is in fair condition and the excavation potential is considered fair.

**State Site #:** 50-10-37-16524 **CSH Site #:** 171
**Site Type:** Platform/Blister
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** (see below)
***Ahupua'a*:** Haleki'i
**Elevation:** 485 ft. a.m.s.l.

**Description:** State site -16524 is a lava blister and adjacent platforms located approximately 6.1 m. (20.0 ft.) from the east/west wall (State site -16793). The terrain consists of pahoehoe outcrops and *kiawe* trees.

A small platform lies above the vertical entrance to the tube. It measures 3.0 m. (9.8 ft.) E/W by 3.0 m. (9.8 ft.) N/S with a maximum height of 1.8 m. (5.9 ft.). The platform is constructed of small to medium cobbles.

No artifacts or midden were observed at the platform.

The blister entrance is located at the north end of the small platform. The maximum height of the blister is 0.80 m. (2.6 ft.). It measures 3.1 m. (10.2 ft.) N/S by 3.4 m. (11.2 ft.) E/W.

Two coral files, two coral fragments, a basalt flake, an *'ili'ili* stone, *kukui* and historic wire were observed within the blister.

A large platform extends north from the entrance of the blister. This platform measures 8.3 m. (27.2 ft.) N/S and 4.3 m. (14.1 ft.) E/W. with a maximum height of 0.7 m. (2.3 ft.). It is constructed of medium and large cobbles and boulders. No facing is visible.



No artifacts or midden were observed at this platform either.

State site -16524 is in fair condition and offers good excavation potential.

**State Site #:** 50-10-37-16525 **CSH Site #:** 172
**Site Type:** Platform-Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 16.0 m.$^2$ (172.8 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 470 ft. a.m.s.l.

**Description:** State site -16525 is a platform attached to a C-shaped enclosure. Vegetation at the site consists of California grass, *kukui*, and hibiscus.

The platform-enclosure measures 5.0 m. (16.4 ft.) E/W by 5.5 m. (18.0 ft.) N/S with a heights ranging from 0.40 m. to 0.45 m. (1.3 to 1.5 ft.).

Incorporated into the northern half of the platform is the C-shaped enclosure. The partially enclosed area measures 1.5 m. (4.9 ft.) N/S by 4.0 m. (13.1 ft.). The northern platform edge and part of the eastern edge define the U-shape and measure 1.0 m. (3.3 ft.) wide. The interior surface of the enclosed area is covered with soil.

Near the center of the southern half of the platform surface is a circular alignment around a depression which measures 1.1 m. (3.3 ft.) in diameter and 0.3 m. (1 ft.) deep. The surface is roughly paved with medium cobbles and small boulders.

No midden or artifacts were observed.

State site -16525 is in fair to good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16526 **CSH Site #:** 173
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 12.5 m.$^2$ (135.0 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 470 ft. a.m.s.l.

**Description:** State site -16526 is a roughly rectangular terrace located approximately 21.3 m. (70.0 ft.) from the fence line running northwest/southeast. The terrace is situated on a gentle grassy slope. Vegetation at the site consists of a large *kiawe* tree, California grass, lantana, and *koa haole*.

The terrace measures 5.0 m. (16.4 ft.) N/S by 2.5 m. (8.2 ft.) E/W with a maximum height of 1.2 m. (3.6 ft.) along its west side. It is constructed of stacked medium cobbles and small boulders and has a fairly level surface. The terrace is flush with the slope on the east side. No facing was observed.

No midden or artifacts were observed.

State site 16526 is in fair condition and the excavation potential is considered fair.

**State Site #:** 50-10-37-16527 **CSH Site #:** 174
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Kalukalu
**Elevation:** 465 ft. a.m.s.l.

**Description:** State site -16527 comprises an enclosure and a platform, designated features A and B respectively. The complex is situated on a slope of soil and bedrock outcrop. Surrounding vegetation is *koa haole*, *kiawe*, and California grass.

**Feature A** is an enclosure measuring approximately 12.0 m. (39.4 ft.) N/S by 11.0 m. (36.1 ft.) E/W. The south wall is a modified outcrop and the north wall is well faced. The east wall is outcrop with some stacked rocks present. The west wall is collapsed.

No midden or artifacts are observed.

Feature A is in fair to poor condition and the excavation potential is considered poor. The enclosure is interpreted as an agricultural feature.

**Feature B** is a mounded rectangular platform situated downslope of Feature A. This platform measures 5.5 m. (18.0 ft.) N/S by 3.8 m. (12.5 ft.) E/W. It is constructed of small boulders and large to small cobbles. No facing remains and the edges are tumbled. There is a level soil area 3.4 m. (11.2 ft.) N/S by 2.3 m. (7.5 ft.) E/W in the southeast portion.

No artifacts or midden were observed.

Feature B is in poor to fair condition. The platform is interpreted as a permanent habitation feature.

**State Site #:** 50-10-37-16528 **CSH Site #:** 175
**Site Type:** Site complex
**Function:** Temporary habitation
**Features (#):** 2
**Site Dimension:** 504.0 $m.^2$ (5,443.2 $ft.^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 415 ft. a.m.s.l.

**Description:** State site -16528 consists of two features, a platform on a bedrock outcrop (Feature A) and a terrace to the south on an outcrop surrounded by grass (Feature B). The site is surrounded by lantana and *koa haole*.

**Feature A** is a somewhat triangular platform which measures 18.0 m.(59.1 ft.) N/S by 8.0 m. (26.2 ft.) E/W at the south end, 2.0 m. (6.6 ft.) E/W at the north end. It is constructed of stacked small to medium boulders with a maximum wall height of 1.0 m. (3.3 ft.) on the west (*makai*) and 1.1 m. (3.6 ft.) on the east.

No interior features and no midden were observed but one water-rounded stone was observed mid-platform on the south side.

**Feature B** is a semi-circular terrace located 13.0 m. (42.7 ft.) to the south of Feature A on a slope. This terrace is now collapsed on its south side which slopes to 2.5 m. (8.2 ft.)



lower than the north side. The terrace measures 5.0 m. (16.4 ft.) on the exterior and 3.5 m. (11.5 ft.) on the interior N/S by 13.0 m. (42.7 ft.) on the exterior and 10.0 m. (32.8 ft.) on the interior E/W. It is constructed of cobble and small to large boulders.

No midden or artifacts were observed.

Feature B is in poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16529 **CSH Site #:** 176
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 4
**Dimension:** (see below)
***Ahupua'a*:** Kalukalu
**Elevation:** 405-425 ft. a.m.s.l.

**Description:** State site -16529 (Figure 24) is a habitation complex comprising four features designated A through D. It is located on a moderate slope vegetated with ungrazed California grass, *koa haole*, and scattered *kiawe* trees.

**Feature A** is a circular enclosure with two attached platforms on the *makai* (west) side. The enclosure measures 3.2 m. (10.5 ft.) in diameter with a maximum height of 0.5 m. (1.6 ft.). Wall width is approximately 1.5 m. (4.9 ft.). It is constructed of medium to small boulders and cobbles with intact facing. The interior consists of a level soil deposit. There is a possible cupboard - measuring 0.5 m. (1.6 ft.) N/S by 0.4 m. (1.3 ft.) E/W - located in the west end of the north wall. A large flat capstone covers the cupboard.

Two rectangular platforms adjoin the enclosures on the north and south *makai* (west) corners. The southwestern platform measures 7.5 m. (24.6 ft.) NE/SW by 2.8 m. (9.2 ft.) NW/SE. It has two levels: the *mauka* (east) level measures 3.0 m. (9.8 ft.) NE/SW with a maximum height of 1.0 m. (3.3 ft.). There is a 0.7 m. (2.3 ft.) drop to the *makai* (west) level which measures 4.0 m. (13.1 ft.) NE/SW with a maximum height of 0.6 m. (2.0 ft.). The platform displays intact boulder facing and a level cobble fill pavement.

The southeastern platform measures 8.5 m. (27.9 ft.) NW/SE by 2.8 m. (9.2 ft.) NE/SW with a maximum height of 0.1 m (0.3 ft.). It is constructed of small to large boulders and makes extensive use of the underlying outcrop for its delineation.

There is a short, collapsed wall section leading to Feature B. It measures 1.0 m. (3.3 ft.) NE/SW by 0.5 m. (1.6 ft.) NW/SE and is constructed with collapsed boulders.

No artifacts or midden were observed.

Feature A is in good condition with excellent excavation potential.

**Feature B** is a level terrace located immediately *makai* (west) of Feature A. It measures 16.0 m. (52.5 ft.) N/S by a maximum 4.5 m. (14.8 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.). It is constructed of small to medium boulders and cobbles. The *mauka* (east) edge is flush with the terrain, creating a level soil pocket extending to the *makai* (west) edge of Feature A approximately 5.0 m. (16.4 ft.) away.

No artifacts or midden were observed.

Feature B is in fair condition with good excavation potential.

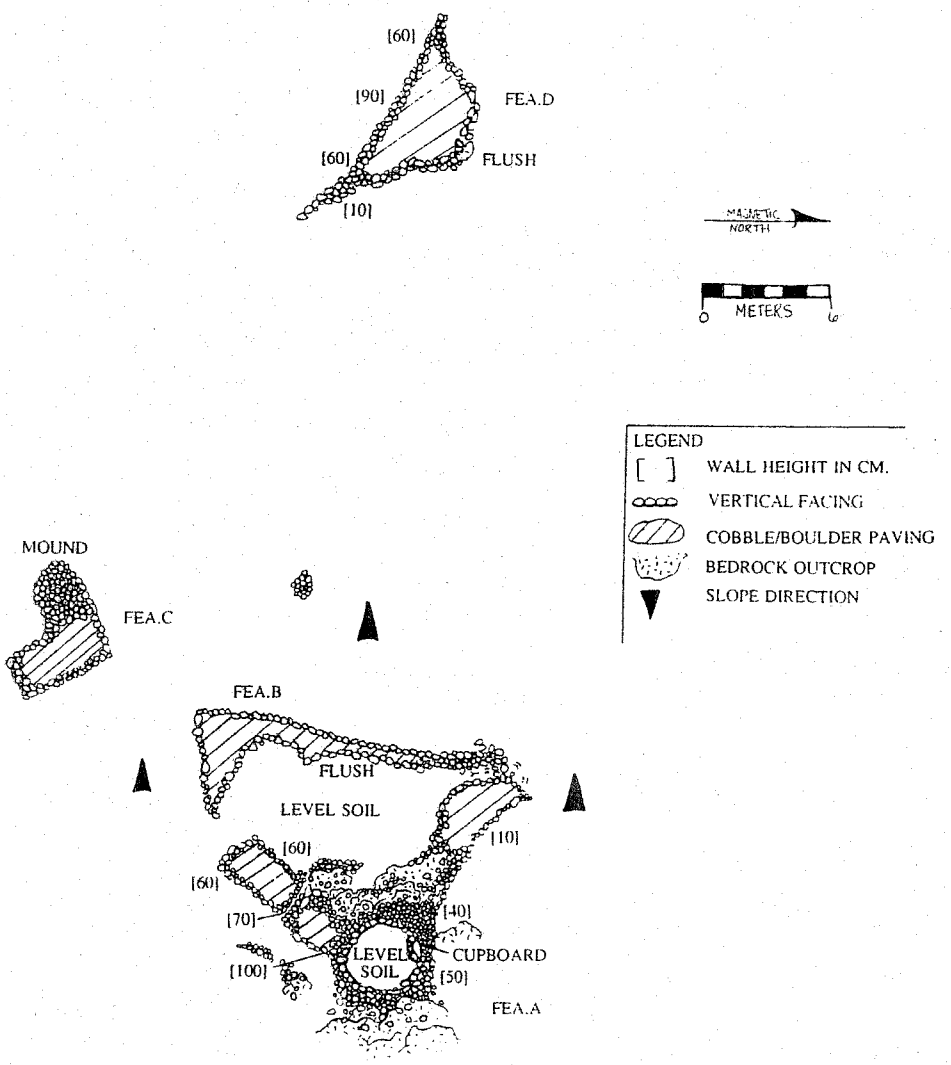



Figure 24 State site 50-10-37-16529; plan view



**Feature C** is a rough platform with an attached mound located 5.0 m. (16.4 ft.) southwest of Feature B. The platform measures 5.5 m. (18.0 ft.) NW/SE by 3.0 m. (9.8 ft.) NE/SW with a maximum height of 0.7 m. (2.3 ft.). It is constructed of piled pahoehoe boulders and cobbles with a roughly level surface. No intact facing remains. The mound is attached to the southwest corner of the platform. It measures 4.0 m. (13.1 ft.) NE/SW by 3.0 m. (9.8 ft.) NW/SE and has a maximum height of 0.7 m. (2.3 ft.). It is constructed of mounded boulders.

No artifacts or midden were observed.

Feature C is in fair condition with good excavation potential.

**Feature D** is a modified outcrop terrace located approximately 26.0 m. (85.3 ft.) *makai* (west) of Feature B. The terrace measures 9.0 m. (26.2 ft.) NW/SE by 4.0 m. (13.1 ft.) NE/SW with a maximum height of 0.9 m. (3.0 ft.). The north and east sides are flush with the terrain. It is constructed of medium to large pahoehoe boulders curbing and overlaying the outcrop.

No artifacts or midden were observed.

Feature D is in poor condition with fair to poor excavation potential.

**State Site #:** 50-10-37-16530 **CSH Site #:** 177
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Kalukalu
**Elevation:** 385 ft. a.m.s.l.

**Description:** State site -16530 is a site complex containing two platforms, designated Features A and B. The site is located on a gentle to moderate slope. Numerous agricultural mounds and outcrop modifications surround the site. The slope appears modified to channel water.

**Feature A** is large, irregularly shaped platform measuring 35.0 m. (114.8 ft.) N/S by 14.0 m. (45.9 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). It is constructed of piled cobbles and boulders with a rough pavement surface.

No midden or artifacts were observed.

Feature A is in fair to poor condition. The excavation potential is considered poor.

**Feature B** is small roughly square platform located just east of Feature A. It measures 7.0 m. (23.0 ft.) N/S by 7.0 m. (23.0 ft.) E/W with a maximum height of 0.4 m. (1.3 ft.). It is curbed with boulders and has a rough cobble and boulder pavement.

No artifacts or midden were observed.

Feature B is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16531 **CSH Site #:** 178
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Kalukalu
**Elevation:** 555 ft. a.m.s.l.

**Description:** State site -16531 is a site complex comprising two platforms, designated Features A and B. The complex is located on a level grassy area containing *koa haole*, *kiawe*, and lantana. The site is situated in a field of agricultural mounds.

**Feature A** is a rectangular platform situated on top of a bedrock outcrop. The platform measures 7.2 m. (23.6 ft.) E/W by 4.0 m. (13.1 ft.) N/S with a maximum height of 0.3 m. (1.9 ft). The east side is paved with small cobbles. The platform is constructed of medium to large cobbles piled atop the outcrop.

No midden or artifacts were observed.

Feature A is in fair condition and offers fair excavation potential.

**Feature B** is a rectangular platform located 6.8 m. (22.3 ft.) from the northwest corner of Feature A. The platform measures 6.8 m. (22.3 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.) and an average height of 0.8 m. (2.6 ft.). It is constructed of large cobbles and small boulders piled on a bedrock outcrop.

No midden or artifacts were observed.

Feature B is in fair condition and offers poor excavation potential.

**State Site #:** 50-10-37-16532 **CSH Site #:** 179
**Site Type:** Platform
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 25.8 m.$^2$ (278.6 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 375 ft. a.m.s.l.

**Description:** State site -16532 is a rectangular platform located on a gentle slope of pahoehoe outcrop, just *makai* (west) of a section of extensive agricultural mounding. Vegitayion includes *kiawe*, *koa haole*, and grass. The platform measures 6.0 m. (19.7 ft.) N/S by 4.3 m. (14.1 ft.) E/W with heights ranging from 0.3 m. (1.0 ft.) to 0.6 m. (2.0 ft.). The surface is roughly paved.

No midden or artifacts were observed.

State site -16532 is in poor condition and offers poor excavation potential.



**State Site #:** 50-10-37-16533 **CSH Site #:** 180
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 29.8 m.$^2$ (321.8 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 450 ft. a.m.s.l.

**Description:** State site -16533 is a terraced platform situated on a bedrock outcrop. Vegetation at the site includes *kiawe*, California grass, and *lantana*.

The platform measures 4.8 m. (15.7 ft.) E/W by 6.2 m. (20.3 ft.) N/S with a maximum height of 2.0 m. (6.6 ft.) along the remnant western facing. The platform is constructed of large cobbles and medium boulders. The surface exhibits rough cobble-and-boulder paving.

No midden or artifacts were observed.

State site -16533 is in poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16534 **CSH Site #:** 181
**Site Type:** L-Shape
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 48.0 m.$^2$ (518.4 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 400 ft. a.m.s.l.

**Description:** State site - 16534 is an L-shaped enclosure situated on a gently sloping grassland scattered with *kiawe*.

The enclosure measures 8.3 m. (27.2 ft.) N/S by 5.2 m. (17.1 ft.) E/W with a maximum wall width of 2.5 m. (8.2 ft.). The *mauka* (east) portion of north/south wall is approximately 0.2 m. (0.7 ft.) high, the *makai* (west) portion is 0.5 m. (1.6 ft.) high. The enclosure is constructed of cobbles and large boulders.

A possible hammer stone was observed on the structure, but no midden was observed.

State site -16534 is in fair condition. The excavation potential is considered poor.

**State Site #:** 50-10-37-16535 **CSH Site #:** 182
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 24.0 m.$^2$ (259.2 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 450 ft. a.m.s.l.

**Description:** State site -16535 is a small platform situated on gentle slope. Vegetation consists of *koa haole*, *kiawe*, California grass, and lantana.

The platform measures 4.0 m. (13.1 ft.) N/S by 5.8 m. (19.0 ft.) E/W with a maximum height of 1.4 m. (4.6 ft.) along the west face. It is roughly paved with cobbles and boulders.

Wall segments extend from the southeast and northwest corners. Facing remains intact along the south side.

A possible pestle stone was observed on the surface, but no midden was observed at the site.

State site -16535 is in poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16536 **CSH Site #:** 183
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 75.0 m.$^2$ (885.0 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 375 ft. a.m.s.l.

**Description:** State site -16536 is a platform with an adjacent remnant soil-retaining structure. The site is situated just below a large boulder outcrop and is surrounded by *kiawe*, *koa haole*, lantana and California grass.

The platform measures 5.0 m. (16.4 ft.) N/S by 5.0 m. (16.4 ft.) E/W with a maximum height of 1.5 m. (4.9 ft.) on the *makai* (west) face.

From the northwest corner of the platform an upright boulder alignment extends west 2.5 m. (8.2 ft.). It measures 0.6 m. (2.0 ft.) in height. The alignment connects to a remnant retaining wall, thus defining a partially enclosed area of level soil on the western side of the platform. The soil area measures approximately 6.0 m. (19.8 ft.) N/S by 2.0 m. (6.6 ft.) E/W.

The wall has a maximum interior height of 0.3 m. (1.0 ft.). The exterior (*makai* side) is collapsed and has a maximum height of 1.3 m. (4.3 ft.). The retaining wall measures approximately 10.0 m. (32.8 ft.) long (north-south). The south end slopes back uphill about 6.0 m. (19.8 ft.). The wall is constructed of medium cobbles and small boulders.

No artifacts or midden were observed.

State site -16536 is in good condition and the excavation potential is considered good.

**State Site #:** 50-10-37-16537 **CSH Site #:** 184
**Site Type:** Mounds
**Function:** Agriculture
**Features (#):** Indeterminate
**Site Dimension:** Indeterminate
***Ahupua'a:*** Kalukalu
**Elevation:** 430 ft. a.m.s.l.

**Description:** State site -16537 is a group of large unfaced boulder mounds and terraces. The site is situated on a fairly steep slope vegetated with California grass, lantana, and *kiawe*.

The main feature is a mound measuring 4.4 m. (14.4 ft.) E/W by 4.8 m. (15.7 ft.) N/S with a maximum height of 1.0 m. (3.3 ft.) on the *makai* (west) side. It is constructed with medium to large boulders.

One small water rounded pebble was observed. Sparse midden was observed.

State site -16537 is in poor condition and offers poor excavation potential.



**State Site #:** 50-10-37-16538 **CSH Site #:** 185
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 48.0 m.$^2$ (518.4 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 250 ft. a.m.s.l.

**Description:** State site -16538 is a bi-level platform situated on a steep slope. Vegetation at the site includes California grass, lantana, and *kiawe*.

The upper level measures 4.5 m. (14.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 2.0 m. (6.6 ft.). The lower platform level is connected by collapsed boulders to the western side of the upper level. The lower level measures 7.0 m. (23.0 ft.) (N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 0.2 m. (0.6 ft.). The slope to the south is lined with small boulders and large cobbles extending approximately 7.0 m. (23.1 ft.) from the platform. The platform is constructed of small to medium boulders with cobble fill.

There were no observable midden or artifacts.

State site -16538 is in poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16539 **CSH Site #:** 186
**Site Type:** Site complex
**Function:** Possible burial
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Kalukalu
**Elevation:** 350 ft. a.m.s.l.

**Description:** State site -16539 is a set of two possible burial mounds, designated Features A and B. The site complex is located on a slope approximately 20.0 m. (65.6 ft.) north of a boundary wall (State site -16799).

**Feature A** is a mound which measures 4.2 m. (13.8 ft.) SW/NE by 5.0 m. SE/NW. It is constructed of medium boulders and small cobbles as fill. The mound bears two raised flat stones which measure approximately 0.2 m. (0.7 ft.) by 0.3 m. (1.0 ft.) on either side of an upright stone.

No artifacts or midden were observed.

Feature A is in fair condition and is considered to be a possible burial mound.

**Feature B** is mound located 16.0 m. (52.5 ft.) to the northwest of Feature A. It measures 4.0 m. (13.1 ft.) N/S by 3.8 m. (12.5 ft.) E/W. This mound's construction is similar to that of Feature A, excluding the flat stones and upright.

No artifacts or midden were observed.

Feature B is in fair condition and is interpreted as a possible burial mound.

**State Site #:** 50-10-37-16540 **CSH Site #:** 187
**Site Type:** Platform-Lava blister
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 130.0 m.$^2$ (1,404.0 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 340 ft. a.m.s.l.

**Description:** State site -16540 is a platform and an adjacent lava blister situated on a level break in the slope. Vegetation includes *kiawe* and California grass.

The platform measures approximately 13.0 m. (42.7 ft.) E/W by 5.0 m. (16.4 ft.) N/S with a maximum height of 0.7 m. (2.3 ft.). It is constructed of cobbles and boulders and has no visible facing.

One bluish green 1940's beer bottle, 0.3 m. (1.0 ft.) -tall, was observed on the platform surface. No midden was observed on the platform.

Near the platform is a small lava blister. A basalt hammerstone and a gin bottle fragment were observed in the small entrance opening. The hammerstone was collected (Acc.# 79).

State site -16540 is in fair to poor condition. The platform offers poor excavation potential while the lava blister is considered to offer good excavation potential.

**State Site #:** 50-10-37-16541 **CSH Site #:** 188
**Site Type:** C-Shape remnant
**Function:** Indeterminate
**Features (#):** 1
**Site Dimension:** 1.0 m.$^2$ (10.8 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 345 ft. a.m.s.l.

**Description:** State site -16541 is a remnant C-shaped enclosure situated on a gentle slope. Vegetation includes *kiawe*, lantana, and California grass.

The enclosed area measures approximately 1.0 m. (3.3 ft.) by 1.0 m. (3.3 ft.). The enclosing walls are approximately 2.0 m. (6.6 ft.) thick with a maximum interior height of 0.3 m. (1.0 ft.) and a maximum exterior height of 1.3 m. (4.3 ft.). The enclosure is constructed of medium to large cobbles stacked on top of bedrock.

There is no observable midden or artifacts at the site.

State site -16541 is in fair condition. The excavation potential is considered to be fair.



**State Site #:** 50-10-37-16542 **CSH Site #:** 189
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** (see below)
***Ahupua'a:*** Kalukalu
**Elevation:** 300 ft. a.m.s.l.

**Description:** State site -16542 consists of an enclosure and a series of mounds randomly situated around the enclosure on a moderately sloping terrain.

The enclosure measures 9.5 m. (31.2 ft.) N/S by 9.0 m. (29.5 ft.) E/W with a maximum height of 0.6 m. (2.0 ft.). It is constructed of medium to large boulders. The general condition is poor although the northeast corner is well faced on the interior.

The most formally constructed mound is located 12.5 m. (41.0 ft.) northeast of the enclosure and measures 3.8 m. N/S by 6.0 m. E/W.

No artifacts or midden were observed.

State site -16542 enclosure offers fair to poor excavation potential.

**State Site #:** 50-10-37-16543 **CSH Site #:** 190
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 408.0 m.$^2$ (4,406.4 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 335 ft. a.m.s.l.

**Description:** State site -16543 is an enclosure situated on a moderate slope. The site is overgrown with California grass, *kiawe* and scattered with *koa haole*. It measures 17.0 m. (55.8 ft.) N/S by 24.0 m. (78.7 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.) on the *makai* (west) side. It is constructed of medium cobbles and boulders. Soil and scattered boulders cover the interior area. Much of the facing has collapsed due to cattle traffic.

No artifacts or midden were observed.

State site -16543 is in fair to poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16544 **CSH Site #:** 191
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 4
**Site Dimension:** 66.0 m.$^2$ (216.5 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 290 ft. a.m.s.l.

**Description:** State site -16544 is a large semi rectangular platform situated on gently sloping well-grazed grassland surrounded by densely *kiawe* trees.

The platform - constructed of large to small boulders and cobbles. It measures approximately 11.0 m. (36.0 ft.) N/S by 6.0 m. (19.6 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). Most of the facing has collapsed. The platform surface displays paving of medium to small boulders. There is a large boulder slab inlaid in the central portion of the surface.

There are three mounds directly to the west of the platform that range in size from 6.0 m. (19.6 ft.) by 4.0 m. (13.1 ft.) to 3.0 m. (9.8 ft.) square. The mounds are all constructed of medium to small piled boulders.

No artifacts or midden were observed.

State site -16544 is in fair condition and excavation potential is considered fair to good.

**State Site #:** 50-10-37-16545 **CSH Site #:** 192
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 14.7 m.$^2$ (158.8 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 295 ft. a.m.s.l.

**Description:** State site -16545 is a semi-circular mounded platform located on a soil terrain sloping *makai* (west). The platform is constructed of cobble and boulders with no visible facing. It measures 3.5 m. (11.5 ft.) N/S by 4.2 m. (13.8 ft.) E/W with maximum height of 0.8 m. (2.6 ft.) on the *mauka* (east) edge and 1.3 m. on the *makai* (west) edge. There is a cupboard measuring 0.4 m. (1.3 ft.) square with a depth of 0.5 m. (1.6 ft.) located in the center of the platform.

No artifacts or midden were observed.

State site -16545 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16546 **CSH Site #:** 193
**Site Type:** Site complex
**Function:** Permanent habitation; Agriculture
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Kalukalu
**Elevation:** 295 ft. a.m.s.l.

**Description:** State site -16546 (Figure 25) comprises a platform and a mound - designated Features A and B - situated *mauka* (east) of the Great Wall of Kuakini (State site -7276) in a gently sloping pasture with grass, *kiawe*, and scattered *koa haole*.

**Feature A** is a well-constructed platform measuring 4.2 m. (13.8 ft.) E/W by 3.8 m. (12.5 ft.) N/S, with an average height of 0.54 m. (1.8 ft.). The platform is constructed of medium-size slabs, boulders, and cobbles.

A wall extends 8.0 m. (26.2 ft.) *makai* (west) from north side of the platform. Modified outcrop extends downslope from the south side of platform for 7.0 m. (23.0 ft.) connecting to a



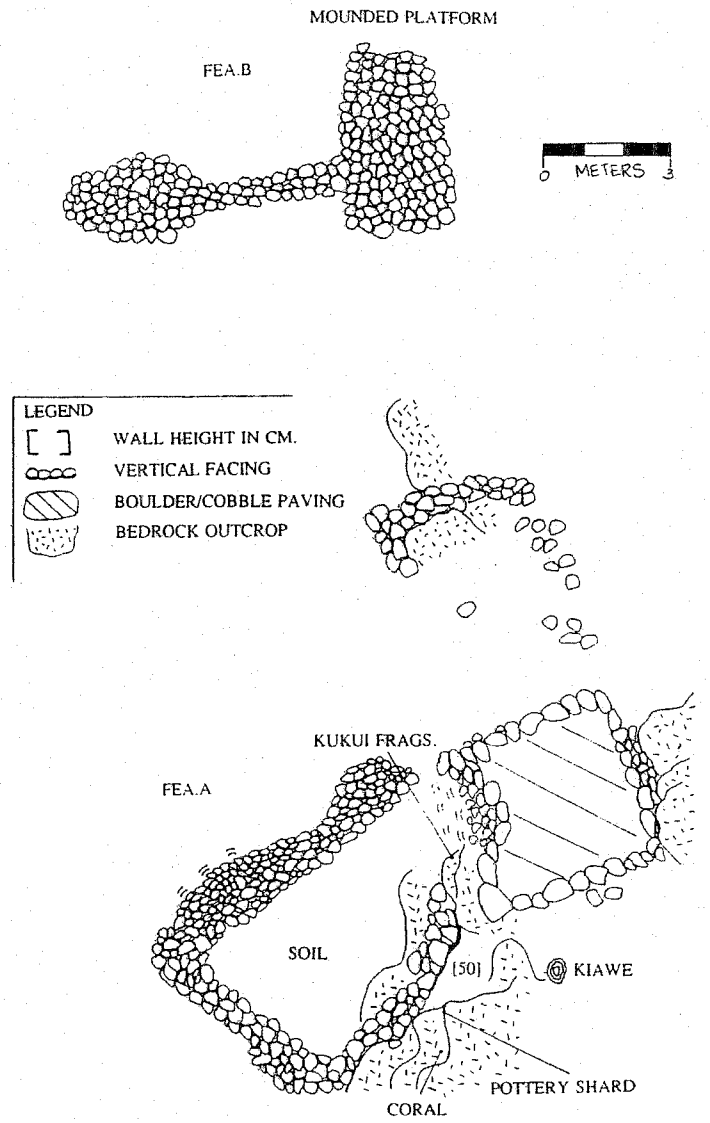



Figure 25 State site 50-10-37-16546; plan view

mounded wall which continues north for 3.5 m. (11.5 ft.) where it connects to the north wall, forming an enclosure.

One metal fragment, a pottery sherd, coral, and *kukui* midden were observed in and around the platform.

Feature A is in good to excellent condition and consider to have good excavation potential.

**Feature B** is an oval shaped mound located 12.5 m. (41.0 ft.) north of Feature A. It is constructed of medium to large boulders with cobble fill. It measures 4.2 m. (13.8 ft.) N/S by 5.0 m. (16.4 ft.) E/W with a maximum height of 0.3 m. (1.0 ft.). It is likely associated with agricultural clearance.

No artifacts or midden were observed.

Feature B is in fair condition and offers poor excavation potential.

**State Site #:** 50-10-37-16547 **CSH Site #:** 194
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 22.8 m.$^2$ (246.2 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 290 ft. a.m.s.l.

**Description:** State site -16547 is a rough mounded platform - constructed of large cobbles and boulders - located on the *makai* (west) edge of a small pahoehoe outcrop. Vegetation on the slope is lantana, *kiawe* and California grass. The platform measures 5.7 m. (18.7 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.).

No midden or artifacts were observed.

State site -16547 is in poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16548 **CSH Site #:** 195
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 659.8 m.$^2$ (7,125 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 305.0 ft. a.m.s.l.

**Description:** State site -16548 (Figure 26) is a large roughly rectangular enclosure with surrounding agricultural features situated on a fairly level field in close proximity to State site -16549 (which is similar). Vegetation consists of California grass, lantana, *koa haole*, and scattered *kiawe* trees.

The enclosure walls - constructed of cobble and small boulders - are low and mounded, with a maximum internal height of 0.5 m. (1.6 ft.) and a external height of 0.85 m. (2.8 ft.), and are approximately 1.5 m. (4.9 ft.) wide except at the south corner which is 3.0 m. (9.8 ft.) wide. One small water-rounded boulder was observed within the west wall. The interior measures 10.0 m. (32.8 ft.) NE/SW by 5.5 m. (18.0 ft.) NW/SE, and



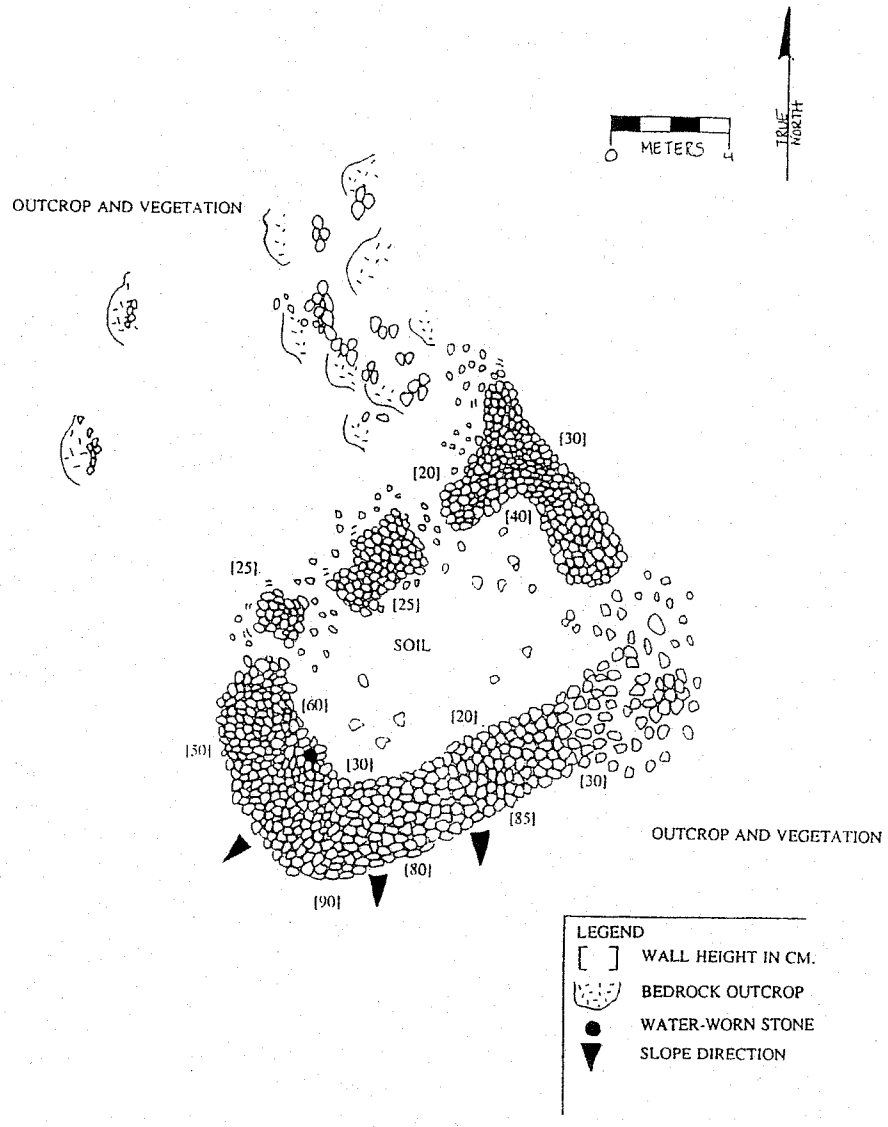



Figure 26 State site 50-10-37-16548; plan view

consists of soil with scattered cobbles.

No midden or artifacts were observed.

State site -16548 is in fair to poor condition with fair to poor excavation potential.

**State Site #:** 50-10-37-16549 **CSH Site #:** 197
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 30.0 m.$^2$ (324 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 320 ft. a.m.s.l.

**Description:** State site -16549 is a roughly rectangular platform situated on top of a bedrock shelf. It is surrounded by ~~*kiawe*~~, California grass, lantana and *koa haole*. The platform measures 5.0 m. (16.4 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a height on the *makai* (west) side of 1.0 m. (3.3 ft.). It is constructed of small boulders piled on top of the outcrop shelf. Remnant facing exists on the south face.

No midden or artifacts were observed.

State site -16549 is in poor condition with poor excavation potential.

**State Site #:** 50-10-37-16550 **CSH Site #:** 198
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a:*** Kalukalu
**Elevation:** 320 ft. a.m.s.l.

**Description:** State site -16550 (Figure 27) consists of a series of features - designated A through D - situated in close proximity along the same contour of slope. They are surrounded by a series of agricultural mounds and field walls. Situated in the corner of a pasture, these features are similar to the styles noted elsewhere in the project. The area appears to be slightly more complex than other areas of the project.

**Feature A** is a two-tiered platform constructed of medium to large boulders, with cobble and small boulder fill. The lower level is roughly circular, ranging from 0.3 to 0.8 m. (1.0 to 2.6 ft.) in height, and measuring 8.0 m. (26.2 ft.) N/S by 8.0 m. (26.2 ft.) E/W. The upper level measures 9.0 m. (29.5 ft.) N/S by 9.7 m. (31.8 ft.) E/W. A small pile of coral was observed on the west end of the lower tier.

Feature A is in fair condition and offers good excavation potential.

**Feature B** consists of a platform and enclosure located 8.5 m. (27.9 ft.) east of Feature A. The platform - constructed of large boulders with cobble fill - measures 8.5 m. (27.9 ft.) N/S



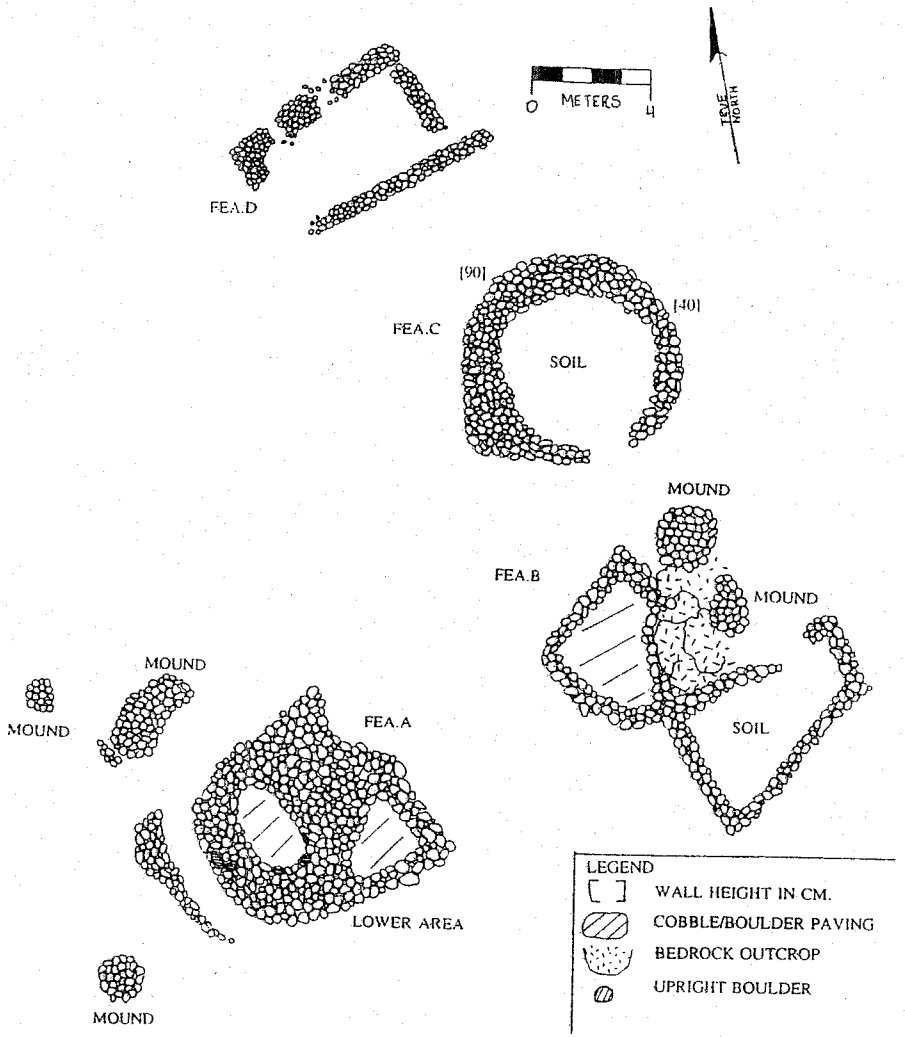



Figure 27 State site 50-10-37-16550; plan view

by 5.7 m. (18.7 ft.). Pahoehoe outcrop is utilized extensively in its construction.

The enclosure is roughly rectangular measuring 8.6 m. (28.2 ft.) NE/SW by 5.9 m. (19.4 ft.) NW/SE. The north side of the enclosure is delineated by the south side of the platform. The enclosure is constructed of medium to large boulders. No artifacts or midden were observed. Feature B is in fair condition and offers fair to good excavation potential.

**Feature C** is a C-shape enclosure - constructed of medium to large boulders with cobble fill - measuring 6.0 m. (19.8 ft.) N/S its *mauka* (east) side. It curves to the west, extending 8.3 m. (27.2 ft.), and measures 7.2 m. (23.6 ft.) N/S on the *makai* (west) side. The wall widths range from 1.5 m. (4.9 ft.) to 3.2 m. 10.5 ft.); average height is approximately 0.7 m. (2.3 ft.). The interior is a soil floor.

No artifacts or midden were observed.

Feature C is in poor condition.

**Feature D** is a C-shape enclosure located on a gentle slope. It measures 9.0 m. (29.5 ft.) E/W on the south side, 3.0 m. (9.8 ft.) N/S on the east side, and 8.0 m. (26.2 ft.) E/W on the north side. The *makai* (west) side is open. It is constructed of mounded medium to large boulders which have collapsed in several places. There is an extensive soil deposit on the interior of the C-shape.

No artifacts or midden were observed.

Feature D is in very poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16551 **CSH Site #:** 199
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 28.0 m.$^2$ (302.4 ft.$^2$)
***Ahupua'a:*** Kanakau
**Elevation:** 575 ft. a.m.s.l.

**Description:** State site -16551 is a L-shaped terrace situated in a level area within a gentle slope. The site is covered with California grass and *kiawe* trees.

The terrace contains two uneven surface areas roughly paved with cobbles and boulders surrounding a pahoehoe outcrop. The terrace measures 7.0 m. (23.0 ft.) N/S by 4.0 (13.1 ft.) E/W with a maximum height of 0.4 m. (1.3 ft.). The terrace is one to two courses high.

One piece of coral was observed, but no other midden or artifacts were observed.

State site -16551 is in fair condition and the excavation potential is considered poor to fair.



**State Site #:** 50-10-37-16552 **CSH Site #:** 200
**Site Type:** Modified outcrop
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 9.0 m.$^2$ (97.2 ft.$^2$)
***Ahupua'a:*** Kanakau
**Elevation:** 600 ft. a.m.s.l.

**Description:** State site -16552 is a modified outcrop situated on a gentle slope. Vegetation at the site includes California grass, *kiawe*, and *koa haole* trees.

The modification measures 4.5 m. (14.8 ft.) N/S by 2.0 m. (6.6 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). It consists of a small wall built against a pahoehoe outcrop. The structure is roughly faced with small boulders.

No midden or artifacts were observed.

State site -16552 is in poor condition. Excavation potential is considered poor.

**State Site #:** 50-10-37-16553 **CSH Site #:** 201
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Kanakau
**Elevation:** 565 ft. a.m.s.l.

**Description:** State site -16553 is a site complex which consists of two features, an enclosure a terrace, designated Features A and B respectively. The site is located on a bedrock bluff. The surrounding vegetation includes California grass, *koa haole*, *kiawe*, and vines.

**Feature A** is an enclosure measuring 8.0 m. (26.2 ft.) N/S by 7.3 m. (24.1 ft.) E/W. It is defined by a stacked boulder wall approximately 1.2 m. (3.6 ft.) high. The enclosure is roughly square and abuts the edge of the bluff on the *mauka* (east) and south sides. There are no visible interior features.

No artifacts or midden were observed.

A large clearing mound was observed 15.0 m. (49.2 ft.) to the northwest of Feature A.

Feature A is in good condition but the excavation potential is considered poor.

**Feature B** is a terrace located on the *makai* (west) edge of the bluff and to the south side of Feature A. The terrace measures 6.0 m. (19.7 ft.) by 5.0 m. (16.4 ft.) E/W. Only 3.0 m. (9.8 ft.) of the 5.0 m. (16.4 ft.) is paved, the remaining 2.0 m. (6.6 ft.) is covered with soil. The area is roughly paved to *makai* (west) with a 2.0 m. (6.6 ft.) soil terrace fronting the bedrock bluff.

A smooth polishing stone fragment (Acc.# 80) was observed on the surface and collected 15.0 m. (49.2 ft.) to the north of Feature B. Also 3.0 m. (9.8 ft.) to the north on the bluff a stone cup was observed measuring 10 cm. N/S by 5 cm. E/W and 5 cm. deep.

Another clearing mound was observed 20.0 m. (65.6 ft.) southwest of Feature B.

Feature B is in fair condition and the excavation potential is considered poor to fair.

**State Site #:** 50-10-37-16554 **CSH Site #:** 202
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a:*** Kanakau
**Elevation:** 565 ft. a.m.s.l.

**Description:** State site -16554 consists of four features: two mounds, a semi-rectangular platform, a modified outcrop, designated A- D respectively. The site complex is located on a gently sloping terrain of soil with scattered outcrops. The site is situated around a north/south running stacked boulder wall measuring 23.0 m. (75.5 ft.) in length north/south. The wall ranges in height from 1.0 m. (3.3 ft.) to 0.5 m. (1.6 ft.) with a maximum width of 1.0 m. to 1.3 m. (3.3 to 4.3 ft.).

**Feature A** is a mound measuring 2.5 m. (8.2 ft.) NW/SE by 3.3 m. (10.8 ft.) SW/NE. The mound is constructed of piled boulders with a maximum height of 1.2 m. (3.9 ft.). The mound is located 15.7 m. (51.5 ft.) E. of the north end of the wall.
No artifacts or midden were observed.
Feature A is in fair condition and offers poor excavation potential.

**Feature B** is a mound located 16.5 m. (54.1 ft.) south of the north end of the wall. It measures 2.0 m. (6.6 ft.) in diameter with a maximum height of 0.4 m. (1.3 ft.). It is constructed of piled boulders.
No artifacts or midden were observed.
Feature B is in fair condition and offers poor excavation potential.

**Feature C** is a semi-rectangular platform located 19.5 m. (64.0 ft.) E. of the north end of the wall. It measures 4.0 m. (13.1 ft.) N/S by 2.7 m. (8.9 ft.) E/W. It is constructed of stacked boulders with a maximum height of 0.7 m. (2.3 ft.). It is situated on a fairly level ground. Features B and A are located to the south of this feature.
No artifacts or midden were observed.
Feature C is in good condition and offers fair excavation potential.

**Feature D** is a low modified outcrop adjacent to the wall. The modification consists of boulders stacked and piled onto the outcrop. the modification measures 4.2 m. (13.5 ft.) N/S by 5.5 m. (18.0 ft.) E/W with a maximum height in the southeastern corner of 1.2 m. (3.9 ft.). The south and east sides have remnant facing while the surface is somewhat mounded.
No artifacts or midden were observed.
Feature D is in fair to poor condition and offers poor excavation potential.



**State Site #:** 50-10-37-16555 **CSH Site #:** 203
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a:*** Kanakau
**Elevation:** 550 ft. a.m.s.l.

**Description:** State site -16555 is a site complex consisting of three features, designated A-C. The features are located on a *makai* (west) -sloping terrain with scattered bedrock outcrop and agricultural features. Surrounding the area is gently undulating pahoehoe. The features are surrounded by thick California grass and *kiawe* trees. There is a large gully which begins at Feature A and continues past Feature C.

**Feature A** is a mounded platform sloping *makai* (west). It measures 8.5 m. (27.9 ft.) N/S by 5.0 m. (16.4 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). It is constructed of small to medium boulders with cobble scattered throughout. There is a small portion of facing evident on the *makai* (west) side; the rest of the feature is collapsed and mounded. There is a boulder wall extending 4.5 m. (14.8 ft.) to the east off the northeast platform corner.
No artifacts or midden were observed.
Feature A is in fair to good condition. The excavation potential is considered fair.

**Feature B** is an enclosure measuring 8.0 m. (26.2 ft.) N/S by 7.5 m. (24.6 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). It is constructed of stacked boulders and cobbles. Located within the enclosure is a terrace which measures 2.0 m. (6.6 ft.) N/S by 1.0 m. (3.3 ft.) E/W with a height of 1.0 m. (3.3 ft.).
No artifacts or midden were observed.
Feature B is in good condition and offers fair to good excavation potential.

**Feature C** is a modified outcrop located *makai* (west) of Features A and B. Modifications consist of boulders stacked on top of an outcrop. The modifications measure 4.0 m. (13./1 ft.) N/S by 2.2 m. (7.2 ft.) E/W.
No artifacts or midden were observed.
Feature C is in fair condition and offers poor excavation potential.

**State Site #:** 50-10-37-16556 **CSH Site #:** 204
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a:*** Kanakau
**Elevation:** 470 ft. a.m.s.l.

**Description:** State site -16556 is a possible historic habitation complex. The vegetation consists of grassland with large *kiawe* trees and scattered *koa haole*. The area to the south is fairly level and to the north is a moderately steep ravine sloping *makai* (west).

**Feature A** is a large semi-rectangular terrace situated in the northeast corner of the complex. The terrace measures 4.2 m. (13.9 ft.) N/S by 5.5 m. (18.0 ft. ) E/W with a maximum height of 1.75 m. (5.7 ft.). It is constructed of large to small stacked boulders and cobbles. The top portion is level and well-paved. A small oval depression in the northwest corner contains a possible cupboard. Facing remains on the west and south sides; the east side is flush with a pahoehoe outcrop.

No artifacts were observed. A metal pan was observed on the terrace. Feature A is in good condition and offers excellent excavation potential.

**Feature B** is an enclosure joined to Feature A along the southeast corner of the terrace. The enclosure measures 5.7 m. (18.7 ft.) E/W by 9.0 m. (29.5 ft.) N/S with an average height of 1.75 m. (5.7 ft.). The enclosure meets with the outcrop on the northeast end. It is constructed of medium to small boulders and is well faced on both sides. The interior is soil with scattered outcrop.

No artifacts or midden were observed.

Feature B is in good condition and offers excellent excavation potential.

**Feature C** is the enclosing wall which runs from the northwest corner of the terrace *makai* (west) for (11.0) m. (36.1 ft.) and 12.0 m. (39.4 ft.) N/S with a constructed gap at 9.0 m. (29.5 ft.) which measures 2.0 m. (6.6 ft.) wide. The enclosure then extends 16.0 m. (52.5 ft.) E/W and joins with the southwest corner of Feature B.

Feature C is in good condition and offers fair to poor excavation potential.

Artifacts observed at the site include several historic bottles (1900-1915 vintage).

The area *makai* (west) of State site -16556 has numerous agricultural features, such as agricultural mounds on outcrops. Modification appears not quite as formal as the *mauka* (east) area. Vegetation suggests that the area maybe been bulldozed or chained in the past.

**State Site #:** 50-10-37-16557 **CSH Site #:** 205
**Site Type:** Modified outcrop
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 1.0 m.$^2$ (10.8 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 415 ft. a.m.s.l.

**Description:** State site -16557 is a modified outcrop situated on the southeast face of a small bowl in a slope. Modifications include a few agricultural terrace walls running north/south and one well-faced wall approximately 1.0 m. (3.3 ft.) long and 0.8 m. high. A small mounded area constructed of large boulders sits on the *makai* (west) end of the outcrop. A small *'ili'ili* stone, a piece of coral, an *opihi* shell and a broken piece of cowrie were observed.

State site -16557 is in fair to poor condition with fair to poor excavation potential.



**State Site #:** 50-10-37-16558 **CSH Site #:** 206
**Site Type:** Platform
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 21.2 m.$^2$ (228.4 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 400 ft. a.m.s.l.

**Description:** State site -16558 is a rectangular platform situated on a fairly level break in a slope. There are various mounds located in the vicinity. The surrounding terrain is grassy with scattered *kiawe* and *koa haole* trees. The platform measures 4.7 m. (15.4 ft.) N/S by 4.5 (14.8 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). It is constructed of small boulders and cobbles.

No midden or artifacts were observed.

State site -16558 is in poor condition with fair to poor excavation potential.

**State Site #:** 50-10-37-16559 **CSH Site #:** 207
**Site Type:** Modified outcrop
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 35.8 m.$^2$ (386.1 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 400 ft. a.m.s.l.

**Description:** State site -16559 is a semi-rectangular modified outcrop located on a relatively level soil and scatter outcrop terrain sloping *makai* (west). Modification consists of a rectangular shaped terracing constructed of large cobbles to medium boulders which measures 6.5 m. (21.5 ft.) (N/S) by 5.5 m. (18.2 ft.) (E/W) with a maximum height of 0.6 m. (2.0 ft.). There is rough stacking on the *makai* (west) side but no true facing. The paving is rough but apparent.

No artifacts or midden were observed.

State site -16559 is in fair condition with poor excavation potential.

**State Site #:** 50-10-37-16560 **CSH Site #:** 208
**Site Type:** Site complex
**Function:** Temporary habitation
**Features (#):** 62
**Site Dimension:** (see below)
***Ahupua'a*:** Kalukalu
**Elevation:** 400 ft. a.m.s.l.

**Description:** State site -16560 (Figure 28) consists of six features - designated A to F - located on a small bluff at the edge of a natural bowl in the terrain on gently sloping grassland with scattered *kiawe* and *koa haole* trees.

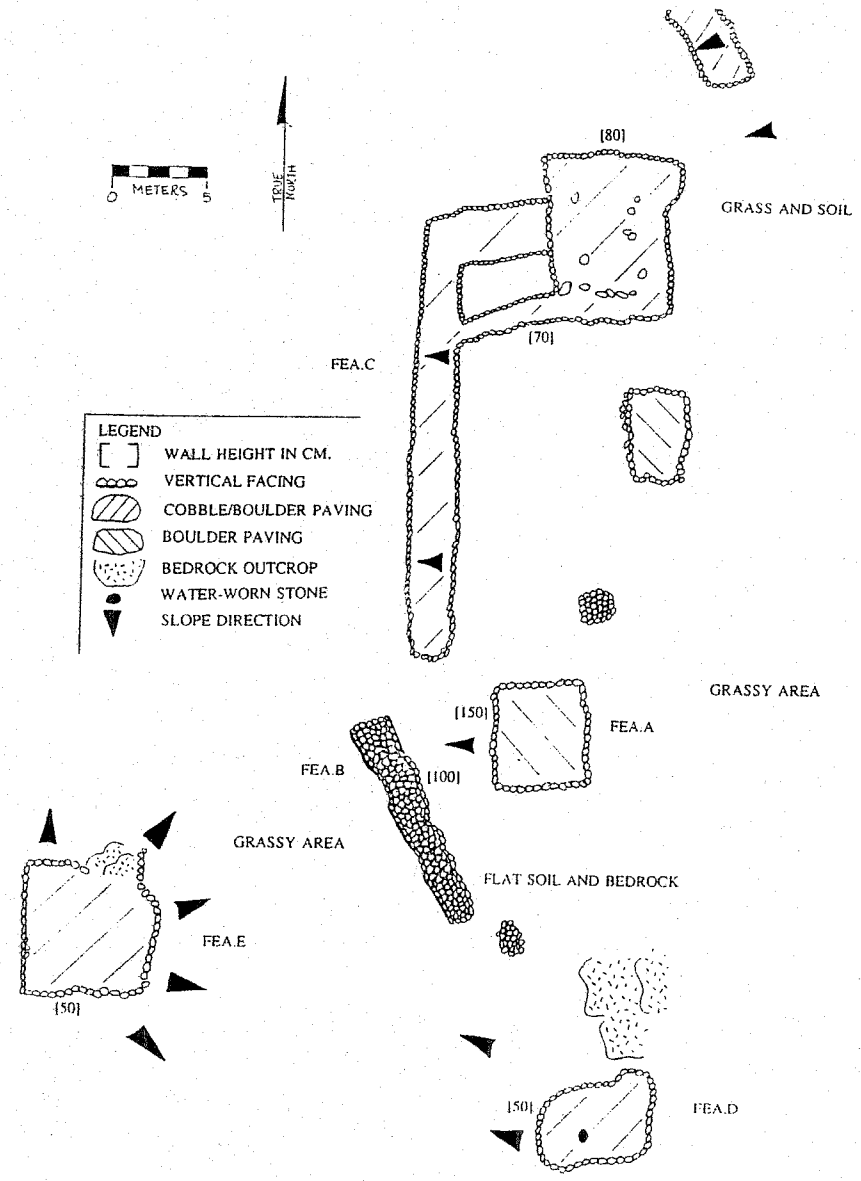



Figure 28 State site 50-10-37-16560; plan view



**Feature A** is a high-mounded platform - constructed of medium to small stacked boulders with cobbles - located in the *mauka* (east) central area of the complex. It measures 5.5 m. (18.0 ft.) E/W by 6.0 m. (19.8 ft.) N/S and 1.75 m. (5.7 ft.) high.

No artifacts or midden were observed.

Feature A is in fair condition and excavation potential is fair to poor.

**Feature B** is a north/south running remnant wall - which is mostly tumbled condition - located *makai* (west) of Feature A. It is constructed of stacked small boulders to large cobbles, and measures 2.5 m. (8.2 ft.) N/S.

Feature B is in poor condition and excavation potential is deemed poor.

**Feature C** is a long, low terrace located northwest of both Features A and B, running along the lower section of the natural bowl in the terrain. The terrace is constructed of piled boulders with cobble to small boulder paving. It measures 24.0 m. (78.7 ft.) N/S by 2.5 m. (8.2 ft.) E/W. At the north end the terrace widens into a rectangular shaped area measuring 9.5 m. (31.2 ft.) N/S by 7.5 m. (24.6 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.).

Feature C in fair to poor condition with fair to poor excavation potential.

**Feature D** is a terrace located on an outcrop southwest of Feature A. The terrace measures 4.0 m. (13.1 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). It is constructed of medium to small piled boulders with cobbles; the east portion is flush with the slope. A medium sized water-rounded cobble was observed on the terrace.

Feature D is in fair condition and offers poor excavation potential.

**Feature E** - located *makai* (west) of Features A and B - is a platform which utilizes outcrop in its construction. The platform measures 7.0 m. (23.0 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). It is constructed of piled boulders; the surface is paved with cobbles and boulders.

No artifacts or midden were observed.

Feature E is in poor condition with poor excavation potential.

**Feature F** is a rectangular platform situated at the *makai* (west) end of the site complex in a grassy area with scattered *koa haole* and *kiawe* trees. The platform measures 7.5 m. (24.6 ft.) N/S by 4.5 m. (14.8 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). It is constructed of cobbles to medium-sized boulders and displays remnants of facing. There is a tier - measuring 0.4 m. (1.3 ft.) high - running north/south across the center of the platform. There is a small agricultural mound located 10.0 m. (32.8 ft.) southwest of Feature F.

No midden or artifacts were observed.

Feature F is in poor to fair condition with poor to fair excavation potential.

**State Site #:** 50-10-37-16561 **CSH Site #:** 209
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 42 m.$^2$ (453.6 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 380 ft. a.m.s.l.

**Description:** State site -16561 comprises a platform and attached enclosure situated on a sloping grassy field with California grass, *kiawe* and *koa haole* trees. The platform measures approximately 7.0 m. (N/S) by 6.0 m. (E/W). It is constructed of large cobbles to small boulders, and has possible remnant facing on the *makai* (west) side.

The enclosure - attached to the *mauka* (east) side of the platform - measures 12.0 m. (39.4 ft.) N/S by 10.0 m. (32.8 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). There are 7 glass bottles in the south wall. The interior consists of soil with scattered cobbles and boulders.

No midden or artifacts were observed.

State site -16561 is in fair condition and has fair excavation potential.

**State Site #:** 50-10-37-16562 **CSH Site #:** 210
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 31.2 m.$^2$ (335.0 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 375 ft. a.m.s.l.

**Description:** State site -16562 is a platform utilizing outcrop located 18.3 m. (60.0 ft.) south-southwest of State site -16561. The platform measures 3.3 m. (10.8 ft.) N/S by 9.4 m. (30.8 ft.) E/W. It is constructed of medium to large boulders and cobbles.

There is a small C-shaped enclosure connected to the *makai* (west) side of the platform. To the south is a small mounded platform measuring 2.0 m. (6.6 ft.) N/S by 3.0 m. (E/W).

No artifacts or midden were observed.

State site -16562 is in fair condition with fair to poor excavation potential.

**State Site #:** 50-10-37-16563 **CSH Site #:** 211
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 12.5 m.$^2$ (135 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 375 ft. a.m.s.l.

**Description:** State site -16563, located approximately 10.0 m. (32.8 ft.) *makai* (west) of State



site -16561, is a rectangular terrace situated on a flat area with grass and scattered *koa haole* and *kiawe* trees. The terrace measures 5.0 m. (16.4 ft.) N/S by 2.5 m. (8.2 ft.) E/W with a maximum height of 1.1 m. (3.6 ft.). It is constructed of small boulders, and displays good facing on all three raised sides; the *mauka* (east) side is flush with the ground. On the *makai* (west) end is a soil depression measuring 1.1 m. (3.6 ft.) deep and approximately 0.9 m. (3.0 ft.) square.

Metal sheets and lumber with nails were observed on the surface. (A water tower is located about 75.0 m. (246.0 ft.) away and may be the source of these materials.)

No midden or artifacts were observed.

State site -16563 is in good condition with fair excavation potential.

**State Site #:** 50-10-37-16564 **CSH Site #:** 212
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Ilikahi
**Elevation:** 445 ft. a.m.s.l.

**Description:** State site -16564 comprises two features, designated A and B. This site consists of well-defined agricultural features, including a long *mauka/makai* (east/west) running wall with two enclosures on either side of the wall.

**Feature A** is an enclosure which measures 13.2 m. (43.3 ft.) N/S by 6.5 m. (21.3 ft.) E/W. The north *mauka* (east) corner is in the best condition with rough facing. The east and west walls are collapsed and range from 1.2 m. (3.9 ft.) to 1.7 m. (5.6 ft.) wide with a height range of 0.2 to 0.5 m. (0.7 to 1.6 ft.). The north wall is in good condition and ranges in width from 1.5 m. to 2.8 m. (4.9 to 9.2 ft.) and it is 1.0 m. to 1.5 m. (3.3 ft. to 4.9 ft.) high. The south wall ranges from 1.0 m. to 1.5 m. (3.3 ft. to 4.9 ft.) wide and the height is 0.5 m. to 1.0 m. (1.6 ft. to 3.3 ft.). The enclosed area contains loose rocks on soil. Extensive cattle degradation has occurred in this location.

No artifacts or midden were observed.

Feature A is in fair condition and offers fair to good excavation potential.

**Feature B** is an enclosure which measures 11.0 m. (36.1 ft.) E/W by 8.2 m. (26.9 ft.) N/S. The height of the enclosure ranges from 0.3 m. to 1.0 m. (1.0 to 3.3 ft.) and the walls range from 0.7 m. to 1.5 m. (2.3 to 4.9 ft.) wide. The highest point on the wall is located in the southwest corner.

No artifacts or midden were observed.

Feature B is in fair to good condition and offers fair to good excavation potential.

**State Site #:** 50-10-37-16565 **CSH Site #:** 213
**Site Type:** C-shape
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 28.0 m.$^2$ (302.4 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 320 ft. a.m.s.l.

**Description:** State site -16565 is a C-shaped enclosure situated on a level break in the slope.

The C-shape measures 4.0 m. (13.1 ft.) E/W by 7.0 m. (23.0 ft.) N/S by 6.0 m. (19.8 ft.) E/W and its wall is approximately 1.0 m. (3.28 ft.) high. It is constructed of small to medium-sized boulders. The area within the C-shape is level soil.

No midden or artifacts were observed.

State site -16565 is in poor condition and it offers poor excavation potential.

**State Site #:** 50-10-37-16566 **CSH Site #:** 214
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** Undetermined
**Site Dimension:** Undetermined
***Ahupua'a*:** Kalukalu
**Elevation:** 320 ft. a.m.s.l.

**Description:** State site -16566 is a site complex consisting of numerous agricultural features situated on a moderate slope which extends *makai* (west) to a cattle wall.

An elongated terrace cross-cutting the slope and a *mauka/makai* (east/west) running wall segment comprise the main features. Other agricultural features include mounds and remnant terraces spread upon grassy pasture with scattered *kiawe* trees. There are also numerous rough faced mounds.

State site -16566 is in poor condition and it offers poor excavation potential.

**State Site #:** 50-10-37-16567 **CSH Site #:** 215
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 34.1 m.$^2$ (368.3 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 300 ft. a.m.s.l.

**Description:** State site -16567 is a large, roughly rectangular platform situated on a rolling slope. The surrounding terrain consists of *kiawe*, *koa haole* and grass.

The platform - constructed of cobbles and medium to large boulders - measures 6.2 m. (20.3 ft.) N/S by 5.5 m. (18.0 ft.) E/W, with heights of 0.5 m. (1.6 ft.) on the east face and 0.8 m. to 0.9 m. (2.6 ft. to 3.0 ft.) on the west face. In the center of the platform is a broken



water-rounded stone.

A small mound adjacent to the platform measures 3.0 m. (9.8 ft.) N/S by 2.5 m. (8.2 ft.) E/W.

No artifacts or midden were observed.

State site -16567 is in fair condition and excavation potential deemed is good to fair.

**State Site #:** 50-10-37-16568 **CSH Site #:** 216
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 16.5 m.$^2$ (178.2 ft.$^2$)
***Ahupua'a*:** Kalukalu
**Elevation:** 305 ft. a.m.s.l.

**Description:** State site -16568 is a rectangular terrace, situated just north and *mauka* (east) of a large corral (State site -16801), adjacent to the Great Wall of Kuakini. The site is located in grassland with scattered *kiawe* and *koa haole*.

The terrace measures 5.5 m. (18 ft.) N/S by 3.0 m. (9.8 ft.) E/W. It is constructed of small boulders and cobbles. Facing is present on its *makai* (west) side, rising 0.7 m. (2.3 ft.) high.

No artifacts or midden were observed.

State site -16568 is in good to fair condition and excavation potential is fair.

**State Site #:** 50-10-37-16569 **CSH Site #:** 218
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a*:** Haleki'i
**Elevation:** 695 ft. a.m.s.l.

**Description:** State site -16569 consists of four features, designated Features A through D. The surrounding terrain consists of a fairly steep slope of exposed pahoehoe bedrock that has been extensively modified and subsequently damaged by cattle grazing. The slope is characterized by short steep drops and flat plateau-like landings. Much of the area appears to have been modified for agricultural purposes in a classic exposed lava flow pattern of mounding, terracing and some faced terrace/modified outcrops. Most of these are remnants of previously much larger features.

**Feature A** is a lava blister that measures 11.3 m. (37.1 ft.) N/S by 3.3 m. (10.8 ft.) E/W and is 0.55 m. (1.8 ft.) high. A small entrance opens at the tube's south side. Its floor has been cleared of rocks which now line the sides of the tube.

One piece of volcanic glass was observed *mauka* (east) of the tube opening. Some charcoal, *kukui*, coral files, wood particles, basalt flakes, and animal bone midden were observed.

Feature A is in fair condition and offers excellent excavation potential.

**Feature B** is an oval-shaped lava tube with no modifications. It measures 12.5 m. (41.0 ft.) N/S by 3.5 m. (11.5 ft.) E/W with a maximum height of 0.4 m. (1.3 ft.). The entrance to Feature B is just *mauka* (east) of Feature A.

Midden including *kukui*, charcoal, small animal bones, were observed on the floor of the tube.

Feature B offers excellent excavation potential.

**Feature C** is a lava blister, with internal modifications. The feature measures 11.0 m. (36.3 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). This feature contains some modification on the inside. A small wall, with remnants of facing lies 1.2 m. (3.6 ft.) from the entrance.

Midden includes, *kukui*, sea urchin, animal bones, and *opihi* shells.

Feature C is in fair condition and offers fair to good excavation potential.

**Feature D** is a 3.0 m. by 3.0 m. (9.8 by 9.8 ft.) lava blister which is divided from Feature C by tumbled rocks between the two blisters. It is not possible to crawl between these two without removing many rocks. The floor is covered with soil and scattered cobbles.

Midden was observed on the floor. Human remains were observed along the SW wall.

Feature D is a burial feature in fair condition.

**State Site #:** 50-10-37-16570 **CSH Site #:** 219
**Site Type:** Lava tube/petroglyphs
**Function:** Habitation; burial
**Features (#):** 1
**Site Dimension:** 512.0 m.$^2$ (5,529.6 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 700 ft. a.m.s.l.

**Description:** State site -16570 (Figure 29) consists of a lava tube which runs north/south for a distance of 128.0 m. (420.0 ft.). The entrance consists of a sink which has been modified with boulder fill. In the center of the boulder fill is a pavement which forms a stairway leading down into the tube. Inside the light chamber several petroglyphs can be seen on the smooth northern wall of the tube.

There is a possible stone-lined crypt 6.0 m. (19.7 ft.) from the entrance. It consists of 3 to 4 large, flat stones inlaid as a floor, surrounded by leveled rubble. Directly inside the entrance is at least one human burial; a skull cap was observed.

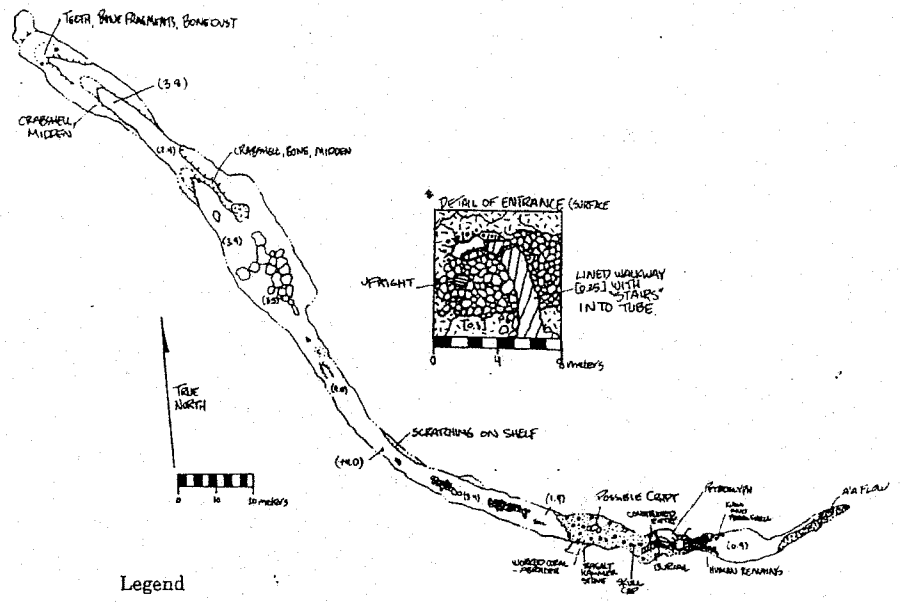
At 45.0 m. (147.6 ft.) from the entrance is a large *opihi* shell and large amounts of midden and artifacts which include hammerstones, coral abraders, files, pumice abraders and shells, *kukui*, charcoal and pig bone were observed on the floor of the tube in the first 50.0 m. (164 ft.).

Beyond the midden concentrations there is a large amount of ceiling collapse. Some of it has been modified, forming an almost terrace-like formation. In this portion of the tube small amounts of charcoal were increasingly observed littering the floor in a random pattern.

At 75.0 m. (246.1 ft.) from the entrance of the tube on the east side of the chamber is a circular charcoal pile measuring approximately 0.5 m. (1.6 ft.) in diameter.

At 82.0 m. (269.0 ft.) from the entrance, the tube splits into two segments. The east






Legend

| | |
|---|---|
| Drip Line/Tube Entrance | |
| Lava Tube Walls | |
| Subsurface/Overhang Height (meters) | (2.8) |
| Surface Depression | |
| Ledge | |
| Charcoal | |
| Rubble | |
| Stone Pavement | |
| Direction of Slope | |

Figure 29 State site 50-10-37-16570; plan view

tube meets again with the main tube at 30.0 m. (98.4 ft.) from the rear. The east tube contains substaintial charcoal samples along with numerous bone fragments which are unidentifiable. The main tube contains large amounts of ceiling collapse in this area. Some of it may be modified but is in remnant condition.

Between 25.0 m. and 12.0 m. (82.0 ft. and 39.4 ft.) from the end of the tube an intermittent scattering of crab shell was observed.

At approximately 10.0 m. (32.8 ft.) from the rear of the tube the floor rises approximately 2.2 m. (7.2 ft.) and meets another smaller tube running north/northwest. Crab shells were observed in this smaller tube.

At the rear of the main tube there is a small shelf raised approximately 0.5 m. (1.67 ft.) above the floor on which there are human remains, including teeth and a circular pile of bone dust. The teeth are scattered over a circular area measuring 2.0 m. (6.6 ft.) in diameter, in no apparent order.

Also present on the back shelf are 2 water-rounded stones, approximately 0.3 m. (0.98 ft.) and 0.25 m. (0.83 ft.) in diameter. These appear to have been used, because of scarring on their surface. Just below the shelf in the rear of the tube is another pile of bone dust and what appears to be a fragment of the femur of a sub-adult human.

The east chamber (east of entrance) extends for approimately 50 m. to the east ranging from approximately 5 m. to 10 m. wide and averaging 40 m. high. The first 10 m. consists of rough boulder cobble paving with visible human remains and midden scattered about the surface. The chamber continues further with no visible signs of modifications and ends with a visible *a'a* flow.

State site -16570 is considered to be in fair condition and offers no excavation potential as it is a burial site.

**State Site #:** 50-10-37-16571 **CSH Site #:** 220
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 9.0 m.$^2$ (97.2 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 660 ft. a.m.s.l.

**Description:** State site -16571 consists of a terrace situated on a slope of bedrock with scattered soil pockets.

The terrace measures 2.7 m. (8.9 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.) on the *makai* (west) side. It is constructed of piled boulders and cobbles. It has a roughly level surface which is flush with the outcrop upon which the terrace was built.

Two upright stones were observed along the eastern portion of the terrace.

No midden or artifacts were visible.

State site -16571 is in remnant condition and offers poor excavation potential.

**State Site #:** 50-10-37-16572 **CSH Site #:** 221
**Site Type:** Modified outcrop



**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 79.5 m.$^2$ (858.6 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 400 ft. a.m.s.l.

**Description:** State site -16572 is a modified outcrop situated on a moderately sloping terrain of pahoehoe flow. Modifications consist of a terrace and a mounded platform. The terrace measures 9.0 m. (29.5 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). The *makai* (west) facing forms a C-shape enclosure with the outcrop. The terrace is constructed with boulder facing and has a level cobble pavement which is flush with the outcrop along the *mauka* (east) edge. The south side of the pavement consists of mounded boulders and cobbles.

No artifacts or midden were observed at the terrace.

The platform is located 3.0 m. (9.8 ft.) north of the terrace, situated on the outcrop surface. It measures 3.0 m. (9.8 ft.) N/S by 2.5 m. (8.2 ft.) E/W with a maximum height of 0.2 m. (0.7 ft.). It is constructed of mounded boulders and cobbles.

Two water-rounded stones were observed just north of the platform.

State site -16572 has been damaged by cattle grazing and is in fair to poor condition. There are other modifications located in the area. The site offers fair excavation potential.

**State Site #:** 50-10-37-16573 **CSH Site #:** 222
**Site Type:** Lava tube
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 79.5 m.$^2$ (858.6 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 550 ft. a.m.s.l.

**Description:** State site -16573 is a lava tube with a faced opening to *makai* (west) and a large paved area in the front of the entrance. The tube measures 6.0 m. (19.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 1.4 m. (4.6 ft.). There is no modification within the tube.

The pavement adjacent to the tube measures 4.5 m. (14.8 ft.) N/S by 7.0 m. (23.0 ft.) E/W. It extends *makai* (west) from the tube entrance.

Midden observed within the tube includes marine bone and shells. Artifacts observed include three coral files, basalt flakes, a basalt core, and volcanic glass.

State site -16573 is in fair condition and offers excellent excavation potential.

**State Site #:** 50-10-37-16574 **CSH Site #:** 223
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 35.7 m.$^2$ (386.1 ft.$^2$)

***Ahupua'a:*** Haleki'i
**Elevation:** 325.0 ft. a.m.s.l.

**Description:** State site -16574 (Figure 30) is a rectangular double-terraced platform located approximately 33.5 m. (110 ft.) from the *mauka/makai* (east/west) wall (State site -16793) and 18.3 m. (60.0 ft.) from State site -16573. The platform is situated on a pahoehoe and a'a outcrop bluff. Vegetation includes *koa haole* and *opiuma* trees.

The platform measures 5.5 m. (18.0 ft.) N/S by 6.5 m. (21.3 ft.) E/W. It is constructed of cobbles and small boulders and has a cobble paving. It averages 0.5 m. (1.67 ft.) high. Some facing is extant on the *makai* (west) and east sides. The upper level of terracing extends 3.5 m. (11.5 ft.) *makai* (west) of the platform, drops down about 0.5 m. (1.6 ft.), and is constructed of small cobbles to small boulders. The second level of terracing extends 2.0 m. (6.6 ft.) from the first terrace and drops 0.7 m. (2.3 ft.).

No artifacts or midden were observed on the site.

State site -16574 is in fair condition. The excavation potential is considered fair.

**State Site #:** 50-10-37-16575 **CSH Site #:** 224
**Site Type:** Site complex
**Function:** Permanent habitation; Agriculture
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Haleki'i
**Elevation:** 103.7 m. (340.0 ft.) a.m.s.l.

**Description:** State site -16575 consists of a platform and attached enclosure with a terraced enclosure designated A and B, respectively. The site is situated on a gentle slope vegetated with *koa haole* and *kiawe* trees.

**Feature A** is a mounded platform and attached enclosure located along a level soil area at the base of a slope. The platform measures 6.5 m. (21.3 ft.) N/S by 7.0 m. (23.0 ft.) E/W with a maximum height of 1.2 m. (3.9 ft.). It is constructed of piled and mounded small to medium pahoehoe boulders. There are two circular depressions each measuring 1.0 m. (3.3 ft.) in diameter on the platform surface.

The enclosure is attached to the north side of the platform. It measures 4.0 m. (13.1 ft.) N/S by 3.1 m. (10.2 ft.) E/W with a maximum wall height of 1.0 m. (3.3 ft.). The walls are constructed of stacked medium-size boulders and are collapsed. The interior floor of the enclosure is outcrop with intermittent soil pockets.

No artifacts or midden were observed.

Feature A is in fair to poor condition and offers fair excavation potential.

**Feature B** comprises three contiguous enclosures located approximately 15.0 m. (49.2 ft.) north of Feature A. The *mauka* (east) enclosure (designated Enclosure 1) measures 12.0 m. (39.4 ft.) N/S by 1.0 m. (3.3 ft.) E/W; its *mauka* (east) wall has an exterior height of 0.4 m. (1.3 ft.) and an interior height of 1.5 m. (4.9 ft.). Its *makai* (west) wall has an interior height of 0.3 m. (1.0 ft.), and descends 1.0 m. (3.3 ft.) to the floor of Enclosure 2.

Enclosure 2 measures 12.0 m. (39.4 ft.) N/S by 2.5 m. (8.2 ft.) E/W and is well faced on its north side. Its *makai* (west) wall has an interior height of 0.4 m. (1.3 ft.) and descends 0.7 m. (2.3 ft.) to the floor of Enclosure 3.



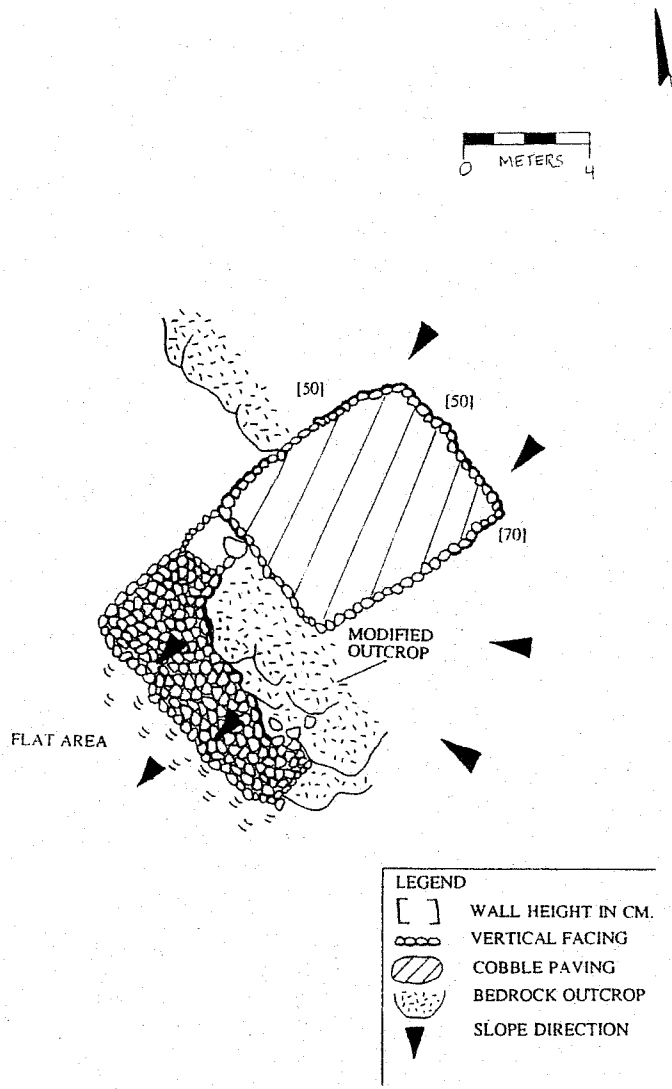



Figure 30 State site 50-10-37-16574; plan view

Enclosure 3 is situated *makai* (west) of the first two enclosures on level ground at the bottom of the slope. It measures 7.0 m. (23.0 ft.) N/S by 9.0 m. (29.5 ft.) E/W; its *makai* (west) wall has a height of 0.1 m. (0.3 ft.). There is a possible entrance in Enclosure 3 in its northwest corner.

All three enclosures are constructed of piled boulders and cobbles and have a soil interior. A water-rounded upright boulder was observed in the center of the *mauka* (east) wall of Enclosure 1.

Feature B is in fair to poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16576 **CSH Site #:** 225
**Site Type:** Modified outcrop
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 1.0 m.$^2$ (10.8 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 350 ft. a.m.s.l.

**Description:** State site -16576 is a modified outcrop situated at the *makai* (west) edge of the outcrop along a moderate slope.

Modification consists of a small area of large cobbles to small boulders stacked one to two course high along the edge of the outcrop. Facing is apparent along the western side. The modification measures 1.0 m. (3.3 ft.) N/S by 1.0 m. (3.3 ft.) with a maximum height of 0.7 m. (2.3 ft.).

No artifacts or midden were observed.

State site -16576 is in fair to poor condition and excavation potential is considered poor.

**State Site #:** 50-10-37-16577 **CSH Site #:** 226
**Site Type:** Pavement
**Function:** Trail
**Features (#):** 1
**Site Dimension:** Indeterminate
***Ahupua'a:*** Haleki'i
**Elevation:** Indeterminate

**Description:** State site -16577 is a pavement oriented *mauka/makai* (east/west) that is level is some places and sloped in others. The area is covered with *koa haole*, grasses, and some lantana. This pavement which probably served as a cart road which appears on a 1919 map.

The pavement averages 5.4 m. (17.7 ft.) wide and is 0.4 m. (1.3 ft.) to 0.5 m. (1.6 ft.) high in most areas. The trail is lined with large a'a chunks and is paved with small a'a pebbles. On the *makai* (west) end the path is faced and it is 0.5 m. (1.6 ft.) away from a level soil area. The *makai* (west) portion is raised off the ground 0.4 (1.3 ft.) to 0.5 m. (1.6 ft.) while the *mauka* (east) portion is lined by a raised stacked alignment of pahoehoe cobbles and boulders which are 0.2 m. (.6 ft.) to 0.3 m. (.9 ft.) high.

The trail is still navigable in most places.

No artifacts and midden were observed.



State site -16577 is in fair condition. The excavation potential is considered poor to fair.

**State Site #:** 50-10-37-16578 **CSH Site #:** 228
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 340.0 m.$^2$ (3672.0 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 200 ft. - 210 ft. a.m.s.l.

**Description:** State site -16578 comprises two features designated A and B. The site is situated on a moderate slope covered with California grass, *koa haole*, and *kiawe*.

**Feature A** consists of two terraces. The main terrace measures 8.0 m. (26.2 ft.) E/W by 5.5 m. (18 ft.) N/S, and is approximately 0.5 m. (1.6 ft.) high on its north and south sides and 1.0 m. (3.3 ft.) high on its *makai* (west) face. The east end of the terrace is flush with the outcrop. The terrace is constructed with small boulders stacked atop outcrop. The terrace appears to have had three separate levels which have since collapsed, forming a presently sloped terrace surface. The terrace also contains numerous possible postholes. There is an upright boulder located at the east end of this terrace.

The second smaller terrace measures 5.5. m. (18.0 ft.) N/S by 4.0 m. (13.1 ft.) E/W. It is adjacent to the northwest corner of the larger terrace. It is constructed of small boulders which fill in the outcrop surface to create a level area.

No midden or artifacts were observed on either terraces.

The terraces are in fair to poor condition and appear to have been damaged by cattle.

**Feature B** is a circular enclosure located on a slope 20.0 m. (65.6 ft.) west of Feature A. The surrounding slope is characterized by outcrop and intermittent soil pockets. The enclosure measures 6.3 m. (20.7 ft.) N/S by 6.5 m. (21.3 ft.) E/W with a maximum wall height of 1.0 m. (3.3 ft.). Intact facing remains on the north wall only. The enclosure has a level soil interior. No midden or artifacts were observed at Feature B.

State site 16578 has fair excavation potential.

**State Site #:** 50-10-37-16579 **CSH Site #:** 229
**Site Type:** Pahoehoe basins
**Function:** Salt bowls
**Features (#):** 1
**Site Dimension:** 150 m.$^2$ (1620.0 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 110 ft. a.m.s.l.

**Description:** State site -16579 consists of pahoehoe salt basins situated east of Pu'u Ohau. The site area encompasses 15.0 m. N/S by 10.0 m. (32.8 ft.) E/W. There are a minimum of 11

basins which are shallow depressions in the pahoehoe outcrop. The basins range in size from 0.15 m. (0.5 ft.) in diameter by 0.12 m. (0.4 ft.) deep to 0.3 m. (1.0 ft.) in diameter and 0.05 m. (0.2 ft.) deep. The bowls have been peched and ground directly into the pahoehoe outcrop.

A few water-rounded boulders were observed on the bedrock. An *'ili'ili* stone was observed as well as scoria lava pieces.

**State Site #:** 50-10-37-16580 **CSH Site #:** 231
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 30.3 m.$^2$ (326.7 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 210 ft. a.m.s.l.

**Description:** State site -16580 is a rectangular enclosure situated in a slight depression within a pahoehoe outcrop. The surrounding vegetation consists of *koa haole* and scattered *kiawe* trees.

The enclosure measures 3.5 m. (11.5 ft.) N/S by 3.5 m. (11.5 ft.) E/W. The walls - constructed of stacked cobbles to medium boulders - have an average width of 1.0 m. (3.3 ft.), a maximum exterior height of 0.4 m. (1.3 ft.) and a maximum interior height of 1.0 m. (3.3 ft.). The *mauka* (east) wall is collapsed. The enclosure interior is soil with scattered cobbles. One water-rounded boulder was observed at the site.

No artifacts or midden were observed.

State site -16580 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16581 **CSH Site #:** 232
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 2
**Site Dimension:** 31.5 m.$^2$ (340.2 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 235 ft. a.m.s.l.

**Description:** State site -16581 consists of terracing and a C-shape enclosure situated on an uneven pahoehoe flow with intermittent soil pockets.

**Feature A** consists of four terraces - designated levels 1 to 4 - situated *mauka/makai* (east/west) on a moderate slope. The *mauka* (east) level (level 1) measures 10.5 m. (34.4 ft.) NW/SE by 3.0 m. (9.8 ft.) NE/SW.

The next level (level 2) is 5.0 m. (16.4 ft.) southwest of level 1. It measures 7.0 m. (23 ft.) NW/SE by 2.5 m. (8.2 ft.) Ne/SW.

The third level is 11.0 m. (36.1 ft.) southwest of the level 1, and measures approximately 10.5 m. (34.4 ft.) NW/SE by 2.0 m. (6.6 ft.) NE/SW. There is facing on the southwest corner of the third level which measures 0.5 m. to 1.2 m. (1.6 ft. to 3.9 ft.) high.



To the south of the third level is a fourth level with facing on its *makai* (west) side. Level 4 measures 2.5 m. (8.2 ft.) E/W by 3.8 m. (12.5 ft.) N/S; the maximum faced height on the *makai* (west) side measures 1.0 m. (3.3 ft.).

The terraces are constructed of cobbles and boulders which fill in an uneven outcrop surface. Some outcrop is still exposed. Lava blisters are in close proximity but none appear to have been utilized. The area between the levels is a combination of gradual slope terrain with soil and outcrop.

One (1) piece of cowrie shell was observed on the surface of level 1 terrace.

The terracing is in poor to fair condition and the excavation potential is considered poor.

**Feature B** comprises a C-shape enclosure located 3.0 m. (9.8 ft.) south of the Feature A level 4. The enclosure measures 4.0 m. (13.1 ft.) E/W by 6.5 m. (21.3 ft.) N/S on the exterior and 3.0 m. (9.8 ft.) E/W by 2.6 m. (8.5 ft.) N/S on the interior. The interior walls are piled boulders on outcrop. Some interior facing exists on the southern side. The C-shape opens *makai* (west).

No midden or artifacts were observed at the feature.

The C-shape is in poor to fair condition and offers fair excavation potential.

**State Site # #:** 50-10-37-16582 **CSH Site #:** 233
**Site type:** Modified sink; Lava tube
**Function:** Temporary habitation
**Features (#):** (see below)
**Site Dimension:** 120.0 m.$^2$ (1296.0 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 275 ft. a.m.s.l.

**Description:** State site -16582 is a modified sink and lava tube located 35.0 m. (115.5 ft.) southwest of State Site -16585.

The sink's surface measurements are 3.0 m. (9.8 ft.) in diameter and 1.5 m. (4.9 ft.) in height (sink edge to floor). Pahoehoe boulders have been stacked around its edges at an average height of 0.5 m. (1.6 ft.) The sink's center floor contains large boulders, apparently from collapse. No cultural material was observed here.

The north chamber is a smaller overhang, 6.0 m. (19.8 ft.) N/S by 5.0 m. (16.4 ft.) E/W, containing soil and a cobble floor, with larger boulders built up to its rear. Cowrie shells, coral, a water-worn cobble and a water-worn hammerstone were observed in the chamber. The chamber opening measures approximately 9.0 m. (29.5 ft.) in diameter.

The south chamber is also quite small, 4.0 m. (13.1 ft.) NE/SW by 3.0 m. (9.8 ft.) NW/SE and 0.9 m. (3.0 ft.) in height. A 2.0 m. (6.6 ft.) square soil floor leads into the chamber, but gives way to a boulder floor. *Kukui* and modified *opihi* shells are observable within the soil, while only water-rounded stones can be seen among the boulders. The northwest side of the boulder floor is slightly built up, and beyond is a very small chamber. The chamber runs north/south from this point for 25.0 to 30.0 m. (82.0 to 98.4 ft.) with an average ceiling height of 0.4 m. (1.3 ft.).

The site is in good condition and offers good excavation potential.

**State Site #:** 50-10-37-16583 **CSH Site #:** 234
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 38.5 m.$^2$ (415.8 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 325.0 ft. a.m.s.l.

**Description:** State site -16583 is a rectangular enclosure situated on a slight slope with scattered *koa haole* and *kiawe* trees.

The enclosure measures 3.3 m. (10.8 ft.) N/S by 5.0 m. (16.4 ft.) E/W with a maximum height of 1.5 m. (4.9 ft.). It is constructed of stacked cobbles to medium boulders. Much of the facing has collapsed. The interior is soil.

One piece of coral was observed.

State site -16583 is in poor condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16584 **CSH Site #:** 235
**Site Type:** Modified sink
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** (see below)
***Ahupua'a*:** Haleki'i
**Elevation:** 295 ft. a.m.s.l.

**Description:** State site -16584 - located 63.7 m. (209.0 ft) west of State site -16583 - is a modified sink situated on the south edge of a pahoehoe outcrop next to an intricate network of agricultural features (Kona field system) (State site -6601).

The modification includes a curved wall - measuring approximately 1.0 m. (3.3 ft.) high and 5.0 m. (16.4 ft.) long - which runs south and then west forming a bowl-shaped structure by incorporating outcrop into its north side. The area circumscribed by the wall has been modified into a terrace or rough platform.

Approximately 12.0 m. (39.4 ft.) to the east is an outcrop which has been modified into a rough wall.

No midden or artifacts were observed.

State site -16584 is in fair condition and it offers fair to poor excavation potential.

**State Site #:** 50-10-37-16585 **CSH Site #:** 236
**Site Type:** Lava tube
**Function:** Burial
**Features (#):** 1
**Site Dimension:** 60.0 m.$^2$ (648.0 ft.$^2$)
*Ahupua'a*: Haleki'i
**Elevation:** 275.0 to 300.0 ft. a.m.s.l.

**Description:** State site -16585 is a modified sink and lava tube situated directly to the south of a *mauka-makai* (east-west) running cattle wall (State site -16793).



The sink's surface measurements are 5.5 m. (18.1 ft.) E/W by 4.0 m. (13.2 ft.) N/S. The sink is mostly paved with medium to small boulders. Facing along the northern edge of the pavement defines the entrance into the lava tube.

The tube entrance measures 0.7 m. (2.3 ft.) N/S by 1.5 m. (4.9 ft.) E/W by 0.75 m. (2.46 ft.) deep. The lava tube extends to the northeast and southwest of the entrance. The southwest chamber was fully explored- no cultural material was observed.

The northeast tube extends for approximately 16.0 m. (52.8 ft.) at which point it connects with another tube but is no longer accessible. The tube has an average width of 1.0 m. (3.3 ft.) but steadily narrows the further northeast the tube extends.

At 11.0 m. (36.3 ft.) a human mandible was observed. At 16.0 m. (52.8 ft.) remains of another human were observed including a mandible, numerous ribs, and portions of the pelvis.

No artifacts were observed. The site is in good condition.

**State Site #:** 50-10-37-16586 **CSH Site #:** 237
**Site Type:** Site complex
**Function:** Temporary habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Haleki'i
**Elevation:** 275 ft. a.m.s.l.

**Description:** State site -16586 consists of a terrace (Feature A) and three small enclosures (Feature B) situated at the base of a steep slope on level terrain. Surrounding vegetation includes California grass, *koa haole*, and scattered *kiawe* trees.

**Feature A** is a terrace located on the *makai* (west) edge of an outcrop. The terrace measures 3.0 m. (9.8 ft.) N/S by 2.5 m. (8.2 ft.) E/W with a maximum height of 1.4 m. (4.6 ft.). It is constructed with boulder facing and has a pebble pavement.

No artifacts or midden were observed.

Feature A is in fair condition and offers poor excavation potential.

**Feature B** comprises three rectangular enclosures located approximately 8.0 m. (26.2 ft.) *mauka* (east) of Feature A. The largest enclosure measures 4.0 m. (13.1 ft.) N/S by 6.0 m. (19.8 ft.) E/W. The smaller enclosures each measure 3.0 m. (9.8 ft.) N/S by 3.0 m. (9.8 ft.) E/W. They are constructed of small cobbles to large boulders.

No artifacts or midden were observed.

Feature B is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16587 **CSH Site #:** 241
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 24.0 m.$^2$ 259.2 ft.$^2$)
**Location:** Haleki'i
**Elevation:** 39.6 m. (130 ft.) a.m.s.l.

**Description:** State site -16587 is a rectangular terrace situated at the base of a slope surrounded by vegetation of *kiawe*, *koa haole* and pasture grass.

The terrace - measuring 8.0 m. (26.2 ft.) by 3.0 m. (9.8 ft.) and 1.0 m. (3.3 ft.) high - is constructed of piled and stacked cobbles and small boulders on top of a natural outcrop ledge.

No midden or artifacts were observed.

State site -16587 is in fair to poor condition with fair to poor excavation potential.

**State Site #:** 50-10-37-16588 **CSH Site #:** 242
**Site Type:** Mound
**Function:** Agriculture or *lua*
**Features (#):** 1
**Site Dimension:** (see below)
**Location:** Haleki'i
**Elevation:** 36.9 m. (120 ft.) a.m.s.l.

**Description:** State site -16588 is a mound with a small depression in its center. The mound is surrounded by *kiawe*, *koa haole* and pasture grass.

The mound measures approximately 3.0 m. (9.8 ft.) in diameter and is constructed of stacked boulders. The depression is roughly faced and measures approximately 0.8 m. (2.6 ft.) in diameter and 0.5 m. (1.7 ft.) deep.

No artifacts or midden were observed.

State site -16588 is in fair to poor condition with fair to poor excavation potential.

**State Site #:** 50-10-37-16589 **CSH Site #:** 243
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Kanaueue
**Elevation:** 400 ft. a.m.s.l.

**Description:** State site -16589 consists of a lava tube (Feature A) and a terrace (Feature B) situated beneath exposed pahoehoe terrain in an area surrounded by *koa haole*, California grass, and *kiawe*.

**Feature A** is a lava tube oriented primarily east west with many chambers extending from the main tube. The entrance is located at the south edge in the eastern part of the mapped extent of the tube. It is blocked with boulders, creating a refuge-type entrance.



From the entrance the main tube extends 20.0 m. (65.6 ft.) to the northeast and pinches into a chamber which is inaccessible due to the low ceiling height. The average width of this chamber is 4.0 m. (13.1 ft.) and it has a height of 0.9 m. (3.0 ft.). Charcoal and pig bone were observed on the floor of this chamber. A dog tooth pendant was also observed.

The main tube also extends to the west for approximately 100.0 m. (328.1 ft.). The tube has an average width of 3.0 m. (9.8 ft.) and a maximum height of 1.6 m. (5.2 ft.).

Midden observed in the main chamber includes charcoal, a sharks' tooth, pig bone, *opihi* (probably used as scrapers), *Thaididae*, *conus*, and numerous small shell fragments in a pile. Artifacts observed include a shell fishhook (Acc.# 85), two bone picks (Acc.# 86 and 87), a basalt *he'e* lure sinker (Acc.# 84), a shell lure (Acc.# 81), two scoria files (Acc.# 82 and 83), three basalt scrapers, numerous *opihi* scrapers, basalt sanding or polishing stones, four possible hammer stones. All of these were collected except the scrapers, polishing stones, and the hammer stones.

At approximately 28.0 m. (91.9 ft.) from the entrance in this main chamber, a side chamber extends northeast and splits immediately into numerous small tubes going in all directions. These chambers were explored thoroughly and no culture was observed.

The modifications at the entrance are in good condition. Feature A offers excellent excavation potential.

**Feature B** is a terrace situated immediately southwest of the Feature A tube entrance. The terrace measures 7.5 m. (24.6 ft.) N/S by 3.5 m. (11.5 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). It is constructed of large stacked boulders. Some facing remains on the southwest side.

In the front of the terrace a stone bowl made from a water-rounded stone was observed. Also a basalt adz (Acc.# 88) with a rounded front and rear edge was observed and collected.

Feature B is in fair condition. The excavation potential is considered good.

**State Site #:** 50-10-37-16590 **CSH Site #:** 244
**Site Type:** Modified outcrop
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 180.0 m.$^2$ (1,944 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 365 ft. a.m.s.l.

**Description:** State site -16590 is a modified outcrop situated along a ridge in the slope. This site affords an excellent view of the coast. The surrounding vegetation is *koa haole* and grass.

The outcrop is modified into levels of terracing. The top level is roughly L-shaped and measures 5.5 m. (18.0 ft.) E/W by 5.0 m. (16.4 ft.) N/S with a maximum height is 0.9 m. (3.0 ft.). Stones are stacked along its north and east sides, and the east facing is well preserved. Only 1.2 m. (3.9 ft.) N/S of the surface is paved along the west side; the rest of the surface is bedrock. The northern portion of this level measures 1.5 m. (4.9 ft.) N/S by 3.0 m. (9.8 ft.) E/W and is 0.7 m. (2.3 ft.) high in the northwest corner.

The lower level is similar in construction with stacking on the north and west faces. The north side measures 3.0 m. (9.8 ft.) E/W by 1.0 m. (3.3 ft.) N/S; the west side is tumbled, measuring approximately 3.0 m. 9.8 ft.) N/S. There is a 0.8 m. (2.6 ft.) level separating the

tiers.

No artifacts or midden were observed.

State site -16590 is in fair to good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16591 **CSH Site #:** 245
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 12.0 m.$^2$ (129.6 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 685 ft. a.m.s.l.

**Description:** State site -16591 is a circular terrace situated on an outcrop of very rough pahoehoe flow. It measures 2.0 m. (6.6 ft.) in diameter and 0.8 m. (2.6 ft.) high. It is constructed of a'a boulders and cobbles. Facing remains intact on the *makai* (west) side.

The terrace is located on the border of two lava flows. There is a shallow depression which extends 4.0 m. (13.1 ft.) west of the facing. It measures 0.4 m. (1.3 ft.) deep.

No artifacts or midden were observed.

State site -16591 is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16592 **CSH Site #:** 246
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 72.0 m.$^2$ (777.6 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 535 ft. a.m.s.l.

**Description:** State site -16592 is a rectangular enclosure situated on a medium slope of exposed pahoehoe and surrounded by ***koa haole*** and California grass.

The enclosure measures 12.0 m. (39.4 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). It is constructed of stacked boulders on the *makai* (west) side which have now tumbled. The *mauka* (east) side utilizes the slope in its construction: it is level with the slope on the exterior of the wall and measures 0.3 m. (1.0 ft.) high on the interior. There is a level pavement *mauka* (east) of the enclosure.

No midden or artifacts were visible.

State site -16592 is in fair condition. The excavation potential is considered poor.



**State Site #:** 50-10-37-16593 **CSH Site #:** 247
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 20.0 m.$^2$ (216.0 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 455 ft. a.m.s.l.

**Description:** State site -16593 is a small enclosure adjacent on its south side to a gravel jeep road and 8.0 m. (26.2 ft.) south of a *mauka/makai* (east/west) running cattle wall (State site -19792).

The enclosure measures 5.0 m. (16.4 ft.) N/S by 4.0 m. (13.1 ft.) E/W on the exterior and 3.5 m. (11.5 ft.) N/S by 2.0 m. (6.6 ft.) E/W on the interior and ranging in height from 0.5 to 1.0 m. (1.6 to 3.3 ft.). The walls of the enclosure are constructed of stacked boulders.

No artifacts or midden were observed.

State site -16593 is in poor condition and the excavation potential is considered poor.

**State Site #:** 50-10-37-16594 **CSH Site #:** 248
**Site Type:** Modified Blister
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 9.0 m.$^2$ (97.2 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 505 ft. a.m.s.l.

**Description:** State site -16594 is a modified lava blister situated 38.1 m. (125.0 ft.) northwest of State site -16591. The surrounding terrain is pahoehoe outcrop on a moderate slope.

The blister measures 2.0 m. (6.6 ft.) N/S by 1.8 m. (5.9 ft.) E/W and has a maximum height of 0.8 m. (2.6 ft.). Modifications consist of a well-faced small boulder and cobble wall with a maximum height of 0.4 m. (1.3 ft.). The wall encloses all but the northwest side of the blister. The interior of the blister is soil.

No midden or artifacts were observed.

State site -16594 is in good condition and offers fair to good excavation potential.

**State Site #:** 50-10-37-16595 **CSH Site #:** 249
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 5
**Site Dimension:** 1,720.0 m.$^2$ (5,641.6 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 555.0 ft. a.m.s.l.

**Description:** State site -16595 (Figure 31) is a large site complex comprising five features, designated A through E. It is located on level ground at the top of a steep slope.

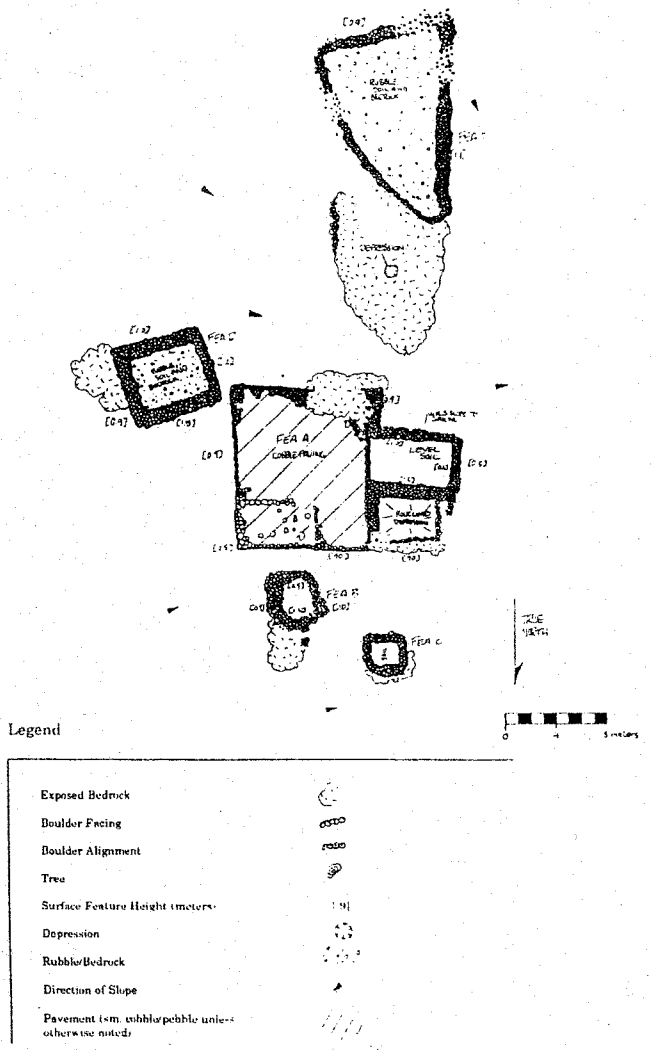



Figure 31 State site 50-10-37-16595; plan view



Feature A is a large platform with an enclosure incorporated into it. It is constructed of boulder facing and a cobble and boulder pavement. There is an area in the central part of the platform which is paved with small cobbles. An underlying outcrop figures extensively in the construction of the platform.

No artifacts or midden were observed.

Feature A is in fair condition and offers fair excavation potential.

**Feature B** is an enclosure situated just north of Feature A. It is rectangular in shape and one side consists of pahoehoe outcrop. The enclosure measures 5.0 m. (16.5 ft.) N/S by 6.0 m. (19.8 ft.) E/W. The walls are constructed of small cobbles to medium boulders with a maximum height of 1.2 m. (3.9 ft.). The interior consists of level soil.

No artifacts or midden were observed.

Feature B is in fair to good condition and offers fair excavation potential.

**Feature C** is a small enclosure situated on the south side of an outcrop. The walls are constructed of stacked cobbles to small boulders. The north side of the enclosure is outcrop. The enclosure measures 4.0 m. (13.2 ft.) N/S by 3.5 m. (11.6 ft.) S/W. The interior consists of soil with scattered cobbles.

No artifacts or midden were observed.

Feature C is in fair to good condition and offers fair excavation potential.

**Feature D** is a small enclosure measuring 6.8 m. (22.3 ft.) N/S by 6.5 m. (21.3 ft.) E/W with a maximum height of 1.2 m. (3.9 ft.). It is constructed with small to medium boulders and has prominent vertical facing on all sides. The interior consist of rubble, soil, and outcrop.

No artifacts or midden were observed.

Feature D is in good condition and offers fair to good excavation potential.

**Feature E** is a blister with an attached enclosure. The blister measures 3.7 m. (21.3 ft.) N/S and extends 5.4 m. (17.7 ft.) E/W with an interior height of 0.75 m. (2.5 ft.). The blister has a horizontal opening and a vertical opening.

The vertical opening is on an exposed bedrock blister with a narrow terrace which measures 7.5 (24.6 ft.) N/S by 1.5 (4.9 ft.) E/W. There is remnant facing on the *mauka* (east) side which is 0.9 m. high. The entrance itself measures 1.5 m. (4.9 ft.) N/S by 1.0 m. (3.3 ft.) E/W by 1.3 m. (4.0 ft.) high.

The horizontal opening measures 0.6 m. (2.0 ft.) high and 1.8 m. (5.9 ft.) wide. There are several juvenile pig skeletons scattered on the floor of the blister. The floor is mostly rough bedrock with some dirt and piled cobbles.

Feature E is in good condition and offers good excavation potential.

**State Site #:** 50-10-37-16596 **CSH Site #:** 250
**Site Type:** Modified outcrop
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 156.0 m.$^2$ (1,684.8 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 470 ft. a.m.s.l.

**Description:** State site -16596 is a modified outcrop situated at the *mauka* (east) end of two

parallel walls directly south of the north access gravel road. This site area appears on a grant map but no proprietor name is given on the map for this area. The terrain slopes moderately *makai* (west) and contains numerous young *koa haole* trees with well-grazed grass between.

The modification consists of a boulder pile measuring 13.0 m. (42.6 ft.) NW/SE by 12.0 m. (39.4 ft.) NE/SW. The north end is level bedrock and the south end has the boulder piling.

No midden or artifacts were observed.

State site -16596 is in fair to poor condition and the excavation potential is considered poor.

**State Site #:** 50-10-37-16597 **CSH Site #:** 251
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 2.6 m.$^2$ (27.5 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 525 ft. a.m.s.l.

**Description:** State site -16597 is an enclosure situated northwest of State site -16595 and southeast of State site -16596 on the edge of a slope. It measures 1.7 m. (5.6 ft.) N/S by 1.5 m. (4.9 ft.) E/W and is constructed of stacked boulders on pahoehoe outcrop. The central area measures 0.8 m. (2.6 ft.) N/S by 0.75 m. (2.5 ft.) E/W. The central depth is 0.5 m. (1.6 ft.) and the boulders inside appear to be tumble.

No artifacts or midden were observed.

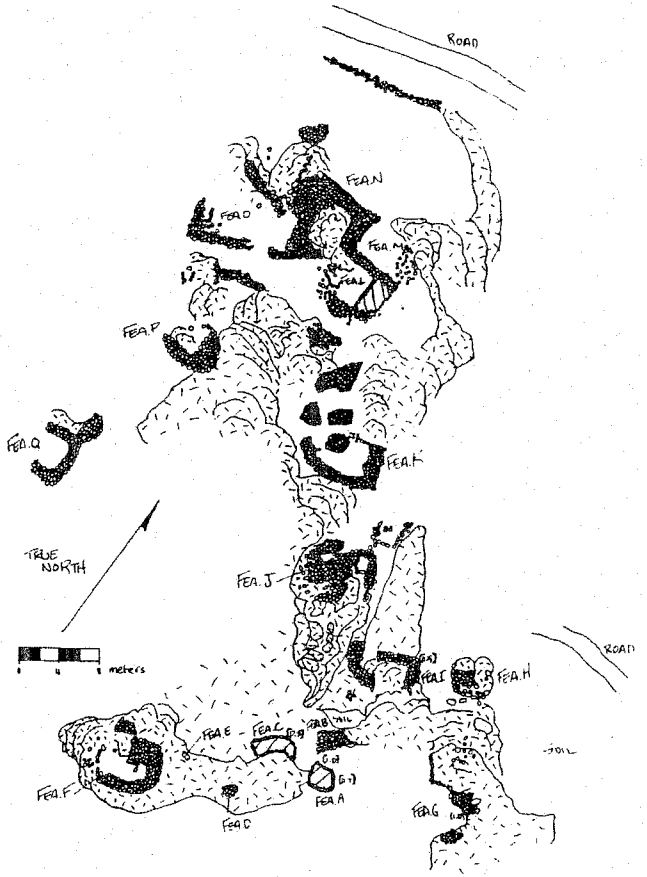
State site -16597 is in good condition and the excavation potential is considered fair to good.

**State Site #:** 50-10-37-16598 **CSH Site #:** 252
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 9
**Site Dimension:** (see below)
***Ahupua'a*:** Kanaueue
**Elevation:** 600 ft. a.m.s.l.

**Description:** State site -16598 (Figure 32) is a site complex consisting of 17 features designated Features A through Q. The site is situated on a level plateau which has a commanding view of the coast from Kona to the south. The terrain is mostly pahoehoe flow with scattered soil pockets. Numerous young *koa haole* trees cover the immediate area and to the north is the large bulldozed project area. The new modern gravel road is approximately 20 to 30 m. (66 to 99 ft.) from Feature H. To the north of Feature K and *mauka* (east) is the edge of the pahoehoe flow in which this site is located. The area along the side of the flow is a clear soil area with well-grazed grass and fewer *koa haole* trees but with a medium growth of *kiawe* trees.

**Feature A** is a small rectangular platform that measures 3.0 m. (9.8 ft.) E/W by 2.5 m. (8.2 ft.) E/W and has a maximum height of 1.0 m. (3.3 ft.). It is constructed of stacked






Legend

| | |
|---|---|
| Exposed Bedrock | |
| Boulder Facing | |
| Surface Feature Height (meters) | [.9] |
| Direction of Slope | |
| Pavement | |

Figure 32 State site 50-10-37-16598; plan view

boulders with facing on the north, east, and west sides. The top is fairly level with a cobble and boulder pavement

No artifacts or midden were observed.

Feature A is in fair condition and is considered a probable burial.

**Feature B**, located 1.0 m. (3.3 ft.) north of Feature A, is a long low-lying mound coming off of the end of a pahoehoe flow. The mound measures 3.0 m. (9.8 ft.) NE/SW by 2.0 m. (6.6 ft.) NW/SE. It is constructed of boulders piled on an outcrop.

No artifacts or midden was observed.

Feature B is in poor condition and the excavation potential is considered poor. It is interpreted as an agricultural feature.

**Feature C** is a modified outcrop, situated *makai* (west) of Features A and B. The modifications measure 4.5 m. (14.8 ft.) NE/SW by 1.5 m. (4.9 ft.) NW/SE. The south portion is level pahoehoe outcrop and the north portion has intact facing constructed with stacked boulders measuring 0.8 m. (2.6 ft.) in height.

No midden or artifacts were observed.

Feature C is in fair condition and the excavation potential is considered fair to poor.

**Feature D** is an *ahu* which is now in tumbled condition and it is situated south of Feature C on level pahoehoe.

No midden or artifacts were observed.

The *ahu* is in collapsed condition and the excavation potential is considered poor. It is interpreted as a religious feature.

**Feature E** is a filled crevice west of Features C and D. The crevice is in the *makai* (west) end of the level pahoehoe area. It measures 0.5 m. (1.6 ft.) N/S by 1.0 m. (3.3 ft.) E/W and has a maximum depth of 0.6 m. (2.0 ft.). The boulders with which the crevice is filled are fairly large and are not filled in uniformly so the crevice does not have a level surface.

No midden or artifacts were observed.

Feature E is in poor condition and the excavation potential is considered fair to poor. The pavement is considered a permanent habitation feature.

**Feature F** is a small enclosure located *makai* (west) of Feature E just off the level pahoehoe flow. It measures 6.0 m. (19.8 ft.) N/S by 6.0 m. (19.8 ft.) E/W and is constructed of stacked boulders. The enclosure is open to the southwest.

No midden and artifacts were observed at the feature.

Feature F is in good condition and excavation potential is considered good. It is interpreted as an agricultural feature.

**Feature G** is a modified outcrop in which the outcrop was modified by filling in the cracks with small boulders and cobble to form a raised level area. The modification measures 2.0 m. (6.6 ft.) N/S by 2.5 m. (8.2 ft.) E/W and has a maximum height of 1.8 m. (5.9 ft.) on the south edge where it is well faced.

No midden and artifacts were observed.

Feature G is in fair condition and the excavation potential is considered fair to poor. It is interpreted as an agricultural feature.

**Feature H** is also a modified outcrop creating a raised level area in the existing outcrop by filling in the central portion with boulders. The modification measures 1.0 m. (3.3



ft.) N/S by 2.0 m. (6.6 ft.) E/W.

No midden or artifacts were observed.

The condition of Feature H is fair and the excavation potential is considered poor. This feature is interpreted as an agricultural feature.

**Feature I** is a modified outcrop. Modifications consist of stacked and piled boulders creating an enclosure with the surrounding outcrop. The construction occurs on the north and east sides of the enclosure.

No midden or artifacts were observed.

The condition of Feature I is good and the excavation potential is considered fair. It is interpreted as an agricultural feature.

**Feature J** comprises two contiguous enclosures with an attached pavement situated on the south side of an outcrop. The *makai* (west) enclosure measures 1.0 m. (3.3 ft.) square, oriented north/south, and has a maximum wall height of 0.5 m. (1.6 ft.). The *mauka* (east) enclosure measures 2.5 m. (8.2 ft.) N/S by 2.0 m. (6.6 ft.) E/W and has a maximum wall height of 0.6 m. (2.0 ft.). The surrounding pavement measures 6.0 m. (19.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W. The feature is constructed of stacked and piled cobbles and boulders and the pavement is roughly level. The interior of the enclosures are level soil with scattered cobbles.

No midden or artifacts were observed.

Feature J is in fair condition and offers fair to poor excavation potential. It is interpreted as an agricultural feature.

**Feature K** is an enclosure that measures 6.0 m. (19.8 ft.) N/S by 8.5 m. (27.9 ft.) E/W and has a maximum height of 0.6 m. (2.0 ft.). It is constructed of stacked and piled boulders with cobble fill. The wall is somewhat collapsed on the north side. There is a possible entrance at the west edge of the enclosure. The interior is level soil with scattered cobbles.

No midden or artifacts were observed.

Feature K is in fair condition and offers fair excavation potential. It is considered an agricultural feature.

**Feature L** is an enclosure that measures 4.0 m. (13.1 ft.) N/S by 5.0 m. (16.4 ft.) E/W. It is constructed of well faced boulders with cobble fill. The west wall has collapsed. There is a paved ledge at the east end of the enclosure interior. It measures 4.0 m. (13.1 ft.) N/S by 1.5 m. (4.9 ft.) E/W with a maximum height of 0.6 m. (2.0 ft.). The enclosure wall has a maximum height of 0.65 m. (2.1 ft.) above the ledge pavement.

A water-rounded cobble was observed on the ledge.

Feature L is in fair to good condition and offers good excavation potential. It is considered a permanent habitation feature.

**Feature M** is an L-shape that forms an enclosed area with an adjacent outcrop. It measures 3.8 m. (12.5 ft.) N/S by 6.4 m. (21.0 ft.) E/W. It is well faced to a maximum height of 0.6 m. (The south wall is shared with Feature L, immediately south of the L-shape. The interior is level soil with scattered cobbles.

No midden or artifacts were observed.

Feature M is in fair to good condition and offers good excavation potential. It is interpreted as a permanent habitation feature.

**Feature N** is a modified outcrop situated immediately west of Feature M. The modifications consist of terracing on the all but the south side of the outcrop. The feature

measures 10.0 m. (32.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.) on the *makai* (west) side. It is constructed of boulders and cobbles with excellent facing and a level pavement. The east edge of the terracing is the west wall of Feature M.

No midden or artifacts were observed.

Feature N is in good condition and offers good excavation potential. It is interpreted as a permanent habitation feature.

**Feature O** is an L-shape enclosure measuring 5.0 m. (16.4 ft.)N/S by 7.0 m. (23.0 ft.) E/W. It is constructed of piled boulders and cobbles. Most of the facing has collapsed. The interior is soil with scattered collapse.

No midden or artifacts were observed.

Feature O is in poor condition and offers fair to poor excavation potential.

**Feature P** is a modified outcrop. Modifications consist of an L-shape terracing atop the outcrop. The L-shape measures 4.5 m. (14.8 ft.) N/S by 4.8 m. (15.7 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.) on the west side. It is constructed of boulders and cobbles and has intact facing on the interior.

No midden or artifacts were observed.

Feature P is in fair condition and offers fair excavation potential. It is considered an agricultural feature.

**Feature Q** is an enclosure that has had the west half destroyed by the bulldozer to make way for the gravel road. The remaining half measures 5.5 m. (18.0 ft.) N/S by 4.5 m. (14.8 ft.) E/W and has a maximum height of 1.2 m. (3.6 ft.). It is constructed of faced boulders with cobble fill. There is a wall extending north for 3.5 m. (11.5 ft.) at the northeast corner of the enclosure.

No midden or artifacts were observed.

The remaining half of Feature Q is in fair to good condition and the excavation potential is considered fair. It is interpreted as an agricultural feature.

**State Site #:** 50-10-37-16599 **CSH Site #:** 253
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 766.4 m.$^2$ (8,277.1 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 685 ft. a.m.s.l.

**Description:** State site -16599 is a semi-rectangular enclosure situated on a gentle slope of well-grazed grassland and surrounded by scattered *koa haole* trees. There is fairly abundant soil with a scattering of cobbles.

This enclosures measures 9.9 m. (32.5 ft.) N/S by 5.9 m. (19.4 ft.) E/W and is constructed of piled boulders and cobbles. The wall ranges from 0.5 (1.6 ft.) to 0.6 m. (2.0 ft.) high. The enclosure is flush with the slope on the west side and there is a mounded wall on the east. The central area is deep, fairly level soil with numerous scattered cobbles (probably from the walls).

No artifacts or midden were observed.

State site -16599 is in fair condition and offers fair excavation potential.



**State Site #:** 50-10-37-16600 **CSH Site #:** 254
**Site Type:** Lava tube
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 98.0 m.$^2$ (1,058.4 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 650 ft. a.m.s.l.

**Description:** State site -16600 is a small lava tube which has two entrances, one located at each end of the tube. The larger entrance is located at the *mauka* (east) end of the tube. The entrance is along the edge of a sink; the sink measures 19.7 m. (64.6 ft.) long by 5.0 m. (16.4 ft.) wide. It appears as if a tube continues *mauka* (east) of the sine, butit has been walled up with extensive piling of boulders.

The tube measures 46.0 m. (150.9 ft.) NE/SW, has an average width of 4.5 m. (14.8 ft.) and a maximum height of 1.0 m. (3.3 ft.) in the central tube area. In this central portion of the tube is a small wall extending across the width of the tube. Adjacent to this wall on the north side of the tube is an area paved with cobbles. There are a few alignments in the tube coming off both the north and south sides of the tube around the pavement.

The *makai* (west) entrance is under a small ledge. It measures 4.0 m. (13.1 ft.) NW/SE wide and has a height of 0.2 m. (0.6 ft.). The light area inside the *mauka* (east) entrance has a substantial soil deposit with a scattering of *kukui* shell fragments and 5 pieces of round bleached wood measuring 30 cm. by 5 cm.

State site -16600 offers good excavation potential. The modifications are in fair to poor condition.

State Site #: 50-10-37-16601 **CSH Site #:** 255
**Site Type:** Site Complex
**Function:** Agriculture
**Features (#):** 3
**Site Dimension:** Indeterminate
***Ahupua'a:*** Kanaueue
**Elevation:** 600 ft. a.m.s.l.

**Description:** State site -16601 is a site complex consisting of 3 enclosures and a N/S running wall. The *mauka* (east)-most wall extends from a *mauka/makai* (east/west) running historic cattle wall toward the south for an undetermined distance. Extenking off the north section of this wall there are two walls running *makai* (west) which are divided north/south to form two enclosures. South of these enclosures is another wall section which heads southeast of form a third enclosure. The walls are constructed of boulder facing with a cobble to small boulder fill.

No midden or artifacts were observed.

State site -16601 is in fair condition. The enclosures offer fair excavation potential.

**State Site #:** 50-10-37-16602 **CSH Site #:** 256
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 132.0 m.$^2$ (1,425.6 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 640 ft. a.m.s.l.

**Description:** State site -16602 consists of a roughly square enclosure on a pahoehoe outcrop surrounded by pasture grass to the north and elsewhere *koa haole*, *kiawe*, and grass.

The enclosure measures 12.0 m. (39.4 ft.) N/S by 11.0 m. (36.1 ft.) E/W and its walls range from 2.5 m. (8.2 ft.) to 3.0 m. (9.8 ft.) in width by 0.7 m. (2.3 ft.) in height. There is a small platform connected to the southwest corner. The walls and platform use the bedrock outcrop for their foundation. The surrounding outcrop has been extensivly modified

No artifacts or midden were observed.

State site -16602 is in fair to good condition and the excavation potential is considered poor to fair.

**State Site #:** 50-10-37-16603 **CSH Site #:** 257
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 43.4 m.$^2$ (468.7 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 660 ft. a.m.s.l.

**Description:** State site -16603 is an enclosure built atop a pahoehoe outcrop situated amongst *koa haole* and *kukui* trees. It measures 4.0 m. (13.1 ft.) N/S by 5.2 m. (17.1 ft.) E/W with a maximum exterior height of 1.0 m. (3.3 ft.). The walls are constructed of stacked boulders and have a maximum width of 1.1 m. (3.6 ft.).

No artifacts or midden were observed at the site.

State site -16603 is in fair condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16604 **CSH Site #:** 258
**Site Type:** Lava blister
**Function:** Burial
**Features (#):** 1
**Site Dimension:** 3.2 m.$^2$ (34.8 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 650 ft. a.m.s.l.

**Description:** State site -16604 is a lava blister with a small filled area on the *mauka* (east) side of the blister. The exterior of the blister is situated on a level break in the slope surrounded by *koa haole*, *kukui* and *kiawe* trees.

The interior measures 2.3 m. (7.5 ft.) N/S by 1.4 m. (4.6 ft.) E/W. The ceiling has a



maximum height of 1.0 m. (3.3 ft.). The blister appears to have been totally sealed, but the entrance is now in a state of collapse. The floor has loose boulders on bedrock.

The burial is located within the blister. There is a thin soil layer on top of the bedrock where a human skull cap was observed but no other bones, midden or artifacts are observed.

State site -16604 is in fair to poor condition.

**State Site #:** 50-10-37-16605 **CSH Site #:** 259
**Site Type:** Modified blister
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 72.0 m.$^2$ (777.6 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 640 ft. a.m.s.l.

**Description:** State site -16605 is a modified blister located on a medium slope of a hill among laua'e fern and a large papaya tree are growing in the entrance of the blister.

The blister chamber measures 4.0 m. (13.1 ft.) N/S by 1.6 m. (5.2 ft.) E/W and has a maximum height of 0.6 m. (2.0 ft.). There is also a partially blocked off chamber of 7.0 m. (23.0 ft.) E/W by 4.0 m. (13.1 ft.) N/S which has a maximum height of 0.3 m. (1.0 ft.) extending off the blister. The floor of the blister is covered with soil with some exposed bedrock areas.

Midden including *pipipi*, *opihi*, bone, volcanic glass, a scoria file, coral files, and a water-rounded hammerstone were observed near the blister entrance.

State site -16605 is in excellent condition and the excavation potential is considered excellent.

**State Site #:** 50-10-37-16606 **CSH Site #:** 260
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 5.0 m.$^2$ (54.0 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 640 ft. a.m.s.l.

**Description:** State site -16606 is an enclosure located on a slightly raised area on an otherwise very level plateau of pahoehoe bluff which has intermittent pockets of soil.

The enclosure measures 4.0 m. (13.2 ft.) N/S by 4.5 m. (14.9 ft.) E/W and is constructed of piled and stacked boulders on pahoehoe outcrop. The interior walls are well faced. The N wall forms a semi-level pavement.

No artifacts or midden were observed.

State site -16606 is in good to fair condition. The excavation potential is considered fair.

**State Site #:** 50-10-37-16607 **CSH Site #:** 261
**Site Type:** Platform; enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 84.5 m.$^2$ (277.2 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 640 ft. a.m.s.l.

**Description:** State site -16607 is a nearly-circular walled enclosure with a platform attached to the north side of a pahoehoe outcrop. The area is gently undulating pahoehoe with soil patches between outcrops. Rock clearing and outcrop modification is obvious. Surrounding vegetation is *koa haole*, and grasses. The area is well grazed by cattle.

The enclosure measures 2.5 m. (8.2 ft.) N/S by 2.0 m. (6.6 ft.) E/W. The platform measures 4.2 m. N/S by 6.5 m. E/W. The enclosure is constructed of medium to large cobbles and a level enclosure wall with a facing of stacked boulders. Tumble has occurred inward on the southeast wall. The east and southeast walls are level with adjacent outcrop.

Blue and red ribbons were observed on the north side of the enclosure, inside the enclosure and on the platform on the south side (possibly Paul H. Rosendahl Inc. flags). The platform is a level area of outcrop of small cobbles to small boulders. A road survey stake was found on the southeast edge of the modified outcrop. A water-rounded cobble was observed on the outcrop at the south edge of the enclosure.

State site -16607 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16608 **CSH Site #:** 262
**Site Type:** Lava tube
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 80.0 m.$^2$ (864.0 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 550 ft. a.m.s.l.

**Description:** State site -16608 is a small lava tube with a modified entrance situated on a gentle sloping pahoehoe flow. The tube extends for 20.0 m. (65.6 ft.). A C-Shape encloses a small sink area in front of the mouth of the cave. The sink area measures 3.5 m. (11.5 ft.) N/S by 2.5 m. (8.2 ft.) E/W. The C-shape is constructed of large cobbles to small boulders which are stacked in 7 to 8 courses high up to a maximum height of 1.6 m. (5.2 ft.). There is well preserved vertical facing on both sides of the C-Shape. The entrance measures 3.5 m. (11.5 ft.) long by 0.8 m. (2.6 ft.) high. There is a small hole in the cave roof (0.8 m. in diameter) which occurs 5.5 m. in from the entrance. This hole appears to be natural collapse. The cave floor consists of loose soil on bedrock.

Scattered cobbles and *kukui* were observed. No artifacts or other midden were observed.

State site -16608 is in good condition and the excavation potential is considered good.



**State Site #:** 50-10-37-16609 **CSH Site #:** 263
**Site Type:** Lava blister
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 96.0 m.$^2$ (1046.4 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 550 ft. a.m.s.l.

**Description:** State site -16609 is a lava blister with surrounding modified outcrop, located on a gentle slope. The blister measures approximately 1.5 m. (4.9 ft.) in diameter. The exterior of the blister is modified on the *makai* (west) side with a modified level section to the west. It is constructed of stacked and piled boulders on the outcrop. No artifacts were observed but there is *kukui* and charcoal present within the blister.

State site -16609 is in fair to good condition and offers good excavation potential. There are two small blisters directly *makai* (west) of this blister which have minimal modifications and small amounts of *kukui* and pig bones.

**State Site #:** 50-10-37-16610 **CSH Site #:** 264
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Kanaueue
**Elevation:** 625 ft. a.m.s.l.

**Description:** State site -16610 consists of two features; a square platform (Feature A) and a modified lava blister (Feature B). A bulldozed road runs SE/NW at the north end of Feature A and 20.0 m. (66.0 ft.) from Feature A at 19° TN there is a small modified lava blister. Surrounding the site is *koa haole*, California grass, and vines.

**Feature A** is a square platform on a low exposed pahoehoe outcrop. The platform measures 2.6 m. (8.5 ft.) N/S by 2.5 m. (8.2 ft.) E/W. It is constructed of one to two courses of boulders with cobble fill. The *mauka* (east) side is 3 courses high.

No artifacts or midden were observed.

Feature A is in good condition and excavation potential is considered good.

**Feature B** is a split modified blister with both *mauka* (east) and *makai* (west) entrances. The *makai* (west) side is 2.5 m. (8.2 ft.) E/W by 4.0 m. (13.1 ft.) N/S with a height of 0.7 m. (2.3 ft.). The *mauka* (east) blister side measures 2.5 m. (8.2 ft.) E/W by 4.2 m. (13.8 ft.) N/S with a maximum height of 0.8 m. (2.6 ft.). In this blister midden, including *Cellana*, and *opihi* were observed. The floor near the entrance has a substainial soil deposit.

State site -16610 is fair condition and offers good excavation potential.

**State Site #:** 50-10-37-16611 **CSH Site #:** 265
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Kanaueue
**Elevation:** 585 ft. a.m.s.l.

**Description:** State site -16611 consists of a two small lava blisters with extensive modifications on a gentle slope of exposed pahoehoe flow.

**Feature A** from the *makai* (west) entrance the blister measures 2.6 m. (8.5 ft.) N/S by 2.6 m. (8.5 ft.) E/W and is 0.8 m. (2.6 ft.) high. The floor has a soil deposit at least 20 cm. (0.7 ft.) deep. There are small amounts of charcoal mixed with *koa haole* debris. There is a small passage way 0.2 m. (0.7 ft.) high extending from the northeast corner of the blister and extending approximately 2.0 m. (6.6 ft.). Another 1.0 m. (3.3 ft.) into the passage way a child's left humerus was observed. No other bone fragments were observed.

**Feature B** is a small blister with collapsed walls around the *mauka* (east) side of the entrance. The blister measures 5.5 m. (18.0 ft.) E/W. The entrance measures 2.0 m. (6.6 ft.) wide. The faced C-shaped wall measures 0.7 m. (2.3 ft.) high. The wall is constructed of medium subangular basalt cobbles and has a maximum height of 1.0 m. (3.3 ft.).

No midden or artifacts were observed, a probable human bone was observed at the back of the blister and there was pig bone around the front of the blister. A small *konane* board (7 row x 5 cellumns) was observed in high grass among *koa haole* trees.

Feature B is in fair to good condition and the excavation potential is considered good.

**State Site #:** 50-10-37-16612 **CSH Site #:** 266
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 41.3 m.$^2$ (445.5 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 500 ft. a.m.s.l.

**Description:** State site -16612 is a large platform built onto the outcrop and is level with it on the north and west sides.

The platform measures 7.5 m. (24.6 ft.) N/S by 5.5 m. (18.0 ft.) E/W. It is constructed of large subangular basalt cobbles to boulders and has a flat subangular pebble to small cobble paving. The platform measures 1.0 m. (3.3 ft.) high on the east and south sides. It is well faced on both of these sides.

No midden or artifacts were observed.

State site -16612 is in fair to good condition and the excavation potential is considered fair.



**State Site #:** 50-10-37-16613 **CSH Site #:** 267
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 13
**Site Dimension:** (see below)
***Ahupua'a*:** Kanaueue
**Elevation:** 600 to 650 ft. a.m.s.l.

**Description:** State site -16613 is a large site complex, consisting of 13 features, designated Features A-M. it is located upon a gentle to medium slope on a relatively flat area. The surrounding vegetation includes *koa haole*, Christmas-berry, air plant, California grass, ilima, monkeypod, papaya, coffee and numerous *kukui* nut trees with *lilikoi* vines covering them. Most of the walls are well faced with many collapsed areas. The complex is in good condition with some areas in fair condition.

**Feature A** consists of 2 major platforms along with a series of walls, small C- and U-shapes and a large level area on the *makai* (west) side of the platforms. This area measures approximately 35.0 m. (114.8 ft.) N/S by 30.0 m. (98.4 ft.) E/W. The walls and platforms are constructed of subangular basalt cobbles and boulders with level dirt and cobble paved areas.

Numerous historic artifacts are observed in and around Feature A. These include metal hoe blades, square nails, a length of chain, several large metal hooks, a horse hitching ring, a metal file, a flat water-rounded cobble, several metal buckets, numerous iron barrel hoop fragments, broken whiskey and beer bottles, broken pottery, a cast iron pot and many bits of unidentified metal.

Just north of Feature A on a gentle slope is a series of boulder terraces faced on their *makai* (west) side.

**Feature B**, located 20.0 m. (65.6 ft.) west of Feature A, is a terrace on the *mauka* (east) side of an outcrop and extends into the soil area. This terrace is 12.0 m. (39.4 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 1.5 m. (4.9 ft.). A large 1.5 m. (4.9 ft.) high boulder wall constructed of large boulders is faced on the *makai* (west) side.

No midden or artifacts were observed.

Feature B was probably used for agriculture, either clearing or planting. Vegitation includes air plant, California grass, *koa haole*, papaya, monkeypod and *kiawe*. Ten meters to the southwest is a large faced mound, which may be a sugar cane clearing mound.

**Feature C** is a circular enclosure approximately 10.0 m. (32.8 ft.) in diameter with walls 0.8 m. (2.6 ft.) high. Feature C is located northeast of Feature A on a medium slope. It is constructed of a piled rock wall of medium to large subangular basalt boulders. The *makai* (west) portion of the wall is in fair to good condition. The *mauka* (east) half of the wall is collapsed and in poor condition. The enclosure interior is largely outcrop and rocks. In addition to the vegetation of Features A and B there are also exotic weeds and several species of vines.

No midden or artifacts were observed.

**Feature D**, located 5.0 m. (16.4 ft.) to the northeast of Feature A, is a large enclosure 15.0 m. (49.2 ft.) in diameter and oblong in shape. This enclosure utilizes the existing pahoehoe outcrop for portions of its walls. It is constructed of stacked sub-angular basalt boulders. The east and west walls are in fair to good condition while the north and south walls are collapsed and in poor condition due to cattle grazing in the area.

No midden or artifacts were observed.

**Feature E**, located north of Feature A on a flat areas, is a small lava blister measuring approximately 2.0 m. 6.6 ft.) in diameter with a small round opening about 0.6 m. (2.0 ft.) in diameter with 2 large basalt cap stones covering the entrance.

Inside there is approximately 5 to 10 cm. of soil, kukui nut shell fragments, *opihi*, and numerous broken bottles, plates, bowls and other historic household items including a early Kona Bottle works bottle, a vertically embossed HB & M Co bottle, several palm tree seal gin bottles, a blob top ceramic sake bottle, various small green and brown whiskey and ginger beer bottles, a large hand blown blob top jug, a wine bottle, broken medicine bottle, several sake cups, a Johnson Brothers stamped plate, a cup stamped "Made in Osaka", a broken glass lantern, lamp covers. It appears that most of the bottles would fit within a date range between 1900 and 1930.

Feature E is in good condition and offers good excavation potential.

**Feature F** is a large rectangular enclosure located 10.0 m. (32.8 ft.) north of Feature E in a relatively flat area. It measures 18.0 m. (59.0 ft.) N/S by 15.0 m. (49.2 ft.) E/W and is constructed of stacked subangular basalt cobbles and small boulders surrounding the exposed bedrock. The 1.0 m. (3.3 ft.) high walls are in fair to good condition. This feature is a probable domestic animal (pig?) pen. The interior is a pahoehoe outcrop.

No midden or artifacts were observed.

Feature F is in fair condition. The excavation potential is considered poor.

**Feature G** is a small lava blister located 20.0 m. (65.6 ft.) east of Feature A on a gentle slope. This blister measures 1.5 m. (4.9 ft.) in diameter and has large basalt slabs on the *makai* (west) side.

No midden or artifacts were observed at the feature. Approximately 1.8 m. north of the blister a water-rounded cobble and a large water-rounded,stone, canoe, anchor was observed.

The excavation potential is considered fair.

**Feature H** is a terrace with an attached rectangular enclosure located 15.0 m. (49.2 ft.) southeast of Feature G. The terrace is roughly paved with cobbles. It measures 19.7 m. (65.0 ft.) N/S by 9.1 m. (30.0 ft.) E/W. The enclosure measures 7.0 m. (23.0 ft.) N/S by 4.5 m. E/W (14.8 ft.) with a maximum height of 1.4 m. (4.6 ft.). This enclosure is in good condition with nice facing which is tumbled on the *makai* (west) side.

A large leopard cowrie shell and a broken medicine bottle were observed on the south side of the enclosure. Numerous papaya trees were observed in the interior of the enclosure. The trees were possibly planted. The excavation potential is considered excellent.

**Feature I** is a split-level platform located on a gentle slope 10.0 m. (32.8 ft.) southwest of Feature H. The lower platform is 0.8 m. (2.6 ft.) high, 10.0 m. (32.8 ft.) N/S and extends 2.8 m. (9.2 ft.) E/W. The upper level measures 10.0 m. (32.8 ft.) N/S by 8.5 m. (27.9 ft.) E/W. It is constructed of large subangular basalt cobbles and boulders. The higher platform is well paved with small cobbles and also well faced. The lower platform is more roughly paved but well faced on the *makai* (west) side. Immediately behind the higher platform is a wall coming off the southeast corner heading south for 15.0 m. (49.5 ft.) and connecting with Feature J. This wall ranges between 0.4 m. and 0.5 m. (1.3 and 1.6 ft.) in height.

A well polished large adz (Acc.# 89) was recovered from the lower platform.

Feature I is in fair to good condition and offers fair to good excavation potential.

**Feature J** is a huge roughly paved slope with three formal pavements located 15.0 m.



(49.5 ft.) southeast and connected by a wall to Feature I. It measures 70.0 m. (229.6 ft.) N/S by approximately 35.0 m. (114.8 ft.) E/W. A *mauka/makai* (east/west) wall connects to the northwest corner and extends westward for approximately 40.0 m. (131.2 ft.).

The first 30.0 m. (98.4 ft.) N/S of Feature J is a paved area containing small circular planting areas. The area is covered with *kukui*, a *ti* leaf plant and other vegetation.

The next section measures 10.0 m. (32.8 ft.) E/W by 12.0 m. N/S (39.4 ft.) and is constructed of subangular basalt cobble to boulder. The pavement is faced on the *makai* (west) and east sides. The *makai* (west) facing is made of large horizontal slabs of basalt stacked one on top of the other to a maximum height of 0.6 m. (2.0 ft.). This area probably served as a house site for the planting area.

Another planting area begins on the south side of Feature J. This area measures 30.0 m. (98.4 ft.) N/S by 30.0 m. (98.4 ft.) E/W constructed of roughly paved subangular cobbles to boulders sloping *makai* (west). It is covered with *kukui*, papaya, monkeypod, *ilima* and guava.

The planting areas are in fair condition with poor excavation potential. The platform is in fair to good condition with fair excavation potential.

There is a N/S wall running *mauka* (east) of the south section measuring 20.0 m. (65.6 ft.) N/S by 0.8 m. (2.6 ft.) wide. It is constructed of stacked boulders. The wall turns at 20.0 m. (65.6 ft.) and continues *mauka* (east) for another 30 m. (98.4 ft.) and connects with the *mauka* (east) most project wall. The walls form a large U-shape that opens to the north above Feature J and it may be another planting area.

**Feature K**, is a medium rectangular terrace located 10.0 m. (32.8 ft.) downslope and west of Feature J. Vegitation includes monkeypod, papaya, chili pepper plants and a mulberry tree. The terrace measures 11.0 m. (36.1 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 0.7 m. (23.0 ft.) on the *makai* (west) side. A large slab boulder, approximately 0.5 m. (1.6 ft.) by 0.5 m. (1.6 ft.) is built into the terrace on the southeast side. The terrace is constructed of medium to large cobbles and boulders facing on *makai* (west) side with a level paved surface of small to large cobbles with a few shattered boulders. The *mauka* (east) side is even with the slope.

No midden or artifacts were observed.

The terrace is in fair condition and offers fair excavation potential.

**Feature L** is a large terrace sloping *makai* (west) with three faced sides and 2 levels and is located immediately west of the project wall. It is constructed of large subangular basalt boulders and smoothly paved with small to medium cobbles. The top level extends 5.5 m. (18.0 ft.) from the *mauka* (east) wall and is faced on the *makai* (west) end with medium boulders. The second level is 0.3 m. (1.0 ft.) lower and extends 4.0 m. (13.1 ft.) out and is faced on three sides by large subangular to small boulders. The maximum height is 1.5 m. (4.9 ft.). The terrace levels extend 10.0 m. (32.8 ft.) E/W and a total of 9.5 m. (31.2 ft.) N/S. The *makai* (west) portion of the platform is basically exposed bedrock while the *mauka* (east) portion is paved.

Artifacts observed included a piece of broken blue and white china plate and a small water-rounded stone. Midden observed included 2 large *opihi giganticus* shells in a small cupboard-like blister on the north side of the platform.

Feature L is a probable house site. Papaya trees grow in the surrounding area. The platform is in good condition and has fair to good excavation potential.

**Feature M** is a small rough platform located 8.0 m. (26.2 ft.) south of Feature L in a soil area 4.0 m. (13.1 ft.) west of the *mauka* (east) project wall. It measures 4.0 m. (13.1 ft.)

E/W by 4.0 m. (13.1 ft.) N/S and has a maximum height of 0.5 m. (1.6 ft.). This platform is constructed of medium subangular cobbles and boulders.

No midden or artifacts were observed.

Feature M is in fair to poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16614 **CSH Site #:** 268
**Site Type:** Site complex
**Function:** Foundation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Kanaueue
**Elevation:** 780 ft. a.m.s.l.

**Description:** State site -16614 consists of two features which are atypical of the sites located in the project area. They are situated in an area known to have early cultivation of sugar cane The area is level above a steep slope and these platforms are surrounded by California grass, *koa haole*, *opiuma*, *kukui*, monkeypod, papaya, coffee, *ilima*, *laua'e* fern with moss and lichen and a small variety of succulent and air plants.

**Feature A** is a platform which measures 4.5 m. (14.8 ft.) N/S by 2.5 m. (8.2 ft.) E/W and is constructed of very well faced subangular basalt cobbles and small boulders. There are also five large flat slabs (1.0 m. by 0.5 m. wide) placed on the top of the platform. The platform is unusually high, averaging 2.8 m. (9.2 ft.).

No artifacts or midden were observed.

Feature A is in good condition.

**Feature B** platform is similar to Feature A and is located 30.0 m. (98.4 ft.) upslope. It measures 8.5 m. (27.9 ft.) N/S by 4.0 m. (13.1 ft.) E/W. It is similarly constructed with large flat slabs on the surface of the platform. There is some collapse on the northwest side. The platform has a maximum height of 2.7 m. (8.9 ft.).

No midden or artifacts are observed.

Feature B is in good condition. The excavation potential is considered excellent.

State site -16614 platforms are interpreted as infrastructure for the historic sugar cane industry. The flat slabs on the platform surfaces would have allowed a wooden floor to be laid down, possibly for supporting water tanks.



**State Site #:** 50-10-37-16615 **CSH Site #:** 269
**Site Type:** Site Complex
**Function:** Permanent habitation
**Features (#):** 5
**Site Dimension:** (see below)
***Ahupua'a*:** Haleki'i
**Elevation:** 700 ft. a.m.s.l.

**Description:** State site -16615 is a site complex consisting of five features designated Features A to E. It is located on a slope above a relatively flat area approximately (200.0 ft.). *mauka* (east) of state site -10302.

**Feature A** is a large planting area and enclosure. The planting area is constructed of small to large cobbles and boulders and measures 27.0 m. (88.6 ft.) E/W by 30.0 m. (98.4 ft.) N/S. Numerous *kukui* nut trees were observed growing in and around the site.

Within this area a *konane* board was observed. It measures 0.6 m. by 0.5 m. (2.0 by 1.6 ft.) and was 0.25 m. (0.8 ft.) thick and has a 10 x 10 grid pecked evenly onto the surface. Modern broken glass, *pipipi* and cowrie shell fragments were also observed.

Upslope and east of the planting area is a square enclosure measuring 10.0 m. (32.8 ft.) E/W by 8.0 m. (26.2 ft.) N/S with walls 1.0 m. (3.3 ft.) wide and 0.8 m. (2.6 ft.) high. It is constructed of large boulders and cobbles using stacked construction.

No midden or artifacts were observed within this enclosure.

Feature A is in fair condition with good excavation potential.

**Feature B** is a large roughly sloped platform located 30.0 m. (98.4 ft.) *mauka* (east) of Feature A in a ravine. The platform measures 14.0 m. (45.9 ft.) N/S by 10.0 m. (32.8 ft.) E/W and is constructed of small to large subangular boulders and cobbles.

No midden or artifacts were observed.

Feature B is in poor condition and the excavation potential is considered poor to fair.

**Feature C** is a semi-rectangular enclosure built on a pahoehoe outcrop and located on a level break in the slope at the base of the planting area of Feature A. The enclosure measures 8.0 m. (26.2 ft.) N/S by 9.0 m. (29.5 ft.) E/W and has a maximum height of 0.8 m. (2.6 ft.). It is constructed of stacked cobbles and boulders. The only facing is on the north/west side.

No midden or artifacts were observed.

The enclosure is in poor condition. It is a probably pen (pig) and its excavation potential is considered poor.

**Feature D** is a large wall with three perpendicular walls extending north from the main wall. The walls are located *mauka* (east) of Feature A and extend 6.8 m. (22.3 ft.) N/S from the main wall. They measure 2.0 to 2.5 m. (6.6 to 8.2 ft.) in width. The main wall runs for approximately 30 m. (98.4 ft.) and this feature most likely delineates a series of agricultural planting areas.

No midden or artifacts were observed.

Feature D is in fair to poor condition and the excavation potential is considered poor to fair.

**Feature E** is a roughly rectangular terrace measuring 10.0 m. (32.8 ft.) E/W by 10.0 m. (32.8 ft.) N/S with a maximum height of 0.4 m. (1.3 ft.). It is constructed of small to

medium subangular boulders and cobbles. It is poorly faced on three sides and is flush with the outcrop on the *mauka* (east) side.

No midden or artifacts were observed.

Feature E is in fair condition with fair excavation potential.

**State Site #:** 50-10-37-16616 **CSH Site #:** 270
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 31.2 m.$^2$ (337.0 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 230 ft. a.m.s.l.

**Description:** State site -16616 is a platform located on a gentle slope of relatively level pahoehoe terrain. The area is surrounded by soil between scattered low weathered outcrops among grazed guinea grass, *kiawe*, and *koa haole* trees.

This semi-circular platform measures 5.2 m. (17.1 ft.) N/S by 6.0 m. (19.8 ft.) E/W and has a maximum height of 1.0 m. (3.3 ft.). The platform is constructed of cobbles and boulders and is mostly collapsed yet interior facing is still evident. There is an alignment on the inside northeast side of the platform.

No artifacts or midden were observed.

State site -16616 is in poor condition and its excavation potential is considered poor.

**State Site #:** 50-10-37-16617 **CSH Site #:** 271
**Site Type:** Paved depression
**Function:** Possible burial/Agriculture
**Features (#):** 1
**Site Dimension:** 120.0 m.$^2$ (1,296.0 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 215 ft. a.m.s.l.

**Description:** State site -16617 is a large sloping mound surrounded by *kiawe*, California grass and numerous *koa haole*. It is located east of the Kuakini Wall (State site -7276) and the old corral. It measures 15.0 m. (49.2 ft.) E/W by 8.0 m. (26.2 ft.) N/S and is constructed of medium to small boulders with some large boulders on the *mauka* (east) end of the site. There are some level areas on the *makai* (west) side and a possible cupboard in the northwest corner.

No artifacts or midden were observed.

State site -16617 is in poor condition.



**State Site #:** 50-10-37-16618 **CSH Site #:** 273
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 13.5 m.$^2$ (145.8 ft.$^2$)
***Ahupua'a:*** Hokukano 2
**Elevation:** 235 ft. a.m.s.l.

**Description:** State site -16618 is a small platform located 8.0 m. (26.2 ft.) downslope of State site -16619. The platform - constructed of cobbles to small boulders - extends out from a steep rocky slope on a flat area of exposed pahoehoe flow. It measures 4.5 m. (14.8 ft.) N/S by 3.0 m. (9.8 ft.) E/W by 0.6 m. (2.0 ft.) high.

No midden or artifacts were observed. A basalt hammer stone was collected (Art. # 90).

State site -16618 is in fair condition.

**State Site #:** 50-10-37-16619 **CSH Site #:** 274
**Site Type:** Lava tube
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano 2
**Elevation:** 245 ft. a.m.s.l.

**Description:** State site -16619 is a modified lava tube located approximately 30.0 m. (98.4 ft.) south of State site -10298, directly above a bulldozed road. (The front of the tube is bulldozed.)

The tube's opening is oriented to *makai* (west), measuring 1.75 m. (5.7 ft.) N/S by 0.8 m. high. Upon entering the lava tube is a chamber measuring 7.2 m. (23.6 ft.) E/W by 4.8 (15.7 ft.) N/S with a ceiling height of about 1.8 m. (5.9 ft.). Collapsed and piled boulders are present throughout this chamber. There is a second opening in the chamber ceiling which measures 3.5 m. (11.5 ft.) E/W by 1.0 m. (3.3 ft.) N/S. The chamber also has a small hole within *mauka* (east) ceiling corner which is 0.8 m. (2.6 ft.) E/W by 0.2 m. (0.7 ft.) N/S. A section of paved boulders and cobbles approximately 1.0 m. (3.3. ft.) E/W by 3.0 m. (9.8 ft.) N/S is present in the main chamber.

The main chamber of the lava tube extends into a *mauka* (east) chamber 10.0 m. (32.8 ft.) long by 0.7 m. (2.3 ft.) wide with a ceiling height of 0.45 m. (1.4 ft.).

A coral file was observed in the *mauka* (east) chamber about 2.0 m. (6.6 ft.) in. A coral abrader or *ulu maika* was observed in the main chamber entrance on top of a pile of boulders (Art. # 91).

Outside of the entrance a hematite bread loaf sinker was collected (Art. #92).

State site -16619 is in fair condition and offers good excavation potential.

**State Site #:** 50-10-37-16620 **CSH Site #:** 275
**Site Type:** Modified outcrop
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 32.5 m.$^2$ (351 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 235 ft. a.m.s.l.

**Description:** State site -16620 is a modified outcrop, located 50.0 to 65.0 m. (164.0 ft. to 197.0 ft.) east of the Great Wall of Kuakini (State site -7276). The site is situated on a level area of outcrop and intermittent soil, directly below an older pahoehoe flow. This site is surrounded by *koa haole*, *kiawe* and grass.

The modifications are defined by boulder walls oriented north to south and east to west. The walls measure 2.5 m. (8.2 ft.)N/S by 5.0 m. (16.4 ft.) E/W. The walls transform into an L-shape and it extends 4.0 m. (13.1 ft.) and has a maximum height of 0.7 m. (2.3 ft.).

State site -16620 is in good condition. No midden or artifacts were observed.

**State Site #:** 50-10-37-16621 **CSH Site #:** 276
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a:*** Kanaueue
**Elevation:** 280 ft. a.m.s.l.

**Description:** State site -16621 (Figure 33) is a site complex comprising six features designated A through F. The complex includes a series of enclosures and a platform with cleared planting areas located on a moderate slope approximately 76.2 m. (250 ft.) southwest of State site -16622. This site is possibly associated with State site -16622 lava tube complex.

**Feature A** is a rectangular enclosure. The interior measures 2.5 m. (8.2 ft.) square and oriented north/south, with a maximum height of 1.0 m. (3.3 ft.). The walls have a width of 1.5 m. (4.9 ft.) and are constructed of piled boulders and cobbles.

No artifacts or midden were observed.

Feature A is in fair condition.

**Feature B** is a small enclosure approximately 182.9 m. (600 ft.) from the Great Wall of Kuakini (State site -7276). The enclosure utilizes pahoehoe outcrop along its exterior; it measures 5.0 m. (16.4 ft.) E/W by 5.6 m. (18.4 ft.) N/S with a maximum wall height of 0.85 m. (2.8 ft.). It is constructed of small to large basalt boulders with some cobbles. The *makai* (west) side is well faced for approximately 2.5 m. (8.2 ft.) as well as a small portion on its interior *mauka* (east) side. The enclosure exterior is completely collapsed on all sides.

A few pieces of *kukui* shells were observed at Feature B.

Feature B of State site -16621 is in fair to poor condition and excavation potential is considered fair.



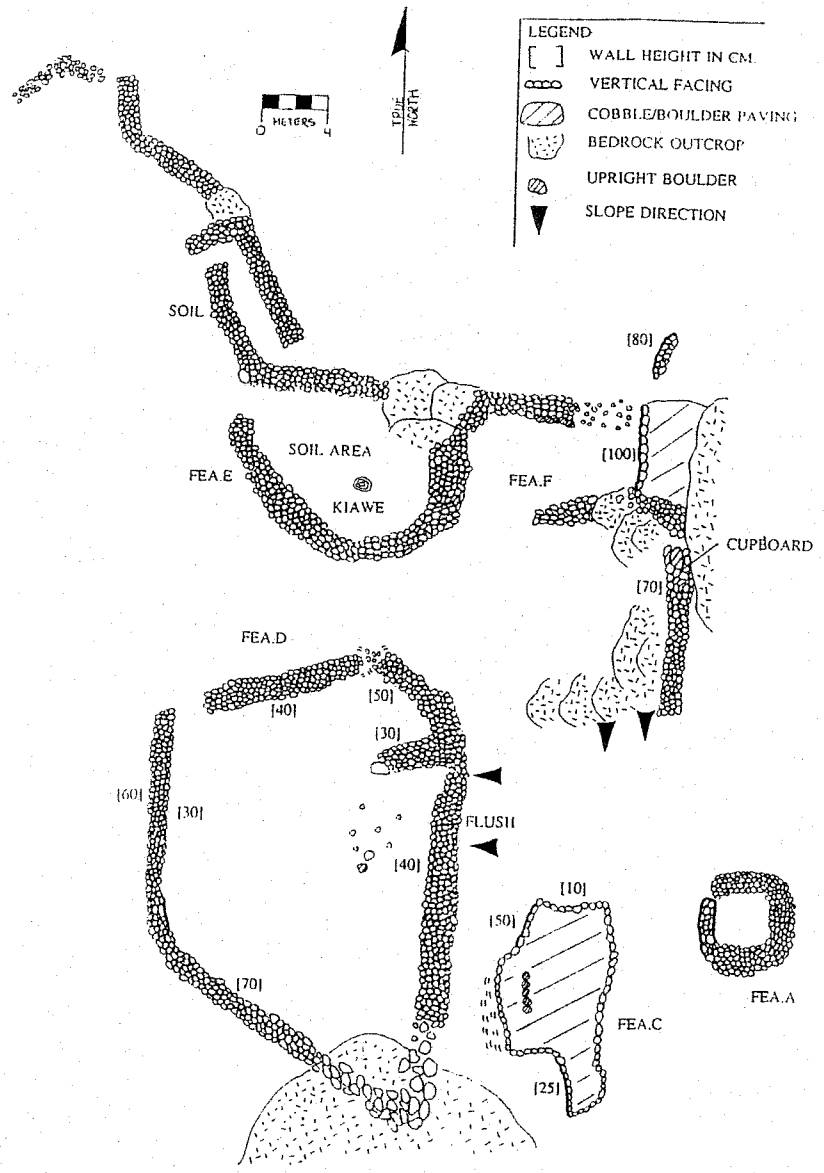



Figure 33 State site 50-10-37-16621; plan view

**Feature C** is an irregular shaped platform situated 4.5 m. (14.8 ft.) east of Feature A. It measures 11.0 m. (36.1 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a maximum height of 0.3 m. (9.8 ft.). It is constructed of boulder facing with a level cobble pavement. The center of the western platform's edge has collapsed. There is a boulder alignment situated in the center of the west platform quad. The alignment is oriented north/south.

No midden or artifacts were observed.

Feature C is in fair to good condition and offers fair excavation potential.

**Feature D** is a large enclosure situated 4.0 m. (13.1 ft.) *makai* (west) of Feature C. It measures 21.0 m. (68.9 ft.) N/S by 13.0 m. (42.6 ft.) E/W and has a maximum wall height of 0.6 m. (2.0 ft.) on the west side. The walls have an average width of 1.5 m. (4.9 ft.) and are constructed of stacked and piled boulders with a cobble fill. There is a possible entrance located at the northwest end of enclosure. The interior consists of level soil.

No artifacts or midden were observed.

Feature D is in fair condition and offers fair excavation potential.

**Feature E** is an enclosure and attached wall situated north of Feature D. The enclosure measures 7.0 m. (23.0 ft.) N/S by 9.0 m. (29.5 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). It is constructed of piled boulders and cobbles. The enclosure has a soil interior. There is a possible entrance located at the northwest enclosure corner. The attached wall serves as the north wall of the enclosure. It extends 18.0 m. (59.0 ft.) northwest beyond the northwest corner of the enclosure. The wall also extends east for 8.0 m. (26.2 ft.) to the *makai* (west) edge of the Feature F terrace. The wall continues south from the south edge of Feature F. It runs along the outcrop for 9.0 m. (29.5 ft.) before fading out. There is a cupboard in this portion of the wall. The wall is similar in construction to the enclosure walls. It measures 1.0 m. (3.3 ft.) in diameter with a depth of 0.7 m. (23.0 ft.).

No artifacts or midden were observed.

Feature E is in fair to poor condition and offers fair to poor excavation potential.

**Feature F** is a terrace situated at the *makai* (west) edge of a pahoehoe outcrop. The terrace measures 7.0 m. (23.0 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.) on the west side. It is constructed with a level cobble and small boulder pavement and has boulder facing.

No artifacts or midden were observed.

Feature F is in poor condition and is considered to have fair to poor excavation potential.

**State Site #:** 50-10-37-16622 **CSH Site #:** 279
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 18.0 m.$^2$ (194.4 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 550 ft. a.m.s.l.

**Description:** State site -16622 comprises a circular enclosure built atop a pahoehoe outcrop which is situated on a level break in the slope. The surrounding terrain consists of pahoehoe



outcrop with *koa haole* and *kiawe*. There is a rough mound located the northwest approximately 1.0 m. (3.3 ft.) from the site.

The enclosure measures 4.0 m. (13.1 ft.) E/W by 4.5 m. (14.8 ft.) N/S and has a maximum height of 0.5 m. (1.6 ft.). The enclosure is constructed of piled and stacked boulders and cobbles. The site is heavily disturbed by cattle.

No artifacts or midden were observed at the site.

State site -16622 is in poor condition. The excavation potential is considered fair to poor.

**State Site #:** 50-10-37-16623 **CSH Site** [illegible]
**Site Type:** Modified outcrop
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 9.0 m.$^2$ (97.2 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 550 ft. a.m.s.l.

**Description:** State site -16623 is a small platform built atop an outcrop of pahoehoe. Surrounding vegetation is *koa haole* and *kiawe* trees.

It measures 3.0 (9.8 ft.) E/W by 3.0 m. (9.8 ft.) N/S with a maximum height of 0.7 m. (2.3 ft.) on the west side. It is constructed of pahoehoe cobbles.

No midden or artidacts were observed.

State site -16623 is in good condition and is interpreted as a burial platform or a temporary habitation site.

**State Site #:** 50-10-37-16624 **CSH Site #:** 281
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 180.0 m.$^2$ (1944.0 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 345 ft. a.m.s.l.

**Description:** State site -16624 is an enclosure situated atop an outcrop of pahoehoe. The surrounding area is vegetated with scattered *koa haole* and *kiawe* trees.

It measures 8.0 m. (26.2 ft.) N/S by 5.0 m. (16.4 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.) on the southwest corner interior. The walls have a width of up to 5.0 m. (16.4 ft.) and have a small to medium boulder pavement. The facing is constructed of stacked boulders. Most of the facing has collapsed. The interior consists of a small soil deposit on pahoehoe.

No artifacts or midden were observed on the surface.

State site -16624 is in fair to poor condition. The excavation potential is considered poor.

**State Site #:** 50-10-37-16625 **CSH Site #:** 282
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 18.0 m.$^2$ (194.4 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 270 ft. a.m.s.l.

**Description:** State site -16625 consists of a rough platform situated on a grassy slope vegetated with scattered *kiawe*, and *koa haole* trees. Surrounding the site are numerous agricultural walls, mounds, and modified outcrops.

It measures 3.0 m. (9.8 ft.) E/W by 4.5 m. (14.8 ft.) N/S with a maximum height of 1.4 m. (4.6 ft.). A large flat basalt slab was collected on the surface of the site with a length of 0.54 m. (1.8 ft.) by 0.4 m. (1.3 ft.) wide by 0.11 m. (0.4 ft.) with a 0.32 m. (1.1 ft.) by 0.32 m. (1.1 ft.) star/asterisk cut into its surface. The platform is curbed with boulders and has a roughly level boulder and cobble pavement.

No artifacts or midden were observed.

State site -16625 is in good condition and is considered to be a burial or habitation platform.

**State Site #:** 50-10-37-16626 **CSH Site #:** 283
**Site Type:** Modified outcrop
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 150.0 m.$^2$ (1,620.0 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 265 ft. a.m.s.l.

**Description:** State site -16626 is a modified outcrop situated on a level break in the slope. Surrounding vegetation is california grass, *koa haole* and *kiawe* trees.

The site measures approximately 15.0 m. (49.2 ft.) E/W by 10.0 m. (32.8 ft.) N/S. The modifications consist of several terraces on *makai* (west) side, and two enclosures on the *mauka* (east) side of the outcrop. The terraces range in size from 4.0 m. (13.1 ft.) in length by 1.5 m. (4.9 ft.) wide to 7.0 m. (23.0 ft.) in length by 2.0 m. (6.6 ft.) wide. The maximum terrace height is 1.5 m. (4.9 ft.). Facing is present on the north and south terraces. The enclosures measure approximately 3.0 m. (9.8 ft.) in diameter. All the features are constructed of cobbles to medium boulders piled and stacked on the outcrop. A bulldozed road runs against south edge of the site. Some features may have been impacted by bulldozing.

No artifacts or midden were observed.

State site -16626 is in fair condition. Excavation potential is considered fair to good.



**State Site #:** 50-10-37-16627 **CSH Site #:** 284
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 48.0 m.$^2$ (518.4 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 375 ft. a.m.s.l.

**Description:** State site -16627 is a roughly paved platform with a small depression on the surface. It is situated on a gentle slope. The surrounding vegetation is scattered *koa haole* and *kiawe* trees.

It measures 6.0 m. (19.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 1.6 m. (5.2 ft.). On the south side of the platform, there is a small depression lined with slabs. The platform is roughly paved with small to medium boulders and curbed with boulders. Portions of the site contain remnant facing.

No observable midden or artifacts were present at the site.

State site -16627 is in fair condition.

**State Site #:** 50-10-37-16628 **CSH Site #:** 285
**Site Type:** Site complex
**Function:** Temporary habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano
**Elevation:** 355 ft. a.m.s.l.

**Description:** State site -16628 is a site complex comprising two features designated Features A and B. The site is situated on a small knoll in an undulating soil/pahoehoe field surrounded by numerous large terraces and agricultural features. Vegetation consists of california grass, *koa haole*, *kiawe*, and hibiscus trees.

**Feature A** is a circular enclosure which measures approximately 2.0 m. (6.6 ft.) in diameter and is skirted with 2.0 m. (6.6 ft.) of paving on bedrock. The average wall height is 0.6 m. (2.0 ft.). It is constructed of piled and stacked boulders and cobbles.

No midden or artifacts were observed.

Feature A is in fair to poor condition and offers poor excavation potential.

**Feature B** is a platform measuring 6.0 m. (19.9 ft.) by 6.0 m. (19.9 ft.) and has a maximum height of 0.8 m. (2.6 ft). The entire platform is well faced. It is similar in construction to Feature A.

No midden or artifacts were observed.

Feature B is in good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16629
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 100.0 m.$^2$ (1080.0 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 415 ft. a.m.s.l.

**CSH Site #:** 286

**Description:** State site -16629 is a small enclosure with surrounding vegetation consisting of scattered *koa haole*, and *kiawe* trees. There is an agricultural mound complex situated to the west of the enclosure.

The enclosure measures approximately 4.0 m. (13.1 ft.) in diameter (interior) and has an average wall width of 3.0 m. (9.8 ft.). It has a maximum exterior height of 1.0 m. (3.3 ft.). It is constructed of small to medium boulders. The enclosure interior is soil.

One coral file was observed; no midden was observed.

State site -16629 is in fair condition and offers good excavation potential.

Testing Results:

Limited subsurface testing was conducted at State site -16629 to determine the presence or absence of human remains. A total of three test units were excavated in three different mounds within the nearby agricultural complex. The test units consisted of three 1.0 m. (3.3 by 3.3 ft.) trenches designated test trenches 1 through 3, one located in the center of each mound.

Excavation within Test trench 1 began with the removal of the mound construction material. The fill extended to a depth of 35 to 40 cm. The removal of the mound fill revealed one stratigraphic layer designated Stratum I. Stratum I - 40 to 100 cm. - consisted of large boulders with a loosely packed, dark brown (10YR 3/3), very fine grained soil fill. Excavation halted at a depth of 100 cm. upon reaching bedrock.

No cultural material was observed within the mound fill or Stratum I of Test trench I.

Test trench I tested negative for human remains; it is likely an agricultural feature.

Excavation within Test trench 2 began with the removal of the mound construction material. The fill extended to a depth of 70 cm. The removal of the mound fill revealed two stratigraphic layers designated Stratums I and II. Stratum I - 70 to 120 cm. - consisted of loosely packed, filtered greyish brown soil (10YR 5/2) soil. Stratum II - 120 to 140 cm. - consisted of dark yellowish brown (10YR 4/6) volcanic ash material. Stratum II is a sterile C horizon. Excavation halted at a depth of 140 cm. upon reaching bedrock.

No cultural material was observed within the mound fill or Strata I and II of Test trench 2.

Test trench 2 tested negative for human remains;it is likely an agricultural feature.

Excavation within Test trench 3 began with the removal of the mound construction material. The fill extended to a depth of 50 cm. The removal of the mound fill revealed bedrock with a soil filled crack measuring 20 cm. wide by 50 cm. deep from the base of the mound construction material.

No cultural material was observed within the mound fill or soil deposit of Test trench 3.

Test trench 3 tested negative for human remains; it is likely an agricultural feature.



**State Site #:** 50-10-37-16630
**Site Type:** Lava Tube/Petroglyphs
**Function:** Burial
**Features (#):** 4
**Site Dimension:** 2,439.0 m.$^2$ (26,341.5 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 400 ft a.m.s.l.

**CSH Site #:** 287

**Description:** State site -16630 is a lava tube situated on a gentle slope underlying a terrain of undulating pahoehoe, grasses, *kiawe*, and *koa haole* trees. The entrance to the tube is composed of a collapsed sink with visible modifications. There are four chambers which have been designated as chambers 1-4.

Upon entering chamber 1 there is a visible circular pit, a possible hearth, containing silty dirt and scattered midden including mammal bones and marine shell.

Examining the tube walls within Chamber 1 two petroglyphs were observed near the entrance. The petroglyphs are both of human images with each standing in different positions. The closer petroglyph to the entrance is a human image with a rounded body, and holding both arms above its head. The second petroglyph is a possible person/idol like figure, with arms at the waist. These two petroglyphs perhaps could be marking the tubes for a specific purpose or use.

The tube then extends approximately 15.0 m. (49.2 ft.) and gradually narrows. As you near the end of the chamber large boulders are concentrated along the right side of the tube. Mammal bones were observed beneathe the boulders.

The entrance to chamber 2 is partitioned with pieces of ceiling collapse. The floor of the chamber is paved with small a'a boulders smooth bedrock stones. Midden was also observed scattered about the surface including mammal bones and marine shell midden.

Two cupboard like enclosures were observed 4.0 m. (13.1 ft) into the chamber 2 along the left side of the chamber. Four meters (13.1 ft) into chamber 2 another passage was found oriented at 285°. This passage curves around and opens up in another sink 13.0 m. (42.7 ft.) to the east of the main sink. This sink contains an upright in the center of the light chamber which measures 0.4 m. (1.3 ft.) tall. *Kukui* nuts and charcoal were observed within the passage.

Chamber 3 is oriented at 290°TN and extends for 6.5 m. (21.3 ft.) and measures 0.8 m. (2.6 ft.) wide by 0.4 m. (1.3 ft) high. The ceiling pinches allowing no access and continues for an unknown distance. There are small openings which lead to Chamber 2. Five side passages extend short lengths *makai* (west). One chamber extends *mauka* (east) for 15.0 m. (49.2 ft.).

A wooden digging stick (Acc.# 93) was collected. Some soil is present within the passages. The *mauka* (east) passage is walled on both sides with piled pahoehoe leaving a crawlspace in the center. The piles have a maximum height of 0.6 m. (2.0 ft.).

Chamber 4 extends southwest for 6.0 m. (19.6 ft.), turns slightly *mauka* (east), then pinches down and continues southwest for an undetermined length.

A second wooden stick (Acc.# 94), was observed within the chamber and collected.

**State Site #:** 50-10-37-16631 **CSH Site #:** 288
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano
**Elevation:** 365 ft. a.m.s.l.

**Description:** State site -16631 is a site complex comprising two features designated Features A and B. The site is situated on a undulating field of pahoehoe that has been extensively modified. Small boulders and cobbles have been cleared and placed in between rolls of undulating pahoehoe to form terraces and soil areas. Vegetation surrounding the site consists of *koa haole*, california grass, and *kiawe*.

**Feature A** is a large platform built on the pahoehoe bedrock. It measures 5.5 m. (18.0 ft.) N/S by 18.0 m. (59.1 ft.) E/W with an average height of 0.5 m. (1.6 ft.) The platform is constructed of mostly medium to small boulders and has a fairly level cobble pavement. There are two internal alignments, the first being a low (0.25 m. or 0.8 ft.) oval alignment that is open on the *makai* (west) side. It measures approximately 3.5 m. (11.5 ft.) N/S by 2.0 m. (6.6 ft) E/W and is located on north end. The second alignment curbs a depression with a depth of 0.2 m. (0.7 ft.) on the east side, 0.5 m. (1.6 ft.) on the west side, and measures approximately 6.0 m. (19.7 ft) E/W long and 1.0 m. (3.3 ft) N/S wide. It has a bottom of exposed bedrock. It runs parallel to the west face. Facing remains on the east and west faces (approximately 1.0 m. [3.3 ft.] high) of the platform.

No artifacts or midden were observed.

Feature A is in good condition and offers fair to good excavation potential.

**Feature B** is a pahoehoe lava blister with modifications at 3 separate openings. The blister runs *mauka/makai* (E/W). It is situated on a level break in the slope 20.0 m. (65.6 ft) south of a gravel access road. The openings have been modified, and are walled off with stacked basalt boulders measuring approximately 0.4 m. (1.3 ft.) in length. The tube measures approximately 42.0 m. (137.8 ft.) E/W and has an average width of 4.5 m. (14.8 ft.). The entrances include openings at the *mauka* (east) and *makai* (west) ends of the blister and a crack in the center. The soil is fairly deep on the floor of the tube.

Midden, coral files and a large porous basalt ulumaika (Acc.# 96) were found in the tube on the soil.

The modifications within Feature B are in fair to good condition and the excavation potential is considered good to excellent.



**State Site #:** 50-10-37-16632 **CSH Site #:** 289
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 28.0 m.$^2$ (302.4 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 335 ft. a.m.s.l.

**Description:** State site -16632 is a small platform on a pahoehoe slope. The site is surrounded by california grass, *kiawe* and numerous *koa haole*.

The platform measures 4.0 m. (13.1 ft.) N/S by 3.5 m. (11.5 ft) E/W with a 3.5 m. (11.5 ft.) portion of outcrop extending west. It is constructed of small to large boulders with small cobble and pebble paving on the *mauka* (east) portion of the platform.

No artifacts or midden were observed.

State site -16632 is in poor condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16633 **CSH Site #:** 290
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 144.0 m.$^2$ (1,555.2 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 320 ft. a.m.s.l.

**Description:** State site -16633 is a multi-level terrace situated on a gentle slope. The surrounding terrain is vegetated with scattered *koa haole* and *kiawe* trees.

It measures 12.0 m. (39.4 ft.) N/S by 12.0 m. (39.4 ft.) E/W and has a maximum height of 0.8 m. (2.6 ft.). It is constructed of small to medium boulders. On the lower level of the terrace is a small cupboard. There is a small soil pocket located in the center of the terracing next to the cupboard. It is lined with small boulders.

No observable midden or artifacts on surface.

State site -16633 is in fair condition and offers fair to good excavation potential.

**State Site #:** 50-10-37-16634 **CSH Site #:** 291
**Site Type:** Platform remnant
**Function:** Indeterminate
**Features (#):** 1
**Site Dimension:** 30.0 m.$^2$ (324.0 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 340 ft. a.m.s.l.

**Description:** State site -16634 is a platform constructed on outcrop. It measures 10.0 m. (32.8 ft.) E/W by 3.0 m. (9.8 ft.) N/S with a maximum height of 1.05 m. (3.4 ft). It is constructed of bedrock slabs and large boulders and forms an "L"-shape with adjacent outcrop. It is in extremely poor condition except for one section of facing along the western face.

No artifacts or midden were observed.
State site -16634 is in poor condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16635 **CSH Site #:** 292
**Site Type:** Mound
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 20.8 m.$^2$ (224.1 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 320 ft. a.m.s.l.

**Description:** State site -16635 is a small mound located on a flat expanse of exposed pahoehoe outcrop. *Koa haole*, *ilima*, *kiawe*, and california grass abound around the site.

The mound measures 2.5 m. (8.2 ft.) E/W by 8.3 m. (27.2 ft) N/S with a maximum height of 0.6 m. (2 ft). It is constructed of small to large cobbles, roughly mounded upon the level pahoehoe.

On one side of the mound is a small water rounded boulder with an unformed knob on one side; it appears to be a plummet stone. A possible adz preform was also observed. No other midden or artifacts were observed.

State site -16635 is in fair to poor condition and is interpreted as a burial mound.

**State Site #:** 50-10-37-16636 **CSH Site #:** 293
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 12
**Site Dimension:** 15,360 m.$^2$ (165,888 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 255 ft. a.m.s.l.

**Description:** State site -16636 (Figure 34) is a large site complex consisting of 12 primary features designated A to L. The site is situated on a gentle slope and is constructed mainly on top of a pahoehoe flow which runs in fingers down the slope. The vegetation is scattered *koa haole*, *kiawe* and California grass, with some lantana growing on the features. All of the site complex features are associated with permanent habitation.

The site was previously recorded by Paul H. Rosendahl Inc.

**Feature A** is a modified outcrop defining by a large rock lined outcrop depression measuring approximately 22.0 m. (72.2 ft) N/S by 19.0 m. (62.3 ft) E/W. The walls lining the depression are at an approximately 45° slope and consist of large boulders, rising a maximum height of 3.0 m. (9.8 ft.). The southeast corner of the lined depression is a soil-filled ramp which leads into a soil area at the center of the depression.

In the northwest corner of the lined depression is a circular platform. The platform is well faced and it measures approximately 1.5 m. (4.9 ft) in height and 4.0 m. (13.1 ft) in diameter. The surface of the platform is depressed.

Immediately north of the platform is a small depression. along the south face of the



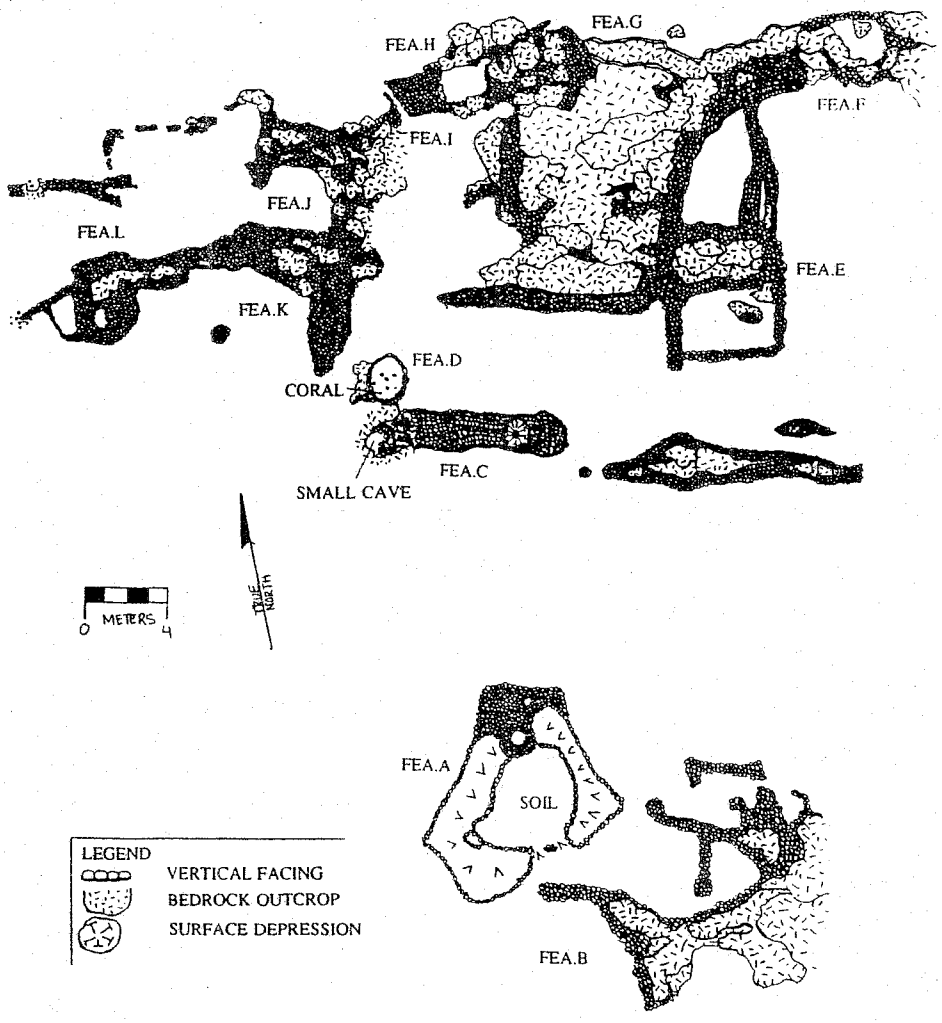



Figure 34 State site 50-10-37-16636; plan view

lined depression is another large depression measuring 2.5 m. (8.2 ft) E/W by 1.0 m. (3.3 ft) N/S.

**Feature B** is an enclosure situated along the edge of a pahoehoe flow. It measures approximately 16.0 m. (52.5 ft.) N/S by 24.0 m. (78.7 ft.) E/W. It is constructed of piled and mounded boulders and cobbles. The interior of the enclosure consists of collapsed boulders and outcrop (minimal soil covering). The walls are in poor condition, no facing remains. The excavation potential is considered poor.

**Feature C** is a small lava tube measuring approximately 8.0 m. (26.2 ft) long by 6.0 m. (19.8 ft.) wide and 1.5 m. (4.9 ft) high. The tube entrance measures approximately 1.5 m. (4.9 ft) high. The lava tube floor has a fair amount of soil and appears to be paved on the northeast side. A terrace is constructed at the base of the entrance to retain rubble from entering the tube. Four flat slabs were observed in the northeast corner of the tube, three of which are situated upright on a larger slab. Another slab sits upright in the front center of the terrace. Numerous pig skeletons are scattered throughout the cave floor. Other midden includes marine midden and ***kukui***. Outside the lava tube to the east is a boulder pavement measuring 19.0 m. (62.3 ft) long.

**Feature D** is a well faced enclosure measuring approximately 4.0 m. (13.1 ft) E/W by 3.0 m. (9.8 ft) N/S with a maximum height of 1.0 m. (3.3 ft.). It is constructed of large boulders including one boulder measuring over a meter (3.3 ft) in length and 0.8 m. (2.6 ft) in width. The interior consists of soil with collapsed boulders. A piece of coral and one water-rounded cobble were observed in the interior floor. The enclosure is in fair to good condition. Excavation potential is fair to good.

**Feature E** is a large enclosure with two partition walls, forming three smaller, contiguous enclosures. The northernmost enclosure is triangular in shape, measuring 11.0 m. (36.1 ft.) N/S by 6.0 m. (19.8 ft.) E/W. All sides are well faced, and of the three enclosures, this one is in the best condition. The interior has a good soil deposit.

The central enclosure is rectangular in shape, measuring 5.0 m. (16.4 ft.) N/S by 9.0 m. (26.2 ft.) E/W. The interior has a an outcrop floor.

The southernmost enclosure measures 6.5 m. (21.3 ft.) N/S by 9.0 m. (26.2 ft.) E/W and has a soil floor with scattered outcrop.

The maximum wall height of the enclosures is 1.0 m. (3.3 ft.). The walls are constructed of small to large boulders with cobble fill and are in fair condition. The enclosures offer fair to good excavation potential.

**Feature F** is a modified outcrop. The modification measures 5.0 m. (16.5 ft.) N/S by 4.0 m. (13.2 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.).

The northern portion consists of outcrop, while the rest is constructed of small boulders with some cobble fill. A finger of outcrop runs *makai* (west) off the northwest corner of the platform. Feature F is in poor condition with fair to good excavation potential.

**Feature G** is a modified outcrop defined by a large flat area of exposed outcrop filled with medium to large boulders. The western edge of the feature forms a terrace between the outcrop and underlying soil area. Feature G is in poor condition and it has fair excavation potential.

**Feature H** is an enclosure measuring approximately 10.0 m. (32.8 ft.) E/W by 4.0 m.



(13.1 ft.) N/S, with a wall height ranging from 0.2 m. (.7 ft.) to 0.7 m. (2.3 ft.). The east half of the enclosure interior is encompassed by outcrop rising 0.2 m. (.7 ft.) above the west floor of the enclosure. The west floor consists of a soil. The enclosure is connected to Feature I along its east side. The enclosure is in poor condition and offers good excavation potential.

**Feature I** is a well faced platform measuring approximately 4.0 m. (13.1 ft.) square, oriented north/south, with a height of 0.7 m. (2.3 ft.). The platform is in fair to good condition. Feature I is in good condition and it offers good excavation potential.

**Feature J** is a soil-filled enclosure formed by modified outcrop on the north and east side and Feature K to the south. The soil area measures 6.0 m. (19.7 ft.) N/S by 6.0 m. (19.7 ft.) E/W.

**Feature K** is a modified outcrop defined on the east side as a terrace and on the west side by a mounded wall and a contiguous terrace. The terrace and small enclosure on the western end measures approximately 34.0 m. (111.5 ft.) E/W by 14.0 m. (45.9 ft.) N/S . The average width of the wall is 3.5 m. (11.5 ft.). The terrsce measures 6.0 m. (19.7 ft.) E/W by 9.0 m. (29.5 ft.) N/S; no facing remains on the entire terrace.

Feature K is in fair to poor condition with excavation potential being fair to good.

**Feature L** is a modified outcrop situated adjacent and to the north of Feature J. The modification consists of a rough wall constructed along the edge of outcrop enclosing a soil area. The enclosed soil area measures 26.0 m. (85.3 ft.) E/W by 12.0 m. (39.4 ft.) N/S. Feature L is in poor condition with poor excavation potential

| | | |
|---|---|---|
| **State Site #:** | 50-10-37-16637 | **CSH Site #:** 294 |
| **Site Type:** | Papamu | |
| **Function:** | Gameboard | |
| **Features (#):** | 1 | |
| **Site Dimension:** | 1.0 m.$^2$ (10.8 ft.$^2$) | |
| ***Ahupua'a:*** | Hokukano | |
| **Elevation:** | 400 ft. a.m.s.l. | |

**Description:** State site -16637 is a 10x10 hole *papamu* board pecked into an exposed pahoehoe flow on a fairly level area of slope covered with *koa haole*, opiuma and *kiawe*. The board is located near two modified outcrops that may have been sites but are now remnants due to cattle damage. There is no clear site near the board except for the State site -16630 which is located approximately 30.0 m. (98.4 ft.) north of the board.

No artifacts or midden were observed.

State site -16637 is in fair to good condition and offers no excavation potential. The nearby modified outcrops offer poor excavation potential.

**State Site #:** 50-10-37-16638 **CSH Site #:** 295
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 26.0 m.$^2$ (280.8 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 375 ft. a.m.s.l.

**Description:** State site -16638 is a terrace built on raised pahoehoe bedrock. The site is located on an area of undulating pahoehoe. It is vegetated with california grass, *kiawe*, *koa haole*, and *opiuma*.

The terrace measures 6.5 m. (21.3 ft.) N/S by 4.0 m. (13.1 ft.) E/W. Facing along the north end measures 0.9 m. (3.0 ft.) high. All other sides are relatively flush. The terrace is constructed differently in certain sections -- the south portion is constructed of small to large cobble paving with some small boulders on the west end. There is a large flat slab in the southwest corner of the terrace. There is an alignment of large boulders separating the well paved southern portion of the terrace from the less refined northern portion which is paved with medium boulders and is well faced on the north end. In the northeast corner there is a small natural lava blister which measures 0.7 m. (2.3 ft.) in length by 0.4 m. (1.3 ft.) in diameter.

There is no observable midden but there was a bucket observed in the NW corner of the blister.

State site -16638 is in good condition and the excavation potential is considered fair to good.

**State Site #:** 50-10-37-16639 **CSH Site #:** 296
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 56.0 m.$^2$ (604.8 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 370 ft. a.m.s.l.

**Description:** State site -16639 is an enclosure situated on a flat area of slope on exposed pahoehoe flow. Observed vegetation included *kiawe*, *opiuma*, *koa haole* and california grass. The enclosure utilizes a pahoehoe bluff in its construction, walled in on the *mauka* (east) side by the 2.0 m. (6.6 ft.) high bluff. It measures 8.0 m. (26.2 ft) N/S by 5.0 to 7.0 m. (16.4 to 23.0 ft.) E/W with a maximum wall height of 0.7 m. (2.3 ft). The walls are constructed of large cobbles and boulders with some cobble fill.

No artifacts or midden were observed.

State site -16639 is in fair condition and offers fair to good excavation potential.



**State Site #:** 50-10-37-16640 **CSH Site #:** 297
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 20.0 m.$^2$ (216 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 235 ft. a.m.s.l.

**Description:** State site -16640 is a small rectangular platform located on a level area at the top of a rise 21.3 m. (70.0 ft.) *mauka* (east) of State site -16645. The site is covered in lantana, hibiscus, *kiawe*, *koa haole* and grass.

The platform measures 5.0 m. (16.4 ft.) N/S by 4.0 m. (13.1 ft.) E/W and has a maximum height of 1.05 m. (3.4 ft.), faced on all sides. It is constructed of pahoehoe cobbles to small boulders.

No midden or artifacts were observed.

State site -16640 is in fair to good condition. This site is interpreted as a possible burial platform.

**State Site #:** 50-10-37-16641 **CSH Site #:** 298
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 37.2 m.$^2$ (401.4 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 245 ft. a.m.s.l.

**Description:** State site -16641 is located on a gently undulating slope approximately 30.5 m. (100.0 ft.) *mauka* (east) of State site -16645 and consists of a bi-level terrace. The *makai* (west) terrace level measures 4.9 m. (16.1 ft.) N/S by 3.3 m. (10.8 ft.) E/W with a maximum height of 0.65 m. (2.1 ft). The *mauka* (east) terrace level measures 7.0 m. (23.0 ft.) N/S by 3.0 m. (9.8 ft.) E/W with maximum height of 0.5 m. (1.6 ft.). The terrace is constructed of small to large cobbles and boulders with remnant facing on *makai* (west) side of each level. There is a soil area between the terrace levels.

No midden or artifacts were observed.

State site -16641 is in fair to poor condition and offers poor excavation potential.

**State Site #:** 50-10-37-16642 **CSH Site #:** 299
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 15.0 m.$^2$ (162.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 185.0 ft. a.m.s.l.

**Description:** State site -16642 is a small platform situated on a grassy slope covered with *kiawe*, *koa haole*, lantana and hibiscus. The platform measures 3.0 m. (9.8 ft.) N/S by 5.0 m. (16.4 ft.) E/W with maximum height of 0.6 m. (2.0 ft.) to 0.9 m. (3.0 ft.). It is constructed of cobbles and small boulders with pebble paving and is faced on all four sides.

No midden or artifacts were observed.

State site -16642 is in good condition. The site is interpreted as a possible burial platform.

**State Site #:** 50-10-37-16643 **CSH Site #:** 300
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 320.0 m.$^2$ (3,456.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 177 ft. a.m.s.l.

**Description:** State site -16643, a large semi-rectangular platform (Feature A) with a series of remnant terraces (Feature B), is located on a gently undulating pahoehoe outcrop surrounded by grass, *kiawe*, *koa haole*, and various shrubs. It is located approximately 53.3 m. (175 ft.) from State site #7276 at an elevation of 54.0 m. (177.0 ft.). The main platform is marked with a Rosendahl metal tag #88-430 - Site #3 Paul H. Rosendahl Inc. 4-20-88.

**Feature A**, the main platform measures 5.0 m. (16.4 ft.) E/W by 4.0 m. (13.1 ft.) N/S, by 0.7 m. (2.3 ft.) high and is constructed of small to large subangular basalt boulders. There is some facing remaining on the *makai* (west) face yet the platform is in poor condition. On the *mauka* (east) side a linear mound extends west approximately 7.0 m. (23.0 ft.) and then cuts back to the south for approximately 2.0 m. (6.6 ft.). The average width of these mounds is 1.0 m. (3.3 ft.) and they have a maximum height of 0.7 m. (2.3 ft.).

**Feature B** is a series of remnant terraces, a small platform and mounds approximately 2.0 m. (6.6 ft.) SW of Feature A. They modify a medium slope and extend for 25.0 m. (82 ft.) E/W by 20.0 m. (65.6 ft.) N/S.

No artifacts and midden were observed on the site.

Both features of State site -16643 are in poor condition. The excavation potential is considered fair to poor.



**State site #:** 50-10-37-16644 **CSH Site #:** 301
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 120.0 m.$^2$ (1,296.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 200 ft. a.m.s.l.

**Description:** State site -16,644 is a bi-level terrace situated on a gentle grassy slope with scattered *koa haole* and *kiawe* trees.

The terrace measures 10.0 m. (32.8 ft.) E/W by 12.0 m. (39.4 ft.) N/S. It is constructed of cobbles and small to medium boulders. The first level contains a level soil surface and scattered boulders and cobbles. The second level is approximately 0.3 m. (1.0 ft.) higher and also contains a level soil surface with scattered rocks. The second tier has a sloped surface. To the south 22.9 m. (75.0 ft.) is a platform in poor condition. It is constructed of stacked boulders.

No midden or artifacts were observed.

State site -16644 is in poor condition. The excavation potential is considered fair.

**State site #:** 50-10-37-16645 **CSH Site #:** 302
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 10.0 m.$^2$ (108.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 220 ft. a.m.s.l.

**Description:** State site -16645 is a platform surrounded by grass, *kiawe* and *koa haole* trees and there is hibiscus tree 20.0 m. (65.6 ft.) to the northeast. The site is located on a gentle slope about 30.5 m. (100.0 ft.) from a wall. Just *makai* (west) there are extensive agricultural mounds and terraces.

The platform measures 4.0 m. (13.1 ft.) N/S by 2.5 m. (8.2 ft.) E/W and it is 0.9 m. (3.0 ft.) high. It is constructed of small to medium boulders with small to medium cobble fill.

The site is in fair condition and it offers fair excavation potential.

**State site #:** 50-10-37-16646 **CSH Site #:** 303
**Site Type:** C-Shape
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 64.0 m.$^2$ (691.2 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 300 ft. a.m.s.l.

**Description:** State site -16646 is a C-shaped enclosure located on a soil and bedrock bluff about 61.0 m. (200.0 ft.) *mauka* (east) of State site -16645 and about 22.9 m. (75.0 ft.) from a

boundary wall (State site -16791). It overlooks a mound concentration between State site -16646 and -16645 and it is situated 15.2 m. (50.0 ft.) *makai* (west) of State site -16647. The site is surrounded by *kiawe*, *koa haole*, California grass and some lantana. Directly to the south is a hibiscus tree.

The enclosure measures 8.0 m. (26.2 ft.) N/S by 8.0 m. (26.2 ft.) E/W and it is constructed of medium to large stacked boulders on a steep slope. The C-shape utilizes the contour of the bluff in its construction. The southeast corner of the C-shape is connected to a long mounded wall which heads eastward (*mauka*) past State site -16647. This mounded wall is 2.0 to 2.5 m. (6.6 ft. to 8.2 ft.) wide by 20.0 m. (65.6 ft.) long and it averages approximately 0.8 m. (2.6 ft.) high.

No artifacts or midden were observed.

State site -16646 is in poor condition and the excavation potential is considered fair to poor.

**State site #:** 50-10-37-16647 **CSH Site #:** 304
**Site Type:** Enclosure
**Function:** Pen
**Features (#):** 1
**Site Dimension:** 25.0 m.$^2$ (270.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 310 ft. a.m.s.l.

**Description:** State site -16,647 is a small, square enclosure located on a landing at the crest of a steep slope; the slope above and below the site area contains numerous agricultural features. Site -16646 is located 10.0 m. (32.8 ft.) *makai* (west) of this site.

The enclosure measures 5.0 m. (16.4 ft.) N/S externally (1.5 m. or (4.9 ft.) on the interior) by 5.0 m. (16.4 ft.) E/W externally (1.5 m. or (4.9 ft.) on the interior), and the maximum height is 1.1 m. (3.3 ft.). It is constructed of stacked cobbles and boulders.

No midden or artifacts were observed.

State site -16647 is in fair condition. The excavation potential is considered poor to fair.

**State site #:** 50-10-37-16648 **CSH Site #:** 305
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 24.0 m.$^2$ (259.2 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 340 ft. a.m.s.l.

**Description:** State site -16648 is located 30.0 m. (98.4 ft.) upslope of State site -16647 and -16648 among agricultural mounds and walls. The site is surrounded by *kiawe*, *koa haole*, grass and hibiscus.

The platform measures 6.0 m. (19.7 m.) N/S by 4.0 m. (13.1 ft.) E/W by 1.0 m. (3.3 ft.)



high at its highest point. It is constructed of stacked boulders.

No artifacts or midden were observed.

State site -16648 is in fair condition. It is a probable temporary habitation site surrounded by agricultural features. The excavation potential is considered fair.

**State site #:** 50-10-37-16649 **CSH Site #:** 306
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 54.0 m.$^2$ (583.2 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 350 ft. a.m.s.l.

**Description:** State site -16649 is a partial enclosure located on the edge of a gully on soil and bedrock among vegetation of *koa haole* and grass. The site is on a slope located approximately 15.0 m. to 20.0 m. (49 ft. to 65.0 ft.) north of State site -16648.

The site measures 6.0 m. (19.7 ft.) E/W by 9.0 m. (29.5 ft.) N/S and its maximum height is 1.25 m. (3.4 ft.). It is constructed of stacked boulders on a steep slope and it is connected to a long linear wall.

No midden or artifacts were observed.

State site -16649 is in poor to fair condition. The excavation potential is considered poor.

**State site #:** 50-10-37-16650 **CSH Site #:** 307
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 2
**Site Dimension:** 612.0 m.$^2$ (6,609.6 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 430 ft. a.m.s.l.

**Description:** State site -16650 comprises an enclosure and a terrace designated Feature A and B, respectively. This site is located in a grassy area with scattered *koa haole* and *kiawe* trees.

**Feature A** is a partial enclosure built into a long linear wall. Its *makai* (west) side is lower than the other walls and it is terraced. This feature measures 15.0 m. (49.2 ft.) E/W by 16.0 m. (52.5 ft.) N/S and it has a level soil interior. There is a small opening in the SW corner of the enclosure. The walls on both sides of the opening are collapsed.

No artifacts or midden were observed.

Feature A is in fair condition and offers fair excavation potential.

**Feature B** is a terrace with a level, well constructed paved surface. It measures 12.0 m. (39.4 ft.) N/S by 1.0 m. (3.3 ft.) E/W. The terrace is constructed of small to medium

boulders.

No midden or artifacts were observed in the area.

The condition of Feature B is fair to good and the excavation potential is considered fair.

**State site #:** 50-10-37-16651 **CSH Site #:** 308
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 72.0 m.$^2$ (777.6 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 230 ft. a.m.s.l.

**Description:** State site -16651 is a platform situated on a gently undulating slope and surrounded by California grass, *koa haole*, and *kiawe*. It is located 1.5 m. (6.0 ft.) from a bulldozed access road.

The platform measures 6.0 m. N/S (19.7 ft.) by 12.0 m. (39.4 ft.) E/W with maximum height of 1.3 m. (4.3 ft.). It is constructed of small to large boulders. Facing is evident along the *makai* (west) side and its south corner.

No midden or artifacts were observed.

State site -16651 is in fair condition and offers fair excavation potential.

**State site #:** 50-10-37-16652 **CSH Site #:** 309
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 7.0 m.$^2$ (75.6 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 330 ft. a.m.s.l.

**Description:** State site -16652 is a platform located on a steeply sloped terrain in an area of dry grass, *kiawe*, and *koa haole*. It measures 3.5 m. (11.5 ft.) E/W by 2.0 m. (6.6 ft.) N/S with a maximum height of 1.3 m. (4.3 ft.). It is constructed of rough a'a cobbles. There is vertical facing on the southwest side.

No midden or artifacts were observed.

State site -16652 is in fair to good condition. The site is interpreted as a possible burial platform.



**State site #:** 50-10-37-16653 **CSH Site #:** 310
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 66.0 m.$^2$ (712.8 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 255 ft. a.m.s.l.

**Description:** State site -16653 is an enclosure similar in construction to State site -16650. The surrounding area is grassy with scattered *koa haole* and *kiawe* trees.

The enclosure measures 11.0 m. (36.1 ft.) E/W by 6.0 m. (19.7 ft.) N/S and ranges from 0.4 m. to 0.8 m. (1.3 to 7.6 ft.) high. It is constructed of small to medium boulders and has a level soil interior with scattered rocks. The *makai* (west) enclosure wall is lower in height than the rest of the enclosure.

No artifacts or midden was observed.

The condition of State site -16653 is poor and excavation is fair to good.

**State site #:** 50-10-37-16654 **CSH Site #:** 311
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 72.0 m.$^2$ (777.6 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 300 ft. a.m.s.l.

**Description:** State site -16654 is a platform on the top of a steep hill. It is overlooks a gully and it is surrounded by California grass, *koa haole*, *kiawe*, and lantana.

The platform measures 12.0 m. (39.4 ft.) E/W by 6.0 m. (19.7 ft.) N/S and has some remnant facing. It is constructed of boulders and has a cobble and small boulder pavement.

Approximately 30.5 m. (100.0 ft.) *mauka* (east) of State site -16654 is an enclosure which measures 25.0 m. (82.0 ft.) E/W by 11.0 m. (36.1 ft.) N/S. It is located on the top of the same hill and may have been attached to a nearby cattle wall (State site -16790).

No artifacts or midden were observed.

State site -16654 is in poor condition and offers fair to poor excavation potential.

**State site #:** 50-10-37-16655 **CSH Site #:** 312
**Site Type:** Site complex
**Function:** Temporary habitation
**Features (#):** 2
**Site Dimension:** 144.0 m.$^2$ (1,555.2 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 305 ft. a.m.s.l.

**Description:** State site -16655 is a platform located on a gently undulating slope of pahoehoe and surrounded by California grass, *koa haole*, *kiawe*, and exposed outcrop. It has two features designated Features A and B: both are platforms.

**Feature A** is a roughly L-shaped platform measuring 6.5 m. (19.7 ft.) N/S by 4.5 m. (14.8 m.) E/W with maximum height of 0.45 m. (1.6 ft.). It is constructed of small to large cobbles and boulders of a'a lava. There is some facing evident on its south and northwest portions. There is an *ahu* of three stacked boulders on the south side.

No artifacts or midden were observed.

Feature A is in poor condition and offers fair to poor excavation potential.

**Feature B** is smaller roughly L-shaped platform measuring 6.5 m. (21.3 ft.) N/S by 2.5 m. (8.2 ft.) E/W with a maximum height of 0.6 m. (2.0 ft.). It is constructed of small to large cobbles and boulders of a'a lava. Some facing is evident on the north and south portions.

No artifacts or midden were observed.

Feature B is in poor condition and it has fair to poor excavation potential.

**State site #:** 50-10-37-16656 **CSH Site #:** 313
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 10.0 m.$^2$ (108.0 m.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 350 ft. a.m.s.l.

**Description:** State site -16656 is a small terrace located adjacent to a boundary wall on a steep hill overlooking a gully and a couple of agricultural mounds. It is surrounded by California grass, *koa haole*, and *kiawe*.

The terrace measures 5.0 m. (16.4 ft.) E/W by 2.0 m. (6.6 ft.) N/S and is 1.0 m. (3.3 ft.) high along the south side and it is flush with the top of the hill on the north side. It is constructed of medium to large boulders with a small cobble fill. No artifacts or midden were observed.

State site -16656 is in fair condition and offers fair excavation potential.

**State site #:** 50-10-37-16657 **CSH Site #:** 314
**Site Type:** Site complex
**Function:** Temporary habitation
**Features (#):** 2
**Site Dimension:** 112.0 m.$^2$ (1,209.6 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 425 ft. a.m.s.l.

**Description:** State site -16657 - located on a steep slope among grass, scattered *koa haole*, and *kiawe* trees - comprises two terraces designated Feature A and B, respectively.

**Feature A** is a terrace with a remnant surface pavement and some vertical facing. The terrace measures 4.0 m. (13.1 ft.) N/S by 7.0 m. (23 ft.) E/W and it is constructed of piled



small to medium a'a boulders.

No artifacts or midden were observed.

Feature A is in poor condition and offers fair excavation potential.

**Feature B** is a terrace located 1.5 m. (4.9 ft.) *makai* (west) of Feature A. It measures 4.0 m. (13.1 ft.) N/S by 7.0 m. (23.0 ft.) E/W and it is constructed of small to medium piled a'a boulders.

No midden or artifacts were observed.

Feature B is in poor condition and its excavation potential is considered fair.

**State site #:** 50-10-37-16658 **CSH Site #:** 315
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 33.0 m.$^2$ (356.4 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 185 ft. a.m.s.l.

**Description:** State site -16658 is a semi-rectangular platform located on a moderate to steep slope of bedrock outcrop. The platform measures 5.5 m. (18.0 ft.) N/S by 6.0 m. (19.7 ft.) E/W with maximum height of 0.7 m. (2.3 ft.). The *makai* (west) side is well faced. The entire platform is well paved with small to large cobbles and boulders.

No artifacts or midden were observed.

State site -16658 is in good condition and offers good excavation potential.

**State site #:** 50-10-37-16659 **CSH Site #:** 316
**Site Type:** Enclosure
**Function:** Pen
**Features (#):** 1
**Site Dimension:** 103.0 m.$^2$ (1,112.4 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 410 ft. a.m.s.l.

**Description:** State site -16659 is a square enclosure located on a gently undulating slope. The site is surrounded by various grasses, *koa haole*, *kiawe*, and shrubs.

The enclosure, measuring 10.5 m. (34.4 f.) E/W by 9.8 m. (32.2 ft.) N/S with a maximum height of 1.8 m. (5.9 ft.), is constructed of small to large boulders. The walls are 1.5 m. (4.9 ft.) wide and all are well faced on the interior and exterior, except for collapse at the northeast corner. The interior of the enclosure is lined with barbed wire fencing, which suggests it is an historic site. The interior is soil with a few collapsed boulders.

Two glass milk bottles - with screw caps still evident - were located on the wall. No other midden or artifacts were observed.

State site -16659 is in good condition and offers fair to good excavation potential.

**State site #:** 50-10-37-16660 **CSH Site #:** 317
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** Indeterminate
**Site Dimension:** 192.0 m.$^2$ (2,073.6 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 400 ft. a.m.s.l.

**Description:** State site -16,660 is a terrace situated within a *mauka/makai* (east/west) running modified gully surrounded by lantana, *kiawe*, *koa haole*, and California grass. There are remnants of a terrace - wall running down the south side of the gully.

The modification is defined by stacked angular basalt cobbles and boulders faced on its downslope side. The terrace measures 4.0 m. (13.1 ft.) E/W by 3.0 m. (9.8 ft.) N/S with a maximum height of 1.0 m. (3.3 ft.); it is well faced on the northwest side.

No midden or artifacts were observed.

State site -16660 is in good condition. The excavation potential is considered fair.

**State site #:** 50-10-37-16661 **CSH Site #:** 318
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 15.0 m.$^2$ (162.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 275 ft. a.m.s.l.

**Description:** State site -16661 is a small terrace situated on a relatively level terrain covered with *koa haole*, *kiawe*, lantana, California grass.

The terrace measures 5.0 m. (16.4 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum height of 1.0 m. (3.3.ft.). It is constructed of boulder facing with a cobble to small boulder pavement. The terrace is faced on the *makai* (west) side and constructed flush with the slope at its *mauka* (east) edge.

No midden or artifacts were observed.

State site -16661 is in fair condition. The excavation potential is considered poor to fair.



**State site #:** 50-10-37-16662 **CSH Site #:** 319
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 20.0 m.$^2$ (216.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 275 ft. a.m.s.l.

**Description:** State site -16662 is a small rectangular terrace situated on level terrain above a steep slope covered with *koa haole*, grass, and *kiawe*. It is located 32.8 m. (100.0 ft.) north of State site -16661.

The terrace measures 5.0 m. (16.4 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 0.8 m. (2.6 ft.). It is constructed of cobbles and boulders with boulder facing.

The site is in fair to good condition and offers fair excavation potential.

**State site #:** 50-10-37-16663 **CSH Site #:** 323
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 280.0 m.$^2$ (3,024.0 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 700 ft. a.m.s.l.

**Description:** State site -16663 (Figure 35) is a platform of irregular shape. It is situated just *mauka* (east) of the historic railroad berm (State site -10302) and south of a water trough.

The platform measures 20.0 m. (65.6 ft.) N/S by 14.0 m. (45.9 ft.) E/W. The platform surface is fairly level with a small raised area in its north central area; this raised surface measures 1.7 (5.6 ft.) N/S by 2.0 m. (6.6 ft.) E/W. The platform is constructed of stacked boulders and cobbles. Facing remains intact along the *makai* (west) and *mauka* (east) sides. The *mauka* (east) portion is raised while the *makai* (west) portion incorporates bedrock into portions of the platform.

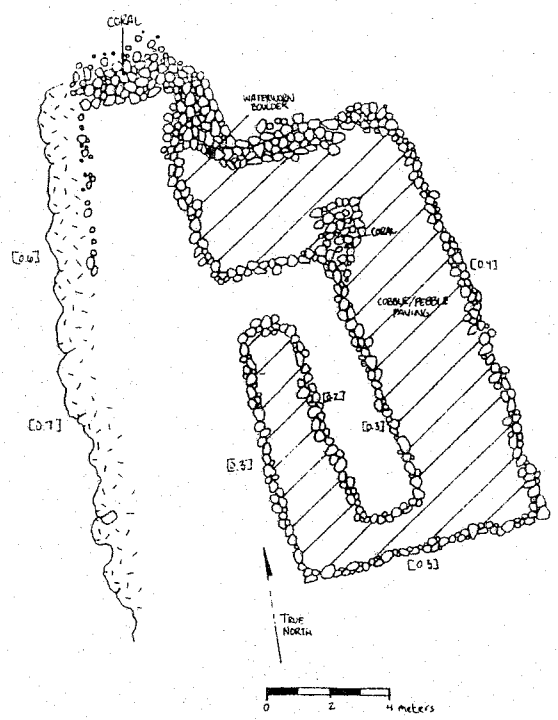
Observed midden included was a piece of branch coral.

State site -16663 is in fair condition and offers fair excavation potential.

**State site #:** 50-10-37-16664 **CSH Site #:** 324
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 20.0 m.$^2$ (216.0 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 735 ft. a.m.s.l.

**Description:** State site -16664 is a terrace located on a level area of pahoehoe outcrop 15.0 m. (49.2 ft.) south of State site -16665. The site is situated among *koa haole*, grass, and monkey pod trees.

The terrace measures 5.0 m. (16.4 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum




Legend

| | |
|---|---|
| Exposed Bedrock | |
| Surface Feature Height (meters) | [.9] |
| Pavement | /// |

Figure 35 State site 50-10-37-16663; plan view



height of 1.0 m. (3.3 ft.). It is constructed of small to medium cobbles and it is faced on the north and west sides.

No midden or artifacts were observed.

State site -16664 is in fair condition.

Testing Results:

Limited subsurface testing was conducted at State site -16664 to determine the absence or presence of human remains. The test unit consisted of a 1.0 m. (3.3 by 3.3 ft.) square trench located in the center of the northern terrace edge. Excavation began with the removal of the terrace construction material. The terrace fill extended to a depth of 40 cm. below its surface. Removal of the terrace fill revealed one stratigraphic layer designated Stratum I. Stratum I - 40 to 100 cm. thick - consisted of a loose, moist, organic, dark brown granular loam (10YR 2/2). Excavation was terminated at 100 cm. upon reaching bedrock.

No artifacts or midden were observed within the terrace fill or Stratum I.

In conclusion, State site -16664 tested negative for human remains and thus, it is interpreted as an agricultural feature.

**State site #:** 50-10-37-16665 **CSH Site #:** 325
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 15.75 m.$^2$ (170.1 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 730 ft. a.m.s.l.

**Description:** State site -16665, located on a fairly level pahoehoe outcrop, is a terrace situated in an area covered with *ilima*, *koa haole*, California grass, common vine and a small monkeypod tree.

The terrace measures 3.5 m. (11.5 ft.) N/S by 4.5 m. (14.8 ft.) E/W and 0.8 m. (2.6 ft.) is its maximum height. It is constructed of cobbles and small boulders. Remnant facing exists on the north and south sides. The west side is well faced, and the site is flush with the bedrock outcrop on the east side. There is a remnant C-shape measuring 0.7 m. (2.3 ft.) wide by 5.0 m. (16.4 ft.) N/S by 2.0 m. (6.6 ft.) E/W located on the southeast side of site.

No artifacts or midden were observed.

State site -16665 is in fair condition.

Testing Results:

Limited subsurface testing was conducted at State site -16665 to determine the absence or presence of human remains. The test unit consisted of a 1.0 m. (3.3 by 3.3 ft.) square trench located in the central east portion of the terrace. Excavation began with the removal of the terrace construction material. The terrace fill extended to a depth of 30 cm. below the terrace surface. Removal of the terrace fill revealed one stratigraphic layer designated Stratum I. Stratum I - 30 to 45 cm. thick - consisted of a loose, moist, organic and granular dark brown to black (10YR 2/2 to 10YR 2/1) loam. Excavation was terminated at 45 cm. upon reaching bedrock.

The trench proved to be sterile. No artifacts or midden were observed within the terrace fill or Stratum I.

In conclusion, State site -16665 tested negative for human remains; it was most likely used for agricultural purposes.

**State site #:** 50-10-37-16666 **CSH Site #:** 327
**Site Type:** Enclosure
**Function:** Pen
**Features (#):** 1
**Site Dimension:** 96.0 m.$^2$ (1,036.8 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 760 ft. a.m.s.l.

**Description:** State site -16666 a large enclosure mostly obscured by impenetrable cat's claw vines on the *mauka* (east) and south side of the site. Other site vegetation includes *koa haole*, California grass, papaya, guava, *kukui* and *'ilima*.

The enclosure measures approximately 12.0 m. (39.4 ft.) E/W by 8.0 m. (26.2 ft.) N/S. It is bi-faced with basalt cobbles and boulders. Only one side corner of the enclosure was accessible because of the thorny vegetation.

No artifacts or midden were observed.

State site -16666 is in fair condition and offers fair excavation potential.

**State site #:** 50-10-37-16667 **CSH Site #:** 329
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 3
**Site Dimension:** 80.0 m.$^2$ (864.0 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 725 ft. a.m.s.l.

**Description:** State site -16667 consists of three features: Feature A, an enclosure; Feature B, a planting area; and Feature C, a modified outcrop.

**Feature A** is a semi-circular enclosure constructed of pahoehoe boulders and cobbles. The enclosure measures approximately 4.0 m. (13.1 ft.) in diameter. The south end of the enclosure utilizes a pahoehoe outcrop bluff in its construction.

No artifacts or midden were observed.

Feature A is in fair condition and offers fair to poor excavation potential.

**Feature B** is a small circular planting area with *kukui* growing in it. It measures approximately 1.5 m. (4.9 ft.) in diameter. It is constructed of piled boulders and cobbles.

No artifacts or midden were observed.

Feature B is in poor condition and offers poor excavation potential.

**Feature C** is a modified pahoehoe outcrop. The modifications consist of pahoehoe boulders stacked atop the outcrop. It measures approximately 4.0 m. (13.1 ft.) E/W by 2.0 m.



(6.6 ft.) N/S. Some facing is present and it measures 0.8 m. (2.6 ft.) high.

No midden or artifacts were observed.

Feature C is in poor condition and offers poor excavation potential.

**State site #:** 50-10-37-16668 **CSH Site #:** 330
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 21.0 m.$^2$ (226.8 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 465 ft. a.m.s.l.

**Description:** State site -16668 is a rectangular platform located in moderately sloped terrain covered by California grass, *koa haole*, and *kiawe*.

The platform measures 6.0 m. (19.7 ft.) N/S by 3.5 m. (11.5 ft.) E/W and is constructed of cobbles and medium to small boulders. No clear facing is visible except for the south edge; where it measures 0.4 m. (1.3 ft.) in height. The platform slopes gently downhill.

No artifacts or midden were observed.

State site -16668 is in poor to remnant condition. The excavation potential is considered fair.

**State site #:** 50-10-37-16669 **CSH Site #:** 331
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 48.0 m.$^2$ (518.4 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 615 ft. a.m.s.l.

**Description:** State site -16669 is a rectangular terrace surrounded by vegetation of *koa haole*, *kiawe*, and pasture grass. The site is situated on a edge of a slope.

The terrace measures 12.0 m. (39.4 ft.) NW/SE by 4.0 m. (13.1 ft.) NE/SW and it is 1.5 m. (4.9 ft.) high on the *makai* (west) side. It is flush with the terrain on the *mauka* (east) side. It is constructed of cobbles and small to medium boulders, with a rough surface.

No artifacts or midden were observed.

The condition of State site -16669 is poor, and its excavation potential is considered poor.

**State site #:** 50-10-37-16670 **CSH Site #:** 332
**Site Type:** Mounds
**Function:** Agriculture
**Features (#):** 6
**Site Dimension:** 7,280.0 m.$^2$ (78,624.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 650 ft. a.m.s.l.

**Description:** State site -16670 is a complex of mounds and rough platforms situated 61.0 m. (200.0 ft.) *makai* (west) of the historic railroad berm (State site -10303). The vegetation is well grazed grass, *kiawe*, *koa haole*, and sparse lantana. The site complex is in a very remnant condition.

All of the site features are extensively disturbed by bulldozing and as a result function and relative age of the complex is indeterminable.

The site is in poor condition but it is recommended for data recovery for a more detailed inspection to determine its cultural significance.

**State site #:** 50-10-37-16671 **CSH Site #:** 333
**Site Type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 96.0 m.$^2$ (1,036.8 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 515 ft. a.m.s.l.

**Description:** State site -16671 is a enclosure situated on a break in slope on a well grazed grass-covered terrain with scattered *kiawe* and numerous *koa haole* trees. The site is located along a relatively old pahoehoe flow which provides good soil deposition. The vast majority of the surrounding outcrop appears to have been historically cleared (bulldozed).

The enclosure measures 12.0 m. (39.4 ft.) N/S by 8.0 m. (26.2 ft.) E/W. Its wall is constructed of stacked boulders. Facing is still present in the interior of the enclosure along its *mauka* (east) side. The enclosure has a soil interior.

No artifacts or midden were observed.

State site -16671 is in fair condition. The excavation potential is considered fair.

**State site #:** 50-10-37-16672 **CSH Site #:** 334
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 12.0 m.$^2$ (129.6 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 525 ft. a.m.s.l.

**Description:** State site -16672 is a small terrace situated on the edge of a steep gully. It measures 6.0 m. (19.7 ft.) N/S by 2.0 m. (6.6 ft.) E/W. Facing which measures 1.2 m. (3.9 ft.)



high exists on the west side. There is small cobble fill on the east edge, which is constructed flush with the terrain. The terrace is constructed of rough pahoehoe boulders and some cobbles.

No midden or artifacts were observed.

The condition of State site -16672 is fair and the excavation potential is considered fair to poor.

**State site #:** 50-10-37-16673 **CSH Site #:** 335
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 71.5 m.$^2$ (772.2 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 550 ft. a.m.s.l.

**Description:** State site -16673 is an irregular shaped, roughly rectangular platform constructed of pahoehoe small to large boulders and cobbles. The site dimensions are 11.0 m. (36.1 ft.) E/W by 6.5 m. (21.3 ft.) N/S with a maximum height of 1.0 m. (3.3 ft.) above the surrounding terrain. Remnant facing was observed on the north side but all sides have essentially tumbled.

The platform has two distinct level areas. The upper level (southern) is the most level surface constructed of a cobble pavement. The lower level is not as level and composed of larger boulders.

No artifacts or midden were observed.

State site -16673 is in poor condition and offers fair to poor excavation potential.

**State site #:** 50-10-37-16674 **CSH Site #:** 336
**Site Type:** Modified outcrop
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 88.0 m.$^2$ (950.4 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 475 ft. a.m.s.l.

**Description:** State site -16674 is a large outcrop which has been modified to form a terrace of large 1.0 m. (3.3 ft.) by 1.0 m. (3.3 ft.) boulder slabs of pahoehoe. The surrounding area appearsto have been bulldozed. The pahoehoe outcrop descends into a valley-like basin and rises approximately 4.0 m. high on the *makai* (west) side.

The site measures 11.0 m. (36.1 ft.) N/S by 8.0 m. (26.2 ft.) E/W. The surface of the outcrop is modified by facing the northwest portion of the outcrop and using a cobble fill to level the outcrop surface.

No midden or artifacts were observed.

State site -16674 is in fair condition and the excavation potential is considered fair to good.

**State site #:** 50-10-37-16675 **CSH Site #:** 337
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Honuaino
**Elevation:** 425 ft. a.m.s.l.

**Description:** State site -16675 is an historic house site situated on a gently sloping area of well grazed grassland, large *kiawe*, scattered *koa haole* and one tamarind tree.

**Feature A** is a platform which measures 38.0 m. (124.6 ft.) N/S by 14.0 m. (45.9 ft.) E/W. It is constructed with stacked boulders. The remnant platform has a possible stairway ascending upon its *makai* (west) central area. Approximately 18.0 m. (59.1 ft.) to the north of the platform is a rough terrace with a faced depression which is considered a possible *lua*.

The terrace is scattered with numerous bottles ranging in age from 1880 - 1950; Japanese and Chinese pottery, medicine, gin and whiskey bottles, numerous metal fragments, pieces of leather, and a possible coin purse and marine midden and coral were also observed.

Feature A is in fair to poor condition. Excavation potential is excellent.

**Feature B** consists of 3 contiguous enclosures; the largest enclosure measures 4.0 m. (13.1 ft.) N/S by 6.0 m. (19.8 ft.) E/W. It is the *mauka* (eastern)-most enclosure. The other two are situated immediately to the southwest. They measure 3.0 m. (9.8 ft.) N/S by 3.0 m.(9.8 ft.) E/W. Feature B enclosures are constructed of cobbles. Feature B is located approximately 8.0 m. (26.2 ft.) *mauka* (east) of Feature A.

No midden or artifacts were observed.

Feature B is in fair condition and the excavation potential is considered fair.

**State site #:** 50-10-37-16676 **CSH Site #:** 338
**Site Type:** Lava tube
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 60.0 $m.^2$ (648.0 $ft.^2$)
***Ahupua'a*:** Honuaino
**Elevation:** 200 ft. a.m.s.l.

**Description:** State site -16676 (Figure 36) is a small lava tube situated near the north end of the project area. The tube measures 10.0 m. (32.8 ft.) E/W by 6.0 m. (19.8 ft.) N/S. The entrance into the tube is small and rubble-filled. A small north-south trending wall extends the width of the tube leaving only a small passage way open to the north; this passage measures approximately 0.6 to 0.7 m. (2.0 to 2.3 ft.) wide. Along the north side of the tube (from the entrance to the rear) there are stacked boulders which fill in a narrow crack at the base of the wall.

One worked wood stick (Acc.# 97) was collected from within the tube. No midden was observed at the site.

The modifications within State site -16676 are in fair to good condition. The



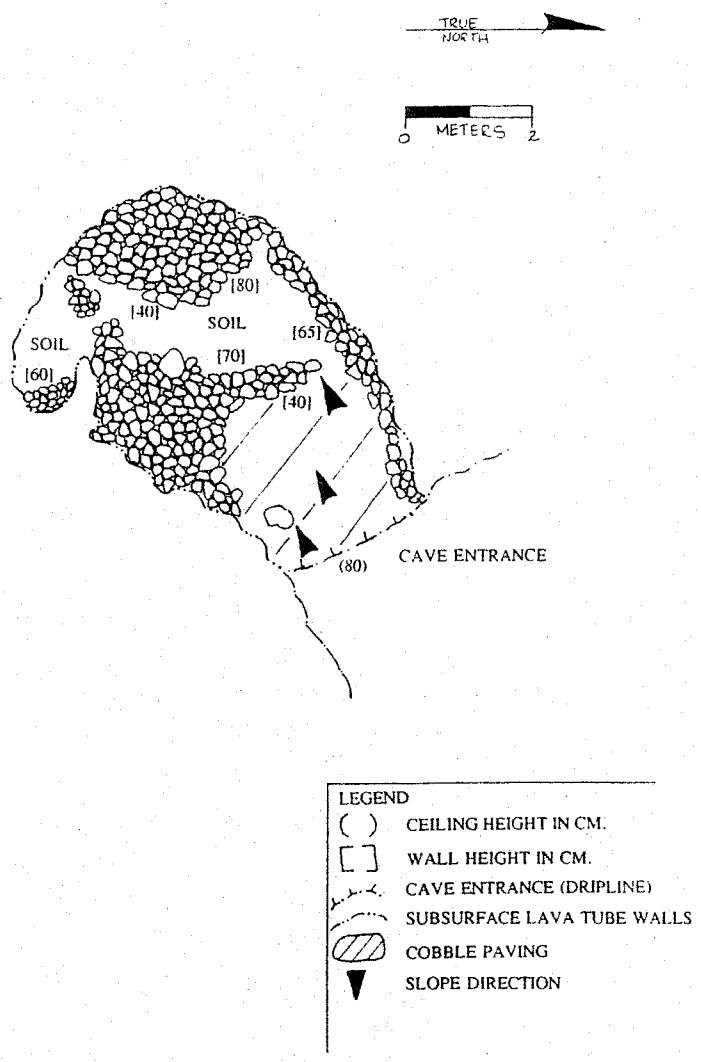



Figure-36 State site 50-10-37-16676; plan view

excavation potential within the tube is considered good. This tube may possibly connect with the *mauka* (east) end of the State site -16677 tube system.

**State site #:** 50-10-37-16677 **CSH Site #:** 339
**Site Type:** Lava tube
**Function:** Burial
**Features (#):** 1
**Site Dimension:** 7800.0 m.$^2$ (84,240.0 ft.$^2$)
***Ahupua'a*:** Honuaino
**Elevation:** 190 ft. a.m.s.l.

**Description:** State site -16677 (Figures 37 & 38) is a lava tube locally referred to as the "Ackerman Cave". The site is located approximately 100.0 m. (328.0 ft.) from a gravel access road. The site is one of several monumentally constructed refuge caves known in the Kona District. Extensive modifications over the tube's entrance within the lava tube's sink area successfully obscures the site for its use as a refuge cave. The lava tube extends into two tubes to the east (Tube #1) and to the southwest (Tube #2) from its main entrance. Numerous burials which equivocally post date the refuge habitation occur within the lava tube.

The modification of the sink area is characterized by a constructed cobble and boulder pavement measuring 16.0 m. (52.5 ft.) E/W by 17.0 m. (55.8 ft.) N/S. The pavement surface slopes downward towards the constructed entry into the underlying lava tube (effectively, the uneven surface of the pavement resembles a natural surface of outcrop rubble). Several depressions and internal alignments are present within the pavement. The main entrance into the lava tube ascends below the pavement into a tunnel-like passage retained by a well constructed boulder facing on all sides and a ceiling formed by boulder slabs. The tunnel passage is generally 1.0 m. (3.3 ft.) wide and 1.0 to 1.5 m. (3.3 to 4.9 ft.) high; it extends for approximately 18.0 m. (59.1 ft.) from the southeast corner of the surface pavement until adjoining the two main tubes.

**Tube #1** begins in a fairly large chamber with an approximate ceiling height of 3.0 m. (9.8 ft.). The tube runs in a generally easterly direction approximately 120.0 m. (393.7 ft.). The presence of several mounds of soil and two small 1/8" screens indicates that the tube has been extensively excavated by amateur archaeologists.

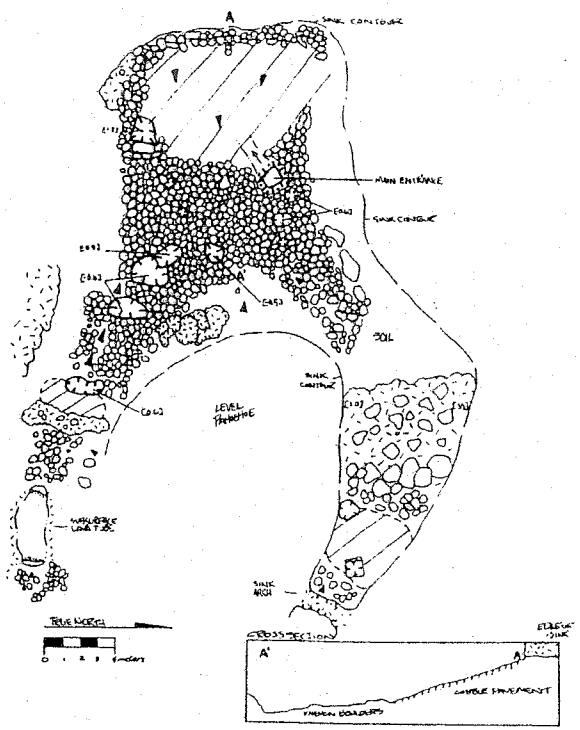
Further *makai* (west) into Tube #1 structural modifications are present. A small terrace built off of the wall and several short and tumbled walls extend across the width of the tube. Charcoal, *kukui* nuts, and mammal bones commonly occur along the soil covered floor of the tube.

A charcoal sample was collected for radio carbon analysis from beneath the terrace. This sample (11.2 grams) revealed a calibrated date ranging from 1650 to 1950 A.D.

At approximately 70.0 m. (229.7 ft.) into Tube #1, human bones are observable on the floor. These include mandibles, large pelvii and two craniums. Some of the skeletal remains were placed within the cracks of boulder ceiling fall; a'a cobbles were also used to cover the rest of the remains.

In the burial area along the north wall of the tube is another lateral tube which extends 10.0 m. (32.8 ft.) long. Within this chamber are fragments of human long bones, ribs, a pelvis and other unidentified human bone fragments. Also present are approximately 2.0 m. (6.6 ft.) long wooden rods, decomposing wood, and charcoal. As suggested by the presence of



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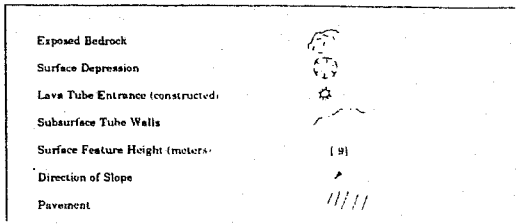
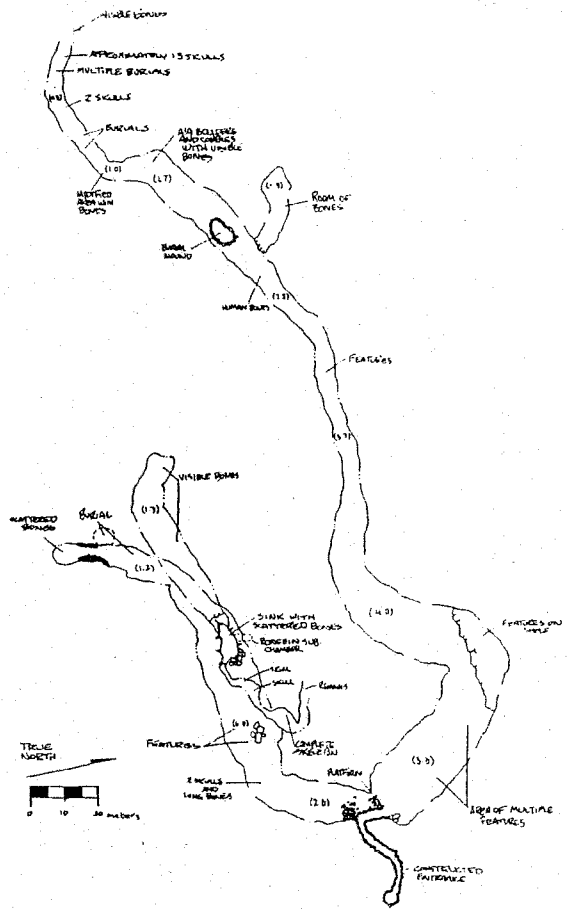



Figure 37 State site 50-10-37-16677; lava tube modified surface area; plan view




Legend

| | |
|---|---|
| Drip Line/Tube Entrance | |
| Lava Tube Walls | |
| Subsurface/Overhang Height (meters) | (2.8) |
| Surface Depression | |
| Direction of Slope | |

Figure 38 State site 50-10-37-16677 lava tube; plan view



ash, charcoal and ritual-like piling of the human bones, this chamber may have been used to prepare the bones for interment or other ritual burial practices.

A third burial area is also present approximately 100.0 m. (328.0 ft.) from the beginning of Tube #1. The burial includes a complete skull and other less visible remains entombed within a modified pile of ceiling fall.

A scattered to dense concentration of human bone also occurs along a floor of rough a'a - from the modified ceiling fall to 10.0 m. (32.8 ft.) further into the tube.

Beyond the a'a floor is a small opening which leads to another chamber; more bones were observed in this smaller area. Anywhere from 3 to 8 burials are present, and towards its end there are 2 full skulls and the skull cap of a baby or small child. Beyond this chamber is a small room, at least 18 more skulls are present, 8 of which are set up on the floor facing the entrance. Although there are rib and vertebrae bones, long bones are totally absent from the room. White ash spots are visible on the floor and ceiling and some burnt bones were observed. The end of the tube pinches off to about 0.3 m. (1.0 ft.) tall, but bones can be seen beyond. The tube is inaccessible at this point. A skull is visible beyond this point.

A long (1.5 m.) wooden rod was observed in the back, and probably acted as a staff or the means by which the bodies were transported.

The floor of the chamber is covered with a'a slabs and cobbles. It is approximately 1.7 m. wide and 1.0 m. high. Small pieces of charred wood are observable (a small section of articulated vertebrae sits along the wall).

Historic items were observed, including a light bulb and the rubber nub of a cane or post.

**Tube #2** runs 60.0 m. (196.9 ft.) northeast/southwest. Beginning from the same sink as Tube #1, Tube #2 runs in approximately the same direction. The entrance is constructed and walled in a refuge type entrance. From the edge of the constructed crawl way, the tube entrance extends to the south. Once inside a small constructed walkway makes its way around the exterior sink construction to the top of a bi-level platform. The platform has been visibly disturbed, as part of it has been dismantled. The height of the feature is a maximum of 1.5 m. (4.9 ft.).

Further along the tube is a large room measuring approximately 10.0 m. by 10.0 m. (32.8 by 3.28 ft.) with ceilings of over 6.0 m. (19.7 ft.) high. Boulder sized stones cover the floor in what seems to be a series of pavements and burials. Two human skulls are sitting openly on the floor with a stack of 11 long bones alongside. In the center of the chamber, a terrace is built utilizing the north side wall and a natural ledge. Three sections of the terrace along the wall have been removed, revealing 3 tomb like interiors. A skull cap sits on top and other bones are visible within. The structure is built to a maximum height of approximately 1.5 m. (4.9 ft.).

Beyond these burials is another terrace extending from the south wall. Built to an approximate height of 1.0 m. (3.3 ft.) and constructed (as the other features are) of a'a boulders. It's top is paved with small a'a cobbles.

On the floor of the tube beyond the large chamber at approximately 40.0 m. (131.2 ft.) lies a collapsed sink which reveals another sub-surface tube running under the main tube. Behind the collapse lies a series of crawl ways which give way to at least 3 small chambers. (These crawl ways are very small - 0.5 m. [1.6 ft.] high). Just inside, 2 skulls were observed; further on is a completely articulated skeleton and skull; further still is an articulated skeleton with no skull. The crawl way continued but was too small to warrant entry.

Back in the main part of the sub-surface tube, it continues under the main tube for approximately 25.0 m. (82.0 ft.) yielding at least 5 to 7 more burials, pieces of wood, shell midden (opihi and cowrie) and various burial structure (4 total). The structures for the most

part are built on the floor along each wall, and consist of 0.5 to 0.8 m. (1.6 to 2.6 ft.) high coffin shaped platforms. The bulk of the structures are constructed with boulders, but they are then covered over with tiny a'a cobbles and soil.

Beyond the sub-surface sink the main tube continues for approximately 30.0 m. (98.4 ft.) and pinches out in a chamber which has a height of 1.1 m. (3.6 ft.). Several burials and terraces were observed in this area.

The modifications within State site -16677 are in fair to good condition although many have been disturbed. The entrance is in excellent condition. The tube is considered to be a major burial site and is highly recommended for preservation.

Testing results:

Limited subsurface testing was conducted within the entrance chamber and Tube #1 of State site -16677 to determine stratigraphy and collect charcoal samples for dating to better determine the habitation period within the tube. The testing consisted of three 1.0 m. by 0.5 m. (3.3 by 1.6 ft.) trenches and one 0.5 m. (1.6 ft.) square trench located within the soil deposits in the tube system. Excavation proceeded in 10 cm. levels according to the stratigraphy.

Test trench 1 was located 13.0 m. (42.7 ft.) from the refuge entrance. The test pit consisted of a 1.0 m. by 0.5 m. (3.3 by 1.6 ft.) trench. Upon excavation two stratigraphic layers were revealed and designated Stratums I and II. Stratum I - 0 to 15 cm. - consisted of fine, silty, slightly compact medium brown soil with a high percentage of charcoal present. Stratum II - 15 to 32 cm. - consisted of compact dark brown soil with white bands of ash or a possible calcium carbonate lenses. The charcoal decreases with depth. Excavation halted when the original bedrock floor was reached at a depth of 32 cm.

Cultural material, including midden, was collected from Stratums I and II of Trench 1. A total of 0.2 grams of marine midden and 43.2 grams of terrestrial midden was collected from Stratum I. A total of 181.5 grams of charcoal was collected from Stratum I. The charcoal from Stratum I received radio carbon analysis. The results showed a possible date of 1675 to 1710, and 1805 to 1930 A.D.

Stratum II midden included 0.2 grams of terrestrial midden. A total of 25.7 grams of charcoal was also collected from Stratum II.

No artifacts were collected from Test trench 1.

Test trench 2 was located 7.0 m. (23.0 ft.) northeast of Test trench 1. The test pit consisted of a 1.0 m. by 0.5 m. (3.3 by 1.6 ft.) trench. Upon excavation two stratigraphic levels were revealed and designated Stratums I and II. Stratum I - 0 to 10 cm. - consisted of very loosely packed unconsolidated soil which may have been previously disturbed. Stratum II - 10 to 57 cm. - consisted of slightly compacted light brown soil with greyish white lenses similar to those encountered in Test trench 1. Again, it appears that Stratum II may have been previously disturbed.

Cultural material, including midden, was collected from Stratums I and II of Trench 2. Stratum I contained a total of 0.1 gram of marine midden and 37.2 grams of terrestrial midden. Stratum I also contained 18.3 grams of charcoal.

Stratum II midden included a total of 2.1 grams of terrestrial midden. A total of 8.6 grams of charcoal was also collected from Stratum II.

No artifacts were collected from Test trench 2.

Test trench 3 consisted of a 1.0 by 0.5 m. (3.3 by 1.6 ft.) trench located near Test trenches 1 and 2 in the entrance chamber. Upon excavation two stratigraphic layers were



revealed and designated Stratums I and II. Stratum I - 0 to 10 cm. - consisted of loose, unconsolidated light brown soil. The south quad contained an area of dark brown soil which diminished on Stratum II. Stratum II - 10 to 23 cm. - consisted of fairly compact brown soil with greyish white lenses similar to those found in test trenches 1 and 2.

Cultural material, including midden, was collected from Stratum I of Test trench 3. Stratum I contained 0.1 gram of marine midden and 269.9 grams of terrestrial midden. A total of 2.8 grams of charcoal was also collected from Stratum I. Stratum II is sterile.

No artifacts were observed within Test trench 3.

Test trench 4 is located in a soil deposit near several terraces within Tube #1. The test pit consisted of a 0.5 m. (1.6 ft.) square trench. Upon excavation one stratigraphic level was revealed and designated Stratum I. The surface layer - 0 to 3 cm. - consisted of very loose light brown soil. Stratum I - 3 to 15 cm. - consisted of slightly compact light brown soil with small greyish white carbonate lenses present.

Cultural material, including midden and artifacts, were collected from Stratum I. Midden included 2.0 grams of marine midden and 48.4 grams of terrestrial midden.

Stratum I artifacts included a bone pick within a sheath (Acc.# 98).

**State site #:** 50-10-37-16678 **CSH Site #:**340
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 25.0 m.$^2$ (270 ft.$^2$)
***Ahupua'a*:** Honuaino
**Elevation:** 150 ft. a.m.s.l.

**Description:** State site -16678 is a small, square platform situated approximately 21.3 m. (70.0 ft.) north of an historic boundary wall (State site -16788). The surrounding vegetation consists of *kiawe*, pasture grass, *koa haole*.

The platform measures 5.0 m. (16.4 ft.) N/S by 5.0 m. (16.4 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). It is constructed of cobbles and boulders and is roughly level on the surface. The only existing facing is located on the *makai* (west) side.

Approximately 30.0 ft. to the west of State site -16678 is a low wall constructed of stacked boulders and cobbles atop bedrock. It runs in a *mauka/makai* (east/west) direction for about 40.0 m. (132.0 ft.) has maximum height of 0.8 m. (2.6 ft.) and a maximum width of 0.8 m. (2.6 ft.).

No midden or artifacts were observed.

State site -16678 is in fair condition, the excavation potential is considered fair.

**State site #:** 50-10-37-16679 **CSH Site #:** 341
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 252.0 m.$^2$ (2,721.6 ft. a.m.s.l.)
***Ahupua'a:*** Honuaino
**Elevation:** 130 ft. a.m.s.l.

**Description:** State site -16679 is a large, multi-level platform with numerous cupboards located approximately 40.0 m. (131.2 ft.) to the northeast of State site -16678 and approximately 30.5 m. (100.0 ft.) south of a boundary wall (State site -16788). The site is situated in an area which has been extensively bulldozed and chained dragged. Some agricultural feature remain intact along a pahoehoe finger below this site.

The platform measures approximately 18.0 m. (59.0 ft.) E/W by 14.0 m. (45.9 ft.) N/S. It is constructed of large (1.0+ m.) boulders, medium to small boulders and cobbles. The platform has four levels. The top two levels contain faced depressions measuring from 0.3 m. to 1.0 m. (1.0 to 3.3 ft.) deep. These depressions were possibly used for storage or as post holes. Facing on the platform remains in various stages of decay along all four sides. The top level has a soil deposit with a pavement fronting it.

No artifacts or midden were observed.

State site -16679 is in fair condition and offers good excavation potential.

**State site #:** 50-10-37-16680 **CSH Site #:** 342
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 328.6 m.$^2$ (3,548.9 ft.$^2$)
***Ahupua'a:*** Honuaino
**Elevation:** 90 ft. a.m.s.l.

**Description:** State site -16680 consists of an enclosure and a platform designated Feature A and B, respectively. The complex is extensive and reveals modification to the surrounding landscape. Numerous terraces, wall segments, remnant platforms, as well as faced linear platforms which appear to be damming gullies are observed nearby. A majority of these features are agricultural in function.

**Feature A** is an enclosure that measures 12.0 m. (39.4 ft.) N/S by 12.0 m. (39.4 ft.) E/W with a maximum height of 1.5 m. (4.9 ft.). The enclosure is roughly square in shape and is constructed of stacked cobbles and boulders. The west face is shortest in length measuring 9.0 m. (29.5 ft.). There is a break in the west wall which may have served as a possible entry way. The break is located in the center of the west wall and measures approximately 1.0 m. (3.3 ft.) in length. The north wall is in better condition than the other walls with vertical facing measures 1.5 m. (4.9 ft.) in height.

No midden or artifacts observed.

Feature A is in fair condition and offers good excavation potential.

**Feature B** is a small remnant platform located approximately 15.0 m.(49.5 ft.) west of



Feature A. The main platform dimensions are 5.8 m. (19.0 ft.) E/W by 3.5 m. (11.5 ft.) N/S with a maximum height of 1.2 m. (3.6 ft.). Facing is still visible on the southern side of the platform.

No artifacts or midden were observed.

Feature B is in fair condition and the excavation potential is considered good.

**State Site #:** 50-10-37-16681 **CSH Site #:** 343
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** 384.2 m.$^2$ (4,149.4 ft.$^2$)
***Ahupua'a:*** Honuaino 4
**Elevation:** 40 ft. a.m.s.l.

**Description:** State site -16681 complex consists of a pavement and a terrace - designated Features A and B - located approximately 9.2 m. (30.2 ft.) E/W apart. The surrounding area is covered with *kiawe* and *koa haole.*

**Feature A** is a pavement situated at the base of a sloped pahoehoe outcrop, within a soil area. It measures 17.0 m. (55.8 ft.) E/W by 9.0 m. (29.5 ft.) N/S and has a C-shaped alignment- and a large boulder pile - just outside the open part of the "C" -in the central portion of the paved area. This feature is constructed of medium to large boulders.

**Feature B** is a terrace built on outcrop; it measures 4.4 m. (14.4 ft.) N/S by 7.2 m. (23.6 ft.) E/W and is raised 0.8 m. (2.6 ft.) on its *makai* (west) side. All other sides are flush with the outcrop. This feature is constructed of small boulders and cobbles.

No midden or artifacts were observed.

State site -16681 is in fair condition and offers fair excavation potential.

**State Site #:** 50-10-37-16682 **CSH Site #:** 344
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 63.0 m.$^2$ (680.4 ft.$^2$)
***Ahupua'a:*** Honuaino 4
**Elevation:** 50 ft. a.m.s.l.

**Description:** State site -16682 is a platform situated on a gentle slope. The terrain consists of an old pahoehoe flow with soil areas vegetated by *koa haole,* well grazed California grass, and *kiawe.*

The platform measures 9.0 m. (29.5 ft.) N/S by 7.0 m. (23.0 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.) on the *makai* (west) side and a minimum height of 0.2 m. (0.7 ft.) along the *mauka* (east) side. It is constructed of piled cobbles and boulders and has a roughly

level cobble pavement. No apparent facing is visible. A few apparent alignments are also visible. The most apparent alignment is in the northern portion running *mauka/makai* (east/west). This site has been heavily disturbed by cattle.

No midden or artifacts were observed.

State site -16682 is in poor condition and offers fair to poor excavation potential.

**State Site #:** 50-10-37-16683 **CSH Site #:** 345
**Site Type:** Lava tube
**Function:** Temporary habitation; Well
**Features (#):** 1
**Site Dimension:** 9,750.0 m.$^2$ (105,300.0 ft.$^2$)
***Ahupua'a*:** Honuaino 4
**Elevation:** 65 ft. a.m.s.l.

**Description:** State site -16683 (Figure 39) is a lava tube which is partially submerged in fresh water. The submerged portion of the lava tube was utilized as a historic well based on the presence of a drilled hole in the tube ceiling. The dry portion of the lava tube was utilized as temporary or recurrent habitation as is evidenced by the presence of cultural deposits and internal modifications.

The entrance to the tube is in a collapsed sink with a wall surrounding it. There is a rough cobble pavement on the ground surface just outside of the tube's entrance. Immediately inside the tube is a chamber measuring 13.0 m. (42.6 ft.) NW/SE by 7.0 m. (23.0 ft.) NE/SW with a maximum height of 1.8 m. (5.9 ft.). The interior has a soil floor. Within this chamber *kukui* and marine midden - including *Cellana* sp., *Cypraea* sp., and *Nerita picea* - were observed. Artifacts observed included a stone bowl fragment, and a cowrie octopus lure fragment. One historic artifact - a metal pipe with an attached wood pole (probably a shovel fragment) - was also observed.

At 42.0 m. (137.8 ft.) beyond the entrance is a ledge where the floor drops just over a meter, then continues. This portion of the chamber has an average height of 1.8 m. (5.9 ft.) and an average width of 7.0 m. (23.0 ft.). There are two platforms and two enclosures in the area *mauka* (east) of the ledge. An archaeological screen from amateur excavations was observed on the floor of the tube between the two platforms.

There is a second ledge 62.0 m. (203.4 ft.) from the entrance. This ledge has two small chambers above the main chamber, which has a small crawlspace below the ledge. The section between the ledge has an average width of 5.0 m. (16.4 ft.) and ranges in height between 0.7 m. (2.3 ft.) and 2.9 m. (9.5 ft.). This area contains one enclosure and one platform. Beyond the ledge to the point where the chamber turns to the northwest another platform is located.

Immediately beyond this platform, 80.0 m. (262.4 ft.) beyond the entrance is a small side chamber which continues to the west for 35.0 m. (114.8 ft.) before pinching out. The entrance to this chamber is walled on both sides, forming a possible refuge tunnel which extends for 13.0 m. (42.6 ft.). The floor is paved with ceiling collapse. This side chamber has a height ranging from 0.6 m. to 0.1 m. (2.0 to 0.3 ft.). There is a small enclosure just beyond the entrance.

The main chamber opens to a maximum height of 4.1 m. (13.5 ft.) with a width of 0.6 m. (2.0 ft.) when it turns to the northwest. The subterranean pool of fresh water begins at approximately 115.0 m. (377.2 ft.) from the entrance of the tube. Also at this point is a historic well drilled through the ceiling of the tube from the surface. The well hole measures



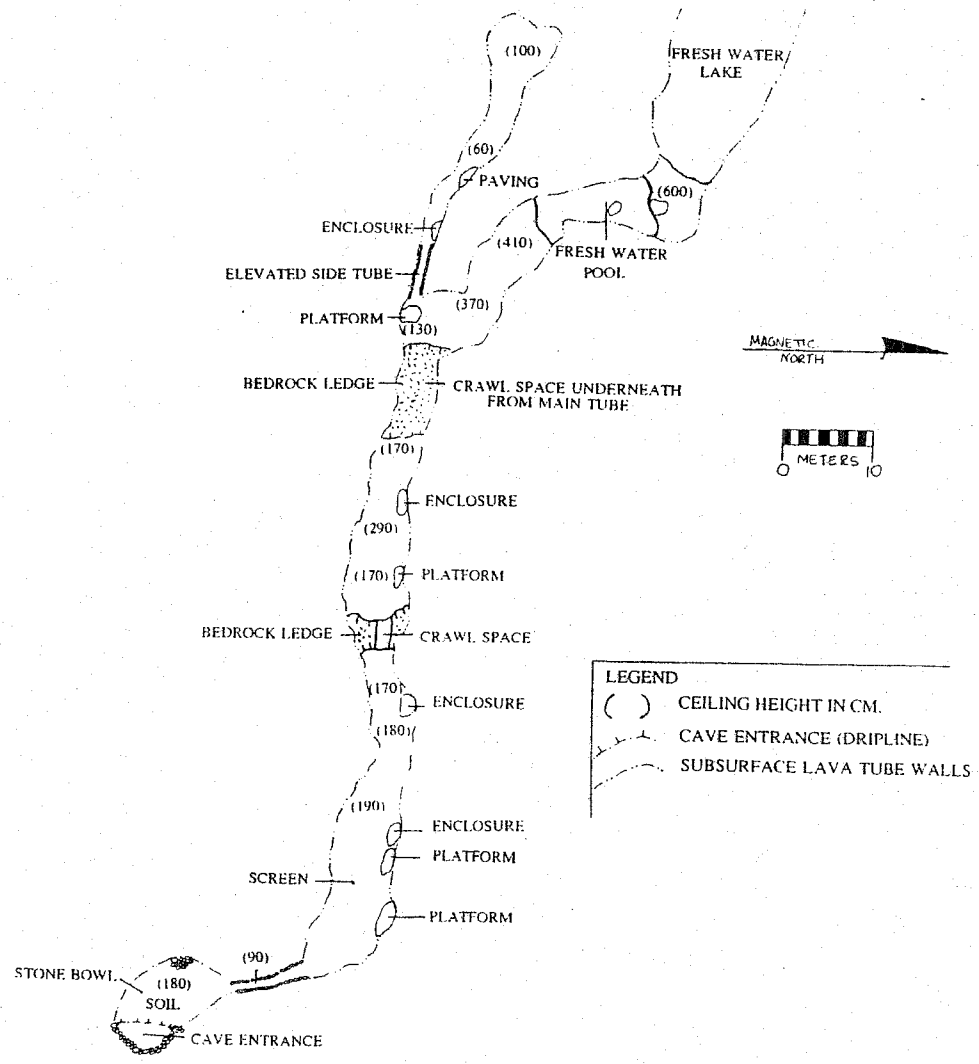



Figure 39 State site 50-10-37-16683; plan view

2.5 m. (8.2 ft.) in diameter and has an approximate length of 15.2 m. (50.0 ft.). The pool was investigated (through swimming) to a maximum length of approximately 25.0 (82.5 m.) at which point the tube become completely submerged. The pool is a maximum approximate depth of 4.5 m. (15.0 ft.). Fresh water shrimp were observed within the pool.

No artifacts or midden were observed beyond the light chamber of the tube.

The features within State site -16683 are in fair to good condition. The tube offers good excavation potential.

**State Site #:** 50-10-37-16684 **CSH Site #:**346
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 36.0 m.$^2$ (388.8 ft.$^2$)
***Ahupua'a*:** Honuaino 4
**Elevation:** 50 ft. a.m.s.l.

**Description:** State site -16684 is a remnant platform. There is very little formal construction remaining. One section of facing is observed in the southwest corner measuring 0.4 m. (1.3 ft.) high. The site dimensions are 8.0 m. (26.2 ft.) N/S by 4.0 m. (13.1 ft.) E/W. The shape is roughly rectangular, and is constructed of cobbles to medium boulders.

One possible coral abrader was observed on the surface just west of the platform's west edge. No other artifacts or midden was observed. To the south 20 m. there is a surface scatter of small *'ili'ili* stones, midden and water-rounded cobbles.

The site condition is poor or remnant and excavation potential is fair.

**State site #:** 50-10-37-16685 **CSH Site #:** 347
**Site Type:** Enclosure
**Function:** Pen
**Features (#):** 1
**Site Dimension:** 270.0 m.$^2$ (2,916.0 ft.$^2$)
***Ahupua'a*:** Honuaino
**Elevation:** 90 ft. a.m.s.l.

**Description:** State site -16685 is a single feature site consisting of a large rectangular enclosure constructed of pahoehoe boulders and cobbles. The enclosure measures 20.0 m. (65.6 ft.) N/S by 13.5 m. (44.3 ft.) E/W. The interior of the enclosure is vegetated with california grass and *kiawe* and is generally level and cleared of rocks. Vertical facing is observed in several segments of the enclosure wall. Facing is seen on each side except the north side, where only a small fragment of facing exists at the northeast corner. The vertical heights measure between 1.0 m. to 1.4 m. (3.3 to 4.6 ft.).

No artifacts or midden were observed.

State site -16685 is in fair condition and offers fair excavation potential.



**State Site #:** 50-10-37-16686 **CSH Site #:**348
**Site Type:** Platform
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 90.0 m.$^2$ (295.2 ft.$^2$)
***Ahupua'a*:** Honuaino 4
**Elevation:** 80 ft. a.m.s.l.

**Description:** State site -16686 is a platform situated among various agricultural features characteristic to the Kona Field System.

The platform measures 10.0 m. (32.8 ft.) E/W by 9.0 m. (29.5 ft.) N/S with heights ranging from 0.5 m. to 1.0 m. (1.6 to 3.3 ft.). The interior surface paving is badly disturbed. A *kua'iwi* wall (*mauka/makai*) (east/west) is attached to the platform. (The *kua'iwi* wall measures 5.0 m. (16.4 ft.) wide.) The platform is constructed of medium cobbles to small boulders. The sides of platform are roughly stacked, no facing remains on the platform or the *kua'iwi* wall. The soil area surrounding the site is covered with scattered cobbles.

No midden or artifacts are observed.

State site -16686 is in fair to poor condition and excavation potential is deemed fair to poor.

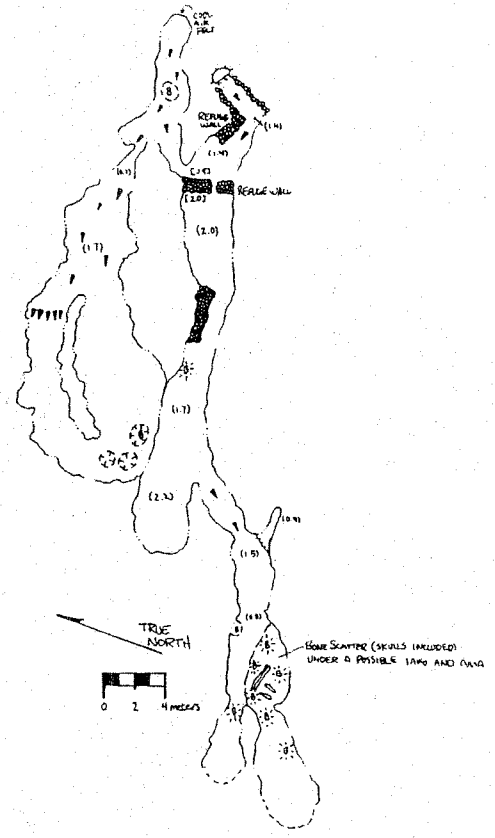
(To the east approximately 30.0 m. (98.4 ft.) is a 1.5 m. (4.9 ft.) square platform with a 1.0 m. (3.3. ft.) square extension, 0.8 m. (2.6 ft.) high on the northeast end.)

**State site #:** 50-10-37-16687 **CSH Site #:** 350
**Site Type:** Lava tube
**Function:** Burial
**Features (#):** ---
**Site Dimension:** 1080.0 m.$^2$ (11,664.0 ft.$^2$)
***Ahupua'a*:** Honuaino
**Elevation:** 100 ft. a.m.s.l.

**Description:** State site -16687 (Figure 40) is a lava tube which contains numerous burials. The main entrance of the tube is approximately 1.0 m. (3.3 ft.) wide. The entrance is well faced on both sides for approximately 3.0 m. (9.8 ft.) into the tube. It opens into a maximum height of 3.0 m. (9.8 ft.) by 1.4 m. (4.6 ft.) wide. The west side of the facing abuts a probable refuge wall which is running in a generally east/west direction. The wall measures 2.0 m. (6.6 ft.) E/W by 0.7 m. (2.3 ft.) N/S with a maximum height of 0.8 m. (2.6 ft.). The wall is constructed of small boulders and cobble and is in fair to good condition. No artifacts or midden were observed in this area of the tube.

Approximately 8.0 m. (26.2 ft.) into the tube from the main entrance there is a another probable refuge wall measuring 3.3 m. (10.8 ft.) NW/SE by 0.7 m. (2.3 ft.) SW/NE, with a maximum height of 0.8 m. (2.6 ft.). The wall is in fair to good condition and it is constructed of small boulders. There is a small opening in the wall measuring approximately 0.7 m. (2.3 ft.) in width.

Directly north of the second refuge wall is another small tube running north for approximately 5.5 m. (18.0 ft.) until intersecting the northern chamber. In the northern chamber unidentified bones were observed. This area of the tube terminates approximately 4.0 m. (13.1 ft.) east of the bones.




Legend

| | |
|---|---|
| Drip Line/Tube Entrance | |
| Lava Tube Walls | |
| Human Bone Concentration | |
| Subsurface/Overhang Height (meters) | (2.8) |
| Surface Depression | |
| Direction of Slope | |

Figure 40 State site 50-10-37-16687; plan view



The tube also extends *makai* (west), opening into a fairly large chamber which marks the *makai* (west) end of the northern chamber. The floor of this chamber is a loose soil. At the south end of the chamber a cranium was observed. The cranium was resting in a small depression measuring approximately 1.0 m. by 1.0 m. (3.3 by 3.3 ft.). There were two other similar depressions in the chamber.

The southern chamber continues in a *makai* (west) direction. Approximately 13.0 m. (42.7 ft.) *makai* (west) of the main entrance on the north side of the tube there is a small mound constructed of small boulders measuring 3.5 (11.5 ft.) E/W by 0.9 m. (3.0 ft.) N/S with a maximum height of 0.5 m. (1.6 ft.). The mound is a probable burial mound as evidenced by the presence of a human mandible located against the south wall of the tube - 3.0 m. (9.8 ft.) from the mound. Other bones were also observed adjacent to the mandible. No midden or artifacts were observed in this portion of the tube.

The back of the southern tube is approximately 40.0 m. (131.2 ft.) *makai* (west) of the main entrance. In the upper portion of the chamber skeletal remains were observed including: three visible skulls, one probable cranium, pelvis bones, vertebrae, and ribs. The skeletal remains were concentrated on a slightly elevated pahoehoe shelf measuring approximately 4.0 m. by 4.0 m. (13.1 by 13.1 ft.). Many of the bones have been disturbed by ceiling collapse.

Associated with the burial area is a fragmented wooden canoe or *ama*. The orientation of the wooden *ama* fragments suggests that the *ama* was originally placed in a east/west or *mauka/makai* (east/west) direction. Perpendicular to the *ama* may be th *'iako*. There are less identifiable wood fragments on the tube's shelf.

Another tube running in a generally E/W direction extending off the burial area. Observed in this tube was another skull and probable skull cap, other bones as well. This tube was not explored due to its inaccessibility.

Just northwest of the elevated area there is another tube which extends for an as yet undetermined distance extending roughly E/W. At the beginning of tube is another skull along with other bone remains. This particular skull and bones are situated on a combination shallow soil area and bedrock. The soil area extends *mauka* (east) approximately 6.0 m. (19.8 ft.).

Some charcoal was observed around the elevated area, no other midden was observed. The site is in good/fair condition.

**State site #:** 50-10-37-16688 **CSH Site #:** 351
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** 1088.0 m.$^2$ (11,750.4 ft.$^2$)
***Ahupua'a*:** Honuaino
**Elevation:** 125 ft. a.m.s.l.

**Description:** State site -16688 is a site complex comprising two platforms and a low wall designated Features A through C, respectively. Surrounding vegetation consists of *koa haole*, *kiawe*, and pasture grass.

**Feature A** is a low platform constructed of cobbles and boulders; it has a generally level surface with vertical facing on all of its sides. The platform measures approximately 4.0 m. (13.1 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 0.9 m. (3.0 ft.).

There is a small circular depression in the NE corner of the platform measuring approximately 0.7 m. (2.3 ft.) in diameter.

There is a small, adjoining platform that is connected to the NW corner of the main platform. This platform measures 2.6 m. (8.6 ft.) by 2.0 m. (6.6 ft.). This platform is constructed in a similar style to the main platform.

No midden or artifacts were observed.

Feature A is in fair condition and offers fair excavation potential.



**Feature B** is a platform similar in construction to Feature A. It measures 5.0 m. (16.4 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.). There is a small depression in the southwest corner which measures approximately 1.0 m. (3.3 ft.) in diameter.

No midden or artifacts were observed.

Feature B is in fair condition and offers fair excavation potential.

**Feature C** is a low wall running east from Feature B for approximately 40.0 m. (131.2 ft.). It is 2.0 m. (6.6 ft.) wide with a maximum height of 0.7 m. (2.3 ft.).

Feature C is in poor to fair condition. The excavation potential is considered poor.

**State Site #:** 50-10-37-16689 **CSH Site #:** 352
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 52.5 m.$^2$ (172.2 ft.$^2$)
***Ahupua'a*:** Hokukano 1
**Elevation:** 30 ft. a.m.s.l.

**Description:** State site -16689 is a rectangular platform located on fairly level ground in a break in the slope. The site is surrounded by California grass, *koa haole*, and *kiawe*.

The platform measures 7.0 m. (23.0 ft.) N/S by 7.5 m. (24.6 ft.) E/W. It is constructed of large to medium boulders which retain a small boulder and cobble surface. The sides are well faced except for the *mauka* (east) face which is low and slightly collapsed. The surface is level with a few circular depressions in the southeast portion. Just off the *mauka* (east) end of the platform is a modified outcrop with large outcrop boulders. Just *makai* (west) of the platform is a crumbling boulder wall oriented roughly north/south with a perpendicular wall just to the south and running east/west.

No midden was observed. A possible water-rounded hammerstone was observed.

State site -16689 is in good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16690 **CSH Site #:**354
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a*:** Hokukano 2
**Elevation:** 110 ft. a.m.s.l.

**Description:** State site -16690 consists of four features designated A through D.

**Feature A** is a platform and an attached wall, both constructed of cobbles and boulders. The *mauka* (east) half of the platform is well faced and was a level cobble pavement. The *makai* (west) half of the platform is in poor condition, and has poorly

preserved facing and a rough pavement. The platform measures 19.0 m. (62.3 ft.) E/W by 6.0 m. (19.7 ft.) N/S.

No midden or artifacts were observed.

Feature A is in fair to poor condition and is considered to offer fair excavation potential.

**Feature B** is an L-shaped enclosure. The north/south leg of the enclosure wall measures 11.0 m. (36.1 ft.) long with height ranging from 0.4 m. to 1.0 m. (1.3 to 3.3 ft.). The east/west leg measures 10.0 m. (32.8 ft.) long with a height of 0.7 m. to 0.9 m. (2.3 to 2.9 ft.). A small enclosure exists in the corner where the two legs meet. The enclosure opens to the north. The walls of this enclosure are tumbled. The small interior enclosure measures 3.5 m. (11.5 ft.) by 2.0 m. (6.6 ft.) and has a soil floor.

No midden or artifacts were observed.

Feature B is in fair condition and it has good excavation potential.

**Feature C** is an enclosure located 18.0 m. (59.1 ft.) from Features A and B. The interior of the enclosure consists of a paved area below the north face of a vertically faced a'a outcrop with a soil floor. It measures 6.0 m. (19.7 ft.) by 7.0 m. (23.0 ft.), with maximum wall heights of 0.8 m. to 1.1 m. (2.6 to 3.6 ft.) and widths of 0.5 to 1.0 m. (1.6 to 3.3 ft.). The enclosure wall consists of coarsely stacked boulders. The condition of the facing is fair to remnant.

No midden or artifacts were observed.

Feature C is in fair to remnant condition with good excavation potential.

**Feature D** is two square concentric enclosures located 25.0 m. (82 ft.) east of Feature C. The feature is located on a level bluff south of Features A, B and C. The interior of the inner enclosure measures 4.0 m. (13.1 ft.) by 4.2 m. (13.8 ft.). The interior of the outer enclosure measures approximately 8.0 m. (26.2 ft.) in diameter. The enclosures' walls are approximately 1.5 m. (4.9 ft.) wide and they are constructed of cobbles and boulders.

No midden or artifacts were observed.

Feature D is in poor condition and it has fair to poor excavation potential.

**State Site #:** 50-10-37-16691 **CSH Site #:**355
**Site Type:** Lava tube
**Function:** Burial; Refuge
**Features (#):** 1
**Site Dimension:** 3,600.0 m.$^2$ (11,808.0 ft.$^2$)
***Ahupua'a*:** Hokukano 1
**Elevation:** 125 ft. a.m.s.l.

**Description:** State site -16691 (Figure 41) is a lava tube and a low platform constructed on the surface. The lava tube contains numerous burials in addition to internal modifications and an abundance of artifacts and midden. Refuge usage of the lava tube is evidenced by its internal modifications which effectively hinders easy access especially into the *mauka* (east) chamber.

There is a small wall surrounding the south side of the tube entrance; the platform abuts its north side.



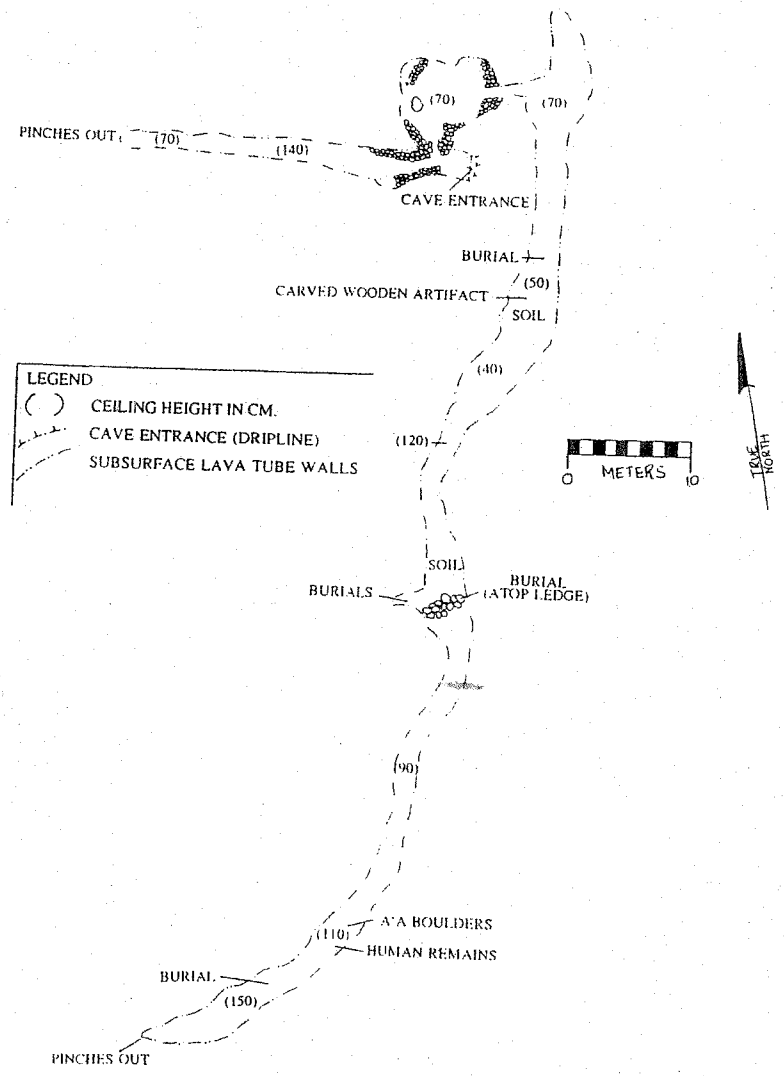



Figure 41 State site 50-10-37-16691; plan view

The tube contains two chambers, one extending directly west of the entrance (chamber 1), and one looping around the entrance, extending in a southernly direction (chamber 2).

Chamber 1 extends 30 m. (100.0 ft.) due west of the entrance. Its chamber is lined with boulders and cobbles along its wall and it contains a soil floor. Average ceiling in the chamber area is 1.0 m. (3.3 ft.). Very little midden was observed in chamber 1.

The chamber 2 extends off the north wall of the chamber 1 immediately beyond the tube entrance; this opening is partially blocked by cobbles, forming a 0.5 m. (1.6 ft.) in diameter opening. A circular chamber is located immediately upon entering the chamber 2. It measures approximately 7.0 m. (23.1 ft.) in diameter and has a soil floor; ceiling height averages 1.0 m. (3.3 ft.). Cobbles and boulders are stacked and piled along the northwest, northeast, and south sides of the chamber.

A small passage - less than 1.0 m. (3.3 ft.) wide - extends off of the east wall of the circular chamber for approximately 5.0 m. (16.5 ft.) until it diverts to the south into the longest axis of the chamber 2.

The longest axis of the chamber 2 extends a total length of approximately 90.0 m. (297 ft.) until terminating. The first human burial was encountered about 20 m. (66.0 ft.) beyond the narrow passage. A second area of burials is located approximately 25.0 m. (82.5 ft.) beyond; these were observed on top of a ledge in the chamber wall and within a small chamber opening adjacent to the ledge. Immediately beyond the second burial area is a low wall extending across the width of the chamber.

The last two observed burial areas occur within the southern extent of the chamber 2, approximately 50.0 m. (165.0 ft.) beyond the second burial area. It is estimated that the skeletal remains observed in the lava tube were of at least eight individuals.

An abundance of artifacts were observed and some were collected from the chamber 2 of the lava tube. These include eight *he'e* lures (adjacent to the second burial area), a carved wooden figure (adjacent to the first burial area) (Acc. #100) and wooden spear points or *o'o*. Various types of midden were also observed, including cowrie, *kukui*, *opihi*, pencil urchin spines, and charcoal. Historic and modern items were also present, including ceramic fragments and a plastic comb.

**State Site #:** 50-10-37-16692 **CSH Site #:** 356
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 42.0 m.$^2$ (453.6 ft.$^2$)
***Ahupua'a*:** Hokukano 1
**Elevation:** 125 ft. a.m.s.l.

**Description:** State site -16692 is a platform with a cupboard and a possible hearth located on the edge of a small gully, 56.4 m. (185.0 ft.) south of State site 50-10-37-16693.

The platform measures 7.0 m. (23.0 ft.) E/W by 6.0 m. (19.7 ft.) N/S. The construction is rough and there is no facing. The cupboard measures 0.5 m. deep and .30 to .40 m. (1.0 to 1.3 ft.)in diameter and located in the SW corner and is approximately 0.4 m. (1.3 ft.) in diameter.

No midden or artifacts were observed.

The condition of State site -16692 platform is poor; however, its internal cupboard is in good condition. The excavation potential is fair to poor.



**State Site #:** 50-10-37-16693 **CSH Site #:** 357
**Site Type:** Terrace
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 48.0 m.$^2$ (518.4 ft.$^2$)
***Ahupua'a*:** Hokukano 1
**Elevation:** 150 ft. a.m.s.l.

**Description:** State site -16693 is a terrace constructed along the edge of pahoehoe outcrop within a level break in the slope. The terrace measures 8.0 m. (26.2 ft.) N/S by 6.0 m. (19.7 ft.) E/W by 1 m. (3.3 ft.) high and it has remnant facing. It is constructed of medium to large boulders and its east side is flush with the outcrop.

There is a small lava blister located immediately east of the terrace edge. An agricultural wall (component of the Kona Field System) extends in a north/south direction along the east side of the terrace. Adjacent to the wall, on the opposite side of the terrace, there is a rough pavement which appears to be filling another opening to the lava blister mentioned above.

State site -16693 is in fair condition and the excavation potential is fair.

**State Site #:** 50-10-37-16695 **CSH Site #:** 359
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 50.4 m.$^2$ (544.3 ft.$^2$)
***Ahupua'a*:** Hokukano 1
**Elevation:** 75 ft. a.m.s.l.

**Description:** State site -16695 is a rectangular enclosure situated on level terrain surrounded by *koa haole* and *kiawe*.

The enclosure measures 5.6 m. (18.4 ft.) E/W by 9.0 m. (29.5 ft.) N/S. It is constructed of mounded and piled boulders and cobbles. Its interior is soil covered. No artifacts or midden were observed.

State site -16695 is in poor condition and the excavation potential is considered poor.

**State site #:** 50-10-37-16696 **CSH Site #:** 360
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 40.0 m.$^2$ (432.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 50 - 100 ft. a.m.s.l.

**Description:** State site -16696 is a platform located on a gentle slope. The site is surrounded by *kiawe*, pasture grass and *koa haole*.

The platform measures 8.0 m. (26.2 ft.) E/W by 5.0 m. (16.4 ft.) N/S (at widest point). It ranges from 0.6 to 0.9 m. (2.0 to 3.0 ft.) in height. The platform is constructed of medium to large boulders. The platform has a roughly paved surface.

No midden or artifacts were observed.

The condition of State site -16696 is poor to fair.

**State Site #:** 50-10-37-16697 **CSH Site #:** 361
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 22.0 m.$^2$ (237.6 ft.$^2$)
***Ahupua'a*:** Hokukano 1
**Elevation:** 65 ft. a.m.s.l.

**Description:** State site -16697 is a small platform situated on a gentle slope along a small pahoehoe outcrop.

The platform measures 5.5 m. (18 ft.) by 4.0 m. (13.1 ft.). It is constructed of medium boulders with a cornerstone in the northwest corner which measures over 1 m.$^2$.

No midden or artifacts were observed at the site.

State site -16697 is in fair condition.

**State site #:** 50-10-37-16698 **CSH Site #:** 362
**Site Type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 85.5 m.$^2$ (923.4 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 50 - 100 ft. a.m.s.l.

**Description:** State site -16698 is a low triangular platform situated on a gentle slope 21.3 m. (70.0 ft.) *mauka* (east) of an access road. The vegetation consists of *koa haole*, *kiawe*, and grazed grass. Agricultural mounds are present in the vicinity.

The platform measures 9.5 m. (31.2 ft.) N/S by 9.0 m. (29.5 ft.) E/W. It is constructed of cobbles and small boulders. Remnant facing exists only on its southeast side. The surface pavement is roughly level. The surrounding area is soil with scattered cobbles.

No midden or artifacts were observed.

State site -16698 is in fair condition. Excavation potential is considered fair.



**State site #:** 50-10-37-16699 **CSH Site #:** 364
**Site Type:** Terraces
**Function:** Temporary habitation
**Features (#):** Indeterminate
**Site Dimension:** 225.0 m.$^2$ (2,430.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 50 - 100 ft. a.m.s.l.

**Description:** State site -16699 is a series of poorly constructed terraces adjacent to a modified gully. The site is constructed of a'a boulders on a moderate to steep slope of outcrop. The area is covered with *koa haole*, *kiawe*, California grass and lantana.

The terraces average 6.0 m. (19.8 ft.) N/S by 2.0 m. (6.6 ft.) E/W with average heights of 0.4 m. (1.3 ft.) to 0.7 m. (2.3 ft.). There is a gully 10.0 m. (32.8 ft.) south of the site with a well constructed wall section; it was probably constructed to channel runoff water downslope. There is also a small platform remnant measuring approximately 4.0 m. by 4.0 m. (13.1 ft. by 13.1 ft.) located 13.0 m. (42.7 ft.) southwest of the main site. The site is located 8.0 m. *makai* (west) of the Kuakini wall (State site #7276) and encompasses a 15.0 m. (49.2 ft.) E/W by 15.0 m. (49.2 ft.) N/S area.

No midden or artifacts were observed.

State site -16699 is in poor condition and the excavation potential is considered poor.

**State site #:** 50-10-37-16700 **CSH Site #:** 369
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 10.2 m.$^2$ (110.2 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 50 - 100 ft. a.m.s.l.

**Description:** State site -16700 is a possible burial platform and a cupboard located on a sloping terrain of pahoehoe outcrop. The platform measures 3.2 m. (10.5 ft.) E/W by 3.2 m. (10.5 ft.) N/S by 1.2 m. (3.6 ft.) high. The platform is constructed of small boulders and cobbles and has a fairly level pavement. Approximately 11.0 m. (36.1 ft.) downslope (west) is a small cupboard measuring 2.0 m. by 2.0 m. (6.6 by 6.6 ft.) by 0.7 m. (2.3 ft.) high; capstones are still in place.

No midden or artifacts were observed.

State site -16700 is in fair condition and is interpreted as a possible burial site.

**State site #:** 50-10-37-16701 **CSH Site #:** 371
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 32.0 m.$^2$ (345.6 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 85 ft. a.m.s.l.

**Description:** State site -16701 is a triangular terrace situated abreast a bedrock ledge. Surrounding vegetation consists of *koa haole*, *kiawe*, pasture grass.

The terrace measures 8.0 m. (26.2 ft.) E/W by 4.0 m. (13.1 ft.) N/S. The terrace is constructed of cobbles to small boulders and has a roughly level pavement.

The condition of State site -16701 is fair and the site offers fair to poor excavation potential.

**State site #:** 50-10-37-16702 **CSH Site #:** 372
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a*:** Kanakau
**Elevation:** 30 ft. a.m.s.l.

**Description:** State site -16702 (Figure 42) is a site complex situated within the conservation zone of the project area. The site consists of three platforms designated Features A through C. The surrounding vegetation is grazed grass and *kiawe*. The terrain consists of a moderate slope descending to a steep-sided cliff of the coastline. There is a deep calm water bay protected by a wave washed lava point located 30.5 to 33.5 m. (100 to 110 ft.) from the site.

All of the site features in the complex appear to be associated by a prehistoric habitation component; however, during the late historic period Feature A platform was reused by the Greenwell family as a structural foundation for its use as a store. The store was known locally as the "Greenwell Store".

**Feature A** is a multi-level platform which once served as the foundation for the historic "Greenwell Store". The platform measures 20.0 m. (66.0 ft.) N/S by 14.0 m. (46.2 ft.) E/W. The platform is separated into two primary levels or tiers in the north and south portions of the platform.

The largest tier of the platform is its northern tier. It measures 9.0 m. (29.7 ft.) N/S by 14.0 m. (46.2 ft.) E/W and it lies at a maximum of 1.25 m. (4.1 ft.) below the southern tier. The north tier has a well paved cobble and soil surface. A slightly raised rectangular surface is present in most of the tier's eastern half. A entrance or formal doorway is present in the southeast corner adjacent to the raised surface.

The southern tier measures 10.0 m. (32.8 ft.) N/S by 14.0 m. (46.2 ft.) E/W and it rises 1.25 m. (4.1 ft.) above the northern tier. This tier contains three additional raised areas, separating the tier into east, central and west sections. The east section is 0.1 m. (0.3 ft) above the central section and it measures approximately 8.0 m. (26.4 ft.) in diameter. It is well paved with basalt cobbles. The central section of the southern tier is also cobble paved and it measures 4.0 m. (13.2 ft.) N/S by 2.0 m. (6.6 ft.) E/W; it rises 0.5 m. (1.6 ft.) above the west section. The lowest western section is well paved with coral and it measures 7.0 m. (23.1 ft.) N/S by 4.0 m. (13.2 ft.) E/W. An abundance of broken ceramic and glass is present in the northern end of the west section.

Overall the platform is faced with small boulders.

A wall segment extends from the northwest corner of Feature A platform's southern tier. The wall extends to the southwest (towards the coastal cliff) for approximately 20.0 m.



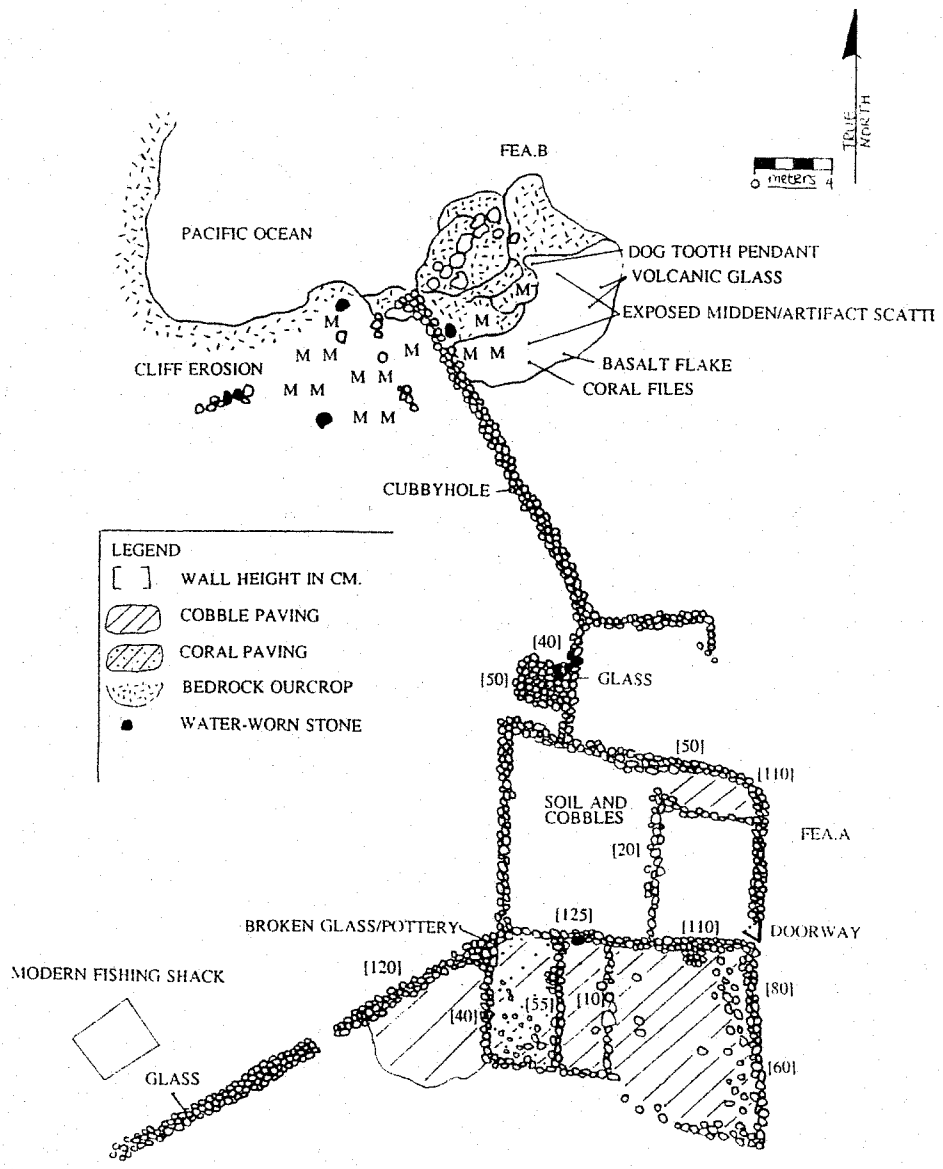



Figure 42 State site 50-10-37-16702; plan view

(65.6 ft.). A modern wood and corrugated tin shack lies to the north of this wall approximately 12.0 to 15.0 m. (39.4 to 49.5 ft.) from the platform.

Another wall segment extends from the north side of the northern tier for approximately 24.0 m. (79.2 ft.) to the northwest. It terminates at the edge of the coastal cliff at Feature B platform. The wall (in conjunction with an east-extending spur wall) also forms a square enclosure immediately north of Feature A's northern tier. The enclosure measures approximately 7.5 m. (24.6 ft.) E/W by 6.0 m. (19.8 ft.) N/S. The enclosure wall is a maximum height of 1.5 m. (4.9 ft.).

Feature A is in good condition. The excavation potential is considered good.

**Feature B** is an eroding, remnant platform located directly adjacent to the coastal cliff. The platform remnant consists of remnant boulder facing surrounding a possible cobble pavement. There may also be a cupboard located in the north side of the platform.

Several prehistoric artifacts were located on the remnant platform; these include one collected artifact: a dog tooth pendant (Acc.# 101), and coral files, basalt flakes and plentiful marine midden, coral and bone.

Excavation potential is considered to be good at Feature B.

**Feature C** is a bi-level terraced platform. The lower platform measures 16.0 m. (52.5 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a height of 1.0 m. to 1.5 m. (3.3 to 4.9 ft.). The upper platform terrace measures 16.0 m. (52.5 ft.) N/S by 3.0 to 5.0 m. (9.8 to 16.4 ft.) E/W with a height of 0.8 to 1.2 m. (2.6 to 3.9 ft.) above the lower level. It is constructed of small to large stacked pahoehoe boulders. There are several water-rounded stones present in the platform's construction. It has a surface pavement of a cobble and boulder mix.

No artifacts were observed at Feature C.

Feature C is in fair condition and offers fair excavation potential.

**State site #:** 50-10-37-16703 **CSH Site #:373**
**Site Type:** Site complex
**Function:** Heiau
**Features (#):** 2
**Site Dimension:** 2,012.5 m.$^2$ (21,735.0 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 50 ft. a.m.s.l.

**Description:** State site -16703 is the *Pali o'Niau Heiau* complex. The complex consists of a central platform, an enclosure, and several smaller platforms. It is located on a bluff near the ocean cliff. The surrounding terrain slopes downward to the north and south. The vegetation consists of *kiawe*, *koa haole*, grazing grass.

**Feature A** is a platform that measures approximately 14.0 m. (46.2 ft.) NW/SE by 11.0 m. (36.1 ft.) NE/SW. The southeastern platform edge is indented where the Feature B terraces connect with it. The platform is paved with small to large cobbles and small boulders. It is faced with small to large boulders. Many small to medium water-rounded boulders have been placed in a 4.0 m. (13.1 ft.) by 4.5 m. (14.8 ft.) area located centrally along the northwest edge of the platform. The water-rounded stones appear to be concentrated around the perimeter of this area. One stone is considered a possible upright, though it's



currently reclined. The stone measures 76 cm. by 28 cm. by 17 cm. Other water-rounded stones are scattered throughout site.

Six constructed depressions are aligned between 0.5 to 1.0 m. (1.6 to 3.3 ft.) below the *mauka* northeast wall. These are spaced 0.4 to 2.0 m. (1.3 to 6.6 ft.) apart from each other. They range in size from 0.4 to 1.5 m. (1.3 to 4.9 ft.) in diameter. Three additional constructed holes appear on the platform.

A 0.3 m. (1.0 ft.) chunk of flat topped coral is used in the pavement construction. It is located along the southeast edge of platform.

Midden was observed at the site; however, no artifacts were present.

Feature A is in good condition and offers excellent excavation potential. The platform is considered a *heiau*.

**Feature B** is a low-lying paved terrace that extends southeast from the southeast corner of the *makai* (west) edge of the main platform. The terrace measures 12.0 m. (39.4 ft.) SE/NW by a maximum of 4.4 m. (14.4 ft.) NE/SW. The *makai* (west) edge of the terrace is 0.8 m. (2.6 ft.) high. The paved surface of the terrace is 1.0 m. (3.3 ft.) below the edge of the main platform.

A second terrace extends from the southeast edge of the main platform from a point 0.6 m. (2.0 ft.) *mauka* (east) of the first terrace. The tier measures 0.3 m. (1.0 ft.) above the first terrace. This terrace measures 10.3 m. (33.8 ft.) NW/SE by a maximum of 2.7 m. (8.9 ft.) NE/SW wide and is constructed of cobbles. There is a roughly circular platform located atop this terrace. It measures approximately 5.5 m. (18.0 ft.) in diameter and is paved with small to medium cobbles.

**Feature C** is located 1.5 m. (4.9 ft.) southeast of Feature B platform. Feature C consists of two contiguous, irregularly shaped platforms. The largest measures approximately 8.3 m. (27.2 ft.) N/S by 3.0 to 7.8 m. (9.8 to 25.6 ft.) E/W. The smaller attached platform measures 2.0 to 3.0 m. (6.6 to 9.8 ft.) in diameter. The platforms have a maximum height of 0.3 m. (1.0 ft.).

No midden or artifacts were observed.

Feature C is in fair to good condition and offers good excavation potential.

**Feature D** is located immediately *mauka* (east) of Feature B. It is a C-shape enclosure formed by the southeast edge of the main platform and a wall that extends from the east corner of the platform. It measures 5.0 m. (16.4 ft.) NW/SE by 4.0 m. (13.1 ft.) NE/SW and it has a maximum height of 0.8 m. (2.6 ft.). The enclosure contains a level soil area and is open to the southwest.

No artifacts were observed. Midden was present within the enclosure.

Feature D is in good condition and offers excellent excavation potential.

**Feature E** is a large platform situated above the main *heiau* platform (Feature A). It is irregular in shape with an arm extending to the southeast. It measures 12.0 m. (39.4 ft.) NW/SE by a maximum of 4.0 m. (13.1 ft.) NE/SW and stands approximately 1.5 m. (4.9 ft.) above Feature A. The arm measures 1.8 m. (5.9 ft.) NE/SW wide. The platform is constructed of medium cobbles. The facing at the northwest end is in somewhat collapsed condition.

No artifacts or midden were observed.

Feature E is in good condition and offers excellent excavation potential.

**Feature F** is a small platform enclosed on three sides by the Feature E platform and the Feature D enclosure wall. It measures 3.0 m. (9.8 ft.) NW/SE by 1.5 m. (4.9 ft.) NE/SW. It

is faced with boulders and has a level cobble pavement.

No midden or artifacts were observed.

Feature F is in good condition and offers excellent excavation potential.

**Feature G** is a small platform and an enclosing wall that lies 20.0 m. (65.6 ft.) northeast of Feature A. The enclosing wall measures approximately 35.0 m. (114.8 ft.) long and is 1.0 m. (3.3 ft.) wide. The wall curves towards the northwest from the platform. It is generally tumbled except for one well-stacked point which is midway along the wall. There are two breaks in the wall each in opposite directions about 7.0 m. (23.0 ft.) from the high point. The platform is situated at the east end of the wall. It measures 12.0 m. (39.4 ft.) N/S by 4.0 m. (13.1 ft.) E/W. It is constructed against the exposed bedrock and is of medium boulders to small cobbles.

No midden or artifacts were observed.

Feature G is in poor to fair condition and the excavation potential is considered fair.

**State site #:** 50-10-37-16704 **CSH Site #:** 374
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 84.0 m.$^2$ (907.2 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 85 ft. a.m.s.l.

**Description:** State site -16704 is a platform with an attached enclosure. The site is situated on a level break in the slope just *makai* (west) of a north/south running access road.

The platform measures approximately 20.0 m. (65.6 ft.) N/S by 7.0 m. (23.0 ft.) E/W. It is constructed of cobbles and boulders. The southernmost 8.0 m. (26.2 ft.) is level and paved with waterworn cobbles and small boulders while the remaining portion of the platform is constructed of rough, subangular boulders. The platform has a maximum height along its west side of 1.4 m. (4.6 ft.) with some remnant facing.

No midden or artifacts were observed in either portion of the platform.

There is a wall that runs along the *makai* (west) side of the road for approximately 127.0 m. (416.7 ft.). The wall is 0.8 to 1.0 m. (2.6 to 3.3 ft.) thick with an average height of 0.5 m. (1.6 ft.). This wall is attached to the east edge of the platform and continues north and south from the corners. Another wall extends south off the southwest corner of the platform. The wall is approximately 0.8 m. (2.6 ft.) thick and varies from 0.5 to 0.8 m. (1.6 to 2.6 ft.) in height on the west side. The wall is constructed of cobbles and small boulders with occasional water-worn stones. It runs south for approximately 26.0 m. (85.3 ft.), then turns downslope (west) for another 14.0 m. (45.9 ft.). A level soil area exists between the two walls.

Three circular depression bowls were observed near the walls of the site, directly in the pahoehoe outcrop.

State site -16704 is in fair condition and offers good excavation potential.



**State site #:** 50-10-37-16705 **CSH Site #:** 375
**Site Type:** Site complex
**Function:** Possible burial
**Features (#):** 2
**Site Dimension:** 264.0 m.$^2$ (2,851.2 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 100 ft. a.m.s.l.

**Description:** State site -16705 is comprised of two features designated Features A and B.

**Feature A** is a roughly square platform constructed of boulders and cobbles with a fairly level and paved interior of cobbles. The platform measures approximately 4.0 m. (13.1 ft.) E/W by 4.0 m. (13.1 ft.) N/S, and is faced on the north, south and west sides with heights measuring 1.1 m. (3.6 ft.), 0.3 m. (1.0 ft.) and 0.9 m. (3.0 ft.) respectively.

No artifacts or midden were observed.

Feature A is considered a possible burial platform. It is in fair condition.

**Feature B** is a platform located 12.0 m. (39.4 ft.) to the west (*makai*) of Feature A. This platform is rectangular shaped measuring approximately 5.5 m. (18.0 ft.) N/Sby 3.5 m. (11.5 ft.) E/W with a maximum height of 0.9 m. (3.0 ft.) on the west face. Tumble extends another 5.0 m. (16.4 ft.) to the south and 2.0 m. (6.6 ft.) to the north off of what appears to be the original platform perimeter. Feature B is of similar construction to Feature A.

No artifacts or midden were observed.

Feature B is in poor condition and is considered a possible burial site.

Approximately 12.0 m. (39.4 ft.) to the west of Feature B is an ocean cliff. Many other cultural structures are located within close proximity to State site -16705, including the State site -16703 *heiau* and the State site --16707 platform. From this spatial association and proximity, these sites may in fact be one large associated complex with the *heiau* serving as the central focus of the site.

**State site #:** 50-10-37-16706 **CSH Site #:** 376
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 35.0 m.$^2$ (378.0 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 85 ft. a.m.s.l.

**Description:** State site -16706 is a platform in close proximity to the State site -16703 *heiau*. The surrounding vegetation consists of *kiawe*, *koa haole*, and pasture grass. The platform measures 5.0 m. (16.4 ft.) N/S by 7.0 m. E/W with a maximum height of 0.7 m. (2.3 ft.). It is constructed of cobbles and small boulders with a few water-worn stones. It is roughly paved with small boulders and its surface slopes gently to the north.

No midden or artifacts were observed.

State site -16706 is in poor to fair condition and it is considered a possible burial site.

**State site #:** 50-10-37-16707 **CSH Site #:** 377
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 25.0 m.$^2$ (270.0 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 50 ft. a.m.s.l.

**Description:** State site -16707 is a platform which measures 5.0 m. (16.4 ft.) N/S by 5.0 m. (16.4 ft.) E/W. The platform is constructed of boulders with a slight cobble pavement. One large flat boulder in the northeast corner is all that is left of vertical facing; it measures 0.75 m. (2.5 ft.) high. Tumbled boulders completely surround the site.

No artifacts or midden were observed.

State site -16707 is in poor/remnant condition and is considered a possible burial site.

**State site #:** 50-10-37-16708 **CSH Site #:** 378
**Site Type:** Terrace
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 54.0 m.$^2$ (583.2 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 75 ft. a.m.s.l.

**Description:** State site -16708 is a long linear terrace running across the slope just *makai* (west) approximately 3.0 to 5.0 m. or 9.9 to 16.5 ft.) of a large and steep pahoehoe outcrop bluff.

The terrace is constructed of boulders and cobbles and it measures 8.0 m. (26.2 ft.) N/S by 3.0 m. (9.8 ft.) E/W. The terrace has a maximum height of 0.9 m. (3.0 ft.) on itswestern side and it is constructed flush with the slope on its eastern side. Continuing south for approximately 10.0 m. (32.8 ft.) from the southern end of the terrace, is a boulder-cobble concentration which may have also been part of the terracing. The condition of this southern length of possible terracing is poor in comparison to the north length of terrace.

There were coral pieces and small water rounded pebbles observed on the terrace. No midden was observed.

State site -16708 is in fair to poor condition and the excavation potential is considered fair.

**State Site #:** 50-10-37-16709 **CSH Site #:** 379
**Site Type:** Mound
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 2.3 m.$^2$ (7.4 ft.$^2$)
***Ahupua'a*:** Kanakau
**Elevation:** 110 ft. a.m.s.l.

**Description:** State site -16709 is a mound located on level terrain, adjacent to the main



access road. The site is surrounded by California grass and *kiawe*.

It measures 1.5 m. (4.9 ft.) N/S by 1.5 m. (4.9 ft.) E/W and is 0.8 m. (2.6 ft.) high (maximum). It is constructed of cobbles and boulders. No midden was observed. A piece of historic-era metal was present on the surface of the mound.

State site -16709 is in fair condition.

**State site #:** 50-10-37-16710 **CSH Site #:** 380
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 10
**Site Dimension:** 3,333.5 m.2 (36,001.8 ft.2)
***Ahupua'a*:** Kalukalu
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16710 is site complex consisting of 10 features designated A through J. The site features include four platforms, three enclosures, one L-shape, one platform-enclosure and one terrace. The surrounding vegetation includes *kiawe* trees, *koa haole* trees, and grass. The slope is moderate and the terrain is covered with a substantial soil base. The site is located within the Land Commission Award 8455-H (Apana 2). Its close proximity to the only canoe landing in the vicinity (at Nawawa) also suggests the benefits of the site area and that the site was likely used during prehistory as well.

**Feature A** is a permanent habitation platform located in the central portion of the site complex. The platform measures 19.0 m. (62.7 ft.) N/S by 6.5 m. (21.5 ft.) E/W. It is constructed of large to small, well stacked boulders with a large portion of them being large, flat, water rounded stones. The western portion of the platform is well faced with heights ranging from 1.0 m. (3.3 ft.) to 1.3 m. (4.3 ft.). The eastern portion of the platform is not as well faced with heights ranging from 0.2 to 0.3 m. (0.7 to 1.0 ft.).

The platform is divided into three sections. The northern section is well paved with sub-angular small boulders and cobbles. In the northwest corner of the platform is a small circular depression measuring approximately 1.5 m. (5.0 ft.) in diameter. The depression is approximately 0.2 m. (0.7 ft.) in depth with the base of the depression being soil with an undetermined depth.

The central portion of the platform is approximately 0.3 m. (1.0 ft.) above the north and south sections of the platform. The central portion is extremely well paved with large flat water rounded stones.

The southern section of the platform is well paved with sub-angular small boulders and cobbles. The northeast corner of the section abuts the southwest corner of feature B and the southeast corner abuts the southwest corner of Feature C.

A basalt polishing stone (Acc.# 102) was collected.

Feature A is in fair to good condition and offers good excavation potential.

**Feature B** is a C-shape enclosure directly abutting Feature A to the east and enclosed within the southwest portion of Feature C. It measures 4.0 m. (13.2 ft.) E/W by 5.0 m. (16.5 ft.) N/S internally with a maximum height of 1.0 m. (3.3 ft.). Facing is present on all sides of the C-shape, both internally and externally. The average width of the walls are approximately 0.8 m. (2.6 ft.). The interior of the enclosure is level soil.

No artifacts or midden were observed.
Feature B is in good condition and offers good excavation potential.

**Feature C** is an enclosure that encompasses Features B, D, and E and forms a portion of Feature A. The enclosure is constructed of small to large boulders. The eastern wall of the enclosure measures 33.5 m. (110.6 ft.) N/S with a maximum height of 1.5 m. (5.0 ft.) internally and 0.7 m. (2.3 ft.) externally. The average width is 1.0 m. (3.3 ft.). The southern portion of the eastern wall is tumbled. The northern wall measures 17.0 m. (56.1 ft.) E/W with a maximum height of 1.3 m. (4.3 ft.) externally and 0.8 m. (2.6 ft.) internally with an average width of 1.0 m. (3.3 ft.). In the central portion of the northern wall, a secondary wall extends off of the northern a northerly direction until intersecting with State site -16713. The southern wall measures 22.0 m. (72.6 ft.) E/W with a maximum height of 1.7 m. (5.6 ft.) and it has an average width of 1.0 m. (3.3 ft.). The southern wall is well faced both internally and externally. The western wall measures 17.5 m. (57.8 ft.) N/S with a maximum height of 1.4 m. (4.6 ft.). The exterior of the wall is well faced in portions and tumbled in others. Feature E abuts the central interior portion of the western wall.
No artifacts or midden were observed.
Feature C is in good condition. The excavation potential is considered good.

**Feature D** is a platform and an attached enclosure situated in the center of Feature C. It measures 8.0 m. (26.4 ft.) N/S by 8.0 m. (26.4 ft.) E/W externally, with the interior portion of the enclosure measuring 4.5 m. (14.9 ft.) N/S by 3.8 m. (12.5 ft.) E/W. The platform and enclosure are both C-shaped and the platform surrounds the C-shape.
Both structures of Feature A are constructed of small to medium stacked boulders. The enclosure portion of the feature is well faced with an average height of 1.0 m. (3.3 ft.). The interior of the enclosure is soil based with scattered boulders and cobble.
Within the northern central portion of the feature is a trash pit containing numerous fragments of shell, coral, historic bottles, pottery, and leather. A basalt flake (Acc.# 106) was collected. Within the southeast corner of the feature is a stone lined depression measuring approximately 0.7 m. (2.3 ft.) in diameter.
Feature D is in good condition and offers good excavation potential.

**Feature E** is a terrace situated within the northwest corner of Feature C. It measures 6.5 m. (21.5 ft.) N/S along its western side, 4.5 m. (14.9 ft.) E/W along its southern side, and 6.0 m. (19.8 ft.) NW /SE along its northern side. It is constructed of large to small boulders and is roughly paved with sub-angular basalt boulders.
No artifacts or midden were observed.
Feature E is in fair condition and offers good excavation potential.

**Feature F** is a large enclosure situated in the northwest corner of the complex. The enclosure abuts the southern wall of State site -16713. The western wall measures 21.0 m. (69.3 ft.) N/S, the southern wall measures 12.5 m. (41.3 ft.) E/W, and the eastern wall measures 25.0 m. (82.5 ft.) N/S. The interior of the enclosure is level soil.
No artifacts or midden were observed.
Feature F is in fair to good condition and offers fair excavation potential. The enclosure probably functioned as an animal pen based on its size and location.

**Feature G** is a platform situated directly to the west of Feature A. Along the western side the platform measures 8.0 m. (26.2 ft.) N/S, the northern side measures 7.0 m. (23.0 ft.) E/W, and the eastern side measures 9.0 m. (29.7 ft.) SW/NE with a maximum height of 0.3



m. (1.0 ft.). Feature H extends off of the southern corner of Feature G.
No midden was observed. A basalt hammerstone (Acc.# 104) was collected.
Feature G is in fair to good condition and offers good excavation potential.

**Feature H** is an enclosure situated in the southwest corner of the complex. The enclosure is located 6.0 m. (19.8 ft.) N/S off of Feature G. The northern portion measures 6.0 m. (19.8 ft.) E/W, the eastern portion measures 9.5 m. (31.4 ft.), and the southern portion measures 16.0 m. (52.8 ft.). The western portion of the enclosure is delineated by the sea cliff which is approximately 15.2 m. (50.0 ft.) above the high tide-mark. The walls of the enclosure are constructed of large to small stacked boulders with facing still present in numerous locations along the interior and exterior of the enclosure. The average width of the enclosure wall is approximately 1.0 m. (3.3 ft.).
No artifacts or midden were observed.
Feature H is in fair condition and offers fair to good excavation potential.

**Feature I** is a platform situated along the western edge of the site complex and the sea cliff. The platform measures 9.0 m. (29.5 ft.) E/W by 6.0 m. (19.8 ft.) N/S with an average height of 0.3 m. (1.0 ft.). The platform is constructed of medium to small stacked boulders with a level small cobble pavement. This feature and Feature J are unique in that they are both constructed directly on the edge of the sea cliff so that their western sides form part of the cliff face.
No midden was observed. Artifacts collected include a basalt hammerstone (Acc.# 103) and a shell fishhook blank (Acc.# 109).
Feature I is in good condition and offers good excavation potential.

**Feature J** is a platform situated 7.0 m. (23.0 ft.) to the north of Feature I. The platform measures 14.5 m. (47.9 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a maximum height of 0.3 m. (1.0 ft.). The platform is constructed of medium to small stacked boulders with a level, small cobble pavement. Access to the shoreline, is easily obtained directly to the north of Feature J.
No midden was observed at the site. Artifacts collected include a basalt adz (Acc.# 105), a basalt adz fragment (Acc.# 107), and a basalt polishing stone (Acc.# 108).
Feature J is in good condition and offers good excavation potential.

**State site #:** 50-10-37-16711 **CSH Site #:** 381
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 27.0 m.$^2$ (291.6 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 85 ft. a.m.s.l.

**Description:** State site -16711 is a platform located on gentle grass-covered slope. The site is surrounded by California grass, *kiawe* and *koa haole*. A north/south trending access road is located 1.0 m. (3.3 ft.) *mauka* (east) of the site.
The platform measures 6.0 m. (19.8 ft.) N/S by 4.5 m. (14.8 ft.) E/W with a maximum height of 1.1 m. (3.6 ft.) along its *makai* (west) face. The *makai* (west) portion of the platform is constructed of boulders and cobbles. The platform is paved with small to medium cobbles.

There is a wall adjacent to the platform which measures 0.3 m. (1.0 ft.) higher than upper portion of platform. The wall extends north/south until it connects to State site -16704.

No artifacts or midden were observed.

State site -16711 is in fair condition and the excavation potential is considered fair.

**State site #:** 50-10-37-16712 **CSH Site #:** 382
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 27.5 m.$^2$ (297.0 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 65 ft. a.m.s.l.

**Description:** State site -16712 is a small, square platform situated at the edge of a steep pahoehoe outcrop. The surrounding vegetation consists of various grasses, *kiawe* and *koa haole*.

The platform measures 5.5 m. (18.0 ft.) N/S by 5.0 m. (16.4 ft.) E/W with a maximum height of 1.2 m. (3.9 ft.) on the south side. The platform is somewhat level on the surface and it is constructed of small to medium boulders intermixed with water-worn boulders of similar size. Remnant facing is located on the south side.

No midden or artifacts were observed.

State site -16712 is located in the *mauka* (east) portion of Land Commission Award 8455. The site is in fair condition and the excavation potential is considered poor to fair.

**State site #:** 50-10-37-16713 **CSH Site #:** 383
**Site Type:** Site Complex
**Function:** Permanent habitation
**Features (#):** 7
**Site Dimension:** (see below)
***Ahupua'a*:** Ilikahi
**Elevation:** 40 ft. a.m.s.l.

**Description:** State site -16713 is a large complex located adjacent to the shoreline and interconnected with State site -16710. The complex is comprised of seven features, two of which connect the site with State site -16710. Although both sites are most definitely associated as components of a small settlement or an extended family household, site boundaries are delineated by the historic Land Commission Award boundaries. All of the features of the site complex are constructed of pahoehoe stone material unless otherwise stated. Many of the features also utilize water-rounded stones, of which an abundance are found nearby along the shoreline. The site is located within the historic Land Commission Award 9753-B (Apana 2).

**Feature A** is a roughly rectangular, multi-level platform. Overall the platform measures 7.0 m. (23.0 ft.) E/W by 6.5 m. (21.3 ft.) N/S. The first level - located at the *mauka* (east) end of the platform - is almost entirely constructed of water-rounded boulders. Level



one measures 1.0 m. (3.3 ft.) E/W from the east edge of the platform and is 0.6 m. (2.0 ft.) higher than level two. There is a very large boulder situated on level two and some outcrop is incorporated into the west edge of the platform.

No midden or artifacts were observed.

Feature A is in good condition and offers good excavation potential.

**Feature B** is a wall segment that connects with State site -16710 complex. The wall runs east/west adjacent to Feature A until diverting south towards State site -16710 complex, approximately 3.0 m. (9.8 ft.) *mauka* (east) of Feature A. The wall has a maximum height of 0.95 m. (3.1 ft.).

No midden or artifacts were observed.

Feature B is in fair to good condition and offers poor excavation potential.

**Feature C** is a large roughly square enclosure located northwest of Features A and B. The wall is constructed of stacked pahoehoe boulders and cobbles with some core-filled sections. The south wall of the enclosure runs *mauka/makai* (east/west) for 26.0 m. (85.3 ft.) E/W . The east wall of this enclosure runs north/south for 24.0 m. (78.7 ft.) and at its northern extent, reaches a modern house site. The north wall borders the modern habitation property line and continues to the west before turning slightly to the north; it serves as a boundary wall for the modern house site property.

No midden or artifacts were observed.

Feature C is in fair to good condition and offers good excavation potential.

**Feature D** is a pavement located in the south corner of the Feature C enclosure. The pavement measures 8.0 m. (26.2 ft.) N/S by 9.0 m. (29.5 ft.) E/W and is constructed of boulders and cobbles with a level surface. Many of the stones within the pavement are water-rounded.

No midden or artifacts were observed.

Feature D is in fair condition and offers fair excavation potential.

**Feature E** is a platform situated along the south wall of Feature C. It measures 3.0 m. (9.8 ft.) NW/SE by 2.0 m. (6.6 ft.) NE/SW and it has a maximum height of 0.3 m. (1.0 ft.). The platform is constructed of boulders and is well faced on the northwest and southwest sides. The southeast side of the platform abuts the Feature C enclosure wall.

No artifacts or midden were observed.

Feature E is in fair condition and offers fair excavation potential.

**Feature F** is a square platform measuring approximately 2.5 m. (8.2 ft.) N/S by 2.5 m. (8.2 ft.) E/W. The west platform edge is well faced with a maximum height of 1.2 m. (3.9 ft.). It is constructed of boulders and cobbles with level cobble paving.

No artifacts or midden were observed.

Feature F is in good condition with good excavation potential.

**Feature G** is a square enclosure located directly *makai* (west) of Feature F. It measures 5.5 m. (18.0 ft.) N/S by 5.0 m. (16.4 ft.) E/W and it has a maximum height of 1.0 m. (3.3 ft.). The north wall segment runs parallel to Feature C's north wall. The west wall of the enclosure is only a remnant alignment of pahoehoe water rounded boulders about 1-2 courses high with a maximum height of 0.5 m. (16.4 ft.). Tumbled and scattered stones were located to the southwest of the feature.

No midden or artifacts were observed.

Feature G is in fair condition and offers fair to good excavation potential.

**State site #:** 50-10-37-16714 **CSH Site #:** 384
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 60.0 m.$^2$ (648.0 ft.$^2$)
***Ahupua'a*:** Ke'eke'e
**Elevation:** 65 ft. a.m.s.l.

**Description:** State site -16714 is a roughly rectangular platform located approximately 125.0 m. (410.0 ft.) from the ocean on a gentle slope. The site is located within Land Commission Award 8455-6:1.

The platform measures 6.0 m. (19.8 ft.) E/W by 10.0 m. (32.8 ft.) N/S. It is constructed of large to small water rounded boulders and medium and small rough boulders with a cobble and pebble pavement. The northeast portion of the platform was bulldozed during construction of the access road which leads to the canoe landing and historic well located 30.0 m. (98.4 ft.) southwest of the site.

No artifacts were observed. Midden observed included coral and shell fragments. Some coral is incorporated into the platform's construction.

State site -16714 is in fair to poor condition and the excavation potential is considered fair.

**State site #:** 50-10-37-16715 **CSH Site #:** 385
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a*:** Ke'eke'e
**Elevation:** 60 ft. a.m.s.l.

**Description:** State site -16715 is a site complex consisting of four features designated Features A through D. This site is part of Land Commission Award 8157. The terrain is sloped along a pahoehoe outcrop with small soil areas. Site vegetation consists of sparse *kiawe*, *koa haole* and grazed grasses.

**Feature A** is an irregular, hexagonal shaped platform which measures 11.0 m. (36.1 ft.) NE/SW by 8.0 m. (26.2 ft.) NW/SE (at its widest point). It is constructed of large boulders and is paved with pebbles and cobbles as well as very smooth, water rounded stones and coral fragments. Three constructed pits are present on the platform surface. The perimeter of the platform consists of sloping piles of boulders. The northwest edge of the platform abuts a bedrock and soil area.

Pieces of broken pottery and glass, a possible mother of pearl cutting tool, a brass button (snap), several *'ili'ili* stones and a basalt adz were observed. The adz was collected (Acc. #110) for analysis. A wide variety of shell midden was also observed.

To the northwest of the platform ther are two areas of alteration to the outcrop. The first area is a smoothed sanding stone. The second area includes a U-shaped outcrop with a hollowed, smoothed depression for grinding; a worked grinding stone; a large flat water-rounded stone and; a large, dense, water-rounded boulder with a circular 0.1 m. deep



depression. Also present are small chunks of hematite.

Feature A is in fair to good condition. The excavation potential is considered excellent.

**Feature B** is a tri-level terrace modifying a bedrock outcrop. The terrace measures roughly 7.0 m. (23.0 ft.) E/W by 5.5 m. (18.0 ft.) N/S. It consists of rough alignments of large cobbles and small boulders - some water rounded - and is paved with small to medium cobbles on several levels modifying the outcrop. Coral fragments are present in the pavement.

Artifacts found include broken glass and pottery. *Cowrie, opihi, nerita picea, thaididae* were all observed in large quantities.

Feature B is in fair condition. Excavation potential is considered good.

**Feature C** is a wall, located 10.5 m. (34.7 ft.) to the east of Feature A, which extends *mauka* (east) for 15.5 m. (50.9 ft.) at 81° MN. The wall is tumbled and mounded, with no stacking or facing, and is constructed of cobbles and large boulders, some of which are water-rounded. An historic pipeline roughly parallels the wall.

Feature C is in poor condition and offers poor excavation potential.

**Feature D** is the *makai* (west) complex wall. It begins 9.0 m. (29.5 ft.) southeast of Feature A and extends south for 8.2 m. (26.9 ft.) at 160°MN. A bulldozed rock alignment continues *mauka* (east), north from the edge of the wall. The wall is constructed of cobbles and boulders. It measures 0.7 to 0.8 m. (2.3 to 2.6 ft.) high, and 0.9 m. (3.0 ft.) wide.

No artifacts or midden were observed.

Feature D is in fair condition and offers poor excavation potential.

**State site #:** 50-10-37-16716 **CSH Site #:** 386
**Site Type:** Site Complex
**Function:** Permanent habitation
**Features (#):** 5
**Site Dimension:** 1,152.0 m.$^2$ (12,441.6 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 80 ft. a.m.s.l.

**Description:** State site -16716 comprises 5 features designated A through E. The site is situated on a gentle grassy slope covered in *kiawe* with surrounding *koa haole*. The site complex is located within LCA 7197.

**Feature A** is a platform measuring 6.0 m. (19.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W, with a maximum height of 1.0 m. (3.3 ft.). It is constructed of stacked boulders and has a small boulder and cobble pavement. (Level 2 of the Feature D terrace connects with the southwest corner of this platform.)

No artifacts or midden were observed.

Feature A is in fair to good condition and offers fair to good excavation potential.

**Feature B** is a platform located 4.0 m. (13.1 ft.) west of Feature A. It measures 9.0 m. (29.5 ft.) N/S by 4.0 m. (13.1 ft.) E/W and has a maximum height of 1.1 m. (3.6 ft.). It is similar in construction to Feature A and connects with Level 1 of Feature D terrace at the southeast platform corner.

No midden or artifacts were observed.
Feature B is in fair to good condition and offers fair to good excavation potential.

**Feature C** is a mounded remnant wall segment situated just north of Features A and B. It measures approximately 7.0 m. (23.0 ft.) long and is constructed of boulders.

There are two small mounds present at the north end of the wall segment. They have a maximum height of 0.7 m. (2.3 ft.) and may once have been part of the wall.

No midden or artifacts were observed.
Feature C is in poor condition and offers poor excavation potential.

**Feature D** is a tri-level terrace situated at the south end of the site.

Level 1, the lowest, *makai* (west)-most level, measures 8.0 m. (26.2 ft.) N/S by 4.5 m. (14.4 ft.) E/W and has a maximum height of 1.0 m. (3.3 ft.) on the *makai* (west) side. It is constructed atop an outcrop and has intact boulder facing. It contains a level soil deposit with scattered cobbles.

Level 2 is situated 1.0 m. (3.3 ft.) above Level 1 and is similarly constructed. It measures 12.0 m. (39.4 ft.) N/S by 5.0 m. (16.4 ft.) E/W. Level 2 also contains a level soil area with scattered cobbles which is partially enclosed by Feature A platform.

Level 3 stands 1.0 m. (3.3 ft.) above Level 2 and measures 8.0 m. (26.2 ft.) NW/SE by 4.0 m. (13.1 ft.) NE/SW. It is constructed of boulders and cobbles; there is a level cobble pavement.

The terrace levels are connected on the south side by a wall that extends east-southeast beyond Level 3 for 13.0 m. (42.7 ft.). The wall - constructed of stacked boulders and cobbles - has an average width of 1.5 m. (4.9 ft.) and a maximum height of 0.8 m. (2.6 ft.) on the south side. The area north of the wall and east of Level 3 consists of exposed pahoehoe with small soil pockets.

No midden or artifacts were observed.
Feature D is in good condition and offers good excavation potential.

**State site #:** 50-10-37-16717 **CSH Site #:** 388
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 38.4 m.$^2$ (414.7 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16717 is a contiguous enclosure situated approximately 10.0 m. (32.8 ft.) south of the historic well and pump house on a level area 20.0 m. (65.6 ft.) *mauka* (east) of the canoe landing.

The enclosure measures 10.0 m. (32.8 ft.) N/S by 12.5 m. (41.3 ft.) E/W with a maximum height of 1.3 m. (4.3 ft.). The enclosure walls - mostly collapsed - are constructed of stacked and piled boulders and cobbles. The interior consists of soil with scattered cobbles and boulders. There is a wall extending north/south through the center of the enclosure, dividing it into two portions. There is an entrance - measuring 1.8 m. (5.9 ft.) wide - to the eastern portion along the south wall.

No artifacts or midden were observed.



State site -16717 is in fair to good condition and offers good excavation potential.

**State site #:** 50-10-37-16718 **CSH Site #:** 389
**Site Type:** Site complex
**Function:** Possible burial
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a*:** Ke'eke'e 2
**Elevation:** 60 ft. a.m.s.l.

**Description:** State site -16718 is a small complex consisting of 3 features designated A to C. The site is located in gently sloping terrain south of *Pu'u Ohao*, approximately 80.0 m. (262.4 ft.) to the southeast of *Puueo heiau* (State site 50-10-37-16719). The surrounding terrain is vegetated with clusters of grass and scattered *koa haole* and *kiawe* trees.

**Feature A** is a long, rectangular, bi-level platform. The entire platform measures 16.0 m. (52.5 ft.) NE/SW by 7.0 m. (23.0 ft.) NW/SE. The upper level comprises 4.3 m. (14.1 ft.) of the total platform length and is raised 0.5 m. (1.6 ft.) above the lower level. The platform is constructed of small to medium boulders with cobble paving. A large upright boulder slab - measuring 0.9 m. (3.0 ft.) high - was observed in the south wall. A small depression in the pavement (0.6 m. [2.0 ft.] in diameter) is directly adjacent to the upright. Two water-rounded stones surround this depression.

Sparse marine shell midden was observed and no artifacts were present.
Feature A is in fair condition. It is considered a possible burial.

**Feature B** is a square platform - measuring 3.0 m. (9.8 ft.) by 3.0 m. (9.8 ft.) - connected to the southwest corner of Feature A. The platform is poorly faced and has a mounded surface.

A small circular depression is located in its center. The depression measures 0.8 m. (2.6 ft.) in diameter and 0.8 m. (2.6 ft.) deep.

No midden or artifacts were observed.
The platform is in fair to poor condition. Feature B is interpreted as a possible burial.

**Feature C** is a mounded platform located 10.0 m. (32.8 ft.) north of Feature B. The platform is constructed of pahoehoe cobbles and boulders, with facing evident on the southeast edge. The surface of the platform is not level, following the slope of the surrounding area. The platform is roughly square with sides measuring approximately 5.0 m. (1.6 ft.) long and a maximum height of 1.2 m. The faced southeast edge measures 0.6 m. (1.6 ft.) high. No artifacts or midden were observed.

Feature C is in fair condition and is considered a possible burial.

**State site #:** 50-10-37-16719 **CSH Site #:** 390
**Site Type:** Enclosure
**Function:** Heiau
**Features (#):** 1
**Site Dimension:** 990.0 m.$^2$ (10,692.0 ft.$^2$)
***Ahupua'a*:** Ke'eke'e
**Elevation:** 35 ft. a.m.s.l.

**Description:** State site -16719 (Figure 43) is *Puueo heiau*. This *heiau* site consists of a large rectangular enclosure constructed of boulders and cobbles. The enclosure measures 33.0 m. (108.3 ft.) E/W by 30.0 m. (98.4 ft.) N/S and the walls generally range between 2.5 and 3.5 m. (8.2 and 11.5 ft.) in width with some sections tumbling out to 4.5 m. (14.8 ft.) in width. Vertical facing exists in isolated stretches along the exterior sides of the south and west walls. Maximum wall height is 1.2 m. (3.9 ft.). The south and north walls are in poor condition with several collapses and no observed facing. Two openings occur in the north and south walls. The north wall opening measures 4.0 m. (13.2 ft.) wide. A 3.0 m. (9.9 ft.) wall section extends to the northwest at the opening's west side. The south opening measures 4.0 m. (13.1 ft.) wide.

The interior of the enclosure is generally clear and level with exposed soil deposits and *kiawe*, *koa haole* and grass vegetation. There are 2 internal features. One terrace-like alignment of water-rounded stones lies approximately 5.0 m. (16.4 ft.) from the center of the south wall. The terrace runs parallel to the wall and measures approximately 6.0 m. (19.8 ft.) long and approximately 2.5 m. (8.2 ft.) wide. The second internal feature is a concentration of boulders and cobbles which may be a remnant platform. The platform is roughly square with sides measuring approximately 6.0 m. (19.8 ft.) long.

A modern barbed-wire fence runs through the enclosure in an east/west direction. Midden - mostly marine shell - is scattered within the enclosed area. Artifacts observed included a cut conus shell pendant or lure, basalt adz fragments, flakes, volcanic glass, and coral.

Overall, State site -16719 is in fair to poor condition with good excavation potential.

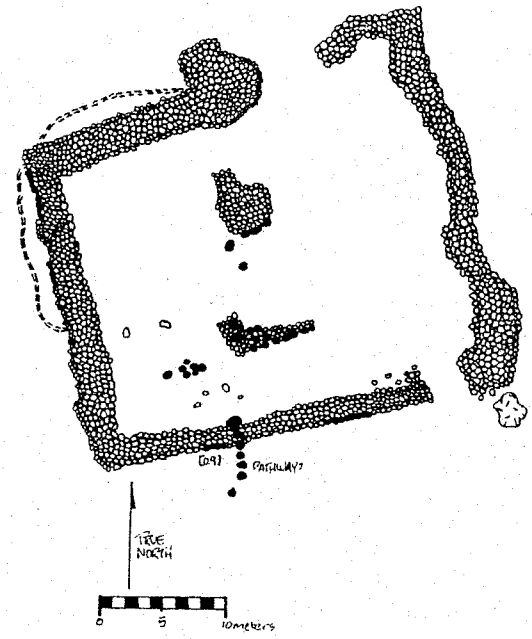
**State site #:** 50-10-37-16720 **CSH Site #:** 391
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 90.0 m.$^2$ (972.0 ft.$^2$)
***Ahupua'a*:** Ke'eke'e
**Elevation:** 75 ft. a.m.s.l.

**Description:** State site -16720 is a square enclosure situated at the southeastern foot of *Pu'u Ohau*. Grass, *koa haole*, and *kiawe* are growing in and around the site. It measures approximately 10.0 m. (32.8 ft.) N/S by 9.0 m. (29.5 ft.) E/W. The enclosure is constructed of medium-size rough pahoehoe boulders and is extremely tumbled. The walls measure approximately 2.0 m. (6.6 ft.) wide and 0.8 m. (2.6 ft.) high. The interior is soil.

No midden or artifacts were observed.

The condition of State site -16720 is poor and excavation potential is deemed poor.






Legend

Exposed Bedrock
Boulder Facing
Surface Feature Height (meters) 9
Direction of Slope
Waterworn Stone

Figure 43 State site 50-10-37-16719, Puueo *heiau*; plan view

**State site #:** 50-10-37-16721 **CSH Site #:** 392
**Site Type:** Site complex
**Function:** Possible burial
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Haleki'i
**Elevation:** 120 ft. a.m.s.l.

**Description:** State site -16721 comprises two features designated A and B. The surrounding vegetation is grass with scattered *kiawe* and *koa haole* trees.

**Feature A** is a small platform on the top of *Pu'u Ohau* on the southern side. The platform is somewhat circular in shape, with a rough pavement of small boulders. Some facing remnants are evident.

The platform measures 4.0 m. (13.2 ft.) N/S by 5.7 m. (18.8 ft.) E/W with a maximum height of 0.5 m. (1.7 ft.). In the center of the platform is a possible trench measuring approximately 1.0 m. (3.3 ft.) square and 0.9 m. (3.0 ft.) deep. The trench reveals soil beneath the platform.

No artifacts or midden were observed.

Feature A is in poor condition and is interpreted as a possible burial.

**Feature B** is a sloping platform located south of Feature A on the southern slope of the *pu'u*. The platform measures 4.0 m. (13.1 ft.) N/S by 8.0 m. (26.2 ft.) E/W. It is constructed of small to medium cobbles with no intact facing.

Many small water-rounded stones are present on the platform surface. Farther down the slope are scatters of water-rounded stones. Some *cowrie* midden was also observed downslope.

Feature B is in fair to poor condition and is interpreted as a possible burial.

**State site #:** 50-10-37-16722 **CSH Site #:** 393
**Site Type:** Mound
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 6.0 m.$^2$ (64.8 ft.$^2$)
***Ahupua'a:*** Haleki'i
**Elevation:** 170 ft. a.m.s.l.

**Description:** State site -16722 is a small mound on the grassy slope of *Pu'u Ohau*. The site is surrounded by California grass, *koa haole* and *kiawe*. The mound - constructed of small boulders with small to large cobble fill - measures approximately 2.0 m. (6.6 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.) on its south side. The mound has some facing on the south end.

Eight (8.0 m.) (26.2 ft.) to the south of the mound is a smaller less formal mound measuring approximately 1.5 m. (4.9 ft.) in diameter.

No artifacts or midden were observed.

State site -16722 is in fair to poor condition. It is deemed a possible burial site.



**State Site #:** 50-10-37-16723 **CSH Site #:** 394
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 4
**Site Dimension:** 9,775 m.$^2$ (105,570 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 2
**Elevation:** 75 ft. a.m.s.l.

**Description:** State site -16723 is a site complex comprising five features - designated A through E - situated to the south of *Pu'u Ohau* on a gentle *makai* (west) slope. The surrounding vegetation is grass, *kiawe*, *koa haole*, and lantana.

**Feature A** is a low mounded wall with an area of level pavement at its western end. The wall measures 36.0 m. (118.8 ft.) E/W with an average width of 5.0 m. (16.5 ft.). Average height is 0.3 m. (1.0 ft.). The paved area measures 8.0 m. (26.4 ft.) N/S by 12.0 m. (39.6 ft.) E/W and is roughly paved with small boulders.

No artifacts or midden were observed.

Feature A is in poor to fair condition.

**Feature B** is a series of three low, paved areas situated to the east of Feature A. The western most pavement measures 7.0 m. (23.1 ft.) E/W by 4.0 m. (13.2 ft.) N/S; the central pavement measures 11.0 m. (36.3 ft.) E/W by 5.0 m. (16.5 ft.) N/S; and the easternmost pavement measures 8.0 m. (26.4 ft.) E/W by 5.0 m. (16.5 ft.) N/S. Average height of the pavements is 0.4 m. (1.3 ft.). The pavements are constructed of medium to small boulders and are in fair condition.

**Feature C** is an enclosure - constructed of medium to small stacked boulders - situated to the south of Feature B and to the east of Feature A. The enclosure measures 16.0 m. (52.8 ft.) N/S by 15.0 m. (49.5 ft.) E/W (exterior) and 10.0 m. (33.0 ft.) E/W by 6.0 m. (19.8 ft.) N/S (interior); average height is 0.8 m.(2.6 ft.). Remnant facing is evident at the southwest and northwest corners; the rest of the enclosure walls are tumbled.

Feature C is in fair condition.

**Feature D** is a triangular enclosure situated to the southwest of features B and C. The enclosure measures 12.0 m. (39.6 ft.) E/W along the northern side, 10.0 m. (32.8 ft.) E/W along the southern side, and 12.0 m. (39.6 ft.) along the eastern side; maximum wall height is 2.0 m. (6.6 ft.). The enclosure walls are mounded and sloping. The fairly level soil interior measures 4.5 m. (14.9 ft.) E/W by 4.0 m. (13.2 ft.).

Feature D is in poor condition.

**Feature E** is a low mounded wall that forms a rough enclosure along its central portion. The wall measures approximately 52.0 m. (171.6 ft.) NE/SW with an average height of 0.8 m. (2.6 ft.). The wall is constructed of large to small boulders; most of the wall is mounded.

The attached enclosure measures 7.0 m. (23.1 ft.) E/W by 10.0 m. (32.8 ft.) N/S (interior). Average wall width is 3.0 m. (9.9 ft.). The interior of the enclosure is level soil. Approximately 40.0 m. (132.0 ft.) northeast of the southwest corner of the enclosure is *Puueo heiau* (State site 50-10-37-16719).

The feature is in fair condition with excavation potential considered fair.

**State site #:** 50-10-37-16724 **CSH Site #:** 395
**Site Type:** Platforms
**Function:** Probable burials
**Features (#):** 4
**Site Dimension:** (see below)
***Ahupua'a*:** Haleki'i
**Elevation:** 70 ft. a.m.s.l.

**Description:** State site -16724 is situated along the south edge of *Pu'u Ohau* at the top of a somewhat steep section. It consists of 4 small platforms which are connected by medium-sized boulder paving. The platforms measure from 2.0 to 4.0 m. (6.6 to 13.1 ft.) E/W by 2.0 to 3.0 m. (6.6 to 9.8 ft.) N/S and are constructed of the rough *a'a* boulders which are plentiful along the *pu'u*. The platforms have a commanding view to the south and of the project area - extending from the coast to *mauka* (east) above the highway.

No artifacts or midden were observed; however numerous *'ili'ili* stones were noticed along with a medium-sized triangular water-rounded stone on one of the platforms. Some coral was also observed.

State site -16724 is in fair condition. Due to their size and location, these are considered probable burial mounds.

**State site #:** 50-10-37-16725 **CSH Site #:** 396
**Site Type:** Site complex
**Function:** Probable burials
**Features (#):** 8
**Site Dimension:** (see below)
***Ahupua'a*:** Haleki'i
**Elevation:** 150 ft. a.m.s.l.

**Description:** State site -16725 comprises 8 rough mounds and platforms situated on the southwest slope of *Pu'u Ohau*. The surrounding vegetation consists of various shrubs, grasses, *kiawe* and *koa haole*. All the features are constructed of rough stacked a'a and pahoehoe boulders and cobbles. They range from 2.0 m. by 2.0 m. (6.6 ft.) to 4.0 m. (13.1 ft.) by 4.0 m. (21.8 ft.) with heights ranging from 0.4 m. (1.3 ft.) to 2.0 m. (6.6 ft.). A Paul H. Rosendahl Inc. site tag was observed at the site.

No midden or artifacts were observed on the features, but coral and *'ili'ili* stones were noted in the surrounding area. Some cement was observed on the largest mound.

State site -16725 is in poor condition and is interpreted as a probable burial site.



**State site #:** 50-10-37-16726 **CSH Site #:** 397
**Site Type:** Platform
**Function:** Probable burial
**Features (#):** 1
**Site Dimension:** 8.0 m.$^2$ (86.4 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 125 ft. a.m.s.l.

**Description:** State site -16726 is a small platform situated along the east side of *Pu'u Ohau*. It is very similar to the other probable or possible burial sites observed along the south side of the *pu'u*. It measures 4.0 m. (13.1 ft.) N/S by 2.0 m. (6.6 ft.) E/W with a maximum height of 0.1 m. (0.3 ft.) on the east side, and is constructed of stacked boulders and cobbles.

No artifacts or midden were observed. Water-worn stones were present.

State site -16726 is in fair to poor condition and is interpreted as a probable burial.

**State site #:** 50-10-37-16727 **CSH Site #:** 398
**Site Type:** Platform
**Function:** Probable burial
**Features (#):** 1
**Site Dimension:** 12.5 m.$^2$ (135.0 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 150 ft. a.m.s.l.

**Description:** State site -16727 is a remnant platform constructed of pahoehoe boulders and cobbles. The shape is roughly rectangular, measuring 5.0 m. (16.5 ft.) N/S by 2.5 m. (8.2 ft.) E/W. Large boulder, one-course high, facing remains on the north edge which measures a height of 0.9 m. (3.0 ft.). The platform is in poor condition and boulders are tumbled downslope to the east.

No artifacts or midden were observed.

State site -16727 is in poor condition. It is considered a probable burial site.

**State Site #:** 50-10-37-16728 **CSH Site #:** 401
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 9
**Site Dimension:** (see below)
***Ahupua'a*:** Ilikahi
**Elevation:** 30 ft. a.m.s.l.

**Description:** State site -16728 (Figure 44) is a site complex originally recorded by John Reinecke in 1930. The site is listed as a portion of State Site -1931 that includes all features south of the Nawawa "landing" and north of the bluff. These features were grouped into separate CSH sites according to Land Commission Award association, proximity, and construction styles. State site -16713 designates the features south of a *mauka/makai* (east/west) wall which is included in the State site -16728 map along the south boundary.

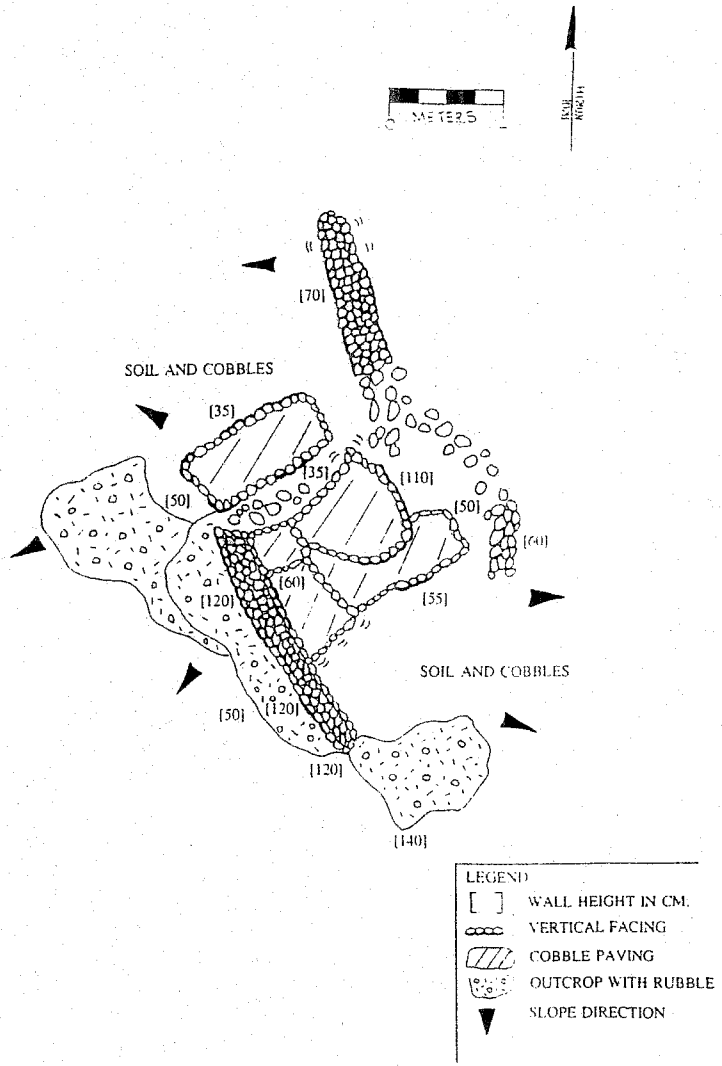



Figure 44 State site 50-10-37-16726: plan view



Distinguishing the age of features within the complex proved difficult due to historic and modern alterations to pre-historic features along with the probable creation of new features. A modern A-frame structure is located within the center of the complex. Due to this difficulty, Features A to F are assigned to those features observed by Reinecke in 1930 and Features G - I are assigned to features which appear to be older than the modern/late historic areas.

The pre-1930 complex includes 6 features extending from the edge of the shoreline ledge *mauka* (east) along moderately sloped terrain.

**Feature A** is a rectangular enclosure constructed along the *makai* (west) edge of the complex. The enclosure measures 15.0 m. (49.2 ft.) NW/SE by 6.2 m. (20.3 ft.) NE/SW. The enclosure wall is free standing along the north, west and east sides and abutting the slope buttressed by interior soil along the south side. The west wall continues to the southeast beyond the enclosure where it becomes free standing until branching off into 2 walls; one of which abuts the shoreline edge to the south and the other continues to the northeast and is included in State site -16711. The enclosure wall is constructed of rounded large cobbles and boulders which are well faced to a maximum 10 courses on the north side. The interior contains a partially exposed rounded cobble paved platform in the southeast corner which is flush with the ground.

An additional interior feature includes a rough linear terrace of cobble and boulders rising 0.2 m. (0.7 ft.) high on the west side. Both features may represent a single platform presently subsurface or subsequently dismantled. Two seats are constructed in the north wall section 0.2 m. (0.7 ft.) below the wall height which are roughly 0.5 m. (1.6 ft.) in diameter.

The formal entrance is located on the north wall and is 1.0 m. (3.3 ft.) wide and the floor is paved with pebbles and medium boulder slabs rising 0.2 m. (0.7 ft.). Another entrance can be found on the east side and is paved with cobbles.

Artifacts and midden are scattered along the interior terrace and a *papamu* board is sunken 0.5 m. (1.6 ft.) below the wall.

Feature A is in good condition.

**Feature B** is a paved terrace, some areas of which seem to be modern modifications but the overall structure is similar to that recorded by Reinecke. The terrace measures 5.0 m. (16.5 ft.) N/S by 12.0 m. (39.4 ft.) E/W and has vertical facing along the south, east and west sides. The north side abuts the slope. The maximum height is 1.3 m. (4.3 ft.) and is 12 boulder/cobble courses high. It is collapsed at present on the southwest side. There is another seat set into the south face which is 0.6 m. (2.0 ft.) above ground and 0.4 m. (1.3 ft.) below the terrace surface. The base slab is a *papamu* board. A low wall abuts the east end of the south face and rises 0.3 m. (1.0 ft.) above the ground. The north side becomes almost flush to the ground and is delineated by a cobble to small boulder alignment 0.3 m. (1.0 ft.) high. The surface of the terrace is roughly paved with subangular pebbles and cobbles and some scattered cobbles.

Artifacts observed included a *papamu*, occasional shell midden (*Conus* sp.) and coral.

Feature B is in good condition.

**Feature C** is a small roughly square enclosure measuring 4.0 m. (13.1 ft.) in diameter, with a partially collapsed wall 1.0 m. to 1.3 m. (3.3 to 4.3 ft.) wide. Its maximum height is 0.6 m. (2.0 ft.) and is 4 courses high with large cobble to small boulder construction. The interior is covered with clearing debris.

No artifacts or midden were observed.

Feature C is in fair condition but dilapidated since Reinecke recorded it.

**Feature D** is a roughly boulder wall roughly 6.5 m. (21.3 ft.) N/S. This wall collapsed to a rough linear pavement 2.0 m. (6.6 ft.) E/W and the south end appears to be a modern modification with a raised construction of boulders and cobbles faced 4 cobbles high to a maximum 0.8 m. (2.6 ft.) high. This portion delineates the walkway between Feature D and B and has an adjacent stepping stone between the two older portions of the feature which have lichen growing on them. The central surface is not visible due to clearing debris pile.

**Feature E** is a rectangular enclosure measuring 9.0 m. (29.5 ft.) E/W by 8.0 m. (26.2 ft.) N/S attached on its north side with a *mauka/makai* (east/west) wall. This wall continues farther than was recorded by Reinecke and the continuation may be a modern modification. Only portions of the feature perimeter are visible due to the presence of a large clearing debris pile and miscellaneous garbage.

The exterior is faced with boulders and large cobbles up to 8 courses of cobbles on the east side. There may be modern stacking on the east side. The west side is paved with cobbles in its northwest corner. The interior is covered with debris.

**Feature F** is a large terrace measuring 17.0 m. (55.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W with the south end paving going back another 10.0 m. (32.8 ft.) E/W. It has a vertical facing along the west and corner portion of the north end. The west face rises to 1.9 m. 6.2 ft.) high (7 to 8 boulder courses high). The south side is raised with a sloped face of collapse. The east side abuts the slope where there is loose soil on the ground and is level with the terrace. The terrace is 2-tiered; the upper tier is delineated by a 1-2 course cobble facing rising 0.3 m. (1.0 ft.) above the lower tier. The upper tier surface is uneven with boulders and some cobbles. The lower tier is more level with cobbles and boulders construction. A level boulder pavement is located within the lower iter. the north end slopes moderately.
Feature F is a probable house foundation central to the LCA perhaps.

Artifacts observed included a *papamu* at 3.0 m. (9.8 ft.) northeast and an olive oil bottle to the west of the feature.

Feature F is in fair to good condition.

**Feature G** is a rough T-shaped platform measuring 4.0 m. (13.1 ft.) N/S along the stem of the T and 5.0 m. (16.4 ft.) E/W across the top of the T. This platform is constructed of large cobbles with a pebble and cobble paving. A *kiawe* trunk protrudes through the center of this platform. The construction appears modern to irregular shape and non-lichen growth. It is unclear whether the construction pre-or post-dates the growth.

This platform is constructed of large cobble facing and pebble to cobble paving. There are some small boulders on the surface.

Artifacts observed included an *ulumaika* and hammerstone, 2 adz preforms, 3 coral abraders, and a net sinker. It is felt that these artifacts were collected elsewhere.

**Feature H** is a linear platform measuring 4.5 m. (14.8 ft.) NE/SW by 1.0 m. (3.3 ft.) NW/SE and ranges from 0.5 to 1.5 m. (1.6 to 4.9 ft.) high. It has a large cobble facing using intermittent angular pebbles and cobbles for paving. Again, a *kiawe* tree is growing from the surface and it is unclear whether the construction pre-or post-dates the growth.

**Feature I** is a roughly oblong platform measuring 4.0 m. (13.1 ft.) N/S by 2.5 m. (8.2 ft.) E/W with cobble facing with pebble and cobble paving and some small boulders. The feature is located adjacent to the *papamu* mentioned in Feature F.



Summary: Features A - F represent traditional Hawaiian site based on the condition of the features and Reinecke's survey. It is unclear how these features relate to State site 16711. The south wall may represent the edge of an LCA and thus can be considered a site boundary.

**State Site #:** 50-10-37-16729 **CSH Site #:** 402
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 45.0 m.$^2$ (486.0 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16729 consists of a platform and modified outcrop situated on the eastern edge of Nawawa landing. The modification to the outcrop is oriented north/south consists of well stacked basalt boulders and water-rounded coral cobbles. It measures 9.0 m. (29.5 ft.) N/S with a maximum height of 0.9 m. (3.0 ft.). The platform, situated directly to the east of the modified outcrop, measures 6.5 m. (21.3 ft.) N/S and ranges from 3.0 m. to 4.0 m. (9.8 to 13.1 ft.) E/W and incorporates numerous water-rounded boulders in its construction. The platform is well faced on the north, south and west sides with an average height of 1.0 m. (3.3 ft.). The east side is constructed against the sloping pahoehoe flow with a maximum height of 0.3 m. (1.0 ft.). The surface of the platform is fairly level with a cobbles and boulders pavement. The platform and surrounding terrain is heavily overgrown with *kiawe*.

Midden and historic artifacts were observed scattered around the site.

State site -16729 is in fair to good condition.

**State Site #:** 50-10-37-16730 **CSH Site #:** 403
**Site Type:** Alignments
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** Indeterminate
***Ahupua'a*:** Ilikahi
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16730 is a number of alignments (6) along the coast which may have been part of a previous house site. They are located 40.0 m. (131.2 ft.) from the well at Nawawa landing. The alignments are constructed of well stacked boulder (the majority being water rounded). The alignments are arranged in such a way to form approximately five terrace areas of level soil. The overall site measures approximately 24.0 m. (79.2 ft.) E/W by 18.5 m. (61.0 ft.). The main alignment follows the contour of the coast and measures 27.0 m. (89.1 ft.). At the eastern end of the alignment five alignments extend off the main alignment at right angles. The secondary alignments have an average length of 5.0 m. (16.5 ft.).

The site appears to have been used both historically and in modern time as a campsite due to the historic and modern trash observed scattered about the site. Large amounts of

shell and coral midden were observed.

The condition of State site -16730 is poor and the excavation potential is considered good.

**State Site #:** 50-10-37-16732 **CSH Site #:** 406
**Site Type:** Platform
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** 25.0 m.$^2$ (270.0 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 60 ft. a.m.s.l.

**Description:** State site -16732 is a rectangular platform located on a pahoehoe outcrop which is situated about 15.0 m. (49.2 ft.) from the coastal cliff. This platform has a commanding view of Kailua and the southern coast. Surrounding the platform are informal mounds that appear to be agricultural. The vegetation is grass, scattered *kiawe*, *koa haole* and lantana.

The platform measures 5.0 m. (16.4 ft.) N/S by 5.0 m. (16.4 ft.) E/W and is 1.1 m. (3.6 ft.) high. It is constructed of piled large cobbles to small boulders. Facing exists on the north side. Approximately 25.0 m. (82 ft.) north of the platform is a small faced mound 2.5 m. (8.2 ft.) square. It is constructed of small to large cobbles with a maximum height of 0.9 m. (3.0 ft.). The mound is faced on all except the eastern edge.

No midden or artifacts were observed.

State site -16732 is in fair to poor condition.

**State Site #:** 50-10-37-16733 **CSH Site #:** 407
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** (see below)
***Ahupua'a*:** Kanaueue
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16733 consists of 3 features situated at the edge of the sea cliff on the eastern slope of Pu'u Ohau. Feature A is a wall which connects 2 platforms (Features B and C). The surrounding vegetation consists of *kiawe*, *koa haole*, and grasses.

**Feature A** is a enclosure which connects Features B and C and encloses a large area around Feature B. It consists of three lengths and the cliff edge. The wall is constructed of cobbles and boulders. Most of the wall is now collapsed but where it is still standing it ranges from 0.8 to 0.9 m. (2.6 to 3.0 ft.) wide and 1.1 m. (3.6 ft.)high with good vertical facing. The collapsed sections have a maximum width of 3.0 m. (9.8 ft.) and a maximum height of 0.6 m. (2.0 ft.).



**Feature B** is a rectangular platform located near the southeast corner of Feature A. The platform measures 8.0 m. (26.4 ft.) NE/SW by 5.0 m. (16.4 ft.) NW/SE and has a maximum height of 0.5 m. (1.6 ft.). It is constructed of cobbles and boulders with occasional water-rounded stones. The sides of the platform are completely collapsed.

No midden or artifacts are observed.

Feature B is in poor condition and offers fair to good excavation potential.

**Feature C** is a bi-level platform situated on the outer edge of the northern portion of the complex. The platform measures 8.0 m. (26.2 ft.) N/S by 8.0 m. (26.2 ft.) E/W. and consists of an inner and outer wall. The inner wall has a maximum height of 1.1 m. (3.6 ft.) and the outer wall has a maximum height of 0.4 m. (1.3 ft.). It is constructed of cobbles and boulders.

No artifacts or midden were observed.

Feature C is in poor condition and offers fair to good excavation potential.

**State Site #:** 50-10-37-16734 **CSH Site #:** 408
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a*:** Kanaueue
**Elevation:** 60 ft. a.m.s.l.

**Description:** State site -16734 consists of 3 features situated 70.0 m. (229.6 ft.) east of the sea cliff in a area of level terrain. The surrounding vegetation consists of grass with scattered *koa haole*, *kiawe*, and lantana.

**Feature A** is an enclosure measuring 7.0 m. (23.0 ft.) N/S by 6.0 m. (19.8 ft.) E/W with a height of 0.5 m. (1.6 ft.). This feature is constructed of stacked small cobbles to small boulders. There is remnant facing but most of the walls are tumbled. The interior is soil and scattered rocks.

No artifacts were observed and there are scattered chunks of coral.

The condition of the enclosure is poor and excavation potential is considered fair. The enclosure is considered a permanent habitation feature.

**Feature B** is a small square platform 21.7 m. (71.2 ft.) south of Feature A at 160° TN. This feature measures 2.5 m. (8.2 ft.) N/S and E/W and has a maximum height of 0.9 m. (2.9 ft.) and is constructed of cobbles piled with facing on 3 sides. The one side not faced has been tumbled.

No midden or artifacts are observed.

The condition of this feature is fair to good. The platform is considered a possible burial.

**Feature C** is a bi-level platform situated east of Features A and B. The feature is on higher terrain than the other features. The surrounding vegetation is the same as the other features. The lower level, of the platform, is constructed of small to large cobbles with cobble paving in the southwest corner. There is a small blister which may have collapsed after the construction of the platform. Within the interior of the blister soil, rocks, and a small amount

of coral were observed. On the north edge of the platform there seems to be a ramp entrance. There are remnants of facing on all sides, however on the edge it is almost flush with the ground.

Scattered around the platform are chunks of coral. No other midden or artifacts were observed.

No artifacts or midden were observed.

The excavation potential is considered good. This feature is considered a permanent habitation site.

**State Site #:** 50-10-37-16735 **CSH Site #:** 409
**Site Type:** Platform remnant
**Function:** Indeterminate
**Features (#):** 1
**Site Dimension:** Indeterminate
***Ahupua'a:*** Kanaueue
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16735 is the remnant of a rough platform situated just within the tree line along the coast north of Pu'u Ohau. The surrounding vegetation includes well grazed grass, *kiawe*, *koa haole*, and lantana which is dense around Pu'u Ohau.

This platform is constructed of stacked a'a boulders with a few intermixed water-rounded boulders. The site is in poor condition.

No artifacts were observed but midden includes coral, *pipipi*, cowrie and *Thaididae*.

Three small lava blisters were observed in the general vicinity of the platform. The *makai* (west)-most blister is approximately 2.0 m. (6.6 ft.) in diameter and 1.0 m. (3.3 ft) deep. There is no sign of any material culture or modifications. Approximately 23.0 m. (75.0 ft.) *mauka* (east) of the first blister is a larger blister, oval in shape measuring 2.0 m. (6.6 ft.) E/W by 3.0 m. (9.8 ft.) N/S with a depth of 2.0 m. (6.6 ft.). There are slight modifications consisting of some piling of small boulders and cobbles in the northern portion of the blister. A mounded boulder and cobble wall extends off the north side for 3.0 m. (9.8 ft.) and off the south side for 10.0 m. (32.8 ft.) It averages 0.7 m. (2.3 ft.) high but is mostly collapsed. The wall on the south side leads to another blister 3.0 m. (9.8 ft.) in diameter and 0.2 m. (0.7 ft.) deep. The northern portion is modified to form a rough terrace like feature. A small blister-like hole, 3.0 m. (9.8 ft.) to the north, has a large water-rounded boulder in it and a small boulder filled crack extending off the blister.

**State Site #:** 50-10-37-16736 **CSH Site #:** 410
**Site Type:** Mound
**Function:** Possible burial
**Features (#):** 1
**Site Dimension:** Indeterminate
***Ahupua'a:*** Kanaueue
**Elevation:** 30 ft. a.m.s.l.

**Description:** State site -16736 is a mound constructed of piled boulders on a flat portion of the pahoehoe flow. The surrounding vegetation is *kiawe*, *koa haole*, and grass.



Coral was observed around the site.

State site -16736 is in poor condition and is considered a possible burial site.

**State Site #:** 50-10-37-16737 **CSH Site #:** 411
**Site Type:** Enclosure
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 104.0 m.$^2$ (1123.2 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 20 ft. a.m.s.l.

**Description:** State site -16737 (Figure 45) is an enclosure situated near the coast on gently undulating terrain amongst *kiawe* and *koa haole* trees. It measures 12.0 m. (39.4 ft.) N/S by 8.0 m. (26.2 ft.)E/W with a maximum height of 0.8 m. (2.6 ft.). The walls are constructed of piled and stacked boulders and cobbles with an approximate width of 0.7 m. (2.3 ft.). The only facing remains along the east wall. The interior consists of a level soil deposit with cobbles scattered about due to wall collapse. There is a small platform built into the south wall of the enclosure. The platform measures 1.5 m. (4.9 ft.) square, oriented N/S. It is constructed with boulder facing and has a level cobble pavement.

No artifacts or midden were observed.

State site -16737 is in poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16738 **CSH Site #:** 412
**Site Type:** Lava blisters
**Function:** Agriculture
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a:*** Kanaueue
**Elevation:** 20 ft. a.m.s.l.

**Description:** State site -16738 consists of three small rock blisters in a pahoehoe flow, on the northwest side of an east/west oriented wall.

The most *makai* (west) blister is approximately 2.0 m. (6.6 ft.) in diameter and 1.0 m. (3.3 ft.) deep. No cultural modifications or remains were observed.

Approximately 22.8 m. (75 ft.) *mauka* (east) of the *makai* (west) blister is a larger blister; it is oval in shape and measures 2.0 m. (6.6 ft.) E/W by 3.0 m. (9.8 ft.) N/S and 2.0 m. (6.6 ft.) deep. There are minor modifications consisting of some piling of small boulders and cobbles in the northern portion of the blister. A mounded boulder and cobble wall extends off to the north of the *mauka* (east) blister for 3.0 m. (9.8 ft.) and then diverts to the south for 10.0 m. (32.8 ft.) where it intersects the third blister. This wall is in collapsed condition and averages 0.7 m. (2.3 ft.) high.

The third blister measures approximately 3.0 m. in diameter and it is 2.0 m. (6.6 ft.) deep. Small modifications exist in the northern portion. There is also a small platform-like feature with no apparent facing. Three (3.0) meters (9.8 ft.) to the north is a small hole in the pahoehoe with large water-rounded boulders and a filled crack with small boulders.

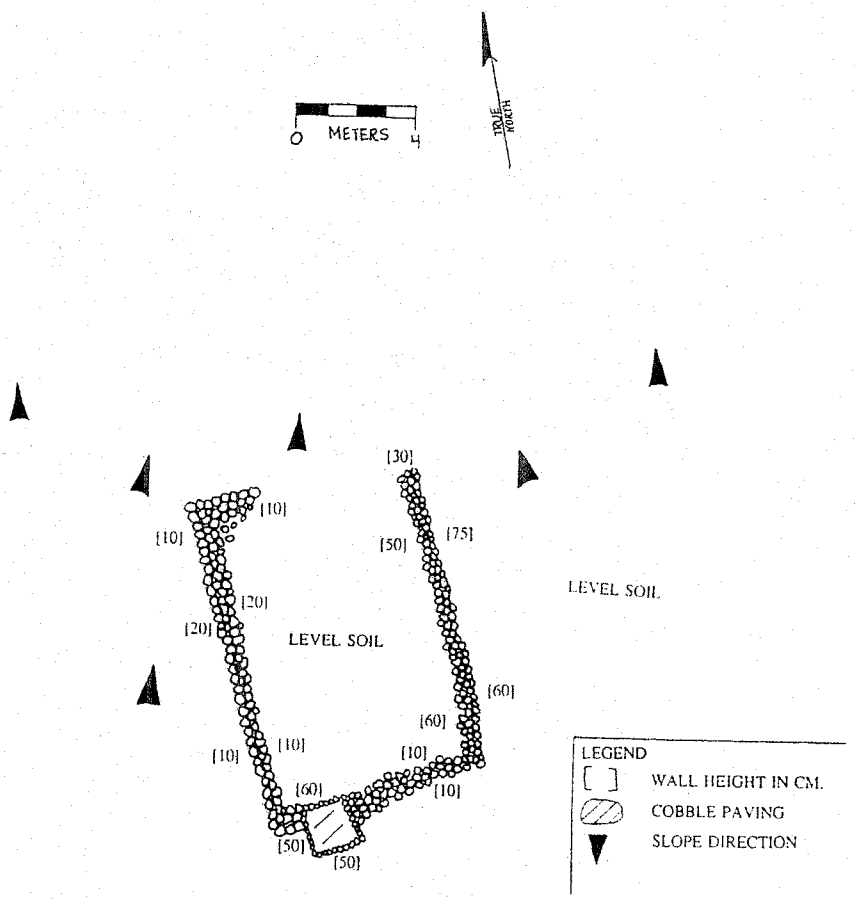



Figure 46 State site 50-10-37-16737; plan view



**State Site #:** 50-10-37-16739 **CSH Site #:** 413
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a:*** Kanaueue
**Elevation:** 30 ft. a.m.s.l.

**Description:** State site -16739 consists of three modified lava blisters designated A through C. A wall extends from the first to the third blister described below. This site was previously recorded by Paul H. Rosendahl Inc.

**Feature A** is a blister located in an area where rocks have been set into the outcrop to level the surface. The depth of the blister is approximately 1.2 m. (3.9 ft.); the blister floor is a paving covered with tumble from the wall above. There are small overhangs all around the blister but none are deeper than 0.6 m. (2.0 ft.).

A wall extends 10.0 m.0 (32.8 ft.) from the first blister to the second one.

**Feature B** is a second blister, slightly larger than the first. The wall from the first blister leads up to this second blister, then continues on the far side of this blister. The bottom of this blister is bedrock and soil. No midden or artifacts were observed. The blister measures approximately 1.7 m. (4.6 ft.) in diameter.

**Feature C** is the largest of the site's blisters. There are soil deposits but no observable midden or artifacts. The uneven floor of this blister is mostly bedrock.

**State Site #:** 50-10-37-16740 **CSH Site #:** 415
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** 875.0 m.$^2$ (9,450.0 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 5 ft. a.m.s.l.

**Description:** State site -16740 consists of 3 features; a wall section, and two platforms designated features A-C respectively. The site complex is located near the tree line along the coast. The surrounding terrain is level and vegetated with *kiawe*, *koa haole* and California grass. Much of the terrain is exposed pahoehoe.

**Feature A** is a wall section measuring 8.5 m. (27.9 ft.) E/W by 1.5 m. (4.9 ft.) in width with and average height of 0.6 m. (2.0 ft.). It is the southern-most feature and is constructed of medium to small stacked boulders and cobble. The wall is probably core filled.

A few water-rounded boulders and cobbles were observed. The west end of the wall abuts the pahoehoe outcrop.

Feature A is in fair condition and offers poor excavation potential.

**Feature B** is a platform located 6.0 m. (19.8 ft.) to the N/NE of Feature A. The platform measures 7.6 m. (24.9 ft.) N/S by 7.5 m. (24.6 ft.) E/W. The platform is constructed

of medium to large water-rounded boulders and basalt boulders. The western face is 0.3 m. (1.0 ft.) in height while the eastern face averages 0.7 m. (23.0 ft.) in height. The western portion of the platform is level and is paved with coral and basalt pebbles. The eastern portion consists of level 'a'a cobble paving with piles of coral and water-rounded cobbles on the surface of the platform. The eastern and western portions of the platform are delineated by an alignment of basalt slabs oriented N/S. A small roughly level area of basalt boulders extends off the northern end of the platform.

A few pieces of historic ceramics and bottle glass were observed along with large quantities of varied shell midden.

Feature B is in good condition and offers good excavation potential.

**Feature C** is located 9.0 m. (29.5 ft.) to the north of Feature B and consists of two low, adjoining platforms. The southern-most of the two is constructed similarly to Feature B with the western portion being paved with small coral and basalt pebbles. The outer perimeter, of the platform, is delineated by water-rounded boulders stacked approximately 0.5 m. (1.6 ft.) high. The eastern portion consists of 'a'a cobbles with coral and small boulders and with an average height of 0.4 m. (1.3 ft.). The surface is level with some coral scattered about. Adjacent to the southern platform is a small sink that has been partially filled with cobbles and small boulders.

Directly *makai* (west) is a boulder wall oriented in a N/S direction that continues to the north and appears to have been cut by a road but continues on the other side of the road.

**State Site #:** 50-10-37-16741 **CSH Site #:** 416
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 8
**Site Dimension:** 216.5 m.$^2$ (2,338.0 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16741 (Figure 46) is a site complex consisting of eight features designated A through H. The site is situated on rough pahoehoe terrain with intermittent soil areas. It is vegetated with *kiawe, haole koa*, and California grass.

**Feature A** is a rectangular paved depression measuring 5.0 m. (16.4 ft.) N/S by 5.5 m. (18.0 ft.) E/W. It is constructed of small to medium cobbles piled one to two courses high.

No artifacts or midden were observed.

Feature A is in fair to poor condition and offers fair excavation potential.

**Feature B** is a platform measuring 5.0 m. (16.4 ft.) N/S by 7.0 m. (E/W) with a maximum height of 0.4 m. (1.3 ft.). It is constructed of piled and stacked boulder facing with a cobble fill. Much of the facing has collapsed.

No artifacts or midden were observed.

Feature B is in fair condition with good excavation potential.



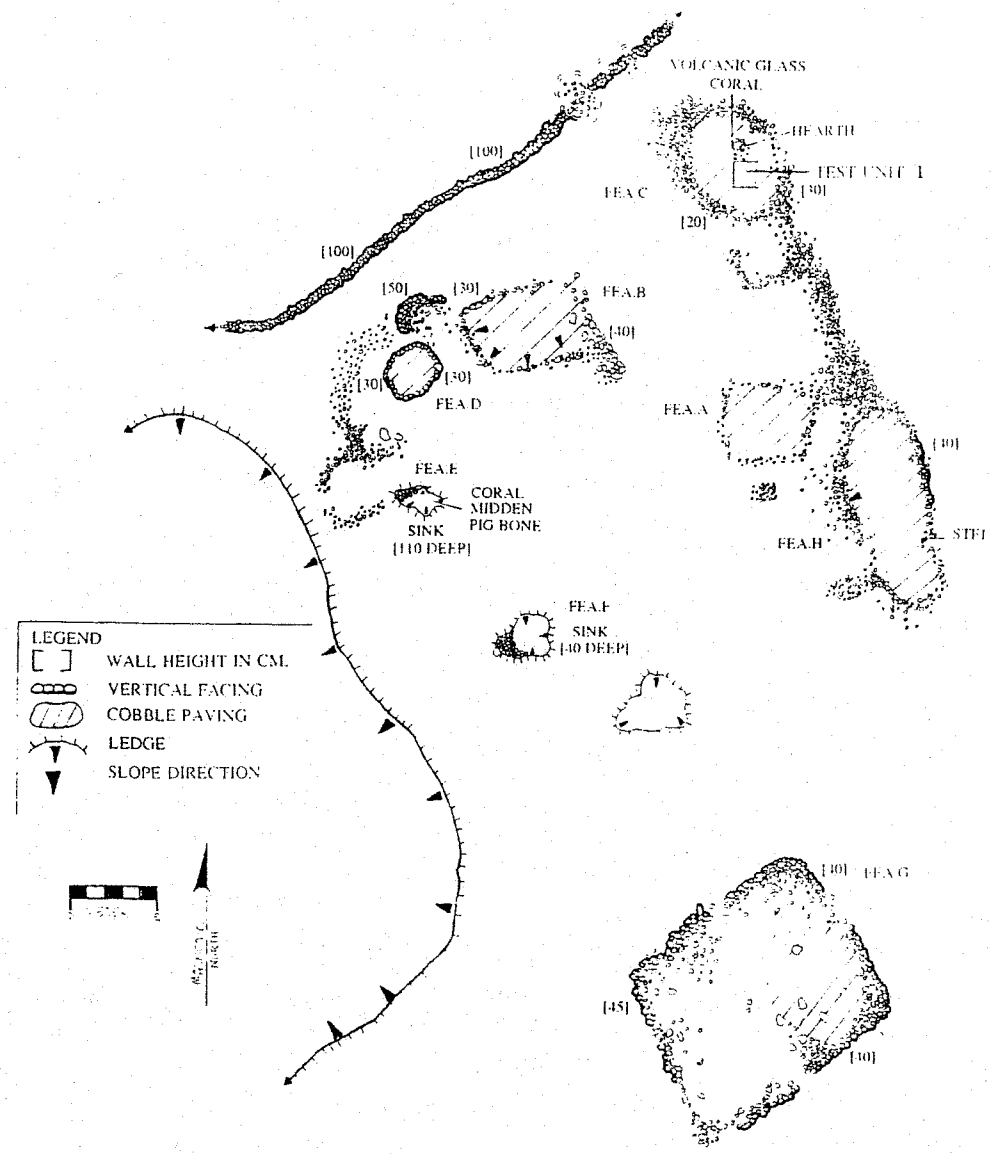



Figure 47 State site 50-10-37-16741; plan view

**Feature C** is an oval-shaped platform which measures 10.0 m. (32.8 ft.) NW/SE by 6.0 m. (19.8 ft.) NE/SW with a maximum height of 0.3 m. (1.0 ft.). It is constructed of piled boulders with a small cobble pavement. There is a wall connecting to the northwest and southeast sides of the platform. A small depression - probable hearth -lined with cobbles is present on the platform surface.

A volcanic glass flake was observed within the hearth, as well as coral and a water-rounded stone.

**Feature D** is a burial platform measuring 3.5 m. (11.5 ft.) NE/SW by 3.0 m. (3.8 ft.), located 3.0 m. (9.8 ft.) southwest of Feature B. It is faced with boulders and has a cobble pavement. There is a slight depression on the southeast side of the platform which measures 0.3 m. (1.0 ft.) deep and is faced with cobbles.

Feature D is in fair to good condition.

Testing Results:

Limited subsurface testing was conducted at State site -16741 (Feature D) which consisted of a 1.0 $m.^2$ (10.8 $ft.^2$) trench located in the center of the mounded platform.

**Feature E** is a modified sink located 6.0 m. (19.8 ft.) south of Feature E. The sink measures 2.5 m. (8.2 ft.) in diameter with a maximum depth of 1.1 m. (3.6 ft.). Walls were constructed around the perimeter of the blister. The interior is paved with cobbles and has a small soil deposit. Coral and pig bone were observed within the sink.

Feature E is in poor to fair condition with fair excavation potential.

**Feature F** is another modified sink located southeast of Feature E. This sink measures 3.0 m (9.8 ft.) N/S by 3.5 m. (11.5 ft.) with a maximum depth of 0.4 m. (1.3 ft.). The interior is paved with cobbles.

Feature F is in fair condition and offers fair excavation potential.

**Feature G** is a large enclosure located at the south end of the complex. It measures 14.0 m. (45.9 ft.) NE/SW by 12.0 m. (39.4 ft.) NW/SE with a maximum wall height of 0.5 m. (1.6 ft.). The walls are constructed of large cobbles to large boulders. Much of the facing has collapsed. The interior consists mainly of soil, although there is also a rough cobble pavement in the east corner. An upright stone is located at the north end of the northwest facing wall. The upright stands 1.1 m. (3.6 ft.) tall.

No artifacts or midden were observed.

Feature G is in fair condition and has good excavation potential.

**Feature H** is an oval-shaped platform located at the east end of the site complex, adjacent to Feature A. It measures 14.0 m. (45.9 ft.) N/S by 6.5 m. (21.3 ft.) E/W with a maximum height of 0.4 m. (13.1 ft.). It is constructed of a boulder facing and has a level cobble pavement. Much of the facing has collapsed. The platform is contiguous to a wall at its north corner. This wall connects Feature H platform with Features A and C.

No artifacts or midden were observed.

Feature H is in fair condition with good excavation potential.



**State Site #:** 50-10-37-16742 **CSH Site #:** 417
**Site Type:** Site complex
**Function:** Agriculture
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16742 is a site complex consisting of two enclosures situated at the edge of the tidal zone just *makai* (west) of a coastal access road. Vegetation consists of *kiawe*, *koa haole*, and grasses.

**Feature A** is an enclosure which measures 18.0 m. (59.0 ft.) NW/SE by 12.0 m. (39.4 ft.) NE/SW. The enclosure abuts an outcrop to the east, incorporating the outcrop face as part of the enclosure. The north, south, and west enclosure walls consist of stacked boulders and cobbles with a maximum width of 0.8 m. (2.6 ft.) and a maximum height of 1.1 m. (3.6 ft.). Portions of the west and south walls have collapsed. The interior of the enclosure is a level sand floor.

Midden was observed within the enclosure. A cowrie shell scraper was also observed.

Feature A is in fair to good condition and offers good excavation potential.

**Feature B** is an enclosure which measures 6.5 m. (21.3 ft.) N/S by 4.5 m. (14.8 ft.) E/W with a maximum height of 0.7 m. (2.0 ft.). It is constructed of boulders and cobbles on the south and west sides, and utilizes outcrop for the north and east walls. The interior consists of a sand floor.

No artifacts were observed although scattered midden was observed within the enclosure.

Feature B is in good condition and offers good excavation potential.

**State Site #:** 50-10-37-16743 **CSH Site #:** 418
**Site Type:** Site complex
**Function:** Burials
**Features (#):** 3
**Site Dimension:** 651.0 $m.^2$ (7,030.8 $ft.^2$)
***Ahupua'a:*** Hokukano 2
**Elevation:** 20 ft. a.m.s.l.

**Description:** State site -16743 (Figure 47) is a site complex consisting of three features designated A to C. The site is situated on rough pahoehoe terrain with intermittent soil areas. Site vegetation consists of cat's claw, *kiawe* and *koa haole* trees.

**Feature A** platform measures 3.1 m. (10.2 ft.) N/S by 3.4 m. (11.2 ft.) E/W with a maximum height of 0.9 m. (3.3 ft.). It is faced with small to medium boulders with a level small to large cobble pavement. There is a large, flat boulder set into the center of the platform. It is considered to be a possible capstone covering an underlying crypt.

No artifacts or midden were observed.

Feature A is interpreted as a probable burial platform; it is in good condition.

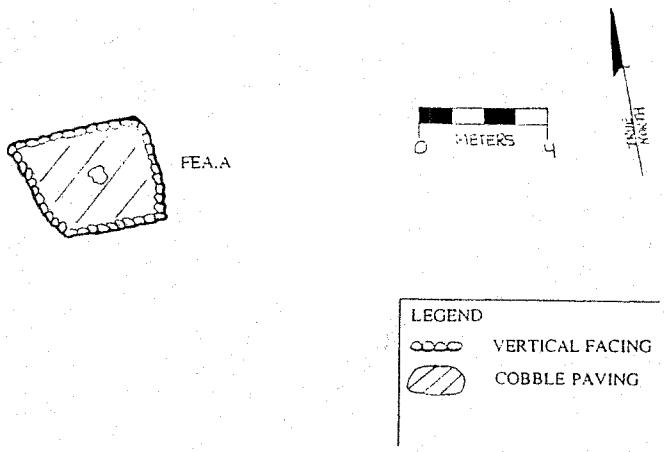



Figure 48 State site 50-10-37-16743; plan view



**Feature B** is a terrace located 13.0 m. (42.6 ft.) south of Feature A. The terrace is situated within a small blister. It measures 3.5 m. (11.5 ft.) N/S by 5.5 m. (18.0 ft.) with a maximum height of 0.8 m. (2.6 ft.). It is constructed with a boulder facing and has a cobble pavement. The terrace utilizes the north wall of the blister in its construction.

No artifacts or midden were observed.

Feature B is in good condition. It is interpreted as a probable burial platform.

**Feature C** comprises four platforms located 4.0 m. (13.1 ft.) south of Feature B. The smallest platform measures 2.5 m. (8.2 ft.) NW/SE by 2.0 m. (6.6 ft.) NE/SW with a maximum height of 0.5 m. (1.6 ft.). The largest platform measures 4.5 m. (14.8 ft.) NW/SE by 2.3 m. (7.5 ft.) NE/SW with a maximum height of 0.5 m. (1.6 ft.). The platforms are similar in construction, with boulder facing on all sides and a level small to large cobble pavement on the surface.

No artifacts or midden were observed.

Feature C is in good condition. All of the platforms are interpreted as probable burials. The largest platform tested positive for human remains.

**State Site #:** 50-10-37-16744 **CSH Site #:** 419
**Site Type:** Lava blister
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** 1.0 m.$^2$ (10.8 ft.$^2$)
***Ahupua'a:*** Hokukano 2
**Elevation:** 20 ft. a.m.s.l.

**Description:** State site -16744 is a small lava blister in pahoehoe outcrop, surrounded by *koa haole* and *kiawe* trees.

It measures 1.0 m. (3.3 ft.) in diameter with a maximum depth of 0.4 m. (1.3 ft.). No apparent modifications are present within the blister.

Coral, coconut shell fragments, and a historic metal fragment were observed within the blister.

State site -16744 is in poor condition and it has poor excavation potential.

**State Site #:** 50-10-37-16745 **CSH Site #:** 420
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 5
**Site Dimension:** 1,600.0 m.$^2$ (17,280.0 ft.$^2$)
***Ahupua'a:*** Hokukano 2
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16745 (Figure 48) is a site complex comprising five features designated A to E. The site is situated near the coast at Coconut Beach. The terrain consists of a rough pahoehoe flow covered with *koa haole* and *kiawe* trees.

The site complex contains an enclosing wall which extends from the west end of

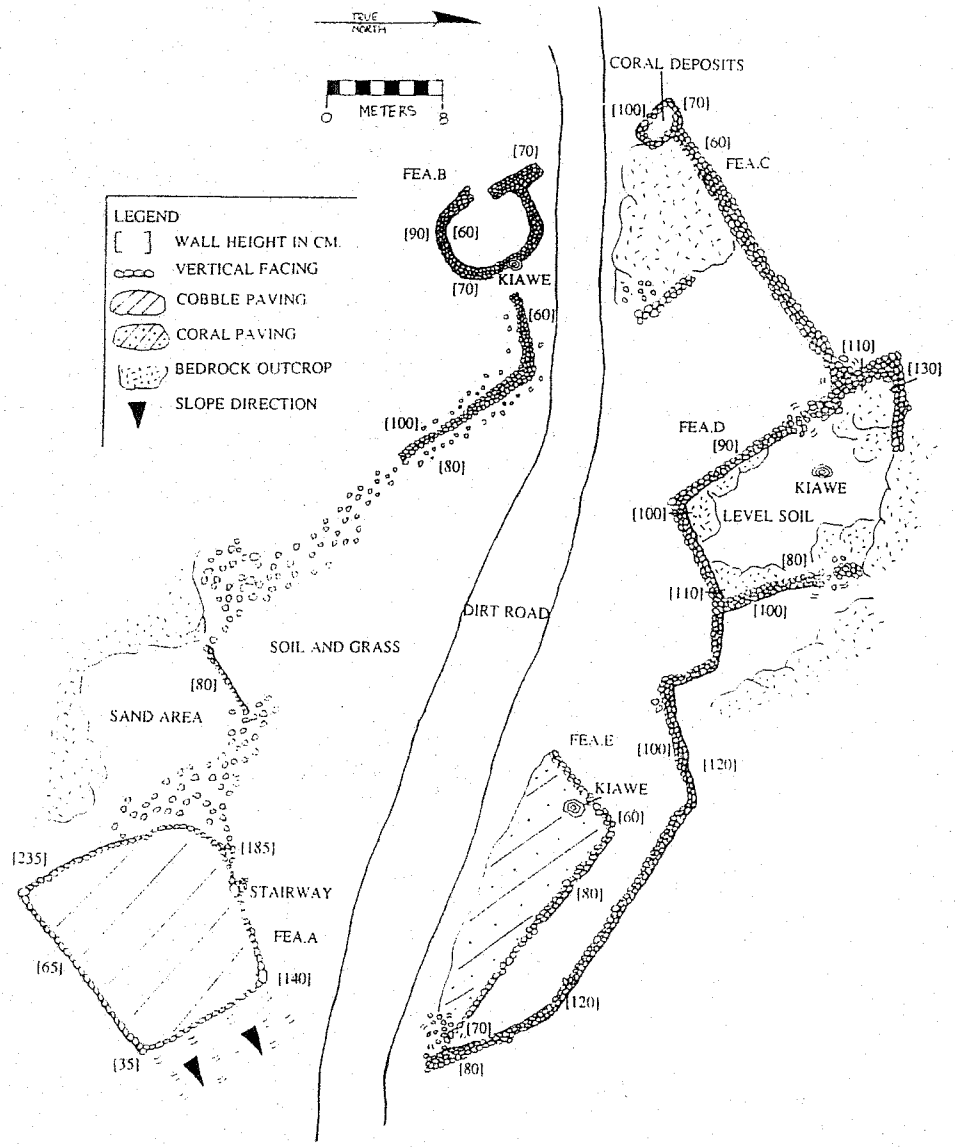



Figure 49 State site 50-10-37-16745; plan view



Feature C, northeast to Feature D, then turns to the east and subsequently to the southeast where it meets with the south corner of Feature E platform. This wall also extends in a northwest/southeast direction between Features A and B. The wall is constructed with stacked boulders with cobble fill and stands a maximum of 1.2 m. (3.9 ft.) tall.

There is also a dirt road which runs through the center of the complex; the construction of this road destroyed portions of the complex's enclosing wall, as well as the majority of Feature E.

**Feature A** is a platform located at the south end of the site complex. It measures 12.0 m. (39.4 ft.) NE/SW by 14.0 m. (45.9 ft.) NW/SE with a maximum height of 2.4 m. (7.9 ft.). It is constructed with a boulder facing and has a level small cobble pavement. There is a stairway on the northwest edge of the platform. There is also an area of coral pavement in the south quad of the platform.

No artifacts or midden were observed.

Feature A is in good condition and offers good excavation potential. It is considered a permanent habitation feature.

**Feature B** is an enclosure at the *makai* (west) end of the complex. It measures 8.0 m. (26.2 ft.) NE/SW by 5.0 m. (16.4 ft.) NW/SE with a maximum wall height of 0.9 m. (3.0 ft.). The walls are constructed of small boulders with intact facing on both sides. The interior has a sand floor. There is an opening in the wall on the southwest side.

Midden and coral were observed, as well as historic glass bottles and wooden 2x4's attached to sheet metal.

Feature B is in good condition and has good excavation potential. It is considered a permanent habitation feature.

**Feature C** is a terrace located at the northwest edge of the complex. It is triangular in shape, measuring 11.0 m. (36.08 ft.) NW/SE by 10 m. (32.8 ft.) NE/SW with a maximum height of 1.0 m. (3.3 ft.). It is constructed of cobbles and boulders filling in pahoehoe outcrop. The outcrop is used extensively in the construction of the terrace.

A piece of coral was observed at the northwest corner of the terrace. No other artifacts or midden were observed.

Feature C is in good condition and is interpreted as a probable burial.

**Feature D** is an enclosure located at the north edge of the complex, situated atop pahoehoe outcrop. It measures 19.0 m. (62.3 ft.) NW/SE by 14.0 m. (45.9 ft.) NE/SW with a maximum height of 1.0 m. (3.3 ft.). The walls are constructed of stacked pahoehoe cobbles and boulders with intact facing. There are small areas of collapse. An outcrop is utilized to delineate the north enclosure wall. The interior consists of a shallow level soil deposit on pahoehoe outcrop.

No artifacts or midden were observed.

Feature D is in fair to good condition and offers good excavation potential. It is considered a permanent habitation feature.

**Feature E** is a platform adjacent to the dirt road. It is presently triangular in shape and measures 22.0 m. (72.2 ft.) NW/SE by 8.0 m. (26.2 ft.) NE/SW with a maximum height of 0.8 m. (2.6 ft.). It is constructed with boulder facing and has a small cobble pavement. It appears to have been heavily disturbed by construction of the road.

The remaining portion of the platform is in fair to good condition and offers good excavation potential. It is considered a permanent habitation feature.

**State Site #:** 50-10-37-16746 **CSH Site #:** 421
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 11
**Site Dimension:** (see below)
***Ahupua'a*:** Hokukano
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16746 is a site complex which consists of 11 features designated Features A through K. The site is situated along the coast within the tree line. The terrain consists of undulating pahoehoe with vegetation consisting of large *kiawe* trees, *koa haole*, scattered coconut trees, and grasses.

**Feature A** is a large enclosure on the north side of the "cowboy beach." The surrounding vegetation is *kiawe* and coconut trees. It measures 14.0 m. (45.9 ft.) NW/SE by 11.0 m. (36.1 ft.) NE/SW with a maximum height of 1.3 m. (4.3 ft.). The enclosure is constructed of small to large boulders. There is facing on the north and west enclosure walls. On the north side there is a walkway approximately 1.0 m. (3.3 ft.) wide leading toward the ocean. On the north side of the walkway is a roughly paved platform of large cobbles to medium boulders. The platform has a maximum central height of 1.5 m. with the edges having a maximum height of 0.3 m. (1.0 ft.). Facing exists on the *makai* (west) and south sides. The interior of the enclosure is soil with scattered cobbles.

Within the enclosure midden such as coral, *opihi*, and cowrie are observed but no artifacts were observed. A coconut tree is growing inside the enclosure. There are piles of lumber and tin in the area

Feature A is in fair to poor condition and the excavation potential is considered good. It is considered a permanent habitation feature.

**Feature B** consists of 3 contiguous enclosures measuring 15.0 m. (49.2 ft.) ENE/WSW by 12.0 m. (39.4 ft.) NNW\SSE and the walls range in height from 1.1 m. (3.6 ft.) at the northwest end to 0.3 m. (1.0 ft.) on the southeast end on the largest enclosure. Constructed of cobbles to medium boulders these three enclosures decrease in size consecutively to the east. The largest enclosure (the western-most) could be a canoe house.

Midden was observed but no artifacts.

The condition of Feature B is poor to fair and the excavation potential is considered fair to good. It is considered a permanent habitation feature.

**Feature C** consists of a N/S running wall that attaches to the Feature D (a enclosure) at the north end. In addition to the regular vegetation around this site this feature also has *noni* trees along the south wall of the enclosure. It measures 38.0 m. (124.6 ft.) N/S. The wall is constructed of stacked cobble and medium boulders. Facing exists along both sides of the wall.

Within the soil deposits, sand,is were midden was observed but no artifacts.

The condition of Feature C is fair and the excavation potential is considered good. It is considered a permanent habitation feature.

**Feature D** is a remnant enclosure which consists of an L-shape wall segment with boulder and cobble collapse delineating the north walls. Feature C comprises the northeast wall of the enclosure. The enclosure measures 10.5 m. (34.4 ft.) NW/SE by 16.0 m. (52.5 ft.) NE/SW. The wall segment is constructed of cobbles and boulders.



Feature D is in poor condition and offers fair to good excavation potential. It is considered a permanent habitation feature.

**Feature E** is an modified sink located just *mauka* (east) of "Cowboy Beach." It measures 6.1 m. (20.0 ft.) NE/SW by 3.0 m. (9.8 ft.) NW/SE. The modification of the sink forms an enclosure. The northeastern side of the enclosure is outcrop. The rest of the enclosure is formed by a wall with a maximum height of 1.7 m. (5.6 ft.) constructed of medium to small boulders and large cobbles with facing and some cobble fill. The interior has a fair soil deposit with scattered cobbles and boulders. A outcrop juts out of the soil on the *mauka* side (NE).

Along the northwest wall is a concentration of kukui shell fragments and *opihi*, coral and *Cypraea* sp. were also observed.

Feature E is in good condition and offers good excavation potential. It is interpreted as an animal pen.

**Feature F** is rectangular pavement and an adjacent remnant wall. The north corner of the pavement is located 3.0 m. (9.8 ft.) south of Feature E. It measures 6.5 m. (21.3 ft.) N/S by 9.5 m. (31.2 ft.) E/W. The pavement is constructed with small boulders and cobbles. The feature is fairly level and curbed with medium boulders. There is a shallow soil deposit (less than 1.0 m. in diameter) located in the center of the pavement. The area is heavily disturbed. A rough boulder alignment is all that is left of the probable former wall. The remnant wall extends southeast from the southern corner of the pavement.

Feature F is in poor condition and offers poor excavation potential. It is considered a permanent habitation feature.

**Feature G** consists of a series of rough alignments within a large enclosure. The alignments are roughly rectangular and constructed of medium to small boulders. The alignments form two small enclosed areas. The interior is soil with numerous boulder scatter. A more formal low-walled enclosure lies adjacent to the alignment and abuts an outcrop bluff on the north side. The enclosure walls are constructed of medium to small boulder facing with cobble core fill. The maximum wall height is 0.6 m. (2.0 ft.).

A possible coral *ulu maika* was observed just outside the northeast corner where the wall is best preserved. There are extensive large soil deposits throughout the area. Historic rubbish, glass and ceramic fragments were observed.

Feature G is in very poor condition and offers fair excavation potential. It is considered a permanent habitation feature.

**Feature H** is a possible burial site located above and just northwest of Feature G atop the outcrop bluff. It is a crevice filled with. It measures 6.5 m. (21.3 ft.) E/W by 2.0 m. (6.6 ft.) N/S and has a level pavement. The crevice is curbed on the west with small boulders. The south side is outcrop raised slightly above the pavement level. The north side is curbed by a large enclosing wall which reaches around Feature G, going west toward Features A and B and which originated at the east corner of the Feature E animal pen.

This feature is in good condition.

**Feature I** is a terrace located on the northeast side of the outcrop bluff in the eastern portion of the complex. The feature measures 10.0.m. (32.8 ft.) N/S by 1.5 m. (4.9 ft.) E/W. It is paved with cobbles and small boulders. Shallow soil deposits are observed below the terrace and atop the outcrop which is level with the surface of the terrace. The facing is well preserved. There is a possible upright located and the center of the northeast terrace edge.

Midden includes coral, *Cypraea*, and *Thaididae* No artifacts were observed.

Feature I is in good condition and offers fair excavation potential. It is interpreted as a permanent habitation feature.

**Feature J** is an enclosing wall which has been discussed in the previous features. The wall is constructed of medium boulder facing with cobble and small boulder fill. It is collapsed in some places and may have been bulldozed near the beach. The wall originates at the west corner of Feature K, goes north and then east and again north to the western corner of Feature E. It continues from the east corner of Feature E up the outcrop bluff and between Features H and I, then curving south down the side of the bluff and around Feature G and ends at Feature I, but picks up again after the clearing and is connected to the Feature B enclosures. It is considered a permanent habitation feature.

**Feature K** is a poorly preserved terrace roughly level and constructed with medium cobbles to medium boulders with a maximum height of 0.5 m. (1.6 ft.). There is a small soil deposit in the center.

A polishing stone located near the northeast corner was observed.

Feature K is in poor condition and offers fair to poor excavation potential. It is interpreted as a permanent habitation feature.

**State Site #:** 50-10-37-16747 **CSH Site #:** 422
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 17.5 m.$^2$ (189.0 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16747 is a platform located about 35 m. northwest of Site 16476. The surrounding terrain consists of *kiawe*, *koa haole* and coastal vegetation.

The platform measures 3.5 m. (11.5 ft.) E/W by 5.0 m. (16.4 ft.) N/S. and is 1.3 m. (4.3 ft.) high on the west face and meets a sloping pahoehoe outcrop. It is constructed of small to medium subangular pahoehoe boulders with a cobble fill.

There is a large soil deposit on the east side of the site with a large quantity of coral scatter. Numerous pieces of broken bottle glass were observed in the area. No other artifacts were observed but a few pieces of shell midden were observed.

State site -16747 is in good condition and offers good excavation potential.

**State Site #:** 50-10-37-16748 **CSH Site #:** 423
**Site Type:** Lava blister
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 7.9 m.$^2$ (84.8 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 10 ft. a.m.s.l.



**Description:** State site -16748 is an oval blister with some man-made modification. The blister is 2.5 m. (8.2 ft.) in diameter and 2.3 m. (7.5 ft.) deep.

Inside the blister shell midden, a possible fire pit, and a soil deposit were observed.

State site -16748 is in poor condition. The excavation potential is considered fair.

**State Site #:** 50-10-37-16749 **CSH Site #:** 424
**Site Type:** Rock Shelter
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 32.0 m.$^2$ (345.6 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16749 is a rock shelter. Little modification exists. The shelter and surrounding modification measures 8.0 m. (26.2 ft.) E/W long by 4.0 m. (13.1 ft.) deep. The modifications consist of roughly level cobble and boulder paving outside the shelter.

Scattered pieces of coral and broken shell litter the feature. The condition is fair. The excavation potential is considered poor.

**State Site #:** 50-10-37-16750 **CSH Site #:** 425
**Site Type:** Rock shelter
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 6.0 m.$^2$ (64.8 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 12 ft. a.m.s.l.

**Description:** State site -16750 is a rock shelter which has been walled off. The entrance to this shallow cave has been greatly modified. A path leads down to the tube with steps and ramps. The area around the entrance has been roughly paved and there is a wall around the entrance which turns *makai* (west). The shelter is about 2.0 m. (6.6 ft.) deep. Within the interior of the shelter pieces of coral and wood were observed. The interior of the shelter also contains a small puddle of water surrounded by soil deposits. No artifacts were observed.

State site -16750 is in fair condition. Excavation potential is considered fair to good.

**State Site #:** 50-10-37-16751 **CSH Site #:** 426
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 5
**Site Dimension:** (see below)
***Ahupua'a*:** Hokukano
**Elevation:** 5 ft. a.m.s.l.

**Description:** State site -16751 is a site complex consisting of 5 features designated Features

A to E.

**Feature A** is a rectangular terrace built on the south side of the ridge. It measures 13.0 m. (42.6 ft.) NE/SW by 9.0 m. (29.5 ft.) NW SE. The terrace is constructed of cobble and medium boulders. There is facing on the *mauka* (east), south and *makai* (west) sides. The north side is flush with the outcrop.

Coral, *Thaididae*, and cowrie were observed but no artifacts.

Feature A is in good condition and excavation potential is considered good.

**Feature B** is a wall which extends from Feature A north. A small rock shelter is located along the edge of the wall. The wall is constructed of medium cobbles and boulders with portions of facing visible in several areas. Numerous rocks are scattered along both sides of the wall and appear to be tumble. The wall extends 35.0 m. (114.8 ft.) to Feature C and continues to the north for 16.5 m. (54.1 ft.).

At the north end is a small platform and on the north side of this platform is a *papamu* board in the bedrock. Both the board and the small platform are considered part of Feature B. A slightly larger platform is present and constructed of small boulders with some facing on the north and east sides. It is roughly paved.

A flake of volcanic glass was observed 1.5 m. (4.9 ft.) north of the *papamu* board. No other midden or artifacts are observed.

Feature B is in poor to fair condition and excavation potential is considered fair.

**Feature C** is an enclosure with a tin roof with a small circular enclosure the size of a fire pit within the interior. The enclosure is partially covered by a tin roof. The walls are constructed of cobbles and small boulders. The enclosure is built on the side of the bedrock. The other small enclosure, probably a fire pit, appears to haven't been used in a long time. The site is probably a historic fishing shelter due to quantities of historic artifacts including lumber, pots, glass, and bamboo fishing poles. Midden includes *opihi*, and cowrie.

Feature C is in fair to good condition and the excavation potential is considered good.

**Feature D** is a terrace which measures 5.0 m. (16.4 ft.) square. It is located approximately 20.0 m. (65.6 ft.) east of Feature C within the tree line. The terrace is built atop a pahoehoe outcrop. Constructed of small to medium boulders, the terrace has facing on its north and east sides while the remaining sides are flush with the bedrock. A small opening is built into the center of the terrace. The surface of the terrace is roughly paved with small boulders. The terrace has a maximum height of 0.7 m.

No artifacts or midden are observed.

The condition of Feature D is fair and the excavation potential is considered also fair.

**Feature E**, approximately 7.0 m. (23.0 ft.) south of Feature D, similar in construction, is a terrace built atop a pahoehoe outcrop. It measures 5.0 m. (16.4 ft.) by 5.0 m. (16.4 ft.) and has a maximum height of 1.1 m. (3.6 ft.) along the east edge. It is constructed of medium-sized cobbles and boulders. The terrace has facing on the north and east sides with the remaining two sides being flush with the outcrop.

No artifacts or midden were observed and the condition and excavation potential of Feature E are both considered fair.



**State Site #:** 50-10-37-16752 **CSH Site #:** 427
**Site Type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 48.0 m.$^2$ (518.4 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16752 is a terrace on an outcrop ledge situated just east of site -16753 at 156° TN. The terrace is surrounded by *kiawe* trees.

The terrace measures 16.0 m. (52.5 ft.) NW/SE by 3.0 m. (9.8 ft.) NE/SW with a maximum height of 1.2 m. (3.9 ft.). It is constructed of piled small boulders. The terrace is constructed in such a way to extend the level outcrop it abuts. The terrace is roughly level. There is a small circular depression 0.3 m. (1.0 ft.) in diameter with a maximum depth of 0.3 m. (1.0 ft.). It is located in the southeast corner and the function is undetermined.

No artifacts were observed but a fair amount of midden was present.

The condition of State site -16752 is fair and the excavation potential is considered poor to fair.

**State Site #:** 50-10-37-16753 **CSH Site #:** 428
**Site Type:** Site complex remnant
**Function:** Indeterminate
**Features (#):** Indeterminate
**Site Dimension:** Indeterminate
***Ahupua'a*:** Hokukano
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16753 is an area extending from Nenue Point northward for approximately 40.0 m. (132.0 ft.). The site area has been heavily disturbed (probably by the ocean). There are numerous rock piles and possible alignments that are remnant. There are no artifacts but a fair amount of midden is scattered about the area.

Due to its proximity to the ocean it is possible that the site is nothing more than natural formations due to ocean activity.

State site -16753 is in very poor condition and offers poor to fair excavation potential.

**State Site #:** 50-10-37-16754 **CSH Site #:** 429
**Site Type:** Modified outcrop
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 40.0 m.$^2$ (432.0 ft.$^2$)
***Ahupua'a*:** Hokukano 1
**Elevation:** 20 ft. a.m.s.l.

**Description:** State site -16754 consists of two outcrop overhangs which have been modified to provide temporary shelter. The modifications consist of low piled boulder walls which enclose the overhangs.

The western overhang shelter measures 3.0 m. (9.8 ft.) NW/SE deep by 3.5 m. (11.5 ft.) NE/SW with a maximum height of 1.5 m. (4.9 ft.). The eastern overhang shelter measures 3.0 m. (9.8 ft.) N/S by 6.0 m. (19.8 ft.) E/W wide with a maximum height of 1.1 m. (3.6 ft.). Both overhang shelters have a soil interior.

No artifacts or midden were observed.

State site -16754 is in poor condition and offers fair excavation potential.

**State Site #:** 50-10-37-16755 **CSH Site #:** 430
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 5
**Site Dimension:** 4,032.0 m.$^2$ (43,545.6 ft.$^2$)
***Ahupua'a*:** Hokukano
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16755 is a site complex of platforms, enclosures and a modified bluff, which cover an area approximately 84.0 m. (275.5 ft.) N/S by 48.0 m. (157.4 ft.) E/W beginning near the tree line along the coast and extending *mauka* (east) and to the north. The 5 features are designated A through E and run from south to north. The vegetation on this flat pahoehoe outcrop with sand consists of California grass, *kiawe* and *koa haole*.

No artifacts were observed although midden and coral are scattered throughout the complex.

The size and construction of these features indicates a probable permanent habitation complex.

**Feature A**, the southernmost feature, consists of a small platform with surrounding walls. The platform measures 6.0 m. (19.8 ft.) NW/SE by 7.0 m. (23.0 ft.) SW/NE and is built on level ground with the pahoehoe outcrop *mauka* (east) and sand on top of pahoehoe bedrock *makai* (west). The platform is constructed of small to medium boulders with a medium to large cobble paving. Good facing exists on the south and east sides of the platform with the north and west sides collapsed. There is a small circular stone lined depression approximately a meter *mauka* (east) of the north corner of the platform. The depression is 0.8 m. in diameter and is 0.7 m. (2.3 ft.) deep. The area around the depression is paved with small to medium boulders with larger cobble fill. To the south of this circular depression there is a wall abutting the pahoehoe outcrop which runs *makai* (west) for 18.0 m. (59.0 ft.) where it then turns north and runs 6.0 m. (19.8 ft.). Approximately 1.5 m. (4.90 ft.) north of the platform is a wall abutting the pahoehoe outcrop which runs *makai* (west) for 10.0 m. (32.8 ft.) where it then runs north and runs 14.0 m. (45.9 ft.). Both walls are constructed of small to medium boulders. Feature A is in fair to good condition and offers good excavation potential.

In between Features A and B there is a remnant paving with visible alignments. The construction consists of small boulders with large to medium cobbles. Some coral was observed but no other midden or artifacts were present.

**Feature B** consists of a rectangular enclosure and adjoining platform to the north. Feature B enclosure measures 5.0 m. (16.4 ft.) N/S by 5.0 m. (16.4 ft.) E/W. The enclosure is situated on a high pahoehoe outcrop. The enclosure is constructed of medium to large



boulders. The enclosure's walls are slightly collapsed on the *makai* (west) side and range from 0.5 to 1.0 m. (1.6 to 3.3 ft.) high. The interior contains shallow soil.

No artifacts or midden were observed within the feature.

The platform measures 8.0 m. (26.2 ft.) N/S by 10.0 m. (32.8 ft.) E/W and has walls ranging from 0.5 m. to 1.0 m. (1.6 to 3.3 ft.) high. The platform is constructed against the high pahoehoe outcrop on the northwest side and is delineated by boulders and filled with cobbles and small boulders. The surface is level in most areas and there is a visible boulder alignment oriented N/S located on the northwest portion of the platform. The platform extends to the east along the pahoehoe outcrop. Intact facing is visible on the north and east sides. Along the portion adjoining the enclosure there are 4 stone uprights.

Coral was observed on the surface of the platform.

Feature B is in good to fair condition and the excavation potential is considered good.

**Feature C** is a platform with adjoining enclosure on a level area in the pahoehoe flow directly adjacent to and *mauka* (east) of Feature B. It measures 18.0 m. (59.0 ft.) by 12.0 m. (39.4 ft.) E/W. The platform is constructed of small to medium boulders with medium to large cobble paving. The platform is well faced on the south and southwest sides. In the center there is an upright stone (probably a godstone) and 4.0 m. (13.1 ft.) north of the upright is a circular depression. The east side of the platform is constructed against the pahoehoe outcrop. At the north end of the platform there is a small enclosure with the *mauka* (east) portion of it abutting the pahoehoe outcrop. Inside the enclosure is a level soil area. This enclosure is constructed of small to medium boulders with large cobbles. It is well faced in the *mauka* (east) portion. The soil interior measures 3.0 m. (9.8 ft.) NW/SE by 2.5 m. (8.2 ft.) SW/NE. Coral and shells were observed in the soil area. No other midden or artifacts are observed.

Feature C is in fair to good condition and offers good excavation potential.

**Feature D**, a roughly rectangular platform, is located 4.0 m. (13.1 ft.) southwest of the Feature C enclosure. It measures 4.0 m. (13.1 ft.) N/S by 3.0 m. (9.8 ft.) E/W with walls ranging from 0.2 to 0.6 m. (0.7 to 2.0 ft.) high. This platform is constructed of boulders and cobbles on the east side of a pahoehoe outcrop. Well-constructed facing still remains on the north and east sides but the west side is low and the south side collapsed. The surface is level with a *kiawe* tree growing in the center. A small paved section extends to the west for 3.0 m. (9.8 ft.) off the northwest corner.

**Feature E** consists of a modified outcrop and platform located 10.0 m. (32.8 ft.) to the north of Features C & D. The outcrop measures 13.0 m. (42.6 ft.) NW/SE by 13.0 m. (42.6 ft.) SW/NE and it has been modified by piling boulders and cobbles to form a paved area. Adjoining this paved area is a small circular enclosure on the *mauka* (east) side.

Just *mauka* (east) of the outcrop a rectangular platform measuring 8.0 m. (26.2 ft.) NW/SE by 4.0 m. (13.1 ft.) SW/SE and curbed with medium boulders on the south and east sides while the north and west sides are collapsed and low.

The surface is level with a few pieces of coral observed, but no artifacts.

Feature E is in fair to good condition and offers good excavation potential.

**State Site #:** 50-10-37-16756 **CSH Site #:** 431
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 18
**Site Dimension:** 1,200.0 m.² (12960 ft.²)
***Ahupua'a:*** Halekiʻi
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16756 (Figure 49) is a site complex comprising 18 features designated A through R. The site is situated on pahoehoe outcrop adjacent to the shoreline and has a general canopy of *kiawe* and *koa haole*. The site features include: an enclosing wall; platforms; a lava tube and modified bubble; and various enclosures. The features represent multiple functions including: permanent habitation, temporary shelter, a probable burial and a salt preparation area. The majority of the features are prehistoric and some appear to have been used or reused during the historic era.

**Feature A** is a large enclosure or enclosing wall which encircles Features B and C and is contiguous to Feature D and E. The interior of the enclosure is a level soil covered floor.

The enclosure measures 38.0 m. (124.7 ft.) N/S by 28.0 m. (91.9 ft.) E/W and ranges from 0.3 m. (1.0 ft.) high on the interior to 1.8 m. (5.9 ft.) high on the exterior. The enclosure walls are constructed of pahoehoe boulder facing, (well preserved on the exterior) with core fill. There are some large slabs on the base course of the walls.

In the west wall of the enclosure is a constructed entrance 1.0 m. (3.3 ft.) wide; the entrance is bound by two large upright slabs. The slab on the south side is water-rounded and carved with grooves.

Feature A enclosure is contiguous to Feature E along its north end. Features A, B, C, and E are considered contemporaneous. (Feature D likely predates the other features since the large enclosure (Feature A) extends over it.)

**Feature B** is a rectangular habitation platform. Soil surrounds the exterior.

Feature B measures 9.0 m. (29.5 ft.) long E/W by 5.2 m. (17.1 ft.) wide N/S by 0.4 m. (1.3 ft.) high at its west end. The platform has an upright and is constructed with smooth pahoehoe facing on all sides. The platform surface is paved with cobbles and pebbles mostly of very uniform size.

At the east end (*mauka*) of the platform is an *ahu*, 1.0 m. (3.3. ft.) in diameter and 0.25 m. (0.75 ft.) high; it may represent a remnant altar which is now collapsed. Construction of the *ahu* includes one piece of coral and 67 water-rounded stones. At the center of the *makai* (west) end of the platform is a boulder with pecked depressions (bait cups). Also, at the north end of the platform is a remnant wall measuring 0.8 m. (2.6 ft.) high, oriented E/W, paralleling the north end of the platform. The wall is discontinuous to the north of the platform; it is well preserved with boulder facing.

Feature A is in good condition.

**Feature C** is a rectangular platform, measuring 4.5 m. (14.8 ft.) E/W by 5.8 m. (19 ft.) N/S by 0.8 m. (2.6 ft.) high. It has well preserved pahoehoe boulder facing which is partially collapsed on the north and east (*makai*) sides. The platform surface comprises a level pebble and cobble paving. At the southeast end of the paving is a broken cowrie shell. At the center of the platform surface is a stone-lined depression measuring 0.7 m. (2.3 ft.) E/W by 0.6 m.



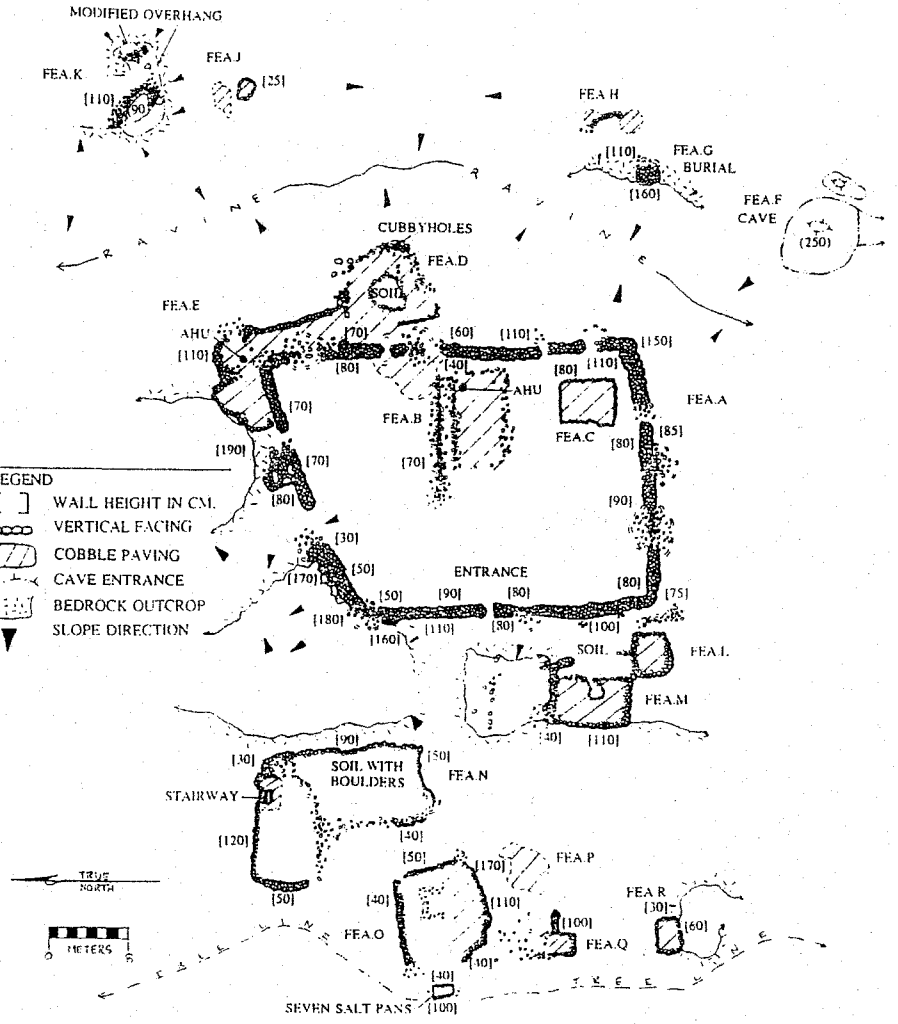



Figure 50 State site 50-10-37-16756; plan view

(2.0 ft.) N/S with a *koa haole* tree growing within it; the depression is likely a hearth.

On the surface at the north end of the platform is a boulder with a pecked depression, possibly representing a bait cup or a salt cup.

There is an abundance of midden, water-rounded stones and coral scattered along the *makai* (west) end of Feature C. This feature is in good to excellent condition.

**Feature D** is a large pavement on the top of a pahoehoe ledge. The ledge drops steeply to the east 3.0 to 4.0 meters (9.8 to 13.1 ft.). This pavement measures 10.0 m. (32.8 ft.) N/S by 6.0 m. (19.7 ft.) E/W and ranges from 0.2 m. (0.7 ft.) high to a maximum height of 1.0 m. (3.3 ft.) at the east end. The east and southeast sides of the paved area are faced with pahoehoe boulders.

At the south end of the boulder faced sides of the pavement are two adjacent stone-lined cupboards which are roughly 1.0 $m.^2$. (10.8 $ft.^2$). The northernmost cupboard has large slabs at the north and west ends which measure 0.6 to 0.7 m. (2.0 to 2.3 ft.) deep.

At the center of Feature D is a soil-filled depression which is fairly clear of rocks. The depression measures 4.0 m. (13.1 ft.) E/W by 2.0 m. (6.6 ft.) N/S. The paved area around the depression is mounded on the south, east and north sides. The depression is roughly faced.

Other internal features include an upright slab at the northeast end of the pavement, a row of 3 slabs oriented E/W at the north end (seats), and an alignment of pahoehoe slabs at the south end. This alignment is level with the surrounding pavement and extends 4.0 m. (13.1 ft.) N/S, then 2.0 m. (6.6 ft.) to the east forming a right angle; the alignment probably marked the boundary of a house site or an addition to the pavement.

As described previously, Feature A enclosure extends across the west side of the paved area. This wall clearly post-dates the paved area on which it is superimposed.

Feature D is a complex structure and is interpreted basically as habitation; the depression at its center may have been a hearth. This feature is in good to excellent condition.

**Feature E** is a bi-level terrace situated atop a pahoehoe bluff (near the coast) just outside the northeast corner of Feature A. A sharp ledge on the north side, measures approximately 1.6 m. (5.2 ft.) high.

The terrace measures 11.0 m. (36.1 ft.) N/S by 5.0 m. (16.4 ft.) E/W. It is constructed mainly of medium to large pahoehoe boulders with some small to medium sized cobble fill. The upper terrace is paved mostly with cobbles while the lower one mostly with boulders. A possible *ahu* is situated on the upper terrace level. This feature is contiguous to Feature D by a low platform-pavement which runs along Feature E's east side.

Feature E is completely faced from the beginning of the connecting platform near Feature D, all the way around to the *makai* (west) end where the facing is of big boulders.

A couple of fine-grain basalt fragments and some shell midden were observed at Feature E. Feature E is in good condition.

**Feature F** is a lava tube shelter located in the southern *mauka* (east) corner of the complex, in an area surrounded by *kiawe*, *koa haole* and California grass.

The main chamber of the lava tube measures 10.0 m. (32.8 ft.) E/W by 6.0 m. (19.7 ft.) N/S. It ranges from 0.5 m. (1.6 ft.) to 2.0 m. (6.6 ft.) high and is oval shaped. The opening to the lava tube is located along the ceiling center of the main chamber. Directly below this opening is an *ahu* of stacked rocks 1.5 m. (4.9 ft.) high on which one climbs down to get into the tube. The floor of the main chamber is lava on its east side and soil covered with boulder rubble from ceiling collapse all remaining sides.

A small side chamber - 2.5 m. (8.2 ft.) in diameter - extends to the east of the main



chamber; no access was achieved into this chamber as it was blocked by boulders.

Adjoining the main chamber to the south is another chamber, measuring 10.0 m. (32.8 ft.) long N/S by 6.0 m. (19.7 ft.) wide E/W, with a roof less than 1.0 m. (3.3 ft.) high. The floor of this chamber is a damp soil.

To the west of the main chamber is a third side chamber measuring 6.0 m. (19.7 ft.) long by 4.0 m. (13.1 ft.) wide with a lava floor and a ceiling less than 1.0 m. (3.3 ft.) high.

Shell midden, a large piece of oyster shell, a bone pick, small cowrie shells, a large *opihi* shell, a boar's tooth, bird bone, and water-rounded cobbles and boulders were observed within the main chamber. On the lava floor at the east side of the main chamber are three rotted but cut wooden planks which are studded with round wire nails.

Feature F is in fair condition.

**Feature G** is a small platform situated directly on a pahoehoe outcrop ledge surrounded by *koa haole*.

The platform measures 2.5 m. (8.2 ft.) N/S by 2.0 m. (6.6 ft.) E/W with boulders stacked a maximum of 0.8 m. (2.6 ft.) high. The edges of the platform are rounded forming an oval shape. Major collapse has occurred at the southeast corner of the platform. The platform surface is level and constructed of small boulders and cobbles. This feature is interpreted as a probable burial platform in fair condition.

**Feature H** comprises a C-shaped enclosure with an attached pavement, situated on the same pahoehoe bedrock ledge 3.0 m. (9.8 ft.) to the east of Feature G.

The paved area is located at the south end of the C-shape and it measures 2.0 m. (6.6 ft.) in diameter and 0.15 to 0.2 m. (0.4 to 0.7 ft.) high.

The C-shape is delineated by curved wall measuring 2.5 m. (8.2 ft.) long, 1.0 m. (3.3 ft.) at its widest, and 0.4 m. (1.3 ft.) high. This wall forms a collapsed shelter open to the west and northwest.

No midden or artifacts were observed at Feature H. Feature H is in poor condition and offers fair excavation potential.

**Feature I** consists of four pahoehoe basins located 9.1 m. (30.0 ft.) north of Feature E, and 36.3 m. (120.0 ft.) at 190° TN from the southeast corner of Feature A.

Each bait cup is 12 cm. (almost 5 inches) wide and 6 cm. (2.5 inches) deep and all are pecked into pahoehoe bedrock.

**Feature J** consists of two low, irregularly-shaped platforms situated atop a raised pahoehoe outcrop.

Each platform measures 4.0 m. (13.1 ft.) by 3.0 m. (9.8 ft.) and is 0.15 to 0.2 m. (0.5 to 2.6 ft.) high. They are constructed of cobbles.

About 14.0 m. (45.9 ft.) to the north of these platforms is a modified overhang.

No artifacts or midden were observed at Feature J.

Feature J is in fair condition and offers fair to poor excavation potential.

**Feature K** is a lava blister overhang with an adjacent terrace. The terrace is constructed along the south portion of the collapsed rim of the bubble; it is faced with boulders on its south side and it has a roughly paved surface. The terrace rises a maximum height of 1.1 m. (3.6 ft.) above the underlying bubble floor. The terrace measures 2.0 m. (6.6 ft.) N/S by 3.0 m. (9.9 ft.) E/W. The overhang has a ceiling height of 0.9 m. (3.0 ft.) and its floor consists of soil and a rough cobble paving around the north and outside perimeter.

**Feature L** is a rectangular platform with boulder facing on all sides. It sits directly on pahoehoe bedrock outside the southwest corner of the Feature A enclosing wall.

The platform measures 4.0 m. (13.1 ft.) N/S by 3.5 m. (11.5 ft.) E/W. Its surface is a level cobble and pebble pavement. This feature is connected to Feature M by a boulder alignment 2.0 m. (6.6 ft.) long.

No artifacts or midden were observed.

Feature L is in excellent condition and exhibits excellent excavation potential.

**Feature M** is a terrace built on a pahoehoe ledge. This feature connects to Feature L by the 2.0 m. (6.6 ft.) long boulder alignment mentioned in Feature L.

The terrace measures 8.5 m. (27.9 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 1.5 m. (4.9 ft.) and 1.1 m. (3.6 ft.) at its *makai* (west) end. The *makai* (west), north and south sides are well faced and the facing is 1.1 m. (3.3 ft.) high on the north side, 1.5 m. (4.9 ft.) high at the northeast corner, and 0.4 to 0.5 m. (1.3 ft to 1.6 ft.) at the south end. The east side is flush with the pahoehoe bluff.

The terrace surface is paved at the *makai* (west) end and the *mauka* (east) end contains a loose soil over outcrop; midden was observed along its *mauka* (east) end. The west end of the terrace has a sloped boulder and cobble paving.

This terrace is a habitation feature which affords a good view of the ocean and adequate protection from the prevailing winds. No artifacts or midden were observed at Feature M.

Feature M is in excellent condition and it exhibits excellent excavation potential.

**Feature N** is an irregular shaped enclosure built on a level pahoehoe bluff. The enclosure measures 14.0 m. (45.9 ft.) N/S by 12.0 m. (39.4 ft.) E/W. An east/west trending wall bisects the enclosure into two north and south areas: the south area measures 11.0 m. (36.3 ft.) N/S by 4.0 m. (13.2 ft.) E/W; and the north area 4.0 m. (13.2 ft.) N/S by 10.0 m. (33.0 ft.) E/W. The enclosure walls are freestanding but collapsed, measuring a maximum 0.8 m. (2.6 ft.) high along the east wall and an average width of 1.0 m. (3.3 ft.).

Two paved areas are present along the north and south interior edge of the enclosure. The northern pavement is constructed of cobbles and it measures 3.0 m. (9.9 ft.) in diameter. The southern pavement extends the width of the enclosure (in the south enclosed area) measuring 2.0 m. (6.6 ft.) N/S by 4.0 m. (13.2 ft.) E/W. It is constructed of boulders and cobbles.

Feature N is a habitation feature. It is in good condition and exhibits good to excellent excavation potential.

**Feature O** is a platform with an attached enclosure constructed on a pahoehoe bluff. The platform measures approximately 2.5 (8.2 ft.) N/S by 2.0 m. (6.6 ft.) E/W and is enclosed to its north and south sides by an L-shaped wall. The platform is constructed of a level cobble pavement faced with boulders along its southern extent to a maximum height of 1.0 m. (3.3 ft.). A smaller area of boulder paving is located immediately west of the platform; seven salt pans lie along the surface of this paving.

The L-shaped wall is attached to the southeast face of the platform. Its long axis is 11.0 m. (36.3 ft.) E/W and its short axis is 8.0 m. (26.4 ft.). The interior of the enclosure is sand intermixed with midden.

Feature O is in good condition and exhibits excellent excavation potential.

**Feature P** is a rough boulder and cobble pavement constructed on pahoehoe outcrop. The pavement measures 6.0 m. (19.8 ft.) N/S by 5.5 m. (18.1 ft.) and it is a maximum 0.4 m.



(1.3 ft.) high.

Based on the presence of a historic bottle on pavement surface, the feature was likely utilized during the historic era and may not be contemporaneous with the other features in the overall site complex.

**Feature Q** is an oval enclosure delineated by intact and collapsed wall portions on outcrop; facing is present on the south and north sides rising a maximum height of 1.0 m. (3.3 ft.).

Overall, the enclosure interior measures 5.0 m. (16.5 ft.) N/S by 2.0 m. (6.6 ft.) E/W. A pavement measuring 1.0 m. (3.3 ft.) N/S by 2.5 m. (8.2 ft.) E/W is located in the south end interior of the enclosure. Along the east side of the enclosure a boulder alignment extends east for 2.0 m. (6.6 ft.).

This feature is in poor condition and exhibits poor excavation potential.

**Feature R**, located on a pahoehoe bluff 12.2 m. (40 ft.) *mauka* (east) of the vegetation line, is a rectangular platform built against the north side of a 4.0 m. (13.1 ft.) wide depression in the pahoehoe.

The platform measures 4.5 m. (14.8 ft.) E/W by 3.0 m. (9.8 ft.) N/S. The south side is well faced with pahoehoe boulders stacked 0.6 m. (2.0 ft.) high. At the east side the facing is 0.4 m. (1.3 ft.) high. The west side (facing the ocean) is sloping from collapse but the original alignment of the facing is still visible. At the north end the platform is level with the bedrock outcrop. The surface is level boulder and cobble paving.

Feature R is in good condition and it exhibits good to excellent excavation potential.

**State Site #:** 50-10-37-16757 **CSH Site #:** 432
**Site Type:** Site complex
**Function:** Shrine
**Features (#):** 2
**Site Dimension:** 630.0 m.$^2$ (680.4 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 20 ft. a.m.s.l.

**Description:** State site -16757 comprises two platforms designated as Features A and B. The site is located on a level area outside the vegetation zone on pahoehoe outcrop. The area is surrounded by small *koa haole* and some *noni* trees.

**Feature A** is a rectangular platform measuring 6.8 m. (22.3 ft.) N/S by 5.1 m. (16.7 ft.) E/W and is 1.7 m. (5.6 ft.) at its highest point on the east side. The platform is constructed of a boulder facing with smaller stones filling in the interior surface

In the center of the platform is a raised area with remnant facing possibly representing a collapsed altar.

Feature A of State site -16757 is in good condition and offers fair to good excavation potential. This platform is interpreted as a fishing shrine because of the possible altar and its proximity to the ocean.

**Feature B**, located *mauka* (east) of Feature A, is a small C-shaped platform with facing on three sides. It measures 7.0 m. (23.0 ft.) NE/SW along the base of the C-shaped

platform, 3.0 m. (9.8 ft.) NW/SE along the south arm and 4.0 m. (13.1 ft.) NW/SE along the north arm.

The platform is constructed of medium to small boulders with rough cobble paving along its northern surface area. There is still intact facing along the north and east corner of the platform. The south side contains large boulders which are piled on the platform and onto the pahoehoe abutting the platform.

No artifacts or midden were observed.

Feature B of State site -16757 is interpreted as a possible burial or a related feature to the Feature A shrine. The feature is in fair condition.

| | | |
|---|---|---|
| **State Site #:** | 50-10-37-16758 | **CSH Site #:** 433 |
| **Site Type:** | Site complex | |
| **Function:** | Possible burial | |
| **Features (#):** | 10 | |
| **Site Dimension:** | 16,320 m.² | |
| ***Ahupua'a:*** | Kanaueue | |
| **Elevation:** | 15 ft. a.m.s.l. | |

**Description:** State site -16758 (Figure 50) is a site complex comprising 10 features, designated as Features A through J. The site features include a burial platform, habitation platforms, a possible *heiau* platform, modified sinks, and various enclosures. This site is located near the *makai* (west) vegetation line. The surrounding terrain consists of undulating pahoehoe flow with intermittent soil pockets and vegetated with *kiawe*, *koa haole*, vines and some grass.

**Feature A** is a possible burial platform located next to the *makai* (west) enclosure wall of State site -16756 Feature A. It is situated atop a raised outcrop.

The platform measures 10.0 m. (32.8 ft.) N/S by 5.0 m. (16.4 ft.) E/W and is oval shaped. It is constructed of medium to large boulders with exterior facing and a roughly level surface of medium boulders to medium cobbles.

The platform appears to be built upon a large crevasse in the outcrop as smaller crevasses are observable to the north and south of the platform from which cool air is felt. The crevasse at the north end of the platform has a diameter of 0.6 m. (2.0 ft.) and extends 2.0 m. (6.6 ft.) deep. The crevasse to the south measures 0.4 m. (1.3 ft.) in diameter and its depth is undetermined.

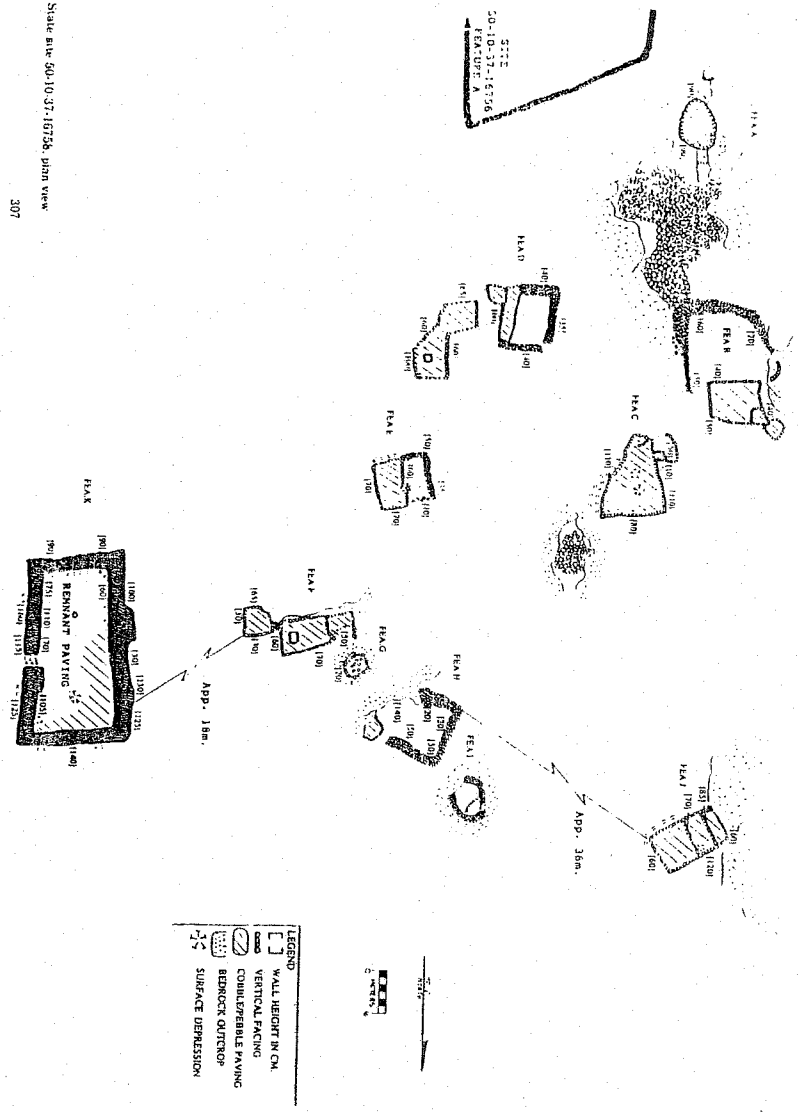
**Feature B** is a low, rectangular platform and attached enclosure located approximately 23.2 m. (76.1 ft.) north of Feature A.

The platform measures 6.0 m. (19.8 ft.) N/S by 10.0 m. (33.0 ft.) E/W. It is constructed of medium cobbles and boulders with a rough surface pavement of medium boulders; no facing remains. The pavement is roughly level and contains a circular depression in its center which measures 1.0 m. (3.3 ft.) in diameter. There is a small pavement attached to the northwest corner of the platform constructed of small to large cobbles.

The enclosure is a C-shape attached to the south wall of the platform. The enclosure wall is constructed of piled pahoehoe cobbles to medium boulders; no facing remains.



Figure 51. State site 50-10-37-16758, plan view.



The enclosure interior is a level soil deposit with scattered boulders and cobbles overlying pahoehoe outcrop.

Feature B is in poor condition and exhibits fair excavation potential. It is interpreted as a permanent habitation platform.

(In between Features A and B is an area of possibly piled boulders filling in the cracks in the outcrop. The area seems to be a walkway between features.)

**Feature C** is a platform located approximately 5.0 m. (16.5 ft.) southeast of Feature B. The platform is slightly triangular in shape, and measures 11.0 m. (36.3 ft.) N/S by 9.0 m. (29.5 ft.) E/W. It is formally constructed with a medium to large boulder facing and a level large cobble to small boulder pavement. The platform surface has two circular depressions measuring 1.0 m. (3.3 ft.) in diameter and depths of 0.4 m. (1.3 ft.) and 0.9 m. (3.0 ft.).

There is a walkway sloping down along the collapsed surface of the platform's *makai* (west) edge.

Just *mauka* (east) of Feature C is a natural depression which appears to have been filled with medium to large boulders. It is roughly level with no facing.

No artifacts or midden were observed at Feature C.

Feature C is in good condition and offers excellent excavation potential. Based on the platform's formal construction and internal depressions, Feature C is interpreted as a possible *heiau*.

**Feature D** comprises an irregular shaped platform and an adjacent enclosure situated on a pahoehoe outcrop. The feature is surrounded by intermittent soil pockets.

The platform is constructed of a medium boulder facing and is paved with cobbles. The south section of facing is mostly collapsed while the north section is intact.

In the center of the northern section of the platform there is a square depression measuring 1.0 m.$^2$ in diameter with a depth of 0.2.m. (0.7 ft.). The depression is faced with boulders. Midden was observed in the surrounding soil areas of the platform.

The adjacent enclosure is rectangular in shape and is located approximately 4.0 m. (13.1 ft.) *makai* (west) of the platform. It measures 10.0 m. (32.8 ft.) N/S by 11 m. (36.1 ft.) E/W and is constructed of piled boulders and cobbles. There is remnant facing on the east wall consisting of one row of large boulders.

The northern half of the enclosure contains a roughly paved area with an abundance of cobbles. The southern half interior is a shallow bed of level soil over a smooth pahoehoe flow. Other modifications exist in the area.

Feature D is fair to poor condition and exhibits fair excavation potential. Both structures of Feature D are interpreted as permanent habitation.

**Feature E** consists of a platform with an attached enclosure located approximately 10.0 m. (32.8 ft.) north of Feature D. It is built atop a raised pahoehoe outcrop with shallow soil on top. The platform measures 7.0 m. (23.0 ft.) N/S by 4.0 m. (13.1 ft.) E/W by 0.7 m. (2.3 ft.) high. It is constructed of a cobble to medium boulder facing of which most areas are intact. Its surface is a level pavement constructed with cobbles.

There is a flat boulder sitting atop several smaller stones abutting the center *makai* (west) edge of the platform; it forms a seat or table. A water-rounded hammerstone and a smaller water-rounded cobble manuport were observed on the platform surface.

The platform is in good condition and exhibits fair excavation potential.

The enclosure is a box C-shape attached to the west side of the platform. The enclosure interior measures 6.0 m. (19.8 ft.) N/S by 2.0 m. (6.6 ft.) E/W. The walls range from



0.35 to 0.5 m. (1.1 to 1.6 ft.) high. The enclosure is constructed of piled large cobbles to medium boulders.

The enclosure is in fair condition. The excavation potential is fair in the surrounding soil deposit and the enclosure interior.

**Feature F** consists of three contiguous platforms located approximately 14.0 m. (45.9 ft.) east of Feature E. The platforms are built along the southern edge of a raised pahoehoe outcrop which stands just over 2.0 m. above the surrounding terrain.

The main platform is the largest of the three, measuring 7.0 m. (23.0 ft.) E/W by 5.0 m. (16.4 ft.) N/S; it is faced with medium to large boulders 1 to 3 courses. It is also well paved with medium cobbles to small boulders. The main platform is 0.5 m. (1.6 ft.) higher than the two adjacent platforms. A faced depression is located at the center of the main platform. It measures 1.5 m. (4.9 ft.) N/S by 1.0 m. (3.3 ft.) E/W with a maximum depth of 0.2 m. (0.6 ft.).

The adjacent platforms are located on the southeast and southwest of the main platform.

The southwest platform is faced with 1 to 2 courses of medium to large boulders and paved with medium cobbles. It measures 4.0 m. (13.1 ft.) in diameter. There is an alignment running off the northwest corner of the platform towards a small sink, designated Feature G. This paving is roughly level.

The southeast platform is well paved with small to medium cobbles and faced with 1 to 2 courses of medium to small boulders. It measures 2.0 m. (6.6 ft.) N/S by 4.0 m. (13.1 ft.) E/W.

Feature F is in good condition and exhibits fair excavation potential. It is interpreted as a permanent habitation feature.

**Feature G**, adjacent to the northwest corner of Feature F, is a small modified sink, measuring 4.5 m. (14.8 ft.) in diameter and 1.4 m. deep. (4.6 ft.). A rough, small to large cobble alignment runs around the edge of the sink rim. The sink floor is soil in the east and possibly paved in the west.

Another collapsed sinkhole is present 3.0 m. (9.8 ft.) to the east of Feature G, is larger but has no modification.

Feature G is in poor condition with fair excavation potential.

**Feature H** is a C-shaped enclosure abutting the north edge of an outcrop of which Features F and G are situated on. There is a *noni* tree in the enclosure. The C-shape encloses an area of 6.0 m. (19.7 ft.) in diameter and it is open to the west.

The enclosure wall is constructed of medium cobbles to large boulders with small to large cobble fill. The interior is a shallow bed of soil atop a pahoehoe flow. The enclosure completes the outcrop. This feature is in very disturbed condition. Just outside the northeast corner against the outcrop is a small, rough, cobble pavement.

A Paul H. Rosendahl Inc. site marker and stake were observed but the inscriptions were illegible.

Feature H is in fair condition and has good excavation potential. It is interpreted as a permanent habitation feature.

**Feature I** is a faced and walled lava blister sinkhole located 5.0 m. south of Feature H. The sink is oval in shape, measuring 4.5 m. (14.8 ft.) in diameter and a maximum 2.3 m. (7.6 ft.) deep. The blister interior is entirely faced except for its the east side.

The facing comprises small to medium boulders stacked 4 to 5 courses high. Piled cobbles and boulders provide a slope to the sink floor but it is in a collapsed condition.

An overhang is observable between the facing in the north corner of the lava blister; it measures 0.9 m. (3.0 ft.) wide E/W and extends the west for approximately 2.8 m. (9.2 ft.) with a maximum ceiling height of 1.5 m. (4.9 ft.). Soil deposits are present beneath the overhang. The east side of the blister contains a cobble pavement under a slight overhang.

A large water-rounded "scooped" grinding stone measuring 0.5 (1.6 ft.) by 0.8 m. (2.6 ft.) was observed beneath the west overhang. A dense water-rounded hammerstone, a scoria abrader and marine midden, coral and *kukui* nuts were also present.

Feature I is in fair condition and has fair to good excavation potential. It is interpreted as a temporary shelter associated with permanent habitation of the site complex.

**Feature J**, located 30.0 m. (98.4 ft.) west of Feature F and just west of Features H and I, is an irregularly shaped enclosure containing 2 rectangular pavements.

The enclosure measures approximately 7.0 m. (23.0 ft.) N/S by 5.0 m. (16.4 ft.) E/W with a maximum height of 0.3 m. (1.0 ft.). One pavement is in the southeast quad of the enclosure interior and the other is abutting the enclosure's southwest corner. They are both constructed of cobbles.

The enclosure walls are constructed of piled large cobbles to medium boulders. The enclosure interior is outcrop with a small amount of soil.

The feature is in fair to poor condition and has poor excavation potential. It is interpreted as a permanent habitation feature.

**Feature K** is a large rectangular enclosure that is located *mauka* (east) of the other features in the complex. It measures 26.0 m. (85.3 ft.) N/S by 16.0 m. (52.5 ft.) E/W with a maximum wall height of 1.6 m. (5.2 ft.). The enclosure wall is constructed of boulder facing with cobble fill and has a level pebble and cobble pavement on its interior. The facing is formally constructed and very well preserved. There is a depression on the north side of the enclosure measuring 2.0 m. (6.6 ft.) in diameter.

No artifacts or midden were observed.

Feature K is in good condition and offers good to excellent excavation potential. It is interpreted as a *heiau*.

**State Site #:** 50-10-37-16759 **CSH Site #:** 434
**Site Type:** Site complex
**Function:** Temporary habitation
**Features (#):** 2
**Site Dimension:** 99.0 m.$^2$ (1,069.2 ft.$^2$)
***Ahupua'a:*** Hokukano 1
**Elevation:** 14 ft. a.m.s.l.

**Description:** State site -16759 is a terrace and a wall, designated Feature A and B, respectively. The site is situated in a small gully between two pahoehoe outcrops and surrounded by *kiawe*, *koa haole*, and California grass. The modifications of Feature A and B roughly enclose an area of the gully which measures approximately 8.0 m. (26.4 ft.) N/S by 18.0 m. (59.4 ft.).

**Feature A** is a terrace located along the west terminus of the gully approximately 4.0 m. (13.2 ft.) west of Feature B. The terrace is constructed against pahoehoe outcrop on it west



and portions of its north side and it measures 2.5 m. (8.2 ft.) N/S by 13.0 m. (31.7 m.) E/W. It is constructed of boulders and cobbles and it is well faced on the portion of its north side - not abutting outcrop. The southeast side is also freestanding at a maximum height of 0.2 m. (0.6 ft.). The majority of the terrace is a level paving with the exception of its central portion.

**Feature B** is a wall constructed against the edge of the outcrop on the south side of the small gully. The wall measures 12.0 m. (39.6 ft.) E/W long and has a maximum width of 1.5 m. (4.9 ft.). It is constructed of stacked small to medium boulders. Directly south of the wall - on the opposite side of the gully - are two paved areas constructed of small to medium boulders and cobbles. The pavings are fairly level and abut the pahoehoe outcrop on the west and north sides. The other sides are flush with the pahoehoe bedrock. The floor of the gully is a intermittent shallow soil deposit on outcrop.

Coral was observed at the site.

State site -16759 is interpreted as a temporary habitation shelter.

**State Site #:** 50-10-37-16760 **CSH Site #:** 435
**Site Type:** Platforms
**Function:** Possible burial
**Features (#):** 2
**Site Dimension:** 247.0 m.$^2$ (2,667.6 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16760 comprises two platforms - designated Features A and B - located in an area measuring 19.0 m. (62.3 ft.) N/S by 13.0 m. (42.7 ft.) E/W. The site is situated on a pahoehoe flow with some shallow sand and vegetation consisting of California grass, *koa haole*, and *kiawe*. It is located approximately 30.0 m. south of State site -16757.

**Feature A** is a large rectangular platform measuring 8.5 m. (27.9 ft.) N/S by 13.0 m. (29.5 ft.) E/W situated just *makai* (west) of the tree line.

The platform is constructed of small to medium boulders with medium to large cobbles. There is no vertical facing and the surface paving is in a remnant condition. On the upper portion of the platform there is a large quantity of historical era bottles. Cowrie and *opihi* shells are also observed as well as some coral. *Makai* (west) of the feature there is a natural pile of small to large boulders.

**Feature B**, located 5.0 m. (16.4 ft.) to the south of Feature A, is a small square-shaped platform measuring 4.0 m. (13.1 ft.) E/W by 4.0 m. (13.1 ft.) N/S. It is situated just *makai* (west) of the tree line.

The platform is constructed of small to medium boulders with medium to large cobbles. The paving is in fair condition in the central portion of the platform with the rest being somewhat tumbled. Just to the south of Feature B is a small circular rock mound.

No artifacts or midden were observed at this feature.

**State Site #:** 50-10-37-16761 **CSH Site #:** 436
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 16
**Site Dimension:** 4,992.0 m.$^2$ (53,913.6 ft.$^2$)
***Ahupua'a:*** Kanaueue
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16761 is a site complex comprising 16 features designated A through P. The site is situated on the coast amongst *kiawe* and *koa haole* trees.

**Feature A** is an enclosure measuring 12.5 m. (41.0 ft.) N/S by 10.0 m. (32.8 ft.) E/W. The east wall is constructed of 1 to 2 courses of cobbles and boulders and it measures 0.4 m. (1.3 ft.) high and 1.0 m. (3.3 ft.) wide. The north wall measures 1.0 m. (3.3. ft.) high and is constructed of piled boulders 1.0 m. wide (3.3. ft.). The west wall is almost totally collapsed and defined as an alignment of loose rocks on outcrop. The south wall shows some facing but is also mostly collapsed. There is some soil in the interior of the enclosure.

A bottle and a rusted pan were observed at the southeast end of Feature A.

Feature is in poor condition and excavation potential is fair. It is interpreted as a permanent habitation feature.

**Feature B** is a platform measuring 10.0 m. (32.8 ft.) E/W by 4.0 m. (13.1 ft.) N/S with a maximum height of 0.4 m. (1.3 ft.). The platform surface is rough roughly paved with cobbles and boulders. Soil deposits are present to the north of Feature B.

Feature B is in good condition and has good excavation potential. It is a permanent habitation feature.

**Feature C**, adjoining Feature B to the east, is a platform which measures 8.0 m. (26.2 ft.) by 4.0 m. (13.1 ft.) E/W. Facing on the east *mauka* (east) side measures 0.5 m. (1.6 ft.) high, 0.4 m. (1.3 ft.) on the north side, and 0.2 m. (0.6 ft.) on the west side. The south side is well faced with large boulders which are contiguous with Feature A.

Midden was observed between Features B and C is amongst a soil area.

This feature is in good condition and has excellent excavation potential. It is a permanent habitation platform.

**Feature D** consists of two salt pans located on the *makai* (west) edge of a pahoehoe bluff. Both salt pans are pecked into a boulder surface and measure 0.6 m. (1.9 ft.) long by 0.4 m. (1.3 ft.) wide and are 0.1 m. (0.3 ft.) deep. The salt pans are situated on a pile of boulders.

Feature D salt pans are in excellent condition.

**Feature E** is a small enclosure built at the east base of the pahoehoe bluff. It measures 2.5 m. (8.2 ft.) N/S by 2.0 m. (6.6 ft.) E/W. The *makai* (west) wall measures 0.4 m. (1.3 ft.) high on the interior and 1.2 m. (3.9 ft.) high on the exterior and slopes down to outcrop. The east end of the enclosure is incorporated into an outcrop ledge.

This feature is located within 4.0 m. (13.2 ft.) south of Feature D salt pans and may be associated with salt preparation. Feature E is in good condition and has good excavation potential.

**Feature F** is a large rectangular enclosure situated atop a pahoehoe bluff. It



measures 12.0 m. (39.4 ft.) N/S by 12.5 m. (41.0 ft.) E/W. The walls are intact, measuring 1.0 m. (3.3 ft.) wide and 0.3 to 0.4 m. (0.9 to 1.6 ft.) high on the south, east and west sides. The northwest side has an entrance 1.0 m. (3.3. ft.) wide. At the northwest corner is a paved area of boulders 3.0 m. (9.8 ft.) N/S by 2.0 m. (6.6 ft.) E/W with rough facing measuring 0.3 to 0.4 m. high.

This permanent habitation feature is in good condition with excellent excavation potential.

**Feature G** is a terrace built into the north side of Feature F. Feature G measures 5.5 m. (18.0 ft.) N/S by 3.0 m. (9.8 ft.) E/W; its *mauka* (east) side is a vertical face 1.6 m. (5.2 ft.) high. The south side measures 0.3 m. (0.9 ft.) high. The north side is a rough boulder paving relatively flush with the outcrop.

This feature is a permanent habitation feature directly associated with Feature F.

**Feature H** is a pavement which lies contiguous with Feature G terrace on its west side. The terrace is roughly paved and rectangular-shaped, measuring 2.0 m. (7.2 ft.) N/S by 1.5 m. (4.9 ft.) E/W and 0.3 m. (0.9 ft.) high.

Eight salt pans are situated on the pavement surface. The largest pan measures 0.4 m. (1.3 ft.) in diameter with a depression 0.15 m. (0.5 ft.) deep. The smallest measures 0.25 m. (0.7 ft.) in diameter and 0.7 m. (.2 ft.) deep.

Feature H is a specialized "food processing" feature in excellent condition. It has good excavation potential.

**Feature I** is a terrace measuring 5.0 m. (16.4 ft.) N/S by 8.2 m. (26.9 ft.) E/W with a maximum height of 1.3 m. (4.3 ft.). It is situated approximately 100.0 m. (328.1 ft.) from the coast in a small crevasse or ravine in the pahoehoe flow.

The terrace is constructed in such a way that its southwest corner connects with the edge of the pahoehoe. It is constructed of medium to small stacked boulders with facing that is still intact along the south side. The remaining sides are either tumbled or constructed flush with the edges of the pahoehoe. The top of the platform is fairly mounded with the south central portion being roughly level.

No artifacts or midden were observed.

Feature I is interpreted as a possible burial.

**Feature J** is a terrace located 7.7 m. (25. 3 ft.) to the south of Feature I, along the same outcrop crevasse. It is situated in a narrower section of the crevasse so that both the east and west sides are completely flush with the edge of the pahoehoe.

The terrace measures 4.0 m. (13.1 ft.) in diameter. Both the north and south sides are faced and in good condition. It is constructed of stacked medium boulders and cobbles. The terrace surface is fairly level and roughly paved with medium cobbles. There is a medium-sized boulder in the center of the platform inset into the paving.

No artifacts or midden were observed.

Feature J - due to its location and construction - is interpreted as a possible burial.

**Feature K** is a terrace located 5.0 m. (16.4 ft.) west of Feature J's west end. It measures 2.0 m. (6.6 ft.) long N/S by 1.5 m. (4.9 ft.) wide E/W and is situated in a crevasse between two outcrop bluffs. The boulders are stacked 1 course high; the terrace has a level surface.

Feature K is in poor condition and - given its close location to Feature K and its construction over a crevasse - it is interpreted as a possible burial.

**Feature L** is a modified outcrop located on the east end of a pahoehoe bluff. The modifications consist of stacked and piled pahoehoe boulders which exhibit a roughly level surface against outcrop. The modification measures 2.0 m. (6.6 ft.) N/S by 6.0 m. (19.8 ft.) E/W.

No artifacts or midden were observed.

Feature L is in fair condition and is interpreted as a possible burial.

**Feature M** is a modified sink measuring 8.0 m. (26.2 ft.) by 5.0 m. (16.4 ft.) which contains an overhang below the sink rim. The sink is roughly triangular in shape and it is modified with boulders placed along its north and south ends. The modification is very slight; no facing was observed.

The sink overhangs are 1.9 m. (5.9 ft.) wide to the north and 1.7 m. (5.6 ft.) wide to the south. The overhangs extend only 1.0 m. (3.3. ft.) deep beyond the dripline of the sink.

No midden or artifacts were observed.

Feature M is in poor condition with fair excavation potential. It is interpreted as a temporary shelter.

**Feature N** is a pavement measuring 4.0 m. (13.1 ft.) N/S by 3.5 m. (11.5 ft.) E/W. The paving is constructed of small boulders and cobbles with medium to large boulders marking the perimeter. Facing is present on the north edge of the pavement.

Feature N is located immediately northwest of Feature O.

No artifacts or midden were observed.

Feature N is in fair to poor condition and has fair to poor excavation potential. It is interpreted as a permanent habitation feature.

**Feature O** is a modified sink. The circular sink depression has overhangs to the north and northeast. The sink measures 3.5 m. (11.5 ft.) in diameter and ranges from 1.5 m. (4.9 ft.) to 2.0 m. (6.6 ft.) deep.

*Opihi* shells were observed amongst the soil covered floor of the sink. Along the soil floor some patches of ashy gray soil - possible hearth areas - were observed.

Feature O is in poor condition and offers good excavation potential. It is interpreted as a temporary habitation feature.

**Feature P** - of State site -16762 - is a short boulder alignment outlining the perimeter of an outcrop. It is 1 to 2 courses high and exhibits no vertical facing.

Feature L is located approximately 12.0 m. (39.4 ft.) *makai* (west) of Feature P..

No artifacts or midden was observed at Feature P. It is in poor condition and has poor excavation potential.



**State Site #:** 50-10-37-16762 **CSH Site #:** 437
**Site Type:** Site complex
**Function:** *Heiau*
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a:*** Kanaueue
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16762 is a site complex comprising three features designated A through C. The site is located on a high pahoehoe outcrop between the tree line and the ocean. It is surrounded by *koa haole* and *kiawe*. The site features include a platform, a pavement and a faced bluff.

Feature A was originally recorded by J.E. Reinecke (1929) as a *heiau* (fishing shrine); he also noted the presence of a "small ruined house site" located just south of the *heiau*. Feature C - as is Feature B - is interpreted as permanent habitation features, likely associated with the Feature A *heiau* and adjacent house site.

**Feature A** *heiau* is a platform complex situated on the north side of a cleft in the pahoehoe ridge. The platform is oval-shaped and measures 12.0 m. (39.4 ft.) NW/SE by 19.0 m. (62.3 ft.) SW/NE.

It is constructed of large to small boulders with an interior cobble and boulder pavement. The pavement has intermittent areas of exposed outcrop. The platform is well faced on all sides and has a remnant wall that appears to have run along the entire perimeter of the platform except along a portion of its south side.

Branch coral was observed on Feature A platform. The west end of the platform has a commanding view of Kona and the coastline.

The "house site" recorded by Reinecke (1929) is located at the base of the ridge, to the south of the *heiau*. It is a bi-level platform with a shallow sand area on the north side abutting the pahoehoe outcrop.

The platform measures 5.0 m. (16.4 ft.) N/S by 4.5 m. (14.8 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). The lower level is at the south end, and measures 0.2 m. (0.7 ft.) lower than the upper level. It is constructed of small to medium boulders with cobble paving. There is some remnant of the vertical paving on the west side. Coral was observed on this platform as well.

Feature A is in good condition and offers excellent excavation potential. A site marker labelled as "Reinecke Feature 35" is present on Feature A.

**Feature B** is a level rectangular pavement with its northeast side abutting pahoehoe outcrop. The pavement measures 11.5 m. (36.1 ft.) N/S by 6.5 m. (21.3 ft.) E/W. The feature is faced with small to medium boulders. The paving consists of small boulders and cobbles. In the southeast corner there is a small circular enclosure. Some coral is observed but no other artifacts or midden were

Feature B is in fair condition and offers fair excavation potential.

**Feature C** - directly *mauka* (east) of Feature B - is a faced bluff constructed of small boulders and cobbles. This feature measures 1.5 m. (4.9 ft.) NW/SE by 6.0 m. (19.7 ft.) SW/NE by 1.0 m. (3.3 ft.) high and is well faced on its west side.

Directly *mauka* (east) of this bluff is flat level pahoehoe outcrop. Here some coral and a *Nerita picea* were observed.

Feature C is in good condition and offers fair excavation potential.

**State Site #:** 50-10-37-16763 **CSH Site #:** 438
**Site Type:** Site complex
**Function:** Possible burials; Temporary habitation
**Features (#):** 3
**Site Dimension:** 247.0 m.$^2$ (2,667.6 ft.$^2$)
***Ahupua'a:*** Hokukano 1
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16763 (Figure 51) is a site complex, consisting of a terrace, a wall section and a platform, designated A through C, respectively. It is situated on level pahoehoe bedrock surrounded by some California grass, *koa haole*, *kiawe*, and fern.

Features A and B are interpreted as possible burials and Feature B wall may represent a non-contemporaneous habitation feature.

**Feature A** is a possible burial terrace built against a pahoehoe outcrop. The terrace measures 7.0 m. (23.0 ft.) N/S by 4.5 m. (14.8 ft.) E/W by 1.0 m. (3.3. ft.) high. It is well paved and the *makai* (west) side has intact vertical facing, while the *mauka* (east) side abuts the pahoehoe outcrop. It is constructed of small to medium boulders and cobbles. There is no view of the ocean due to another outcrop just *makai* (west) of this feature.

Feature A is in good condition.

**Feature B**, directly to the west of Feature A, is a J-shaped enclosure with its long axis running 5.0 m. (16.4 ft.) N/S. Its north end is attached to outcrop. The wall is an alignment of boulders approximately 0.8 m. (2.6 ft.) high.

A soil area is located between Feature A and B.

No artifacts or midden was observed. The ocean view is also blocked at feature B by an intervening outcrop. *Makai* (west) of this feature there are various modifications of the surrounding pahoehoe outcrop.

Feature B is in good condition and has good excavation potential in the enclosed soil area.

**Feature C** is a platform located just *mauka* (east) of Feature A on the top level of the outcrop. The platform measures 4.0 m. (13.1 ft.) N/S by 5.0 m. (16.4 ft.) E/W by 0.9 m. (3.0 ft.) high.

It is constructed of small boulders and large cobbles. The platform is well paved on the top central portion with vertical facing on the south and eastern sides. The north and west sides are collapsed.

Feature C is in good condition.

No artifacts or midden were observed at State site -16763.



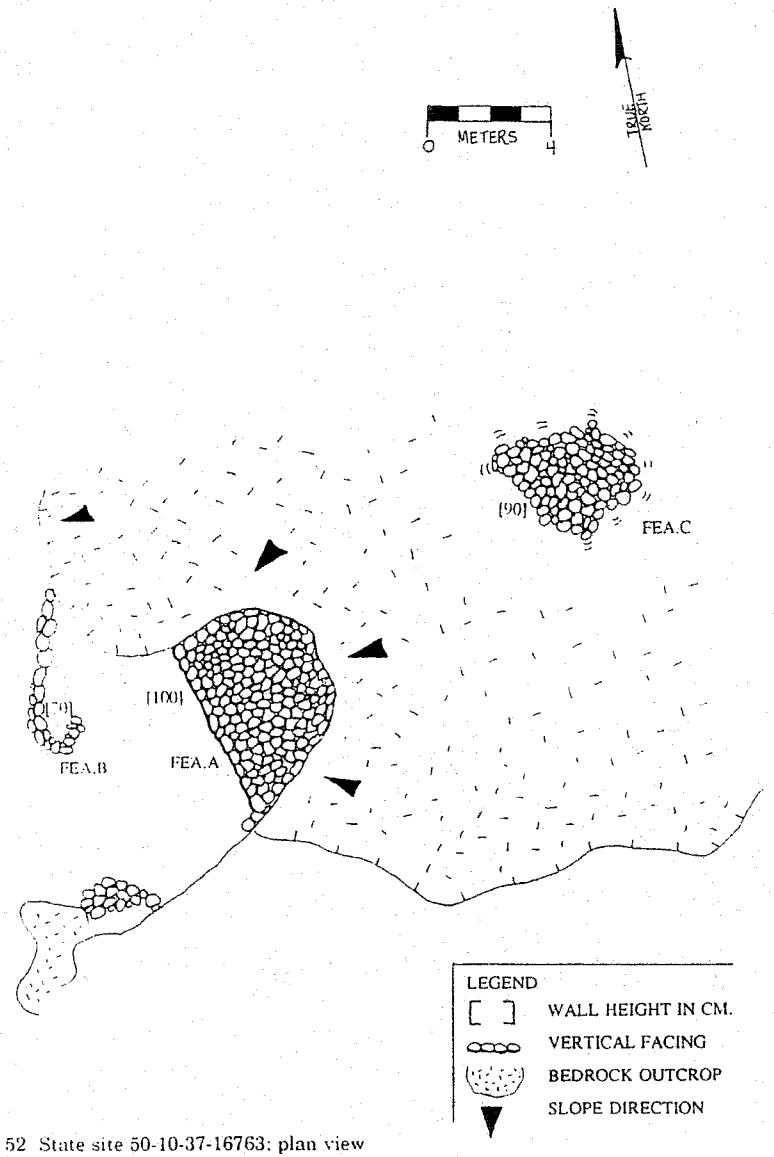



Figure 52 State site 50-10-37-16763: plan view

**State Site #:** 50-10-37-16764 **CSH Site #:** 439
**Site Type:** Site complex
**Function:** Probable burials
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano 1
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16764 (Figure 52) consists of 3 features designated as Features A and B. The site is situated among soil pockets in the surrounding pahoehoe outcrop terrain. Vegetation consists of *kiawe* and *koa haole* with some ferns.

**Feature A** is a terrace with its southeast side abutting an outcrop ledge. The terrace measures 6.0 m. (19.8 ft.) NE/SW by 4.5 m. (14.8 ft.) NW/SE with a maximum height of 0.8 m. (2.6 ft.). It' perimeter is constructed of small to medium boulders with cobbles and its surface is paved with cobbles and boulders. There is some vertical facing along the west side of the feature while its remaining perimeter is mostly collapsed.

The outcrop adjacent to the terrace's southeast side rises 2.0 m. (6.6 ft.) above the terrace surface.

To the west of Feature A, the soil pocket (bound by outcrop) is paved with cobbles and boulders.

Feature A is in good condition.

**Feature B** consists of two terraces constructed within an adjacent soil pocket, approximately 8.0 m. (26.4 ft.) northeast of Feature A.

The *makai* (west)-most platform measures 3.5 m. (11.5 ft.) NW/SE by 4.5 m. (14.8 ft.) NE/SW with a maximum height of 0.8 m. (2.6 ft.). It is rectangular shaped with medium boulders facing its perimeter and its interior surface is paved with cobbles. It is situated between two outcrop ledges.

A Paul H, Rosendahl Inc. site marker labelled "W-35" was observed on the surface of the *makai* (west) terrace.

The adjacent *mauka* (east) terrace measures 2.5 m. (8.2 ft.) N/S by 3.0 m. (9.8 ft.) E/W with a maximum height of 0.3 m. (1.0 ft.). Its southeast side is constructed against the outcrop ledge. It has no visible facing.

Directly to the south of Feature B area is a small area of modification defined by surface fill along the outcrop surface.

Feature B terraces are in fair to good condition.

No artifacts or midden were observed at State site -16764.



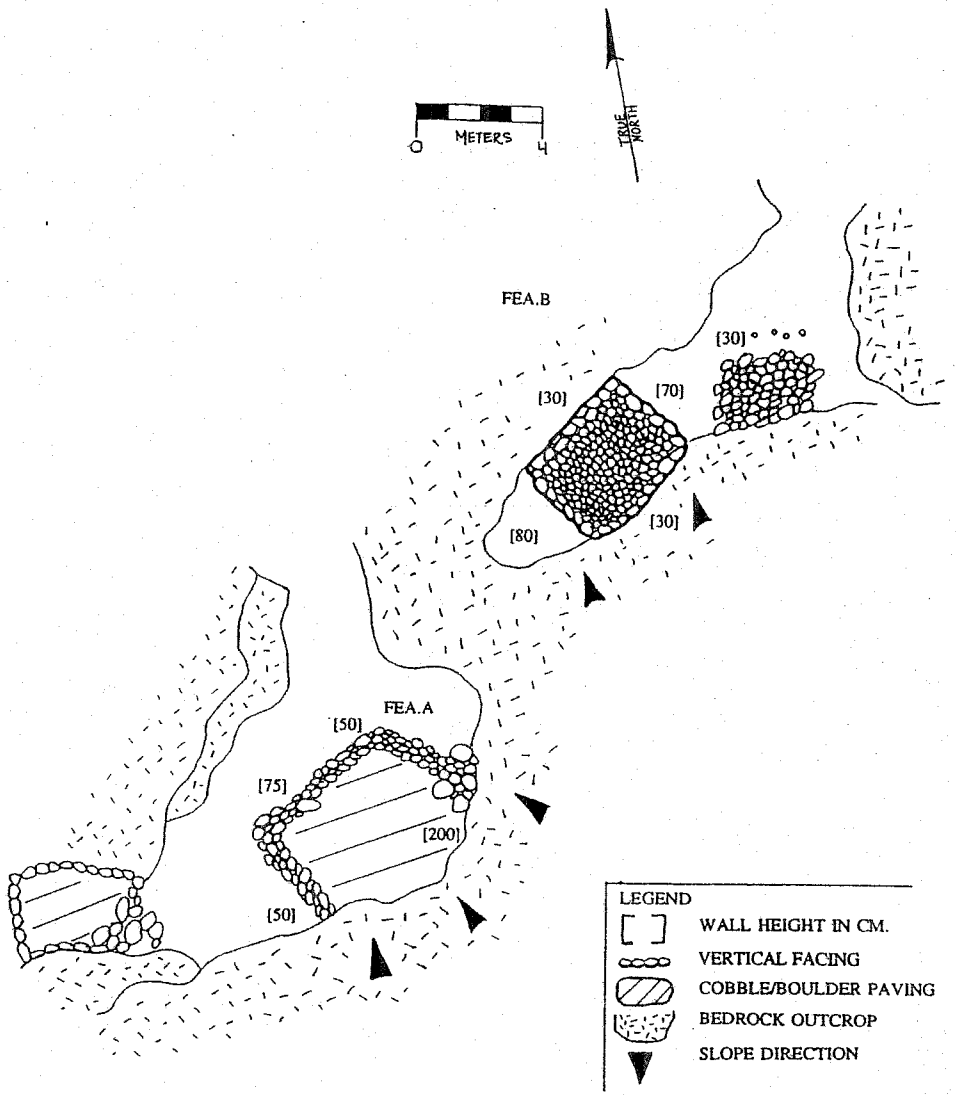



Figure 53 State site 50-10-37-16764; plan view

**State Site #:** 50-10-37-16765 **CSH Site #:** 440
**Site Type:** Site complex
**Function:** Temporary habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano 1
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16765 consists of a C-shaped pavement and an enclosure designated A and B, respectively. The site is situated on a fairly level pahoehoe outcrop terrain which contains no soil. There are *koa haole* and *kiawe* trees nearby.

**Feature A** consists of a C-shaped pavement constructed of small boulders and cobbles situated atop a level pahoehoe flow. The paved area measures 7.0 m. (23.0 ft.) by 5.0 m. (16.4 ft.) and it rises not more than 0.3 m. (1.0 ft.).

**Feature B** is a roughly circular enclosure located directly to the south of Feature A. It measures 7.0 m. (23.0 ft.) by 5.0 m. (16.4 ft.) and its wall has a maximum height of 0.3 m. (1.0 ft.). The wall is constructed of piled cobbles and boulders with no vertical facing present.

The interior of the enclosure is paved with small boulders and cobbles. A circular alignment of cobbles and boulders is present within the west portion of the enclosure, adjacent to its south wall; it measures approximately 1.0 m. (3.3 ft.) in diameter and has a height of 0.3 m. (1.0 ft.)

No midden or artifacts were observed at either features of the site.

State site -16765 is in fair condition and the excavation potential is fair to poor.

**State Site #:** 50-10-37-16766 **CSH Site #:** 441
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 3
**Site Dimension:** 1,152.0 m.$^2$ (12,441.6 ft.$^2$)
***Ahupua'a:*** Hokukano 1
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16766 is a site complex comprising three platforms designated A through C. The site is situated along the coast just within the tree line. It is surrounded by *kiawe*, *koa haole*, opiuma, and sparse grasses.

**Feature A** is a roughly rectangular platform measuring 6.0 m. (19.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W with a maximum height of 1.0 m. (3.3 ft.). It is constructed of large to small stacked boulders with a cobble pavement.

Marine midden was observed on the platform.

Feature A is in good condition and it has good excavation potential.

**Feature B** is an irregular shaped platform located 11.0 m. (36.1 ft.) south of Feature A. The platforms are connected by two walls forming an enclosure between the platforms. The enclosure interior consists of level soil and grass.



The Feature B platform measures 6.0 m. (19.8 ft.) N/S by 9.5 m. (31.2 ft.) E/W with a maximum height of 0.9 m. (3.0 ft.). Its southeast corner is slightly indented 2.0 m. (6.6 ft.), which forms an inverted corner. It is constructed of large to small stacked boulders with a cobble pavement.

Marine midden was observed. No artifacts were present on Feature B.

Feature B platform is in good condition and offers good excavation potential.

**Feature C** is at the *makai* (west) edge of the site complex. It is an L-shape platform with an attached wall. It measures 12.0 m. (39.4 ft.) N/S by 11.0 m. (36.1 ft.) E/W with a maximum height of 0.5 m. (16.4 ft.).

It is constructed of small to large stacked boulders with a level cobble pavement.

A wall extends form the southwest corner of the platform and it continues approximately 20.0 m. (65.6 ft.) to the southwest until it turns and continues for 12.0 m. (39.4 ft.). Both the wall and platform are stacked with boulders and are well faced.

Marine midden was observed on the platform. Historic artifacts were also present, including one gallon glass jugs, liquor bottles, and other unidentifiable bottles.

Feature C is in fair to good condition and offers good excavation potential.

**State Site #:** 50-10-37-16767 **CSH Site #:** 442
**Site type:** Site complex
**Function:** Multi-function
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano 1
**Elevation:** 15 ft. a.m.s.l.

**Description:** State Site -16767 is a small site complex which consists of three features: a paved enclosure (Feature A); a terrace (Feature B); and a remnant platform and wall segment (Feature C). The terrain consists of pahoehoe outcrop with intermittent soil deposits. The vegetation includes *koa haole*, *kiawe*, and *opiuma*.

**Feature A** is a paved enclosure located approximately 30.0 m. (98.4 ft.) *mauka* (east) of State site -16766 on a pahoehoe outcrop ridge. A narrow gully passes to the southwest.

The enclosure exterior measures 6.0 m. (19.8 ft.) NW/SE by 3.0 m. (9.8 ft.) NE/SW. The enclosed area is roughly paved with cobbles and small boulders and measures 3.0 m. (9.8 ft.) by 1.2 m. (3.9 ft.). The enclosure wall has a maximum height of 0.6 m. (2.0 ft.) and are constructed of small to medium boulders and some large boulders.

Feature A is in fair condition. It is interpreted as a permanent habitation unit.

**Feature B** terrace is located on the same pahoehoe ridge as Feature A, 5.0 m. (16.4 ft.) southeast. The terrace appears to cover a crack in the outcrop.

The terrace measures 3.0 m. NW/SE by 1.0 m. NE/SW. It is constructed of pahoehoe boulders along its perimeter and an interior surface of cobbles. There is vertical facing on the southwest edge which measures 0.9 m. (3.0 ft.) high.

Feature B is in fair condition and it is interpreted as a possible burial.

**Feature C** - located 8.0 m. (26.2 ft.) north of Feature A on the same pahoehoe ridge -

is a remnant platform with short wall segments. Together, these structures form a small enclosure with an attached platform.

The platform has been disturbed by *kiawe* treefall and root growth. It is roughly square with sides measuring approximately 4.0 m. (13.2 ft.) in diameter. The platform is constructed of medium to large pahoehoe boulders along its perimeter and a cobble and small boulder pavement with exposed soil along its surface. Vertical facing 0.6 m. (2.0 ft.) high is observed on the southwest side of the platform.

Two parallel wall segments extend 2.0 (6.6 ft.) to 3.0 m. (10.0 ft.) off the southwest edge of the platform and enclose a small level grassy area which is open to the southwest. The enclosed area measures 6 $m.^2$ (64.8 $ft.^2$).

A contiguous enclosure lies to the south of the platform which is approximately 9 $m.^2$ (97.2 $ft.^2$). This enclosure is tumbled and less soil is visible in its interior.

No artifacts were observed. One piece of branch coral is observed. The feature has been disturbed but is in fair condition.

Feature C is in remnant condition and has good excavation potential. It is probably a permanent habitation feature.

No artifacts or midden were observed at State site -16767.

**State Site #:** 50-10-37-16768 **CSH Site #:** 443
**Site type:** Site complex
**Function:** Multi-function
**Features (#):** 3
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano 1
**Elevation:** 20 ft. a.m.s.l.

**Description:** State site -16768 is a site complex consisting of an enclosure, a terrace and an alignment designated A through C, respectively. The site is situated on a pahoehoe ridge about 100.0 m. (328.0 ft.) from the ocean.

**Feature A** is a remnant enclosure with an interior measuring 8.0 $m.^2$. (86.4 $ft.^2$). The enclosure wall is constructed of small to medium boulders which are mostly collapsed

The feature is in poor to fair condition. The excavation potential is poor to fair. It is a habitation feature.

**Feature B** - located atop a pahoehoe ridge approximately 7.0 m. (23.0 ft.) northeast of Feature A - is a terrace. The terrace is constructed flush to the underlying outcrop along its south and southeast side and its northwest side is well faced at a maximum height of 0.9 m. (3.0 ft.). The terrace measures 6.0 m. (20.0 ft.) NE/SW by 4.0 m. (13.2 ft.) NW/SE. It is constructed of small to medium boulders. The pahoehoe ridge drops steeply *makai* (west) beyond the terrace.

Feature B is in fair condition. It is interpreted as a possible burial.

**Feature C** is a wall segment located just northeast of Feature B, along the perimeter of the pahoehoe ridge. The wall measures at least 12.0 m. (39.4 ft.) NW/SE long and has a maximum height of 0.6 m. (2.0 ft.). It is constructed of small to large boulders.



Feature C is in fair condition and has poor excavation potential.

No artifacts or midden were observed at State site -16768.

**State Site #:** 50-10-37-16769 **CSH Site #:** 444
**Site type:** Walls
**Function:** Agriculture
**Features (#):** 1
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano 1
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16769 is a series of wall segments which cross cut the slope extending across the width of a naturally formed gully. The site is located approximately 20.0 m. (65.6 ft.) within the tree line and 20.0 m. (65.6 ft.) north of State site -16767.

The site consists of three wall segments beginning at the terminus or *makai* (west) end of the gully which opens towards the coast.

The first wall section is located approximately 15.0 m. (49.2 ft.) from the *makai* (west) end of the gully . The wall is 5.0 m. (16.4 ft.) long and 0.6 m. high. It is constructed of small to medium pahoehoe boulders.

The second wall is located 4.0 m. (13.1 ft.) upslope or *mauka* (east) of the first wall. It measures approximately 5.0 m. (16.4 ft.) long and 0.3 m. (1.0 ft.) high. It makes partial use of the bedrock outcrop and is also constructed of small to medium pahoehoe boulders.

The third wall segment, approximately 7.0 m. (23.1 ft.) *mauka* (east) of the second wall, measures 5.0 m. (16.4 ft.) long and 0.7 m. (2.3 ft.) high. It is constructed of pahoehoe boulders.

State site -16769 is in fair condition and the excavation potential is poor. The site likely functioned as an agricultural complex in which the walls were constructed to retain moisture within the gully, as well as form boundaries between crops.

**State Site #:** 50-10-37-16770 **CSH Site #:** 445
**Site type:** Terrace
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 31.5 $m.^2$ (340.2 $ft.^2$)
***Ahupua'a:*** Hokukano 1
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16770 (Figure 53) is a terrace located 40.0 m. (131.2 ft.) *mauka* (east) or east of State site -16769. The site is situated on undulating pahoehoe amongst sinks and ridges of exposed outcrop with patchy soil deposits. Vegetation including *koa haole*, *kiawe*, and one *noni* tree surrounds the site.

The terrace measures 7.0 m. (23.0 ft.) N/S by 4.5 m. (14.8 ft.) E/W. It is constructed of

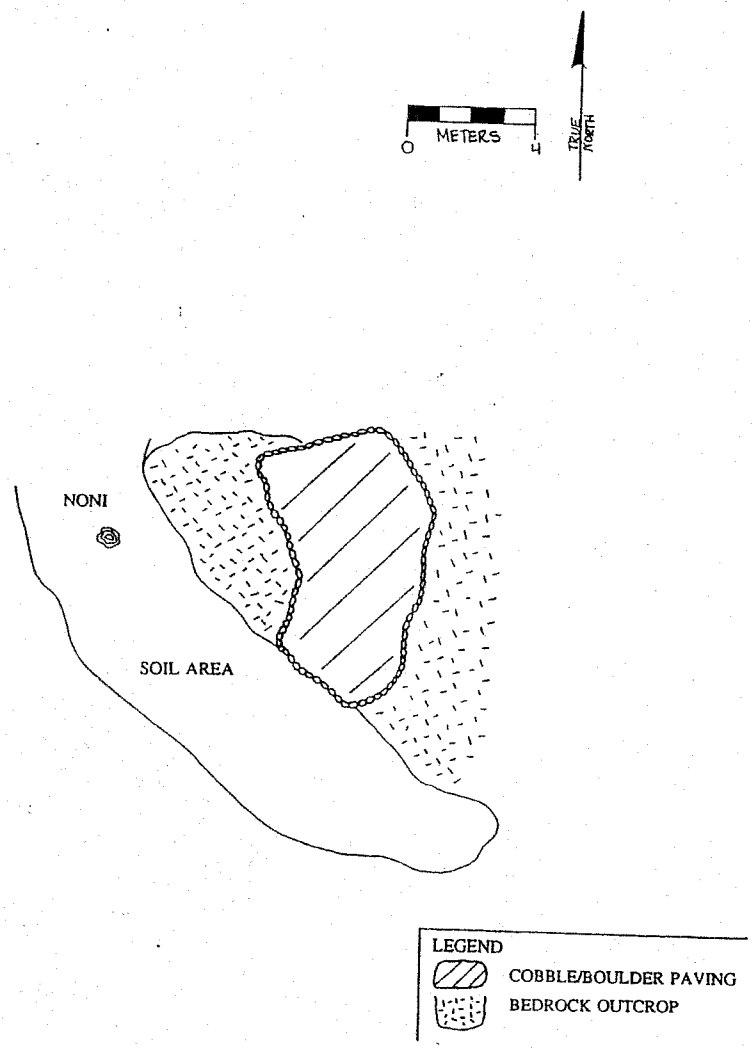



Figure 54 State site 50-10-37-16770; plan view



small boulders and cobbles and it has a level surface pavement. The terrace is bound by the outcrop on its west, east and north sides and on its south the terrace borders the sink. The site is not formally constructed and no vertical facing is present.

A linear sink runs roughly southwest of the terrace. Within this sink ample soil deposits are present.

No artifacts or midden are observed at the site.

State site -16770 is a temporary habitation site and the adjacent sink feature may have served as a planting area.

**State Site #:** 50-10-37-16771 **CSH Site #:** 446
**Site Type:** Site complex
**Function:** Permanent habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a*:** Hokukano
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16771 consists of an enclosure and a platform (Features A and B), located on level pahoehoe just inside the tree line. The surrounding vegetation includes *koa haole*, *kiawe*, and California grass.

**Feature A** is an enclosure which measures 14.0 m. (45.9 ft.) E/W by 10.0 m. (32.8 ft.) N/S with a maximum height of 1.0 m. (3.3 ft.). This feature probably coincides with Reinecke's Site 37. The enclosure is constructed of small to medium boulders and large cobbles. The *makai* (west) section of the enclosure is paved with small to medium boulders and cobbles. In the south corner there is a faced depression measuring 1.0 m. (3.3 ft.) by 1.0 m. (3.3 ft.) by 0.8 m. (2.6 ft.) in depth. The enclosure interior is pahoehoe bedrock and shallow soil. The west end is well faced with the rest of the enclosure being in remnant condition.

Feature A is in poor condition. The excavation potential is considered good.

**Feature B** is a small platform located 2.5 m. (8.2 ft.) to the southwest of Feature A. This small platform measures 8.0 m. (26.2 ft.) N/S by 8.0 m. (26.2 ft.) E/W. It is constructed of small to large boulders and cobbles. There is no vertical facing due to the pervasive collapse. As with Feature A, this feature is bounded by large boulders.

Coral is observed but no other artifacts or midden were observed.

Feature B is in fair to poor condition. The excavation potential is considered good.

**State Site #:** 50-10-37-16772 **CSH Site #:** 447
**Site Type:** Site complex
**Function:** Multi-function
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano
**Elevation:** 10 ft. a.m.s.l.

**Description:** State site -16772 consists of a low boulder mound (Feature A) and a U-Shape (Feature B). The site is situated along the coast on undulating pahoehoe terrain. It is vegetated with *kiawe*, koa haole, and California grass.

**Feature A** is a low boulder mound heavily disturbed by a *kiawe* tree. It measures 2.5 m. (8.2 ft.) E/W by 2.8 m. (9.2 ft.) N/S and is approximately 0.3 m. (1.0 ft.) high. It is located on the south side of a high pahoehoe cliff. The mound is roughly rectangular in shape and the construction is of small boulders and cobbles with no visible facing.

An uprooted *kiawe* tree has exposed a human skull. There is midden and coral in the surrounding area. Many historic artifacts are also present. Close by are several boulder mounds heavily disturbed by the *kiawe* growth.

Feature A is in poor condition and is considered a burial location.

**Feature B**, located 20.0 m. (65.6 ft.) to the west of Feature A is a U-Shape enclosure measuring 2.6 m. (8.5 ft.) N/S by 2.5 m. (8.2 ft.) E/W on the exterior and 2.1 m. (6.9 ft.) N/S by 1.3 m. (4.3 ft.) E/W on the interior. The walls stand 0.8 m. (2.6 ft.) high maximum and are 0.9 m. (3.0 ft.) wide. The west wall is partially collapsed due to *kiawe* growth. The interior consists of loose boulders and sand.

There is midden and historic artifacts visible.

Feature B is in fair to poor condition and offers good excavation potential. This feature is considered a temporary habitation site which may have been used historically for fishing purposes.

**State Site #:** 50-10-37-16773 **CSH Site #:** 448
**Site type:** Enclosure
**Function:** Hearth
**Features (#):** 1
**Site Dimension:** 1.8 m.$^2$ (19.4 ft.$^2$)
***Ahupua'a:*** Hokukano 1
**Elevation:** 30 ft. a.m.s.l.

**Description:** State site -16773 is a small circular enclosure situated approximately 50.0 m. (164 ft.) southeast of State site -16774 and a jeep access road The site is situated approximately 90.0 m. (295.2 ft.) within the tree line, atop a pahoehoe outcrop. The vegetation at the site consists primarily of grass and some randomly scattered *koa haole* trees.

The enclosure interior measures approximately 0.5 m. (1.6 ft.) in diameter and it has a wall height of 0.5 m. (1.6 ft.). The wall is entirely faced and constructed of small to medium boulders. The enclosure interior is exposed outcrop.



State site -16773 is in good condition and it has no excavation potential. The site is likely a solitary hearth structure.

**State Site #:** 50-10-37-16774 **CSH Site #:** 449
**Site type:** Enclosure
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 59.5 m.$^2$ (642.6 ft.$^2$)
***Ahupua'a:*** Hokukano 1
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16774 is a remnant enclosure located adjacent to the coastal access road. The site is situated atop a level soil deposit covered with a dense vegetation.

The site is defined by several alignments of upright boulders and rough configurations of scattered boulders which together form an enclosure. Based on the rough configuration of the site, it is estimated that the enclosure covered an area of roughly 8.5 m. (27.9 ft.) N/S by 7.0 m. (23.0 ft.) E/W.

State site -16774 is in remnant condition and its excavation potential is fair.

**State Site #:** 50-10-37-16775 **CSH Site #:** 450
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 96.0 m.$^2$ (1,036.0 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16775 is a rectangular enclosure situated just within the tree line north of "Dr. Trousseau's" house site. Directly west of this site is the northern most coastal access road.

The site measures 12.0 m. (39.4 ft.) N/S by 8.0 m. (26.2 ft.) E/W and the walls range from 0.8 m. (2.6 ft.) in width on the north to 1.3 m. (4.3 ft.) in width at the southeast corner. The enclosure is constructed of medium to small stacked boulders and a majority of the walls are still well faced. A 1.0 m. (3.3 ft.) break in the wall was noted in the northwest corner.

Midden includes numerous shell such as *opihi*, *pipipi*, and cowrie and modern historic artifacts include a broken Kona Bottling Works Ltd soda bottle on the southeast corner, 4 whiskey bottles in the central area, 2 older, possibly medicine bottles and 2 china rice bowls.

State site -16775 is in good condition and offers good excavation potential.

**State Site #:** 50-10-37-16776 **CSH Site #:** 451
**Site Type:** Enclosure
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 143.0 m.$^2$ (1,544.4 ft.$^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 20 ft. a.m.s.l.

**Description:** State site -16776 is a large enclosure situated just *mauka* (east) of the northern coastal. The enclosure measures 11.0 m. (36.1 ft.) NW/SE by 13.0 m. (42.6 ft.) NE/SW and is constructed of large to small stacked boulders with cobble fill. The walls are walls are well faced both internally and externally. The walls have an average height of 1.0 m. (3.3 ft.) and range in width from 0.9 m. to 1.0 m. (3.0 to 3.3 ft.). There is a probable entrance in the southwest corner of the enclosure which measures 1.0 m. (3.3 ft.) in width. The interior of the enclosure is level sand with a large quantity of scattered midden. No artifacts were observed.

State site -16776 is in good condition and its excavation potential is considered good.

**State Site #:** 50-10-37-16777 **CSH Site #:** 452
**Site type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 7.5 m.$^2$ (81.0 ft.$^2$)
***Ahupua'a:*** Hokukano 1
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16777 is a small, square platform located on level terrain, within 40.0 m. (132 ft.) southeast of a modern house site.

The platform measures 3.0 m. (9.8 ft.) E/W by 2.5 m. (8.2 ft.) N/S with a maximum height of 0.5 m. (1.6 ft.). It is constructed of pahoehoe boulders and cobbles. A boulder alignment extends off of the northeast corner of the platform and continues north until it connects with State site -16778.

A Paul H. Rosendahl Inc. site marker inscribed "W-21 Feature C" was observed on the southern end of the platform. Another Paul H. Rosendahl Inc. site marker inscribed "84-174 Feat. B" was observed on the alignment connecting sites 16777 and 16778. A historic enclosure lies 12.0 m. to the west of the site.

No artifacts or midden were observed at State site -16777.



**State Site #:** 50-10-37-16778 **CSH Site #:** 453
**Site type:** Platform
**Function:** Temporary habitation
**Features (#):** 1
**Site Dimension:** 36.0 m.$^2$ (388.8 ft.$^2$)
***Ahupua'a:*** Hokukano 1
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16778 is a square platform located 15.0 m. (49.2 ft.) north of State site -16777. The two sites are associated by a boulder alignment which extends between the two structures.

The platform measures 6.0 m. (19.8 ft.) in diameter and it is constructed of pahoehoe cobbles with larger boulders along its perimeter. The platform is roughly paved with cobble.

No artifacts or midden were observed at the site. The site is in fair condition and has a fair excavation potential.

**State Site #:** 50-10-37-16779 **CSH Site #:** 454
**Site type:** Rock shelters
**Function:** Temporary habitation
**Features (#):** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano 1
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16779 (Figure 54) consists of two modified rockshelters - designated Features A and B - situated within the southwest edge of a very low pahoehoe crevasse. The surrounding vegetation includes *koa haole*, *kiawe*, and California grass.

**Feature A** is a rockshelter that measures 3.1 m. (10.2 ft.) wide by 1.1 m. (3.6 ft.) high and extends 1.6 m. (5.2 ft.) deep. This shelter has large boulders roughly stacked on its outside edge. The interior floor of the rockshelter is a shallow soil deposit covered with loose stones and organic material.

A few pieces of midden is visible inside the shelter, including kukui nut and marine shell. On the north end of the shelter an adz fragment was also observed.

**Feature B**, located 4.0 m. (13.1 ft.) to the southeast of Feature A, is a rockshelter with an adjacent paved area The overhang of the shelter measures 2.1 m. (6.9 ft.) wide by 1.0 m. (3.3 ft.) high and it extends 1.8 m. (5.9 ft.) deep. The modifications include stacking of small boulders and cobbles along the shelter's entrance and a small area of paving between Features A and B, to the east of Feature B. The interior of Feature B is similar to that of Feature A.

Midden observed included kukui nut and marine shell midden. No other midden or artifacts are observed.

State site -16779 is in good condition and offers good excavation potential.

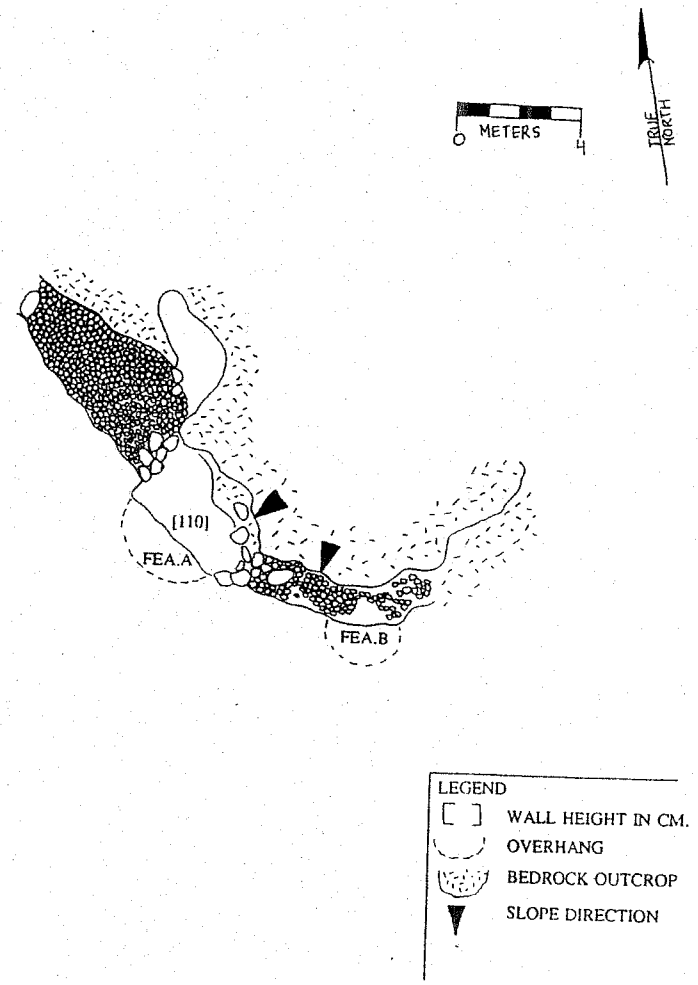



Figure 55 State site 50-10-37-16779; plan view



**State Site #:** 50-10-37-16780
**Site type:** Site complex
**Function:** Permanent habitation
**Features (#)** 2
**Site Dimension:** (see below)
***Ahupua'a:*** Hokukano 4
**Elevation:** 25 ft. a.m.s.l.

**CSH Site #:** 455

**Description:** State site -16780 (Figure 55) is a site complex consisting of an enclosure encircling a platform and a remnant enclosure designated Features A and B, respectively. The site is situated on level pahoehoe outcrop which contains intermittent soil pockets. The site is located along the north edge of a bulldozed road.

**Feature A** enclosure measures 30.0 m. (98.4 ft.) E/W by 17.5 m. (57.4 ft.) N/S. It is constructed of medium boulders and cobbles and it appears to have been intersected along its south side by the bulldozed road.

Feature A platform is situated in the east portion of the enclosure and it measures 9.0 m. (29.7 ft.) in diameter with a maximum height of 1.0 m. (3.3 ft.). It is well constructed of a boulder facing and interior paved surface of cobbles. A lower tier of the platform is located along its east side; it descends approximately 0.2 m. (0.6 ft.) below the main platform and extends 1.5 m. (4.9 ft.) to the east.

An adz fragment and midden was within the Feature A area.

Feature A is in good condition and offers good excavation potential. It is interpreted as a permanent habitation feature.

**Feature B** enclosure remnant is located 8.0 m. (26.4 ft.) north of Feature A. It is roughly L-shaped and open to the north; both its legs measure 4.0 m. (13.2 ft.) E/W and N/S, respectively. The enclosure wall is a maximum 1.0 m. (3.3 ft.) wide and 0.7 m. (23.1 ft.) high. It is boulder faced and cobble filled.

State site -16788 is in good condition and has good excavation.

**State Site #:** 50-10-37-16781
**Site Type:** Enclosure
**Function:** Pen
**Features (#):** 1
**Site Dimension:** 80.0 $m.^2$ (864.0 $ft.^2$)
***Ahupua'a:*** Hokukano
**Elevation:** 20 ft. a.m.s.l.

**CSH Site #:** 456

**Description:** State site -16781 is an enclosure located approximately 40.0 m. (131.2 ft.) north of the northern coastal access road. The surrounding terrain consists of gently sloping undulating pahoehoe covered by grass and sparse *koa haole*.

The enclosure measures 10.0 m. (32.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W and is oblong in shape. The site is constructed of small to medium stacked pahoehoe boulders. The walls have a maximum exterior height of 1.3 m. (4.3 ft.) and the interior heights range from 1.7 m. (5.6 ft.) to 2.0 m. (6.6 ft.). The walls average 1.1 m. (3.6 ft.) in width. The enclosure is in good

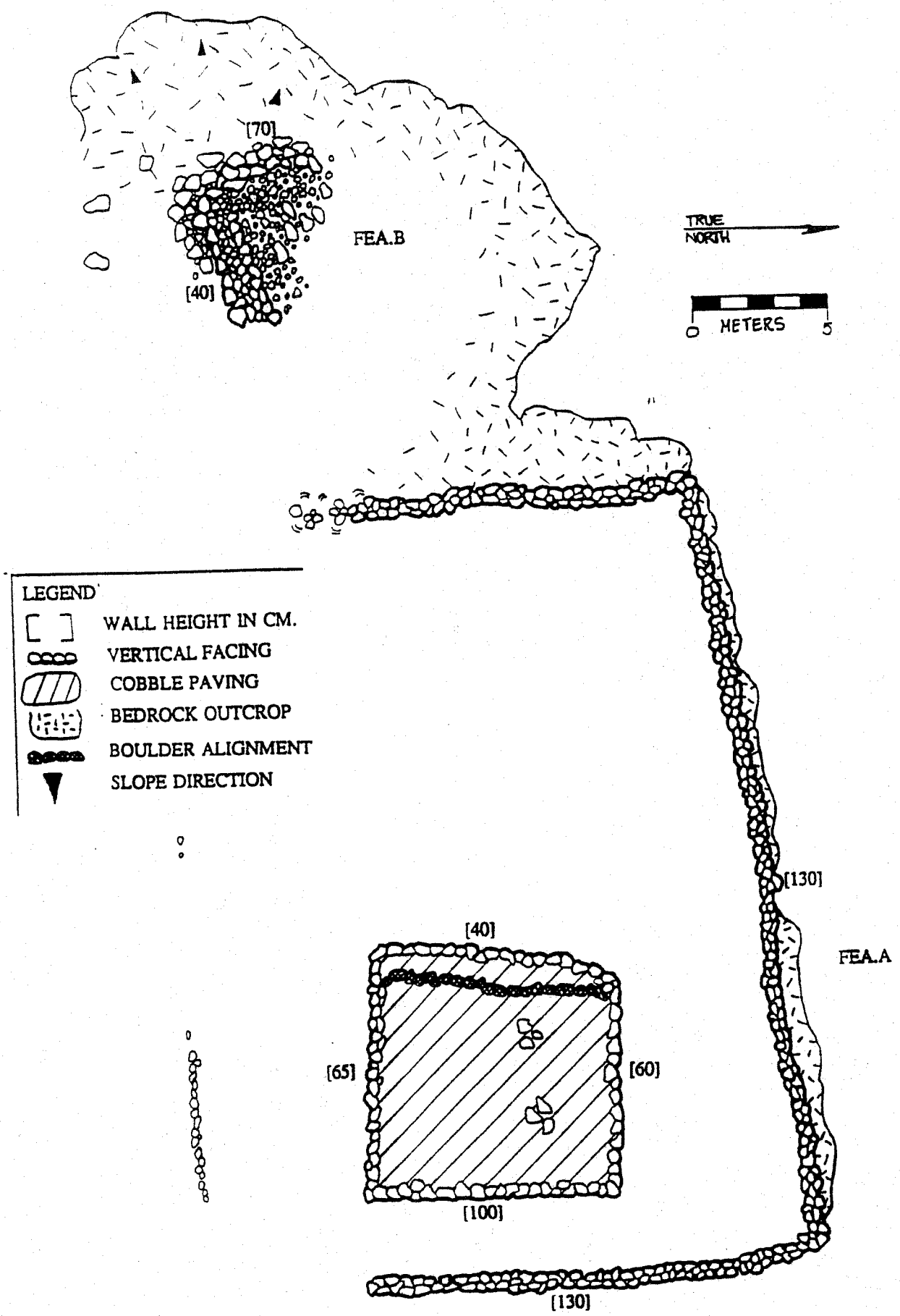



Figure 56 State site 50-10-37-16780; plan view

condition with facing still present on all sides of the enclosure. The interior of the enclosure is semi-level dark soil.

No artifacts or midden were observed.

State site -16781 excavation potential is considered fair.

**State Site #:** 50-10-37-16782 **CSH Site #:** 457
**Site type:** Terrace
**Function:** Permanent habitation
**No. of features:** 1
**Site Dimension:** 36.0 m.$^2$ (388.8 ft.$^2$)
***Ahupua'a:*** Honuaino 4
**Elevation:** 25 ft. a.m.s.l.

**Description:** State site -16782 is a terrace located in close proximity to a house site. It is situated on pahoehoe outcrop.

The terrace measures 8.0 m (26.4 ft.) NW/SE by 7.0 m. (23.1 ft.) NE/SW. It is constructed of large boulders along its northeast and southeast perimeter and its interior surface and remaining sides are level and paved with cobbles.

A wooden crate - probably associated with a wooden water trough located to the north - was observed on the surface of the terrace.

No artifacts or midden were observed at the site.

The site is in fair to poor condition and the excavation potential is fair to poor.

**State Site #:** 50-10-37-16783 **CSH Site #:** 458
**Site Type:** Platform
**Function:** Permanent habitation
**Features (#):** 1
**Site Dimension:** 68.0 m.$^2$ (734.4 ft.$^2$)
***Ahupua'a:*** Honuaino 3
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16783 is a rectangular platform located at the northwest boundary of the project area just south of the Greenwell family's beach house approximately 39.5 m. (130.0 ft.) from the shoreline. The surrounding terrain consists of level pahoehoe with scattered *kiawe* and grass.

The platform measures 8.0 m. (26.2 ft.) N/S by 8.5 m. (27.9 ft.) E/W and is constructed of roughly stacked large to medium pahoehoe boulders with the east, west and south sides are still retain remnant facing. The north side is tumbled with the tumble extending out approximately 2.0 m. (6.6 ft.). The platform is not level and averages 1.0 m. (3.3 ft.) in height along the faces and approximately 2.0 m. (6.6 ft.) in the center. There is a depression measuring 0.8 by 0.9 m. (2.6 by 3.0 ft.) with a maximum depth of 0.5 m. (1.6 ft.) in the center of the platform. There are a few possible alignments on the surface of the platform that are in remnant condition.

A few historic bottle fragments were observed along the northern side of the platform.



No midden was observed.

State site -16783 is in poor to fair condition and the excavation potential is considered fair to good.

**State Site #:** 50-10-37-16784
**Site type:** Lava tube
**Function:** Burials
**No. of features:** 1
**Site Dimension:** 210.0 m.$^2$ (2,268.0 ft.$^2$)
**Ahupua'a:** Onouli 1
**Elevation:** 200 ft. a.m.s.l. (entrance)

**Description:** State site -16784 is a lava tube system containing two primary chambers. Numerous human burials, wooden cultural remains, and two *ahu* were observed within the lava tube system.

The main chamber of the lava tube is oriented in a northeast/southwest direction and a secondary chamber - midway along the main chamber - diverts in a northwest direction.

The main chamber measures a total length of roughly 120.0 m. (396 ft.) The secondary chamber extends approximately 60.0 m. (198 ft.) northwest of the main chamber. Both chambers have widths ranging from 2.0 m. (6.6 ft.) to 5.0 m. (16.5 ft.) and ceiling heights are variable.

The lava tube is accessible in the main chamber through a small opening approximately 0.5 m. (16.5 ft.) in diameter. Upon entering the main chamber, long pieces of lumbered (2.0 m. long) were observed along a soil covered floor. The wood is well preserved.

Moving farther in, a higher ceiling of roughly 1.8 m. (5.9 ft.) allows easier access. Approximately 25.0 m. (82.0 ft.) within the main chamber there is a collapsed wooden coffin with an articulated skeleton observable. Although the coffin is collapsed due to the nails rotting out of the wood, the wood is still intact and in good condition.

Approximately 20.0 m. (65.6 ft.) beyond the first burial there are 7 or 8 more coffins laid out on the floor and in two instances are stacked two coffins high. Two of the coffins are collapsed, the rest are partially collapsed. Bones are scattered about on the floor with some articulated sections still intact within the coffins.

Immediately following the coffins, the tube gets drastically smaller and its floor rougher; the floor is no longer soil, but a rough stalagmite surface. The secondary chamber is located roughly 25.0 m. (82.5 ft.) beyond the second coffin burials; it will be discussed below

The main chamber extends approximately 55.0 m. (181.0 ft.) beyond the secondary chamber until pinching out. Two *ahu* are present: one approximately 30.0 m. (100 ft.) beyond the secondary chamber and the second at the very end of the main chamber. A low chamber runs parallel to the main chamber with its two entrances 20.0 m. (66.0 ft.) before the first *ahu* and immediately beyond.

Immediate access into the secondary chamber is hampered by a narrow width of 1.0 m. to 2.0 m. (3.3 ft. to 6.6 ft.). A wooden rod - possibly part of a canoe - was observed 18.0 m. (59.4 ft.) into the chamber.

Approximately 20.0 m. (66.0 ft.) into the secondary chamber the ceiling height ascends to 1.5 m. (4.9 ft.) and a lava island bisects the chamber into two north and south passages approximately 3.0 m. to 5.0 m. (10.0 ft. to 16.5 ft.) wide. Disarticulated skeletal remains - including two skulls and various long bones - were observed in the north passage amongst

the remains of a wooden canoe. Two adjacent chambers extends to the north of the north passage area and the eastern-most chamber is inaccessible. The west chamber contains multiple burials including at least eight skulls and 40 or more long bones; A second wooden (possible koa wood) canoe was also present.

The secondary chamber terminates approximately 30 .0 m. (100 ft.) beyond the furthest burials. No other cultural or human remains were observed.

**State Site #:** 50-10-37-16785
**Site type:** Lava tube
**Function:** Refuge/Permanent habitation
**Features (#):** 1
**Site Dimension:** 1,829.3 m.$^2$ (19,756.0 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 15 ft. a.m.s.l.

**Description:** State site -16785 (Figure 56) is a lava tube with its entrance situated on the face of a cliff overlooking a small crescent-shaped bay. The only access to the lava tube is by means of a 75.0 m. (246 ft.) swim from one side of the bay to the cliff face. The cave entrance is approximately 5.0 m. (16.4 ft.) above sea level.

At the lava tube entrance recent usage is evident, as indicated by the presence of batteries, propane stove tanks, and beer cans. Various mammal bones and teeth (some human) were also observed. The lava tube entrance measures 3.0 m. (9.8 ft.) wide by 2.5 m. (8.2 ft.) high.

Upon entering the lava tube, kukui nuts, water-rounded stones, and mammal bones were observed in abundance. At approximately 10.0 m. (32.8 ft.) into the tube, piles of a loose soil cover the center of the lava tube chamber; this soil is evidence of previous excavations.

Further beyond the excavated area the lava tube becomes larger and presence of artifacts more abundant. Bone picks, bone scrapers and at least one sea urchin file were observed. Rotting wood pieces are also scattered about the floor and along ledges which extend along both sides of the tube.

At approximately 76.0 m. (249.3 ft.) within the lava tube is a small enclosure constructed of medium to large boulders which utilizes the lava tube's southern wall. The floor of the enclosure is covered with soil and rotting wood fiber. Charcoal was observed in this section of the chamber, but no artifacts were present.

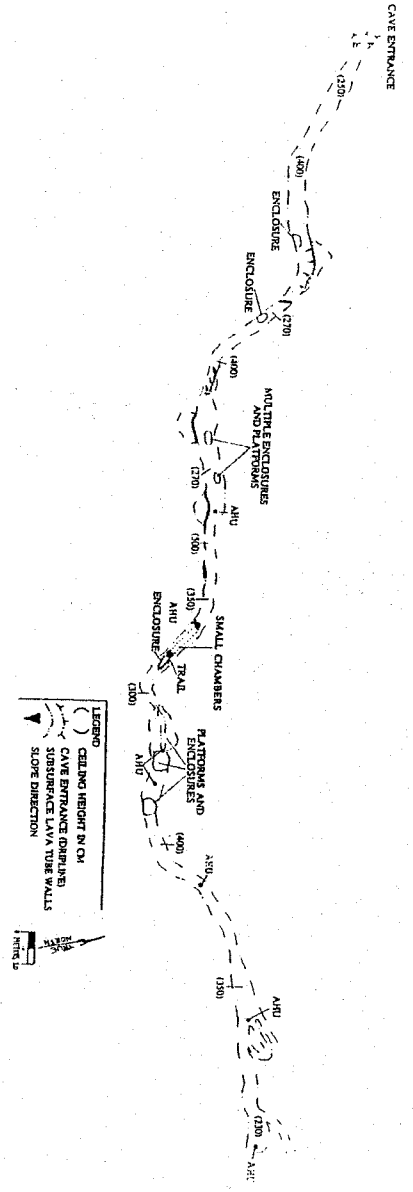
At 90.0 m. (295.2 ft.) within the lava tube, the chamber becomes smaller and lower and another enclosure begins. This structure is constructed of long pieces of ceiling tumble. The floor of the enclosure is composed of a rough lava surface lines this section of the lava tube. Various wood and plant fibers were observed in this area and may represent perishable artifacts or remnant matting. A dog mandible and an unidentified mammal bone were present here.

Beginning at 134.0 m. (439.5 ft.) from the lava tube entrance is a series of platforms and terraces lining the edges of the tube. The first structure is a terrace which utilizes a natural ledge in its construction. It is constructed to a height of 1.2 m. (3.9 ft.). This terrace has wood fiber on its surface as well as kukui nut, charcoal and a bone pick.

Beyond the first terrace covering the whole floor of the chamber is a series of stepped terraces. Rotting wood fiber is present on the first terrace, as is a conch shell fragment. About half way up these stepped terraces is an excavated depression.



Figure 57 State site 50-10-37-16785; plan view



At approximately 154.0 m. (505.1 ft.) beyond the lava tube entrance is another terrace which utilizes the southern ledge/wall of the chamber. The two-tiered terrace measures 6.0 m. (19.8 ft.) by 3.0 m. (9.8 ft.). It is constructed of random tumble and is paved with extremely small a'a cobbles. A heavy covering of wood fiber is layered on top. A large *opihi* shell is on the surface of the lower level of the terrace.

At approximately 163.0 m. (534.6 ft.) from the lava tube entrance, there is yet another terrace series constructed along the southern wall of the chamber. Again, the terraces are constructed of ceiling tumble and paved with small a'a cobbles. The surface of the first terrace contains a concentration of charcoal and wood fibers, but no artifacts were observed. On the terraces there is a paved pathway which leads to a small protected area 3.0 m. (10.0 ft.) along the wall. This area has obviously been culturally modified, but no midden or artifacts were observed. A small chamber is partially closed off to the back of the feature, but nothing was observed there.

Farther along, at the 198.0 m. (649.4 ft.) mark, are two chambers constructed beneath the rubble floor of the chamber. Each of these chambers extend parallel with the main chamber for approximately 5.0 m. (16.4 ft.). Bone picks, decomposed grass or wood, kukui nuts, and gourd pieces are observed. Each chamber is approximately 1.0 m. (3.3 ft.) high.

At the end of the southernmost constructed chamber is a small enclosure constructed of rough a'a boulders. Decomposed wood or grass is inside, but nothing else.

Beyond the underlying chambers, the main chamber of the lava tube opens up into a multiple feature area. The first feature is a flat natural ledge with a'a boulders aligned along the outer edge. The ledge has a crumbled face along its east side, which has been filled in and terraced to a height of 1.4 m. (4.6 ft.).

Farther up the tube is a multiple level terrace built to span the entire width of the tube. On the top terrace sits an *ahu* measuring 0.6 m. (1.9 ft.) 0.8 m. (2.6 ft.) in diameter. All the terrace tiers are paved with small to medium cobble. The back of the terrace feature contains a small circular area, bordered by a'a boulders and paved with small cobbles; charcoal, kukui nuts, and a possible decomposed gourd were observed on the pavement. A small paved pathway and alignment runs *mauka* off the terrace feature into the next area.

This next area also contains a multiple level platform, much like the previous area. No artifacts, and only grass, wood and kukui midden were observed. From this point to approximately 330.0 m. (1,082.4 ft.) from the lava tube entrance the chamber consists of ceiling tumble with minor modifications.

At approximately 335.0 m. (1098.8 ft.) from the lava tube entrance to the end of the tube, a series of minor modifications and at least 9 *ahu* are present. Three of the *ahu* located in the far end of the tube contain possible godstones on their surface. The highest *ahu* measures 1.3 m. (4.3 ft.).

Also at the end of the lava tube is a painted pictograph on the wall, 1.5 m. (4.9 ft.) above the chamber floor. The image is that of a man with an inverted triangular body, painted with a reddish brown clay. It appears to have been applied by hand to the chamber wall.



**State Site #:** 50-10-37-16786
**Site Type:** Platform
**Function:** *Heiau*
**Features (#):** 1
**Site Dimension:** 2,324.0 m.$^2$ (25,099.2 ft.$^2$)
***Ahupua'a*:** Ke'eke'e
**Elevation:** 273 ft. a.m.s.l.

**Description:** State site -16786 (Figure 57) is a large platform situated against the *mauka* side of the Kuakini Wall. A second, smaller platform is located immediately *makai* of the large platform and the Kuakini Wall. The site is located along a level soil plateau at the top of a moderate to steep slope. Vegetation consists of *koa haole*, *kiawe* and California grass.

The large platform is unequivocally a *heiau* of great importance and appears to correlate with Ukanipo *heiau* (dedicated to a shark) described by William Ellis (see SURVEY RESULTS - Heiau volume 1). The smaller platform located *makai* of the *heiau* is definitely associated based on its similar construction and proximity and it may have been a house site for the *kahuna* or caretaker.

The *heiau* platform measures approximately 83.0 m. (272.2 ft.) N/S by 28.0 m. (91.8 ft.) E/W with a maximum height of 2.0 m. (6.6 ft.) on its *makai* side and 0.9 m. (3.0 ft.) on its *mauka* side. It is constructed of small to large stacked pahoehoe boulders with a level cobble and pebble pavement.

There are two C-shape enclosures, two upright boulders, and at least 37 faced depressions located on or within the platform surface. The depressions range in size from 0.3 to 2.0 m. (1.0 to 6.6 ft.) in diameter and extend between 0.25 to 1.5 m. (0.8 to 4.9 ft.) deep. At the southwest corner of the platform is a lined depression which measures 4.0 m. (13.1 ft.) N/S by 15.0 m. (49.2 ft.) E/W and has a sloping cobble and boulder interior. Near the southeast corner on the south side is a formal stairway ascending from the ground to the platform surface. It measures 2.5 m. (8.2 ft.) wide. Another stairway is located on the *makai* side of Kuakini Wall, 8.0 m. (26.2 ft.) from the southwest corner of the platform. There are also four faced depressions in the southeast corner.

The first C-shaped enclosure is located approximately 22.0 m. (72.2 ft.) north of the platform's south edge, along the east edge of the platform. It measures 8.0 m. (26.2 ft.) NW/SE by 5.0 m. (16.4 ft.) NE/SW and has a maximum height of 0.1 m. (0.3 ft.) on the *makai* side. Its *mauka* side is open to the platform pavement. The enclosure wall is constructed with cobble and small boulder facing; the interior of the enclosure is pebble paved. Several faced depressions surround the C-shape, including a large, roughly rectangular depression measuring 1.5 m. (4.9 ft.) wide by 1.5 m. (4.9 ft.) deep.

The second C-shaped enclosure is located 2.0 m. (6.6 ft.) northwest of the first C-shape. It measures 14.0 m. (45.9 ft.) N/S by 9.0 m. (29.5 ft.) E/W with a maximum height of 0.5 m. (1.6 ft.) along its south wall. The enclosure opens to *makai*. Outside of the enclosure - immediately adjacent to its east wall - is a large circular depression lined with boulders, measuring 3.0 m. (9.8 ft.) in diameter. There are also five smaller circular depressions just outside the *makai* edge of the enclosure. Two uprights boulders are located 3.0 m. (9.8 ft.) east of the north corner of the enclosure. The tallest measures 0.6 m. (2.0 ft.) high.

There are ten faced depressions between 55.0 and 65.0 m. (180.4 to 213.2 ft.) from the south edge of the platform. Eight of the depressions form a rectangular grid in the center of the platform. Beyond these depressions to the north edge of the platform is one more faced depression. This area of the depressions is roughly paved with cobbles, as is the south end of the platform.

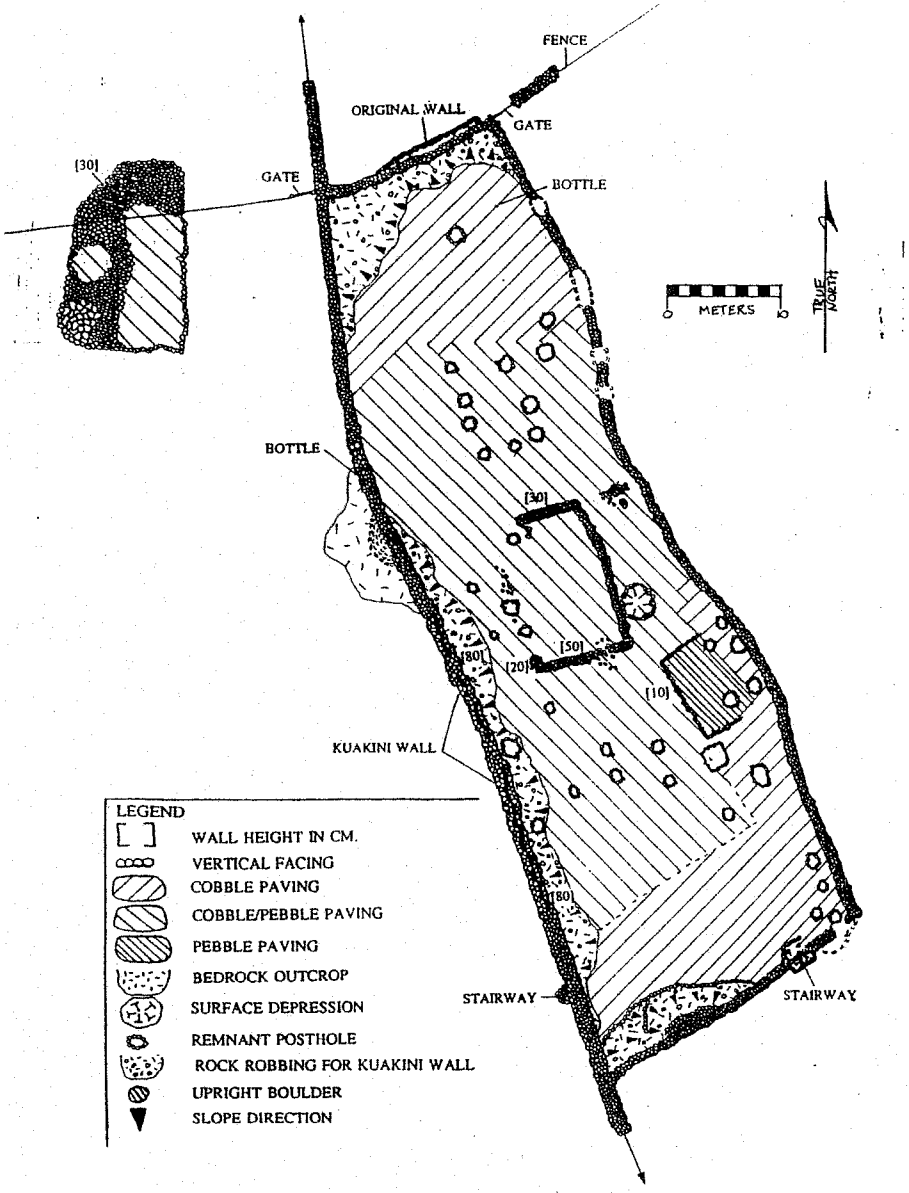



Figure 58 State site 50-10-37-16786; plan view



The central portion the platform - from 13.0 m. (42.6 ft.) to 67.0 m. (219.8 ft.) from its south edge - has a level cobble and pebble pavement.

Along the north and west edge of the platform its surface slopes to the edge of the Kuakini Wall. It appears that this pavement was robbed of boulders and cobbles in order to build and repair the Kuakini Wall. This is also seems to be the case for the lined depression in the southwest corner of the platform.

Two historic glass bottles and one coconut shell fragment were observed on the platform surface. There are also historic road gates attached to the outside edge of the northwest and northeast platform corners.

The *heiau* is in good condition and has excellent excavation potential

The smaller platform is located 11.0 m. (36.1 ft.) west of the *heiau*, along the upper edge of the *makai* slope. It measures 16.0 m. (52.5 ft.) N/S by 11.0 m. (36.1 ft.) E/W with a maximum height of 0.6 m. (2.0 ft.) on its north and west sides. The east portion of its south half is well paved with medium to small cobbles. The north and west portions are roughly paved with cobbles and small boulders; its surface slopes *makai*.

There are stacked upright boulders in the center of the north portion of the platform. The pavement slopes slightly upward *mauka* and *makai* from the uprights.

No artifacts or midden were observed on this platform. It is in good condition.

| | |
|---|---|
| **State Site #:** | 50-10-37-16787 |
| **Site Type:** | Wall |
| **Function:** | Boundary; Agriculture |
| **Features (#):** | 1 |
| **Site Dimension:** | 4,451.2 m.$^2$ (48,073.2 ft.$^2$) |
| ***Ahupua'a*:** | Honuaino 3 |
| **Elevation:** | 15 ft. to 1,050 ft. a.m.s.l. |

**Description:** State site -16787 is a large *mauka-makai* wall extending along the northern boundary of Honuaino 3 *ahupua'a*.

The wall measures 2,225.6 m. (7,300.0 ft.) E/W long, 1.0 m. (3.3 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of a large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16788
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 4,146.0 m.$^2$ (44,776.8 ft.$^2$)
***Ahupua'a*:** *Honuaino* 4
**Elevation:** 195 ft. to 1,200 ft. a.m.s.l.

**Description:** State site -16788 is a *mauka/makai* running wall extending along the boundary of Honuaino 3 and Honuaino 4 *ahupua'a*. It measures 2,073.2 m. (6,800.0 ft.) E/W long, 1.0 m. (3.3 ft.) N/S wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16789
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 3,963.4 m.$^2$ (42,804.7 ft.$^2$)
***Ahupua'a*:** Hokukano 1
**Elevation:** 175 ft. to 1,120 ft. a.m.s.l.

**Description:** State site -16789 is a *mauka/makai* running wall extending along the boundary between Hokukano 1 and Honuaino *ahupua'a*. It measures 1,981.7 m. (6,500.0 ft.) E/W long, 1.0 m. (3.3 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16790
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 2,012.2 m.$^2$ (21,731.8 ft.$^2$)
***Ahupua'a*:** *Hokukano* 1
**Elevation:** 690 ft. to 1,140 ft. a.m.s.l.

**Description:** State site -16790 is a *mauka/makai* running wall extending within the *ahupua'a* of Hokukano 1. It measures 1,006.1 m. (3,300.0 ft.) E/W long, 1.0 m. (3.3 ft.) N/S



wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the facing remains intact, although the wall has been disturbed by cattle and recent modifications have been made to allow for roadways.

The wall is a cattle wall which does not extend along a presently delineated *ahupua'a* boundary.

**State Site #:** 50-10-37-16791
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 5426.8 m.$^2$ (58,609.8 ft.$^2$)
***Ahupua'a*:** Hokukano 2
**Elevation:** 175 ft. to 1,450 ft. a.m.s.l.

**Description:** State site -16791 is a is a *mauka/makai* running wall extending between Hokukano 1 and Hokukano 2 *ahupua'a* . It measures 2,713.4 m. (8,900.0 ft.) E/W long, 1.0 m. (3.3 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-19-37-16792
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 1,646.3 m.$^2$ (17,780.5 ft.$^2$)
***Ahupua'a*:** Kanaueue
**Elevation:** 420 ft. to 800 ft. a.m.s.l.

**Description:** State site -16792 is a is a *mauka/makai* running wall extending between Hokukano 2 and Kanaueue *ahupua'a*. It measures 823.2 m. (2,700.0 ft.) E/W long, 1.0 m. (3.3 ft.) N/S wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16793
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 4,146.3 m.$^2$ (44,780.5 ft.$^2$)
***Ahupua'a*:** Haleki'i
**Elevation:** 240 ft. to 1,175 ft. a.m.s.l.

**Description:** State site -16793 is a is a *mauka/makai* running wall extending between Kanauenue and Haleki'i *ahupua'a*. It measures 2,073.2 m. (6,100.0 ft.) E/W long, 1.0 m. (3.3 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16794
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 4,146.3 m.$^2$ (44,780.5 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 2
**Elevation:** 275 ft. to 1,225 ft. a.m.s.l.

**Description:** State site -16794 is a *mauka/makai* running wall extending between the *ahupua'a* of Haleki'i and Ke'eke'e 2. It measures 2073.1 m. (6,800.0 ft.) E/W long, 1.0 m. (3.3 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16795
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 1,829.3 m.$^2$ (19,756.1 ft.$^2$)
***Ahupua'a*:** Ke'eke'e 1
**Elevation:** 720 ft. to 1,220 ft. a.m.s.l.

**Description:** State site -16795 is a *mauka/makai* running wall extending between the *ahupua'a* of Ke'eke'e 1 and Ke'eke'e 2. It measures 914.6 m. (3,000.0 ft.) E/W long, 1.0 (3.3 ft.)



wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16796
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 3,048.8 m.$^2$ (32,926.8 ft.$^2$)
***Ahupua'a*:** Ilikahi
**Elevation:** 250 ft. to 950 ft. a.m.s.l.

**Description:** State site -16796 is a *mauka/makai* running wall extending between the *ahupua'a* of Ke'eke'e 1 and Ilikahi. It measures 1,524.4 m. (5,000.0 ft.) E/W long, 1.0 (3.3-6.6 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16797
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 3,018.3 m.$^2$ (32,597.6 ft.$^2$)
***Ahupua'a*:** Kanaka'u
**Elevation:** 490 ft. to 1,225 ft. a.m.s.l.

**Description:** State site -16797 is a *mauka/makai* running wall extending between the *ahupua'a* of Ilikahi and Kanaka'u. It measures 1,509.1 m. (4,950.0 ft.) E/W long, 1.0 m. (3.3 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16798
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 2,987.8 m.$^2$ (32,268.3 ft.$^2$)
***Ahupua'a:*** Kalukalu
**Elevation:** 50 ft. to 700 ft. a.m.s.l.

**Description:** State site -16798 is a *mauka/makai* running wall extending between the *ahupua'a* of Kanaka'u and Kalukalu. It measures 1,493.9 m. (4,900.0 ft.) E/W long, 1.0 m. (3.3 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16799
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 4,207.3 m.$^2$ (45,439.0 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 260 ft. to 1,180 ft. a.m.s.l.

**Description:** State site -16799 is a *mauka/makai* running wall extending between the *ahupua'a* of Kalukalu and Onouli 1. It measures 2,103.7 m. (6,900.0 ft.) E/W long, 1.0 m. (3.3 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16800
**Site Type:** Wall
**Function:** Boundary; Agriculture
**Features (#):** 1
**Site Dimension:** 6,036.6 m.$^2$ (65,195.1 ft.$^2$)
***Ahupua'a:*** Onouli 1
**Elevation:** 0 to 1,360 ft. a.m.s.l.

**Description:** State site -16800 is a *mauka/makai* running wall extending along the southern boundary of the *ahupua'a* of Onouli 1. It measures 3,018.3 m. (9,900.0 ft.) E/W long, 1.0 m.



(3.3 ft.) wide and reaches a maximum height of 1.5 m. (4.9 ft.). It is constructed of large to small boulder facing with small boulder and cobble fill. A majority of the wall remains intact. However, portions of the wall have been altered due to cattle disturbance and recent road construction.

The wall is a historic cattle wall which also delineates the *ahupua'a* boundary. It is possible that this wall was originally part of the Kona Field System and that it was historically modified for its use as a cattle wall and land boundary.

**State Site #:** 50-10-37-16801
**Site Type:** Enclosure
**Function:** Pen
**Features (#):** 1
**Site Dimension:** 554.8 m.$^2$ (5991.8 ft.$^2$)
***Ahupua'a:*** *Kalukalu*
**Elevation:** 285 ft. a.m.s.l.

**Description:** State site -16801 is a large enclosure abutting the Great Wall of Kuakini situated on a moderate slope of pasture.
The site measures 30.5 m. (100.0 ft.) N/S along the eastern wall, 36.5 m. (120.0 ft.) N/S along the western wall(the Great Wall of Kuakini) and 15.2 m. (49.9 ft.) E/W along both the north and south walls approximately, with an average height of approximately 1.5 m. (4.9 ft.). The enclosure is constructed of medium to small stacked boulders. A "pig door", constructed of lumber, was observed within the western wall of the enclosure. No artifacts or midden were observed and the site is in good condition. Excavation potential is considered fair.

**State Site #:** 50-10-37-16802
**Site Type:** Enclosure
**Function:** Pen
**Features (#):** 1
**Site Dimension:** 747.7 m.$^2$ (8075 ft.$^2$)
***Ahupua'a:*** Ke'eke'e 1
**Elevation:** 80 ft. a.m.s.l.

**Description:** State site -16802 is a large enclosure situated on a level soil area south of *Puu Ohau*. Vegetation includes lantana and kiawe. The enclosure measures 25.9 m. (85.0 ft.) N/S along the eastern wall, 24.4 m. (80.0 ft.) N/S along the western wall and 29.0 m. (95.0 ft.) E/W along the southern wall, 27.4 m. (90 ft.) E/W along the northern wall with an approximate height of 2.0 m. (6.6 ft.). The site is constructed of large to small stacked stacked boulders with facing still intact along the interior and exterior of all sides.

No artifacts or midden were observed.

State site -16802 is in fair condition. Excavation potential is considered fair.

# IV. Market & Economic/Fiscal Reports

# IV - 1 Market Assessment

**KPMG** Peat Marwick

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Oceanside 1250

# MARKET ASSESSMENT FOR THE VILLAGES AT HOKUKANO

Final Report
January 1993


*This report was prepared by*

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January 4, 1993

Mr. Dick Frye
Project Manager
Oceanside 1250
74-5620 A Palani, Suite 200
Kailua-Kona, HI 96740

Dear Mr. Frye:

KPMG Peat Marwick is pleased to submit the attached report entitled "Market Assessment for the Villages at Hokukano."

The accompanying report is divided into seven chapters as follows:

1. Background and Executive Summary
2. Project Overview and Regional Setting
3. Acreage Lot Overview
4. Residential Lot Overview
5. Golf Market Overview
6. Market Assessment for Single-Family Lot Development
7. Market Assessment for the Hokukano Golf and Sports Club

We have appreciated the opportunity to assist you on this important project and look forward to assisting you in the future.

Very truly yours,

KPMG Peat Marwick



# MARKET ASSESSMENT FOR THE VILLAGES AT HOKUKANO

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# MARKET ASSESSMENT FOR THE VILLAGES AT HOKUKANO

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## 1 - BACKGROUND AND EXECUTIVE SUMMARY

### BACKGROUND AND PROJECT OVERVIEW

Oceanside 1250 is pursuing development approvals for a 1,540-acre site known as The Villages at Hokukano (Hokukano) on the island of Hawaii. Oceanside 1250 consists of Red Hill, Inc., an entity related to Lyle Anderson, and Ocean Club Development, Co. Inc., an entity related to Japan Airlines. The managing partner for Oceanside 1250 is Lyle Anderson, who has earned a reputation for high quality residential/golf developments through such award winning projects as Desert Mountain and Desert Highlands in Scottsdale, Arizona, and Las Campanas in Santa Fe, New Mexico.

Preliminary development plans for Hokukano are for a high-end, fee simple and leasehold development, to include:

- 27-hole private membership golf course designed by Jack Nicklaus
- Clubhouse and other ancillary facilities
- 100-unit members' lodge
- 367 agricultural lots, of one-acre or more
- 1,073 residential lots, ranging from 8,000 square feet to just under an acre

A portion of the proposed development requires urbanization by the State Land Use Commission (LUC), and a General Plan Amendment by the County of Hawaii, entailing preparation of an Environmental Impact Statement (EIS). KPMG Peat Marwick was asked to provide an evaluation of the anticipated market support for Hokukano as well as its economic, fiscal and affordable housing impacts for the county and state of Hawaii. This volume presents the findings of the market assessment. The findings of the economic, fiscal and affordable housing impact assessment are contained in a separate volume.

Hokukano is located in the North and South Kona districts of West Hawaii, just north of Kealakekua Bay. The property is *makai* (towards the ocean) of the village of Kealakekua and is surrounded by relatively undeveloped land. The site itself contains lush vegetation on sloping terrain ranging from grassy pastures to areas of dense foliage. A State Conservation District extends approximately 300 feet inland from the shoreline along the property.

#### The subdivision would be divided into *mauka* acreage size lots and *makai* residential sized lots

The plans for the project currently include 367 agriculturally zoned 1.0- to 3.0-acre lots and 1,073 residentially zoned lots ranging from approximately 8,000 square feet to just under 1-acre. The agricultural or acreage lots, would be set in the *mauka* (towards the mountain) portion of the site, while the residential lots are to be located on the *makai* portion closer to the golf course. The larger acreage lots are located in a more secluded area of the project and will offer greater privacy. An agricultural easement will be associated with these acreage lots, requiring a portion of each lot to be dedicated to agricultural production. The residential lots will enjoy generally closer proximity to the golf course and ocean. Some will also offer golf frontage and/or excellent ocean views.

As currently proposed, a charter membership program consisting of two golf membership options, a limited play and regular membership would be offered with lot purchases in the initial years of sales. The buyer would choose to exercise one of the two options. After a specified holding time the lot could be resold with the initial purchaser retaining for his or her lifetime the membership option that was exercised. The second, unselected membership option would go to the resale purchaser. If the resale purchaser then resells the lot, he or she would be required to relinquish his or her membership under terms and conditions to be specified.

**The majority of home-sites are planned to offer ocean and/or golf course views**

The current conceptual plan classifies the home-sites at Hokukano into four categories: prime view sites, golf front sites with ocean views, golf front sites, and nonfrontage sites with golf and/or ocean views. The majority of lots, approximately 63%, are planned to offer views of the golf course or ocean. Approximately 27% are planned to offer golf course frontage.

**Hokukano plans to offer a 27-hole golf course, clubhouse and members' lodge facility**

As a traditional Lyle Anderson project, golf will be the underlying theme of Hokukano. The private golf club will include lot owners and a limited number of nonproperty members (nonproperty members will be required to stay in the lodge to use the amenities). Membership would entitle individuals to play on the 27-hole championship golf course designed by Jack Nicklaus, and to use the anticipated 24,000 square foot clubhouse and the members' lodge.

## REGIONAL SETTING AND DEMOGRAPHIC TRENDS

**The project is located in a premier visitor destination**

Within the past decade, West Hawaii has experienced major tourism development and currently includes some of the most luxurious and modern resorts in the world. Thus the location of Hokukano in such an emerging visitor destination, could be expected to significantly enhance the market performance of the project.

**Visitor arrivals to the state of Hawaii have shown strong growth**

Visitor arrivals to the state of Hawaii have generally increased during the past 20 years, reaching their peak in 1990 with about 7.0 million visitor arrivals. Average compounded annual increases in westbound and eastbound visitor arrivals to the state over the last twenty-two years are as follows:

| Years | Westbound | Eastbound | Total |
|---|---|---|---|
| 1970 to 1980 | 8.7% | 7.8% | 8.5% |
| 1980 to 1990 | 4.5% | 9.7% | 5.9% |
| 1990 to 1992 | -8.0% | 6.2% | -3.2% |

Despite the increase in eastbound arrivals, overall visitor arrivals have declined since 1990, as a direct result of the national recession, and less competitive air fares from the U. S. mainland.



**By 1994, an additional 2,360 visitor accommodation units are planned for the Kona area**

The Kona area currently maintains about 47% of the total available visitor accommodation units on the Island, or about 4,401 rooms. By 1994 an additional 2,360 rooms are planned for the area, representing 50% of the islandwide planned room inventory.

The expansion of Keahole Airport will also provide better access to West Hawaii. Scheduled for completion in 1993, the current expansion of the runway to accommodate jumbo jets will allow for international flights and non-stop air service beyond the West Coast. Additionally, as the region of West Hawaii continues to gain in popularity, and as new developments occur, the exposure generated by marketing efforts can be expected to further enhance West Hawaii's desirability.

**The island resident population is growing**

The resident population on the island of Hawaii is projected to increase by about 14% from 1990 to 1995, or by approximately 3% per annum to 137,600 residents. The population is expected to further increase by approximately 27% by the year 2000, to 154,900 residents. By 2010, the Island resident population is expected to approach 200,000 residents.

## AGRICULTURAL LOT OVERVIEW

**Agricultural and resort lot subdivisions were reviewed to determine the pricing and absorption of the lots offered at Hokukano**

The Hokukano project would be unlike any other project currently in existence in Hawaii. The projects considered to be most comparable to Hokukano include upscale agricultural lot subdivisions that offer various amenities, and resort communities that contain residential lot subdivisions. For this analysis, four agricultural lot subdivisions and seven resort lot projects located on Hawaii and Maui were reviewed.

**Most of the agricultural subdivisions primarily offer distant ocean views**

Four agricultural lot projects were surveyed. These included Kohala Ranch, Puu Lani Ranch and Kona Hills on the Big Island, and Plantation Estates located on Maui.

Most of the selected agricultural lot subdivisions surveyed are in *mauka* locations, elevated above the coastline. Thus, the majority (76%) of the lots offer primary views of the distant ocean and mountains. A portion of the lots located at Kohala Ranch Phase I offer primary ocean views due to their lower elevations and close proximity to the shoreline. Additionally, an estimated 53% of the lots at Plantation Estates offer golf course views or frontage.

**In 1992, the average price per acre at Hawaii island subdivisions was $148,000**

From 1991 to 1992, pricing for agricultural lot projects on the Big Island ranged from $61,000 to $320,000 an acre, resulting in average pricing of $148,000 in 1992. A direct correlation between price per acre and average lot size is evident, with the smaller parcels commanding significantly higher per acre prices.

On Maui, the Plantation Estates, the state's only existing golf-front agricultural community, has been selling at $860,000 to $880,000 per acre, for 2.1- to 2.3-acre lots.

**Average annual sales absorption for selected agricultural lot projects ranges from 8 to 61 lots**

Absorption for selected comparable subdivisions varied greatly, ranging from 8 sales per year at Puu Lani to 61 sales per year at Kohala Ranch. The overall weighted average annual sales absorption per project was thus 26 units.

Higher sales activity between 1987 and 1990 was evident, and can be associated with the overall strength of the Hawaii real estate market during this period. Conversely, the lagging national economy and the slowdown in the Japanese economy has had an immediate effect on sales activity over the past two years.

**About 40% of the buyers at agricultural lot subdivisions are from the U. S. mainland**

A survey of comparable agricultural lot projects indicated that 40% of the buyers were from Hawaii and another 40% were from the U. S. mainland. The remaining 20% of the buyers included Japanese and other foreign investors. A further breakdown of these segments indicates that the West Coast market is the largest, representing 35% of all buyers. The large percentage of West Coast purchasers is attributed to this market's preference for larger, more spacious residential developments. Conversely the Japanese, who only accounted for 15% of the market, typically prefer less private but well-known resort communities.

**Six potentially competitive agricultural lot projects are currently planned for the island of Hawaii**

Six potentially competitive agricultural lot projects located in North and South Kona, and North and South Kohala are currently planned to be marketed. These projects include:

- Makalei, a residential golf community located in North Kona. The project includes 179 one-acre lots and an 18-hole golf course. Although the course opened in November 1992, marketing of the lots has been postponed until current market conditions improve.
- Kohala Ranch Phase IV, the final phase of the existing Kohala Ranch in North Kohala. The project will include an additional 962 half-acre to one-acre lots, and a 27-hole golf course. The timing of market entry for the lots is unknown at this time.
- Puako, a master-planned golf community located in South Kohala. Plans for the project include 750 one-acre lots, 1,800 residential units and 6 championship golf courses. Project opening is unknown at this time.
- Ouli, a planned residential community located in South Kohala. Plans for the project include 45 five-acre lots and an 18-hole golf course. The timing of market entry for this project is unknown at this time.



- Kaupulehu Mauka, planned to include 36 holes of golf to be managed by TPC and up to 1,000, 1- to 5-acre lots on an approximately 8,000-acre site in North Kona. The project requires county zoning changes to proceed.
- Kealakekua Ranch Lands, a proposed agricultural lot and Arnold Palmer-designed golf course community located south and *mauka* of Hokukano in the Kealakekua area, South Kona. Kealakekua Ranch requires major land use entitlements to proceed.

The Hokukano development would be differentiated from these projects due to its Nicklaus and Lyle Anderson affiliations and its ocean frontage.

## RESIDENTIAL LOT OVERVIEW

**Seven residential lot projects located on Hawaii and Maui have been reviewed**

Seven resort lot projects located on the Big Island and Maui were compared to Hokukano even though Hokukano's plan does not include a resort. The four projects on the island of Hawaii were located within the West Hawaii communities of Mauna Lani, Mauna Kea and Keauhou. They included:

- The Point Estates
- Champion Ridge
- The Fairways North
- Keauhou Estates

The three projects located on Maui were within the communities of Kapalua and Wailea. These projects included:

- Pineapple Hill
- Kapalua Place
- Wailea Kialoa

The resort lot developments were considered as indicators of the Hawaii state market conditions for amenitized single-family lots, although they are not necessarily representative of the products to be marketed at Hokukano.

**Location and views are key elements for the surveyed lots**

Pricing of the surveyed lots is highly contingent on the views each lot offers, with the majority of resort lots offering either ocean or golf course views. None of the resort communities, with the exception of Kapalua Place, has ocean front lots. Most allocate such prime sites to the resort's hotels.

**In 1992, the average price per square foot at the surveyed lots has been $43**

In 1992, the average price per square foot ranged from $21 at Keauhou Estates to $58 at Wailea Kialoa. This resulted in an average of $43 per square foot for both Hawaii and Maui projects.

In 1991 per square foot prices ranged from $33 at Mauna Kea and Keauhou, to $72 a square foot at The Point Estates. The average price per square foot for Hawaii island resort lots was $45 in 1991, while the overall resort lot average was $51 a square foot. With the exception of Mauna Lani's Champion Ridge, the price per square foot at the majority of projects declined from 1991 to 1992.

**Average annual sales absorption for selected projects ranges from 4 to 31 lots**

The resort projects surveyed indicated a broad range of annual sales activity, ranging from 4 to 31 sales per year. The average absorption for the Big Island was 13 units per year, while Maui was significantly higher at 22 units per year.

A direct correlation between project size and annual absorption is evident among the selected developments. Larger projects such as Pineapple Hill and Keauhou all experienced healthy absorption rates of 29 to 31 units overall, and from 30 to 60 units per year from 1987 through 1990. Similarly, the limited number of lots and higher prices offered at smaller projects such as Kapalua Place, Fairways North and The Point Estates has resulted in low absorption numbers.

**About 50% of the buyers of the surveyed lots are mainland residents**

About 50% of resort lot buyers are from the U. S. mainland, while Hawaii residents comprise 20% of the market and Japanese and other foreigners account for 30% of all resort lot sales. West Coast purchasers are the largest market segment, comprising approximately 40% of all sales, while the Japanese have a significant market share, representing approximately 25% of all purchases.

Japanese buyers represent a substantial number of lot purchases at the Maui resorts, while the U. S. mainland residents maintain the majority of purchases at Hawaii island resorts. The Japanese preference for Maui resort lots can be directly associated with the increase in popularity of Maui as a primary destination for many Japanese who frequently return to Hawaii. Additionally, while the number of Japanese to the island of Hawaii has continued to grow, this segment comprises less than 20% of the Hawaii County visitor market.

**Four golf communities with residential lot projects are entitled for development on the island of Hawaii**

Four North Kona and South Kohala golf communities with proposed lot projects are currently entitled and planned for development. The projects with entitlements include:

- The Regent Kona Coast Resort, a 376-acre proposed resort community located in North Kona. The project will offer single-family home lots, commercial facilities and a medium scale resort and golf course. Project opening is unknown at this time.
- The High Bluffs at Mauna Kea, a future single-family lot development within the existing Mauna Kea Resort planned to include nine 30,000 or more square foot lots. Market entry for this project has not yet been announced.



- Kaupulehu Makai, a proposed resort community located in North Kona. Plans for the project include a hotel, two 18-hole golf courses and 1,164 residential units. The units will consist of about 700 condominium units and 465 residential lots ranging from 10,000 feet to 1/2-acre. All entitlements, include zoning, SMA, building and grading permits, are in place.
- Waikoloa Heights, a proposed golf resort community located in South Kohala. Current plans include a Gary Player designed golf course and 650 lots ranging from 12,000 - 20,000 square feet. Phase I is proposed to be introduced in 1995.

## GOLF MARKET OVERVIEW

**Hawaii island courses and private country clubs throughout Hawaii were reviewed to determine fees and utilization of the proposed golf course**

Resort golf courses on the island of Hawaii and country clubs throughout the state were reviewed to project membership pricing and dues, green and cart fees, annual membership absorption and rounds of play.

**Hawaii has 13 existing golf courses**

The island of Hawaii has 13 existing golf courses. Although several of these courses offer memberships, all of the courses are open for public play. Currently, there are 8 courses located in West Hawaii, 6 of which are within or associated with resort communities. These courses are all of championship quality and are known as some of the best courses in the world.

**Hotel guest green and cart fees average $61 at resort courses**

Green and cart fees for resort guests range from $33 to $80, and average approximately $61 per round. Nonguest visitors pay substantially higher rates, ranging from $50 to $130 per round.

Club members, where offered, were only required to pay cart fees which ranged from $14 to $18 a round. Waikoloa Beach was the only exception, where members consist solely of property owners who pay no dues or initiation fees, and were therefore charged a green and cart fee of $50 per round.

**Hawaii island resort golf courses averaged 46,000 rounds in 1991**

The estimated number of rounds played at Big Island resort courses in 1991 averaged about 46,000 rounds, or 126 rounds per day. Estimated annual rounds were determined by combining the average daily rounds played during regular and peak seasons. The peak season for Hawaii golf courses is traditionally during the winter months of November through March. Estimated daily rounds played during peak times averaged about 180 rounds per day, while the average daily rounds played during normal season was about 100 rounds per day. Thus, a significant increase (approximately 80%) in course play occurs during the peak season.

**The island of Hawaii has 32 proposed golf courses**

Currently, there are 32 new golf courses under construction, permitted, or proposed for Hawaii. Nine courses are under construction, while 21 have been approved by the county of Hawaii. Approximately 23 of these courses will be located within West Hawaii, with the majority intended for resort or private club use.

Several of the courses will be located in planned residential or resort communities. These courses include projects such as Kohala Ranch, Ouli, Kaupulehu, Puako, Waikoloa Highlands, Waikoloa Beach and the Queens Golf Course.

**Private golf clubs averaged 164 rounds per day in 1990**

Private golf clubs in Hawaii averaged 164 rounds per day in 1990. About 90% of all rounds can be attributed to actual members, with the remaining 10% played by guests of members.

**Initial fees at private golf clubs for Hawaii residents range from $5,000 to $43,000 for regular golf memberships**

Initiation fees at Hawaii's private golf clubs for Hawaii residents range from a low of $5,000 at the Maui Country Club, to $43,000 at Waialae Country Club for regular golf memberships. Each of the private clubs charge members monthly dues ranging from $40 for social members at Honolulu Country Club, to $205 for regular members at Oahu Country Club. The monthly dues generally include green fees for golf memberships and the use of club facilities.

Hawaii's private clubs do not charge members green fees for golf play. They do, however, charge between $5 and $9 for cart rentals. Members are also charged a green fee for any guests using the golf course at the club. Guest green fees range from $27 at Oahu Country Club, to $90 for social members at Honolulu who sponsor a guest during nonrestricted times. Maui also allows public play on Mondays at a rate of $45 a round.

## HOKUKANO SINGLE-FAMILY LOT MARKET ASSESSMENT

**Hokukano's recreational amenities and site location could result in an outstanding single-family lot development**

Although West Hawaii has several existing agricultural and resort lot subdivisions, the combination of a secluded, spacious residential community that offers extensive recreational facilities has not yet been offered. While several projects such as Puako and Makalei are planned to be marketed or under construction, Hokukano has an added benefit over these projects due to its access to the coastline, its sloping topography, lush vegetation and calm winds.



**The privacy offered at Hokukano is anticipated to draw many resort lot purchasers to the project**

Hokukano is expected to attract many resort lot purchasers who appreciate privacy. This market segment traditionally purchased at resort developments to take advantage of the amenities offered, while in turn sacrificing the privacy of a residential community. The Hokukano project would address this issue by allowing residents more playing time on the golf course and providing the secluded feeling associated with a residential community. An additional benefit Hokukano has over other high-end golf properties on the island, is its typically calm, 5 to 8 mph winds.

**The two golf memberships associated with each lot will be an added draw for the project**

As currently planned, a charter membership program consisting of two golf membership options will be offered with lot purchases in initial years of marketing. The value of these memberships will add to the marketability of the lots. Currently, few of the resort lot projects include memberships with the lot purchase, therefore this benefit is expected to be an attractive feature to former resort lot purchasers.

Due to the long-term need to market Hokukano, the developer will need to alter the membership program from time to time. The developer's goal is to provide a level of memberships that sustains a comfortable and uncrowded golf play experience. Since a substantial portion of the sales will be from outside the islands, experience with the amount of play from members will be needed to know what the ultimate number of members should be.

**The success at other Lyle Anderson projects can be anticipated for Hokukano**

Lyle Anderson Companies is known throughout the golf community as a premier golf and residential/resort community developer. Current golf community projects in Arizona and New Mexico have been successful in terms of pricing and sales activity, reportedly out-selling the competition by more than two-to-one. A major factor attributed to the success of Lyle Anderson projects is the appeal of their trademark Jack Nicklaus golf courses. Additionally, the beautiful lands chosen for development and Mr. Anderson's attention to integrating his developments into the land are significant factors. Thus, the reputation and success of other Lyle Anderson projects is anticipated to attract a large number of mainland purchasers to the Hokukano project.

**Proposed target buyers will primarily be from the U. S. mainland**

Potential buyers for the acreage and residential lots will include U. S. mainland residents, Hawaii residents and foreign nationals. The largest buyer market (40%) is expected to be from the U. S. mainland. Foreign investors are expected to represent 30% of the market, while Hawaii residents could account for an additional 30% of all purchases. The project buyer mix at Hokukano was based on the buyer mix of potentially competitive agricultural and resort lot projects. The unique characteristics of the Hokukano project were also considered when projecting the overall buyer mix. These figures are for overall lot development at Hokukano, and would differ for the acreage and residential lots, as shown in Exhibits 1-A and 1-B.

**Initially marketed acreage lots are projected to range from $460,000 to $930,000**

A summary of the market assessment for the 367 acreage lots planned for Hokukano is presented in Exhibit 1-A. In general, the acreage lots are expected to range from $460,000 to $930,000, in 1992 dollars. Set back within the project, the acreage lots are expected to offer ocean and/or golf course views, but will not offer frontage along the golf course or ocean.

Pricing for the acreage lots at Hokukano was projected based on the average per acre price of comparable Hawaii island projects, adjusted to Hokukano in terms of location, views and amenities. An additional premium for the two golf memberships associated with each lot was also assigned to the lot price. Thus, pricing for the acreage lots was determined as follows:

- Base per acre prices of $275,000 for the 1-acre lots and $200,000 for the 3-acre lots were determined, based on the recent sales of comparable projects.
- A 15% per acre upward adjustment was made to compensate for Hokukano's superior location and views relative to the competition. None of the Hawaii island agricultural lot subdivisions were located along the coastline, thus the Hokukano site was considered superior in location and view orientation. The benefit of being close to downtown Kona and Keahole airport were additional advantages to the site.
- An upward adjustment of 30% per acre was made to compensate for the amenities offered at Hokukano, including its golf course, clubhouse, members' lodge, tennis courts and access to a deep sea fishing boat. While the projects surveyed offered some amenities, none of them had facilities as extensive as those planned at Hokukano.
- To compensate for the charter Golf Membership program, a further premium was subsequently assigned to each lot.

Based on this analysis, initial pricing for the residential lots is projected to range as follows:

- 1.0-acre lots - $460,000
- 3.0-acre lots - $930,000

**The acreage lots at Hokukano are projected to have an eight-year absorption period**

An estimated 80-lot sales are projected for year one, which is almost double the project's overall annual sales average of 46 units. Higher sales activity in the first year can be achieved through effective premarketing programs and due to the closing of sales reservations collected in prior years. Sales are projected to be 50 units per annum during years two and three, and to stabilize in years four through eight at an average of 40 units per year.



EXHIBIT 1-A

# Summary of Hokukano acreage lot market assessment

**Project concept:**

- 367, 1.0- to 3.0-acre lots.
- Lot ownership will allow access to Hokukano amenities, and will include a charter membership program, consisting of two Golf Membership options for initial buyers.
- Lots will be set back from the golf course allowing for more privacy and excellent distant ocean and golf course views.

**Target buyer markets:**

| | Percentage of total purchasers |
|---|---|
| U.S. mainland | 35% |
| Oahu | 10% |
| Hawaii and other neighbor island | 35% |
| Foreign | 20% |
| Total | 100% |

**Projected initial sales prices (1992 dollars):**

| Lot size (acres) | Price per acre | Sales price |
|---|---|---|
| 1.0 | $460,000 | $460,000 |
| 3.0 | $310,000 | $930,000 |

**Projected sales absorption:**

| | Annual sales | Cumulative sales |
|---|---|---|
| Year 1 | 80 | 80 |
| Years 2 - 3 | 50 | 180 |
| Years 4 - 8 | 40 | 367 |

EXHIBIT 1-B

# Summary of Hokukano residential lot market assessment

**Project Concept:**

- 1,073 residential lots ranging from 8,700 square feet to 1-acre.
- Lot ownership will allow access to Hokukano amenities, and will include a charter membership program, consisting of two Golf Membership options for buyers in the initial years.
- Parcels will offer ocean and/or golf course views or frontage.

**Target buyer markets:**

| | Percent of total purchasers |
|---|---|
| U.S. mainland | 45% |
| Oahu | 10% |
| Hawaii and other neighbor island | 15% |
| Foreign | 30% |
| Total | 100% |

**Projected initial sales prices (1992 dollars):**

| Primary view | Number of lots | Price per square foot | Price per lot |
|---|---|---|---|
| Nonfrontage | 581 | $25 - $40 | $410,000 - $600,000 |
| Prime view/ golf frontage | 492 | $33 - $54 | $530,000 - $780,000 |

**Projected sales absorption:**

| | | Annual sales | Cumulative sales |
|---|---|---|---|
| Year | 1 | 70 | 70 |
| Year | 2 - 4 | 45 | 205 |
| Years | 5 - 33 | 30 | 1,073 |

**Initial pricing for the residential lots is projected to range from $410,000 to $780,000**

A summary of the market assessment for the 1,073 residential lots is presented in Exhibit 1-B. Pricing for these lots will differ in terms of view orientation, location and lot size. Overall pricing for the residential lots initially marketed is estimated to range from $410,000 to $780,000, in 1992 dollars, including the charter membership program. Despite the smaller sizes of the residential lots planned for Hokukano, the convenience and image of the golf course community and the lots' proximity to the golf course and ocean will make the residential lots comparable to those at the luxury and upscale resorts.

The pricing for residential lots at Hokukano was estimated considering the market performance of lots at resorts located on both Maui and the Big Island. The pricing for the residential lots was determined as follows:

- Nonfrontage lots which will offer ocean and/or golf course views, were estimated to range from $25 to $40 per square foot based on sales at the comparison lots.
- Prime view and golf front lots are anticipated to generate the highest prices. An upward adjustment of 30% to 35% per square foot was thus assigned to these lots.
- Similar to the acreage lots, a charter Golf Membership premium was subsequently added to the lot price for those to be marketed initially.

Based on this analysis, overall residential lot pricing has been projected as follows (in 1992 dollars):

- Nonfrontage - $410,000 to $600,000
- Prime view/golf frontage - $530,000 to $780,000

**A sell-out period of about 33 years is anticipated for the residential lots**

Lot sales in the first year are expected to be high, with an estimated absorption of 70 lots. Sales are projected to slow to 45 units per annum during years two through four, and stabilize in year five at an average of 30 units per annum.

## HOKUKANO GOLF AND COUNTRY CLUB MARKET ASSESSMENT

**The majority of members are anticipated to be property owners**

The majority of members will be lot buyers and considered Golf Members while a limited number of nonproperty owners, called Lodge Members, are also planned for Hokukano.

Initially, Golf Memberships will be conveyed with lot purchases. For a specific number of early sales, each lot will include a charter membership program consisting of two membership options: a regular limited play and a limited play membership. The option the charter buyer chooses to activate would be available to the lot buyer for his or her lifetime and is not to be resold. The option not activated would run with the land and would be transferable to the next buyer or revert to the club for resale if the lot is again resold. The two charter membership program options are as follows:

- **The limited play membership** would offer lower dues but restricted or limited days of play.
- **The regular membership** would offer unlimited access to the course, subject only to the availability of tee times.

Lodge Memberships are also planned to be sold on a limited basis. These memberships would convey a use right to the lodge, golf course and other property amenities. Lodge members would probably be entitled to the same rights and privileges of Golf Members except that these rights would only be available during periods when the member is staying at the Hokukano Lodge. Like the Golf Memberships, Lodge Memberships will include a provision for their resale.

### Membership initiation fees and dues

Initiation fees for Golf Memberships would be included with the lot purchase price. A premium is estimated for the initial lot sales that include the charter membership program. Dues are projected at $400 per month, considering the lot buyers will be more frequent users of the club and its facilities, as shown in Exhibit 1-C.

Initiation fees for the Lodge Memberships have not been determined, but are expected to be based on the value of access to the golf club and facilities as well as the use rights for the lodge. Dues for these members are projected at $1,000 per year, assuming they will be using the facilities less frequently than the Golf Members.

### Golf course green and cart fees

Cart fees for members are estimated to be about $20 to $30 and green and cart fees for guests of members are estimated to be about $125 to $150.

### Up to 1,500 Golf and Lodge Memberships are anticipated

Based on its experience in operating similar residential/golf developments in Arizona and New Mexico, Lyle Anderson anticipates that the project's facilities and demand for them could support up to 1,150 Golf Memberships and 350 Lodge Memberships, for a total of about 1,500 members. This figure would be subject to review based on lot sales and course utilization patterns over time.



EXHIBIT 1-C

# Summary of Hokukano Golf and Sports Club market assessment

**Project concept:**

- 27-hole championship golf course designed by Jack Nicklaus.
- Private course, with memberships open to property owners, charter members and Lodge Members.
- To include a 24,000 square foot clubhouse and a 100-unit lodge.

**Projected pricing:**

| | Pricing/Value |
|---|---|
| Golf Memberships (charter program): | |
| Regular play option: | |
| Initiation fee | Included with lot |
| Dues | $400/month |
| Limited play option: | |
| Initiation fee | Included with lot |
| Dues | $1,500/year |
| Lodge Memberships: | |
| Initiation fee | To be determined |
| Dues | $1,000/year |
| Green & cart fees: | |
| Members (cart fees only) (1) | $20 - $30 |
| Guests of members | $125 - $150 |
| Kamaainas | To be determined in discussion with government agencies |

(1) Includes regular and limited play Golf Members as well as Lodge Members.

## PROJECTED GOLF ROUNDS

**The 27-hole golf course is estimated to support 60,000 rounds per year**

The 27-hole course at Hokukano could be expected to support up to 60,000 rounds per year, or 165 rounds per day at stabilization. The supportable rounds at the Hokukano course will result in comfortable playing time for members and guests.

Guest play is anticipated to account for 20% of all Hokukano rounds. Members at Hokukano were expected to have a number of out of town guests coming to visit, subsequently guest play was anticipated to be higher than guest play at other country clubs. At stabilization, this would result in about 50,000 member rounds and 10,000 nonmember rounds. The Club may limit guest access to whatever level necessary to support desirable conditions for numbers.

## PRICING AND UTILIZATION OF THE HOKUKANO LODGE

**The lodge is anticipated to be utilized by club members and their guests**

A 100-unit lodge to be used by members, their guests and guests of the development company, is currently planned for the project. One of the main purposes is to provide lot owners with a place to stay while visiting Hokukano before, they have constructed their home. The lodge is also expected to serve as a convenient and comfortable place for Lodge Members, guests of members and potential buyers to stay while visiting the site.

**Rates at the Hokukano golf lodge are projected to range from $200 to $500 per night**

Lyle Anderson's suggested rates for the golf lodge range from $200 to $500 per night, in 1992 dollars. Members of Hokukano were expected to be charged a lower nightly rate ranging from $200 to $250 a night, while guests of members were expected to pay higher rates ranging from $400 to $500. Although the lodge will serve as a private accommodations facility rather than a hotel, nightly unit rates were estimated based on a premium over the nightly rates charged at luxury hotels located on both Maui and Hawaii. The higher rates are justified due to the unique facility, limited availability, the private atmosphere and the level of anticipated project amenities.



# MARKET ASSESSMENT FOR THE VILLAGES AT HOKUKANO

## TABLE OF CONTENTS

## 2 - PROJECT OVERVIEW AND REGIONAL SETTING

### HOKUKANO PROJECT OVERVIEW

Plans for the 1,540-acre site known as The Villages at Hokukano (Hokukano) are for an upscale, master-planned residential community that centers around golf. The project will be targeted to a high-end market, that will value both the amenities and location of Hokukano. Plans for the project currently include:

- 27-hole private membership golf course designed by Jack Nicklaus
- Clubhouse and other ancillary facilities
- Members' lodge
- Approximately 367 agricultural lots, of one to three acres
- About 1,073 residential lots, each ranging from 8,000 square feet to just under an acre.

**Hokukano is located in West Hawaii, which has emerged as a premier visitor destination and residential location**

Hokukano is located south of Kailua-Kona on the west coast of the island, as shown in Exhibit 2-A. The island of Hawaii has two primary regions, East Hawaii (Hilo) and West Hawaii (Kona). Hilo is on the eastern or windward side of the island, which is lush and generally receives a large amount of rainfall. In contrast, Kona enjoys a sunny, dry climate and has been the destination of choice for most Hawaii island visitors.

The northern portion of the coastline on the western or leeward side of the island is known as the Kohala coast. Within the past decade, West Hawaii has been the site of major tourism development and it now includes some of the most luxurious and modern resorts in the world. As presented in Exhibit 2-A, most of the major existing resorts are located along the approximate 40-mile coastline of the northwestern shore of West Hawaii.

Hokukano is located approximately 12 miles south of downtown Kailua-Kona, and 20 miles south of the Keahole Airport, the island's major point of entry. The well-known resort destinations of the Kohala Coast, such as Kona Village, Waikoloa Beach, Mauna Lani and Mauna Kea, are approximately an hour's drive away.

As the number of visitors continues to increase, resort development is now extending southward along the Kohala coast to the North Kona district at the planned Kaupelehu, Regent Beach, O'oma and Kohanaiki resorts. Keauhou Resort, located in South Kona and just north of Hokukano, is also growing with several more resort lot and condominium sites planned. The development of Hokukano thus represents a continuation of this southward momentum. As a whole, the marketing efforts of these resorts to the traveling public has created a great deal of exposure for the entire West Hawaii region.



Location of the project site

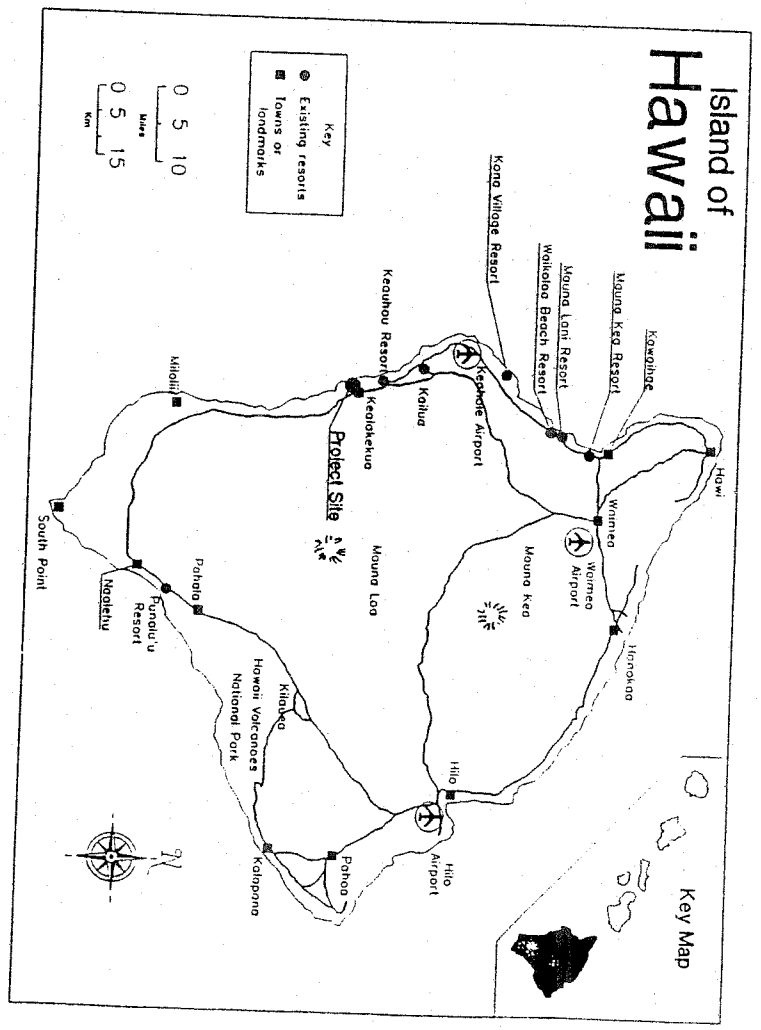



EXHIBIT 2-A

The ideal weather conditions and spectacular resort developments of the Kona and Kohala Coast districts, important historical sites and other attractions have increased the popularity of the West Hawaii area. Major visitor attractions include:

- Village of Kona, a traditional whaling and fishing town, has become a tourist center with numerous restaurants, shops, bill and sport fishing and other attractions.
- City of Refuge which is a historic area used by ancient Hawaiians as a refuge and place of forgiveness by the gods.
- Captain Cook Monument.
- Fish ponds, Hawaiian archaeological sites, petroglyphs, and ancient Hawaiian trails.

**Hokukano enjoys superior site attributes**

The Hokukano project benefits from a location convenient to major visitor attractions and shopping opportunities within a naturally attractive, rural, private setting. Hokukano is readily accessible from central Kona by heading southward along the Mamalahoa Highway (Hwy. 11), and turning *makai* (towards the ocean) at Kealakekua. Future access to the site may be enhanced by a proposed bypass planned to bisect the *mauka* tip of the project. The bypass would permit direct access to the property.

Relatively undeveloped land bounds the property with the exception of the residential area *mauka* of the site, and a small number of beach front homes in the northwest corner of the property. Current usage of the acreage is limited to cattle grazing.

The 1,540-acre property enjoys dramatic coastal frontage, sloping terrain, and lush vegetation ranging from grassy pastures punctuated with large monkey pod trees in the mauka portion, to dense hale koa and kiawe in the *makai* portion. *Mauka* elevations at the project entrance are at about 1,200 feet, which allows for superior views throughout the eastern portion of the site. Though occasionally steep and heavily vegetated, the general slope and terrain is gentle enough to allow for residential development. A subtle depression in the northern-*makai* portion of the site limits views to the ocean. However, the preliminary plan for the site, as developed by PBR Hawaii, utilizes such areas for golf holes, or involves water features to provide alternative views.

The area's rich and interesting history is represented by numerous Hawaiian archaeological sites found throughout the site. These are planned to be connected by nature trails to illustrate the cultural and historical significance of the land.

Coastal temperatures in the region average about 80 degrees, although the higher elevation of the mauka portion of the site may make for slightly cooler temperatures. Average annual rainfall reportedly ranges between 20 and 40 inches per annum, with heavier rainfall recorded mauka. Predominantly exceptional to this lee point location is its relatively calm winds, as opposed to those experienced north of Keahole Point on Hawaii's west coast.



**The development concept centers around single-family golf lots**

As shown in Exhibit 2-B, the conceptual master-plan calls for a mix of agricultural acreage lots, and low- to medium-density residential lots combined with recreational and lodging facilities. Amenities include golf, water features, clubhouse, lodge, historical sites and access to deep sea fishing and diving boats. Various buyer incentives, such as the right to retain club membership after a lot resale, may be made available on a limited basis.

The conceptual master-plan calls for about 367 lots of 1.0 or more acres, and about 1,073 residential lots, ranging from 8,000 square feet to just under 1-acre. Exhibit 2-C outlines the characteristics of the 23 land use types or parcels designated in the plan.

Although Oceanside 1250 is still negotiating the fee simple interests for a portion of the site, the majority of the site is owned as fee simple. The lots are subsequently intended to be sold in fee, and were therefore valued as such.

In general, the larger agricultural zoned lots are positioned towards the *mauka* end of the project, while the residentially zoned lots increase from low- to medium-density as they approach the *makai* end. The recreational and lodging facilities are also arranged at the *makai* end of the site. The immediate coastline is zoned as open space land within the State's Conservation District.

An agricultural easement will be associated with each acreage lot, which will require a portion of the lot to be dedicated towards agricultural production. Agricultural consultants have been retained by Oceanside 1250, to determine a crop that is best suited to the site. Once selected, the signature crop will serve as a trademark for the project.

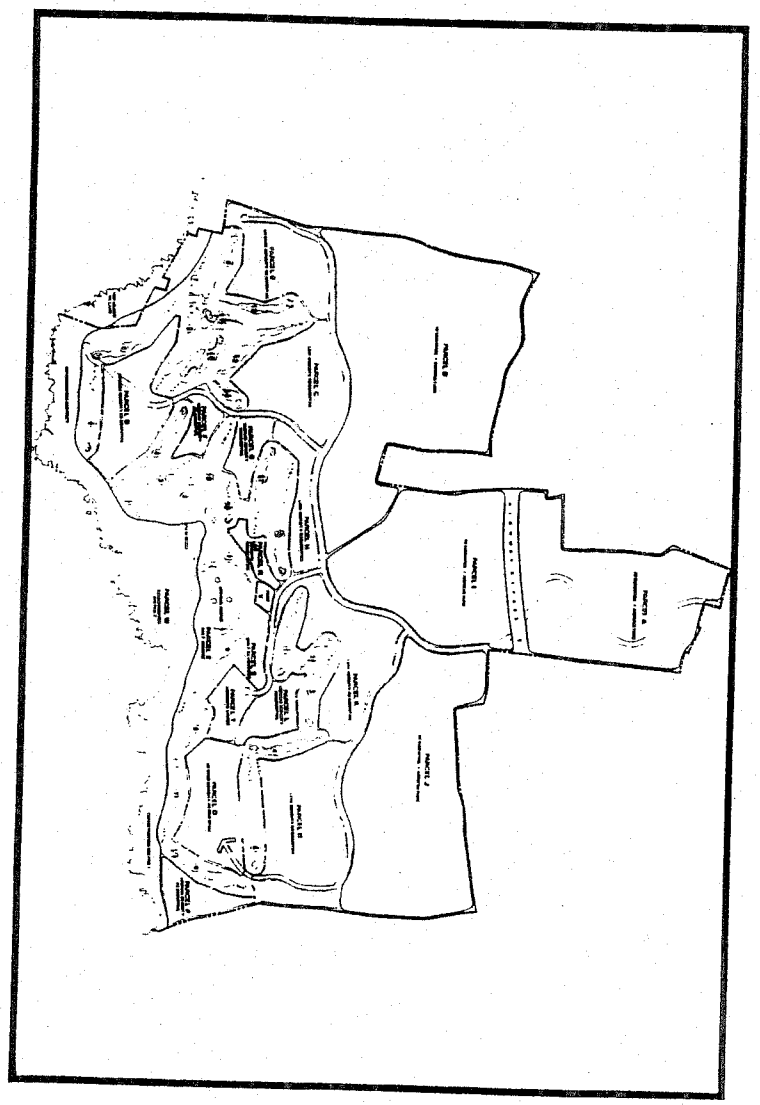
A contiguous strip of land which will run through each lot will be leased for cultivation of selected crops, to local farmers at a nominal rate. Thus the easement will be mutually beneficial to local farmers, as well as the residents of Hokukano who will benefit by having a portion of their lot maintained in a productive, attractive land use.

Overall unit density at Hokukano would be approximately one unit per acre. This relatively low density is key to the overall concept as unit densities affect privacy, viewscapes and the style of development. Lower unit densities result in a more secluded and exclusive atmosphere which is important to the perception of a quality development.

**Hokukano's site configuration provides lots with superior views**

The current conceptual plan classifies the 1,440 lots planned for Hokukano into four separate categories:

- Prime view lots - Lots that offer panoramic ocean views due to their proximity to the shoreline and their elevation.
- Golf front/oceanview lots - Lots that front directly onto the golf course. The terrain continues to fall away beyond the golf course, allowing for good ocean views.
- Golf frontage - Lots that front directly onto the golf course without significant ocean views.



Site plan of the proposed Hokukano development

EXHIBIT 2-B

EXHIBIT 2-C

# The Hokukano conceptual development plan focuses on low density residential lots

HOKUKANO CONCEPTUAL DEVELOPMENT PLAN

| Parcel | Use | Area | Units | Gross density | Average lot size (acres) |
|---|---|---|---|---|---|
| A | Residential/Agriculture | 118.0 | 60 | 0.5 | 2.0 |
| C | Residential | 47.3 | 95 | 2.0 | 0.5 |
| D | Residential/Agriculture | 226.0 | 154 | 0.5 | 2.0 |
| E | Residential | 45.5 | 140 | 3.0 | 0.3 |
| F | Residential | 8.5 | 35 | 4.0 | 0.3 |
| G | Residential | 12.0 | 50 | 4.0 | 0.3 |
| H | Residential | 20.0 | 40 | 2.0 | 0.5 |
| I | Residential/Agriculture | 123.5 | 65 | 0.5 | 1.9 |
| J | Residential/Agriculture | 170.0 | 88 | 0.5 | 1.9 |
| K | Residential | 46.0 | 100 | 2.1 | 0.5 |
| L | Residential | 15.0 | 50 | 3.1 | 0.3 |
| N | Residential | 66.0 | 139 | 2.1 | 0.5 |
| O | Residential | 35.0 | 140 | 4.0 | 0.3 |
| P | Residential | 17.0 | 68 | 4.0 | 0.3 |
| Q | Residential | 42.5 | 200 | 4.7 | 0.2 |
| R | Residential | 7.5 | 16 | 2.1 | 0.5 |
| | Subtotal | 1,000.0 | 1,440 | 1.4 | 0.7 |
| S | Golf Clubhouse | 4.0 | -- | -- | -- |
| T | Lodge | 14.0 | 100 | -- | -- |
| V | Historic Park | 2.0 | -- | -- | -- |
| W | Conservation District | 140.0 | -- | -- | -- |
| X | Golf Course | 349.0 | -- | -- | -- |
| Y | By-Pass | 17.0 | -- | -- | -- |
| Z | Roads | 14.0 | -- | -- | -- |
| | Subtotal | 540.0 | 100 | -- | -- |
| | Total | 1,540.0 | 1,540 | -- | -- |

Source: Provided by 1250 Oceanside Partners and PBR Hawaii.

- Ocean/golf views - Lots that do not front the golf course or the ocean, but due to their elevation and to site planning allow golf and/or ocean views, and in some cases *mauka* views.
- Nonfrontage residential lots - lots that do not front the golf course or ocean, but due to the elevation and site planning allow golf and/or ocean views, and in some cases *mauka* views.

The distribution of these view orientations is presented in Exhibit 2-D. As shown, the ocean/golf view lots are most common, consisting of 63% of the home sites. Prime ocean view lots represent a select 10% of the lots offered, while golf front lots represent the remaining sites.

## REGIONAL SETTING AND DEMOGRAPHIC TRENDS

The island of Hawaii, or the "Big Island", is the largest and youngest of all the islands in the Hawaiian island chain. The island of Hawaii his distinguished by its vast open spaces, diverse climates, spectacular scenery, active volcanoes, working ranches and world-class resorts. The visitor industry has benefited from these natural and man-made phenomena, with tourism increasing by approximately 3% per annum from 1980 to 1990.

The science center atop Mauna Kea has gained recent notoriety with 1991s solar eclipse and for its recent astronomical discoveries, and has generated permanent international interest within the scientific communities. By the year 2000, total international capital investments in 13 telescopes on Mauna Kea could exceed $1 billion. These long-term investments in scientific research could benefit the local economy, adding to the growth of the island as a whole.

The island of Hawaii has also shown signs of positive growth in the area of energy research and salt-water aquaculture. The State's Natural Energy Laboratory of Hawaii Authority (NELHA) located in Keahole, has several commercial ventures which produce or grow seafood products including salmon, oysters, and abalone. The NELHA also conducts research in the area of recycling and materials testing.

### Demographics of Hawaii island residents

**Population** - As illustrated in Exhibit 2-E, the resident population on the island of Hawaii is projected to grow by about 14% from 1990 to 1995, to about 137,600 residents. Continued growth is expected throughout the century and beyond, increasing approximately 27% by the year 2000, to 154,900 residents, and to nearly 200,000 residents by 2010. As compared to other islands, the increase in population density to date has not been as evident on the Big Island due to its relatively large size.

**Median family income** - As shown in Exhibit 2-F, median family income on the island of Hawaii was $33,400 in 1992. As compared to other states in the nation, the state of Hawaii ranked 8th in family income in 1990.

Projected growth in per capita personal income for the island of Hawaii is presented in Exhibit 2-E. As illustrated, per capita income is expected to increase to $18,800 (1990 dollars) by 2000, an increase of about 14%. The primary source of this income would be generated through wage and salary jobs with a large portion stemming from services and government related positions. The emphasis placed on service related jobs reflects the heavy reliance on tourism for the island of Hawaii.



EXHIBIT 2-D

# The majority of lots at Hokukano will offer ocean or golf views

PROPOSED VIEW ORIENTATIONS OF THE LOTS AT HOKUKANO

| Parcel | Dwelling units | View orientation: Prime view | Golf front oceanview | Golf frontage | Ocean/ golf views | Total |
|---|---|---|---|---|---|---|
| A | 60 (1) | 0% | 0% | 0% | 4% | 4% |
| C | 95 | 1% | 1% | 0% | 5% | 7% |
| D | 154 (1) | 0% | 0% | 0% | 11% | 11% |
| E | 140 | 2% | 1% | 0% | 7% | 10% |
| F | 35 | 1% | 0% | 1% | 1% | 3% |
| G | 50 | 1% | 0% | 1% | 1% | 2% |
| H | 40 | 0% | 1% | 0% | 1% | 2% |
| I | 65 (1) | 0% | 0% | 0% | 4% | 4% |
| J | 88 (1) | 0% | 0% | 0% | 6% | 6% |
| K | 100 | 0% | 3% | 0% | 4% | 7% |
| L | 50 | 0% | 1% | 2% | 0% | 3% |
| N | 139 | 0% | 2% | 0% | 7% | 10% |
| O | 140 | 2% | 2% | 1% | 4% | 10% |
| P | 68 | 2% | 2% | 0% | 1% | 5% |
| Q | 200 | 1% | 0% | 6% | 7% | 14% |
| R | 16 | 0% | 1% | 0% | 0% | 1% |
| Total, rounded | 1,440 | 10% | 15% | 11% | 63% | 100% |

(1) Proposed as acreage lots with agricultural zoning.

Source: Information provided by Gage Davis Associates.

EXHIBIT 2-F

# In 1992 median family income in the County of Hawaii was estimated at $33,400

MEDIAN FAMILY INCOME BY COUNTY: 1990 AND 1992

| | 1990 | 1992 |
|---|---|---|
| Oahu | $41,200 | $46,000 |
| Hawaii | N/A | $33,400 |
| Kauai | N/A | $36,400 |
| Maui | N/A | $39,400 |

(1) Among states.
Source: U.S. Department of Housing and Urban Development, memorandum dated February 1, 1990.

EXHIBIT 2-E

# The island's resident population is projected to grow 27% by the year 2000

POPULATION AND ECONOMIC PROJECTIONS FOR THE ISLAND OF HAWAII: 1990 TO 2010 (IN THOUSANDS)

| | 1990 | 1995 | Percent change | 2000 | Percent change | 2005 | Percent change | 2010 | Percent change |
|---|---|---|---|---|---|---|---|---|---|
| Resident population(1) | 120.3 | 137.6 | 14% | 154.9 | 13% | 174.6 | 13% | 199.0 | 14% |
| De facto population(1) | 135.1 | 159.4 | 18% | 183.9 | 15% | 212.1 | 15% | 244.2 | 15% |
| Civilian jobs(1): | 57.5 | 66.8 | 16% | 76.4 | 14% | 87.3 | 15% | 99.7 | 15% |
| Wage & salary jobs- | 49.4 | 57.9 | 17% | 66.7 | 16% | 77.1 | 16% | 89.0 | 16% |
| Agriculture | 3.5 | 3.6 | 3% | 3.7 | 3% | 3.8 | 3% | 3.9 | 2% |
| Manufacturing | 2.3 | 2.4 | 4% | 2.4 | 0% | 2.5 | 4% | 2.5 | 0% |
| Construction | 3.3 | 3.9 | 19% | 4.5 | 16% | 5.2 | 14% | 6.0 | 16% |
| Transportation | 2.5 | 2.9 | 15% | 3.3 | 13% | 3.8 | 15% | 4.3 | 15% |
| Trade | 12.6 | 14.7 | 16% | 17.1 | 16% | 19.8 | 16% | 23.0 | 16% |
| Banking | 2.4 | 2.7 | 12% | 3.1 | 16% | 3.7 | 18% | 4.2 | 15% |
| Services-- | 14.3 | 17.8 | 25% | 21.5 | 21% | 25.8 | 20% | 30.9 | 19% |
| Hotels | 6.3 | 7.6 | 21% | 9.0 | 17% | 10.5 | 18% | 12.4 | 17% |
| Other | 8.0 | 10.2 | 28% | 12.6 | 23% | 15.3 | 22% | 18.6 | 22% |
| Government-- | 8.5 | 9.9 | 16% | 11.1 | 12% | 12.6 | 13% | 14.2 | 13% |
| State/local | 7.6 | 8.8 | 16% | 10.0 | 14% | 11.6 | 15% | 13.2 | 14% |
| Federal | 0.9 | 1.1 | 17% | 1.1 | 0% | 1.1 | 0% | 1.1 | 0% |
| Self-employed | 8.1 | 8.9 | 10% | 9.7 | 8% | 10.2 | 5% | 10.7 | 5% |
| Personal income(2) | $1,960 | 2,425 | 24% | 2,900 | 20% | 3,457 | 19% | 4,150 | 20% |
| Per capita income(3) | $16.3 | 17.6 | 7% | 18.8 | 7% | 19.8 | 6% | 20.8 | 5% |

(1) As of April 1.
(2) Estimated in millions, 1990 dollars.
(3) Estimated in thousands, 1990 dollars.
Source: U.S. Bureau of the Census, June 1991; Department of Business and Economic Development, "Population and Economic Projections to 2010," November 1988.

**Visitor arrivals to the state of Hawaii have shown strong growth since 1970**

As shown in Exhibit 2-G, visitor arrivals to the state of Hawaii have generally increased during the past 20 years reaching their peak in 1990 with nearly 7.0 million visitor arrivals. Average compounded annual increases in westbound and eastbound visitor arrivals to the state over the last 22 years are as follows:

| Years | Westbound | Eastbound | Total |
|---|---|---|---|
| 1970 to 1980 | 8.7% | 7.8% | 8.5% |
| 1980 to 1990 | 4.5% | 9.7% | 5.9% |
| 1990 to 1992 (July) | -8.0% | 6.2% | -3.2% |

Visitor arrivals have declined in 1991 and 1992, due to the continued U. S. recession and discount air fares on the mainland. Eastbound visitor arrivals, however, show overall growth despite a drastic fall-off that occurred in early 1991 during the Gulf War. As shown in the table above, the average annual growth rate for westbound visitors was 8.7%, from 1970 to 1980, but declined to 4.5% during the period 1980 to 1990. In comparison, the eastbound market has shown relatively steady increases, primarily due to the popularity of Hawaii among Japanese travelers.

Throughout the last two decades, approximately 75% of the visitors to the state of Hawaii were westbound visitors consisting of travelers from the U. S. mainland, Canada, and Europe, as shown in Exhibit 2-G. It is important to note, however, that as Hawaii matures as a visitor destination for the westbound market, the rapid growth of the past may decrease to more stabilized levels. This trend is indicated in the significantly lower increase in arrivals during the period 1980 to 1992. Conversely, the eastbound market continues to show healthy increases in overnight visitors, reporting an average annual increase of 9.0% during the period of 1980 through 1992.

Exhibit 2-H shows westbound and eastbound visitor counts and average annual growth for the island of Hawaii since 1970. As shown, westbound visitors account for about 80% of all Hawaii County visitor arrivals. While representing a significantly smaller portion of the market, the number of eastbound visitor arrivals has increased considerably over the past two decades, with an average annual increase of 8% from 1980 to 1990, and an annual increase of 11% during the period 1990 to 1992.

**Visitor arrivals to the state are expected to increase significantly**

Exhibit 2-I presents total visitor arrivals to the state over five-year periods through the year 2000. The following can be observed from the projections:

- By 1995, total visitor arrivals could increase to nearly 8.4 million, representing a 20% increase over a five-year period.
- By 2000, total visitor arrivals are expected to increase to over 9.7 million or about 17% more than in 1995.



EXHIBIT 2-G

# Growth in the eastbound visitor market has exceeded that of the westbound market since the 1980s

## OVERNIGHT VISITORS TO THE STATE OF HAWAII: 1960 TO 1992

| | Westbound | | Eastbound | | |
|---|---|---|---|---|---|
| | Arrivals | Percent of total | Arrivals | Percent of total | Total |
| 1960 | 250,795 | 85% | 45,722 | 15% | 296,517 |
| 1965 | 567,218 | 83% | 119,710 | 17% | 686,928 |
| 1970 | 1,326,135 | 76% | 420,835 | 24% | 1,746,970 |
| 1975 | 2,207,417 | 78% | 621,688 | 22% | 2,829,105 |
| 1980 | 3,046,132 | 77% | 888,372 | 23% | 3,934,504 |
| 1985 | 3,708,610 | 76% | 1,175,500 | 24% | 4,884,110 |
| 1990 | 4,719,730 | 68% | 2,251,450 | 32% | 6,971,180 |
| 1991 | 4,584,460 | 67% | 2,289,430 | 33% | 6,873,890 |
| 1992 | 3,997,380 | 61% | 2,539,850 | 39% | 6,537,230 |
| Compounded annual % increase: | | | | | |
| 1960 to 1970 | 18.1% | | 24.9% | | 19.4% |
| 1970 to 1980 | 8.7% | | 7.8% | | 8.5% |
| 1980 to 1990 | 4.5% | | 9.7% | | 5.9% |
| 1990 to 1992 | -8.0% | | 6.2% | | -3.2% |

Source: Hawaii Visitors Bureau, Westbound Visitors to Hawaii, annual.

EXHIBIT 2-H

# Hawaii County visitor arrivals show continued growth

HAWAII ISLAND VISITOR ARRIVALS: 1970 TO 1992

| | Westbound | | Eastbound (1) | | |
|---|---|---|---|---|---|
| | Arrivals | Percent of total | Number | Percent of total | Total |
| 1970 | 446,370 | 98% | 9,110 | 2% | 455,480 |
| 1975 | 769,779 | 94% | 49,680 | 6% | 819,459 |
| 1980 | 761,103 | 90% | 85,743 | 10% | 846,846 |
| 1985 | 697,380 | 86% | 115,299 | 14% | 812,679 |
| 1990 | 982,900 | 84% | 187,930 | 16% | 1,170,830 |
| 1991 | 975,610 | 82% | 213,020 | 18% | 1,188,630 |
| 1992 | 954,530 | 80% | 232,850 | 20% | 1,187,380 |
| Compounded annual % increase: | | | | | |
| 1970 to 1980 | | 5.5% | | 25.1% | 6.4% |
| 1980 to 1990 | | 2.6% | | 8.2% | 3.3% |
| 1990 to 1992 | | -1.5% | | 11.3% | 0.7% |

(1) Eastbound data has only been collected by HVB since 1989, prior years are estimated.

Source: Hawaii Visitors Bureau, Westbound Visitors to Hawaii, annual.

EXHIBIT 2-I

# State visitor arrivals are expected to grow significantly

PROJECTIONS FOR VISITOR ARRIVALS TO THE STATE: 1995 - 2000
(IN THOUSANDS)

| | Actual | Projected | | Average annual compounded % increase |
|---|---|---|---|---|
| | 1990 | 1995 | 2000 | 1990 - 2000 |
| State arrivals: | | | | |
| Non-Japanese | 4,720 | 5,462 | 6,248 | 2.8% |
| Japanese | 2,251 | 2,917 | 3,522 | 4.6% |
| Total | 6,971 | 8,379 | 9,770 | 3.4% |

Source: Hawaii Visitors Bureau, records; State of Hawaii, Department of Business and Economic Development, 1991.

The statewide growth could be led by Japanese visitor arrivals which are projected to increase to nearly 3 million visitors per annum by 1995. In comparison, non-Japanese visitors are expected to increase by only 32% to about 6.2 million by the year 2000.

One factor that could favor tourism for Hawaii island is the extension of the runway at Keahole Airport from 6,500 to 11,000 feet. The extension of the runway could accommodate jumbo jets allowing for international flights and non-stop air service beyond the West Coast. This project is scheduled to be completed in 1993.

### Visitor accommodation units reflect vacation interest in the island of Hawaii

The number of visitor accommodation units in a given region can be an indicator of the popularity of the area with the traveling public. Exhibit 2-J presents the existing total room inventory and planned room inventory for the island of Hawaii. Currently there are 9,384 rooms available for visitor use with 4,746 more planned over the next several years.

As shown, the Kona area currently maintains about 47% of the total available visitor accommodation units on the island with 4,401 rooms. By 1994 an additional 2,360 rooms are planned for the area, representing half of the total planned room inventory.

The Kohala area is also a popular destination for the traveling public as 35% or 3,318 rooms are currently located in this area. In the future, an additional 786 units are planned to be added in this region.

Thus, as the region of West Hawaii continues to gain popularity, and as new developments occur, the exposure generated by marketing efforts can be expected to further enhance West Hawaii's desirability as a primary visitor destination and real estate/second home investment locale within the state of Hawaii.

### The island of Hawaii's visitors are diverse

The travel patterns with respect to place of origin, purpose of trip, accommodation usage, average length of stay, and travel status for westbound and eastbound visitors to the island of Hawaii, are reviewed below and summarized in Exhibit 2-K.

**Average length of stay** - The average length of stay for westbound visitors is more than double that of eastbound visitors. Westbound visitors stay an average of 6.4 days compared to 3.0 days for eastbound visitors.

**Travel status** - Westbound visitors tend to travel independently while eastbound visitors tend to travel as part of a tour group. About 59% of westbound visitors to the island of Hawaii are FIT's (free and independent travelers). In contrast, only 33% of eastbound visitors to the state traveled independently, while the majority (67%) traveled as GIT's (group inclusive travelers).

**Average party size** - Westbound and eastbound visitors traveled in similarly sized groups averaging 1.9 and 1.4 persons per party, respectively.



EXHIBIT 2-J

# 82% of existing visitor accommodations are located in the Kona and Kohala area

ISLAND OF HAWAII EXISTING AND PLANNED VISITOR PLANT INVENTORY BY REGION: 1991 TO 1994

| Region | Total number of properties(1) | Total available rooms | Percent of total |
|---|---|---|---|
| **Existing:** | | | |
| Kona | 63 | 4,401 | 47% |
| Kohala | 16 | 3,318 | 35% |
| Hilo-Honokaa | 20 | 1,492 | 16% |
| Volcano | 10 | 133 | 1% |
| Naalehu-Ka'u | 2 | 40 | 0% |
| Total existing | 32 | 9,384 | 100% |
| **Planned:** | | | |
| Kona | 7 | 2,360 | 50% |
| Kohala | 3 | 786 | 17% |
| Naalehu-Ka'u | 2 | 1,600 | 34% |
| Total planned | 12 | 4,746 | 100% |

(1) Includes hotels, hotel-condominiums, condominiums & bed and breakfast accommodations.
Source: Hawaii Visitors Bureau, Market Reserch Department, Visitor Plant Inventory, 1991.

EXHIBIT 2-K

# In 1991, 64% of total westbound visitors to the island of Hawaii were repeat visitors

## VISITOR TRAVEL PATTERNS AND DEMOGRAPHIC CHARACTERISTICS FOR THE ISLAND OF HAWAII: 1991

| | Westbound visitors | Eastbound visitors |
|---|---|---|
| Pleasure trip (% of total) | 80.8% | 79.3% |
| Length of stay (days) | 6.4 | 3.0 |
| Travel status (% of total): | | |
| FIT (1) | 59% | 33% |
| GIT (2) | 41% | 67% |
| Total | 100% | 100% |
| Average party size | 1.9 | 1.4 |
| Median age (years) | 44 | 38 |
| Occupation (% of total): | | |
| Professional and technical | 30% | 21% |
| Business and managerial | 31% | 33% |
| Clerical, office, sales | 13% | 16% |
| Retired | 14% | 7% |
| Other | 12% | 23% |
| Total | 100% | 100% |
| Repeat visitors (percent of totals) | 64% | 49% |

(1) Free and independent traveler.
(2) Group inclusive traveler.
Source: Hawaii Visitors Bureau, The 1990 Island Supplement, 1991.

**Age** - The median age of the westbound traveler to the island of Hawaii was 44 years, representing an older visitor market than that of eastbound travelers who averaged 38 years of age.

Over 51% of the visitors to the island of Hawaii are between the ages of 30 and 50, as shown in Exhibit 2-L. Another sizable age group is those 50 and above, which accounted for 31% of all Big Island visitors in 1991.

**Occupation** - Business and managerial visitors represented 31% of the westbound visitors, and 33% of eastbound visitors that traveled to the island of Hawaii during 1991. A notable difference was among retired visitors. Approximately 14% of the westbound visitors belonged to this category, compared to only 7% of the eastbound visitors.

Professionals and those with managerial/business oriented careers represented over 50% of the visitor population to Hawaii during 1991.

**Visitor status** - In 1991, approximately 40% of the island's westbound visitors consisted of first-time visitors compared to 50% for eastbound visitors.

**Average daily expenditures** - In 1991, average daily expenditures for westbound visitors on the Neighbor Islands was estimated at $153, while eastbound visitor spending was estimated to average $270 per day.

EXHIBIT 2-L

# Over 50% of Hawaii island visitors are professionals or managers

DEMOGRAPHIC CHARACTERISTICS OF VISITORS: 1991

| | By island | | | | | | | Statewide | |
|---|---|---|---|---|---|---|---|---|---|
| | Oahu | Hawaii | Maui | Kauai | Molokai | Lanai | Total | Westbound | Eastbound |
| Age: | | | | | | | | | |
| 10 to 19 years | 3.5% | 2.2% | 1.8% | 1.5% | 1.7% | 1.6% | 3.1% | 2.5% | 4.2% |
| 20 to 29 years | 28.9% | 15.1% | 21.6% | 19.0% | 14.7% | 15.9% | 25.6% | 18.9% | 39.0% |
| 30 to 39 years | 23.8% | 25.3% | 26.3% | 26.8% | 19.2% | 20.5% | 25.3% | 26.5% | 22.7% |
| 40 to 49 years | 21.2% | 26.0% | 25.1% | 24.9% | 24.1% | 24.1% | 22.9% | 26.0% | 16.8% |
| 50 to 59 years | 12.2% | 15.7% | 13.4% | 14.1% | 16.2% | 17.0% | 12.5% | 13.7% | 10.1% |
| 60 years and older | 10.5% | 15.7% | 11.8% | 13.7% | 24.0% | 20.8% | 10.6% | 12.3% | 7.2% |
| Total | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| Average age | 39 | 43 | 41 | 42 | 45 | 45 | 39 | 41 | 36 |
| Occupation (percent distribution): | | | | | | | | | |
| Professional and technical | 25.8% | 28.7% | 28.6% | 30.3% | 27.5% | 26.0% | 26.9% | 29.2% | 22.2% |
| Business, managerial, official | 17.8% | 22.0% | 22.4% | 21.7% | 20.3% | 25.4% | 19.6% | 21.4% | 15.8% |
| Clerical, office, sales | 18.2% | 13.3% | 16.1% | 14.1% | 9.9% | 11.2% | 17.2% | 14.2% | 23.3% |
| Retired | 8.3% | 12.4% | 9.1% | 11.2% | 19.1% | 14.6% | 8.2% | 9.8% | 5.1% |
| Other | 29.8% | 23.6% | 23.7% | 22.6% | 23.2% | 22.8% | 28.0% | 25.4% | 33.6% |
| Total | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

Source: Compiled by KPMG Peat Marwick, based on information obtained from the Hawaii Visitors Bureau, Island Supplement, annual. Hawaii Visitors, Bureau, Annual Research Report, annual.

MARKET ASSESSMENT FOR
THE VILLAGES AT HOKUKANO

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## 3 - ACREAGE LOT OVERVIEW

Due to the limited number of large lots in golf-related developments and acreage lot subdivisions in Hawaii, several agricultural lot projects on Hawaii and Maui were used to analyze the 367, 1.0-acre and larger lots planned at Hokukano. Historically, acreage lot purchasers have been more concerned with open space and privacy, and tended to be less interested in the amenities offered at resorts. Subsequently, the majority of such projects on Hawaii island are located in the less populated, more rural areas of North Kona and Kohala.

The two most common motivations for acreage lot purchases are for primary homes or for future retirement /second homes. A distinction between these two groups can be observed at the various projects surveyed, with some projects catering to the primary market and others to the second home/retirement market.

### Nine acreage lot projects have been reviewed

Eight agriculturally-zoned subdivisions located on Hawaii and one project on Maui were reviewed. As shown in Exhibit 3-A, all of the Big Island projects are located within West Hawaii. Plantation Estates, located in West Maui, was also considered in this analysis due to its similarities to Hokukano in terms of its association with a golf course, its lot sizes, ocean views and amenities. Because of these attributes, Plantation Estates may actually be more comparable to Hokukano than the marketed Hawaii island projects.

The acreage lot projects surveyed range from vast ranch subdivisions such as Waiki'i Ranch and Kohala Ranch, to more residential oriented subdivisions such as Anekona Estates, Kona Heavens, Kona Hills and Sandalwood Estates, as seen in Exhibit 3-B. Lot sizes are diverse, ranging from 10- to 80-acre parcels at Waiki'i Ranch, to 1-acre lots at Kona Heavens, Kona Hills, Puu Lani Ranch and Sandalwood Estates.

The number of lots offered at these subdivisions ranges from 36 lots at Anekona Estates to over 470 lots at Kohala Ranch. The majority of existing acreage lot projects with the exception of Kohala Ranch, offer significantly fewer units than proposed at Hokukano.

### Acreage lot subdivisions generally offer few amenities

Exhibit 3-C demonstrates how the acreage lot subdivisions differ in terms of amenities and typical buyers. The Hokukano project, which will focus on recreational activities, is expected to attract retirement and second home purchasers who value lifestyle amenities. Many of the agricultural lot projects on Hawaii do not fit this description and were thus eliminated from further analysis.

Subdivisions such as Anekona Estates, Maliu Ridge, Sandalwood Estates and Kona Heavens offered no recreational or lifestyle amenities. The majority of buyers at these subdivisions are typically more concerned with affordability than amenities; thus these projects were not included for further study.

Although Waiki'i Ranch offers several amenities and has a number of second home or retirement home purchasers, this development offers significantly larger lots (10 to 80 acres) and is located in an isolated area some 30 to 40 minutes from the nearest town. Thus, Waiki'i was also eliminated from further analysis.



# Existing and proposed acreage lot projects on the Island of Hawaii

EXHIBIT 3-A

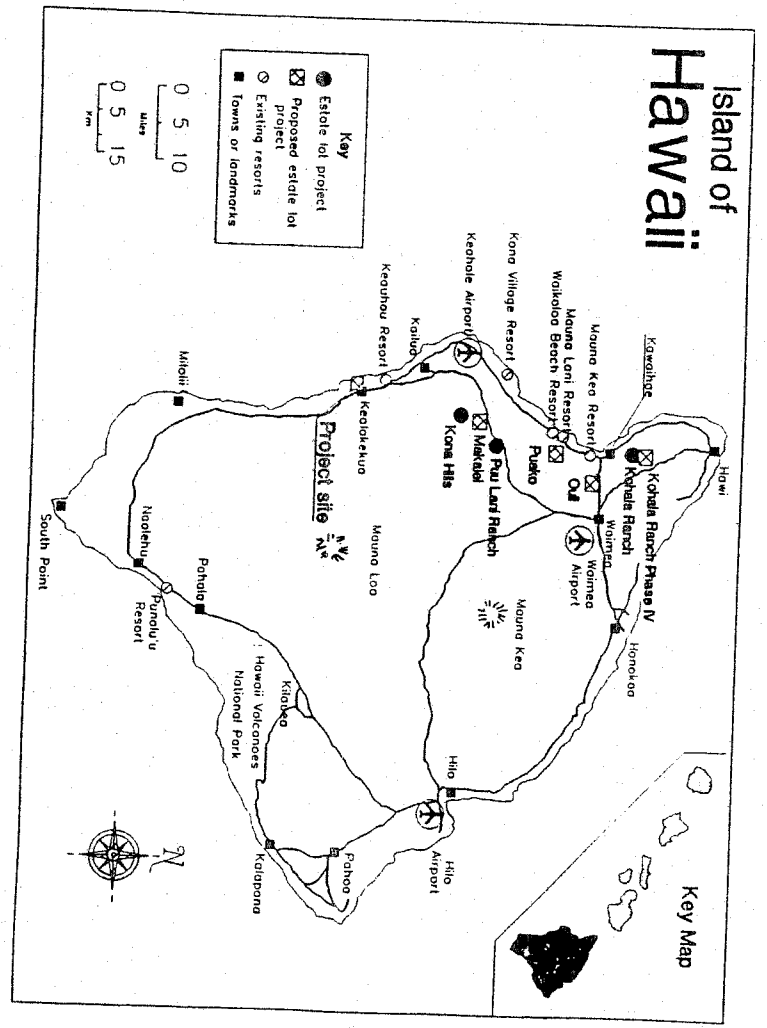

EXHIBIT 3-B

# Acreage lot subdivisions range from 1 to 80 acres

CHARACTERISTICS OF ACREAGE LOT PROJECTS ON THE ISLANDS OF HAWAII AND MAUI

| Project | Location | Total number of lots | Lot size (acres) Range | Average |
|---|---|---|---|---|
| **Hawaii:** | | | | |
| Anekona Estates | Waimea | 36 | 5.0 - 6.0 | 5.3 |
| Maliu Ridge | North Kohala | | | |
| Phase 1 | | 57 | 1.2 - 2.4 | 1.8 |
| Phases 2 & 3 | | 115 | 1.0 - 6.6 | 2.2 |
| Sandalwood Estates | Waimea | 44 | 1.0 - 5.0 | 2.0 |
| Kohala Ranch | North Kohala | | | |
| The Summit & The Heathers | | 223 | 3.0 - 10.0 | 5.0 |
| The Meadows | | 154 | 3.0 | 3.0 |
| The Meadows II | | 100 | 5.0 | 5.0 |
| Puu Lani Ranch | North Kona | 110 | 1.0 - 5.0 | 2.0 |
| Waiki'i Ranch | South Kohala | 202 | 10.0 - 80.0 | 14.0 |
| Kona Hills Estates | North Kona | 72 | 1.0 | 1.0 |
| Kona Heavens | North Kona | 115 | 1.0 | 1.0 |
| **Maui:** | | | | |
| Plantation Estates | West Maui | 76 | 2.0 - 7.0 | 2.6 |
| Average/range | | 109 | 1.0 - 80.0 | 3.7 |
| **Proposed Hokukano Lots** | | **367** | **1.0 - 3.0** | **1.8** |

Source: Compiled by KPMG Peat Marwick based on discussions with project representatives.

EXHIBIT 3-C

# Acreage lot subdivisions generally offer few amenities

CHARACTERISTICS OF ACREAGE LOT PROJECTS ON THE ISLANDS OF HAWAII AND MAUI

| Project | Amenities | Typical buyers |
|---|---|---|
| Anekona Estates | Underground utilities. | 2/3 Hawaii residents and 1/3 from U. S. mainland. Many of the original purchases were investment oriented. Now they are for primary residences. |
| Maliu Ridge<br>Phase 1<br>Phases 2 & 3 | Underground utilities. | Hawaii residents to use as primary residence. |
| Sandalwood Estates | Underground utilities. | Big Island residents to use as primary home. |
| Kohala Ranch<br>The Summit & The Heathers<br>The Meadows<br>The Meadows II | Secured gate, underground utilities, equestrian facilities. Golf course and tennis courts under construction. | Majority are from the U. S. mainland, some local and foreign investors. Original purchases were investment oriented, now seeing more second homes and future retirees. |
| Puu Lani Ranch | Gated community, underground utilities and equestrian facilities. Clubhouse and tennis courts are under construction, and hiking trails and picnic area are planned. | 50% from the U. S. mainland, 25% from Hawaii and 25% foreign. Half of the purchases are second homes, while 30% are investment oriented. |
| Waiki'i Ranch | Gated community, underground utilities and equestrian facilities. Clubhouse with pool, tennis and health club is planned. | Majority Hawaii residents; 1/3 from the west coast; few foreign. The majority of homes are for retirement, with 20% used for primary residence. |
| Kona Hills Estates | Electronic gate and underground utilities. | Half of the purchasers are from Hawaii and half are from the U. S. mainland. |
| Kona Heavens | Underground utilities. | N/A |
| Plantation Estates | Resort community with secured entrance, tennis courts and golf course. | Purchasers are a mixture of U.S mainland, Japanese and Hawaii residents. |

Source: Compiled by KPMG Peat Marwick based on discussions with project representatives

EXHIBIT 3-D

# Selected acreage lots range from one to ten acres

## CHARACTERISTICS OF SELECTED EXISTING AGRICULTURAL LOT SUBDIVISIONS

| Project | Location | Developer | First marketed | Total project size (acres) | Total number of lots | Lot size (acres) Range | Lot size (acres) Average |
|---|---|---|---|---|---|---|---|
| Kohala Ranch | Kohala Coast | Kohala Joint Venture | 1986 | | | | |
| The Summit & The Heathers | | | | 1,500 | 223 | 3.0 - 10.0 | 5.0 |
| The Meadows | | | | 600 | 154 | 3.0 | 3.0 |
| The Meadows II | | | | 600 | 100 | 5.0 | 5.0 |
| Puu Lani Ranch | S. of Waimea | Puu Lani Ranch Corp. | 1988 | 245 | 110 | 1.0 - 5.0 | 2.0 |
| Kona Hills Estates | North Kona | N/A | 1981 | 90 | 72 | 1.0 | 1.0 |
| Plantation Estates | West Maui | Kapalua Land Company | 1990 | 270 | 76 | 2.0 - 7.0 | 2.6 |
| **Proposed Hokukano acreage lots** | Kealekekua | Oceanside 1250 | **1995** | **1,540** | **367** | **1.0 - 3.0** | **1.8** |

Source: Compiled by KPMG Peat Marwick based on discussions with project representatives.

The projects that were subsequently considered for review included Kohala Ranch, Puu Lani Ranch, Kona Hills Estates and Plantation Estates. These projects were chosen because of their similarity in size, typical buyer mix and amenities.

**The selected subdivisions have lot sizes of one to ten acres**

As shown in Exhibits 3-D and 3-E, the four agricultural lot subdivisions considered most comparable to Hokukano can be described as follows:

- **Kohala Ranch**, located along the Kohala Coast, currently covers some 2,700 acres and is comprised of three separate subdivisions. The agriculturally-zoned portion of the project contains over 470 lots which range in size from 3 to 10 acres. Kohala Ranch amenities include a secured gate, a polo field, riding trails, a 27-hole golf course (under construction), a clubhouse, tennis courts and a new equestrian and polo facility. The project offers distant coastline views from most of the lots.
- **Puu Lani Ranch**, located south of Waimea, spans over 245 acres and contains 110 lots. Lot sizes range from 1 to 5 acres, and average about 2 acres. Puu Lani Ranch is a gated community that offers horse stables, riding trails and picnic areas. A 3,000 square foot clubhouse with 2 tennis courts is currently under construction. A golf course is proposed for a parcel adjacent to Puu Lani Ranch and the project is seeking to enter an agreement to share the planned course in exchange for sharing Puu Lani Ranch's equestrian and clubhouse facilities. Views from Puu Lani are generally inferior to those from Kohala Ranch.
- **Kona Hills Estates**, located in North Kona, is a 90-acre subdivision containing 72 one-acre lots. The project does not offer any amenities other than an electronic gate and underground utilities. It offers excellent ocean views due to its sloping terrain.
- **Plantation Estates**, located in Kapalua, West Maui, spans over 270 acres and contains 76 one-acre lots around a Ben Crenshaw designed golf course and an extensive new clubhouse. The project is located within a resort community and thus allows access to amenities such as 2 additional golf courses, tennis courts and pool facilities. Plantation Estates offers excellent views of Maui's northwest coastline and the lush green Kapalua Resort and its golf courses.

**Home building restrictions and covenants help maintain the desired image of a subdivision**

The selected subdivisions generally maintain stringent building codes, covenants and restrictions (CC & R's) to uphold their desired image. Puu Lani Ranch requires owners to invest a minimum of $10,000 within the first year of ownership for landscaping, and requires home construction within the first 3 years of ownership. In addition, home architectural designs which include a floor space of no less than 2,500 square feet must be met.

Kohala Ranch has similar home design guidelines and requires owners to invest over $200,000 for home construction.

Kona Hills Estates requires home sizes to be no less than 2,000 square feet and architectural designs require owners' association approval.

**Most of the selected subdivisions primarily offer distant ocean views**

All four of the selected agricultural lot subdivisions maintain a mauka orientation, elevated above the coastline. The majority (75%) of the lots, offer primary views of the distant ocean and mountains, as shown in Exhibit 3-F. A portion of the lots located at Kohala Ranch Phase I offer primary ocean views due to their lower elevations and close proximity to the shoreline. An estimated 53% of the lots at Plantation Estates offer golf course views or frontage.

It is important to note that the views described in Exhibit 3-F represent primary view orientations. Some of these lots may have multiple ocean, mountain and golf views, however, only the primary view is indicated.

**In 1992, the average price per acre at Hawaii island subdivisions was $148,000**

Exhibit 3-G presents the average sales price per project of lots sold in all of 1991 and during the first seven months of 1992. In 1992, the average price per acre ranged from $61,000 at Kohala Ranch to $878,000 an acre at Plantation Estates. This resulted in an average price per acre/per project of about $310,000. In 1991, per acre prices ranged from $74,000 at Kohala Ranch, to $862,000 an acre at Plantation Estates, resulting in an average of $359,000 per acre/per project.

An inverse correlation between price per acre and average lot size is evident, with the smaller parcels at Kona Hills commanding significantly higher per acre pricing. Another factor contributing to the higher pricing of the Kona Hills lots is the subdivision's close proximity to Kailua-Kona.

Although the higher price per acre at Plantation Estates is in part due to Maui's higher real estate prices, a large premium is also associated with the project due to its golf frontage, good views and its prime location within the upscale resort community of Kapalua.

**Average annual vacant lot sales absorption for selected projects ranges from 8 to 61 lots**

Exhibit 3-H shows annual vacant lot sales and resales for the selected projects from 1982 to 1992. The exhibit indicates a broad range of annual sales activity, ranging from 8 sales per year at Puu Lani Ranch to 61 sales per year at Kohala Ranch. The overall weighted average annual sales absorption per project was thus 26 units.

Higher sales activity between 1987 and 1990 can be associated with the overall strength of the Hawaii real estate market during this period. Conversely, the lagging national economy and the slowdown in the Japanese economy has had an affect on sales activity for the past 2 years. As shown, average lot sales on the island of Hawaii in 1991 decreased by about 79% to 44 lot sales, as compared to 214 lot sales in 1990.



EXHIBIT 3-E

# The surveyed acreage lot projects feature underground utilities but few amenities

AMENITIES AND FACILITIES AT SELECTED COMPARABLE AGRICULTURAL LOT PROJECTS

| Project | Gated community | Secured gate | Under-ground utilities | Equestrian | Golf course | Tennis courts | Pool | Club-house | Health/ fitness club | Jogging/ hiking trails | Picnic area |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kohala Ranch | Yes | Yes | Yes | Yes | (1) | (2) | No | (2) | No | No | No |
| Kona Hills Estates | Yes | Electronic | Yes | No | No | No | No | No | No | No | No |
| Puu Lani Ranch | Yes | (2) | Yes | Yes | (3) | (1) | No | (1) | No | (2) | (2) |
| Plantation Estates | Yes | Yes | Yes | No | Yes | (4) | (4) | Yes | No | No | No |
| **Proposed Hokukano agricultural lots** | **Partially** | **Partially** | **Yes** | **No** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |

(1) Under construction.
(2) Planned.
(3) Planned on neighboring site by a different developer.
(4) Feature is not located at the lot development site but owners have privileged use of these features at other areas in the resort.
Sources: Site visits; interviews with developers, realtors and project managers; various published materials.

EXHIBIT 3-G

# The average 1992 price per acre ranged from $148,000 at the Hawaii island projects to $878,000 at a golf-front development in Kapalua

LOT PRICES AT SELECTED AGRICULTURAL LOT SUBDIVISIONS: 1991 AND 1992

| | Land tenure | Primary view | 1991 Average lot size (acres) | 1991 Average sales price | 1991 Average price per acre | 1992 (1) Average lot size (acres) | 1992 (1) Average sales price | 1992 (1) Average price per acre |
|---|---|---|---|---|---|---|---|---|
| Island of Hawaii: | | | | | | | | |
| Kona Hills Estates | Fee | Ocean | 1.00 | $320,000 | $320,000 | 1.00 | $235,000 | $235,000 |
| Puu Lani Ranch (2) | Fee | Ocean/Mountain | 1.30 | 233,000 | $179,000 | 1.70 | 112,000 | $66,000 |
| Kohala Ranch (2) | Fee | Ocean/Mountain | 4.90 | 361,000 | $74,000 | 5.10 | 312,000 | $61,000 |
| Hawaii average/total | | | 2.40 | $305,000 | $191,000 | 3.05 | $273,500 | $148,000 |
| Percent change: | | | | | | 27% | -10% | -23% |
| Island of Maui: | | | | | | | | |
| Plantation Estates | Fee | Ocean/Golf | 2.32 | $2,000,000 | $862,000 | 2.12 | $1,861,000 | $878,000 |
| Overall average per project total | | | 2.38 | $729,000 | $359,000 | 2.48 | $630,000 | $310,000 |

(1) All numbers reflect sales through August except where indicated.
(2) 1992 numbers represents sales from January 1992 through September 1992.
N/S= No sales.
Source: Compiled by KPMG Peat Marwick, based on information obtained from MLS Hawaii Inc., 1992.

EXHIBIT 3-F

# Most agricultural lot projects offer ocean or distant ocean/mountain views

VIEW ORIENTATION OF AGRICULTURAL LOTS IN SELECTED SUBDIVISIONS

| | Percentage distributions (1) | | | | |
|---|---|---|---|---|---|
| | Mountain | Golf course | Ocean | Distant ocean / mountain | Total |
| **Hawaii:** | | | | | |
| Kona Hills Estates - Phase I | 0% | 0% | 0% | 100% | 100% |
| Kohala Ranch - Summit and Heathers | 0% | 0% | 0% | 100% | 100% |
| Kohala Ranch - Meadows | 0% | 0% | 0% | 100% | 100% |
| Kohala Ranch - Meadows II | 0% | 0% | 0% | 100% | 100% |
| Puu Lani Ranch - Phase I | 70% | 0% | 0% | 30% | 100% |
| **Maui:** | | | | | |
| Plantation Estates | 0% | 53% | 27% | 20% | 100% |
| Average | 12% | 9% | 5% | 75% | 100% |

(1) Some lots have multiple views of the ocean, golf course and interior/mountain, however, the primary view orientation is indicated.
Source: Interviews with project managers, various published materials and site visits.

EXHIBIT 3-H

# Average sales absorption at selected projects ranged from 8 to 61 lots per year

NEW & RESALES OF VACANT LOTS AT SELECTED AGRICULTURAL SUBDIVISIONS: JANUARY 1982 TO JULY 1992

| | Total lots | Number of sales | Annual lot new sales/resales | | | | | | | | | | | Weighted average annual sales/ project |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 (1) | |
| Kona Hills Estates | 72 | 94 | 11 | 0 | 0 | 10 | 7 | 17 | 17 | 8 | 19 | 3 | 2 | 9 |
| Puu Lani Ranch | 110 | 43 | - | - | - | - | - | 0 | 0 | 3 | 34 | 5 | 1 | 8 |
| Kohala Ranch | 477 | 399 | - | - | - | - | 20 | 116 | 77 | 8 | 133 | 34 | 11 | 61 |
| Plantation Estates | 76 | 33 | - | - | - | - | - | - | - | - | 28 | 2 | 3 | 13 |
| Average | 184 | 142 | 11 | 0 | 0 | 10 | 14 | 44 | 31 | 6 | 62 | 14 | 5 | 26 |
| Total | 735 | 569 | 11 | 0 | 0 | 10 | 27 | 133 | 94 | 19 | 214 | 44 | 17 | 90 |

(1) Based on sales recorded through August.
Source: Compiled by KPMG Peat Marwick, based on information obtained from MLS Hawaii, Inc.

- Kona Hills Estates averaged 9 vacant lot sales per year. This project, which was first marketed in 1981, saw the majority of its sales activity from 1987 to 1990 when sales ranged from 8 to 19 lots per year.
- In 1990, Puu Lani Ranch is shown to have sold 34 lots, however, this may be the recording date of many presales that occurred during the 1987 through 1990 period.
- Kohala Ranch has been the most active agricultural lot subdivision since its initial marketing in 1986. Kohala Ranch sold an average of 61 lots per year since 1986, with strong sales activity occurring between 1987 and 1990.
- Plantation Estates has had an average sales rate of 13 units per year. The majority of lots were sold within the first year with substantially fewer sales in the following 2 years. The second phase was released in late 1992, and thus a large number of sales are expected to follow as more of a selection becomes available.

The comparatively higher absorption rates at Kohala Ranch are partly the result of aggressive marketing and pricing strategies. Scheduled price increases provide land appreciation for buyers by marketing a limited number of lots per year at prices which were always greater than the previous year. To date, Kohala Ranch has deliberately withheld marketing 27 five-acre lots until the overall real estate market in Hawaii improves.

**About 40% of the buyers of agricultural lots are from the U.S. mainland**

The buyer origins at selected agricultural lot subdivisions from 1990 to 1992 are presented in Exhibit 3-I. The projects had very similar buyer markets, with the exception of Puu Lani Ranch which had a relatively large percentage (60%) of Hawaii resident buyers. The similarity in buyer mix is largely due to the shared theme of these projects as upscale, second home or retirement communities.

The overall average indicates an even distribution of 40% Hawaii and 40% mainland purchasers, with the remaining 20% foreign investors. A further breakdown of these groupings indicates that the West Coast market is the largest, representing 35% of the market. Non-Oahu, Hawaii residents are another significant market accounting for 30% of all purchases. The Japanese maintained a smaller market share representing approximately 15% of all purchases.

The large number of West Coast, Hawaii and Maui island buyers is attributed to the fact that these individuals are more accustomed to larger lots than Japanese or other foreign purchasers. Thus, these purchasers often prefer the more spacious feeling of agricultural lot subdivisions.

**Buyers of estate lots are usually professionals, entrepreneurs or business executives**

Discussions with Realtors have indicated buyers are usually professionals, entrepreneurs or business executives between 35 and 55 years of age. These buyers usually purchase lots to build retirement homes, second homes or vacation retreats. Other buyers include real estate developers and investors. Purchasers of primary homes are typically found in the subdivisions offering smaller lots of about one to two acres.

EXHIBIT 3-I

# About 40% of the buyers for selected agricultural subdivisions are from the U.S. mainland

ORIGINS OF BUYERS AT SELECTED AGRICULTURAL SUBDIVISIONS: JANUARY 1990 TO JULY 1992

| | Hawaii residents | | U.S. mainland | | Foreign | | |
|---|---|---|---|---|---|---|---|
| | Oahu | Other Hawaii | West coast (1) | Other | Japan | Other | Total |
| Kona Hills Estates | 13% | 25% | 50% | 0% | 12% | 0% | 100% |
| Kohala Ranch | 15% | 15% | 30% | 20% | 15% | 5% | 100% |
| Puu Lani Ranch | 10% | 50% | 25% | 5% | 10% | 0% | 100% |
| Plantation Estates | 7% | 37% | 27% | 0% | 17% | 12% | 100% |
| | 10% | 30% | 35% | 5% | 15% | 5% | 100% |

(1) Includes California, Oregon, Washington and Alaska.

Source: Compiled by KPMG Peat Marwick, based on information obtained from MLS Hawaii, Inc.

**A significant number of buyers plan to build second/vacation homes or retirement homes**

Since 1986, about 400 sales transactions have occurred at Kohala Ranch, however, there are currently only 44 homes built or under construction. Similarly, since its opening in 1989, only 5 homes have been constructed at Puu Lani Ranch, although over 43 sales have occurred.

One reason for this lack of construction is the large number of purchases made for future retirement, investment, or for second/vacation homes. These buyers are usually in no rush to build, and thus may own the lots for several years before development occurs. This is especially true for lots purchased for future retirement.

**Over 6,300 agricultural lots are planned for West Hawaii**

As presented in Exhibit 3-J, over 6,300 agricultural lots are currently planned for West Hawaii. These lots are planned to be located within upscale communities, containing golf courses and/or other such amenities. Thus, despite the lack of comparable existing projects, Hokukano may find substantial competition in the future. Six potentially competitive future projects include the following:

- **Makalei** is a residential golf community located in North Kona, at which lot sales are expected to begin sometime in 1993. The project spans over 1,700 acres and contains 179, one-acre lots. An 18-hole championship golf course was completed and opened in November 1992. Planned amenities include a golf lodge, and possible tennis and equestrian facilities.
- **Kohala Ranch Phase IV** will be the final phase of the existing Kohala Ranch. The project will add an additional 1,288 acres to the Kohala Ranch project and will include 962 lots ranging from one-half to one-acre. Plans for the project include a 27-hole golf course, which is currently under construction. Additional planned amenities include a clubhouse, tennis courts, equestrian/polo and commercial facilities. Market entry for the lots is unknown at this time.
- **Puako** is a proposed master-planned golf community located in South Kohala, directly across from Mauna Lani Resort. The project contains 3,000 acres and plans to offer 863 one-acre lots and nearly 1,800 other residential units. Entitlements for the site also include 6 championship golf courses, a golf academy and commercial space.
- **Ouli** is a planned residential community located in South Kohala, approximately five minutes from Waimea. The project is situated on 458 acres and has a master plan for 45 five-acre estate lots. Plans for the site also include an 18-hole golf course and clubhouse.
- **Kealakekua Ranch Lands** is proposed as a golf and agricultural lot community with a *mauka* orientation at elevations ranging from 2,400 to 6,200 feet. The entire project encompasses some 11,000 acres including forest, pasture, and proposed agricultural areas. The projects 18-hole golf course is proposed to be developed by Arnold Palmer. The development is in a planning phase and still requires major land use entitlements.
- **Kaupulehu Mauka** is a residential and recreational community that plans to offer 1,000 lots ranging from 1 to 5 acres, and 2, 18-hole golf courses. The development requires County zoning changes to proceed.

EXHIBIT 3-J

## Approximately 6,300 agricultural lots are proposed for development on the island of Hawaii

CHARACTERISTICS OF PROPOSED HAWAII ISLAND AGRICULTURAL LOT SUBDIVISIONS

| Project | Location | Developer | Projected release | Total project size (acres) | Total number of lots | Estimated range in lot sales(1) | Amenities |
|---|---|---|---|---|---|---|---|
| **Future phases of existing projects:** | | | | | | | |
| Kohala Ranch Phase IV | North Kohala | Kohala Joint Venture | INA | 1,288 | 962 | 0.5 - 1.0 | Presented in Exhibit 3-C. |
| Mallu Ridge - Phases 2 & 3 | North Kohala | Chalon International | 1993 | 330 | 115 | 1.0 - 6.0 | Presented in Exhibit 3-C. |
| Puu Lani - Phase 2 | North Kona | Puu Lani Ranch Corp. | INA | | 61 | 1.0 - 5.0 | Presented in Exhibit 3-C. |
| Waikoloa - Phase 2 | South Kohala | Kremkow Properties | INA | 3,000 (2) | 72 | 10.0 - 80.0 | Presented in Exhibit 3-C. |
| Subtotal new phases | | | | | 1,210 | | |
| **Existing:** | | | | | | | |
| Makalei | North Kona | Makalei HI. Corp. | INA | 1,700 | 179 | 1.0 | Golf course, clubhouse, and equestrian facilities. |
| **Proposed:** | | | | | | | |
| Waikoloa Highlands | South Kohala | Waikoloa Land Co. | INA | 9,600 | 1,100 | 5.0 - 20.0 | Two 18-hole golf courses, resort, equestrian lodge, park and civic center. |
| Waikoloa Highlands Golf Estates | South Kohala | Waikoloa Land Co. | INA | INA | 420 | 1.0 | Two 18-hole golf courses, resort, equestrian lodge, park and civic center. |
| Puako(3) | South Kohala | Nansay | INA | 3,000 | 863 | 1.0 | Six, 18-hole golf courses, a golf academy, and commercial space. |
| Cuil | South Kohala | Nansay | 1996 | 458 | 45 | 5.0 | 18-hole golf course and clubhouse. |
| Kealakekua Ranch Lands | South Kona | Kealakekua Development Corp. | 1997 | 11,000 | 500 | 1.0 - 40.0 | 18-hole golf course, clubhouse, equestrian facilities, agricultural park, nature reserve and trails. |
| Mahukona | North Kohala | Chalon International | 1995 | 429 | 125 | 1.0 | 18-hole golf course, historic park, lodge and clubhouse. |
| Kukuipahu | North Kohala | Chalon International | INA | 1,237 | 130 | 1.0 | 18-hole golf course, horse ranch and agricultural park. |
| Parker 2020 | North Kohala | Parker Ranch | 1998 | 229 | 117 | 1.0 - 2.0 | Within master planned new town development. |
| Keauhou | South Kona | Kamehameha Inv. Group | INA | 500-600 | 300 | 1.0 - 4.0 | Golf course |
| Hokukano Ranch | South Kona | Tom Pace | INA | 8,500 | INA | 1.0 - 20.0 | Golf course |
| Kaupulehu Mauka | North Kona | PIA Sports Properties | INA | 8,000 | 1,000 | 1.0 - 5.0 | Two 18-hole golf courses |
| The Villages at Hokukano(4) | South Kona | Oceanside 1250 | 1996 | 1,540 | 367 | 1.0+ | Jack Nicklaus golf course, golf lodge, historic sites, club memberships for lot owners, water features and fishing boat. |
| Subtotal new project | | | | | 5,146 | | |
| Total/range | | | | | 6,356 | 0.5 - 80.0 | |

INA = Information not available

(1) Range in lot sizes was reported based on interviews with project representatives and published materials

(2) Includes acreage in Phase I

(3) Another 1,795 residential units are also planned for the project.

(4) Another 1,078 lots planned, ranging from .2 to .5 acres for a total of 1,445 lots.

Source: Compiled by KPMG Peat Marwick based on discussions with project representatives.

MARKET ASSESSMENT FOR
THE VILLAGES AT HOKUKANO

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## 4 - RESIDENTIAL LOT OVERVIEW

Substantial amenities are associated with the ownership of resort single-family lots, including privileged access to golf courses, tennis centers, swimming pools and other various recreational facilities. As currently planned, the Hokukano project will offer a charter golf membership program with initial lot sales, use of a members' lodge, clubhouse, a deep sea fishing boat and tennis facilities. Thus, the facilities and the overall image of Hokukano is expected to attract buyers who have in the past favored amenitized projects such as have previously been offered only at resorts.

With the development of Hokukano, Hawaii's former resort lot buyers could enjoy a more private setting without sacrificing the amenities they value such as access to championship golf courses and other facilities. Because Hokukano is expected to draw potential resort lot buyers to its project, the market trends of resort single-family lots are reviewed as an indicator of the market performance of lots that offer recreational facilities.

### Seven resort lot projects have been reviewed

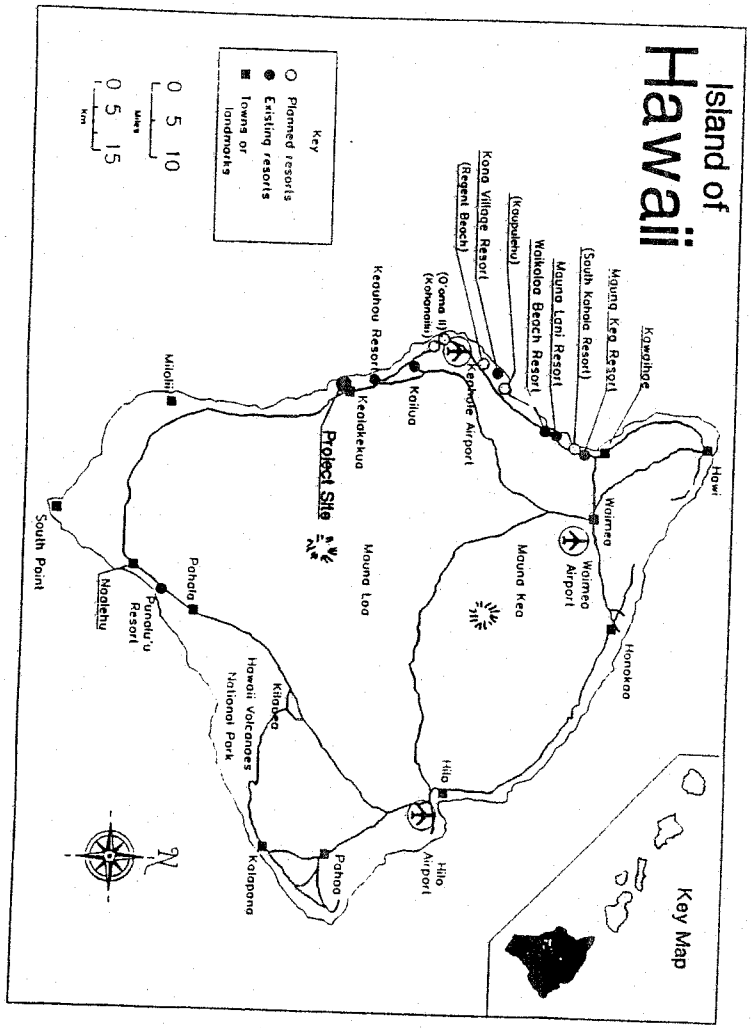
Seven resort lot projects located on Hawaii and Maui were reviewed to analyze the 1,073 residential lots planned at Hokukano. The four projects located on the island of Hawaii are shown in Exhibit 4-A. The other three projects are located in the resort communities of Kapalua and Wailea on Maui. A description of the projects is presented in Exhibit 4-B:

- Located along the Kohala Coast, Mauna Lani is a 4,000-acre resort community. The development currently contains 2 luxury hotels, 7 residential communities, 2 golf courses, tennis facilities and a Beach Club. Mauna Lani's most comparable single-family residential communities include The Point Estates and Champion Ridge.
  - **The Point Estates**, first marketed in 1989, contains 19 single-family home sites that overlook the ocean and golf course. Lot sizes range from 14,800 to 25,600 square feet.
  - **Champion Ridge**, first marketed in 1990, contains 33 lots centered around an 18-hole putting course and overlooking the golf course. Lot sizes range from 20,200 to 32,000 square feet.
- **The Fairways North** contains 32 single-family leasehold lots that range in size from 22,000 to 62,000 square feet with an average lot size of 27,000 square feet. The project is located in the Mauna Kea Resort on the Kohala Coast, which currently consists of a luxury hotel, an 18-hole golf course, and 5 existing residential projects. The Fairways North was first marketed in 1982.
- **Keauhou Estates**, located within Keauhou Resort in South Kona, is just north of the proposed Hokukano development. The Keauhou community contains 3 hotels, 9 residential projects, the Keauhou Shopping Village, two 18-hole golf courses and other recreational amenities. Keauhou Estates contains 135 single-family lots. The first phase was first marketed in 1985, with the second phase following in 1987. The lot sizes range from 10,000 to 28,500 square feet, with many lots fronting the golf course.



EXHIBIT 4-A

# Existing and proposed resort lot projects on the Island of Hawaii



# Eight residential lot developments were surveyed for comparison to Hokukano

CHARACTERISTICS OF SELECTED EXISTING RESORT LOT PROJECTS

| Resort/ project | Location | Developer | First marketed | Total number of lots | Lot size (sq. ft.) Range | Lot size (sq. ft.) Average | Units per acre |
|---|---|---|---|---|---|---|---|
| **Hawaii:** | | | | | | | |
| Mauna Lani- | | | | | | | |
| The Point Estates | South Kohala | Mauna Lani Resort, Inc. | 1989 | 19 | 14,800-25,600 | 18,900 | 2.3 |
| Champion Ridge | | | 1990 | 33 | 20,200-32,000 | 24,300 | 1.8 |
| Mauna Kea- | | | | | | | |
| Fairways at Mauna Kea North | South Kohala | Mauna Kea Properties | 1982 | 32 | 22,000-62,000 | 27,000 | 1.6 |
| Keauhou- | | | | | | | |
| Keauhou Estates - Phase I | South Kona | Kamehameha Investment | 1985 | 85 | 10,500-26,200 | 18,500 | 2.4 |
| Keauhou Estates - Phase II | | | 1987 | 50 | 15,000-28,500 | 15,800 | 2.8 |
| **Maui:** | | | | | | | |
| Kapalua- | | | | | | | |
| Pineapple Hill | West Maui | Maui Land and Pine | 1987 | 99 | 8,800 - 26,800 | 11,600 | 3.8 |
| Kapalua Place | | | 1988 | 8 | 21,800 - 72,300 | 43,800 | 1.0 |
| Wailea- | | | | | | | |
| Wailea Kialoa | South Maui | Alexander & Baldwin | 1986 | 102 | 8,000 - 13,000 | 10,500 | 4.1 |
| Average, all projects | | | | | | 21,300 | 2.0 |
| **Proposed Hokukano residential lots** | | | **1996** | **1,073** | **10,400 - 21,800** | **14,500** | **3.0** |

Source: Compiled by KPMG Peat Marwick based on discussions with project representatives.

- Located in West Maui, the Kapalua Resort encompasses 750 acres. The development contains 6 residential projects, 2 luxury hotels, 3, 18-hole golf courses, a tennis club, and various dining and shopping facilities. Two comparable projects within Kapalua are Pineapple Hill and Kapalua Place.
  - **Pineapple Hill** is a 99 lot development that was first marketed in 1987. Lot sizes range from 8,800 square feet to 26,800 square feet.
  - **Kapalua Place** is an 8 lot development, with lot sizes ranging from 21,800 to 72,300 square feet located near on the ocean front. The project was first marketed in 1988.
- **Wailea Kialoa** is located within the resort community of Wailea in South Maui. Wailea Resorts spans over 1,500 acres and contains 5 hotels, 3 golf courses and several condominium and residential lot developments. First marketed in 1986, Wailea Kialoa is a 102 single-family lot project, with lot sizes ranging from 8,000 to 13,000 square feet.

The selected resort lot projects are relatively new, all having opened within the past ten years. Lot sizes range from 8,000 square feet at Wailea Kialoa, up to 72,300 square feet at Kapalua Place, resulting in an overall average lot size of 21,300 square feet. While not as spacious as agricultural lot projects, the resort lot projects still offer a relatively low density of about 2 units per acre.

**Resort lot projects all offer preferred golf course access**

Exhibit 4-C lists the various amenities offered at the selected resort projects. The projects all offer preferential golf course access, but private golf memberships are not packaged with the lot as the associated courses all offer daily fee access. The projects do offer the use of tennis courts associated with the resort. Several developments, with the exception of Mauna Lani and Wailea, also offer a secured gate entrance. Additional recreation areas are also available at the two Mauna Lani projects and at Pineapple Hill.

**Location and views are key elements for resort lots**

Resort lot pricing is highly contingent on the views each lot offers, with the majority of lots offering either ocean or golf course views, as shown in Exhibit 4-D. Excluding Kapalua Place, the selected resort communities do not offer ocean front lots, generally allocating these prime sites to the hotels.

It is important to note that the views described in Exhibit 4-D represent primary view orientations. Some of these lots may have multiple ocean, mountain and golf views; however, only the primary view is indicated.

EXHIBIT 4-C

# All existing resort lot projects offer privileged access to golf courses but not exclusive club memberships

PROJECT AMENITIES AT SELECTED RESORT SUBDIVISIONS ON THE ISLANDS OF HAWAII AND MAUI

| Resort/project | Secured gate entrance | Tennis courts | Recreation area | Preferential golf course access |
|---|---|---|---|---|
| **Hawaii:** | | | | |
| Mauna Lani- | | | | |
| The Point Estates | No | (1) | (1) | Yes |
| Champion Ridge | No | (1) | (1) | Yes |
| Mauna Kea- | | | | |
| Fairways at Mauna Kea North | Yes | (1) | No | Yes |
| **Maui:** | | | | |
| Kapalua- | | | | |
| Pineapple Hill | Yes | (1) | Yes | Yes |
| Kapalua Place | Yes | (1) | No | Yes |
| Plantation Estates | Yes | (1) | No | Yes |
| Wailea- | | | | |
| Wailea Kialoa | No | (1) | No | Yes |
| **Proposed Hokukano residential lots** | Partially | Yes | Yes | Yes |

(1) Feature is not located at the lot development site but owners have privileges to use this feature at other sites at the resort.

Source: Interviews with resort managers, site visits and various published material.

EXHIBIT 4-D

# Most resort lot projects offer ocean and golf views

VIEW ORIENTATION OF SELECTED RESORT LOT PROJECTS ON THE ISLANDS OF HAWAII AND MAUI

| | Actual primary views/ frontage(1) | | | |
|---|---|---|---|---|
| Resort/ project | Ocean | Golf & Ocean | Golf | Total |
| **Hawaii:** | | | | |
| Mauna Lani- | | | | |
| The Point Estates | 0% | 100% | 0% | 100% |
| Champion Ridge | 0% | 76% | 24% | 100% |
| Mauna Kea- | | | | |
| Fairways at Mauna Kea North | 0% | 53% | 47% | 100% |
| **Maui:** | | | | |
| Kapalua- | | | | |
| Pineapple Hill | 0% | 24% | 76% | 100% |
| Kapalua Place | 100% | 0% | 0% | 100% |
| Plantation Estates | 0% | 53% | 47% | 100% |
| Wailea- | | | | |
| Wailea Kialoa | 0% | 0% | 100% | 100% |
| Average | 14% | 44% | 42% | 100% |
| **Proposed Hokukano Residential Lots** | 1% | 82% | 16% | 100% |

(1) Some lots have multiple views of the ocean, golf course and interior/mountain, however, the primary view orientation is indicated.

Source: Interviews with project managers, various published materials and site visits.

EXHIBIT 4-F

# Average annual sales absorption at selected projects ranged from 4 to 31 lots per year

NEW & RESALES OF LOTS AT SELECTED RESORTS: 1982 TO 1992

| Resort/ project | Total lots | Total number of sales | Annual lot new sales and resales 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 (1) | Weighted average annual sales |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Hawaii:** | | | | | | | | | | | | | | |
| Mauna Lani- | | | | | | | | | | | | | | |
| The Point Estates | 19 | 28 | - | - | - | - | - | - | - | 20 | 6 | 2 | 0 | 8 |
| Champion Ridge | 33 | 29 | - | - | - | - | - | - | - | - | 25 | 3 | 1 | 11 |
| Mauna Kea- | | | | | | | | | | | | | | |
| Fairways at Mauna Kea North | 32 | 47 | 1 | 4 | 2 | 1 | 0 | 11 | 13 | 9 | 3 | 3 | 0 | 4 |
| Keauhou- | | | | | | | | | | | | | | |
| Keauhou Estates | 135 | 223 | - | - | - | 10 | 20 | 30 | 63 | 56 | 41 | 1 | 2 | 29 |
| Hawaii average | 55 | 82 | 1 | 4 | 2 | 6 | 10 | 21 | 38 | 28 | 19 | 2 | 1 | 13 |
| **Maui:** | | | | | | | | | | | | | | |
| Kapalua- | | | | | | | | | | | | | | |
| Pineapple Hill | 99 | 173 | - | - | - | - | - | 57 | 61 | 21 | 27 | 5 | 2 | 31 |
| Kapalua Place | 8 | 8 | - | - | - | - | - | - | - | 7 | 1 | - | - | 4 |
| Wailea- | | | | | | | | | | | | | | |
| Wailea Kialoa | 102 | 171 | - | - | - | - | - | 43 | 64 | 28 | 28 | 3 | 5 | 31 |
| Maui average | 70 | 117 | - | - | - | - | - | - | - | - | 19 | 4 | 4 | 22 |
| Total Hawaii & Maui | 428 | 679 | 1 | 4 | 2 | 11 | 20 | 141 | 201 | 141 | 131 | 17 | 10 | 118 |
| Average Hawaii & Maui | 61 | 97 | 1 | 4 | 2 | 6 | 10 | 35 | 50 | 24 | 21 | 3 | 2 | 15 |

(1) Represents sales from January 1992 to July 1992.
Source: Compiled by KPMG Peat Marwick, based on information obtained from MLS Hawaii Inc.

EXHIBIT 4-G

# About 40% of recent resort lot buyers are from the West Coast

ORIGINS OF BUYERS AT SELECTED RESORT LOT PROJECTS IN HAWAII: JANUARY 1990 - JULY 1992

| Resort/ project | Hawaii residents: Oahu | Hawaii residents: Other Hawaii | U.S. mainland: West coast(1) | U.S. mainland: Other | Foreign: Japan | Foreign: Other | Total |
|---|---|---|---|---|---|---|---|
| **Hawaii:** | | | | | | | |
| Mauna Lani- | | | | | | | |
| The Point Estates | 17% | 8% | 67% | 8% | 0% | 0% | 100% |
| Champion Ridge | 14% | 43% | 24% | 5% | 14% | 0% | 100% |
| Mauna Kea- | | | | | | | |
| Fairways at Mauna Kea North | 0% | 0% | 100% | 0% | 0% | 0% | 100% |
| Keauhou- | | | | | | | |
| Keauhou Estates | 7% | 10% | 41% | 15% | 17% | 10% | 100% |
| **Maui:** | | | | | | | |
| Kapalua- | | | | | | | |
| Pineapple Hill | 9% | 4% | 26% | 9% | 48% | 4% | 100% |
| Kapalua Place | 0% | 0% | 0% | 50% | 50% | 0% | 100% |
| Wailea- | | | | | | | |
| Wailea Kialoa | 28% | 24% | 8% | 4% | 32% | 4% | 100% |
| Average, rounded | 10% | 10% | 40% | 10% | 25% | 5% | 100% |

(1) Includes California, Oregon, Wahington and Alaska.
Source: Compiled by KPMG Peat Marwick, based on information obtained from MLS Hawaii, Inc.

# Average sale price per square foot at selected resort lot projects in 1992 was $43, or about $8 less than in 1991

LOT PRICES AT SELECTED RESORT LOT PROJECTS: 1991 - 1992

| Resort/ project | Land tenure | 1991 Average lot size (sq. ft.) | 1991 Average sales price | 1991 Average price per sq. ft. | 1992(1) Average lot size (sq. ft.) | 1992(1) Average sales price | 1992(1) Average price per sq. ft. |
|---|---|---|---|---|---|---|---|
| **Hawaii:** | | | | | | | |
| Mauna Lani- | | | | | | | |
| The Point Estates | Fee | 18,124 | $1,300,000 | $72 | N/S | N/S | N/S |
| Champion Ridge | Fee | 22,113 | 933,000 | 42 | 22,438 | 1,075,000 | 48 |
| Mauna Kea- | | | | | | | |
| Fairways at Mauna Kea North | Lease | 26,559 | 878,000 | 33 | N/S | N/S | N/S |
| Keauhou- | | | | | | | |
| Keauhou Estates | Fee | 15,682 | 375,000 | 33 | 15,464 | 322,500 | 21 |
| Hawaii average | | 20,620 | 872,000 | 45 | 18,951 | $698,750 | $34 |
| **Maui:** | | | | | | | |
| Kapalua- | | | | | | | |
| Pineapple Hill | Fee | 11,931 | $650,000 | $54 | 11,900 | $541,000 | $45 |
| Kapalua Place | Fee | N/S | N/S | N/S | N/S | N/S | N/S |
| Wailea- | | | | | | | |
| Wailea Kialoa | Fee | 8,070 | 555,000 | 69 | 10,918 | 638,000 | 58 |
| Maui average | | 10,001 | $603,000 | $62 | 11,409 | $590,000 | $52 |
| Overall average | | 17,080 | $781,833 | $51 | 15,180 | $644,125 | $43 |
| Overall percentage change from 1991 | | | | | -11% | -18% | -15% |

(1) Represents sales from January 1992 to July 1992
N/S = No sales
Sources: Compiled by KPMG Peat Marwick, based on information obtained from MLS Hawaii Inc

**In 1992, the average price per square foot at the surveyed resort lots has been $43**

Exhibit 4-E presents the average sales price of lots sold in all of 1991 and during the first seven months of 1992. In 1992, the average price per square foot ranged from $21 at Keauhou Estates to $58 a square foot at Wailea Kialoa. This resulted in an average of $34 a square foot for Hawaii island projects, and an overall average of $43 per square foot for both Hawaii and Maui projects.

Similarly, in 1991 per square foot prices ranged from $33 at Mauna Kea and Keauhou, to $72 a square foot at The Point Estates. The average price per square foot for Hawaii resorts was $45, but $51 per square foot for the projects overall, including the Maui projects. With the exception of Mauna Lani's Champion Ridge, the price per square foot at the majority of projects declined from 1991 to 1992.

**Average annual sales absorption for selected projects ranges from 4 to 31 lots**

Exhibit 4-F shows annual lot sales and resales for the selected projects from 1982 to July 1992. The exhibit indicates a broad range of annual sales activity, ranging from a weighted average of 4 sales per year at Fairways North and Kapalua Place, to an average of 31 sales per year at Wailea and Pineapple Hill. The average absorption for the Big Island was 13 units per year, while Maui was significantly higher at 22 units per year. The overall weighted average annual sales absorption per project was thus 15 units.

A direct correlation between project size and annual absorption is evident among the selected developments. The larger projects such as Pineapple Hill, Wailea and Keauhou have all experienced healthy absorption rates of 29 to 31 units overall, and from 30 to 60 units per year from 1987 through 1990. Similarly, the limited number of lots offered at smaller projects such as Kapalua Place, Fairways North and The Point Estates has resulted in low absorption numbers.

Higher sales activity was noted from 1987 through 1990, related to the overall strength of the Hawaii real estate market, as discussed above. Conversely, the lagging national economy and the slowdown in the Japanese economy has had an immediate effect on sales activity.

**About 50% of the buyers of resort lots are U. S. mainland residents**

The buyer origins at selected resort lot projects from 1990 to 1992 are presented in Exhibit 4-G. The overall average indicates a distribution of 20% Hawaii purchasers, 50% U. S. mainland purchasers and 30% foreign investors. A further breakdown of these segments shows that the largest buyer market is from the West Coast representing 40% of the market. The Japanese also have a significant market share representing approximately 25% of all purchases.

The large number of West Coast and Japanese buyers is attributed to this market's attraction to the features associated with resorts. These buyers are looking for not only the amenities offered at such developments, but also the golf access and prestige of the resort itself. Current owners of resort condominiums are a large market for resort lots. These individuals, once satisfied with the resort community, frequently make the further commitment of a lot purchase for long-term ownership.

It is interesting to note that the Japanese represent a substantial number of lot purchases at the Maui resorts, while the U.S. mainland residents maintain the majority of purchases at Hawaii Island resorts. The Japanese preference for Maui resort lots can be directly associated with the established popularity of Maui as a primary destination for many Japanese who frequently return to Hawaii. Conversely, while the number of Japanese visiting the island of Hawaii has continued to grow, this segment can also be expected to increase its activity in the Big Island real estate market.

**Resort lot buyers tend to be young entrepreneurs ranging from 35 to 55 years of age**

Characteristics of the residential lot buyers are presented in Exhibit 4-H. These characteristics are anticipated to be similar to the characteristics of those purchasing lots at Hokukano. The most common objective for purchasing such a residential lot is for future use as a vacation or retirement home. Investors also represent a significant portion of the buyer market, however, this market has dropped off considerably in the past two years as a result of the recession and more stabilized pricing levels.

Typical occupations for resort lot buyers include entrepreneurs or professionals ranging from 35 to 55 years of age. As vacant lots do not generate rental income, these individuals have financial stability and, for the most part, do not depend on rental income to alleviate the financial burdens associated with real estate ownership.

**A significant number of resort lot buyers plan to build future second/vacation homes or retirement homes**

As shown in Exhibit 4-I, home development on resort lots averages 10% per year. Similar to the agricultural lot projects surveyed, this unusually slow building period is due to the significant number of purchases for future retirement use.

**Six projects containing resort lots are planned for Hawaii, but only four currently have entitlements**

Currently, six resorts with lot subdivisions are planned for the island of Hawaii, as seen in Exhibit 4-J. These projects all have plans for hotel, residential and recreational facilities, including golf courses. All are located along the coastline in the North Kona or South Kohala areas.

- **Kohanaiki** is a planned resort community located south of Keahole Airport in North Kona. The proposed project spans over 450 acres and plans were to include single-family lot sites. Planned amenities include a Lee Trevino golf course, hotels, condominiums, athletic club, child care facilities and artisan's village. Due to a court decision, however, major land use entitlements for the development have been declared null and void. This decision is currently under appeal.



EXHIBIT 4-H

# Resort lots are typically purchased for future use

## TYPICAL BUYER CHARACTERISTICS FOR RESORT LOTS IN HAWAII

| | |
|---|---|
| Primary purchase motivations: | ■ Purchased to be improved at a later date with single-family homes to be used as vacation or future retirement homes. Some lots are purchased by investors or home contractors. |
| Intended uses: | ■ Future use. Typically homes are not completed for three to five years from the date of purchase.<br>■ About 20 to 25% of completed homes are rented when not in use. Primarily used as vacation homes. |
| Common considerations: | ■ Privacy, exclusivity and single-family living.<br>■ Preferred access to a "playable" golf course.<br>■ Opportunity to build custom homes.<br>■ Avoidance of higher maintenance fees associated with condominium ownership.<br>■ Not ready to undertake the financial outlay required for a constructed home or condominium. |
| Buyer profile: | |
| Occupation | ■ Dependent on the quality of the subdivision. Buyers range from professionals to real estate developers, entrepreneurs and senior executives. |
| Age | ■ 35 to 55 years of age. |
| Other | ■ Some lots purchased by Japanese corporations for executive retreats. |

Source: Interviews with developers and realtors.

EXHIBIT 4-I

# Homes are constructed on about 10% of selected resort lots each year

PERCENTAGE OF RESORT HOMES COMPLETED PER YEAR

| Resort/project | Building requirement(1) | Number of lots | Year of completion | Years since completion | Home completions Number | Home completions % of total | % homes completed per year |
|---|---|---|---|---|---|---|---|
| Hawaii: | | | | | | | |
| Mauna Lani | | | | | | | |
| The Point Estates | 5 years | 19 | 1989 | 2 | 3 | 16% | 8% |
| Champion Ridge | 3 years | 33 | 1990 | 1 | 0 | 0% | 0% |
| Mauna Kea | | | | | | | |
| Fairways at Mauana Kea North | 5 years | 32 | 1982 | 9 | 11 | 34% | 4% |
| Maui: | | | | | | | |
| Kapalua | | | | | | | |
| Pineapple Hill | None | 99 | 1987 | 4 | 34 | 34% | 9% |
| Kapalua Place | None | 8 | 1988 | 3 | 0 | 0% | 0% |
| Wailea | | | | | | | |
| Wailea Kialoa | None | 102 | 1986 | 5 | 82 | 80% | 16% |
| Average | | | | | | 31% | 10% |

(1) Number of years from sale date in which owners are required to build their home.
Source: Discussions with representatives of the respective resorts or sales brochures.

EXHIBIT 4-J

# Six golf or resort communities with residential lot projects are currently entitled and planned for the island of Hawaii

CHARACTERISTICS OF PROPOSED HAWAII ISLAND RESIDENTIAL/GOLF LOT PROJECTS

| Resort/ project | Location | Developer | Projected first marketing | Total project size(acres) | Total number of lots | Average lot size (sq. ft.) | Amenities | Major entitlements in place |
|---|---|---|---|---|---|---|---|---|
| Kohanaiki | North Kona | Nansay Hawaii | N/A | 450 | N/A | N/A | Lee Trevino golf course, hotels, condos, athletic club, child care center, artisans village. | No -jeopardized by 1993 court decision |
| Regent Kona Coast Resort | North Kona | Huehue Ranch Associates | N/A | 667 | N/A | N/A | Commercial facilities, medium scale resort and golf course and historical/cultural sites. | Yes |
| Mauna Kea Resort: The High Bluffs | South Kohala | Mauna Kea Properties | N/A | 8 | 9 | 30,000+ | Golf course and resort with tennis, swimming, etc. | Yes |
| O'oma Resort | North Kona | Kahala Capital Corporation | N/A | 300 | 70-100 | 10,000 | Golf course, hotel, acquarium and water recreation center, condominium units, retail center. | No |
| Waikoloa Heights | South Kohala | Waikoloa Heights Investment Partners | 1995 | 866 | 650 | 15,000 | Gary Player 18-hole golf course. | Yes |
| Kaupulehu Makai | North Kona | Potomac Investment Associates | 1996+ | 695 | 465 | 14,000 | Hotel, 2, 18-hole golf courses, condominium units. | Yes |
| **Proposed Hokukano residential lots(1)** | **North/ South Kona** | **1250 Oceanside Partners** | **1996** | **1,540** | **1,073** | **14,500** | **Jack Nicklaus golf course, golf lodge, historic sites, club memberships for lot owners, water features, deep sea fishing boat.** | |

(1) Includes acreage and lots for residentially zoned land only.
Source: Compiled by KPMG Peat Marwick based on discussions with project representatives.

- **O'oma Resort** is another golf resort community located near the planned Kohanaiki site. This project is preliminarily planned to contain 70 to 100, 10,000 square foot lots. Plans for the project also include hotel, golf course, marine exploratorium, conference center, water recreation park, condominiums and retail shops. O'oma II has not yet received its State Land Use nor its County zoning permits.

- **The Regent Kona Coast Resort** is a proposed resort community located in North Kona with major entitlements in place. The project contains nearly 670 acres and plans to offer single-family home lots, commercial facilities and a medium scale resort and golf course.

- **The High Bluffs at Mauna Kea** is a future project for the existing Mauna Kea Resort with major entitlements in place. The development will contain nine 30,000 square foot lots.

- **Waikoloa Heights** is a proposed golf resort community located in South Kohala. Current plans include a Gary Player designed golf course and 650 lots ranging from 12,000 - 20,000 square feet. Phase I is proposed to be introduced in 1995.

- **Kaupulehu Makai**, a proposed resort community located in North Kona. Plans for the project include a hotel, two 18-hole golf courses and 1,164 residential units. The units will consist of about 700 condominium units and 465 residential lots ranging from 10,000 feet to 1/2-acre. All entitlements, including zoning, SMA, building and grading permits, are in place.



MARKET ASSESSMENT FOR
THE VILLAGES AT HOKUKANO

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## 5 - GOLF MARKET OVERVIEW

### HAWAII ISLAND GOLF MARKET REVIEW

The anticipated golf market for Hokukano consists of a mixture of island residents, U. S. mainlanders, Japan and other foreign residents. The majority of these individuals will be familiar with and attracted to Lyle Anderson projects due to the organization's reputation in golf course community development. To address all facets of this diverse target market, three different golf markets were reviewed, including the Hawaii island golf market, the traditional Hawaii Country Club market, and the Japanese golf market.

#### Hawaii has 16 existing golf courses

The island of Hawaii currently has 16 existing golf courses, as shown in Exhibit 5-A. Although several of these courses offer memberships, all are open for public play. Currently, there are 10 courses located in West Hawaii, 7 of which are within or associated with resort communities that contain either condominiums or single-family units. These 10 courses are all of championship quality, and are known as some of the best courses in the world. Some of the most comparable resort courses are described below:

- **Mauna Kea Beach Golf Course** - Located along the Kohala Coast at the Mauna Kea Beach Resort, this course is a 7,144-yard, 18-hole championship course designed by Robert Trent Jones, Sr. Club memberships are offered to property owners within the Mauna Kea community.

- **Mauna Lani North and South Courses** - Located in the Mauna Lani Resort community on the Kohala Coast. The North Course measures 6,968 yards while the South Course is slightly larger, measuring 7,015 yards. Both courses are 18-hole championship resort courses designed by Homer Flint and Ray Cain, Robin Nelson and Rodney Wright. Club memberships are offered to properties owners within the resort community.

- **Waikoloa Beach King's and Beach Courses** - Located in Waikoloa Beach Resort along the Kohala Coast. The Beach course is a 6,566-yard, par-70 course designed by Robert Trent Jones, Jr. The King's course is a 72-par course measuring 7,074 yards and designed by Tom Weiskopf and Jay Moorish. Free memberships are offered to property owners, allowing them discounted green fees and preferential tee times.

- **Waikoloa Village Course** - Located several miles *mauka* or Waikoloa Beach Resort, the related Waikoloa Village Community contains one golf course. The Village course is a 6,687-yard, 18-hole course, designed by Robert Trent Jones, Jr. Memberships are offered to both property owners and nonproperty owners.

- **Punalu'u SeaMountain Course** - Located in Punalu'u Resort, approximately 70 miles south of Kona. The course is an 18-hole course measuring 6,492 yards. The course was designed in 1974, by Arthur J. Snyder and is within a resort community that offers memberships to both property owners and nonproperty owners.

- **Kona Country Club Ocean and Mountain Courses** - Located in South Kona and part of the resort community of Keauhou. The Club contains the Ocean Front and Mountain courses, which combined total 36 holes. The Ocean course and 9 holes of the Mountain course were designed by William Bell, Sr. The Mountain back, which opened in 1991, was designed by Robin Nelson and Rodney Wright.



EXHIBIT 5-A

## The Island of Hawaii has sixteen existing golf courses, totaling 279 holes

HAWAII ISLAND GOLF COURSES: 1992

| Resort courses: | Location | Number of holes | Course designer |
|---|---|---|---|
| Mauna Kea Beach Resort: | | | |
| Mauna Kea Beach Golf Course | Kohala Coast | 18 | Robert Trent Jones, Sr. |
| Hapuna Golf Course | Kohala Coast | 18 | Arnold Palmer |
| Mauna Lani Resort: | | | |
| North Course | Kohala Coast | 18 | Flint & Cain |
| South Course | Kohala Coast | 18 | Nelson & Wright |
| Waikoloa Beach Resort: | | | |
| Waikoloa Beach Golf Course | Kohala Coast | 18 | Robert Trent Jones, Jr. |
| Waikoloa Kings Golf Course | Kohala Coast | 18 | Weiskopf & Moorish |
| Waikoloa Village: | | | |
| Waikoloa Village Golf Course | Kohala Coast | 18 | Robert Trent Jones, Jr. |
| Punalu'u Resort: | | | |
| SeaMountain Golf Course | Pahala | 18 | Arthur J. Snyder |
| Naniloa Hotel: | | | |
| Naniloa Country Club | Hilo | 18 | Alexander Kahaboa |
| Kona Surf (Keauhou Resort) (1): | | | |
| Kona Country Club Ocean Course | Kona | 18 | William Bell, Sr. |
| Kona Country Club Mountain Course | Kona | 18 | Nelson & Wright<br>William Bell, Sr. |
| Semi-private courses: | | | |
| Volcano Golf & Country Club | Volcano Natl. Park | 18 | Blackshear & Snyder |
| Hamakua Country Club | Honoka'a | 9 | Frank Anderson |
| Makalei Hawaii Country Club | North Kona | 18 | Dick Nugent |
| Daily fee courses: | | | |
| Discovery Harbor Golf Course | Ka'u | 18 | Robert Trent Jones, Sr. |
| Municipal courses: | | | |
| Hilo Municipal Golf Course | Hilo | 18 | Willard Wilkinson |
| Total holes | | 279 | |

(1) First 27 holes at Keauhou were designed by William Bell, Sr.; Nelson and Wright later developed an additional 9 holes and incorporated them with 9 of the existing holes.

Source: Compiled by KPMG Peat Marwick based on published information.

# Competitive resort golf courses typically offer the same type of facilities

GOLF AMENITIES AT EXISTING HAWAII ISLAND RESORT GOLF COURSES: 1992

| | Amenities | | Other amenities | | | | |
|---|---|---|---|---|---|---|---|
| | Driving range | Practice green | Pro shop | Food & Beverage | Clubhouse | Lockers/ showers | Tennis/ swimming |
| Mauna Kea Beach Course | Yes | Yes | Yes | Yes | Yes | Yes | (1) |
| Mauna Lani Course | Yes | Yes | Yes | Yes | Yes | No | (1) |
| Waikoloa Beach : | | | | | | | |
| Beach and King's Courses | Yes | Yes | Yes | Yes | Yes | No | (1) |
| Waikoloa Village | Yes | Yes | Yes | Yes | Yes | No | (1) |
| Punalu'u SeaMountain Course | Yes | Yes | Yes | Yes | Yes | No | (1) |
| Kona Country Club | Yes | Yes | Yes | Yes | Yes | No | (1) |
| Hapuna Golf Course (2) | Yes | Yes | Yes | Yes | Yes | No | (1) |
| Makalei Hawaii Country Club | Yes(3) | Yes | Yes | Yes | Yes(4) | Yes(5) | No |

(1) Tennis and swimming are offered at the resort, but are not directly associated with the golf course.

(2) Temporary facilities are currently available due to the construciton of the Hapuna Hotel. Permanent facilities will be constructed with the completion of the adjacent hotel.

(3) Driving range will be offered, however, it is not in operation at this time.

(4) Temporary clubhouse exists, permanent clubhouse planned for eventual development.

(5) Lockers only.

Source: Compiled by KPMG Peat Marwick based on discussions with golf representatives or representatives of the respective courses.

**Competitive courses typically offer the same type of facilities**

The eight resort courses surveyed offer for the most part, similar amenities as seen in Exhibit 5-B. All eight courses have driving ranges and practice greens. Other amenities include pro shops, food and beverage facilities and clubhouses. Only the Mauna Kea and Makalei courses offers lockers and none of the courses offered tennis or swimming facilities, other than those directly associated with the resort.

**Hotel guest green and cart fees average $61 at resort courses**

Green and cart fees at Hawaii's resort golf courses range from $33 at the Punalu'u Resort to $80 at the Waikoloa Beach courses and at the Mauna Kea course, as shown in Exhibit 5-C. The average fee for resort guests is $61. Nonguest visitors pay substantially higher rates, ranging from $50 at Punalu'u to $130 at Mauna Kea, Makalei and Mauna Lani. The average green and cart fee for nonguest visitors is $97.

Club members, where offered, were only required to pay cart fees which range from $14 to $18 per round. Waikoloa Beach was the only exception, where members consist solely of property owners who pay no dues or initiation fees, and were therefore charged a green and cart fee of $50 per round.

To encourage additional play during slow periods, Hawaii residents are often offered discounted green and cart fees. Fees for state of Hawaii residents average $59, while fees for Hawaii island residents average $40.

**Hawaii island resort golf courses averaged 46,000 rounds in 1991**

The estimated number of rounds played at Big Island resort courses in 1991 averaged about 46,000 rounds, or 126 rounds per day, as shown in Exhibit 5-D. Estimated annual rounds were determined by combining the average daily rounds played during regular and peak seasons. The peak season for Hawaii golf courses is traditionally during the winter months of November through March, when many U. S. mainland visitors flock to Hawaii to escape the cold weather. The length of the peak season varied from course to course, and was subsequently reflected when calculating the annual total. Average daily rounds played during this time were estimated at 180 rounds per day, while the average daily rounds played during the normal season, were estimated at 100 rounds per day. Thus, a significant increase (approximately 80%) in course play occurs during the peak periods.

**Eleven golf courses on the island of Hawaii offer memberships**

Currently, there are 11 Hawaii island golf courses offering memberships, as shown in Exhibit 5-E. Memberships at 8 of the facilities, had a total of nearly 3,800 members, or an average of 473 members per club.

Visitors comprise the largest golf segment, with nearly 2,900 memberships. These individuals were predominantly members of the Makalei Hawaii and the Naniloa Country Clubs.

Resort courses such as Mauna Kea and Mauna Lani offer memberships primarily to property owners, although some courses such as Mauna Kea and SeaMountain offer memberships to Hawaii island residents as well. Memberships at these facilities are generally nontransferable and limited to 100 to 200 members.

EXHIBIT 5-C

# Green and cart fees for Hawaii Island resort and golf community guests average $61

GREEN AND CART FEES AT COMPETITIVE HAWAII ISLAND GOLF COURSES BY CLASS OF PLAYER: 1992

| Resort courses: | Club member Green fee | Club member Cart fee | Hotel/ resort guest (1) | Non-guest visitor (1) | State of Hawaii resident (1) | Hawaii Island resident (1) |
|---|---|---|---|---|---|---|
| Mauna Kea Beach | - | $18 | $80 | $130 | N/A | $45 |
| Hapuna Golf Course | N/A | N/A | 60 | 90 | $40 | 40 |
| Makalei Hawaii Country Club | INA | INA | N/A | 130 | 130 | 40 |
| Mauna Lani North and South Courses | - | 15 | 65 | 130 | 70 | N/A |
| Waikoloa Beach and King's Courses | $50 (2) | 50 | 80 | 95 | 50 | 35 |
| Waikoloa Village | - | 15 | 50 | 68 | 38 | N/A |
| Punalu'u SeaMountain | - | 14 | 33 | 50 | 27 | N/A |
| Kona Country Club Courses | N/A | N/A | 60 | 80 | N/A | 38 |
| Average | $50 | $22 | $61 | $97 | $59 | $40 |

INA = Information not available.
N/A = Not applicable.
(1) Includes green and cart fees.
(2) Residents are allowed free membership, no initiation or dues are paid.
Source: Compiled by KPMG Peat Marwick based on discussions with representatives of the respective courses.

EXHIBIT 5-D

# Hawaii Island resort and golf community courses average over 46,000 rounds per year

ROUNDS OF GOLF AT SELECTED HAWAII ISLAND COURSES: 1991

| | Regular average daily | Peak average daily (1) | Total annual |
|---|---|---|---|
| Mauna Lani Resort: | | | |
| North Course | 80 | 160 | 40,800 |
| South Course | 120 | 240 | 61,200 |
| Mauna Kea Resort: | | | |
| Mauna Kea Beach Course | 160 | 190 | 63,000 |
| Hapuna Golf Course | INA | INA | INA |
| Waikoloa Beach Resort: | | | |
| Beach Course | INA (2) | INA | INA |
| King's Course | INA | INA | INA |
| Waikoloa Village Course | 120 | 230 | 59,700 |
| Kona Country Club courses: | | | |
| Beach Course | 90 | 145 | 40,000 |
| Mountain Course | 85 | 130 | 35,000 |
| Punalu'u SeaMountain Course (Nov-Mar) | 50 | 180 | 37,500 |
| Naniloa Country Club Course | 90 | INA | 32,850 |
| Average | 100 | 180 | 46,000 |

(1) Peak seasons range from one to six months.
(2) Would not release figures.
N/A = Information not available.
Souce: Based on discussions with golf pros or representatives of the respective courses.

EXHIBIT 5-E

# Hawaii Island private golf memberships totaled over 3,800 in 1992

HAWAII ISLAND GOLF COURSES OFFERING MEMBERSHIPS: 1992

| | Number of memberships | | | | |
|---|---|---|---|---|---|
| | On-site resident | Hawaii Island resident | Visitor | Social | Total |
| Mauna Kea Beach Golf Course | 80 | 20 | 0 | 87 | 187 |
| Hapuna Golf Course | INA | INA | INA | INA | INA |
| Mauna Lani North & South Courses | 27 | N/A | N/A | N/A | 27 |
| Waikoloa Beach & King's Courses | INA | INA | INA | INA | INA |
| Waikoloa Village Golf Course | INA | INA | INA | INA | N/A |
| Makalei Hawaii Country Club | N/A | 0 | 1,800 | N/A | 1800 |
| SeaMountain Golf Course | 90 | 10 | 0 | N/A | 100 |
| Naniloa Country Club | N/A | 150 | 700 | N/A | 850 |
| Volcano Golf &Country Club | N/A | 300 | N/A | N/A | 300 |
| Kona Country Club | N/A | 0 | 400 | N/A | 400 |
| Hamakua Country Club | 0 | 119 | 0 | 0 | 119 |
| Total | 197 | 599 | 2,900 | 87 | 3,783 |
| Percent distribution | 5% | 16% | 77% | 2% | 100% |
| Average | | | | | 473 |

INA = Information not available.

N/A = Not applicable.

(1) Members at Naniloa Country Club are allowed access to Volcano Country Club

Source: Compiled by KPMG Peat Marwick based on interviews with course representatives and owners.

**Nonmember visitors account for over 56% of the rounds played at membership courses**

Course play at five select semi-private courses was divided into member and nonmember play, as shown in Exhibit 5-F. Information on rounds played at the Waikoloa Beach courses was unavailable and therefore not included in this analysis.

The largest number of users were nonmember visitors, who played an average of 56% of the total rounds. Members only accounted for 35% of the rounds played, consisting of 9% resort residents or visitors members and 24% Hawaii island residents. Resort resident members accounted for 5% of the play at Mauna Lani and 35% of the rounds played at Waikoloa Village.

**Resorts offer memberships to Hawaii residents and property owners**

Resort courses such as Mauna Kea, Waikoloa Village and SeaMountain offer memberships to both Hawaii island residents and property owners at the resort, as shown in Exhibit 5-G. Resort courses such as Mauna Lani and Waikoloa Beach, however, only offer memberships to property owners.

Most resort courses on Hawaii have annual fees ranging from $500 to $2,700. Membership fees are waived at Waikoloa Beach, but members must pay green fees of $50 per round. Mauna Kea and Mauna Lani have the highest annual fees, reported at $2,700 and $2,200, respectively. Social memberships are also available at Mauna Kea for $760 per year.

**The island of Hawaii has 26 proposed golf courses besides Hokukano**

Other than Hokukano, there are 26 new golf courses under construction, permitted or proposed for Hawaii, located on 19 sites as shown in Exhibit 5-H. Four courses are under construction, while 16 have been approved by the county of Hawaii. Twenty of these courses will be located within West Hawaii, with the majority intended for resort or private club use.

Several of the courses will be located in planned residential or resort communities similar to Hokukano. These courses include projects such as Makalei, Kohala Ranch, Ouli, Puako, Kohanaiki, Waikoloa Highlands, Waikoloa Beach and the Queens Golf Course.

- **The Queens golf course** is another course planned for Mauna Kea. Permits have been received, and the championship course is currently under design by Robert Trent Jones, Sr.
- **Kohala Ranch** is planning to add a golf course to its existing residential community in South Kohala. Grading for the course has begun, but financing has not yet been secured.
- **Ouli** is a championship course planned for a residential community located near Waimea. Plans for the course include a clubhouse and the facility is expected to be operational by late 1992.
- **Puako** is a master planned resort community planned to contain six internationally designed championship golf courses. The project is located in South Kohala, across from Mauna Lani resort. Permits have been received for all six courses.

EXHIBIT 5-F

# Nonmember visitors account for 56% of the rounds played at select membership courses

PLAYER MIX AT SELECTED HAWAII ISLAND MEMBERSHIP GOLF COURSES, ROUNDED: 1991 - 1992

| | Members | | | Nonmembers | | | |
|---|---|---|---|---|---|---|---|
| | Resort residents & visitors | Island residents | Subtotal | Visitors | Island residents | Subtotal | Total |
| **Resort courses:** | | | | | | | |
| Mauna Lani | | | | | | | |
| North & South courses | 5,100 | N/A | 5,100 | 91,800 | 5,100 | 96,900 | 102,000 |
| Waikoloa Village | 20,900 | 17,900 | 38,800 | 17,900 | 3,000 | 20,900 | 59,700 |
| Naniloa Country Club | INA | 28,000 | 28,000 | 1,600 | 3,300 | 4,900 | 32,900 |
| Resort average (1) | 6,500 | 11,500 | 18,000 | 27,800 | 2,900 | 30,700 | 48,700 |
| Percentage of all rounds (2) | 13% | 24% | 37% | 57% | 6% | 63% | 100% |
| **Semi-private courses:** | | | | | | | |
| Volcano Country Club | 2,000 | 6,100 | 8,100 | 24,300 | 8,100 | 32,400 | 40,500 |
| Hamakua Country Club | 0 | 5,100 | 5,100 | 700 | 1,500 | 2,200 | 7,300 |
| Hawaii Island average (1) | 3,800 | 9,500 | 14,200 | 22,700 | 3,500 | 26,200 | 40,400 |
| Percentage of all rounds (2) | 9% | 24% | 35% | 56% | 9% | 65% | 100% |

INA = Information not available.

N/A = Not applicable.

(1) Adjusted to reflect two courses at Mauna Lani.

(2) Percentages may not total 100% due to rounding of numbers.

Source: Based on discussions with golf professionals or representatives of the respective courses regarding their typical golfer profile.

EXHIBIT 5-G

# The majority of resorts only offer memberships to Hawaii residents and property owners

MEMBERSHIP FEES AT SELECTED SEMI-PRIVATE GOLF COURSES ON THE ISLAND OF HAWAII: 1992

| Semi-Private Golf Clubs | Type of membership | Initiation fees | Annual fees | Member Green & Cart fees | Comments |
|---|---|---|---|---|---|
| Resort courses: | | | | | |
| Mauna Kea Golf Course | Full member | 0 | $2,700 | $18 | Members are primarily property owners. |
| | Social member | 0 | 760 | 80 | Membership limited to 105 members. |
| Hapuna Golf Course | N/A | N/A | N/A | N/A | N/A |
| Mauna Lani Golf Courses | Family member | 0 | 2,200 | 15 | Property owners only. |
| | Single member | 0 | 1,200 | 15 | Family memberships allow one round per day. |
| Waikoloa Village Golf Course | Nonproperty owner | 0 | 1,600 | 15 | Predominately property owners. |
| | Property owner | 0 | 950 | | Memberships are for both husband and wife. |
| Waikoloa Beach Golf Courses | Property owner | 0 | 0 | 50 | Property owners only. |
| SeaMountain Golf Course | | 0 | 950 | N/A | Members are primarily property owners. |
| Naniloa Country Club | Resident member | $500 | 480 | N/A | Offers individual and corporate nonresident |
| | Nonresident member | 60,000 | 369 | 0 | memberships. No wait list. |
| | Nonresident member | 122,000 | 738 | 0 | |
| Kona Country Club courses | Nonresident member | 77,000 | 77 | 13 | Offers individual and corporate nonresident |
| | Nonresident member | 154,000 | 154 | 13 | memberships. |
| Semi-private/daily fee courses: | | | | | |
| Makalei Hawaii Country Club | Nonresident | 39,000 | 0 | 45 | To date, memberships marketed in Japan only. |
| Volcano Golf & Country Club | Hawaii resident | 0 | 1,200 | N/A | Nonresident members from Naniloa are also allowed playing rights at Volcano. |
| Hamakua Country Club | Full member | 0 | 200 | N/A | Members are island residents. |

N/A = Not available.

Source: Compiled by KPMG Peat Marwick based on discussions with representatives of the respective courses

EXHIBIT 5-H

# 26 golf courses with over 520 holes hold development permits on the island of Hawaii

PROPOSED GOLF COURSES ON THE ISLAND OF HAWAII: 1992

| | Location | Type | Number of holes | Owner/Dev. | Status |
|---|---|---|---|---|---|
| Waimea Country Club | Hamakua | Private | 18 | Otaka, Inc. | Expected to be operational in 1993 |
| Ponohawai Country Club | Hilo | Private | 18 | ISF Dev. | Expected to be operational in 1994 |
| Oueloa Golf Course | Pohoiki | Semi-priv. | 18 | INA | Under construction |
| Waikoloa Highlands | Waikoloa | Resort | 18 | Waikoloa Development | Under construction |
| Kohala Ranch | Kohala | Private | 18 | Kohala Ranch | Grading has begun, financing being sought |
| Kaupulehu Makai | North Kona | Resort | 18<br>18 | PIA Sports Properties | Grading has begun |
| Ouli Golf Course | South Kohala | Private | 18 | Nansay Hawaii | Approved, construction expected to begin by late 1992 |
| Kealakehe Golf Course | North Kona | Municipal | 18 | Hawaii County | Approved, design stage |
| Puako Golf Courses | South Kohala | Various | 108 | Nansay Hawaii | Permits received for six courses, looking for financing |
| Waikoloa Heights | Waikoloa | Resort | 18 | Waikoloa Heights Investment Partners | Permits received; construction bids obtained |

INA = Information not available.
Source: Compiled by KPMG Peat Marwick.

EXHIBIT 5-H (CONTINUED)

# 26 golf courses with over 520 holes hold development permits on the island of Hawaii

PROPOSED GOLF COURSES ON THE ISLAND OF HAWAII: 1992, CONTINUED

| | Location | Type | Number of holes | Owner/Dev. | Status |
|---|---|---|---|---|---|
| Royal Vista Golf Course | North Kona | Resort | 18 | Royal Vista | Permits received |
| Kohanaiki Golf Course | North Kona | Resort | 18 | Nansay | Entitlements jeopardized by recent court decision vacating SMA approvals |
| Opihihale Golf Course | South Kona | Private | 27 | Akahi Jt. Vent. | Special permit has been pulled. Use permit currently being contested |
| Kona Int. Country Club | Kona | INA | 18 | TSA | |
| Regent Beach Golf Course | North Kona | Resort | 18 | Huehue Ranch | Permits received |
| Waikoloa Beach | Waikoloa | Resort | 18<br>18 | Transcontinental & Elleair | Permits received |
| Queens Golf Course | Mauna Kea | Resort | 18 | Mauna Kea | Permits received |
| Kaumana Golf Course | Hilo | N/A | 18 | INA | Permits received |
| Hamakua Sugar Courses | Waipio | N/A | 63 | Hamakua Sugar | Permits received for three golf courses |
| Subtotal | | | 522 | | |

INA = Information not available
Source: Compiled by KPMG Peat Marwick.

- **Kohanaiki** is a planned resort community located in North Kona. An 18-hole championship course designed by Lee Trevino is planned for this site. Permits were lost, however, in a 1993 court decision which is currently under appeal.

- **Waikoloa Beach** and **Waikoloa Highlands** are two additional courses planned at the existing Waikoloa resort community, located in South Kohala. Construction has begun at the Highlands course while permits have been received for the Beach course.

While the majority of courses have received permits or approvals, development at many of these courses has been delayed due to the current financing environment. Since 1990, each golf course developer has been expected to provide three million dollars or more in community benefits to the county of Hawaii. Many developers have had a difficult time meeting these requirements thus the completion of the many courses that have received permits, is still questionable.

## STATE OF HAWAII PRIVATE GOLF CLUB REVIEW

### The state of Hawaii currently has five exclusively private golf clubs in operation

The state of Hawaii currently has five exclusively private golf clubs in operation, as shown in Exhibit 5-I. Four of these clubs are located on the island of Oahu, while one is on Maui. A brief description of these clubs is as follows:

- **Honolulu Country Club** - Oahu's newest country club, located in Moanalua. The club has both local and international (mostly Japanese) members.

- **Waialae Country Club** - located in Waialae/Kahala next to the Kahala Hilton Hotel, and considered by many to be the most prestigious local club.

- **Oahu Country Club** - located in Nuuanu and considered to be a prestigious social and golf club.

- **Mid-Pacific Country Club** - located in Kailua, catering to upscale windward Oahu residents.

- **Maui Country Club** - The neighbor islands' only private country club, catering to local residents, located in Paia. The club is open to the public on Mondays.

### Private golf clubs typically have 18 holes and substantial golf amenities

Hawaii's private golf clubs predominantly have 18 holes, with the exception of the Maui Country Club that has nine, as shown in Exhibit 5-J. The clubs generally include a driving range and practice and chipping greens. A pro shop is another standard facility, which range in size from about 300 to 4,000 square feet. Each club also provides restroom facilities on the golf course, that serve a dual purpose as rain shelters. Free-standing rain shelters are currently unavailable on the existing private courses.



EXHIBIT 5-I

# The state of Hawaii currently has five private golf clubs in operation

EXISTING PRIVATE GOLF CLUBS IN THE STATE OF HAWAII: 1992

| | Location | Number of holes | Golf course designer |
|---|---|---|---|
| Island of Oahu: | | | |
| Honolulu Country Club | Moanalua | 18 | Francis Duane |
| Waialae Country Club | Kahala | 18 | Seth Raynor |
| Oahu Country Club | Nuuanu | 18 | Alex Bell |
| Mid-Pacific Country Club | Kailua | 18 | Seth Raynor |
| Island of Maui: | | | |
| Maui Country Club (1) | Paia | 9 | Alex Bell |

(1) Public play allowed on Mondays.

Source: KPMG Peat Marwick.

All the clubs offer at least one restaurant, with the Oahu clubs offering two or three restaurants. Snack bars and cocktail lounges are also standard features at each facility. Private clubs in Hawaii also provide swimming and spa facilities, and three of the five clubs have tennis courts. Men's and women's shower and locker facilities are also standard features at all the facilities. In each case, the men's locker rooms are larger and comprise a greater number of lockers and showers than the women's locker room.

**Private golf clubs averaged 164 rounds per day in 1990**

Private golf clubs in Hawaii averaged 164 rounds per day in 1990. Honolulu Country Club achieved the highest, at 214 rounds, and the 9-hole Maui club averaged the lowest at 90, 18-hole equivalent rounds, as shown in Exhibit 5-K. At the clubs that restrict golf play to members and guests only, about 90% of all play can be attributed to actual members, with the remaining 10% played by guests of members.

Maui Country Club averages approximately 25 rounds of golf on Mondays when the club is open to the general public. The play on Mondays is predominantly nonmember, as members generally do not patronize the club on this day.

**Hawaii private golf club memberships totaled 3,300 in 1990**

The five private golf clubs in Hawaii had a total of 3,300 regular and limited golf memberships in 1990, as shown in Exhibit 5-L. The majority of these members were Hawaii residents, predominantly from the island of Oahu. On average, private clubs in Hawaii had about 550 regular golf members residing in the state, with additional members under a variety of other classifications. The different membership classifications entitle members to a stratification of privileges. The following provides a summary of the privileges of the membership classes:

- **Regular golf memberships** provide unlimited and unrestricted use of club facilities subject only to availability. Regular members also have the privilege of bringing guests to use the clubhouse and golf facilities. Private clubs typically limit the number of guests during both restricted and nonrestricted times, to one and three, respectively.
- **Limited golf memberships** allow full use of most facilities but restrict golf play to weekdays or other lower demand times. Limited golf members also have the privilege of bringing guests on a limited basis.
- **Social memberships** provide for use of clubhouse facilities without golf privileges. Golf can be played on a limited basis in some private clubs when the social member plays as a guest of a regular member.
- **Nonresident memberships** typically allow the same privileges as resident members according to their membership classification.

Hawaii's private golf clubs have established complex schedules of golf playing times and privileges for members. Typically, the private clubs have restricted the morning tee-times on Wednesdays and Saturdays to regular, male golf members. During these times, guests are generally not allowed to use the golf course. Tuesday mornings have usually been set aside for female, regular golf members, with the same restrictions applying to guest play. Mondays are generally unrestricted and regular golf members can bring up to three guests, except in the case of Maui Country Club, at which golf play on Mondays is open to the general public.



EXHIBIT 5-J

# Private golf clubs in Hawaii offer substantial amenities

## AMENITIES OF PRIVATE GOLF CLUBS IN THE STATE OF HAWAII: 1992

| | Oahu | | | | Maui |
|---|---|---|---|---|---|
| | Honolulu Country Club | Waialae Country Club | Oahu Country Club | Mid-Pacific Country Club | Maui Country Club |
| Golf amenities: | | | | | |
| Number of holes | 18 | 18 | 18 | 18 | 9 |
| Driving range | Yes (1) | Yes | Yes | Yes (1) | No |
| Practice green | Yes | Yes | Yes | Yes | Yes |
| Chipping green | Yes | Yes | Yes | Yes | Yes |
| Additional amenities: | | | | | |
| Restaurant (#) | 2 (2) | 2 (2) | 2 (2) | 3 (2) | 1 (3) |
| Snack bar | Yes | Yes | Yes | Yes | Yes (3) |
| Cocktail lounge | Yes | Yes | Yes | Yes | Yes (2) |
| Locker rooms | Yes | Yes | Yes | Yes | Yes |
| Pro shop | Yes | Yes | Yes | Yes | Yes |
| Swimming pool | Yes | Yes | Yes | Yes | Yes |
| Tennis | Yes | Yes | No | No | Yes |
| Spa | Yes | Yes | Yes | Yes | No |

(1) Lighted.
(2) Includes men's grill.
(3) Restaurant and snack bar operated from within the same facility.
Source: Compiled by KPMG Peat Marwick based on discussions with golf representatives or representatives of the respective courses.

EXHIBIT 5-K

# Private golf clubs averaged 164 rounds of golf per day in 1990

ROUNDS OF GOLF PLAYED AT PRIVATE GOLF COURSES IN THE STATE OF HAWAII: 1990

| | Number of rounds | |
|---|---|---|
| | Total annual | Average daily |
| Island of Oahu: | | |
| Honolulu Country Club | 78,000 | 214 |
| Waialae Country Club | 73,000 | 200 |
| Oahu Country Club | 50,000 | 137 |
| Mid-Pacific Country Club | 66,000 | 181 |
| Average | 66,750 | 183 |
| Island of Maui: | | |
| Maui Country Club (1)(2) | 33,000 | 90 |
| Total | 300,000 | 822 |
| Average | 60,000 | 164 |

(1) 9-hole course; figures adjusted downwards to 18-hole equivalent golf course.
(2) Includes golf rounds played on Monday when the course is open to the public.
Source: Based on discussions with golf professionals or representatives of the respective courses.

EXHIBIT 5-L

# Hawaii private club golf memberships totaled 3,300 in 1990

PRIVATE GOLF MEMBERSHIPS IN THE STATE OF HAWAII: 1990

| | Oahu | | | | Maui |
|---|---|---|---|---|---|
| Membership class | Honolulu Country Club | Waialae Country Club | Oahu Country Club | Mid-Pacific Country Club | Maui Country Club |
| Resident: | | | | | |
| Regular | 523 | 500 (1) | 608 | 600 | 620 |
| Limited | 25 | 100 | 80 | 52 | 0 |
| Social | 32 | 100 | 160 | 194 | 0 |
| Tennis | 60 | 50 | 0 | 0 | 0 |
| Other | 0 | 500 (2) | 3 | 0 | 0 |
| Subtotal | 640 | 1,250 | 851 | 846 | 620 |
| Nonresident: | | | | | |
| Regular | 25 | 40 | 61 | 0 | 30 |
| Limited | 0 | 40 | 0 | 0 | 0 |
| Social | 0 | 25 | 15 | 0 | 0 |
| Tennis | 4 | 10 | 0 | 0 | 0 |
| Other | 677 (3) | 0 | 0 | 13 | 0 |
| Subtotal | 706 | 115 | 76 | 13 | 30 |
| Total | 1,346 | 1,365 | 927 | 859 | 650 |

| | |
|---|---|
| Total Oahu regular golf | 2,357 |
| Total Maui regular golf | 650 |
| Total regular golf | 3,007 |
| Total Oahu limited golf (4) | 297 |
| Total Maui limited golf (4) | 0 |
| Total limited golf | 297 |
| Total golf members (4) | 3,304 |

(1) Includes 100 senior members.
(2) Includes associates who are sons, wives, or widows of members.
(3) Information on Japanese members by category is not available.
(4) Excludes social, tennis and other memberships.
Source: Based on discussions with golf professionals or representatives of the respective courses.

# Regular golf club initiation fees for Hawaii residents range from $5,000 to $43,000

MEMBERSHIP FEES AT PRIVATE GOLF CLUBS IN THE STATE OF HAWAII: 1992

| | | Initial membership fees | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Type of membership | Initiation fees | Membership certificate | Total | Monthly dues | Monthly mini-charge | Cart fees | Guest green fees |
| Honolulu Country Club | Regular golf | $34,000 | N/A | $34,000 | $200 | $0 | $9.00 | $40 - $45 |
| | Weekday golf | 24,000 | N/A | 24,000 | 125 | 0 | 9.00 | 50 - 65 |
| | Social | 4,000 | N/A | 4,000 | 40 | 0 | 9.00 | 80 - 90 |
| Waialae Country Club | Regular golf | $34,000 | $6,000 | $40,000 | $200 | $75 | $9.00 | $40 - $80 |
| | Limited golf | 29,000 | 6,000 | 35,000 | 165 | 75 | 9.00 | 40 - 80 |
| | Nonres. regular golf | 50,000 | N/A | 50,000 | 275 | 0 | 9.00 | 40 - 80 |
| | Nonres. limited golf | 37,500 | N/A | 37,500 | 231 | 0 | 9.00 | 40 - 80 |
| | Social | 8,000 | N/A | 8,000 | 90 | 75 | N/A | N/A |
| | Nonres. social | 9,000 | N/A | 9,000 | 161 | 0 | N/A | N/A |
| Oahu Country Club | Regular | $36,000 | $7,000 | $43,000 | $205 | $200 | $8.50 | $26.50 |
| | Limited regular | N/A | 7,000 | N/A | 175 | 200 | 8.50 | 26.50 |
| | Limited golf | N/A | 7,000 | N/A | 155 | 200 | 8.50 | 26.50 |
| | Social | 1,500 | 2,000 | 3,500 | 120 | 200 | N/A | N/A |
| Mid-Pacific Country Club | Proprietary | $25,000 | $8,000 | $33,000 | $200 | $63 | $7.00 | $38 - $58 |
| | Social/awaiting proprietary | 17,000 | 8,000 | 25,000 | 200 | 63 | 7.00 | $38 - $58 |
| | Nonresident | 47,000 | 8,000 | 55,000 | 283 | 0 | 7.00 | 38 - 58 |
| | Social | 300 | N/A | 300 | 50 | 44 | N/A | N/A |
| Maui Country Club | One classification | $5,000 | N/A | $5,000 | $90 | $0 | $6 - $8 | $25.00 |

Source: Compiled by KPMG Peat Marwick based on discussions with representatives of the respective clubs.

**Initiation fees at private golf clubs for Hawaii residents range from $5,000 to $43,000 for regular golf memberships**

Initiation fees at Hawaii's private golf clubs for Hawaii residents range from a low of $5,000 at the Maui Country Club, to $43,000 at Oahu Country Club for regular golf memberships, as shown in Exhibit 5-M. Three of the clubs offer proprietary memberships in which a membership certificate fee is charged in addition to the initiation fee. The certificate provides the member with an equity participation in the club, and is fully refundable upon the termination of the membership. In some cases, the certificate is transferable upon death.

The limited golf and social memberships are offered at substantial discounts from the regular golf memberships. These lower privileged memberships allow the clubs to generate revenue during off-peak hours and through increased utilization of club facilities. This increased utilization is especially important in the food and beverage departments, which typically do not achieve positive operating cash flows. In an effort to stimulate food and beverage consumption and to achieve a net operating profit, the Oahu Country Club recently lowered the initiation fee for social members from $4,000 to $1,500.

Each of the private clubs charge members monthly dues, ranging from $40 for social members at Honolulu Country Club, to $205 for regular members at Oahu Country Club. The monthly dues generally include green fees for golf memberships and the use of club facilities. Club storage and locker fees are included in the monthly fees for some clubs, such as Oahu Country Club, and charged additionally at others, such as Waialae Country Club.

Three of the private golf clubs in Hawaii also charge members a monthly or quarterly mini-charge that can be applied to food and beverage purchases at the clubhouse. At Waialae, Oahu and Mid-Pacific, the mini-charge is billed on a quarterly basis, while at Oahu the charge is reconciled quarterly. At Oahu, the mini-charge is currently $200 with a 50% credit applied to food and beverage purchases. Thus, if a member spends $50 on food and beverage items, the mini-charge would be reduced by $25.

Hawaii's private clubs do not charge members green fees for golf play. They do, however, charge between $5 and $9 for cart rentals. For most private clubs, the use of powered carts is required. Members are also charged a green fee for any guests using the golf course at the club. Guest green fees range from $27 at Oahu Country Club, to $90 for social members at Honolulu who sponsor a guest during nonrestricted times. Maui also allows public play at a rate of $45 per round.

## THE JAPANESE GOLF MARKET REVIEW

**The majority of Japanese clubs are now open to public play**

During the late 1980s the Japanese golf membership sales in Hawaii were widespread and successful, with initiation fees often exceeding $70,000. However, as a result of the global recession and the severe decline in the Tokyo stock market over the last two years, new overseas golf membership sales in Hawaii are now practically nonexistent. As a consequence of Japan's overseas financial crisis, membership prices have declined as much as 40% to 50%. Resales of existing memberships are the only activity occurring in the Japan golf market, and even these memberships are having a difficult time selling despite the deep discounts in value.

As a result, all but one course designed for the Japanese market is now open for public play, as shown in Exhibit 5-N. These courses were not able to depend on the Japanese market as originally anticipated, and were subsequently opened for public play.

While many industry observers believe the Japanese market will eventually return, few expect it to resemble the boom years of the 1980s. Although the Japanese are expected to remain a primary segment for golf memberships, developers will have to address all major market segments in order to maximize membership sales and achieved rounds of play.

EXHIBIT 5-N

# The majority of Japanese Clubs are now open to public play

GOLF COURSES GEARED TOWARDS JAPANESE MEMBERSHIPS: 1992

| | Location | Number of holes | Year opened or due to open | Owner | Comments |
|---|---|---|---|---|---|
| Honolulu Country Club | Oahu | 18 | 1977 | Hawaiian Club Co (Yanase Group) | Not open to the public |
| Mililani Golf Club | Oahu | 18 | 1967 | Nakajima | Open to public play |
| Pukalani Golf Club | Maui | 18 | 1984 | Sport Shinko | Open to public play |
| Kiahuna Golf Club | Kauai | 18 | 1984 | Sports Shinko | Open to public play |
| Hawaii Prince | Oahu | 18 | 1992 | Ewa Beach Int. Golf Club | Open to public play |
| Minami Golf Club | Oahu | 18 | 1992 | Minami Group | Open to public play |
| Royal Hawaiian Country Club | Oahu | 36 | 1992/93 | Nesco Bending Co. | Open to public play |
| Waihee Golf Club | Maui | 18 | 1993 | Sokan, Inc. | Open to public play |
| Wailea Golf Club Gold Course | Maui | 18 | 1993 | Shinwa Golf Co. | Open to public play |
| Waimea Country Club | Hawaii | 18 | 1993 | Otaka | Open to public play |
| Kauai Lagoons (Lagoons and Kiele courses) | Kauai | 36 | 1988/89 | Shinwa Golf Co. | Open to public play |
| Kona Country Club | Hawaii | 27 | N/A | Takao Bld. | Open to public play |
| Ewa Beach International Country Club | Oahu | 18 | 1992 | H. Hashimoto | Open to public play |
| Makalei Hawaii Golf Course | Hawaii | 18 | 1992 | Sokan Co. | Open to public play |
| Naniloa Country Club | Hawaii | 18 | N/A | Nakano Co. | Open to public play |

Source: Compiled by KPMG Peat Marwick based on interviews with project representatives.

MARKET ASSESSMENT FOR
THE VILLAGES AT HOKUKANO

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# 6 - MARKET ASSESSMENT FOR SINGLE-FAMILY LOT DEVELOPMENT

Selected agricultural and residential lot subdivisions located on Hawaii and Maui were analyzed to evaluate the anticipated lot buyer mix, pricing and absorption of the lots at Hokukano. The competitive advantages and distinct characteristics of Hokukano are also considered in this analysis.

## COMPETITIVE ADVANTAGES

### Hokukano's recreational amenities and location could support a premier single-family development

Although West Hawaii has many agricultural and residential lot subdivisions, the combination of a secluded, spacious residential community that offers extensive recreational facilities without hotel or resort facilities has not yet been offered. While several projects such as Puako and Makalei are currently planned to be marketed or still under construction, Hokukano's advantage is its location along the coastline, its sloping topography and lush vegetation.

### The privacy offered at Hokukano is anticipated to attract purchasers

Hokukano is expected to attract many former resort lot purchasers who would prefer the privacy available in a nonresort development. This market segment has traditionally purchased at resort developments to take advantage of the amenities offered, while sacrificing the privacy of a residential community. The Hokukano project, in contrast, would allow residents more playing time on the golf course as well as the greater sense of community and seclusion typically associated with a residential community.

### Hokukano's close proximity to Kailua-Kona is a benefit

Many of the Hawaii Island residential lot projects surveyed are located in the North and South Kohala districts. Residents of these projects were thus limited in their selection of nearby shopping and entertainment facilities. Located just 20 minutes from Kona and approximately 35 minutes from Keahole Airport, the subject project would allow Hokukano residents easy access to the airport as well as to restaurants, cultural attractions and shopping facilities.

### The Golf Memberships associated with lots will be an added draw

As currently planned, a charter membership program consisting of two Golf Membership options will be offered with initial lot purchases, adding to the marketability of the lots. Currently, few of the resort lot projects offer memberships, therefore, this benefit is expected to be an attractive feature to potential lot purchasers.



### The success of other Lyle Anderson projects is anticipated for Hokukano

The Lyle Anderson Companies is known throughout the golf development community as a premier residential/resort community developer. Current Lyle Anderson golf community projects in Arizona and New Mexico have met unprecedented success in terms of pricing and sales activity, reportedly out-selling the competition by more than two to one. A major factor attributed to the success of Lyle Anderson projects is the appeal of their trademark Jack Nicklaus golf courses and their "environment-respecting" designs. Thus, the reputation and success of other Lyle Anderson projects is anticipated to attract significant U. S. mainland interest in the Hokukano project.

## ANTICIPATED BUYER MIX

### Anticipated buyers include U. S. mainland and Hawaii residents, and foreign nationals

Exhibit 6-A presents the projected buyer market mix at Hokukano, based on the buyer mix of the surveyed agricultural and other residential lots at selected projects. The unique characteristics of the project were also considered when projecting the overall buyer mix.

The majority of lot buyers at Hokukano (40%) are expected to be from the U. S. mainland, of which three-quarters could be from the U. S. west coast. Characteristics of these U. S. mainland buyers could include:

- Individuals who are familiar with the island of Hawaii and seek a vacation or retirement home near the coastline.
- Individuals who consider golf a key amenity but also prefer a private residential atmosphere not available at resorts.
- Individuals who are familiar with and attracted to Lyle Anderson projects.

Hawaii residents are expected to represent about 30% of the lot purchases at Hokukano. This market can be characterized as follows:

- Resort condominium or lot owners who have previously located to Hawaii from the U. S. mainland, and are now looking for a move-up purchase or more privacy.
- Individuals from Oahu who consider golf a key amenity and are purchasing a second home, future retirement home or investment property on the Big Island.
- Island residents desiring private golf club memberships.

Foreign purchasers are estimated to represent 30% of the buyer market. This market can be characterized as follows:

- Individuals looking for second homes and who consider golf a key amenity.
- Individuals who have traveled widely in the western U. S. and are familiar with and attracted to Lyle Anderson projects.
- Individuals attracted to private golf club membership, especially at a Jack Nicklaus-designed course.

# About 30% of the lot buyers at Hokukano are expected to be Hawaii residents

PROJECTED ORIGINS OF LOT BUYERS AT HOKUKANO

| | Total number of lots | Hawaii residents | | U.S. mainland | | Foreign | | |
|---|---|---|---|---|---|---|---|---|
| | | Oahu | Other Hawaii | West coast (1) | Other | Japan | Other | Total |
| Acreage lots (2) | 367 | 10% | 35% | 30% | 5% | 15% | 5% | 100% |
| Residential lots (3) | 1,073 | 10% | 15% | 35% | 10% | 25% | 5% | 100% |
| Weighted average | 1,440 | 10% | 20% | 30% | 10% | 25% | 5% | 100% |

(1) Includes California, Oregon, Washington and Alaska.
(2) Based on information presented in Exhibit 3-I.
(3) Based on information presented in Exhibit 4-G.
Source: KPMG Peat Marwick.

PROJECTED LOT PRICING

**Acreage lots at Hokukano are estimated to range from $460,000 to $930,000 fee simple**

Initial pricing for the 1.0 - to 3.0-acre estate lots proposed at Hokukano are projected to range from $460,000 to $930,000, in 1992 dollars, or approximately $348,000 per acre as shown in Exhibit 6-B. As for the acreage lots, these represent fee simple prices as Oceanside 1250 intends to sell all properties in fee even though the leased fee title has not yet been obtained for a small portion of the site.

Pricing was projected based on the achieved prices per acre at surveyed projects, and then adjusting this price relative to Hokukano in terms of project plan, location, views and amenities. An additional premium for the charter Golf Membership program to be associated with initial lot sales was also assigned to the initial lot prices. Thus, initial pricing for the acreage lots was determined as follows:

- A base price per acre of $200,000 to $275,000, based on the recent sales of comparable Hawaii projects. Due to the lack of sales that occurred in 1992, 1991 sale prices were also analyzed.
- A 15% per acre upward adjustment to compensate for Hokukano's superior location and views relative to most of the Hawaii island competition. None of the Hawaii island agricultural lot subdivisions were located along the coastline, thus the Hokukano site was considered superior in this respect. The proximity to downtown Kona and Keahole Airport is an additional advantage to the site.
- An upward adjustment of 30% per acre to compensate for the amenities offered at Hokukano, including the golf course, clubhouse, members' lodge and deep sea fishing boat. While the three Hawaii island projects surveyed offered some amenities, none of them had facilities as extensive as those planned at Hokukano. Only Plantation Estates, where per-acre prices of nearly $900,000 have been achieved, has a similar range of amenities.
- Based on this analysis, adjusted average prices per acre for the 1.0- to 3.0-acre lots excluding the value of golf memberships are estimated at $399,000 and $290,000, respectively.
- A premium of $60,000 to compensate for the charter Golf Membership program to be offered with initial lot sales.

Based on this analysis, projected average pricing for the acreage lots to be initially marketed is as follows:

- 1-acre lots - $460,000, including Golf Memberships
- 3-acre lots - $930,000, including Golf Memberships

EXHIBIT 6-B

# Acreage lots at Hokukano are projected to range from $460,00 to $930,000 initially

PROJECTED FEE SIMPLE PRICING OF HOKUKANO ACREAGE LOTS INITIALLY MARKETED: 1992 DOLLARS

| | 1-acre lots | 3-acre lots |
|---|---|---|
| Average Hawaii island price per acre | $275,000 | $200,000 |
| Adjustments: | | |
| Location & views (+15%) | 41,000 | 30,000 |
| Facilities and amenities (+30%) | 82,500 | 60,000 |
| Adjusted price per acre | 398,500 | 290,000 |
| Average lot size | 1.0 | 3.0 |
| Estimated lot price | 398,500 | 870,000 |
| Charter golf membership premium (1) | 60,000 | 60,000 |
| **Estimated initial Hokukano acreage lot prices, rounded** | **$460,000** | **$930,000** |

(1) One limited play and one regular Golf Membership planned to be included with initial lot sales. See discussion of charter membership program in chapter 7.

Source: KPMG Peat Marwick.

EXHIBIT 6-B (CONTINUED)

# Acreage lots at Hokukano are projected to range from $460,000 to $930,000 initially

PROJECTED FEE SIMPLE PRICING OF HOKUKANO ACREAGE LOTS INITIALLY MARKETED: 1992 DOLLARS, Continued

| | Range in size (acres) | Range in price per lot | Average price per acre |
|---|---|---|---|
| Lyle Anderson projects: | | | |
| Project A | 0.5 - 1.0 | $170,000 - $300,000 | $250,000 |
| Project B | 0.3 - 1.5 | $130,000 - $645,000 | 390,000 |
| Selected Hawaii projects (1): | | | |
| Hawaii island | 1.0 - 3.75 | $235,000 - $407,000 | 185,000 |
| Maui island | 2.1 - 2.3 | $1,861,000 - $2,000,000 | 870,000 |
| **Hokukano lots** | **1.0 - 3.0** | **$460,000 - $930,000** | $348,000 |

(1) Includes 1991 sales transactions due to the small number of 1992 transactions.

Source: KPMG Peat Marwick.

**The residential lots at Hokukano are estimated to range from $410,000 to $780,000 fee simple**

Prices for the residential lots are projected to range from $410,000 to $780,000, in 1992 dollars, as shown in Exhibit 6-C.

The convenience and image of the golf course community and the lots' proximity to the golf course and ocean could make the residential lots comparable in value to prices at Hawaii's luxury and upscale resorts. Thus, the pricing for residential lots at Hokukano was based on the dollar per square foot pricing of lots at resort residential projects located on Maui and the Big Island. The pricing for the residential lots was determined as follows:

- Base prices for nonfrontage lots which will offer ocean and/or golf course views, were estimated to range from $25 to $40 per square foot based on recent sales at the selected resort lots. This range was directly correlated to the size of the lots, with the smaller lots receiving a higher dollar per square pricing than the larger lots.
- The prime ocean view and the golf front lots are anticipated to generate the highest prices. An upward adjustment of approximately 30% to 35% per square foot was thus assigned, a conservative adjustment based on the premiums associated with golf frontage within Hawaii resort communities, as shown in Exhibit 6-D.
- As with the acreage lots, an additional $60,000 premium was assigned in recognition of the unique charter Golf Membership program to be included with initial lot sales.

Based on this analysis, overall lot pricing has been projected as follows:

- Nonfrontage lots - $410,000 to $600,000, including Golf Membership program
- Prime views and golf front lots - $530,000 to $780,000, including Golf Membership program

## PROJECTED LOT SALES ABSORPTION AT HOKUKANO

**Acreage lot sales at Hokukano are expected to span about eight years**

Exhibit 6-E provides the estimated absorption rate of the estate lots at Hokukano, based on the absorption of comparable agricultural lot projects on Hawaii, and of other Lyle Anderson projects on the U. S. mainland relative to their local competition.

The average annual absorption rate of comparable Hawaii projects ranged from 8 to 61 units per year, resulting in an overall combined project average of 26 units per year. These absorption rates were somewhat higher during the period of 1987 to 1990, before the current real estate market slow-down took hold in Hawaii.



EXHIBIT 6-C

# Prices for initial residential lots are projected to range from about $410,000 to $780,000

PROJECTED FEE SIMPLE PRICING OF HOKUKANO RESIDENTIAL LOTS INITIALLY MARKETED: 1992 DOLLARS

| Lot size by frontage | Number of lots | Average lot size (square feet) | Average price per square foot | Golf membership premium (1) | Average lot price |
|---|---|---|---|---|---|
| Nonfrontage lots: | | | | | |
| 20,000-22,000 sf | 260 | 21,780 | $25 | $60,000 | $600,000 |
| 12,000-14,000 sf | 100 | 13,068 | 30 | 60,000 | $450,000 |
| 9,000-11,000 sf | 119 | 10,890 | 35 | 60,000 | $440,000 |
| 8,000-10,000 sf | 102 | 8,712 | 40 | 60,000 | $410,000 |
| Subtotal/average | 581 | 15,756 | 31 | 60,000 | $510,000 |
| Prime view and golf frontage lots: | | | | | |
| 20,000-22,000 sf | 130 | 21,780 | 33 | 60,000 | $780,000 |
| 12,000-14,000 sf | 90 | 13,068 | 39 | 60,000 | $570,000 |
| 9,000-11,000 sf | 174 | 10,890 | 45 | 60,000 | $550,000 |
| 8,000-10,000 sf | 98 | 8,712 | 54 | 60,000 | $530,000 |
| Subtotal/average | 492 | 13,732 | 43 | 60,000 | $610,000 |
| Total/average | 1,073 | 14,828 | 36 | 60,000 | $560,000 |

(1) The choice of one limited play membership or one regular Golf Membership is planned to be included with initial lot sales.

Source: KPMG Peat Marwick.

EXHIBIT 6-C (CONTINUED)

# Prices for initial residential lots are projected to range from about $410,000 to $780,000

PROJECTED FEE SIMPLE PRICING OF HOKUKANO RESIDENTIAL LOTS INITIALLY MARKETED: 1992 DOLLARS, Continued

| | Range in size (square feet) | Price per square foot excluding memberships | | Range in price per lot |
|---|---|---|---|---|
| | | Range | Average | |
| **Comparable Hawaii projects(2)** | 8,000 - 27,000 | $21 - 72 | $42 | $325,000 - 1,300,000 |
| **Lyle Anderson projects:** | | | | |
| Project A | 22,000 - 44,000 | 5 - 7 | 6 | 170,000 - 300,000 |
| Project B | 13,000 - 63,000 | 10 - 12 | 10 | 130,000 - 645,000 |
| **Proposed Hokukano** | **8,712 - 21,780** | **$25 - 54** | **$36** | **$410,000 - 780,000** |

(2) Includes 1991 sales transactions due to the limited number of 1992 transactions.
Source: KPMG Peat Marwick.

EXHIBIT 6-D

# Golf frontage premiums at selected golf community projects averaged about 134%

AVERAGE PER SQUARE FOOT PRICES FOR FRONTAGE AND NONFRONTAGE LOTS AT SELECTED GOLF COURSE COMMUNITIES: 1990 - 1992

| Golf community | Golf frontage | | Nonfrontage | | Percentage change |
|---|---|---|---|---|---|
| | Number of sales | Price per square foot | Number of sales | Price per square foot | |
| Hawaii: | | | | | |
| Mauna Lani: | | | | | |
| Champion Ridge | 13 | $40 | 15 | $34 | 18% |
| Point Estates | 22 | $93 | 1 | $36 | 158% |
| Keauhou | 5 | $78 | 39 | $21 | 271% |
| Maui: | | | | | |
| Kapalua: | | | | | |
| Plantation Estates | 16 | $22 | 7 | $16 | 38% |
| Pineapple Hill | 27 | $56 | 3 | $45 | 24% |
| Total/weighted average | 83 | $58 | 65 | $25 | 134% |

Source: Compiled by KPMG Peat Marwick, based on information obtained from MLS Hawaii.

EXHIBIT 6-E

# Projected acreage lot absorption averages about 46 units per year

## PROJECTED HOKUKANO ACREAGE LOT ABSORPTION

**Competitive projects, per year:**

| | Comparable Hawaii island project averages | | Comparable Lyle Anderson projects (1) | |
|---|---|---|---|---|
| | Over entire project period | From 1987-1990 | Project A | Project B |
| Range | 8 - 61 | 14 - 71 | 50 - 200 | 30 - 170 |
| Average | 26 | 35 | 100 | 70 |

**Projected Hokukano absorption:**

| | Year 1 | Years 2 - 3 | Years 4 - 8 | **Average** |
|---|---|---|---|---|
| Per year | 80 | 50 | 40 | **46** |
| Cumulative | 80 | 180 | 367 | -- |

(1) As reported by Lyle Anderson.
Source: KPMG Peat Marwick.

Based on this information, absorption of the acreage lots at Hokukano is estimated to average 46 units per year. Although this absorption rate is higher than the overall Hawaii island average, lots at Hokukano are expected to sell at a higher rate due to the project's character, location, golf amenities, and size. Absorption is anticipated to be more like the larger Kohala Ranch, which recorded an overall average absorption rate of 61 units per year. Additionally, the success of other Lyle Anderson projects, as also noted in Exhibit 6-E, is expected at Hokukano due to the following these developments have.

A large number of sales are anticipated in year one when the project first opens. The 80 sales projected in this year will include presales contracted in prior years. After somewhat higher sales in years two and three, acreage lot sales at Hokukano are expected to stabilize at about 40 per year, continuing until sell-out.

**Residential lot sales at Hokukano are expected to average 32 sales per year**

Exhibit 6-F provides the estimated absorption rate of the residential lots at Hokukano based on the absorption of comparable resort lot projects and other Lyle Anderson projects.

The average annual absorption rate of comparable Hawaii projects ranged from 4 to 31 units, or an overall combined average of 16 units per year. Again, the absorption rates were significantly higher during the period from 1987 through 1990, when the general Hawaii market was strong.

Based on this information, absorption of the residential lots was estimated to average 32 units per year over the long-term. Although this absorption rate is higher than the overall absorption rate of the comparable Hawaii projects combined, Hokukano lots were expected to sell at a higher rate due to the project's relatively lower pricing given its golf and other amenities. Similarly, as mentioned in Chapter 4, several of the comparable resort projects offered significantly fewer units than the number proposed at Hokukano, resulting lower absorption rates due to their lesser available inventory. Due to Hokukano's size, higher absorption rates similar to Keauhou Estates and Wailea are anticipated. As for the acreage lots discussed above, the strong sales performance of other Lyle Anderson projects was also considered.

As shown in Exhibit 6-F, a large number of sales are anticipated when the project first opens. The 70 sales projected for year one includes presale activity. After somewhat higher sales levels in years two through four when multiple and charter Golf Memberships are expected to be included with lot sales, sales at Hokukano are expected to stabilize at about 30 sales per year until sell-out.

*EXHIBIT 6-F*

# Projected residential lot absorption averages about 32 units per year

## PROJECTED HOKUKANO RESIDENTIAL LOT ABSORPTION

**Competitive projects:**

| | Comparable Hawaii island project averages | | Comparable Lyle Anderson projects (1) | |
|---|---|---|---|---|
| | Over entire project period | From 1986-1990 | Project A | Project B |
| Range | 4 - 31 | 4 - 42 | 50 - 200 | 30 - 170 |
| Average | 16 | 25 | 100 | 70 |

**Projected Hokukano absorption:**

| | Year 1 | Years 2 - 4 | Years 5 - 33 | **Average** |
|---|---|---|---|---|
| Per year | 70 | 45 | 30 | **32** |
| Cumulative | 70 | 205 | 1,073 | -- |

(1) As reported by Lyle Anderson.

MARKET ASSESSMENT FOR
THE VILLAGES AT HOKUKANO

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# 7 - MARKET ASSESSMENT FOR THE HOKUKANO GOLF AND SPORTS CLUB

With golf serving as the focal point of the Hokukano project, current plans for the site include a 27-hole, Jack Nicklaus-designed golf course, a 24,000 square foot clubhouse and a 100-unit members' lodge. The following assessment provides information on the mix of memberships offered, the origin of members, green and cart fees, and projected rounds played by members and nonmembers.

## MEMBERSHIP CONCEPT AND BENEFITS

The Hokukano Golf and Sports Club is conceived as an important central amenity and theme to the Hokukano development. Memberships would consist of at least two types initially:

- Golf Memberships, as conveyed with lot purchases
- Lodge Memberships, which may be purchased separately from the lots

The sections below outline the preliminary concept for the memberships. Due to the long-term need to market Hokukano, the developer will need to alter the membership program from time to time. The developer's goal is to provide a level of memberships that sustains a comfortable and uncrowded golf play experience. Since a substantial portion of the sales will be from outside the islands, experience with the amount of play from members will be needed to know what the ultimate number of members should be.

### Golf Memberships would be conveyed with lot purchases

Based on past experience in operating similar clubs, Lyle Anderson proposes to make the full Golf and Sports Club membership available only to property buyers at Hokukano. This is anticipated to enhance the prestige of the club, and therefore add value to the real estate products of the project. A number of original lot buyers who purchase from the developer would receive a charter membership program consisting of one limited play membership and one regular membership. These initial buyers would have the choice of activating one of these membership options, either of which would belong to the buyer for his or her lifetime provided the lot is held a specific length of time before it is resold. Either could also be retained even if the lot is sold:

- **The limited play membership** would have certain restrictions on the amount and times of play allowed, but would entail a lower level of dues. Thus, it is conceived to appeal to buyers who do expect to spend less of the year at Hokukano and/or who are not frequent golfers.
- **The regular membership** would offer unlimited access to the course, subject only to the availability of tee times, and thus is conceived to appeal to buyers who anticipate spending more time at Hokukano, and/or who are avid golfers.

The membership option not activated by the original buyer would run with the land, and would transfer to the next buyer of the lot or may revert to the club for resale if the lot is again resold. Thereafter, memberships could only be purchased from the club when available. There may be a financial return when memberships are resold by the club.

Based on this concept, the charter membership program would only be available to a select number of original buyers in the Hokukano property. Current plans are to offer such memberships with the earlier lots sold, in order to enhance early market momentum. Subsequent lot sales by the developer, like the resales, would be conveyed with one regular membership only or in accordance with other membership programs that may be developed.



### Lodge Memberships would also be marketed

In addition to the memberships to be conveyed with lot purchases, Lyle Anderson plans to sell a limited number of Lodge Memberships which would convey a use right to the lodge, golf course and other property amenities, also subject to the availability of each facility and subject to the provisions of the Lodge Memberships. Lodge Members are expected to be entitled to all the rights and privileges of Golf Club Members, except that these rights would only be available during periods when the member is staying at the Hokukano Lodge. Lodge Members would likely also be entitled to bring accompanying guests to stay at the lodge.

As for the Golf Memberships, Lodge Memberships will include a provision for their resale. These provisions will be defined prior to their marketing.

### The majority of members are anticipated to be property owners

Golf Members will be lot owners. Therefore, the market mix used in the single-family lot analysis presented in Exhibit 6-A is a guideline for the mix of Golf Members anticipated for the Golf and Sports Club. Approximately 50% of the members are expected to be from the U. S. mainland, 30% from abroad, while the remaining 20% will include Hawaii residents.

A limited number of nonproperty Lodge Memberships is also planned for Hokukano, as explained above.

## MEMBERSHIP PRICING AND CLUB UTILIZATION FEES

Proposed initiation fees, dues and other club utilization fees are summarized in Exhibit 7-A and discussed in the sections below.

### Golf Membership initiation fees and dues

Initiation fees for Golf Memberships would be included with the lot purchase price. At this time, a $60,000 premium is estimated for the initial lot sales that include the charter membership program. This premium was based on evaluation of fees charged at selected Hawaii private clubs, as reviewed in Chapter 5, with adjustments for the different amenities and type of membership to be offered at Hokukano.

For the purposes of this analysis dues are projected at $400 per month, considering that these lot buyers would be committed users of the club and its facilities. At this time, there are no anticipated provisions for "mini-charges."

### Lodge Membership initiation fees and dues

Initiation fees for the Lodge Memberships have not yet been determined, but are expected to be based on the estimated value of access to the golf club and its related facilities, as well as the use rights for the lodge.

Since Lodge Members are assumed to be less frequent visitors to and/or only seasonal residents of the property than are Golf Members, their dues are estimated on an annual rather than monthly basis. For the purposes of this analysis dues are projected at $1,000 per year, with no "mini-charges."

EXHIBIT 7-A

# Golf and Lodge Memberships are planned to be offered

PROJECTED GOLF MEMBERSHIP PRICES AND GREEN FEES

**Initiation fees and dues:**

| | Initiation fee | Dues |
|---|---|---|
| Golf Members (1): Regular | Included with lot purchase price | $400/month |
| Limited play | Included with lot purchase price | $1,500/year |
| Lodge Members | To be determined | $1,000/year |

**Green and cart fees:**

| | |
|---|---|
| Member (cart fee only) | $20 to 30 |
| Guests of members | $125 to 150 |
| Kamaainas | As determined in discussion with goverment agencies |

(1) Based on concept for initial charter membership program.
Source: Oceanside 1250.

EXHIBIT 7-B

# About 1,500 Golf and Lodge Memberships are anticipated at Hokukano

PROJECTED GOLF MEMBERSHIP ABSORPTION AT HOKUKANO

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | Total projected sales |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Projected annual membership absorption(1)** | 160 | 100 | 240 | 170 | 190 | 185 | 175 | 140 | 60 | 60 | 20 | 15 | 15 | 1,530 |
| **Projected cumulative absorption (1)** | 160 | 260 | 500 | 670 | 860 | 1,045 | 1,220 | 1,360 | 1,420 | 1,480 | 1,500 | 1,515 | 1,530 | |

(1) Membership absorption based on 1-1/2 Golf Memberships per initial lot sale, one per lot sale in subsequent years and estimated 3/10 per lot resale in years 1999 to 2002 (based on lot sales occurring 4 years prior). Also, Lodge Memberships are projected to be sold to nonproperty owners at a rate of 1 membership per 2 lot sales in initial years. Total represents maximum club subscription, since Charter memberships are not transferable and the number of charter members will eventually decline as the members quit golfing.
Source: Oceanside 1250.

### Golf course green and cart fees

There would be no greens fees for members, but cart fees are estimated at about $20 to $30 for all categories of members, and greens and cart fees of about $125 to $150 for guests of members.

A special green and cart fee will also be established for kamaaina public access play, as to be determined in discussion with governmental agencies.

## GOLF MEMBERSHIP ABSORPTION

Anticipated membership sales at Hokukano as provided by Oceanside 1250, are shown in Exhibit 7-B. In initial years, absorption of memberships is expected to be tied to lot sales, since early lot sales would offer the charter membership program. Subsequent lot sales may offer only one Golf Membership. An additional allowance is allocated to the anticipated offering of Lodge Memberships in initial years. Based on this analysis, about 1,500 memberships are anticipated at project buildout.

## PROJECTED GOLF ROUNDS

### The 27-hole golf course is estimated to be managed at an average 60,000 rounds per year

Exhibit 7-C summarizes the projected supportable play at the Hokukano Golf and Sports Club. As shown, the 27-hole course at Hokukano is projected to be managed at an average 60,000 rounds per year, or about 165 rounds per day at stabilization. These figures were estimated based on the average annual rounds played at comparable country club and resort courses and Lyle Anderson's golf club operating experience. The supportable rounds at the Hokukano course will result in comfortable playing time for members and guests. On an 18-hole equivalent basis, this would represent about 40,000 rounds per year, or 110 per day.

Guest play is anticipated to account for 20% of all Hokukano rounds. Hokukano was expected to have a higher percentage of guest play than other Hawaii country clubs due to the club's high percentage of U. S. mainland and foreign members who may have out-of-town visitors. At stabilization, this could result in an estimated 48,000 member rounds and 12,000 nonmember rounds per year.

Member and guest play would account for few rounds in the first years of operation. As lot sales continue, however, demand from members is expected to increase significantly.

In addition to the figures shown, Kamaaina play, as required, could increase the rounds played.

## PRICING OF THE HOKUKANO MEMBERS' LODGE

### The members' lodge is anticipated to be utilized by club members and their guests

A 100-unit members' lodge to be used by members, their guests and guests of the development company is currently planned at the Hokukano project. A major intended use of the lodge is to provide lot owners with a place to stay while visiting Hokukano before they have constructed their home. The lodge is also expected to serve as a convenient and comfortable place for Lodge Members and guests of members and potential buyers to stay while visiting. Thus, although it is compared to island hotels in terms of room rates, the lodge is conceived as private accommodations in a residential setting, and not as a hotel.



EXHIBIT 7-C

# Play at the 27-hole golf course is anticipated to be managed at about 60,000 rounds per year

PROJECTED ROUNDS OF GOLF AT HOKUKANO BY PLAYER CLASSIFICATION AT STABILIZATION (1)

| | Number of holes | Average annual rounds | Percentage guest or nonmember rounds | Number of member rounds | Number of guest or nonmember rounds |
|---|---|---|---|---|---|
| Oahu country club courses | 18 | 60,000 | 10% | 54,000 | 6,000 |
| Hawaii island resort courses | 18 | 46,000 | 70% | 13,800 | 32,200 |
| **Projected Hokukano** | **27** | **60,000 (1)** | **20%** | **48,000** | **12,000** |

(1) Kamaaina play would increase these rounds.
Source: KPMG Peat Marwick and Oceanside 1250.

**Standard rates at the Hokukano members' lodge are projected to range from $200 to $500 per night**

For purposes of this analysis, suggested standard rates for the members' lodge range from $200 to $500 per night, in 1992 dollars. Standard rates at luxury and upscale resorts on Maui and the Big Island, which range from $215 to $500 per night, were considered in determining the nightly rates at Hokukano.

The anticipated rates could represent the following fees by user type:

- Golf and Lodge Members: $200 to $250 per night
- Guests of members: $450 to $500 per night

Rates would vary depending on the season and type of room, and will be subject to change over time.

# IV - 2 Economic & Fiscal Impact Assessment

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Oceanside 1250

# ECONOMIC AND FISCAL IMPACT ASSESSMENT FOR THE VILLAGES AT HOKUKANO

Final Report
March 1993

*This report was prepared by*

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March 26, 1993

Mr. Dick Frye
Project Manager
Oceanside 1250
74-5620 A Palani, Suite 200
Kailua-Kona, HI 96740

Dear Mr. Frye:

KPMG Peat Marwick is pleased to present the findings and conclusions of our study regarding your proposed development. Our report is entitled "Economic and Fiscal Impact Assessment for The Villages at Hokukano." The attached report is organized in five chapters as follows:

1. Introduction and Executive Summary
2. Project Description and Regional Overview
3. Employment and Population Impacts
4. Economic Impacts
5. Fiscal Impacts

We have appreciated the opportunity to assist you and Oceanside 1250 on this important project and look forward to providing further support to its development.

Very truly yours,

KPMG Peat Marwick



Oceanside 1250

ECONOMIC AND FISCAL IMPACT ASSESSMENT
FOR THE VILLAGES AT HOKUKANO

Oceanside 1250

ECONOMIC AND FISCAL IMPACT ASSESSMENT
FOR THE VILLAGES AT HOKUKANO



# I - INTRODUCTION AND EXECUTIVE SUMMARY

This chapter presents the background and objectives of the assistance provided to Oceanside 1250, and summarizes the conclusions of our study. More detailed findings and conclusions are presented in the following chapters.

## STUDY BACKGROUND AND OBJECTIVE

Oceanside 1250 plans to develop a master-planned community to be named The Villages at Hokukano (Hokukano) on a 1,540-acre site, in the South Kona district on the island of Hawaii. The development would be a residential-oriented community with recreational facilities that include a golf course, clubhouse and golf members' lodge.

In January 1993, KPMG Peat Marwick assessed the market for the project in a report entitled "Market Assessment for the Villages at Hokukano." The objective of the current study is to evaluate the anticipated economic and fiscal impacts of the proposed development in the State of Hawaii (State) and the County of Hawaii (County). This study assumes that the project is developed and received in the marketplace as described in the January 1993 market study.

## SITE DESCRIPTION AND PROJECT CONCEPT

The project site is located in the North and South Kona Districts of West Hawaii. The site is located 12 miles from downtown Kailua-Kona, *makai* (towards the ocean) of Kealakekua town. The 1,540-acre property enjoys coastal frontage and a sloping terrain which offer a variety of ocean and mountain views.

Hokukano is proposed to be a residential community with a semi-private 27-hole golf course, a golf clubhouse, a lodge to be used by members and their guests, 367 acreage lots and 1,073 residential lots. The project is anticipated to offer a private, residential atmosphere complete with extensive amenities, resulting in more privacy and less congestion than resort communities. Hokukano is anticipated to attract buyers and users primarily from the U.S. mainland, and secondarily from the State of Hawaii and from outside the U.S.

## EMPLOYMENT AND POPULATION IMPACTS

The Hokukano development could generate employment opportunities and impact resident population in the districts of North and South Kona.

### Construction and operational employment

Hokukano would generate both construction and operational employment in the State. Direct employment effects would be those supported directly by construction or by the consumer expenditures generated by the project. However, the total employment effects of the project would also include its indirect and induced effects through spending multipliers throughout the State.

The anticipated total direct, indirect and induced construction employment effects of the project are expected to represent about 210 to 320 average annual person years during the period 1997 to 2029. Operational employment effects could represent 190 to 330 permanent, full-time equivalent positions.

Projected employment at Hokukano
(Average annual person years)

| | 1994 to 1997 | 1998 to 2008 | 2009 to 2019 | 2020 to 2029 |
|---|---|---|---|---|
| Construction: | | | | |
| Direct | 180 | 160 | 120 | 120 |
| Total | 320 | 290 | 220 | 210 |
| Operational: | | | | |
| Direct | 110 | 180 | 180 | 180 |
| Total | 190 | 330 | 330 | 330 |
| Total: | | | | |
| Direct | 290 | 340 | 300 | 300 |
| Total | 510 | 620 | 550 | 540 |

**Population**

The project is considered to impact population in the County and State by generating three types of population growth:

- Full-and part-time residents at the project.
- Temporary day time population consisting of visitors to the project such as guests of members and non-Hokukano resident golf members.
- Direct employees of the project who move to the island of Hawaii because of employment opportunities at the project along with their dependent household members.

Visitors and employees of Hokukano would only impact the de facto population of the community, that is, the average daily number of persons present, including visitors and residents. In contrast, residents and employees who choose to move into the community because of the employment generated by the project would contribute to the community's resident population growth.

The population impact elsewhere in the County would be somewhat less than for the Hokukano community, since a large number of employees and residents attracted to the project may already reside in the County. Thus, the above mechanisms also impact the population of the County, but only in the cases where visitors to or residents and employees of the community are attracted from off-island. The only in-migrant population effect on the County could be the new residents from out of the County attracted to Hokukano and the operational employees drawn to the County for employment.



Similarly, the population impact for the State could reflect the on-site community residents attracted to the State by the Hokukano project as well as the operational employees and their dependents who move to Hawaii to fill job positions as a result of Hokukano. Because all construction employment requirements are assumed to be satisfied by the existing State labor pool, a population impact from construction employment is not projected.

The projected de facto population of Hokukano and the in-migrant population to the County and the State are summarized below:

Projected impacts of Hokukano's development
on Hokukano's de facto population and
County and State resident population

| | 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|
| Hokukano community (1) | 368 | 1,080 | 1,660 | 2,130 |
| County of Hawaii (2) | 200 | 720 | 1,160 | 1,530 |
| State of Hawaii (2) | 70 | 480 | 900 | 1,220 |

(1) De facto population
(2) Resident population

## ECONOMIC IMPACTS

The proposed development could be expected to impact the State and County economy by generating additional consumer expenditures and personal income.

Residents who may move to the State to live at Hokukano would create direct expenditures for recreation-related fees, rentals, and purchases of food, beverages, and other goods and services. These expenditures would, in turn, require those establishments serving direct resident demands to purchase goods and services from other establishments in the State. The latter expenditures are considered indirect expenditures. Induced expenditures are those made by employees and proprietors with income derived from establishments benefiting from these new direct and indirect expenditures.

Hokukano is also anticipated to attract visitors who would normally not come to Hawaii. These visitors could include nonresident members of the Hokukano Golf Club as well as guests of Hokukano residents. These visitors could create State revenues from direct expenditures relating to lodging, food and beverage purchases, recreation-related fees, rentals and other goods and services, which in turn, could create indirect expenditures.

### Consumer Expenditures

Consumer expenditures generated as a result of the Hokukano development could include green and cart fees for members and guests, monthly membership dues and expenditures from overnight visitors staying at the club members' lodge. Including these and other anticipated new-resident expenditures for other recreation related fees, food and beverage, and retail items at the Hokukano facilities, the community could be expected to generate $21.4 million in direct additional consumer expenditures per year by 2029, in 1992 dollars.

Considering their anticipated multiplier effects throughout the State's economy, these direct expenditures could be expected to support total additional spending in Hawaii of about $12.7 million per year by 2029, in 1992 dollars.

Projected consumer expenditures

(Millions of 1992 dollars)

| | 1994 to 1997 | 1998 to 2008 | 2009 to 2019 | 2020 to 2029 |
|---|---|---|---|---|
| Direct expenditures | $5.84 | $17.78 | $21.09 | $21.40 |
| Indirect and Induced expenditures | 3.45 | 10.51 | 12.46 | 12.65 |
| Total | $9.30 | $28.29 | $33.55 | $34.04 |

### Personal income

Hokukano would have an impact on income from residents of the County and the State through employee wages, salaries and fringe benefits, as well as through revenue to proprietors. Wages and salaries paid to direct employees of the project could be anticipated to represent about $9.4 million per year by 1997, $10.2 million by 2008, and stabilizing at about $8.6 million by 2019 as shown below:

Projected annual personal income

(Millions of 1992 dollars)

| | 1994 to 1997 | 1998 to 2008 | 2009 to 2019 | 2020 to 2029 |
|---|---|---|---|---|
| Construction | $7.04 | $6.26 | $4.69 | $4.69 |
| Operational | 2.33 | 3.94 | 3.94 | 3.94 |
| Total | $9.37 | $10.20 | $8.63 | $8.63 |

The personal income figures presented above do not include the potential wages and salaries paid to those employed through the project's indirect and induced economic effects, and do not include proprietors income. Thus, the total personal income effects of the project's development could be considerably greater than the direct personal income effects shown.



## FISCAL IMPACTS

The fiscal impacts of the proposed development are evaluated by comparing the tax revenues and operating expenditures that could be expected to be generated by the governments of the County and the State.

### Government revenues and expenditures

Potential fiscal benefits of the project's development, in terms of additional tax revenues, are anticipated to exceed the government operating expenditures generated by additional demands for County service as a result of the project's development. Projected net additional revenues for the County are expected to be about $1.6 million by 1997, about $4.6 million by 2008, $6.7 million by 2019, and $8.7 million by 2029 with the County benefits exceeding costs associated with the project by ratios ranging from 10.4 to 8.2 during the same time periods.

Similarly, the State is also expected to realize net additional revenues, as a result of Hokukano's development. Added revenues will be received in terms of transient accommodations taxes and GET from construction and Hokukano user spending, and income taxes from in-migrant residents. Projected net additional revenues are expected to be $2.5 million by 1997, $5.0 million by 2008, $7.1 million by 2019 and nearly $8.7 million by 2029. This will result in revenues exceeding expenses by a ratio of 8.9 in 1997, 3.5 in 2008, 2.9 in 2019 and 2.8 in 2029. The significant ratio of revenues over expenses during 1997 is a result of added GET revenues from construction spending.

The projected County and State revenue and expenditure comparisons are summarized below:

Projected County and State Revenue and Expenditure Comparison

(Millions of 1992 dollars)

| | 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|
| County government: | | | | |
| Net additional revenues | $1.56 | $4.58 | $6.74 | $8.67 |
| Revenue/expenditure ratio | 10.4 | 8.8 | 8.3 | 8.2 |
| State government: | | | | |
| Net additional revenues | $2.45 | $5.02 | $7.11 | $8.69 |
| Revenue/expenditure ratio | 8.9 | 3.5 | 2.9 | 2.8 |

Oceanside 1250

ECONOMIC AND FISCAL IMPACT ASSESSMENT
FOR THE VILLAGES AT HOKUKANO



# 2 - PROJECT DESCRIPTION AND REGIONAL OVERVIEW

This chapter describes the proposed Hokukano residential community and golf club. It also surveys economic and demographic trends for Hawaii County as a whole and the North and South Kona districts of West Hawaii in particular, as pertinent to the impacts of development at the project site.

## PROJECT DESCRIPTION

This section presents the preliminary development plans for Hokukano and the characteristics of the project site.

### Hokukano is located on the North and South Kona district border

Oceanside 1250 plans to develop a residential community and golf course named The Villages at Hokukano (Hokukano) on about 1,540 acres of land that spans both the North Kona and the South Kona districts, on the island of Hawaii, as shown in Exhibit 2-A. Plans for the project include an upscale, master-planned residential community that centers around a 27-hole Jack Nicklaus designed golf course.

### Hokukano is projected to include 1,440 residential units and extensive recreational facilities

The development would include a mixture of 367 low density acreage lots and 1,073 low-to-medium density residential lots as well as extensive recreational amenities including a 27-hole golf course, clubhouse, lodge units to be used by visiting members and guests, deep sea fishing boat and a historic park. The development is proposed to be built in several phases, beginning with the golf course and required infrastructure. Assuming timely obtainment of entitlements, construction at the development is projected to commence in 1994 with lot sales commencing in 1995 and the first homes completed by 1997. The 27-hole course, the clubhouse and the first 50 golf members' lodge units are anticipated to open by 1997.

### Hokukano is located approximately 12 miles south of Kailua-Kona

Hokukano is approximately 12 miles, or a 20-minute drive to the nearest major commercial center, Kailua Kona, and about 20 miles south of Keahole Airport. The well-known resort destinations of the Kohala Coast, such as Kona Village, Waikoloa Beach, Mauna Lani and Mauna Kea are approximately 40 minutes to an hour's drive away.

## HAWAII COUNTY

Spanning over 4,000 square miles, Hawaii County, which includes the entire island of Hawaii, is the largest county in the State. This section briefly reviews the demographic characteristics of both residents and visitors to the island of Hawaii.

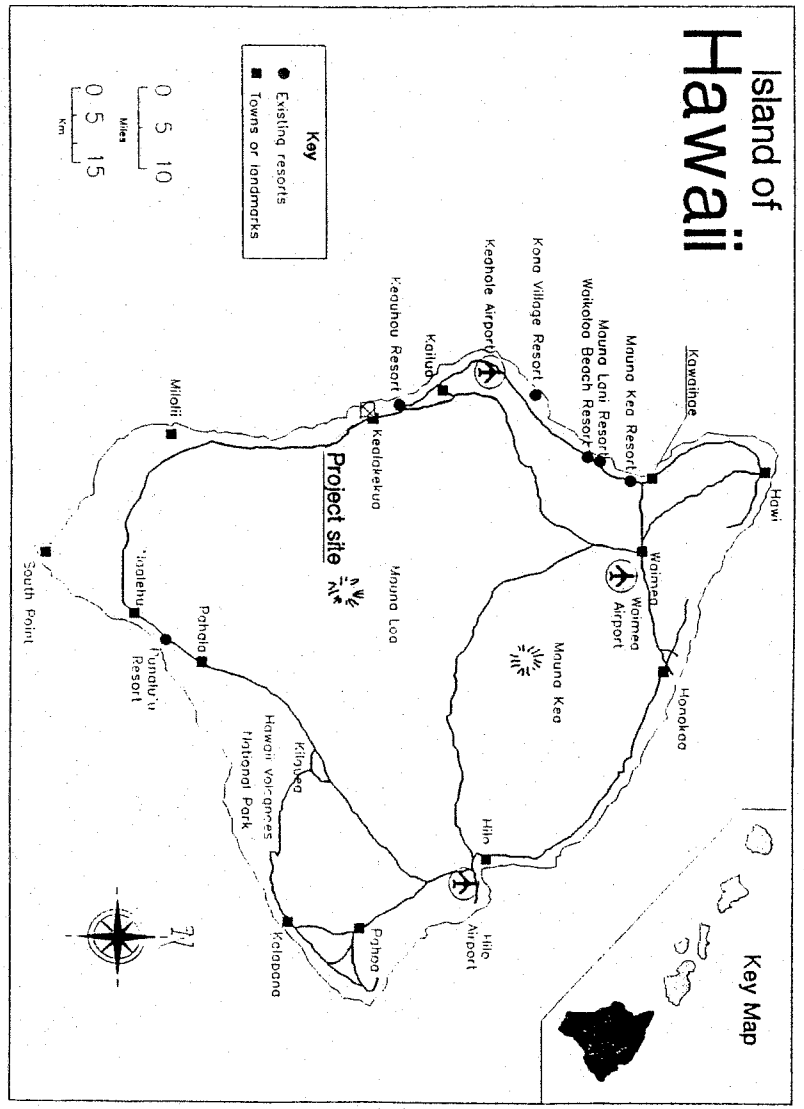


EXHIBIT 2-A

**Hawaii County's resident population exceeded 120,000 residents in 1990**

As of April 1990, the County of Hawaii maintained a resident population of about 120,300, while the de facto population was approximately 135,100, as presented in Exhibit 2-B.

The resident population grew at a rate of approximately 2.7% per annum during the period 1980 to 1990, while the de facto population grew at a slightly faster rate of 3.2% per annum during this same time period. As also shown in the exhibit, the North Kona district is by far the largest district within West Hawaii, maintaining nearly half the West Hawaii population. From 1980 to 1990, the South Kohala district experienced the most growth at approximately 7.1% increase per annum, while North Kona also showed significant growth of 4.9% per annum.

Hawaii County's resident population is projected by the Hawaii State Department of Business, Economic Development and Tourism (DBED) to continue to grow at a steady rate, increasing by 2.4% to 2.7% per annum from 1990 to 2010, as shown in Exhibit 2-C.

**Visitor arrivals to Hawaii County have shown continued growth**

In 1990, total visitor arrivals reached 1.19 million, representing a 3.3% annual increase since 1980. Although eastbound visitors have increased as a percentage of total visitors to the County, westbound visitors comprise the majority of the market, representing approximately 80% of all Big Island visitors.

Although the number of Westbound visitors increased steadily from 1970 to 1990, the period 1990 to 1992 indicated an average annual decline of 1.5%, as a result of the Gulf War and the U. S. recession. Eastbound visitors continued to increase during this period, however, resulting in an overall increase in the island's visitor market of 0.7% from 1990 to 1992.

Visitor arrivals to the State were projected by the DBED to reach 8.4 million and 9.8 million visitors by 1995 and 2000, respectively. This would represent an annual visitor growth rate 3.4% from 1990 to 2000.

**The civilian labor force in Hawaii County has increased by 3.5% per year from 1980 to 1990**

As presented in Exhibit 2-D, the civilian labor force for the County of Hawaii increased from about 43,600 in 1980 to 61,600 in 1990, or about a 3.5% per annum increase. This increase in labor force also resulted in a decline in the unemployment rate from 6.2% in 1980, to 3.8% in 1990. As a result of the recent downturn in the economy, however, unemployment levels for the County have increased, estimated to be 7.2% in October 1992. This increase can be attributed to recent decline in the construction and tourism industries.

Hawaii County's civilian labor is projected by the Hawaii State DBED to continue to grow at a steady rate, increasing from 57,500 jobs in 1990 to 99,700 jobs by 2010, or a 2.8% annual increase, as shown in Exhibit 2-C.

EXHIBIT 2-B

# The South Kona district has experienced less growth than the South Kohala and North Kona districts

RESIDENT AND DE FACTO POPULATION OF THE SOUTH KOHALA, NORTH KONA, SOUTH KONA AND KA'U DISTRICTS AND THE COUNTY OF HAWAII: 1980 - 1990

| | April 1 | | Average annual percent change 1980 to 1990 |
|---|---|---|---|
| | 1980 | 1990 | |
| Resident population of selected districts: | | | |
| South Kohala | 4,607 | 9,140 | 7.1% |
| North Kona | 13,748 | 22,284 | 4.9% |
| South Kona | 5,914 | 7,658 | 2.6% |
| Ka'u | 3,699 | 4,438 | 1.8% |
| Total region | 27,968 | 43,520 | 4.5% |
| County of Hawaii: | | | |
| Resident population | 92,053 | 120,317 | 2.7% |
| De facto population (1) | 98,700 | 135,100 | 3.2% |

1) Includes all persons physically present in area; includes visitors present but excludes residents who are temporarily absent.

Sources: U.S. Bureau of the Census, 1980 Census of the Population, Number of Inhabitants, Hawaii PC80-1-A13 (October 1981), table 4 and 1990 census printouts transmitted February 21, 1991.

EXHIBIT 2-C

# The civilian labor force in Hawaii County is projected to exceed 76,000 jobs by the year 2000

POPULATION AND EMPLOYMENT PROJECTIONS FOR THE COUNTY OF HAWAII: 1995 - 2010

| | Resident population | | Civilian labor force | |
|---|---|---|---|---|
| | Population | Annual increase | Jobs | Annual increase |
| 1990 (1) | 120,300 | -- | 57,500 | -- |
| 1995 | 137,600 | 2.7% | 66,800 | 3.0% |
| 2000 | 154,900 | 2.4% | 76,400 | 2.7% |
| 2005 | 174,600 | 2.4% | 87,300 | 2.7% |
| 2010 | 199,000 | 2.7% | 99,700 | 2.7% |

(1) Based on historical figures.

Sources: U.S. Bureau of the Census, June 1991; Hawaii State Department of Labor, "Labor Force Data Book", April 1991; "Population and Economic Projections to 2010", Nov. 1988.

EXHIBIT 2-D

# The civilian labor force in Hawaii County has increased by 3.5% per year from 1980 to 1990

AVERAGE ANNUAL LABOR FORCE ESTIMATES FOR THE COUNTY OF HAWAII: 1980 - 1990

| | 1980 | 1990 | Average annual percent change 1980 to 1990 |
|---|---|---|---|
| Civilian labor force | 43,550 | 61,550 | 3.5% |
| Percent unemployed | 6.2% | 3.8% | |
| Nonagricultural wage and salary jobs by industry: | | | |
| Construction | 1,800 | 3,250 | 6.1% |
| Manufacturing | 2,800 | 2,250 | -2.2% |
| Transportation, communication and utilities | 1,950 | 2,500 | 2.5% |
| Wholesale trade | 1,250 | 2,000 | 4.8% |
| Retail trade | 5,600 | 10,600 | 6.6% |
| Finance, insurance and real estate | 1,200 | 2,350 | 7.0% |
| Hotel services | 3,150 | 6,250 | 7.1% |
| Other services and miscellaneous | 3,900 | 8,000 | 7.4% |
| Government | 6,550 | 8,450 | 2.6% |
| Total | 28,200 | 45,650 | 4.9% |

Sources: Hawaii State Department of Labor and Industrial Relations, Labor Force Data Book (March 1978), as revised annually through April 1991.

## NORTH AND SOUTH KONA DISTRICTS

The Hokukano site is located in the West Hawaii region on the border of the North and South Kona districts. Historically, the Kona area's economic activity has focused around agricultural and ranching activities. Since the 1960s, however, development of North Kona began a growth cycle that added hundreds of new hotel and condominium units to the market, resulting in a new emphasis in real estate and visitor industries.

### North Kona is West Hawaii's major residential district

The North Kona district is West Hawaii's primary residential market, with a relatively large labor base supported by tourism. Major development areas include the existing Keauhou and Kona Village resorts, and the planned Kohanaiki, Regent Kona Coast, Kaupulehu and O'oma developments.

### South Kona is an expanding residential community

The South Kona district can be characterized as a growing residential community. Currently, the area is limited to residential and agricultural uses, with some commercial facilities. A southward movement of development has been seen within the area, beginning with the on-going development of Keauhou. Several new developments are planned for the South Kona district in addition to Hokukano.

### Civilian employment in the North and South Kona districts totaled 15,300 in 1990

The civilian labor force in the North and South Kona districts exceeded 15,300 workers in 1990, as reported by the Hawaii State Data Center. North Kona was home to the majority of workers, estimated at 11,600 employed persons, while South Kona included about 3,800 employed persons in 1990, as shown in Exhibit 2-E.

EXHIBIT 2-E

# The civilian labor force for North and South Kona totaled 15,300 employees in 1990

LABOR FORCE ESTIMATES FOR THE NORTH AND SOUTH KONA DISTRICTS OF HAWAII COUNTY: 1990

| | South Kona | North Kona | Total |
|---|---|---|---|
| Wage and salary jobs by occupation: | | | |
| Executive/administrative/managerial | 362 | 1,569 | 1,931 |
| Professional specialty | 659 | 1,368 | 2,027 |
| Technicians and related support | 54 | 191 | 245 |
| Sales | 457 | 1,801 | 2,258 |
| Administrative support | 370 | 1,236 | 1,606 |
| Private household | 13 | 44 | 57 |
| Protective service | 55 | 195 | 250 |
| Service except protective and household | 426 | 1,898 | 2,324 |
| Farming/forestry/fishing | 554 | 664 | 1,218 |
| Precision production/craft/repair | 476 | 1,512 | 1,988 |
| Machine operators/assemblers/inspectors | 30 | 194 | 224 |
| Transportation and material, moving | 174 | 506 | 680 |
| Handlers/helpers/laborers | 154 | 374 | 528 |
| Total civilian labor force | 3,784 | 11,552 | 15,336 |

Source: Hawaii State Department of Labor and Industrial Relations, Labor Force Data Book (March 1978), as revised annually through April 1991.



ECONOMIC AND FISCAL IMPACT ASSESSMENT FOR THE VILLAGES AT HOKUKANO

## 3 - EMPLOYMENT AND POPULATION IMPACTS

The proposed Hokukano community is expected to have significant employment and population impacts in the North and South Kona area. This chapter illustrates the population impact at the district, County and the State levels that can be expected from Hokukano's development, in terms of both Hokukano residents and non-site employees. Exhibit 3-A presents an overview of the proposed developments on which subsequent calculations are based.

### EMPLOYMENT

Planned development will generate short-term employment during the construction of new facilities and long-term employment in the operation and support of those facilities. Employment effects may also be classified as being direct, indirect or induced. Direct employment is that supported by expenditures at the Community, such as those at the golf course, food and beverage establishments and lodges. Most of the direct employment effects would occur at Hokukano.

**Direct construction employment is projected to average 140 full-time equivalent employees annually**

Direct construction employment is that which would be supported directly by the construction of the facilities. Such employment includes on-site laborers, operatives and craftsmen, as well as the professional, managerial, sales and clerical workers whose usual places of employment may be elsewhere on the island or in the State.

As presented in Exhibit 3-B, total direct employment is calculated by estimating the percentage of development costs devoted to labor (assumed to be 40% for lot, clubhouse and infrastructure development and 35% for home and lodge development) and dividing this amount by the estimated wages and benefits of an average construction worker (estimated as $47,000 for neighbor island workers), to estimate the number the full-time person years required for construction. As shown in the exhibit, total direct construction employment could be highest between 1998 and 2008 when a substantial amount of home development is anticipated to occur, with an estimated 3,120 total person-years.

Average annual full-time construction employment is estimated by dividing the total person-years by the construction time period. Annual direct construction employment would be highest between the periods mid-1994 and 1997, and 1997 and 2008 with an estimated 180 and 160 direct construction employees per year, respectively. Direct annual construction employment could decrease to about 120 person-years per year from 2009 to 2029 resulting in overall average direct employment of 140 employees per year.



Exhibit 3-A

## Hokukano is planned to offer single-family lots, golf and lodge facilities, and a membership program

HOKUKANO DEVELOPMENT AND OPERATIONAL ASSUMPTIONS

| | Opening date(1) | Project period 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|---|
| Single-family lot sales and home development (cumulative)(1): | 1995 | | | | |
| Homes completed(2) | 1996 | 30 | 409 | 774 | 1,087 |
| Unbuilt lots | | 220 | 403 | 368 | 353 |
| Total sold lots(3) | | 250 | 812 | 1,142 | 1,440 |
| Golf course holes completed | 1996 | 27 | 27 | 27 | 27 |
| Hokukano Golf Memberships (cumulative number sold)(4) | 1995 | 375 | 1,148 | 1,148 | 1,148 |
| Hokukano Lodge Memberships (cumulative number sold)(4) | | 125 | 383 | 383 | 383 |
| Total memberships | | 500 | 1,530 | 1,530 | 1,530 |
| Average daily golf rounds(5): | 1996 | | | | |
| Club members | | 48 | 128 | 128 | 128 |
| Guests of members(6) | | 12 | 32 | 32 | 32 |
| Total rounds | | 60 | 160 | 160 | 160 |
| Club members' lodge (3): | 1997 | | | | |
| Available rooms | | 50 | 100 | 100 | 100 |
| Average annual occupancy | | 40% | 55% | 70% | 70% |
| Daily occupied rooms | | 20 | 55 | 70 | 70 |

(1) Assumes that the approval process is completed during 1993 with construction beginning in 1994
(2) Based on 8% of sold lots being improved per year.
(3) Based on estimates provided by Oceanside 1250.
(4) Provided by Oceanside 1250.
(5) Does not include per rounds played by the public.
(6) Estimated at 20% of total guest and member play, rounded.

Source: Discussions with representatives from Oceanside 1250 and PBR Hawaii; information in the report entitled "Market Assessment for the Villages at Hokukano," January 1993.

Exhibit 3-B

# Development of Hokukano could generate total average construction employment of about 250 annual positions, statewide

PROJECTED TOTAL EMPLOYMENT FOR FACILITY CONSTRUCTION

| | Assumptions | Total and annual person-years 1994 to 1997 | 1998 to 2008 | 2009 to 2019 | 2020 to 2029 | Total |
|---|---|---|---|---|---|---|
| Direct employment by facility type: | | | | | | |
| Single-family homes- | | | | | | |
| Lot development (1) | | 128 | 290 | 190 | 160 | 770 |
| Home construction (2) | | 88 | 1,130 | 1,090 | 930 | 3,240 |
| Golf course (3) | | 50 | -- | -- | -- | 50 |
| Golf clubhouse (4) | | 50 | -- | -- | -- | 50 |
| Club members' lodge (5) | | 90 | 90 | -- | -- | 180 |
| Infrastructure (6) | | 230 | 230 | 60 | 60 | 570 |
| Subtotal, direct employment | | 640 | 1,740 | 1,340 | 1,150 | 4,860 |
| Indirect and induced employment: | | | | | | |
| On-island (7) | 30% of other employment | 150 | 410 | 320 | 270 | 1,150 |
| Elsewhere in State | | 360 | 970 | 740 | 640 | 2,690 |
| Subtotal, other employment | | 510 | 1,380 | 1,060 | 910 | 3,840 |
| Total (8) | 179% of direct employment | 1,150 | 3,120 | 2,400 | 2,060 | 8,700 |
| Average annual full-time equivalent employment: | | | | | | |
| Period (number of years) | | 3.5 | 11.0 | 11.0 | 10.0 | 35.5 |
| Direct employment | | 180 | 160 | 120 | 120 | 140 |
| Indirect and induced employment- | | | | | | |
| On-island | | 40 | 40 | 30 | 30 | 30 |
| Elsewhere in State | | 100 | 90 | 70 | 60 | 80 |
| Total average | | 320 | 290 | 220 | 210 | 250 |

(1) Calculated at 0.5 total person-years over a one year construction period per lot.
(2) Calculated at 3.7 total person-years over a one year construction period per home.
(3) Based on information provided by Gadge Davis Associates, assuming 47 total person-years over a one and a half year construction period.
(4) Calculated at about 53.7 total person-years over a two year construction period.
(5) Calculated at 1.9 total person-years per unit over a one year construction period (based on a lodge configuration).
(6) Calculated at about 571.2 total person-years and a development curve reflecting the nature and level of development occurring per period.
(7) Estimated at 30% of total indirect and induced (other) employment.
(8) Total direct, indirect and induced effect estimated at 1.79 full-time equivalent positions per direct position, based on 1990 ratios from the DBED Input-Output Model and Hawaii Econometric Model, as presented in the Department of Business and Economic Development, "The Hawaii State Data Book," 1991.

Note: All employment estimates are based on estimated development costs as presented in Exhibit 5-A. Labor as a percentage of construction costs was assumed to equal 40% for lot and infrastructure development and 35% for home and lodge construction. The labor portion of the development cost is then divided by an average construction workers wages and benefits (estimated at about $47,000 in 1992 dollars) to calculate full-time equivalent positions. The remaining costs were allocated to materials, financing costs and developers profit.



**Indirect and induced construction employment from the island and elsewhere in the State are projected to average 110 employees per year**

The direct employment of construction workers at Hokukano will stimulate additional employment on the island and elsewhere in the State. Based on ratios derived from DBED, an estimated 0.79 full-time equivalent jobs are created in the State for every full-time equivalent job in the building construction industry. This multiplier is used to project the indirect and induced employment to be supported statewide by the direct construction employment, as shown in Exhibit 3-B.

About 30% of indirect and induced employment is anticipated to occur on the island of Hawaii, with the remainder occurring elsewhere in the State. As with direct construction, the greatest employment could occur in the second construction period from 1998 to 2008 when indirect and induced construction employment effects are expected to provide employment opportunities amounting to about 1,380 total person-years. Indirect and induced construction employment would then average about 140 annual person-years between mid-1994 and 1997, decreasing to 90 annual person-years between 2020 and 2029, resulting in overall average annual indirect employment of 110 employees per year.

**Total construction employment could average 250 persons per year**

Direct, indirect, and induced construction employment at Hokukano could reach 320 employees per year from mid-1994 through 1997, 290 employees per year between 1998 and 2008, 220 employees per year between 2009 and 2019 and 210 employees per year from 2020 to 2029.

**Direct operational employment is projected to reach 180 full-time equivalent employees by 2008**

In the later years of the project, the majority of direct operational employment will be associated with the club members' lodge, resulting in an estimated 110 full-time equivalent employees in 2008. Operational employment at the lodge is based on 1.1 full-time equivalent jobs per unit. Based on employment requirements at other private golf clubs in Hawaii, adjusted to account for the characteristics unique to Hokukano, the golf course and the clubhouse are each anticipated to employ 20 to 25 full-time equivalent direct employees. Combined, these employees will include management, food and beverage, retail and maintenance positions. Facilities administration, which includes project administration, property development, sales and management and other grounds keeping and maintenance personnel, is estimated to include about 10 to 15 full-time equivalent direct employees.

Thus, the Hokukano community could be expected to have generated about 110 full-time equivalent direct operational positions by 1997 and about 180 at employment stabilization, expected by 2008, as shown in Exhibit 3-C.

Exhibit 3-C

## Hokukano could generate about 330 total full-time equivalent operational employees at sell-out

PROJECTED DIRECT OPERATIONAL EMPLOYMENT IMPACTS OF THE HOKUKANO DEVELOPMENT

(Full-time equivalent positions)

| Employment type | Full-time equivalent assumptions | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|---|
| Direct employment: | | | | | |
| Golf course | 20 to 25 | 20 | 25 | 25 | 25 |
| Golf clubhouse | 20 to 25 | 20 | 25 | 25 | 25 |
| Club members' lodge | 1.10 per unit | 55 | 110 | 110 | 110 |
| Facilities administration (1) | 10 to 15 | 10 | 15 | 15 | 15 |
| Subtotal, direct (rounded) | | 110 | 180 | 180 | 180 |
| Indirect and induced employment (2): | | | | | |
| Golf course | 68% of direct | 14 | 17 | 17 | 17 |
| Golf clubhouse | 63% of direct | 13 | 16 | 16 | 16 |
| Club members' lodge | 91% of direct | 50 | 100 | 100 | 100 |
| Facilities administration | 81% of direct | 8 | 12 | 12 | 12 |
| Subtotal, indirect and induced (rounded) | | 80 | 150 | 150 | 150 |
| Total | | 190 | 330 | 330 | 330 |

(1) Category includes project administration, property development, sales and management and other groundskeeping and maintenance of developed facilities and infrastructure.

(2) Weighted estimate based on the projected mix of employment type and ratios, measuring the added economic activity generated by visitor related expenditures, of 0.72, 0.53, 0.93 and 0.68 full-time equivalent positions per direct position for eating and drinking, other retail, hotel and real estate and other services, respectively.

Reference: 1990 DBED Input-Output Model and Hawaii Econometric Model as published in the "Hawaii State Data Book," 1991.



**Indirect and induced operational employment are projected to stabilize at 150 full-time equivalents by 2008**

Facility operations at Hokukano would also indirectly generate employment elsewhere in the State. Recent studies on the total economic impacts of direct, indirect and induced employment multipliers in the food and beverage and other retail trade industries by the DBED suggest that the activities at the community could be expected to support between .63 and .91 indirect and induced full-time equivalent positions elsewhere in the State for each direct job created.

Thus, indirect and induced operational employment could be expected to amount to 80 full-time equivalent positions by 1997, or 150 full-time equivalent positions in 2008, as shown in Exhibit 3-C.

**Total operational employment is projected to reach 330 full-time equivalents by 2008**

Total direct, indirect and induced operational employment is estimated to represent about 190 full-time equivalent positions per year by 1997, and stabilize by about year 2008 with 330 positions, as also shown in Exhibit 3-C.

## POPULATION

The development of facilities could lead to a population increase in the Kealakekua area, and to a lesser extent, in the County and the State. Those who buy lots may be residing during most or part of each year in the residential portion of the community, while day visitors to the golf course and Hokukano employees will contribute to the average daily population.

The added population could also include non-site community residents such as temporary construction employees and permanent operational employees.

**Resident population of Hokukano could reach 1,670 by 2029**

Projections for the project's resident population impacts at the site are based on key assumptions regarding usage patterns of completed homes at the site, as shown in Exhibit 3-D. These assumptions are based on information collected from selected other completed projects on the neighbor islands. Residents of Hokukano could reach 1,670 by 2029 when all 1,440 residential units are assumed to be sold, as shown in Exhibit 3-E. The resident population is anticipated to be small in 1997, estimated to be less than 50 residents, but increasing in later years of the project as home development progresses.

**Day visitor population is projected to reach 140 in 2029**

Day visitors at Hokukano would primarily consist of non-Hokukano resident golf members and guests utilizing the golf course and club members' lodge. These individuals were expected to come to Hawaii for the primary purpose of visiting Hokukano. The guest population was thus estimated by using the projected daily occupied rooms of the club members' lodge, assuming two persons per unit, as shown previously in Exhibit 3-D. Based on this assumption, the average daily visitor population is projected to reach 40 persons in 1997 and increase to 140 persons by 2019, as shown in Exhibit 3-E.

Exhibit 3-D

# Average occupancy is estimated at 68% for single-family homes

UNIT USAGE ASSUMPTIONS FOR ON-SITE POPULATION PROJECTIONS

| Source of population impact | Percent distribution | Projected occupancy rate | Persons per unit |
|---|---|---|---|
| Completed single-family homes: | | | |
| Full-time residences | 50% | 95% | 2.2 |
| Part-time residences | 50% | 40% | 2.5 |
| Total/ average per unit | 100% | 68% | 1.5 |
| Members' lodge (1) | 100% | 70% | 2.0 |

1) At stabilization.



Exhibit 3-E

# Total daily population could average over 2,110 people

PROJECTED AVERAGE DAILY RESIDENT AND VISITOR POPULATION AT HOKUKANO

| | Project year | | | | Distribution |
|---|---|---|---|---|---|
| | 1997 | 2008 | 2019 | 2029 | (2029) |
| Single-family lot resident households: | | | | | |
| Full-time | 15 | 200 | 390 | 540 | 50% |
| Part-time | 15 | 200 | 390 | 540 | 50% |
| Total households | 30 | 400 | 780 | 1,080 | 100% |
| Daily population: | | | | | |
| Single-family lot residents- | | | | | |
| Full-time | 31 | 420 | 820 | 1,130 | 54% |
| Part-time | 15 | 200 | 390 | 540 | 26% |
| Subtotal, daily residents | 46 | 620 | 1,210 | 1,670 | 79% |
| Hokukano guests/member visitors - | | | | | |
| Club members' lodge | 40 | 110 | 140 | 140 | 7% |
| Direct Hokukano employees (1): | | | | | |
| Construction workers | 180 | 160 | 120 | 120 | 6% |
| Operational employees | 110 | 180 | 180 | 180 | 9% |
| Subtotal, employees | 290 | 340 | 300 | 300 | 14% |
| Total daily population | 376 | 1,070 | 1,650 | 2,110 | 100% |

Based on Exhibits 3-A, 3-B, 3-C and 3-D.
(1) Does not include induced or indirect employment.

**Average daily construction employee population is projected to reach 120 persons by 2029**

As also shown in Exhibit 3-E, on-site construction employment is projected to contribute 180 persons per year by 1997, 160 persons in 2008, 120 in 2019 and 120 in 2029 to the de facto population of Hokukano.

**The operational employee population could amount to 180 persons by 2008**

The operational employee requirements of Hokukano, also shown in Exhibit 3-E, will contribute to the de facto population of the development. Hokukano's operations could require 110 persons per year by 1997, and up to 180 persons per year by 2008.

**Total projected de facto population could reach about 2,110 persons by 2029**

The development at the Hokukano community is projected to generate a total de facto population of about 376 persons in 1997, increasing to 1,070 persons by 2008, 1,650 persons by 2019 and about 2,110 persons by 2029, as shown in Exhibit 3-E.

**In-migrant population to the County could reach 1,530 by 2029**

The in-migrant population to the County as a result of the Hokukano development could include residents of the community as well as construction and operational employees and any dependents who may move with the employees to the Islands as a result of construction opportunities at Hokukano. As presented in Exhibit 3-F, Hokukano residents new to the County could equal 80% of the total project population. This would result in about 37 in-migrant Hokukano residents by 1997, and as many as 1,340 by 2029.

Additional in-migrant residents to the County could include about 35% of all construction employees and about 40% of all operational employees. These persons could be expected to move to the Big Island for employment at Hokukano. Other family members or dependents could be expected to move with these workers, estimated to represent 25% of all in-migrant construction workers and 100% of all in-migrant operational employees.

Total in-migrant population to the County is subsequently expected to reach 200 by 1997, 720 by 2008, 1,160 by 2019 and 1,530 by 2029.

**In-migrant population to the State could reach 1,220 residents by 2029**

The in-migrant population to the State would also include that portion of Hokukano residents, operational employees and their dependents who move to any island in the State from outside of the State, as a result of the project's development. Construction employees required for the development were assumed to be satisfied by the State labor pool.

Residents of the Hokukano community are expected to include new residents to both Hawaii County and the State. The estimated in-migrant residents to the State are based on the on-site resident population assumptions, also shown in Exhibit 3-F. It was assumed that 70% of the project residents would be in-migrant residents to the State, such as retirees. This results in approximately 32 in-migrant residents to the State by 1997 and 1,170 in-migrant residents to the State by the year 2029.



Exhibit 3-F

# About 1,530 and 1,220 new residents could in-migrate to the County and State, respectively

TOTAL PROJECTED IN-MIGRANT RESIDENT POPULATION

| In-migrant type | Assumptions | Project year 1997 | 2008 | 2019 | 2029 | Distribution (2029) |
|---|---|---|---|---|---|---|
| **Hawaii County** | | | | | | |
| Hokukano community residents(1) | 80% of total | 37 | 500 | 970 | 1,340 | 88% |
| Non-site community residents: | | | | | | |
| Temporary- | | | | | | |
| Construction employees(2) | 35% of direct | 60 | 60 | 40 | 40 | 3% |
| Dependents(3) | 25% of above | 20 | 20 | 10 | 10 | 1% |
| Permanent- | | | | | | |
| Operational employees(4) | 40% of direct | 40 | 70 | 70 | 70 | 5% |
| Dependents(5) | 100% of above | 40 | 70 | 70 | 70 | 5% |
| Subtotal | | 160 | 220 | 190 | 190 | 12% |
| Total in-migrant population impact, County | | 200 | 720 | 1,160 | 1,530 | 100% |
| **State of Hawaii** | | | | | | |
| Hokukano community residents(1) | 70% of total | 32 | 430 | 850 | 1,170 | 96% |
| Non-site community residents: | | | | | | |
| Temporary- | | | | | | |
| Construction employees(6) | 0% of direct | 0 | 0 | 0 | 0 | 0% |
| Dependents(3) | 50% of above | 0 | 0 | 0 | 0 | 0% |
| Permanent- | | | | | | |
| Operational employees(6) | 15% of County | 17 | 27 | 27 | 27 | 2% |
| Dependents(5) | 100% of above | 17 | 27 | 27 | 27 | 2% |
| Subtotal | | 34 | 54 | 54 | 54 | 4% |
| Total in-migrant population impact, State | | 70 | 480 | 900 | 1,220 | 100% |

(1) Total daily population from Exhibit 3-E less 20% projected to be resort relocations from other Hawaii County projects or other island residents for the County; and less 30% for the State as a whole, as presented in the market study, Exhibit 6-A.
(2) Total average direct construction employment as shown in Exhibit 3-C.
(3) Assumes 0.25 additional in-migrant(s) for each in-migrant full-time equivalent employee.
(4) Based on direct operational employment as shown in Exhibit 3-E.
(5) Assumes 1.0 additional in-migrant(s) for each in-migrant full-time equivalent employee.
(6) Percentage of those in-migrating to the County who are also in-migrating to the State.

A number of permanent, operational employees and their dependents could also in-migrate to the State. Operational employees migrating to the State could represent about 15% of all direct operational employees, with an estimated one additional dependent for every employee. This could result in about 34 additional non-site residents by 1997 and about 54 by 2008.

Total in-migrant population to the State is subsequently expected to reach 70 by 1997, 480 by 2008, 900 by 2019 and 1,220 by 2029.

**About 140 temporary housing units could be required by construction workers at peak construction levels**

An estimated 90% of all construction workers who normally live off-island may be expected to require temporary housing units while working at Hokukano, with an estimated 1.5 workers per rental unit. This would result in an overall average requirement of 30 temporary housing units per year between mid-1994 through 2029, as presented in Exhibit 3-G.

Required temporary housing units could be significantly higher during peak employment periods, during the years that substantial home, facilities and infrastructure may occur. As also shown in the exhibit, up to 140 rental units per year could be required during these periods.

**About 70 new households could be generated by operational employees of the project**

The project's housing impacts resulting from its operational employment come from two sources:

- New households formed from within the island's existing population. For example, due to the employment opportunities and hence personal income provided by Hokukano, a young person may decide to move out from his or her parents' home and establish a new household.
- Persons moving to the island from elsewhere as a result of employment opportunities at the project. Such persons may be accompanied by other household members or new island households are estimated to represent about 15% of the available island labor force employed as a result of Hokukano.
- New homes would also be required by all in-migrant operational employees, assuming 1.5 workers per household. This would result in demand for 40 additional housing units in 1997, increasing to and stabilizing at demand for about 70 new homes by the year 2008, as shown in Exhibit 3-H.





## Construction workers could require between 30 and 140 temporary housing units

PROJECTED TEMPORARY HOUSING UNITS REQUIRED FOR OFF-ISLAND CONSTRUCTION WORKERS

| | Assumptions | Project year 1994 to 1997 | 1998 to 2008 | 2009 to 2019 | 2020 to 2029 |
|---|---|---|---|---|---|
| **At average annual employment level** | | | | | |
| Average annual employment(1) | | 180 | 160 | 120 | 120 |
| Off-island construction workers(2) | 35% of direct | 60 | 60 | 40 | 40 |
| Workers requiring rental units(3) | 90% of above | 50 | 50 | 40 | 40 |
| Housing units required(4) | 67% of above | 30 | 30 | 30 | 30 |
| **At peak employment level** | | | | | |
| Peak employment(5) | | 450 | 390 | 120 | 120 |
| Off-island construction workers(2) | 50% of peak | 230 | 200 | 60 | 60 |
| Workers requiring rental units(3) | 90% of above | 210 | 180 | 50 | 50 |
| Housing units required(4) | 67% of above | 140 | 120 | 30 | 30 |

(1) From Exhibit 3-C.
(2) Estimate based on 50% of construction workers originating from off-island.
(3) Estimate based on 90% of workers requiring rental units.
(4) Projected at 1.5 construction workers per rental unit.
(5) Estimated based on project timing and development schedule provided by Oceanside 1250 and PBR Hawaii.

*Exhibit 3-H*

70 new households could be generated by operational employees

DIRECT OPERATIONAL HOKUKANO EMPLOYEES PROJECTED TO DEMAND ADDITIONAL HOUSING

| Housing demand source | Assumptions | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|---|
| Direct operational employees(1) | | 110 | 180 | 180 | 180 |
| Employees from island labor force(2) | 60% of direct | 70 | 110 | 110 | 110 |
| New households | 15% of above | 11 | 20 | 20 | 20 |
| In-migrants(3) | 40% of direct | 40 | 70 | 70 | 70 |
| New in-migrant households(4) | 1.5 workers per household | 27 | 47 | 47 | 47 |
| Total new housing demand (rounded) | | 40 | 70 | 70 | 70 |

(1) From Exhibit 3-D.
(2) Island labor force estimated at total operational employees less in-migrant employees (Exhibit 3-F).
(3) As shown in Exhibit 3-F.
(4) Projected at 1.5 employees sharing each household, or less than the surveyed resort employee ratio of 1.7 resort workers per household on the island of Hawaii.





ECONOMIC AND FISCAL IMPACT ASSESSMENT
FOR THE VILLAGES AT HOKUKANO

# 4 - ECONOMIC IMPACTS

The proposed Hokukano community is expected to generate significant positive economic benefits to the County and State. This chapter describes the expected economic impacts of Hokukano in terms of new consumer expenditures and personal income.

## CONSUMER EXPENDITURES

Hokukano would contribute to direct, indirect and induced consumer expenditures in Hawaii. Residents at Hokukano, and Hokukano members and guests who come to Hawaii solely because of Hokukano, would make direct expenditures for recreation-related fees, rentals, and purchases of food and beverages, and other goods and services. These expenditures would, in turn, require those establishments serving direct resident demands to purchase goods and services from other establishments in the State. The latter expenditures are considered indirect expenditures. Induced expenditures are those made by employees and proprietors with income derived from establishments benefiting from these new direct and indirect expenditures.

### Direct consumer expenditures could reach $21.4 million per year by 2029

Additional direct consumer expenditures generated as a result of the Hokukano development include those expenditures incurred by Hokukano members and visitors. These new expenditures are estimated based on the following:

- Projected golf course utilization at Hokukano by club members and guests, as presented in Exhibit 3-A.
- Projected use of the club members' lodge at Hokukano by members and guests, as presented in Exhibit 3-A.
- Projected use of the club members' lodge at Hokukano by non-Hokukano residents who do not live in the state, as presented in Exhibit 3-A.

Based on these factors, direct consumer expenditures could be expected to reach $5.8 million in 1997, $17.8 million in 2008, $21.1 million in 2019 and $21.4 million in 2029, as shown in Exhibit 4-A.

### Indirect and induced additional consumer expenditures are projected to reach $12.7 million by 2029

The Hawaii State DBED 1990 Input/Output model estimates the total economic activity generated in the State by various types of direct expenditures. A ratio of 1.59 per $1 direct visitor-related expenditure was derived from the most recent DBED model. The projected direct expenditures could be expected to generate indirect and induced expenditures throughout the State amounting to about $3.5 million per year by 1997 and increasing to $12.7 million by 2029, in 1992 dollars, as also shown in Exhibit 4-A.



Exhibit 4-A

## Total Hokukano expenditures could reach about $34.0 million

PROJECTED DIRECT, INDIRECT AND INDUCED ANNUAL VISITOR EXPENDITURES ATTRIBUTABLE TO HOKUKANO

(Millions of 1992 dollars)

| Expenditure source | Assumptions | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|---|
| Green fees: | | | | | |
| Average annual Hokukano club member rounds(1) | | 17,600 | 48,000 | 48,000 | 48,000 |
| Subtotal expenditures(2) | $25/ round | $0.44 | $1.20 | $1.20 | $1.20 |
| Average annual Hokukano guest rounds(3) | | 4,400 | 12,000 | 12,000 | 12,000 |
| Subtotal expenditures(2) | $138/ round | $0.61 | $1.66 | $1.66 | $1.66 |
| Membership dues: | | | | | |
| Average annual Hokukano Regular Memberships(1) | | 281 | 861 | 861 | 861 |
| Subtotal expenditures(2) | $4800/ year | $1.35 | $4.13 | $4.13 | $4.13 |
| Average annual Hokukano Limited Play Memberships(3) | | 94 | 287 | 287 | 287 |
| Subtotal expenditures(2) | $1500/ year | $0.14 | $0.43 | $0.43 | $0.43 |
| Average annual Hokukano Lodge Memberships(3) | | 125 | 383 | 383 | 383 |
| Subtotal expenditures | $1000/ year | $0.13 | $0.38 | $0.38 | $0.38 |
| Club members' lodge visitors: | | | | | |
| Average daily members(4) | | 25 | 44 | 43 | 37 |
| Subtotal expenditures(5) | $170/ member/ day | $1.57 | $2.70 | $2.68 | $2.27 |
| Average daily guests(4) | | 15 | 66 | 97 | 103 |
| Subtotal expenditures(5) | $300/ guest/ day | $1.62 | $7.28 | $10.61 | $11.33 |
| Total direct annual expenditures | | $5.84 | $17.78 | $21.09 | $21.40 |
| Indirect and induced expenditures | | 3.45 | 10.51 | 12.46 | 12.65 |
| Total annual expenditures(6) | 159% of direct expenditures | $9.30 | $28.29 | $33.55 | $34.04 |

(1) Based on data shown in Exhibit 3-A, does not account for Kamaaina play.
(2) Based on data presented in market study, Exhibit 7-A.
(3) Based on data shown in Exhibit 3-A, does not account for Kamaiana play.
(4) Based on data shown in Exhibit 3-E.
(5) Based on projected guest mix, accommodation rates, party size, golf play and 1991 average visitor spending; net of golf expenditures. Includes accomodations, food and beverage, retail and other expenditures net of golf.
(6) Projected at $1.59 per one dollar of direct visitor expenditures based on 1990 ratios derived from the DBED Input-Output Model and Hawaii Econometric Model, as published in the "Hawaii State Data Book," 1991.

Source: Hawaii Visitors Bureau, "1991 Visitor Expenditure Survey," 1992.

**Total expenditures are projected to reach $34.0 million per year by 2029**

Direct, indirect and induced expenditures attributable to the use of the community facilities are projected in 1992 dollars to total $9.3 million in 1997, $28.3 million in 2008, $33.6 million in 2019 and $34.0 million per year by 2029.

## PERSONAL INCOME

Hokukano would have an impact on income for residents of the County and State through employee wages, salaries and fringe benefits, as well as through revenue to its proprietors. Personal income, the most direct portion of the project's total income effects, is defined as the wages and salaries paid to the direct construction and operational employees of the development. Personal income is projected on the basis of average industry wages and salaries for the various types of employment anticipated and on the projected future employment demands.

**Total annual personal income from employment is projected to reach $8.6 million in 2029**

Personal income paid to Hawaii residents involved in direct employment at Hokukano could amount to about $9.4 million in 1997 and $10.2 million in 2008, for both construction and operational employment. In the ensuing years, it could stabilize at about $8.6 million per year as construction activity subsides, as shown in Exhibit 4-B. These figures would exclude employee fringe benefits, proprietors' income and the other indirect and induced impacts of such earnings.





# Annual direct personal income from operations could approach $3.9 million in the year 2029

PROJECTED DIRECT PERSONAL INCOME FROM DIRECT EMPLOYMENT ASSOCIATED WITH HOKUKANO

(Millions of 1992 dollars)

| Type of direct employment | Full-time equivalent wages(1) | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|---|
| Personal income(2): | | | | | |
| Construction(3) | $39,100 | $7.04 | $6.26 | $4.69 | $4.69 |
| Operational(4)- | | | | | |
| Golf course | $20,890 | 0.42 | 0.52 | 0.52 | 0.52 |
| Golf clubhouse | $18,880 | 0.38 | 0.47 | 0.47 | 0.47 |
| Club members' lodge | $23,420 | 1.29 | 2.58 | 2.58 | 2.58 |
| Facilities administration | $24,610 | 0.25 | 0.37 | 0.37 | 0.37 |
| Subtotal, operational income | | $2.33 | $3.94 | $3.94 | $3.94 |
| Total annual personal income | | $9.37 | $10.20 | $8.63 | $8.63 |

(1) 1991 salaries adjusted to reflect full-time equivalence based on a 40-hour work week adjusted to 1992 dollars based on an increase of 4.8% in the consumer price index from 1991 to 1992; as reported by the Bank of Hawaii Information Center, 1993. Figures differ from those shown in Exhibit 3-B, because they exclude employee benefits.
(2) For direct employment effects only.
(3) Average Hawaii County wage for category multiplied by average number of construction workers for period as shown in Exhibit 3-B.
(4) Weighted average pay estimated by applying the expected distribution of employment type and the number of employees (Exhibit 3-C) to their respective wages in the following categories: Hotel, rooming houses ($24,330), Amusement and recreation ($20,650), Retail trade ($19,780), Eating & drinking places ($14,620), and Administrative ($25,600).

Source: Department of Labor and Industrial Relations, "Labor Area News," August 1992 and "1991 Employment and Payrolls in Hawaii," September 1992.

Oceanside 1250

ECONOMIC AND FISCAL IMPACT ASSESSMENT
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## 5 - FISCAL IMPACTS

Hokukano is expected to generate significant positive fiscal benefits for both the County and the State. These fiscal impacts have been evaluated by comparing the operating tax revenues and expenditures which are projected to be incurred by the State and County governments.

### GOVERNMENT REVENUES

Development of Hokukano would bring additional tax revenues to the County and State governments. County government revenues would be principally in the form of real property taxes on the new facilities, however, additional County revenue sources would include fuel, utility, motor vehicle and other nongrant taxes. Revenues to the State government would be composed principally of specific excise taxes and personal income taxes paid by new State residents, the general excise taxes and transient accommodations taxes on sales revenues attributable to consumers at the community, and general excise tax revenues from construction spending. The following sections project the additional revenues that could be generated for the County and State governments as a result of the Hokukano development.

**Net new annual property tax revenues to the County are projected to reach $9.6 million by 2029**

Real property in the County is currently taxed from $7.00 to $10.00 per $1,000 of net taxable value depending on the land use class and user status. Owner-occupied improved residential lots are currently taxed at $7.00 per $1,000 of assessed value, while non-owner-occupant improved lots are taxed similar to unimproved lots, at $8.50 per $1,000 of assessed value. Owner-occupant tax exemptions were estimated to average $50,000 for the owner-occupied units. This estimate considers the standard County exemption of $100,000 for owner-occupants 71 years of age and older, $80,000 for those 61 through 70 and $40,000 for those under age 61.

All other land, improved and unimproved, is taxed at $10.00 per assessed value, as are improvements such as the clubhouse and lodge. Net additional real property taxes, for improvements and improved land, were projected according to preliminary construction costs for the Hokukano project.

Based on these tax rates and estimated assessed values, the single-family lots (both improved and unimproved) the golf course, clubhouse, club members' lodge and undeveloped land could be expected to annually generate net new property tax revenues for the County of about $1.7 million by 1997, increasing to about $5.0 million by 2008, $7.5 million in 2019 and $9.6 million by 2029, in 1992 dollars as shown in Exhibit 5-A.

**Total annual revenues to the County are projected to reach $9.9 million by 2029**

Additional revenues to the County from fuel, utility, motor vehicle weight and other collections, are estimated to be $154 per person per year, in 1992 dollars, for both residents who move to the island and visitors.

Adding these additional county revenue sources to the projected net new property taxes noted above, total new taxes to the County as a result of the Hokukano project are thus estimated to reach $1.7 million by 1997, $5.2 million in 2008, $7.7 million in 2019 and $9.9 million by 2029 as shown in Exhibit 5-B.

Exhibit 5-A

# Net new annual property taxes to the County could reach $9.62 million per year

PROJECTED REAL PROPERTY TAX REVENUES TO THE COUNTY GOVERNMENT ATTRIBUTABLE TO HOKUKANO

(Millions of 1992 dollars)

| Source of property tax revenue | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|
| Residential and acreage(1): | | | | |
| Residential(2) | $0.32 | $2.49 | $4.73 | $6.84 |
| Acreage | 0.66 | 1.84 | 2.11 | 2.21 |
| Golf course(4) | 0.23 | 0.23 | 0.23 | 0.23 |
| Clubhouse(5) | 0.07 | 0.06 | 0.06 | 0.06 |
| Club members' lodge (6) | 0.12 | 0.25 | 0.25 | 0.25 |
| Other undeveloped land(7) | 0.30 | 0.18 | 0.12 | 0.06 |
| Total new property tax revenues | $1.70 | $5.06 | $7.49 | $9.63 |
| Less current property taxes(8) | $0.01 | $0.01 | $0.01 | $0.01 |
| Net new property tax revenues | $1.69 | $5.04 | $7.47 | $9.62 |

(1) Based on development of sold lots from Exhibit 3-A.
(2) Based on assessments of $500,000 for improvements and $632,000 for land; an average $50,000 owner occupant tax exemption; and a weighted tax rate of $7.75 per thousand dollars of value reflecting different owner- and non-owner occupant tax rates. Average exemption of $50,000 was estimated based on exemptions of $60,000 for those 60 to 69, $100,000 for those over 70 and a standard exemption of $40,000.
(3) Based on assessments of $632,000 land and a tax rate of $10.00 per thousand dollars of value.
(4) Based on an assessment of $65,000/acre and a tax rate of $10.00 per thousand dollars of value.
(5) Based on a total improvement assessment of $6.3 million and land at $200,000/acre.
(6) Based on improvement assessments of $250,000/unit and land at $200,000/acre.
(7) Includes infrastructure and other undeveloped land; assessed value estimated at $30,000 per acre.
(8) Current property tax is estimated at about $13,000, as reported by Oceanside 1250.

Note 1992 Hawaii County tax rates are $7.00 per $1,000 of assessed value for owner-occupied improved residential land. Non owner-occupied occupied improved land and all improvements receive the same tax rate of $8.50 per $1,000 of assessed value. All other land is taxed at $10.00 per $1,000 of assessed value, while all other improvements are taxed at $8.50 per $1,000 of assessed value.



Exhibit 5-B

# Total new taxes to the County are projected to reach $9.88 million per year

PROJECTED TOTAL NEW TAX COLLECTIONS TO THE COUNTY GOVERNMENT ASSOCIATED WITH HOKUKANO

**Hawaii County per capita non-real property tax collections**

(Millions of 1992 dollars)

| Collection sources | Total collections FY'90 (000's)(1) | Source population(2) | Annual revenue Per resident | Per visitor |
|---|---|---|---|---|
| Liquid fuel | $5,101 | 133,700 | $38 | $38 |
| Utility franchise | 1,900 | 133,700 | 14 | 14 |
| Motor vehicle weight | 2,156 | 133,700 | 16 | 16 |
| Other (non-grant) sources | 9,122 | 133,700 | 68 | 68 |
| Total 1990 dollars | $18,279 | | $137 | $137 |
| Total 1992 dollars, rounded(3) | | | $154 | $154 |

**Total County tax collections associated with Hokukano**

| | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|
| Net new property tax revenues(4) | $1.69 | $5.04 | $7.47 | $9.62 |
| Daily member and guest visitor population(5) | 40 | 110 | 140 | 140 |
| Subtotal, new revenues(6) | $0.01 | $0.02 | $0.02 | $0.02 |
| In-migrant residents(7) | 200 | 720 | 1,160 | 1,530 |
| Subtotal, new revenues(6) | $0.03 | $0.11 | $0.18 | $0.24 |
| Total new County revenues | $1.72 | $5.17 | $7.67 | $9.88 |

(1) County government operating revenues for fiscal year ended June 30, 1990 as reported in Tax Foundation of Hawaii, "Government in Hawaii," 1991.
(2) De facto population estimates for the county as of January 1, 1990.
(3) Adjusted to 1991 dollars based on an increase of 7.2% in the Consumer Price Index between 1990 and 1991, and a 4.8% increase from 1991 to 1992; as reported by Bank of Hawaii Information Center, 1992
(4) From Exhibit 5-A.
(5) From Exhibit 3-C.
(6) Revenues per de facto population multiplied by the increase in County population associated with Hokukano.
(7) Includes Hokukano and non-site residents who moved to the island, as shown in Exhibit 3-F.

**Annual State revenues from Hokukano user spending could reach $2.0 million by 2029**

New revenues for the State government could be generated in the form of general excise and transient accommodations taxes, from members and guests of Hokukano who utilize the golf course and club members' lodge. Additional revenues received from visitors utilizing the lodge could also be generated from expenditures for food and beverage, retail, rentals and entertainment exclusive of golf and lodging. Revenues from these Hokukano users could reach $50,000 by 1997, $1.6 million in 2008, $1.9 million by 2019 and nearly $2.0 million by 2029, as shown in Exhibit 5-C.

**Annual State revenues from construction spending could reach $1.2 million per year by 1997**

New revenues for the State could also be generated by general excise taxes related to construction spending. A .5% tax is charged to contractors on all wholesale construction materials, while a 4% general excise tax is also charged to the developer for materials and labor upon development completion. Annual revenues from direct construction spending could reach $1.2 million from mid-1994 through 1997, $1.0 million from 1998 through 2008, $760,000 from 2009 through 2019 and about $730,000 from 2020 through 2029 as shown in Exhibt 5-D.

Indirect and induced expenditures could also be generated as a result of the construction expenditures associated with Hokukano. Total economic activity generated from construction spending was subsequently estimated based on a ratio of $1.59 per $1 of direct construction expenditures.

Annual revenues from construction spending, including direct, indirect and induced expenditures could reach $1.9 million from 1994 to 1997, $1.6 million per year from 1998 to 2008 and $1.2 million per year from 2009 to 2029, as shown in Exhibit 5-D.

**In-migrant residents could contribute over $10.4 million in annual State revenues by 2029**

In addition to the revenues received from visitor and construction spending, revenues to the State government would also be generated by new residents drawn to the State because of the project. These in-migrant residents would bring in additional excise sales taxes, individual income taxes and other specific State taxes such as liquor, tobacco, fuel, inheritance, estate and conveyance taxes.

In-migrant residents that will reside at Hokukano are estimated to contribute about $8,920 per person, in State revenues, while non-site in-migrant residents are estimated expected to contribute $1,666 per person in 1992 dollars, based on a 1991 report issued by the Tax Foundation of Hawaii. Thus, new tax revenues to the State government attributable to in-migrant residents are expected to be about $350,000 in 1997, $3.9 million in 2008, $7.7 million in 2019 and $10.5 million in 2029, as shown in Exhibit 5-E.



Exhibit 5-C

## Hokukano users could generate about $1.95 million in State revenues

PROJECTED ANNUAL REVENUES TO THE STATE GOVERNMENT ATTRIBUTABLE TO HOKUKANO USERS

(Millions of 1992 dollars)

| Revenue source | Basis per unit | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|---|
| General excise tax on direct Hokukano user spending(1): | | | | | |
| Golf course green and cart fees | | 0.04 | 0.12 | 0.12 | 0.12 |
| Member dues | | 0.06 | 0.19 | 0.19 | 0.19 |
| Club members' lodge (2) | | 0.13 | 0.42 | 0.55 | 0.57 |
| Subtotal | | $0.24 | $0.72 | $0.86 | $0.88 |
| General excise tax on indirect and induced visitor spending(1) | | $0.14 | $0.44 | $0.52 | $0.53 |
| Transient accommodations tax(3): | | | | | |
| Club members' lodge | | | | | |
| Members | $225 per room | 0.05 | 0.09 | 0.09 | 0.08 |
| Guests | $475 per room | 0.07 | 0.30 | 0.44 | 0.47 |
| Subtotal | | $0.12 | $0.40 | $0.53 | $0.55 |
| Total revenues | | $0.50 | $1.56 | $1.92 | $1.95 |

(1) Based on a general excise tax of 4.167%. Direct, indirect and induced spending as shown in Exhibit 4-A
(2) Includes food and beverage, retail, rentals, entertainment and other expenditures net of golf and lodging.
(3) Based on a transient accommodations tax of 5.25% on estimated visitor rental revenues.

Exhibit 5-D

# Construction at Hokukano could generate $1.16 million in annual State revenue

PROJECTED AVERAGE ANNUAL REVENUES TO THE STATE GOVERNMENT FROM CONSTRUCTION SPENDING

(Millions of 1992 dollars)

| Source of property tax revenue | Average annual construction revenues 1994 to 1997 | 1998 to 2008 | 2009 to 2019 | 2020 to 2029 |
|---|---|---|---|---|
| General excise tax on direct construction spending (1) | | | | |
| Sold single-family lots: | | | | |
| Improved lots | $0.17 | $0.69 | $0.66 | $0.62 |
| Unimproved lots | $0.18 | $0.13 | $0.08 | $0.07 |
| Golf course | 0.28 | 0.00 | 0.00 | 0.00 |
| Clubhouse | 0.08 | 0.00 | 0.00 | 0.00 |
| Club members' lodge | 0.16 | 0.05 | 0.00 | 0.00 |
| Infrastructure | 0.33 | 0.11 | 0.03 | 0.03 |
| Subtotal | $1.20 | $0.98 | $0.76 | $0.73 |
| General excise tax on indirect and induced spending (2) | $0.71 | $0.58 | $0.45 | $0.43 |
| Total annual general excise tax on construction spending (3) | $1.90 | $1.56 | $1.21 | $1.16 |

(1) Based on wholesale construction material tax of 0.5% charged to contractors for materials (assumed to be 40% of construction costs) and an additional 4.167% general excise tax charged to the developer (including total construction costs).
(2) Projected at $1.50 per one dollar of construction spending.
(3) Refers to annual revenue.



Exhibit 5-E

# New State revenues are projected to reach $14 million annually

PROJECTED TOTAL ANNUAL REVENUES TO THE STATE GOVERNMENT ATTRIBUTABLE TO HOKUKANO MEMBER/GUEST VISITORS, RESIDENTS AND EMPLOYEES

(Millions of 1992 dollars)

| Revenue source | Basis per unit | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|---|
| GET and TAT from member/guest visitors(1) | | $0.50 | $1.56 | $1.92 | $1.95 |
| GET from construction spending (2) | | $1.90 | $1.56 | $1.21 | $1.16 |
| In-migrant residents: | | | | | |
| On-site- | | | | | |
| Number of persons(3) | | 32 | 430 | 850 | 1,170 |
| State tax revenues(4) | $8,920 per person | $0.29 | $3.84 | $7.58 | $10.44 |
| Non-site- | | | | | |
| Number of persons(3) | | 34 | 54 | 54 | 54 |
| State tax revenues(5) | $1,666 per person | $0.06 | $0.09 | $0.09 | $0.09 |
| Subtotal resident revenues | | $0.35 | $3.93 | $7.67 | $10.53 |
| Total state revenues | | $2.75 | $7.04 | $10.80 | $13.64 |

(1) As shown in Exhibit 5-C.
(2) As shown in Exhibit 5-D.
(3) From Exhibit 3-F.
(4) Includes state income, general excise, employment and specific excise taxes; based on typical tax burdens for households with incomes of $100,000+ for on-site residents; Tax Foundation of Hawaii, "The Arnica Aloha Family," 1991, adjusted to 1992 dollars.
(5) Includes state income, general excise, auto weight, gas and specific excise taxes; based on typical tax burdens for households earning the median 1992 income of $46,000 (HUD), based on marginal state income tax rates, and ratio of income to other state taxes paid as shown for "The Tax Burden of The Arnica Aloha Family," by the Tax Foundation of Hawaii.

**Total State revenues are projected to reach $14.0 million by 2029**

Considering all the sources identified above, total new revenues to the State attributed to the Hokukano project could reach about $2.8 million by 1997, $7.0 million by 2008, $10.8 million by 2019 and $13.6 million by 2029, as also shown in Exhibit 5-E.

## GOVERNMENT OPERATING EXPENDITURES

New residents attracted to the County and State by Hokukano would also necessitate additional expenditures of State and County public resources. In-migrant residents would require additional public expenditures for public safety, maintenance of highways, recreational facilities and natural resources, health and sanitation measures, special cash capital improvements, education, retirement and pension funds, public welfare and other government functions.

**New County expenditures are projected to reach $1.2 million by 2029**

The various County government operating expenditures for fiscal year 1990 were analyzed with respect to the relevant population served by each of the government functions. This analysis indicates that Hawaii County government expenditures in 1990 totaled about $661 per resident and $455 per visitor, as shown in Exhibit 5-F. A 7.2% annual increase, equal to the rise in the Honolulu Consumer Price Index (CPI) between 1990 and 1991 and a 4.8% increase, equal to the rise in the Honolulu CPI between 1991 and 1992 are applied to estimate per capita expenditures in 1992 dollars of about $740 for residents and $510 for visitors.

Based on these County government outlays, annual public expenditures by the County on behalf of the added population of Hokukano, could be expected to total about $170,000 in 1997, and increase to about $1.2 million by 2029, in 1992 dollars, as shown in Exhibit 5-G. These expenditures were based on the projected total in-migrant residents to the County attributable to Hokukano's development.

**State expenditures could reach $4.9 million by 2029**

A similar analysis of State government operating expenditures and the relevant populations for the various government services indicates that expenditures in 1990 totaled about $3,467 per resident, and $1,087 for visitors as shown in Exhibit 5-H. This is equivalent to about $3,900 per resident, and $1,220 per visitor when adjusted to 1992 dollars.

Based on these operating costs, annual State government expenditures are projected to total about $310,000 by 1997 and increase to about $4.9 million per year by 2029, as shown in Exhibit 5-I. These expenditures are based on the projected total in-migrant residents to the State.



Exhibit 5-F

# Hawaii County per capita expenditures are $740 and $510 for residents and visitors, respectively

COUNTY OF HAWAII PER CAPITA GOVERNMENT EXPENDITURES

(Fiscal Years 1990 and 1991)

| Function | Total expenditures FY'90 (000's)(1) | Service population(2) | Annual expenditure Per resident | Annual expenditure Per visitor |
|---|---|---|---|---|
| General government | $12,649 | 119,300 | $106 | -- |
| Public safety | 36,100 | 133,700 | 270 | 270 |
| Highways | 6,009 | 133,700 | 45 | 45 |
| Health and sanitation | 4,851 | 133,700 | 36 | 36 |
| Public welfare and schools | 3,555 | 119,300 | 30 | -- |
| Recreation | 7,219 | 133,700 | 54 | 54 |
| Interest | 5,083 | 133,700 | 38 | 38 |
| Bond redemption | 3,022 | 119,300 | -- | -- |
| Retirement and pension | 5,969 | 119,300 | 50 | -- |
| Mass transit | 490 | 133,700 | 4 | 4 |
| Cash capital improvements | 1,067 | 133,700 | 8 | 8 |
| Miscellaneous | 2,457 | 119,300 | 21 | - |
| Total 1990 dollars | $88,472 | | $661 | $455 |
| Total 1992 dollars, rounded(3) | | | $740 | $510 |

(1) Hawaii County government operating expenditures for fiscal year ended June 30, 1990 as reported in Tax Foundation of Hawaii, "Government in Hawaii," 1991.
(2) Resident or de facto population estimates for the County as of January 1, 1990.
(3) Adjusted to 1991 dollars based on an increase of 7.2% and 4.8% in the Consumer Price Index between 1990 and 1991 and 1991 and 1992, respectively, as reported by Bank of Hawaii Information Center, 1992.

Exhibit 5-G

# Total new County expenditures are estimated at $1.2 million

PROJECTED ANNUAL COUNTY GOVERNMENT EXPENDITURES ASSOCIATED WITH HOKUKANO

(Millions of 1992 dollars)

| Population and expenditure type | Basis per unit | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|---|
| New service population (average annual persons)(1): | | | | | |
| Average daily member/guest visitors(2) | | 40 | 110 | 140 | 140 |
| Hokukano residents | | 37 | 500 | 970 | 1,340 |
| In-migrant employees & dependents(3) | | 160 | 220 | 190 | 190 |
| Total | | 237 | 830 | 1,300 | 1,670 |
| Expenditures(4): | | | | | |
| Member and guest visitors | $510 per visitor | $0.02 | $0.06 | $0.07 | $0.07 |
| Hokukano residents | $740 per resident | 0.03 | 0.37 | 0.72 | 0.99 |
| In-migrant employees & dependents | $740 per resident | 0.12 | 0.16 | 0.14 | 0.14 |
| Total expenditures | | $0.17 | $0.59 | $0.93 | $1.20 |

(1) As shown in Exhibits 3-C and 3-F.
(2) Based on 100% of projected average daily member/guest visitors.
(3) Including temporary and permanent employees.
(4) Based on per capita expenditures, as shown in Exhibit 5-F.



Exhibit 5-H

# State of Hawaii per capita expenditures are$3,900 and $1,220 for residents and visitors, respectively

STATE OF HAWAII PER CAPITA GOVERNMENT EXPENDITURES

(Fiscal Years 1990 and 1991)

| Function | Total expenditures FY'90 (000's)(1) | Service population(2) | Annual expenditure Per resident | Per visitor |
|---|---|---|---|---|
| General government | $331,006 | 1,102,900 | $300 | -- |
| Public safety | 131,690 | 1,241,400 | 106 | 106 |
| Highways | 79,841 | 1,241,400 | 64 | 64 |
| Natural resources | 45,750 | 1,241,400 | 37 | 37 |
| Health and sanitation | 186,317 | 1,241,400 | 150 | 150 |
| Hospitals and institutions | 167,947 | 1,102,900 | 152 | -- |
| Public welfare | 474,659 | 1,102,900 | 430 | -- |
| Education | 1,122,513 | 1,102,900 | 1,018 | -- |
| Recreation | 43,951 | 1,241,400 | 35 | 35 |
| Utilities and other enterprises | 212,062 | 1,241,400 | 171 | 171 |
| Debt service | 272,820 | 1,241,400 | 220 | 220 |
| Retirement and pension | 71,300 | 1,102,900 | 65 | -- |
| Employees' health insurance | 1,013 | 1,102,900 | 1 | -- |
| Unemployment compensation | 47,846 | 1,102,900 | 43 | -- |
| Grants-in-aid to counties | 73,472 | 1,241,400 | 59 | 59 |
| Urban redevelopment and housing | 321,005 | 1,102,900 | 291 | -- |
| Cash capital improvements | 303,834 | 1,241,400 | 245 | 245 |
| Miscellaneous | 87,479 | 1,102,900 | 79 | -- |
| Total 1990 dollars | $3,974,505 | | $3,467 | $1,087 |
| Total 1992 dollars, rounded(3) | | | $3,900 | $1,220 |

(1) State government operating expenditures for fiscal year ended June 30, 1990 as reported in Tax Foundation of Hawaii, "Government in Hawaii," 1991.
(2) Resident or de facto population estimates for the State as of January 1, 1990.
(3) Adjusted to 1991 dollars based on an increase of 7.2% in the Consumer Price Index between 1990 and 1991 and a 4.8% increase between 1991 and 1992; as reported by Bank of Hawaii Information Center, 1992.

Exhibit 5-I

## Total new State expenditures are estimated at $4.9 million annually

PROJECTED ANNUAL STATE GOVERNMENT EXPENDITURES ASSOCIATED WITH HOKUKANO

(Millions of 1992 dollars)

| Population and expenditure type | Basis per unit | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|---|
| New service population (average annual persons)(1): | | | | | |
| Average daily member/guest visitors(2) | | 40 | 110 | 140 | 140 |
| Community residents | | 32 | 430 | 850 | 1,170 |
| In-migrant employees & dependents(3) | | 34 | 54 | 54 | 54 |
| Total | | 106 | 594 | 1,044 | 1,364 |
| Expenditures(4): | | | | | |
| Member/guest visitors | $1,220 per visitor | $0.05 | $0.13 | $0.17 | $0.17 |
| Community residents | $3,900 per resident | 0.13 | 1.68 | 3.32 | 4.56 |
| In-migrant employees & dependents | $3,900 per resident | 0.13 | 0.21 | 0.21 | 0.21 |
| Total expenditures | | $0.31 | $2.02 | $3.70 | $4.94 |

(1) As shown in Exhibits 3-E and 3-F.
(2) Based on 100% of projected average daily member/guest visitors.
(3) Including temporary and permanent employees.
(4) Based on per capita expenditures, as shown in Exhibit 5-H.



Exhibit 5-J

## Net new annual revenues to the County associated with Hokukano are projected at over $8.7 million annually

SUMMARY OF COUNTY GOVERNMENT REVENUE AND EXPENDITURES ASSOCIATED WITH HOKUKANO

(Millions of 1992 dollars)

| | Project year 1997 | 2008 | 2019 | 2029 |
|---|---|---|---|---|
| New revenues(1) | $1.72 | $5.17 | $7.67 | $9.88 |
| New expenditures(2) | 0.17 | 0.59 | 0.93 | 1.20 |
| Net additional revenues | $1.56 | $4.58 | $6.74 | $8.67 |
| Revenue/expenditure ratio(3) | 10.4 | 8.8 | 8.3 | 8.2 |

(1) As shown in Exhibit 5-B.
(2) As shown in Exhibit 5-G.
(3) New revenues divided by new expenditures.

## REVENUE AND EXPENDITURE ANALYSIS

The net fiscal impacts of the planned development to the County and State operating budgets are estimated by comparison of the projected operating revenues and expenditures.

### Net additional revenues to the County could reach $8.7 million by 2029

Comparison of projected public revenues and expenditures attributable to the project's development indicates that the County government could expect to net about $1.6 million dollars per year by 1997, $4.6 million by 2008, $6.7 million by 2019, and $8.7 million per year by 2029 as shown in Exhibit 5-J. The analysis also indicates that additional County government revenues generated by the proposed community and its facilities could be about 10.4 times the operating expenditures incurred by the County government in initial years and about 8.2 at the end of the projection period, as also shown in the exhibit.

### Net additional revenues to the State could reach $8.7 million by 2029

Based on a similar analysis, the State is also expected to realize net additional revenues as a result of Hokukano's development. In 1997, State revenues are projected to exceed expenditures by $2.5 million per year, while by 2029 revenues are projected to exceed expenditures by $8.7 million per year, as shown in Exhibit 5-K. Thus, State government revenues generated by the development could be 8.9 times the expenditures incurred by the State government in 1997, and about 2.8 by 2029, as also shown in the exhibit.



Exhibit 5-K

## Net new annual revenues to the State associated with Hokukano are estimated at about $8.7 million

SUMMARY OF STATE GOVERNMENT REVENUE AND EXPENDITURES ASSOCIATED WITH HOKUKANO

(Millions of 1992 dollars)

| | Project year | | | |
|---|---|---|---|---|
| | 1997 | 2008 | 2019 | 2029 |
| New revenues(1) | $2.75 | $7.04 | $10.80 | $13.64 |
| New expenditures(2) | 0.31 | 2.02 | 3.70 | 4.94 |
| Net additional revenues | $2.45 | $5.02 | $7.11 | $8.69 |
| Revenue/expenditure ratio(3) | 8.9 | 3.5 | 2.9 | 2.8 |

(1) As shown in Exhibit 5-E.
(2) As shown in Exhibit 5-I.
(3) New revenues divided by new expenditures.

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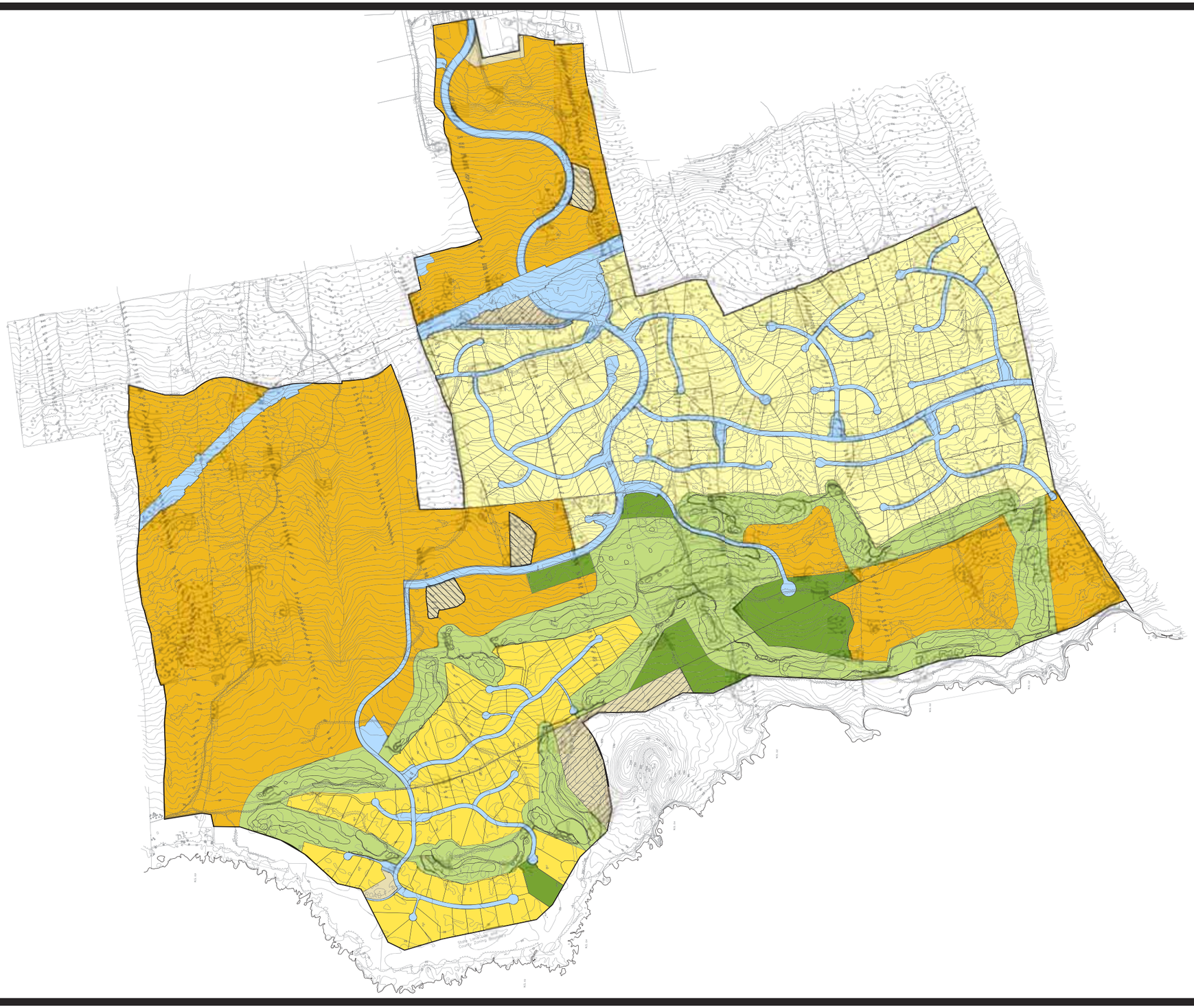
# PETITIONER'S
# EXHIBIT 7



**LEGEND**

- Golf Course
- Golf Club Support
- Open Space
- Open Space (Agricultural Preserves)
- Open Space (Cultural Preserves)
- Subdivision (Ph. 1)
- Subdivision (Ph. 2)
- Future Phases
- Infrastructure

Note: Although the Old Government Road, Stepping Stone Trail, and Old Cart Road are excluded from the Petition, they function as public access routes within and through the Petition Area. See Petitioner's Exhibit 1 for their respective alignments.

Belt Collins

NORTH

0 400 800 1200
SCALE IN FEET

**PETITIONER'S EXHIBIT 7**
**THE PETITION AREA DEVELOPMENT PLAN**

HŌKŪLIA

1250 Oceanside Partners
October 11, 2006

# PETITIONER'S
# EXHIBIT 8

## COMPARISION OF CURRENT PROJECT TO 1993 FINAL EIS

| Development Plan Presented in 1993 Final EIS | Present Petition Area Development Plan |
|---|---|
| 1,540 acres | 1,434 acres |
| 27-hole Golf Course | 18-hole Golf Course |
| Practice Range | Practice Range |
| Clubhouse (approx. 21,000 sf) including pro shop, grill, bar, locker rooms, cart storage and staging. | A Pavilion featuring a restaurant, and a separate golf shop, have already been built and are presently functioning as the clubhouse. |
| Maintenance Center | Maintenance Center |
| 100-unit Members' Lodge including accommodation for hospitality, reception, dining, swimming pool, administrative and service areas, tennis center, two tennis courts and pro shop. | No Lodge. Golf Club Member's Facilities (distributed throughout the Petition Area) including a restaurant, spa, swimming pool, tennis club, and new club house. |
| 1,440 single-family residential and residential/agricultural lots | 665 lots |
| Shoreline access with parking and hiking trails | Shoreline access with parking and hiking trails |
| Historic Park | Historic Park abuts Petition Area; two cultural preserves within Petition Area |
| Trail System | Trail System |
| Related Infrastructure | Related Infrastructure (roadways and ancillary infrastructure including water lines, sewer lines and utilities have already been developed) |
| Potable Water Transmission System | Potable Water Transmission System |
| Non-Potable Water Transmission System (irrigation purposes). | Non-Potable Water Transmission System (irrigation purposes). |
| Open Space | Open Space including 3 Agricultural Preserves |
| Wastewater Treatment Plant (1.9 MGD capacity) | Wastewater Treatment Plant (400,000 GPD capacity) |

**PETITIONER'S EXHIBIT 8**

# PETITIONER'S
# EXHIBIT 9

**1250 Oceanside Partners**
Consolidated Balance Sheet
August 31, 2006
(UNAUDITED)

| | |
|---|---|
| **Assets** | |
| Cash and cash equivalents | $531,400 |
| Notes receivable | 25,802,949 |
| Interest receivable | 4,129,702 |
| Inventories | 124,131 |
| Prepaid expenses | 511,216 |
| Real estate held for development and sale | 178,262,977 |
| Club amenities | 64,977,795 |
| Furniture, fixtures and equipment | 2,708,486 |
| Accumulated depreciation | (8,431,632) |
| Other assets | 696,755 |
| **Total assets** | **$269,313,779** |
| | |
| **Liabilities and partners' deficit** | |
| Accounts payable and accrued liabilities | $8,032,760 |
| Interest payable | 21,275,493 |
| Notes payable | 188,446,656 |
| Buyers' deposits | 60,362,830 |
| Deferred profit | 12,926,856 |
| Membership deposits | 37,200,000 |
| Partners' deficit | (58,930,816) |
| **Total liabilities and partners' deficit** | **$269,313,779** |

**PETITIONER'S EXHIBIT 9**

**1250 Oceanside Partners**
Consolidated Income Statement
Eight Months Ended August 31, 2006
(UNAUDITED)

| | |
|---|---|
| **Revenues** | |
| Interest income | $1,548,343 |
| | |
| **Expenses** | |
| Selling, general and administrative | $8,529,711 |
| Club operations, net | 3,791,384 |
| Depreciation and amortization | 1,059,745 |
| Interest incurred | 9,838,155 |
| | **23,218,995** |
| **Net loss** | **($21,670,652)** |

# PETITIONER'S
# EXHIBIT 10

**October 13, 2006**

## NOTIFICATION OF PETITION FILING

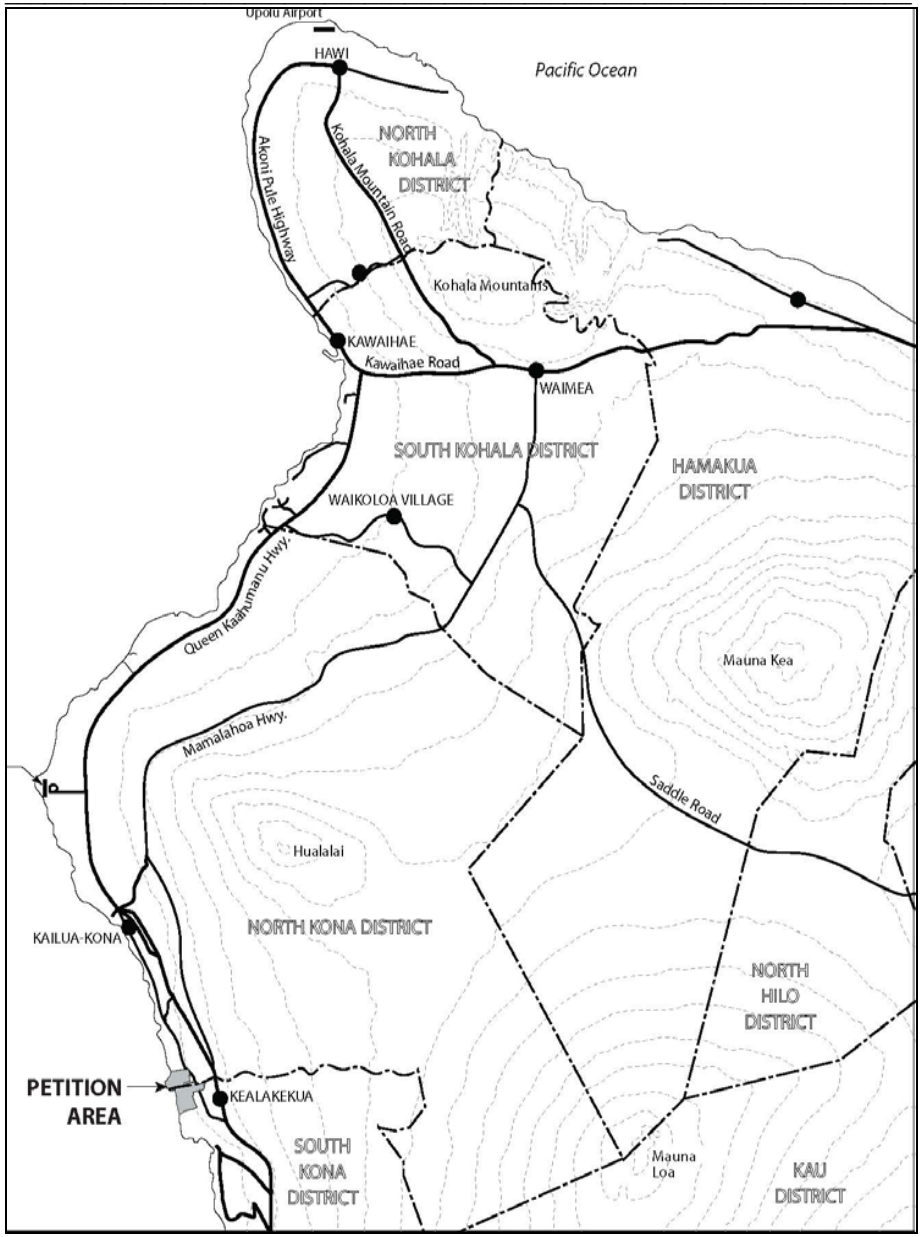
This is to advise you that a petition to amend the State Land Use District Boundaries with the following general information has been submitted to the State Land Use Commission:

| | |
|---|---|
| Docket No.: | A06-769 |
| Petitioner's Address: | 1250 Oceanside Partners<br>78-6831 Ali`i Drive, Suite K-15<br>Kailua-Kona, Hawai`i 96740 |
| Landowner: | 1250 Oceanside Partners, et al. |
| Tax Map Key Nos.: | (3) 7-9-12:04, 06, 11, 29, 34 (por.)<br>(3) 8-1-04:03, 56, 59-62, 64, 65, 68, 70 (por.), 71<br>(3) 8-1-26:01-57<br>(3) 8-1-27:01-44<br>(3) 8-1-28:01-47<br>(3) 8-1-29:01-63<br>(3) 8-1-30:01-53<br>(3) 8-1-32:01-54<br>(3) 8-1-33:01-20<br>(3) 8-1-34:01-25 |
| Land Area: | Approximately 1,434.755 acres |
| Location: | North & South Kona, Island, County & State of Hawai`i |
| Request: | Reclassification from Agricultural to Rural & Conservation |
| Proposed Use: | Low density rural community and related amenities |
| Date Submitted: | October 11, 2006 |

You may review detailed information regarding the petition at the Land Use Commission office (located at 235 South Beretania Street, Rm. 406; Honolulu, HI) or the County of Hawai`i Planning Department (located at 101 Pauahi Street, Hilo, HI). The hours for both offices are 7:30 a.m. to 4:30 p.m., Monday through Friday.

A hearing on this petition will be scheduled at a future date. If you are interested in participating in the hearing as a public witness, please write or call the Land Use Commission office at P.O. Box 2359; Honolulu, HI 96804-2359; telephone: (808) 587-3822.

If you intend to participate in the hearing as an intervenor, you should file a notice of intent to intervene with the Commission within 30 days of receiving this notice, pursuant to Title 15, Subtitle 3, Chapter 15, Section 15-15-52, Hawai`i Administrative Rules. Please contact the Commission office for further information.




**PETITIONER'S EXHIBIT 10**