State of Hawaii
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

FILE COPY

HAWAIIAN RIVIERA RESORT

KAHUKU, KA'U, HAWAII

Final Environmental Impact Statement

December 1987

COPY

PLANNING DEPARTMENT
25 AUPUNI STREET

COUNTY OF HAWAII
HILO, HAWAII 96720

'88 FEB 22 A11:19

February 19, 1988

Mr. James R. Bell, President
Belt Collins & Associates
605 Coral Street
Honolulu, HI 96813

FILE COPY

Dear Mr. Bell:

Final EIS - Hawaiian Riviera Resort
Determination of Acceptability

We have reviewed the final EIS for the proposed Hawaiian Riviera Resort development.

Chapter 343, HRS, requirements were triggered by the filing of a petition to amend the County General Plan by listing the Kahuku site as a Major Resort area and to change the LUPAG Map from Conservation Extensive Agricultural and Open Area to Resort, Medium Density and Low Density Urban, Industrial, and Open Area designations.

It should be noted that the Final EIS is to serve as an informational document for a General Plan amendment. Since the development plans at this stage are conceptual and specific site plans have not yet been determined, evaluation of the impacts were made at the General Plan level of review.

We have determined the Final EIS to be acceptable as we find that said document has satisfied the following criteria:

1. Procedures for assessment, consultation, review and revisions required for the EIS have been complied with;

2. Content requirements for a Final EIS have been satisfied; and

3. Comments submitted during the review process have been responded to satisfactorily and have been incorporated or appended to the EIS.

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OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 Vineyard Street, Suite 702
Honolulu, Hawaii 96813

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QUALITY CONTROL

HAWAIIAN RIVIERA RESORT

KAHUKU, KA'U, HAWAII

Final Environmental Impact Statement

December 1987

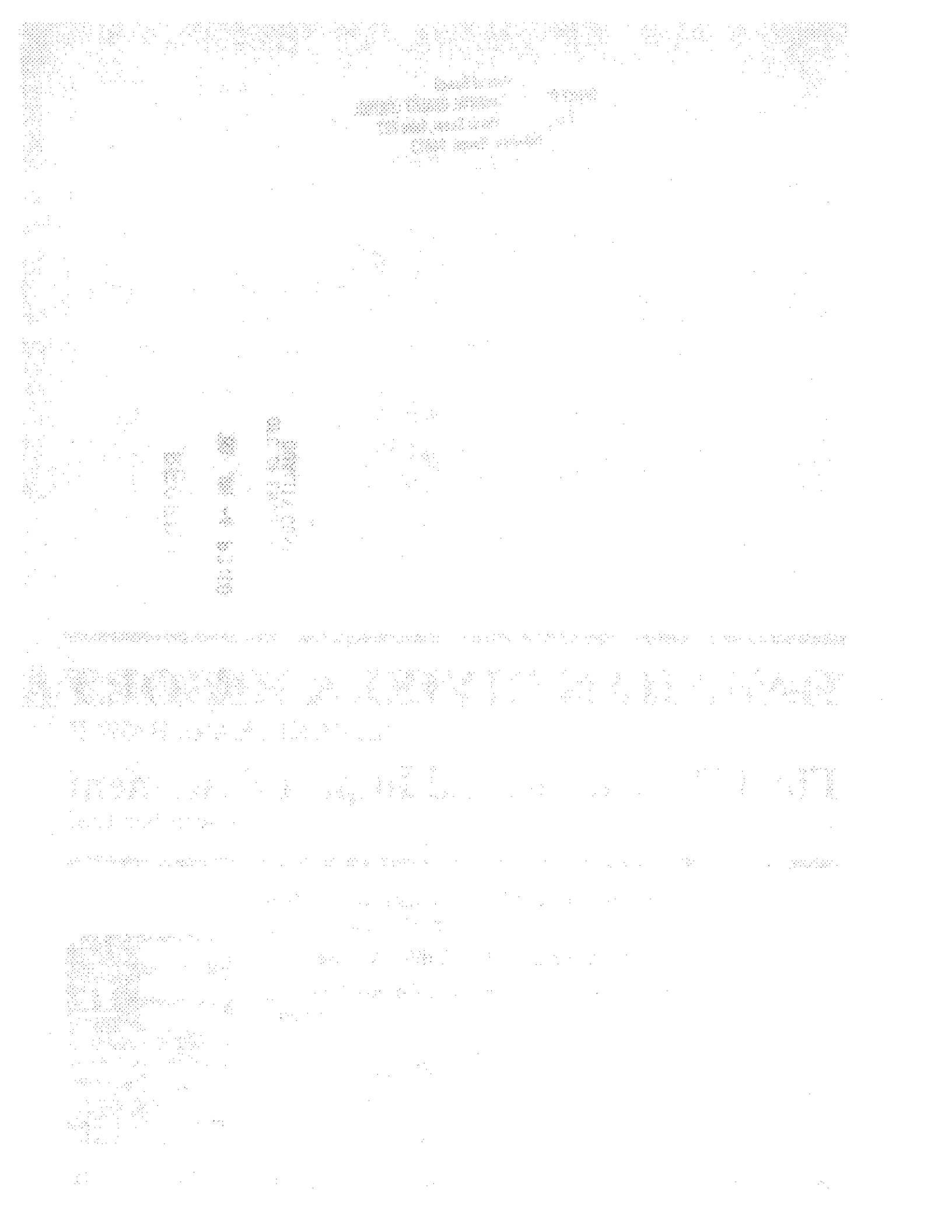
Prepared for: Palace Development Corporation
Hawaii Ka'u Aina Partnership

Prepared by: Belt Collins & Associates

For Submission to: Hawaii County Planning Department

Submitted by: _____

James R. Bell, President
Belt Collins & Associates
Honolulu, Hawaii



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CHAPTER I

INTRODUCTION AND SUMMARY

1. PURPOSE OF THIS DOCUMENT

This environmental impact statement has been prepared to accompany a General Plan amendment for the designation of a Resort Residential Community at Kahuku, Ka'u, Hawai'i and to change the Land Use Pattern Allocation Guide (LUPAG) Map from the existing designation of Conservation to Major Resort for the resort portion, and from Extensive Agriculture to Medium Density, Low Density, Industrial and Open Space for other components of the resort. This document is submitted jointly by the landowners, Palace Development Corporation and Hawaii Ka'u Aina Partners. It has been prepared in compliance with requirements of Chapter 343, Hawaii Revised Statutes and related regulations.

2. PROPOSED GOVERNMENTAL ACTION

The property owners are requesting that approval be granted for the above application. During the processing of the General Plan Amendment, or upon approval of the amendment, the applicants will petition the State Land Use Commission for a Boundary Amendment from Conservation District to Urban District for the Resort portion of the project and from Agriculture District to Urban District for the Airport and Support Community portions of the project.

3. PROJECT SUMMARY

The project is proposed for designation on the County General Plan as a major resort destination community called the Hawaiian Riviera Resort. The proposed project consists of three separate but integrated development sites: 1) an extensive visitor destination area consisting of two distinct components; the Hawaiian Palace Resort, and the Hawaii Ka'u Aina Resort; 2) a support community; and 3) a regional airport. The combined resort area is situated on 2,344 acres along the coast, extending southeast from Humuhumu Point to an area just east of Kahakahakea Point, and northeast to approximately the 200-foot elevation contour. The 800-acre support community, located in the northeastern corner of the property, borders the Mamalahoa Highway, about five miles upslope from the resort area. The 100-acre regional airport is situated along the proposed entrance road, about two miles south of Mamalahoa Highway and approximately three miles north of the resort area. Together, these three development sites total 3,244 acres. The remaining 17,372 acres of the total property are not being proposed for development and remain in their current land use designations.

The Hawaiian Riviera Resort is proposed as a major visitor destination area and employment center for the Ka'u District. The project is intended to be a self-contained resort/residential community. The 2,344 acre resort component will be mostly a low-density, low intensity development set within a leisure retreat environment. The Hawaiian Palace Resort will contain at buildout, a total of 1,500 visitor units, including 900 hotel rooms distributed between two hotels, 375 Luxury Villa apartments, 225 garden apartments, and 727 residential units. The Hawaii Ka'u Aina Resort will contain 1,500 visitor units and 200 residential units. The Ka'u Aina Resort's three hotels total 1,200 rooms, with the remaining 300 visitor units planned as 200 multi-family condominium units and 100 detached units.

The topography and relative location of the Hawaiian Riviera Resort to the public highway and neighboring properties distinguishes it from any other Hawaii resort area. The coastal resort portion of the project enjoys more than a 200-foot elevation variance, thereby permitting

spectacular ocean vistas from all portions of the resort. This in turn enables the development of lower-profile, lower density resort structures, masterplanned to compliment existing terrain. At the same time, the 1,700+ foot difference in elevation between the resort and the public highway, support community and neighboring residential areas ensures that panoramas from these areas will not be affected. The visitor's "entry descent" across barren expanses of lava to the lush "oasis" of the resort area will present an unparalleled sense of arrival.

The Pohue Bay area of the Hawaii Ka'u Aina resort will provide a relatively low density core area surrounded by a visitor setting somewhat similar in density and atmosphere to the Kona Village Resort in North Kona. This portion of the resort will be intended to focus upon the unique natural and archaeological features of the area, while adapting to the existing terrain. A Petroglyph Park and Cultural Center are planned for the enjoyment of resort guests, day visitors, and area residents.

More concentrated development will occur at the Humuhumu Point end of the Palace Resort property with a resort and residential community, and an extensive commercial area around a proposed 400-slip marina. The region-serving airport is intended to provide air access to the resort area in particular and to the Ka'u district in general. This facility, as well as a proposed cruise ship docking facility, will help to reduce the impacts of the resort upon the existing highway by providing alternate means of transportation to the resort.

The support community will serve as a location for housing for the resort employees and will also be the site of region-serving commercial and public facilities, including a school, police/fire station, and a civic center. A medical facility is also planned to be located within the Hawaiian Palace Resort. Finally, a variety of recreational amenities will be provided at the Hawaiian Riviera Resort, including three 18-hole golf courses, an equestrian facility, a boat launch, and extensive park and shoreline openspace areas.

Construction of the marina, three of the five hotels (containing 1,500 units, or half of the total 3,000 proposed visitor units), recreational amenities, and associated facilities is expected to begin in mid-1990 and be completed by mid-1992. The additional visitor and residential units will be built according to market demand over a 15-year period following the opening of the resort.

4. NEED FOR PROJECT

A major concern among residents of the Ka'u region is the need for increased employment and business opportunites. The proposed resort project will be able to address this need by providing as many as 1,600 jobs on-site at the opening of the first phase in the early 1990's, as well as many additional off-site jobs in the Ka'u region and around Hawaii County.

Access to the coastal areas of Ka'u is presently limited by landownership patterns and exceedingly rugged terraine. There are very few public accessways to coastal areas and few public parks. The proposed resort will open an extensive coastal area that is quite popular with resident fishermen, and will provide public access to parks, a large campground, marina facilities and historical and cultural resources.

Fishing is both a commercial enterprise and recreational activity in the Ka'u region. In addition to the lack of adequate coastal access for fishermen, public boat ramps now serving the district tend to be overcrowded and not easily accessible. It has been long recognized that the district is in great need of a harbor facility to serve the communities' needs. The Hawaiian Riviera Resort will address this problem by developing a 400-slip marina which will accommodate the moorage needs of visitors and area residents. A public boat launching ramp will also be developed

separately from the marina. The Hawaiian Riviera marina will provide the only sheltered mooring area between Hilo and Honokahau.

Presently, residents of Ka'u who are not employed in agricultural occupations must commute relatively long distances to their jobs and many former residents have been forced to relocate out of the district to seek employment. The development of a Support Community at the resort is proposed to help meet the housing needs of employees and reduce commuting time. The support community will also contain public facilities such as a fire/police station and a school which will benefit the residents of surrounding areas.

Medical care is not readily available in the Ka'u region. Major health facilities are located in Hilo and Kailua, more than an hour's drive from the district. Elderly residents in particular have expressed the need for emergency facilities in their community. As part of the development plan, an emergency medical facility is proposed for the resort area and will be available to residents and visitors alike.

Visitors to Hawaii County arrive at two points, Hilo and Kailua Kona. The project site is approximately midway between these two airports and it may, therefore, be assumed that automobile traffic by inbound visitors to the resort will be from both sides of the island. At present, access to the Ka'u area is by a single highway. Therefore, in order to provide alternative transportation opportunities for visitors and area residents, the Hawaiian Riviera Resort intends to develop a region-serving airport and a cruise ship docking facility on its property.

Although extensive areas of Ka'u have been subdivided for residential development, the lack of public utilities, and especially water, has constrained growth. The proposed resort will develop wells to serve the needs of its visitors and project residents. To the extent that water supply produced by these wells exceeds the needs of the resort and support community, it is intended that excess supply will be made available for use by neighboring residential areas.

In sum, the development of the Hawaiian Riviera Resort will address many of the most fundamental needs of Ka'u's residents, including employment, expanded services and facilities, public access to the shoreline, new recreational opportunities, and alternative means of transportation.

5. SUMMARY OF IMPACTS AND MITIGATION MEASURES

The potential for significant environmental effects and social impacts is summarized in this section. Mitigation measures proposed to reduce project impacts are summarized below and in Chapter IV of this document.

5.1 PHYSICAL ENVIRONMENT

The project area is covered by prehistoric and historic lava flows and and has no value as agricultural land. Development of the land for resort use will substantially improve the present physical condition of the property through the creation of landscaped areas and public accessways while increasing its general usefulness and productivity. Geologic features typical of lava flows such as lava tubes, blisters, tumuli and ground cracks have been identified in portions of the project site.

Mitigation Measures: No unique land forms have been identified on the subject property. Standard construction procedures and methods will be sufficient to reduce any risks that geologic features may present during project construction. Preliminary project site designs have been

revised to avoid impacting areas believed to contain large lava tubes and ground cracks. Further studies to determine the extent and nature of ground cracks located parallel to portions of the shoreline and the effect construction may have upon them must be conducted prior to construction in those affected areas. The project has also been sited to enhance the most interesting geological features on the property including littoral cones and lava formations.

5.2 NEARSHORE AND MARINE ENVIRONMENT

The shoreline of the project site is characterized by lava cliffs interspersed with occasional sand or cobble strewn beaches. Offshore, a narrow coral shelf gives way to a steeply sloping ocean bottom resulting in nearshore depths in excess of 50 feet. Littoral cones are located in some areas of the property coastline. Some aspects of project construction, paticularly the excavation of a 400-slip marina and the public boat ramp inland of the existing shoreline, will temporarily affect ocean water quality. The primary effect will be a temporary increase in turbidity. However, deep offshore water conditions provide excellent natural flushing action which will effectively counteract the effects of temporary loading of suspended materials. Furthermore, the offshore biological community is characteristic of areas which are subjected to significant wave action. Thus, marine environments are routinely subjected to stresses that can be much more destructive than any incremental changes that could result from development activity. Construction activity could have a minor impact upon endangered species (humpback whales and green sea turtles). However, no green sea turtle nesting areas have been located on the subject property and the incidence of humpback whales in the general region is restricted to only a few months of the year.

Twenty anchialine ponds, some of them clustered together, have been located on the subject property. It is anticipated that these ponds will be preserved. Construction activity will have no adverse impact upon them.

Permanent impacts on the nearshore and marine environment include alteration of the existing shoreline for entrance channels to the proposed marina and inland swimming areas and the construction of a public boat launching ramp. Offshore areas presently show evidence of substantial fishing pressure. Increased public access to the coastal areas may increase fishing activities. Construction of the marina will involve the excavation of basaltic rock inland of the existing shoreline, as will the development of two inland swimming areas, one on each side of the marina entrance.

Mitigation Measures: Construction activities will be conducted in a manner that will minimize temporary loading of suspended materials. Monitoring programs can be developed to ensure that marine mammals are not in the immediate area during blasting associated with marina construction. Blasting activities associated with marina construction could be restricted during the months when humpback whales are present, if necessary. Most of the anchialine ponds are located in the southern or central portions of the property coastline and are well-removed from the marina construction area. It is anticipated that they will be preserved. A monitoring program can be implemented prior to construction to ensure that the ponds are not impacted during project construction or by subsequent operation of the resort. It is intended that all development associated with the resort will be set back from the shoreline an adequate distance, thereby establishing a broad, undeveloped Openspace Shoreline Corridor. The creation of the Openspace Shoreline Corridor and a series of parks along the property coastline will further ensure the preservation of coastal areas, anchialine ponds, and archaeological sites. The proposed swimming lagoons will be designed in a manner similar to the lagoon at Magic Island on Oahu. Large barrier rocks at the mouth of the lagoon will prevent the loss of beach sand while enabling adequate circulation of water in the lagoons.

5.3 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Numerous archaeological sites have been identified on the subject property, mostly in the coastal areas. Most of these sites had not been previously identifed and represent new findings. Archaeological studies conducted for this document include recommendations for preservation of significant sites. A large area of petroglyphs exists in a portion of the project site.

Mitigation Measures: A two part mitigation plan has been developed. Part one of the plan includes a detailed assessment of all sites identified in the project area and a determination of the recommended treatment for each site. It also includes identification of sites to be preserved and those which will require limited data recovery. The second part of the plan involves the designation of restricted areas containing the significant sites recommended for preservation and further data recovery. A conceptual master plan of land uses within the proposed resort is based upon the location of these restricted areas. These restricted areas will be flagged prior to the beginning of construction to ensure that no accidential damage or adverse impacts to the sites occur. The restricted areas are designated as a variety of natural features including an Openspace Shoreline Corridor, a Petroglyph Park, and other park and openspace areas on the project's masterplan. Specific management plans for these areas will be developed at the time of zoning to ensure that the integrity of each area is preserved and that individual sites are not adversely impacted.

5.4 SOCIO-ECONOMIC CONSIDERATIONS

At buildout, the proposed resort will contain 3,000 visitor units, 900-930 resort residential units and about 800 support community units. The projected average daily visitor census will be about 4,700 persons, including day-visitors.

The Hawaiian Riviera Resort will generate economic benefits and social change in the Ka'u region. In addition to signficant increases in employment opportunities, many new public services and facilities will be developed, which do not presently exist in the immediate area. These include a major marina, an airport, a fire/police station, a medical facility and a public boat launching ramp.

Construction of the first phase of the Hawaiian Riviera Resort will include a total of 2,375 units, about 50% of the entire project. Included in the first phase will be three of the five hotels planned for the resort, the marina and a portion of the surrounding village area, the Petroglyph Park and golf courses, and all of the necessary supporting infrastructure. Once the first phase is completed, the volume of construction activity during subsequent years will be substantially lower. Development of the first phase is projected to create about 2,300 jobs on site and an additional 1,000 jobs off site. An additional 2,300 on-site jobs will be generated by subsequent development from 1992 to 2009 (build-out). A total of 2,700 additional jobs will be created off-site.

The long-term labor demands of the proposed resort substantially exceed the available supply in the Ka'u/South Kona region. Consequently, as many as 1,650 workers would ultimately have to either switch employers, relocate to the Ka'u/South Kona area or commute from other areas of the island. Should these levels of in-migration actually occur, this will result in a signficant percentage increase over the existing population of the region. Demands for employee housing would increase correspondingly.

In terms of financial benefits to the county and state, the project's revenue-cost ratio is very favorable. For every dollar the State spends on facilities or services for the proposed resort, $3.40 to $5.20 of revenue will be received in the form of taxes. Similarly, for every dollar the

county spends providing such services as police and fire protection to the resort, it will receive between $2.80 and $3.20 in tax revenue and fees.

Mitigation Measures: The developers of the Hawaiian Riviera Resort are committed to mitigating the impacts of development upon the surrounding communities. It is clear that construction of the resort will bring social change to the district. New employment opportunities will result in population growth and in-migration. Expanded visitor facilities will bring increases in traffic and the number of tourists in the region.

The development of specific mitigation measures to minimize social impacts requires more refined information than is presently available. As the project moves into later stages of the zoning process, specific information about the development will become available. Potential resort operators will be selected and mitigation measures can be developed. At this present level of planning, the subject of mitigations has been addressed through an exhaustive presentation in Chapter IV of potential strategies which may be available to the applicants. The actual determination of mitigation strategies will be the subject of future discussions between the applicants and representatives of the State and County governments. It is recommended in Chapter IV that three broad objectives be included in a mitigation program. These objectives would include methods to assist current residents in acquiring jobs, methods to assist current businesses in capturing resort-related opportunities, and targeted employee recruitment efforts by the resort to ensure that in-migrants are socially compatible with current residents (e.g. former Ka'u residents wanting to return home, residents of the Big Island, etc.). Specific mitigation measures will be developed by the project developers to implement these objectives.

5.5 TRANSPORTATION FACILITIES

The Hawaiian Riviera Resort will be located along the coastline just west of Ka Lae (South Point) and approximately mid-way between Hilo and Kailua-Kona. Mamalahoa Highway, therefore, connects the subject property with both of these population centers. The support community component of the project will be located along the Mamalahoa Highway and linked to the resort component via an internal roadway system. Mamalahoa Highway will be impacted by resort development due to the large number of employees and visitors. The effect will be a significant percentage of increase in traffic volumes.

Mitigation Measures: The project's self-contained resort community concept is intended, and the internal roadways will be designed, to minimize vehicular trips on Mamalahoa Highway by resort visitors and support community residents. The project's proposed regional airport and cruise ship docking facility will provide alternative means of arrival to resort guests. Specific employee-targeted transportation programs such as carpooling and shuttles will be discussed with government officials at later stages of the development process. The project's location, approximately mid-way between the Kona and Hilo airports, will also enable project developers and operators to apportion visitor arrivals approximately equal between these two airports, thereby further reducing traffic impacts. Improvements to the intersection of the project's access road with Mamalahoa Highway will be funded by the developer if required.

5.6 AIR QUALITY AND NOISE

Increased volumes of traffic associated with the resort will affect air quality to some degree during construction and operation of the hotels and visitor facilities. The proposed airport will generate additional noise in the area.

Mitigation Measures: Transportation related programs designed to mitigate the effects of increased

resort-related traffic will be the subject of discussions between the applicants and County government. The airport facility has been sited in such a manner as to minimize any impacts upon surrounding residential areas and proposed resort facilities. The noise impacts of the airport will be minor.

5.7 PUBLIC SERVICES AND FACILITIES

Development of the proposed resort will increase the demand for public services and facilities in the Ka'u region. It is expected that this demand can be met with currently planned, as well as new proposed facilities. The resort and related development will also substantially increase the area's property tax base.

Mitigation Measures: As part of the overall development proposal, the applicants are proposing the inclusion of a school, community center and a fire/police facility within the Support Community. In addition, a medical facility will be developed within the resort. Additional public facility and service needs will be the subject of subsequent discussions between the applicants and government officials.

5.8 VISUAL CHARACTER

Visual character of an area can be evaluated in terms of three conditions: vividness, unity and intactness. Vividness relates to the memorableness of the landscape and how components within it combine to create contrasts or striking visual patterns. Unity concerns the degree of coherence or visual harmony. Intactness concerns the degree of encroachment by visually disrupting features.

The Hawaiian Riviera Resort will be developed with these conditions in mind. The most striking visual impression of the property is its barren lava and immense size. Building designs will draw upon the natural land forms to complement their surroundings. Project components will present a consistent theme within each of the resorts. The European motif of the Hawaiian Palace will enhance the marina village and hotel facilites. The terraced village will blend with the slope of the region. The visual impact of the high-activity commercial area will be lessened through the use of extensive landscaping.

The lower density Hawaii Ka'u Aina Resort is intended to complement the existing terraine, natural features, and archaeological sites. Thus, the visual impact will be much less with relatively low-rise resort development interspersed among lava flows and landscaped areas. Its two golf courses will be virtually concealed from view within the broken lava fields.

Because of its substantial distance (nearly five miles) from the highway, a 1,900-foot drop in elevation, and the existence of more than 17,000 acres of undeveloped land as a buffer, specific resort facilities will probably not be visible from the Mamalahoa Highway. The only distinguishing feature will be the resort entrance and the residential Support Community located along the highway. From the shoreline, the Hawaiian Riviera Resort will blend in with the gently sloping land behind it.

6. SUMMARY OF ALTERNATIVES

In addition to the proposed development plan, other development alternatives have been considered but were rejected because they did not meet the objectives of establishing a unique self-contained resort community in Hawaii and providing a broad range of recreational opportunities for visitors, guests and area residents. The principal drawback for alternative

development plans is the extremely large financial commitment required to provide infrastructure to serve the proposed activity. These alternatives, as discussed Chapter V, included:

- o No development at the project site, which would result in no economic benefits to the region and continued limited access to the coastline.
- o Development of the project site as an intermediate level resort ,which would not be economically feasible because of substantial upfront capital investments for development of infrastructure, including roadways and a water system.
- o Development of the project site as a minor resort area, which would not be feasible for the same reasons as above.
- o Alternative uses of the subject property for agricultural development, commercial, industrial or residential use, each of which is impractical given the existing condition of the property and its lack of infrastructure.
- o Development of the project site for recreational activities, which is infeasible unless funded by government.

7. SUMMARY OF UNRESOLVED ISSUES

The General Plan is a broadly stated policy document accompanied by land use maps depicting the general catagories of activity proposed throughout the island. A number of issues cannot be resolved at this stage in the planning process because they require a greater level of detail and information that will only become available in latter stages of the zoning review process. These issues include:

- o Impact of geological features upon specific project facilities.
- o Impacts of employee in-migration.
- o Location of off-site population growth and related public facilities.
- o Location, type and number of employee housing units.
- o Impacts of increased traffic volumes and improvements required.
- o Water resource development.
- o Space-related facilities.

In addition, some issues cannot be resolved at this time because the extent of their impact cannot be accurately predicted. Mitigation measures can be discussed in general terms. However, actual methods for resolution of the problems can not be developed. Once specific facilities are constructed, the quantification and measurement of the actual development impacts can be accomplished. These issues include:

- o Impact of shoreline modifications upon water quality.
- o Impact of shoreline modifications upon marine species.

o Archaeological site preservation.

8. SUMMARY OF COMPATIBILITY WITH LAND USE PLANS AND POLICIES

The project is generally consistent with applicable State and County land use policies and programs.

9. NECESSARY PERMITS AND APPROVALS

The existing land use authorities, designations, and related permits or approvals required are listed in the following table.

Table 1: PERMITS OR APPROVALS REQUIRED

Authority/Land Use Designation	Approval Required
COUNTY OF HAWAII	
General Plan Designations:	
Open	None
Conservation to Resort	General Plan Amendment
Agriculture to Residential & Industrial	General Plan Amendment
Zoning:	
Open to various urban uses	Change of Zone
Agriculture to various urban uses	Change of Zone
Special Management Area (SMA)	SMA Permit
Subdivision Approval	Subdivision (Preliminary & Final)
Grubbing, Grading Excavation & Stockpiling Permit	Grading Permit
Sign Permit	Sign Permit
STATE OF HAWAII	
State Land Use Commission	
State Land Use District:	
Conservation to Urban	SLUC Boundary Amendment
Agriculture to Urban	SLUC Boundary Amendment
Department of Land & Natural Resources:	
Conservation: Resource Subzone	Conservation District Use Application for Marina and Boat Launch

TABLE 1-1: Permits or Approvals Required (continued)

Conservation: General Subzone	None, if SLUC Boundary is Amended
Historic Sites	Review & Approval
Department of Health:	
Section 401 Permit	Permit Approval
Private Wastewater Treatment	Certification/Permit
Underground Injection Control	UIC Permit
Certificate of Need for Hospital Facility	Permit Approval
Department of Business & Economic Development:	
Coastal Zone Management Consistency Review	If Modified, COE Permit Required
FEDERAL GOVERNMENT	
Army Corps of Engineers:	
Section 10	COE Permit
Section 404	COE Permit
U.S. Fish & Wildlife Services	Section 7 Consultation (Endangered Species)
National Marine Fisheries Service	Section 7 Consultation (Endangered Species)
Federal Aviation Administration	Notice of Landing Area Proposal

CHAPTER II

DESCRIPTION OF THE PROPOSED PROJECT

1. LOCATION

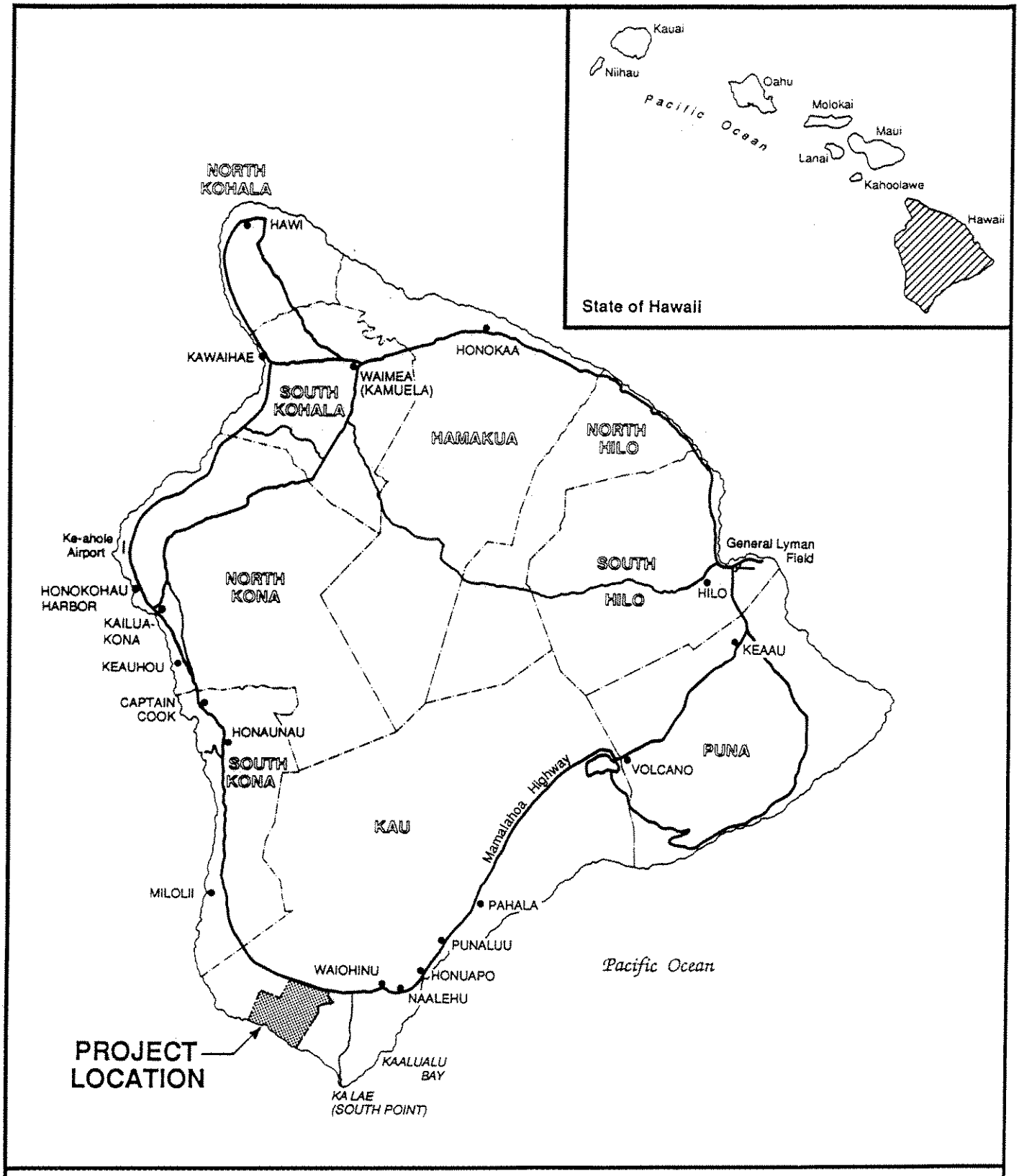
The Palace Development Corporation/Hawaii Ka'u Aina Partnership property is located within the Ka'u Judicial District, near the southern tip of the island of Hawaii (see Figure 2.1). The project, identified as Tax Map Key 9-2-1:72, is located on portions of three parcels, one, at the western end of the project containing 3,127 acres is owned by the Palace Development Corporation. The other two, containing 17,489 acres, are owned by the Hawaii Ka'u Aina Partnership or its affiliates. The entire project area is situated on the southwestern slope of Mauna Loa between the Mamalahoa Highway (Hawaii Belt Road) and the ocean, a distance of approximately 5.4 miles. It abuts the Hawaiian Ranchos subdivision's eastern and southern boundaries, as depicted in Figure 2.2. At the shoreline, the property extends 6.4 miles from the Manuka-Kahuku boundary at Humuhumu Point to Kaimu'uwala. The southeastern boundary of the property is approximately 6.5 miles from Ka Lae Point (South Point) which is the southern-most point in the United States. The property lies about 40 road miles south of Kailua-Kona, the island's second major urban center. Naalehu, a principal town in the Ka'u district, is located approximately 12 road miles southeast of the property. Hilo, the island's major urban center, is 77 miles to the northeast.

Table 2: DISTANCES TO IMPORTANT ACTIVITY CENTERS

Activity Center	Distance	Trip Time
Ke-ahole Airport	47 miles	1-1/2 hrs.
Honokohau Harbor	43 miles	1-1/2 hrs.
Kailua-Kona	40 miles	1-1/2 hrs.
Kawaihae	72 miles	2 hrs.
Kaumela/Waimea	82 miles	2-1/4 hrs.
Hilo	77 miles	2-1/4 hrs.
Volcano	44 miles	1 hr
Honolulu	214 miles	

2. DESCRIPTION OF THE PROJECT SITE

The subject property is currently undeveloped, consisting entirely of prehistoric and historic lava flows. The majority of the property is covered by a prehistoric pahoehoe lava flow with the western edge and eastern portions overlaid by a more recent a'a flow dated 1907 on the United States Geological Survey (USGS) map of the area. The coastal areas are defined by lava sea cliffs interspersed with small stretches of rocky or coarse sand shoreline. A 245 foot high basalt and cinder lava cone (Na Puu a Pele) is located at the western shoreline boundary of the property. The inland areas are dominated by a barren lava landscape with occasional forested kipuka's (small oasis or clearing in the lava field). The entire property is unimproved except for a jeep trail (in poor condition). The property slopes upward from the 10-50 foot high coastal cliffs to an elevation of about 1,900 feet at the Mamalahoa Highway.



15 12 9 6 3 0 15

SCALE IN MILES

NORTH

Figure 2.1

ISLAND LOCATION MAP

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

3. GENERAL DESCRIPTION OF THE PROPOSED ACTION

The project is proposed for designation on the the County General Plan as a major resort destination community.

The two property owners have different but complementary development concepts integrated into a single master plan: a Mediterranean port ambiance for the Hawaiian Palace Resort concentrated on 784 acres, and a lower-density resort/residential development focusing on historical and natural resources for the Hawaii Ka`u Aina Resort's 1,560 acres. It is intended that internal connecting roads and some design similarities will produce an integrated resort destination area.

The 3,245 acre project area is divided into an 800-acre residential support community near the highway, a 100-acre airport for small planes, and 2,345 acres of resort property extending for approximately 4.5 miles along the Ka`u shoreline, as shown in Figure 2.3.

Major components of the support community will include 800 residential units and regional public facilities such as a school, police/fire station, and civic center. Major resort components (see Figure 2.3) will include:

Hawaiian Palace Resort

- A 400-slip marina (and a nearby cruise ship docking facility) will provide the Hawaiian Palace Resort's development core, surrounded by several hotels, a 120,000-square-foot entertainment, dining, and commercial village and terraced resident/guest units. Artificial beach and lagoons will be created to the east and west of the marina in conjunction with hotel development.

- A 275-unit luxury hotel with amenities and staffing similar to the Westin Mauna Kea or the Mauna Lani Bay Hotel, plus a 625-unit hotel with amenities and staffing similar to Neighbor Island Sheraton or Hyatt hotels.

- Several structures -- totalling 375 units -- comprising exclusive "self-contained residential condominiums" (Luxury Villas) which will offer certain hotel-type services such as room service. These units will be marketed at $1 million to $2 million apiece.

- Mauka of the marina and shopping complex will be 300 spacious condominium units (the "Marina Village Apartments") and 300 townhouse units. The development will also ultimately feature 352 residential homesites on lots of one-third to one-half acre size.

- Luxury recreational facilities, including an 18-hole golf course and clubhouse; a tennis center plus stadium court; and polo field (which could service other recreational uses such as lawn bowling or archery) and stables.

Hawaii Ka`u Aina Resort

- A 200-unit deluxe hotel, with atmosphere and service levels comparable to those of the Kona Village or a Club Med.

- o A 600-unit high-activity hotel with levels of service and staffing comparable to Neighbor Island Westin or Hyatt hotels, but with architectural designs adapting to existing natural features and terrain.

- o A 400-unit first-class hotel with levels of service and staffing comparable to a Neighbor Island Sheraton hotel.

- o 300 single-family homesites, some of which may have dwellings built upon them before marketing. It is possible that some single-family homes might be used for rental purposes, such as employee rentals.

- o 200 condominium units, in up to four separate developments of 50 units each, some of which are presently being considered for on-site rental housing for employees during construction of both resort complexes.

- o A 142-acre petroglyph park.

- o A cultural center providing tour and information services related to the petroglyph park, preshistoric Hawaiian fishing sites, anchialine ponds, and beach park.

- o A 40,000 square-foot commercial center catering to both resort visitors and residents, as well as visitors to the cultural center.

- o Two 18-hole championship golf courses, clubhouses, and related recreational facilities.

- o A public boat launch and adjoining campground area.

Thus, the combined resort properties will include one luxury hotel (total 275 units); 375 Luxury Villa units; two deluxe and two first-class hotels (total 1,825 units); various resort condominium and townhouse structures of different levels (total 800 units); 652 homesites; 160,000 square feet of commercial space; three 18-hole golf courses; and major tennis and equestrian and other recreational facilities. Additionally, a marina, cruise ship docking facility, petrogyph park, and a cultural center will provide visitor attractions which will shape the nature of the overall resort. A complete listing of unit counts and acreages is presented in Table 3.

The recreational amenties listed above, together with the marina, cruise ship docking facility and the cultural center/petroglyph park provide unique visitor attractions which can not be found elsewhere in Hawaii. In addition, the resort will benefit from its relative proximity to Volcanoes National Park and South Point, and midway position between Hilo and Kona.

The development of the Hawaiian Riviera Resort as a resort community, with its extensive infrastructure and support facilities, will also cause a large permanent resident population to locate at the resort. This combination of visitor and resident populations will provide the necessary economic support to establish the resort as a viable destination in the visitor market.

Among European resorts, the name "Riviera" refers to a proximity to the ocean, a sea-coast village, a center of activity. Thus, the name Hawaiian Riviera was chosen to reflect the proposed resort's relationship with ocean.

Figure 2.2

REGIONAL LOCATION MAP

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

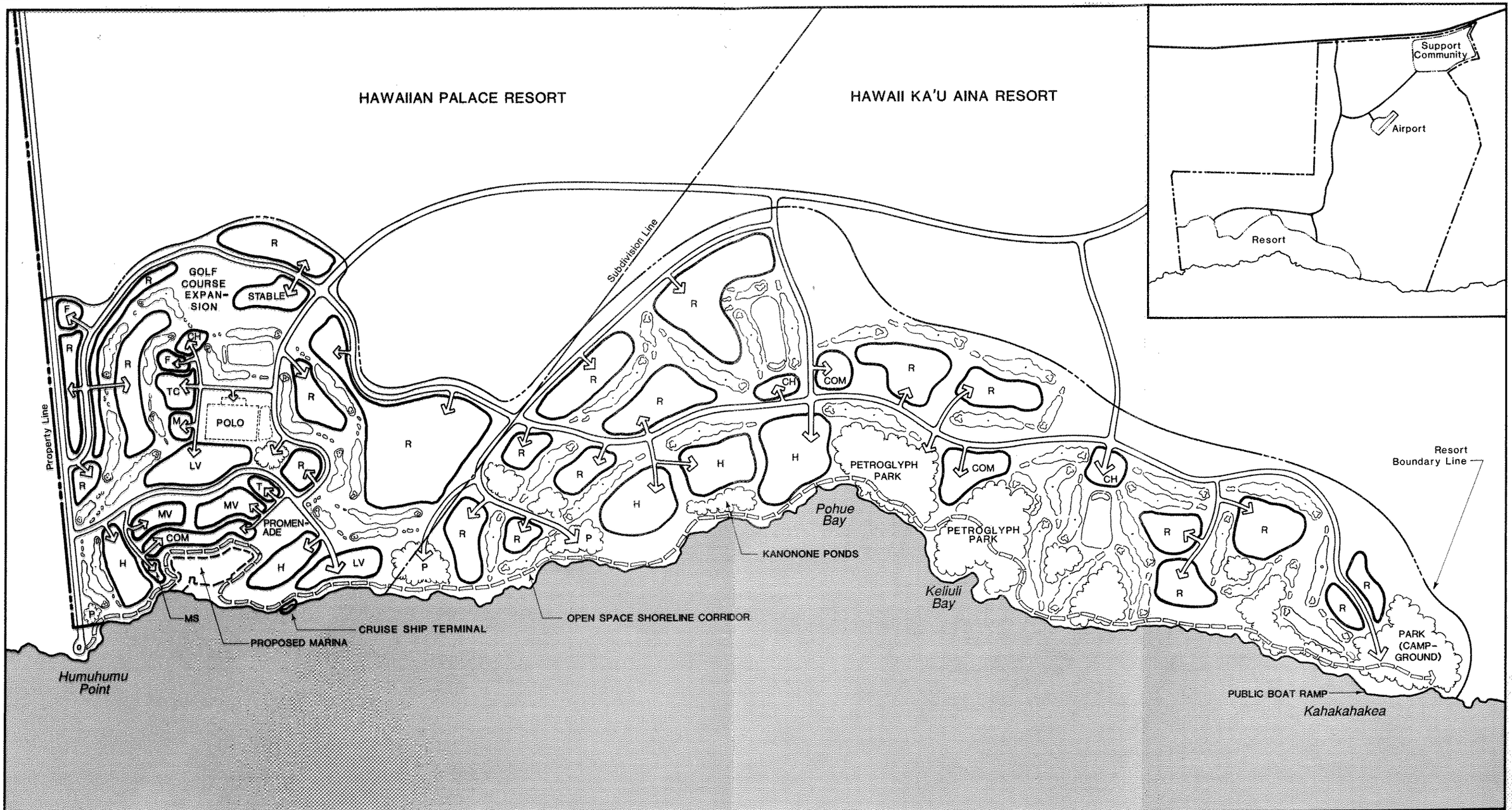


Figure 2.3

DEVELOPMENT CONCEPT PLAN

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

4. OVERALL DEVELOPMENT CONCEPT

The proposed project is being master planned through the joint efforts of the Palace Development Corporation and the Hawaii Ka'u Aina Partnership, and contains two separate but contiguous developments; the Hawaiian Palace Resort and the Hawaii Ka'u Aina Resort. Collectively, the two components, along with their common facilities, which include the 800 acre support community and 100 acre regional airport, will be known as the Hawaiian Riviera Resort. Table 4 presents land use allocations for the entire resort and the initial phasing of construction.

4.1 HAWAIIAN PALACE RESORT

The Hawaiian Palace Resort is intended to be a 'world-class' luxury resort providing the best quality accommodations possible combined with the best level of European-style service. Located on 784 acres (at the western end of the 2,344 acre resort area), development of this top-scale, service-oriented resort residential community will focus on a European-style marina village flanked by a luxury and a deluxe hotel. A 400-slip marina will be cut into the coastal lava cliffs with a terraced marina village and commercial structures surrounding the marina basin, as shown in Figure 2.3. An artificial beach and lagoon will be developed to the east and west of the marina and landward of the existing coastline in conjuction with the two hotel developments. The Mediterranean flavor of the marina village will be further enhanced by low and medium resort and permanent residential development extending up the slopes behind the marina and interwoven with a polo/equestrian facility and an 18-hole championship golf course. With its spectacular vistas and extensive recreational facilities, the Hawaiian Palace Resort is intended to provide a luxury setting for its residents and guests, as well as cruise ships visiting Hawaiian waters. A focal component of the marina area will be an adjacent cruise ship docking facility allowing access to the Hawaiian Riviera Resort's recreational and shopping areas.

4.2 HAWAII KA'U AINA RESORT

The Hawaii Ka'u Aina Resort will draw its inspiration from the (existing) unique historical and natural resources of the project area, as well as its relative proximity to South Point and the Volcanoes National Park. The project will complement the existing terraine and stark natural beauty of the area, its coastline and geological formations, and will provide visitors and area residents with an exceptional opportunity to experience the recreational and historic/cultural aspects of the project in close proximity to the first landing areas of early Polynesians. With a deluxe resort hotel, a high-activity resort hotel and a first-class resort hotel, a variety of residential developments, as well as numerous recreational and cultural amenities spread over 1,560 acres, the Ka'u Aina Resort is intended to provide a lower density and configuration of resort facilities. Appealing to a broader range of clientele, its residential facilities will attract second home purchasers, primary home owners and renters, including retirees, middle income area residents and resort staff. An Openspace Shoreline Corridor along the coastline of the Hawaii Ka'u Aina Resort will join together picnic areas, a public boat launching ramp, pristine anchialine ponds, historic and prehistoric archaeological sites, and an extensive petroglyph park. In addition, two tournament-level 18-hole golf courses will enhance and define the low-density character of the surrounding residential developments.

Table 3: ACREAGES OF PROPOSED PROJECT COMPONENTS*

Land Use		Acreage	Total Units	Visitor Units	Resident Units
Hawaiian Palace Resort:					
Hotels	-	104 acres	1275	1275	
Residential	-	232 acres	952	225	727
Commerical	-	8 acres			
Recreation**	-	324 acres			
Service/Administration	-	17 acres			
Transportation***	-	99 acres			
SUB TOTAL	-	784 ACRES	2227	1500	727
Hawaii Ka'u Aina Resort:					
Hotels	-	116 acres	1200	1200	
Residential	-	346 acres	500	300	200
Commerical	-	32 acres			
Recreation and Parks	-	858 acres			
Service/Administration	-	16 acres			
Transportation***	-	192 acres			
SUB TOTAL	-	1,560 ACRES	1700	1500	200
TOTAL RESORT AREA	-	2,344 ACRES	3927	3000	927
Support Community:					
Residential	-	700 acres	800		800
Commercial	-	20 acres			
Recreation	-	40 acres			
Public Facilities	-	20 acres			
Transportation***	-	20 acres			
TOTAL	-	800 ACRES	800		800
Regional Airport	-	100 ACRES			
TOTAL PROJECT AREA	-	3,244 ACRES			
TOTAL UNITS	-		4727		

* These acreages reflect revisions made to the project site plan since the Environmental Assessment was published in February, 1987. These revisions were in response to recommendations made in technical reports as well as community suggestions.

** Includes a 22 acre marina.

***Roads, pedestrianways

5. PROPOSED LAND USE PATTERN

The land use pattern of the Hawaiian Riviera Resort is intended to provide a sense of balance among the project components through the use of nodes of high-activity surrounded and separated by low density land uses. Resort activities will be physically separated from the support community to maintain the latter's desired residential character. Support facilities for the Hawaiian Riviera Resort, including the regional airport and support community, are situated on the property to optimize their function. Open lava areas provide extensive buffers among the project components

Table 4: LAND USE ALLOCATIONS & PHASING

Hawaiian Palace Resort	Phase One	Later Phases
5-Star Luxury Hotel	275 units	
Deluxe Hotel	625 units	
Luxury Villas	250 units	125 units
Marina Garden Apartments	150 units	150 units
Townhouses	75 units	225 units
Residential Lots/Homesites		352 units
TOTAL:	1375 units	852 units
Marina Commercial Area	80,000 sq ft	40,000 sq ft
Hawaii Ka'u Aina Resort		
High-Activity Hotel	600 units	
Deluxe/Retreat Hotel		200 units
First Class Hotel		400 units
Single-Family Residential	100 units	200 units
Condominiums*	200 units	
TOTAL:	900 units	800 units
Commercial Center	10,000 sq ft	30,000 sq ft
Petroglyph Park	142 acres	
Recreation	758 acres	
Support Community		
Residential	100 units	700 units

* Some may be initially developed as Employee Rentals and later converted and sold as condominium apartments for permanent area residents.

as well as within them. The airport is sited to reduce noise impacts on the resort area, support community, and adjacent residential communities. In turn, the support community is located on the upper elevations of the property to further enhance an ambiance of seclusion for the resort and its stark, barren surroundings.

Within the resort area, development will be balanced with open space and recreational facilities. In addition to open space around resort facilities established by standard set-back and lot-coverage requirements, nearly 45% of the Hawaiian Palace Resort's 784 acres are proposed for recreational and open space land uses. In the Ka'u Aina Resort, 64% of the 1560 acres will remain in open space, park, and recreational uses. Visitor accommodations will be generally focused in a linear configuration along the coastal areas with residential developments inland. Golf courses and other recreational activities will provide openspace and view corridors among the residential developments.

Strong linkages within the resort area will be provided by the shoreline Openspace Corridor, as well as bikeways and the main arterial roadways. The high-activity commercial area of the Palace Resort's marina village will be easily accessible from the rest of the resort and yet, will remain somewhat separated from the lower density residential areas. Although planned at a much lower density than the marina village, the Ka'u Aina's commercial center will provide a similar focus and ease of access. This area will be balanced with the surrounding low-density resort activities through extensive use of openspace and park designations. Individually, the commercial nodes of the Palace and Ka'u Aina Resorts represent major activity centers and will be linked by a variety of alternative transportation modes.

6. PROPOSED CHARACTER OF DEVELOPMENT COMPONENTS

The Development Concept Plan (Figure 2.3) shows a conceptual layout for the resort portion of the Hawaiian Riviera Resort project. The character of the entire resort will result from a number of facets, including:

Clustering: Structures within the major activity centers of the Palace Resort and Ka'u Aina Resort will be clustered so that resort facilities and commercial areas are centralized and easily accessible. The use of openspace and recreational areas such as golf courses or equestrian facilities will provide buffers between moderate density areas and low-density residential components of the resort.

Heights: Although specific building heights have not yet been determined, it is intended that structures be sized so as to not dominate their surroundings.

Densities: The densities of the Hawaiian Palace Resort will be generally greater than those of the Ka'u Aina Resort. The Mediteranean theme of the marina village and its high-activity profile will be enhanced by moderate densities to establish the esssential critical mass of day and nighttime activities. Clusters of commercial shops and garden apartments will contribute to the village ambiance. Moderate densities in this central core will give way to lower density development in the residential areas inland of the marina.

The Ka'u Aina Resort is intended to be a relatively low density area. The central core of the resort will be the 600-room high-activity hotel and nearby commercial area/cultural center. However, the careful use of openspace including natural lava formations and landscaping will create a sensation of openness, even for this busy area. Outside of the central core, the resort will appear to be a vast area of small residential communities situated among park areas, openspace lava areas, and golf course fairways.

Design: The Palace Resort's marina village will be created with a European character. The resort residences, garden apartments, commercial area, and central promenade will all be designed to be consistent with this theme. The hotels will reflect an architectual character similar to the Iolani Palace in Honolulu. Upon leaving the marina village, the rush of activity will give way to a sense of openness and rugged beauty created by the surrounding lava fields. The Ka'u Aina Resort will draw upon the natural beauty and the historical significance of the surrounding area for its inspirations. Building design and layout will be intended to provide broad panoramas of the ocean and natural terrain, and to emphasize the contrasts between landscaped and stark lava areas. A sense of majesty of, and respect for, the aina, the land, will establish a consistent theme for the resort.

Colors and building materials will be selected to blend in with the natural surroundings and landscaping. The use of natural plants and exotic vegetation will provide a touch of elegance and contrast to the surroundings.

The Openspace Corridor along the shoreline of the Ka'u Aina Resort will contribute greatly to the character of the resort. The Corridor will establish a broad setback from the shoreline within which public accessways will be located. Many of the archaeological sites identified within the project area are located in this area, along with most of the anchialine ponds. Thus, the setback will allow for the preservation of these features for enjoyment by residents and guests alike.

7. INFRASTRUCTURE

The following sections are based on the premise that all required on-site infrastructure for the proposed project will be provided by the developers.

7.1 SITE ACCESS

Based on an agreement reached with the State Department of Land and Natural Resources (DLNR) as a condition of the initial property subdivision, site access will be from Mamalahoa Highway, the only highway connecting the area to the regional urban centers of Hilo to the east and Kailua-Kona to the west. A new access road will be located approximately 2.3 miles east of the entrance to the Hawaiian Ranchos subdivision. It will extend south across the Ka'u Aina property on agriculturally designated lands about 4.2 miles to the entrance of the proposed airport, then west one-half mile to the first of two entranceways to the Hawaii Ka'u Aina Resort.

The access road will continue about one mile to the second entrance and then curve south two miles and terminates at the Hawaiian Palace Resort. It is envisioned that the easement for this access road will be 120 feet wide, with an initial 2-lane highway into and out of the property and a future addition of a second 2-lane roadway with buffer median eventually providing two lanes into the project and two lanes out. The intersection at Mamalahoa Highway will be improved with a left-turn stacking lane designed to allow safe access to the project site without impeding regional traffic.

7.2 INTERNAL CIRCULATION

Circulation within the project will be provided by nearly 18 miles of road corridors emanating from a boulevard paralleling the shoreline and extending the length of the resort. The boulevard will be located inland, behind the proposed resorts and marina and will roughly parallel the southern portion of the major access road. Access to individual resort facilities, residential areas, and public park areas will stem from the main boulevard via 2-lane, two-way residential-quality streets. Low-speed roadways set within nearly 34 acres of landscaped corridors will typically be used throughout the project.

7.3 MARINA

The marina basin and its surrounding development area, located within the Hawaiian Palace Resort, will be excavated out of the lava substrata in much the same manner as Honokohau Harbor in Kona. The material excavated will be used to construct the terraces behind the marina upon which the marina village will be built, as well as for fill material for construction of the golf courses and equestrian facilities. It is expected that the marina will provide moorage facilities for both private pleasure boats and fishing, tour and charter boats. The marina will be designed to accommodate vessels such as fishing and charter boats in the 25 to 50 foot size as well as larger sailboats and motor vessels up to 150 feet in length and capable of overseas travel. Primary emphasis for berthing will be on boats 25 to 50 feet in length (85 percent of the total capacity).

The harbor channel is oriented to take advantage of the protection afforded by South Point, twelve miles to the southeast. A baseline study of off-shore conditions indicates that occasionally unfavorable wave conditions are generated from the southwest and are associated with Kona storms. The development of the marina will create a safe harbor in inclement weather or sea conditions.

Up to 400 slips will be provided along with an adequate turning basin. These slips will be made available to existing local boaters in the area and resort-generated demand. Facilities to be provided at the marina include a fueling dock, water and power to the boats moored in the marina, and sewage connections to the slips for removal of waste to the resort's waste treatment system. Due to the low tidal range in the area, the slips will be fixed rather than floating. An emergency boat ramp will be provided in the marina. A public boat ramp will be located in the Ka'u Aina area.

A cruise ship docking area is presently the subject of negotiations between the property owners and representatives of the American Hawaii Cruise Lines. Figure 2.4 depicts the configuration of the docking area. Approximately 42 to 45 feet of draft are required for docking. Prevailing winds and bathymetry are deemed appropriate for the siting of a docking area.

7.4 REGIONAL AIRPORT

A small regional airport providing service to the Hawaiian Riviera Resort, as well as the

surrounding Ka'u area, will be located on about 100 acres of land approximately three miles above the shoreline and mauka of the Hawaii Ka'u Aina Resort. This facility will link the resort to the Kona and Hilo airports and may also provide access to small commuter inter-island flights. It will be sited to minimize impacts on the resort and residential land uses associated with the project as well as all existing residential communities in the area. A small terminal building, along with fueling, maintenance, and storage facilities will be located at the airport.

7.5 WATER DISTRIBUTION SYSTEM

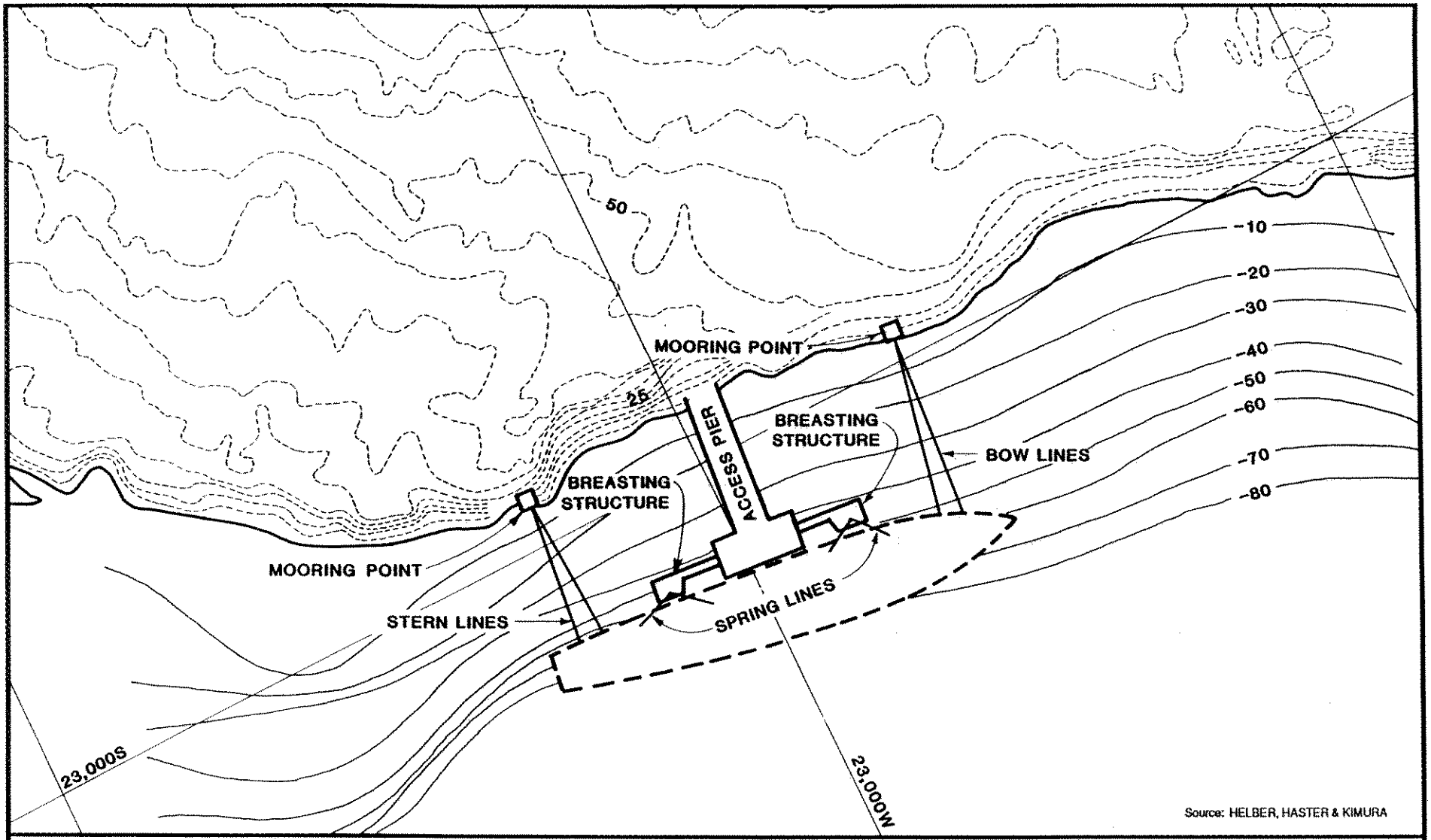
Potable water for the Hawaiian Riviera Resort will be provided by a series of wells located at the 2000-foot elevation just north of the subject property. Non-potable wells for irrigation will be located at lower elevations on the property. The general location of these wells and their proposed infrastructure is shown in Figure 2.5. It is estimated that the first phase of the development will require approximately 1.2 mgd of potable water and 2.0 mgd of non-potable water. Total build-out as proposed will require a total of 2.4 mgd of potable and 2.9 mgd of non-potable water. Table 5 presents the various allocations associated with water usage at the resort. The development of wells and the distribution system will be provided by the property owners for use within the project area, including the support community. To the extent that water supply produced by these well systems exceeds the needs of the resort, it is intended that the excess supply will be made available for use by neighboring residential areas.

7.6 WASTE WATER TREATMENT AND DISPOSAL

A privately constructed waste water treatment system with an ultimate capacity of 1.68 million gallons/day will be constructed as part of the Hawaiian Riviera Resort Project. The system will consist of three separate treatment plants; two facilities totaling 1.05 mgd serving the Hawaiian Palace Resort, and a .63 mgd facility serving the Hawaii Ka'u Aina Resort. The selection of these plant locations was determined based on prevailing wind directions and golf course irrigation requirements. Lift stations will be constructed to transmit sewage collected by gravity systems from the hotels to the treatment plants situated at higher elevations. Each of the plants will be landscaped and buffered from surrounding land uses. The wastewater infrastructure facilities will be constructed and operated entirely with private funding, and will be designed to meet all county, state and federal water quality and public health standards.

7.7 IRRIGATION

The Hawaiian Riviera Resort will be landscaped to the typical standard associated with the more developed resort areas of Hawaii such as the Mauna Lani Bay Resort in South Kohala. The total non-potable water requirement for the resort will be 3.6 mgd based on full development of the project. This is assuming no natural rainfall (the worst case scenerio). Irrigation of the resort grounds is based on a standard of 5,000 gallons of water per acre per day. This number is based on the judicious use of lava as a landscape feature, as done with the Mauna Lani Resort golf course. The phase one development area will require approximately 2.2 mgd for irrigation. Irrigation will be done primarily with non-potable water. Sources of irrigation water include shallow wells drilled at an elevation where the brackish mix of the water is sufficient to support vegetation. A single test will has already been developed at the 1,050 ft. elevation on the Hawaii Ka'u Aina parcel. Water from this well indicates chloride levels of 280mg., approximately 10% above established levels for potability. The result will be the creation of a lush tropical setting in a formerly barren location. Once the first phase of the project has been completed, the brackish irrigation water will be augmented by the use of treated effluent.



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SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

Figure 2.4

CRUISE SHIP DOCKING FACILITY

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

Table 5: DAILY POTABLE AND NON-POTABLE WATER ALLOCATIONS

	Phase One	Total
Hawaiian Palace Resort:		
Potable	.58	.99
Non-Potable	1.15	1.24
Hawaii Ka'u Aina Resort:		
Potable	.38	.73
Non-Potable	.88	1.69
Support Community:		
Potable	.18	.53
Non-Potable	.02	.02
TOTAL HAWAIIAN RIVIERA		
TOTAL POTABLE	1.14	2.25
TOTAL NON-POTABLE	2.05	2.95
TOTAL EFFLUENT (from STP for irrigation)	1.12	2.30

7.8 STORM DRAINAGE

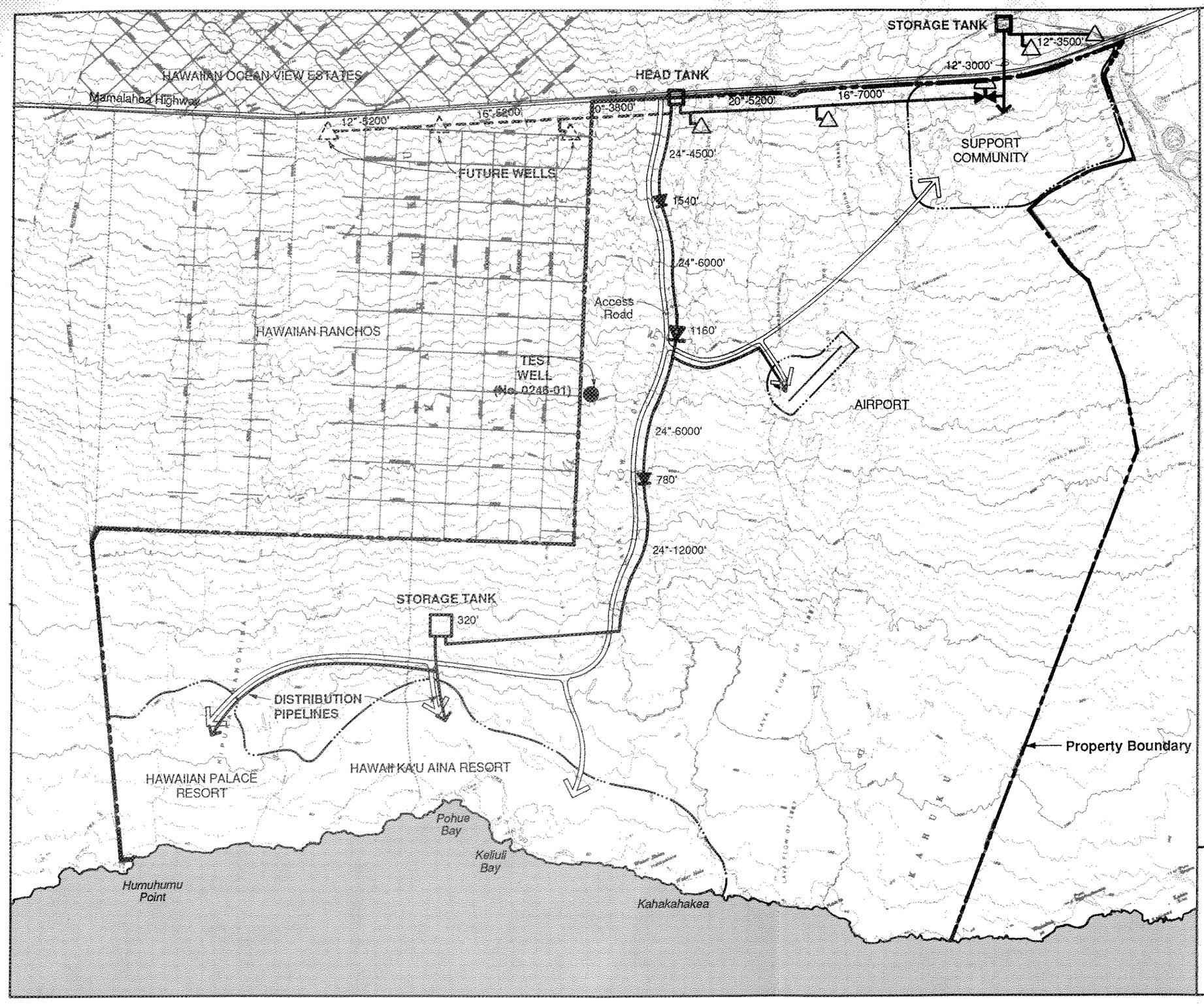
There are no existing drainage channels through the lava area of the project site. All storm drainage systems at the resort will be designed and constructed in accordance with County Standards. Storm runoff into the ocean will be minimized through the use of landscaping features and irrigation basins. An increase in runoff is anticipated with the development of top soil and vegetation, which will seal the lava allowing a portion of the rainfall to accumulate on the surface and runoff. This will be particularly true in the hard surface areas required for parking, roads, streets, roofs, etc.

7.9 SOLID WASTE COLLECTION AND DISPOSAL

The disposal of solid waste from the resort will be contracted with a private firm. Disposal will be in an approved County landfill and will be accomplished through a network of drop-off, compacting and transfer points around the southern portion of the island. Phase One of the resort development will generate approximately 22 tons of solid waste per day. Full development will result in the production of about 40 tons per day. The County of Hawaii is presently studying the siting of new landfill areas. Because the projected solid waste from the Hawaiian Riviera Resort will probably exceed the remaining capacity of the existing landfill in the Kailua-Kona area, the opening of new landfill sites by the County would meet the projected demand for landfill capacity.

7.10 POWER AND COMMUNICATIONS

Electricity will be acquired from the Hawaii Electric Light Company (HELCO) by accessing the existing island-wide power grid. A new substation will be required in the general



LEGEND:

- 24"-6000' — Pipeline Size & Length
- Water Tank
- Source Well
- Pressure Reducing Station
- Control Valve Station

Figure 2.5

POTABLE WATER SYSTEM

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

4000 2000 0 4000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

vicinity of the project. At full development, the Hawaiian Riviera Resort is projected to require about 39 Megawatts of power daily. Phase One will require about half that amount. Once the project is complete, it is anticipated that some of its energy demands may be offset by capturing the energy from water transmitted downstream from wells serving the resort. The captured energy will help to offset the electricity needed to pump water from the wells, and any excess energy can be returned to the electrical grid.

Communications requirements for the project will be provided by an on-site telephone exchange providing 3,900 cable parts to the project. Electrical and communications distribution within the resort portion of the project will be located underground. A television cable duct system may also be provided.

8. PROJECT MARKET ANALYSIS

8.1 OVERVIEW

In the broadest sense, the location of a resort community in Ka'u represents a significant new direction for the development of visitor-oriented facilities on the island of Hawai'i. A shift in population growth and development from Hilo to Kona in the 1970's, accompanied by relatively rapid growth in the Waimea area, has resulted in the opening of the South Kohala coast to major resort development. Presently, this area is popularly considered to be the center of future resort development on the island and has been designated accordingly in County plans and policies. Considerable attention has recently been devoted to the cumulative impacts generated by the proposed development.

It is not the intent, however, of the Palace Development Corporation or the Ka'u Aina Partners to undermine this growth policy. Rather, it is believed that the natural features and climate of the Ka'u region make it sufficiently different and sufficiently competitive in the resort industry to warrant this request for County approvals. As will be demonstrated in this section, the market support for the proposed Hawaiian Riviera Resort is readily identifiable as based upon "niches" within the market which are not currently served elsewhere in Hawaii County or the State and are sufficient to merit policy approval. Further, the property owners believe that the uniqueness and diversity of the proposed resort will generate an attractive alternative for capital investment benefitting the residents of Ka'u, as well as the population of the entire island while stimulating the economy of the County and the State. It will also provide a much needed "mid-point" attraction between Kona and Hilo, thus adding to the overall vitality of the entire island as an independent visitor destination.

The property owners also recognize that the region of Ka'u is presently engaged in a slow and sometimes painful process of transition from a traditional agricultural economy to an uncertain future. It is believed that the siting of a resort community in a sparsely populated, relatively remote area of the district, well removed from existing population centers, will help to reduce the anticipated social impacts while inducing prosperity and the provision of sorely needed public facilities and services. The entirely self-contained resort, set apart from the existing communities, is intended to create minimum disruption in the traditional character of Ka'u while taking advantage of a distinctly untapped sector of the visitor market.

8.2 HAWAII TOURISM

Visitors were the largest source of income for the state of Hawaii in 1986. Although little information is available to determine trends related to east-bound travelers from Asia and Australia, west-bound travelers from the Americas and Europe have been extensively surveyed by

the Hawaii Visitors Bureau and some of its findings are presented herein.

Overnight visitor arrivals to Hawaii totalled 5.6 million in 1986, of which 4.3 million were west-bound travelers and 1.3 million were east-bound travelers. The total figure represented a 14.8% increase over the 1985 figures. From 1970 to 1980, the number of west-bound travelers increased at an average annual rate of 8.7%. For the period from 1980 to 1986, this figure has decreased to annual average rate of 5.7%.

Visits by west-bound travelers to the Neighbor Islands have increased dramatically since 1970, when Oahu captured a full 94% of all west-bound travelers to the state. In 1986, the Neighbor Islands secured 26% of the west-bound traveler market, largely due to the attraction of new major resort developments such as Kaanapali, Wailea and Kapalua on Maui.

Although Hawaii County had the smallest share of west-bound travelers to the Neighbor Islands in 1986 (19%, as opposed to nearly 50% for Maui and 24% for Kauai), its total of 787,000 visitors was a 12.8% increase over the previous year. Increases are expected to continue due to the following factors:

- Nonstop air service to Kona from Chicago, Los Angeles, San Francisco and Seattle/Tacoma has recently been initiated.
- Hilo has the state's second largest airport facility.
- Visitor industry interest and general public awareness of Hawaii County has increased since the opening of the Mauna Lani Bay Hotel and with the construction of the Hyatt Regency Waikoloa Hotel.
- A number of new resort destination complexes proposed for development are expected to be competitive with Maui's major resorts.
- Hawaii County has a wide range of scenic attractions making it an attractive alternative to Oahu and Maui.
- Portions of Maui County are approaching "infrastructure gridlock", thereby potentially causing repeat visitors to seek other resort alternatives within the state.

The Hawaii State Department of Business and Economic Development (DBED) projects a continuing increase in visitor arrivals to the state, resulting in more than 8 million visitors by the year 2005. With the expectation that Hawaii County will continue to grow as one of the state's major resort destination areas, visitors to the island are expected to represent about 30% of westbound visitors and 9% of eastbound visitors to the state within the next 20 years. This could result in nearly 2 million visitor arrivals on the island by the year 2005.

8.3 HOTEL MARKET ASSESSMENT

As of 1986, there were approximately 7,000 visitor rooms on the island of Hawaii. Hotel rooms represented about 70% of the total with condominium units making up the difference. Occupancy rates in Hawaii County have increased steadily from 55.6% in 1984 to 67.2% in the first half of 1987. During these same years, occupancy rates have tended to be about 10% higher in Kona than in the Hilo area.

As discussed above, resort development in West Hawaii is expected to increase

dramatically in the next fifteen years. Although only a portion of the projects proposed have received the necessary permit approvals, the total number of units developed could reach 9,000 by 1992. In addition, there are a number of other projects considered for possible development, although no specific development timetables exist. These total over 14,000 hotel rooms and 19,000 condominium units, according to the County estimates. Realistically, however, based upon experiences throughout the state, a substantial percentage of these potential units will not be constructed in the forseeable future. To date, four major luxury facilities are planned, including 1,244 rooms at the Hyatt Regency Waikoloa, 450 rooms at the Ritz-Carlton Mauna Lani, 350 rooms at the South Kohala Resort, and 600 rooms at the planned Kaupulehu resort. The existing resort at Punalu'u is also planned for expansion, however, agreement over the precise location and number of new units has not yet been reached as of this writing.

In 1984, the State Department of Planning and Economic Development (DPED) projected the 1995 daily visitor census in Hawaii County to be 17,900. Based upon an average of 1.8 persons per rooming unit, a projected 1995 daily demand could reach 9,900 rooms island wide. However, it is believed that this projection may be somewhat understated because it does not take into account the synergistic effect of present projected development on the Big Island. An additional consideration is a projection by the Hawaii State Airport System Plan of a 110% increase in airport arrivals between 1985 and 1995 for Hawaii County. Assuming that these arrivals will be almost entirely visitor oriented, the projected daily visitor census for the island of Hawaii could be about 20,000 persons, creating a room demand of about 11,000 visitor units. Assuming traditional occupancy rates of 65%-75%, this represents between 14,700 and 17,000 actual visitor units.

The estimated number of rooms that can be supported at the Hawaiian Riviera Resort is dependent upon the market position of this resort in relationship to overall room demand on the island. Additionally, achieved market capture rates for resorts are usually directly related to factors such as:

- Perceived attractiveness, quality and range of available facilities.
- Maturity of development and the reputation the resort has earned.
- Level of activity (synergism) within the resort as a whole.
- Number of established competitive resorts.
- Relative size of the islandwide visitor room demand.

For major destination resorts, market capture rates have varied from as little as 2% to as much as 47% of the total room demand on a Neighbor Island. Examples of 1985 market share capture rates for major destination resorts are presented in Table 6.

The projected market share for the Hawaiian Riviera Resort is calculated to be 18% of the island. This figure is based upon the experience of market shares captured by major destination resorts in locations comparable to that of the Riviera. As indicated above, the attractiveness of the resort, the wide range of amenities, its reputation and level of overall activity, as well as its competition and relative market size are all factors to be considered in projecting market share.

The Marina Village will provide a unique destination area characterized by a large, spacious commercial area offering a variety of shopping opportunities. Set in an attractive European motif, the entire marina area of the Palace Resort will offer an intensive activity node designed to attract day visitors, area residents, and of course, resort guests.

The Ka'u Aina Resort will offer glimpses of ancient Hawaii, its culture and its history, in a spectacular setting of panoramic ocean views, varied terrain and stark contrasts of lush vegetation and barren lava. The pristine quality of its anchialine ponds and the quiet beauty of extensive archaeological sites, accessible through the petroglyph park and cultural center, will offer an attractive and more relaxed alternative to the nearby Palace Resort.

Together, these two resorts will present the traveler, whether arriving via car, plane, cruise ship, or day-coach, a unique vacation experience, which will attract a significant share of the Big Island's visitor market.

Resorts such as Princeville on Kauai and the Hilo/Volcano/Ka'u destination area offer valuable insight. The Princeville Resort provides excellent first-class facilities, but is relatively far from the nearest airport. In contrast, Hilo hotels are located near the airport but lack first-class resort facilities, visitor attractions and the favored climate exposure of southern and leeward resort areas. Thus, given the fact that the Hawaiian Riviera Resort will offer an extensive array of visitor attractions including over 100,000 square feet of tourist-related commercial space, a "village" setting with a permanent resident population, and extensive recreational and cultural attractions, all in relatively close proximity to the volcano tourist attractions, it is reasonable to expect the resort to capture a market share similar to other "rural" resorts (despite its being a new resort with no established reputation per se). This share could increase over time as the Hawaiian Riviera Resort matures, its name recognition increases, and its level of service becomes more familiar.

Table 6: NEIGHBOR ISLAND RESORT MARKET SHARES

Resort	Island	Market Share of Island
Keauhou	Hawaii	29%
Kailua-Kona	Hawaii	30%
Mauna Kea/ Mauna lani/ Waikoloa	Hawaii	22%
Hilo/Ka'u/Volcano	Hawaii	19%
Kaanapali	Maui	42%
Napili/Honokowai/ Lahaina	Maui	17%
Wailea	Maui	9%
Princeville	Kauai	17%
Poipu/Kalaheo/ Kokee	Kauai	36%

8.4 CONDOMINIUM MARKET SHARE

About 51 condominium projects are presently located on the island of Hawaii, mostly in resort areas. These projects represent over 2,100 units, 83% of which are located in the Kona area. According to a 1984 survey on resort condominiums by Monitor Hawaii, Inc., an average of 49% of units at resort condomium projects are kept in transient visitor rental pools. The remaining 51% of the condominium units are either kept for full-time or part-time use by unit owners.

Four projects are planned for development in West Hawaii. These projects include the 72-unit first increment of the Villas at Keahou, which is now in the presales stage, a 28-unit project at Keauhou Resort, 120 units at the proposed South Kohala Resort, and 24 units at the Shores at Waikoloa. Reportedly, there are several thousand more condominium units proposed or in the early stages of planning for the West Hawaii area.

A total of 1,175 condominium units are planned for the Hawaiian Riviera Resort, 975 units for the Hawaiian Palace Resort and 200 units at the Ka'u Aina Resort. Condominium sales at the Riviera have been estimated based on the following general assumptions:

- The Resort is developed in a timely and quality manner as scheduled and represented by the property owners. Especially critical to the market support is the development of the planned hotels from which potential condominium buyers could be expected to emerge, as well as the development of the resort amenities which distinguish the resort from other Hawaii resorts and make it a true visitor destination.

- Condominium sales are estimated to begin in about 1994 or two years after the development of the first hotels at both the Hawaiian Palace and the Ka'u Aina Resort areas.

The emergence of the general area as a major visitor destination will contribute greatly to the success of condominium sales. Condominium unit demand is to a large extent related to a resort's ability to attract a base of repeat visitors from which resort condominium buyers may emerge.

Between 1992 and 1996, new condominium sales at the Hawaiian Riviera are estimated at about 20 units per 100 completed hotel units. This is comparable to the lower range of condominium units to hotel units experienced by other Hawaii resorts. This assessment is based upon the following considerations:

- The Hawaiian Riviera Resort will be a new resort on the island with less name recognition than many of its major competitors.

- Sales rates in relatively new areas could be expected to be limited compared to areas which are more mature or are associated with nearby resort areas such as the Mauna Lani Resort which has benefited from its proximity to the Mauna Kea Resort.

- The first phase of units offered at the Palace Resort include higher-priced villas which typically experience lower sales absorption rates as they have a narrower buyer market.

In the next three successive five-year periods, the Hawaiian Riviera Resort is expected to achieve higher rates of condominium sales which are projected at 40, 50, and 60 condominium sales per 100 developed hotel units, based on the following factors:

- The Ka'u area would have achieved greater recognition, maturity and a repeat clientel base upon which it could attract a pool of purchasers.

- As the Hawaiian Riviera Resort matures, it could support increased primary residential unit owners who work at the resort or are supported by jobs generated by the resort.

- Ultimately, the Hawaiian Riviera Resort could be expected to experience a rate of 60 condominium unit sales per 100 hotel units, comparable to the Wailea, Keauhou or Mauna Lani Resorts, due to: a wide mix of units, higher income clientel, and greater maturity of the resort.

The total annual rate of condominium units sales is equivalent to about 32 units sold annually at each of the two component resorts. In comparison, other Hawaii resorts have reached levels of sales of about twice as much per year. However, considering new tax law changes and more stable real estate values this lower rate for the Riviera is considered reasonable.

8.5 RESORT RESIDENTIAL LOT MARKET ASSESSMENT

Resort residential lots are differentiated from other residential lots by their integration within a master-planned and self-supporting resort community. Resort communities are oriented towards recreational activities and usually include golf and tennis facilities. In addition, homes built on resort lots are primarily used as secondary or vacation homes rather than as a primary residence.

Since 1978, an average of about 110 resort residential lots in the state were sold annually. Lots sales were relatively brisk in 1978, 1979, and 1981 as new inventory was offered at Princeville and Wailea resorts, respectively. From 1982 through 1985, lot sales have been relatively weak, ranging from 35 to 80 annual sales. This decline is primarily due to the decrease in purchases by investors. In the past, investors represented a major market segment, but investor purchases were limited by high interest rates and the economic slump of 1981 to 1983 when resort real estate values declined. Since 1986 sales have increased again and resort real estate values have stablized.

On the island of Hawaii there are presently 76 resort residental lots planned for sale between 1987 and 1992. An additional 2,000 lots are proposed but the timing of these lots is indefinite.

About 352 resort lots are planned at the Palace Resort and 300 lots at the Hawaii Ka'u Aina. The marketing of lots is assumed to begin in 1994, two years after the development of the resort's first hotels.

The major market for single family lot develoment at the Hawaiian Riviera Resort is expected to come from West Coast and other mainland visitors to the resort who are purchasing the lots for a part-time vacation home. These purchasers are likely to have stayed at the resort and possibly owned condominiums previous to purchasing lots at the Riviera. The tranquil lifestyle of the Ka'u region, along with the strong recreational appeal, especially of the Palace Resort, are

expected to be major attractions to lot ownership in the area. At the Ka'u Aina Resort, the low-density development and emphasis on a Hawaiian vacation experience as well as the potentially lower sales prices are seen as the major draw for lot purchasers.

In addition to the part time vacation home purchasers, both the Palace and Ka'u Aina resorts are expected to have about 15% to 20% of their lots purchased by full-time residents of the area. This is based on an estimate of 260 new managerial or professional housing units required in the region and a 40% to 50% market share of these new households. This would include both employees of the resort (mainly management or professional employees) and entrepeneurs or in-migrants to the region. These purchasers are expected to be attracted by the convenience of commuting to the resort to work or other businesses in the area which are indirectly supported by the two resorts.

The sales absorption of single-family lots at the Hawaiian Riviera Resort is based on the historical rate of new single-family lots at other resorts. Over the past decade, typically 20 to 50 lots have been sold annually. At the Ka'u Aina Resort, all 300 planned lots are expected to be sold over a twenty year period ending in 2011. At the Palace Resort, lot sales are expected to take an additional five years to be absorbed and all 352 planned lots are projected to be sold by 2016. Lot sales are generally expected to follow the characteristic patterns of condominium sales. That is to say, sales will be slow in the early years and increase annually as the resorts mature and the number of repeat visitors increases.

8.6 COMMERCIAL MARKET ASSESSMENT

The commercial facilities planned at the Hawaiian Riviera Resort are intended to be among the most unique and extensive specialty shopping complexes in the state. As planned, they will be more than resort amenity, but a major marketing tool and attraction. The target market for the proposed commercial centers are expected to be derived primarily from resort guests and residents and secondarily from local residents and off-resort visitors. As is typical with resorts, a significant percentage of the support for commercial activity is expected to be derived from hotel guests seeking personal goods and services. This will be especially true for the Hawaiian Riviera Resort which will be located away from alternate shopping facilities.

A key element of the commercial area is the concept of outdoor seating which increases the total commercial floor space by 25% to 30% from the general leaseable areas. Potential tenant catagories include: restaurants; bars, pubs and cafes; convenience goods; boutiques; and various service businesses such as beauty shops, cleaners and laundry services, post office and chapels of various demoninations.

The commercial areas are anticipated to serve upscale, affluent individuals, many from international origins. The commercial facilities are envisioned to include a complementary array of quality goods and services, each offering a different experience to the resort guest. The primary commercial attraction will be the boardwalk or promenade integrating hotels, marina, and shopping complex at the Hawaiian Palace Resort. This area will be a gathering place and activity core for the resort, and especially the marina village, and will feature restaurants, delicatessens, sidewalk cafes, theaters and an arcade of boutiques and shops.

Commercial facilities at the Ka'u Aina Resort are anticipated to be more consistent with those which exist in other Neighbor Island resort communities. They are expected to be developed along a rustic, Hawaiian theme and in a more relaxed, subdued atmosphere and to complement the recreational and cultural aspects of the property for both visitors and local residents. Because the Ka'u Aina Resort has extensive public park areas and anticipated employee housing, and is

somewhat closer to the support commmunity, it is also anticipated that this area is more likely to contain automobile-accessable shopping areas such as groceries, drug and hardware stores, etc. to serve the entire resort.

The Hawaiian Riviera Resort is expected to have 1,500 visitor units in 1992 increasing to 3,000 visitor units in 2007. The range of required square feet for the commercial shopping area was selected based on a review of comparable resort operations, although it should be noted that the commercial facilities are expected to be unique to the state, and therefore not presently represented at other resorts. The requirements of the Hawaiian Riviera Resort are estimated to be 50 square feet of commercial space per unit in 1992 decreasing to 35 square feet per unit in 2007 and the years thereafter. The higher initial ratio is based on the marketing strategy of using the commercial areas as a means of attracting visitors and the estimated critical mass of shopping areas needed to achieve this effect. In subsequent years, this ratio is assumed to decrease as the resort matures and becomes more established.

Based on the number of units projected to be built and the commercial space per unit ratios, the estimated supportable commercial space at the resort generated by the resort population is about 75,000 square feet in 1992 and increasing to 127,000 square feet in 2012.

Secondary commercial support from off-resort guests is estimated to account for an additional 8% to 12% of supportable commercial space, amounting to about 6,000 square feet in 1992 and increasing to 17,000 square feet in 2012.

Thus, the total supportable commercial space has been estimated at 81,000 square feet in 1992, 103,000 square feet in 1997, 130,000 square feet in 2002, 134,000 square feet in 2007 and 144,000 square feet in 2012.

8.7 SUPPORT COMMUNITY MARKET ASSESSMENT

The planned Support Community is proposed to be located on 800 acres of land along Mamalahoa Highway east of the Hawaiian Ranchos subdivision, about five miles upland from the central resort area. The primary residential market is projected to consist of existing and new residents in the region who are employed either directly or indirectly by the resort. A secondary residential market could be expected from independent households (self-employed, semi-retired, and retired) and second home buyers attracted to the community by the support facilities and amenities, proximity to the resort and the rural nature of the surrounding region.

The current residential market in the Ka'u region is characterized by a significant supply of vacant lots. However, these are mainly located in subdivisions that are lacking water, electricity and/or other public utilities and services. According to the County of Hawaii, as of 1985 there were an estimated 17,280 lots in the Ka'u region with about 15,450 or 90% of the total inventory being vacant. In 1985, there were 1,650 housing units in Ka'u.

Development activity experienced in Kona and Kohala has also stimulated the housing market in the Ka'u area. According to area Realtors, there has been greater interest in Ka'u house lots because of the still affordable land prices, and relative proximity to employment and population centers in both Kona and Hilo. Also, the demand for rental housing has increased at a faster rate than supply has become available, mainly from young, working people who choose to commute or retirees who own property in Ka'u and may be in the process of building homes.

Development of the proposed Hawaiian Riviera Resort will result in an estimated 1,027 housing units being needed in the Ka'u area during the period from 1992 to 2009, according to

projections by Community Resources, Inc. and discussed in detail in Chapter IV of this document. An additional 250 housing units would be formed through natural growth of existing households. The bulk of required housing demand is projected for the 5-year period from 1992 to 1997 when a total of 940 units will be needed to accommodate the direct employment created by the resort. This 940 unit figure represents six percent of the existing inventory of vacant residential lots in the area.

Market capture rates for residential development in the Support Community are based on two principal assumptions:

- Market attractiveness of being within a master planned community with water and other utilities and services, relative to the number of existing vacant lots within undeveloped subdivisions in the area; and,

- Possible prestige and convenience for residents to live nearby the resort area which will include substantial improvements and infrastructure, facilities such as schools, a police/fire station, community center, and commercial shopping facility.

Based on these assumptions, the capture rates for the Support Community are projected to be 540 units by 1997, an additional 120 units by 2002, and 40 more units by 2009. The total of 700 units is allocated in the following manner. Managerial and professional employment housing is expected to be about 40 units, based on a capture rate of 70% of total demand from this segment. Supervisory, service and other employment housing is estimated at about 320 units, based on a 70% capture rate. Indirect and induced labor is estimated at about 280 units, based on a capture rate of 60%. Existing resident housing is estimated at about 60 units, based on a capture rate of 25%

8.8 SUPPORT COMMUNITY COMMERCIAL MARKET ASSESSMENT

Existing commercial space in the Ka'u region is currently limited due to the small population base. The towns of Na'alehu and Pahala have some commercial space for key tenants such as financial institutions, grocery stores, gift shops and professional offices. A small strip shopping center is located at the Hawaiian Ranchos project and a two acre commercial development is planned at the Hawaiian Oceanview Estates.

Although there is presently no large-scale development of commercial facilities in the area, potential future facilities could be developed based on an expansion of the resident population. Based on factors such as potential competition and consumer behavior patterns, it is estimated that commercial facilities at the support community could capture about 30% of the total projected resident shopping expenditures, or about 6.74 million dollars during the period from 1992 to 1997 and as much as 8.2 million dollars by 2009.

Based on annual sales revenues of $160 per square foot of gross leasable area, and the projected shopping expenditures at the Support Communty, the estimated supportable commercial space amounts to 42,000 square feet in 1997, increasing 1,000 feet in 2002, and another 8,000 feet by 2009. Thus, the planned 40,000 feet of commercial space for the Support Community is projected to be supported as early as 1997.

CHAPTER III

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

1. STATE LAND USE LAW

All lands in the State have been placed in one of four land use districts (Urban, Agriculture, Conservation, or Rural) by the State Land Use Commission (SLUC). State Land Use District Boundary Reviews are undertaken by the State Land Use Commission to update its Land Use District Maps. Besides this SLUC-initated review, provisions for applicant-initiated amendments to the district boundaries have been established in Section 205-4 of the Hawai'i Revised Statutes (HRS), and further promulgated in the State Land Use Commission: Rules of Practice and Procedure and District Regulations (12-21-75 as amended).

The seaward portion of the proposed Hawaiian Riviera Resort project is in Conservation designated land, while the higher elevations are Agricultural designated land as shown in Figure 3.1.

2. CONSERVATION DISTRICT RULES

The administrative rules of the Hawai'i State Department of Land and Natural Resources (June 1981) Title 13, Chapter 2 (formerly Regulation No. 4) govern land use within the conservation district and provide for four categories, or subzones. The Palace Development Corporation/Hawaii Ka'u Aina Corporation proposes use of the State-owned conservation district land fronting the property site. The actions for which it seeks approval from the Board of Land and Natural Resources are summarized below and following that is a discussion of the relationship of the proposed project to the conservation district rules.

The proposed resort project site is located on lands presently designated Conservation by the State Land Use Commission. However, a redesignation to Urban classification will be sought by the landowners. Development of the remaining Conservation lands inland of the coastal resort area is not being proposed, except for the siting of the single access roadway.

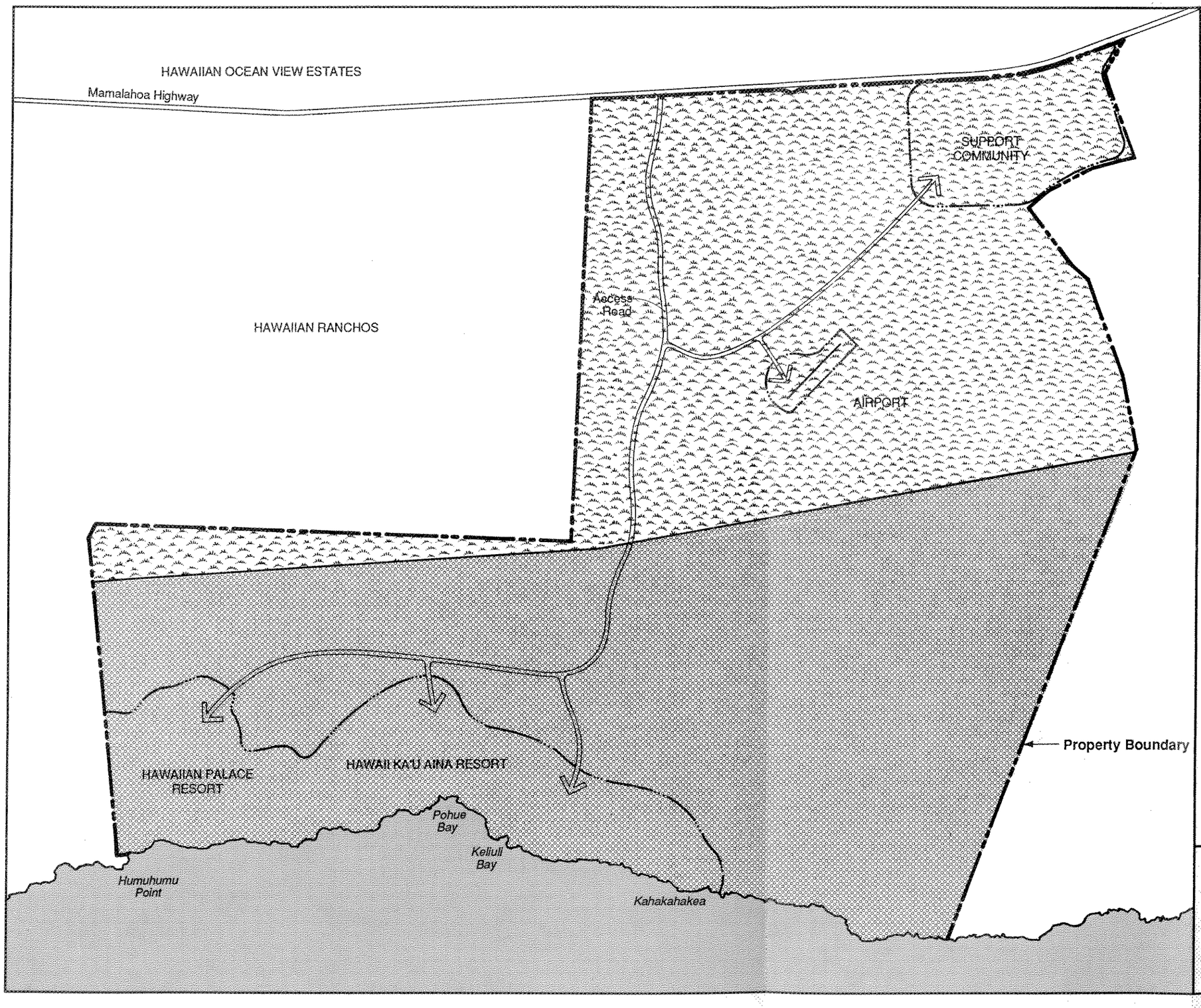
2.1 PROPOSAL FOR THE CONSERVATION DISTRICT

As established by State Law, all property located makai of the certified shoreline is designated Conservation. Therefore, in conjunction with the proposed development of the 400-slip marina harbor and the boat launching ramp the ocean entry channel portions of those features will be situated within this shoreline Conservation area.

The marina will be cut into the lava formations behind the shoreline. The focal point of the marina will be a cruise ship wharf allowing cruise ships access to resort's the commerical facilities. The boat ramp is intended more for emergency use - a separate public boat ramp is to be located in the southern portion of the Hawaiian Riviera Resort.

2.2 EXISTING SUBZONE

The portion of the subject property currently designated Conservation is divided into two subzones. The seaward portion of the site is designated as a Resource (R) subzone extending approximately 1,500 to 3,000 feet inland. The remaining mauka portion of the Conservation district is identified as General Use (G).



LEGEND:

- Agriculture
- Conservation

Figure 3.1

STATE LAND USE CLASSIFICATIONS

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

4000 2000 0 4000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

2.3 PROCEDURES FOR PERMITS AND AMENDMENTS

An application for a Conservation District Use Permit for the marina, boat launch and roadway uses discussed above will be filed with the Board of Land and Natural Resources. This EIS will be included as part of the application materials. All other portions of the proposed development will, after Land Use Commission reclassification, be outside of the Conservation district and therefore exempt from these particular permit requirements.

2.4 CONDITIONS OF CONSERVATION DISTRICT USE

All allowed uses in the conservation district are subject to the conditions outlined in Section 13-2-21 of the regulations. The conditions relevant to the Hawaiian Riviera Resort's conservation district use proposals are shown below in boldface and following each is a discussion of the proposed actions' compliance with them.

(1) The use shall be compatible with the locality and surrounding areas, and appropriate to the physical conditions and capabilities of the specific parcel or parcels of land.

The development projects to be located seaward of the certified shoreline (i.e. marina and boat launch access channels) and mauka of the proposed Urban district boundary (i.e. entrance roadway) are compatible with the general locality and surrounding areas. The Hawaiian Rivieria Resort project site consists entirely of relatively barren lava flows. Because this area is entirely vacant, the projects proposed within the Conservation areas will have no impact on other land uses and will be a substantial improvement to the present physical conditions. The construction of a major marina facility constitutes an appropriate improvement, especially when considering the fact that it will be the first harbor facility to be developed in Ka'u, the state's largest geo-political district. The only portion of the Hawaiian Riviera Resort development which directly impacts Conservation District lands will be marina-related components of the project, including an off-shore berthing area for cruise ships, and a resort access road mauka of the proposed Urban district boundary. The marina and public boat ramp are consistent with recreational activities in the area which include fishing and diving. In point of fact, the proposed public boat ramp will enhance recreational opportunities.

(2) The existing physical and environmental aspects of the subject areas, such as natural beauty and open space characteristics, shall be preserved, or improved upon, whichever is applicable.

While greatly increasing the recreational potential of the area, the projects proposed in the Conservation district will significantly improve the quality of the coastal area. The development of the marina, the public boat ramp and the access road will not significantly detract from the natural beauty of the barren lava shoreline. The vast openness of the property will be generally preserved.

Approximately twenty anchialine ponds and/or water features have been identified on the project site, along the coastline. Wherever practicable, these ponds will be preserved for the benefit of the resorts' guests and visitors.

(13) Clearing areas for construction purposes shall require prior approval by the chairperson, ground cover of slopes over 40% shall not be removed unless specifically authorized by the chairperson.

The areas within the Conservation district which are proposed for development are very sparsely vegetated. Nevertheless, approval of the clearing plan for these areas will be obtained

before commencing construction. The areas that would be cleared have slopes much less than 40%.

(14) **Cleared areas shall be revegetated within thirty days unless otherwise provided for in a plan on file with and approved by the department.**

The provisions of this condition will be complied with.

(15) **Upon approval of a particular use by the board, any work or construction to be done on the land shall be initiated within one year of the approval of the use and all work and construction shall be completed within three years of the approval of the use.**

The provisions of this condition regarding time limits will be met.

3. HAWAII STATE PLAN

The Hawai'i State Plan (Hawai'i, State of, Department of Planning and Economic Development, 1978) consists of a series of broad goals, objectives and policies which are to act as the guidelines for the growth and development of the State. In general, the proposed action is consistent with the overall intent of the State Plan. Discussed below are the specific goals, objectives, policies, and priority actions contained in Part I and Part III of the State Plan which are thought to be most directly related to the proposed project.

3.1 PART I: OVERALL THEMES, GOALS, OBJECTIVES, AND POLICIES

Section 226-4 State Goals

(1) **A strong, viable economy, characterized by stability, diversity, and growth, that enables the 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.**

The proposed project is consistent with the goals of the State Plan. Resort development in the Ka'u district will provide new employment opportunities and enhance economic development. The construction and operation of five new hotels and accompanying support facilities will bring job opportunities to nearby residential communities. Urban development on otherwise unusable land characterized by barren lava flows does not encroach upon other types of land uses and affords the opportunity to create a physical environment which will greatly enhance the area's ecosystem. While unique flora will be preserved and allowed to flourish, innovative landscaping and design will provide new habitats for native flora and fauna which would otherwise be unable to survive in the arid climate. The end result will be the development of a well-designed, aesthetically pleasing environment providing previously unavailable recreational opportunities to visitors and area residents alike.

Section 226-5 Population

(a) **OBJECTIVE: It shall be the objective in planning for the State's population to guide population growth to be consistent with the achievement of physical, economic, and social objectives contained in this chapter.**

(b) **To achieve the population objective, it shall be the policy of this State to:**

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

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

(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.

At a time when employment opportunities are decreasing in the agricultural sector of Hawaii's economy, opportunities are increasing in the visitor industry. The development of the Hawaiian Riviera Resort will create a major visitor destination area for Ka'u that is consistent with the community desire for new jobs in the district. Resultant primary and secondary employment at the resort will provide new opportunities for socio-economic growth and development. The coordinated planning and development of the proposed resort and its accompanying infrastructure will result in the optimal use of land and water resources.

Section 226-6 Economy - General

(a) **Planning for the State's ecomony in general shall be directed toward achievement of the following objectives:**

(1) Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawaii's people.

(b) **To achieve the general economic objectives, it shall be the policy of the State to:**

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

(8) Encourage labor-intensive activities that are economically satisfying and which offer opportunites for upward mobility.

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

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

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

Development of the Hawaiian Rivieria Resort will provide new employment opportunities in the Ka'u District and generate growth in the overall job market on the island of Hawaii.. The development of the infrastructure necessary to support the proposed hotel, residential, commercial and marina facilities will take a number of years to complete. This substantial investment in the property will ensure healthy economic growth in the area for a considerable time to come, thereby contributing to sustaining a beneficial level of construction activity on the island. Both service and construction employment have favorable financial multiplier effects, as does the commerical

development that will follow. Due to the decline of the sugar industry in Ka'u and a relative lack of employment alternatives, local unemployment rates have been higher than statewide rates. Direct and indirect employment related to the Hawaiian Riviera Resort will contribute to alleviating this problem.

Section 226-7 Economy - Agriculture

(a) **OBJECTIVE: Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:**

(1) Continued viability in Hawaii's sugar and pineapple industries.

(2) Continued growth and development of diversified agriculture throughout the State.

(b) **To achieve the agricultural objectives, it shall be the policy of this State to:**

(8) Expand Hawaii's agricultural base by promoting growth and development of flowers, tropical fruits and plants, livestock, feed grains, forestry, food crops, aquaculture, and other potential enterprises.

(11) Institute and support programs and activities to assist the entry of displaced agricultural workers into alternative agricultural or other employment.

The development of the Hawaiian Riviera Resort will provide a new, expanded market for local fruits, vegetables, fish, meat and beverages. Local agricultural products are featured at the food service establishments of major resorts around the island where, very often, visitors are first introduced to some of these products. The proposed marina at the Hawaiian Palace Resort will be large enough to accommodate commercial fishing vessels. This facility will, therefore, contribute to the improvement of commercial fishing's viability on the island of Hawaii.

Section 226-8 Economy - Visitor Industry

(a) **OBJECTIVE: Planning for the State's economy with respect to the visitor industry shall be directed towards the achievement of the objective of a visitor industry that constitutes a major component of steady growth for Hawaii's economy.**

(b) **To achieve the visitor industry objective, it shall be the policy of this State to:**

(1) Support and assist in the promotion of Hawaii's visitor attractions and facilities.

(2) Ensure that visitor industry activities are in keeping with the social, economic, and physical needs and aspirations of Hawaii's people.

(4) Encourage cooperation between the public and private sectors in developing and maintaining well-designed, adequately serviced visitor industry and related developments which are sensitive to neighboring communities and activities.

(5) Develop the industry in a manner that will continue to provide new job opportunities and steady employment for Hawaii's people.

(6) **Provide opportunities for Hawaii's people to obtain job training and education that will allow for upward mobility within the visitor industry.**

(7) **Foster a recognition of the contribution of the visitor industry to Hawaii's economy and the need to perpetuate the aloha spirit.**

(8) **Foster an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawaii's cultures and values.**

The scale and character of the Hawaiian Riviera Resort with its extensive facilities, including five major hotels and a European-style fishing village around the marina will generate a wide variety of employment opportunities. Employee training programs will enable first-time job holders, as well as experienced workers to learn new skills. The goods and services required by the resort will generate a positive economic benefit for businesses in the region, island and statewide. Businesses stimulated by the new resort will, in turn, contribute to further economic growth and new opportunities for employment.

The establishment of a "world class" luxury resort in Ka'u will benefit surrounding communities by bringing a wide range of visitors to the District, ranging from the international traveler to the local visitor wishing to escape for the weekend. The proposed marina will greatly aid the fishing industry by providing new mooring facilities in the area and a convenient market for fish caught.

At the same time, however, the success of the Hawaiian Riviera Resort will depend in part upon the ability to preserve the scenic beauty of the area. This is especially true for the Ka'u Aina portion of the property. To that end, preservation and enhancement of the natural resources on and around the project site will be a matter of great importance and concern during the construction and operation of the facility.

Section 226-11 Physical Environment - Land-based, Shoreline, and Marine Resources.

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

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

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

(b) **To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:**

(1) **Exercise an overall conservation ethic in the use of Hawaii's natural resources.**

(2) **Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.**

(3) **Take into account the physical attributes of areas when planning and designing activities and facilities.**

(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.

(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.

(8) Pursue compatible relationships among activities, facilities, and natural resources.

(9) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.

The project area is presently in its natural state, consisting entirely of prehistoric and historic lava flows. The resort, its surrounding landscaping and recreational amenities will all be designed to enhance and protect the existing environment. The 400-slip marina will be cut into the basalt lava at the shoreline and will be constructed with a focus on reducing impacts upon the shoreline and marine resources. The preservation of existing anchialine ponds along the shore, wherever possible, represents an attempt to integrate compatible natural resources into the overall design of the resort. Large regional parks, including a 142-acre petroglyph park, will be included in the resort development. Numerous smaller Openspace Areas are proposed to be integrated into a continous Shoreline Openspace Corridor extending along the seaward portion of the property. Public access to fishing areas around Humuhumu Point and other portions of the project coastline will be maintained.

Section 226-12 Physical Environment - Scenic, Natural Beauty, and Historic Resources

(a) OBJECTIVE: 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 multicultural/historical resources.

(b) To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:

(1) Promote the preservation and restoration of significant natural and historic resources.

(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.

(4) Protect those special areas, structures, and elements that are an integral and functional part of Hawaii's ethnic and cultural heritage.

(5) Encourage the design of developments and activities that complement the natural beauty of the islands.

The applicant is commited to the preservation and enhancement of the natural features associated with the project site including, but not limited to, the shoreline and mountain vistas, the existing anchialine ponds and the pristine character of off-shore areas. Existing anchialine ponds will be preserved wherever possible and integrated into the landscape design. An extensive petroglyph park is proposed for the resort. This will provide extensive opportunties for the preservation of the natural environment and its integation into the surrounding development. A

300+/- acre Shoreline Openspace Corridor will be established along the seaward portion of the project site. This feature will accomplish multiple objectives, including: preservation of the shoreline resources; provision of public access; protection of numerous anchialine ponds and archaeological sites associated with the coastal environment; as well as protection of the resort faclities from wave run-up. In addition, numerous parks and Openspace Areas will be integrated with the shoreline accessway. Finally, although a small portion of the development is proposed for medium density resort and resort-residential uses, the vast majority of the 3,245 acre project will be developed in low-density resort uses, similar to the Kona Village Resort in North Kona. This style design is appropriate and complimentary to the surrounding environment.

Section 226-13 Physical Environment - Land, Air, and Water Quality

(a) **OBJECTIVE: Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:**

(1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources.

(2) Greater public awareness and appreciation of Hawaii's environmental resources.

(b) **To achieve the land, air, and water quality objectives, it shall be the policy of this State to:**

(2) Promote the proper management of Hawaii's land and water resources.

(3) Promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters.

(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

(6) Encourage design and construction practices that enhance the physical qualities of Hawaii's communities.

(8) Foster recognition of the importance and value of the land, air, and water resources to Hawaii's people, their cultures and visitors.

The design, construction and management of the Hawaiian Riviera Resort will be in keeping with the standards established for luxury hotels and first-class resorts. Landscaping will be designed to intercept and minimize on-site drainage into the ocean. Construction plans for the development will focus on reducing long term impacts on coastal water quality and mitigating short term impacts wherever practicable. The development of the proposed marina will occur onshore and inland with very little, if any, impact on ocean resources. Structures will be sited and constructed in a manner which will mitigate the threat of damage from natural disasters such as tsunamis, earthquakes, and volcanic eruptions. The Hawaiian Riviera Resort will provide services and support facilities including public facilities, parks and commercial areas which will benefit the entire region. The operation and maintenance of resort facilities will be consistent with the principle of environmental awareness and actions will be taken to mitigate impacts upon land, air, and water resources in the region. The development of water resources for the area will take into account the extent of available water resources and will be designed so as to minimize adverse impacts upon fresh water supplies. Alternate methods of transportation to and from the resort, as well as within

the resort, will be emphasized; including ocean-going vessels, air transportation, shuttles, and bikeways for intra-resort use.

Section 226-15 Facility Systems - Solid and Liquid Wastes

(a) **OBJECTIVE: Planning for the State's facility systems with regard to solid and liquid wastes shall be directed towards the achievement of the following objectives:**

(1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes.

(2) Provision of adequate sewerage facilities for physical and economic activities that alleviate problems in housing, employment, mobility, and other areas.

(b) **To achieve solid and liquid waste objectives, it shall be the policy of this State to:**

(1) Encourage the adequate development of sewerage facilities that complement planned growth.

Four privately constructed waste water systems with an ultimate combined capacity of 2.4 mgd will be constructed as part of the project. The design capacity of the individual wastewater treatment plants planned to serve the Hawaiian Palace Resort is presented in Table 7. The needs of the resort will be fully accommodated by the proposed facilities' planned capacity.

Table 7: PROPOSED SEWAGE TREATMENT PLANT CAPACITIES

Project Area	Total Units	STP Phase 1 Capacity	STP Ultimate Capacity
Hawaiian Palace	2227	.7 MGD	1.0 MGD
Ka'u Aina	1700	.4 MGD	.6 MGD

Solid waste disposal will be privately contracted. Disposal will be in an approved County landfill via the various drop-off points around the island. The completed Hawaiian Riviera Resort will generate approximately 40 tons per day with Phase One generating about 22 tons per day.

Section 226-16 Facility Systems - Water

(a) **OBJECTIVE: Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.**

(b) **To achieve the facility systems water objective, it shall be the policy of this State to:**

(1) Coordinate development of land use activities with existing and potential water supply.

(3) Reclaim and encourage the productive use of runoff water and waste water discharges.

(4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.

(5) Support water supply services to areas experiencing critical water problems.

(6) Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.

The ultimate success of the Hawaiian Riviera Resort project is dependent upon the successful development of potable water resources. Potable and non-potable water resources to service the project will be obtained from privately developed wells located on-site or just above the mauka property line. Water demand for the entire project is estimated at 6.0 mgd. Water development will be phased with project construction. Total potable water demand is estimated to be 2.5 mgd and non-potable water demand for irrigation is 3.5 mgd. In addition, water conservation and reclaimation programs will be implemented at the resort.

Section 226-18 Facility Systems - Energy/Telecommunications

(a) OBJECTIVE: Planning for the State's facility systems with regard to energy/telecommunication shall be directed towards the achievement of the following objectives:

(2) Increased energy self-sufficiency.

(c) To further the energy objectives, it shall be the policy of this State to:

(3) Promote prudent use of power and fuel supplies through conservation measures including education and energy-efficient practices and technologies.

The design, construction and operation of the Hawaiian Riviera Resort will utilize the most appropriate energy technologies and conservation methods.

Section 226-19 Socio-Cultural Advancement - Housing

(a) OBJECTIVE: Planning for the State's socio-cultural advancement with regard to housing shall be directed towards achievement of the following objectives:

(1) Greater opportunities for Hawaii's people to secure reasonably priced, safe, sanitary, livable homes located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals.

(2) The orderly development of residential areas sensitive to community needs and other land uses.

(b) To achieve the housing objectives, it shall be the policy of this State to:

(1) Effectively accommodate the housing needs of Hawaii's people.

(2) Stimulate and promote feasible approaches that increase housing choices for low-income, moderate-income, and gap-group households.

(3) Increase homeownership and rental opportunities and choices in terms of

quality, location, cost, densities, style, and size of housing.

(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.

(6) Facilitate the use of available vacant, developable, and underutilized urban lands for housing.

(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.

A variety of residential developments are planned for the Hawaiian Riviera Resort. In addition to resort-residential units, single family dwellings and multi-family dwellings will be developed within the resort. These units will be available for a broad mix of occupants ranging from owner-occupants, to second home buyers as well as renters. Recognizing that the development of the Hawaiian Riviera Resort will further stimulate economic and population growth in the region, the landowners are presently engaged in discussions with County authorities focused on identifying appropriate alternatives for the provision of employee housing to serve the needs of the employees of the Hawaiian Riviera Resort. At present, an 800-acre support community is proposed for the resort. Additional employee housing units are also planned for development with the Hawaii Ka'u Aina Resort property. Housing and job development at the Hawaiian Riviera Resort will help to restore the vitality to aging communities in the general area by inducing the return of former residents of the Ka'u District as well as in-migration and new commercial development for goods and services required by the support community. The specific method of providing employee housing to meet future demand will be determined through negotiations prior to the completion of the zoning process.

Section 226-23 Socio-Cultural Advancement - Leisure

(a) OBJECTIVE: Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.

(b) To achieve the leisure objective, it shall be the policy of this State to:

(4) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historic, geological, or biological values while ensuring that their inherent values are preserved.

(5) Ensure opportunities for everyone to use and enjoy Hawaii's recreational resources.

(10) Assure adequate access to significant natural and cultural resources in public ownership.

The identification and preservation of appropriate historic and natural resources onsite will further the public's understanding of their historic, cultural and scientific signficance. An extensive petroglyph park is proposed as a means of preserving and providing monitored access to the numerous petroglyphs in the area. The Shoreline Openspace Corridor along the seaward portion of the project site will contain numerous archaeological sites associated with the shoreline. In total,

over 900 acres of Openspace Area will be provided in the project area, including picnic areas and a public camping ground. Development of the proposed marina will increase recreational opportunities in the area without compromising the integrity of the natural coastal resources at the Hawaiian Riviera Resort. The marina will be developed on-shore resulting in minimal disruption of the offshore environment. Shoreline access along the coastline will be provided through the development of the Shoreline Openspace Corridor.

Section 226-25 Socio-Cultural Advancement - Culture

(a) **OBJECTIVE: Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawaii's people.**

(b) **To achieve the cultural objective, it shall be the policy of this State to:**

(1) Foster increased knowledge and understanding of Hawaii's ethnic and cultural heritages and the history of Hawaii.

(3) Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community life styles in Hawaii.

As appropriate, historic sites determined to be of significant cultural interest on the Hawaiian Riviera Resort property will be preserved and interpreted for the public and resort guests according to the resource management plan developed for the project. A large field of petroglyphs extending 142 acres will be preserved as a park within the Ka'u Aina portion of the resort, affording visitors and residents alike a unique opportunity to view an ancient artform in its natural, undisturbed environment. A large number of archaeological sites including fishing shrines, shelters, and manufacturing areas will be preserved as part of the Shoreline Openspace Corridor. Ancient trails will be integrated into the Hawaiian Riviera Resort's land use design and openspace network.

3.2 PART 2: PRIORITY GUIDELINES

The Priority Guidelines of the Hawai'i State Plan are established to provide overall guidelines to address areas of statewide concern. The proposed action is generally consistent with the general intent of the guidelines. Discussed below are the specific Priority Guidelines that are thought to be most directly related to the proposed project.

Section 226-103 Economic

(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:**

(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) An industry that can take advantage of Hawaii's unique location and available physical and human resources.

(B) A clean industry that would have minimal adverse effects on Hawaii's environment.

(C) An industry that is willing to hire and train Hawaii's people to meet the industry's labor needs.

(D) An industry that would provide reasonable income and steady employment.

Development of the Hawaiian Riviera Resort will contribute to construction employment over a period of years, permanent full-time and part-time operational jobs, and will stimulate the growth of employment in sectors of Hawaii's economy other than the visitor industry. As a major visitor destination area, the Hawaiian Riviera Resort will make a significant contribution to the economy of Hawaii County while having a relatively negligable physical impact on the environment. The harsh, inhospitable topography of the project site will be transformed into a productive, aesthetically pleasing environment with negligable impacts upon sensitive environmental resources.

(b) **Priority guidelines to promote the economic health and quality of the visitor industry:**

(1) Promote visitor satisfaction by fostering an environment which enhances the Aloha Spirit and minimizes inconveniences to Hawaii's residents and visitors.

(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 provides for adequate shoreline setbacks and beach access.

(4) Encourage visitor industry practices and activities which respect, preserve, and enhance Hawaii's significant natural, scenic, historic, and cultural resources.

(5) Develop and maintain career opportunities in the visitor industry for Hawaii's people, with emphasis on managerial positions.

In the tradition of world-class resorts, the Hawaiian Riviera Resort will promote visitor satisfaction by offering luxury-class and first-class facilities and services that are carefully and sensitively integrated into the natural beauty of the surrounding environment. The European character of the hotels and marina village in the Hawaiian Palace resort, the low density natural character of the Hawaii Ka'u Aina Resort, and the support facilities will all conform to relevant State and County zoning and other regulations. The quality of each hotel development will be further enhanced by its commitment to providing long-term employment and advancement opportunites to its employees.

(e) **Priority guidelines for water use and development:**

(1) Maintain and improve water conservation programs to reduce the overall water consumption.

(f) Priority guidelines for energy use and development:

(2) Initiate, maintain, and improve energy conservation programs aimed at reducing energy waste and increasing public awareness of the need to conserve energy.

The Hawaiian Riviera Resort will develop water resources where none currently exist. It will, at the same time, implement appropriate conservation programs with regard to water and energy use in a manner consistent with the appropriate governmental guidelines.

Section 226-104 Population Growth and Land Resources

(b) **Priority guidelines for regional growth distribution and land resource utilization:**

(1) Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures and away from areas where other important benefits are present, such as protection of important agricultural land or preservation of lifestyles.

(2) Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

(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.

(13) Protect and enhance Hawaii's shoreline, open spaces, and scenic resources.

The development of the Hawaiian Riviera Resort will focus new growth in an desolate area with no present potential for alternative uses. This implements the policies of maximizing the use of limited land resources and increasing the availability of non-essential lands. Futhermore, the development of new private infrastructure for water and waste disposal will reduce the need for public expenditures to provide similar services. Finally, the design and construction of the facility will enhance the shoreline, open spaces and scenic resources of the area by providing nearly 900 acres of recreational activities and open space within the resort.

Section 226-106 Affordable Housing

(1) Seek to use marginal or non-essential agricultural land and public land to meet housing needs of low and moderate-income and gap-group households.

(6) Encourage public and private sector cooperation in the development of rental housing alternatives.

(7) Encourage improved coordination between various agencies and levels of government to deal with housing policies and regulations.

The provision of affordable housing for employees of the Hawaiian Riviera Resort and their families is of vital concern to the resort's owners, who are confident that this concern can be adequately addressed through a close working relationship between the resort's owners and appropriate agencies of the County and State. As presently planned, an 800-acre support community will be developed in the mauka portion of the property providing housing units for employees and their families. The development of single-family and multi-family units within the resort will increase the opportunites for homeownership on the Island of Hawaii.

4. STATE FUNCTIONAL PLANS

State functional plans are intended to provide more detail to the Hawai'i State Plan in twelve specific areas of concern - agriculture, conservation lands, education, higher education, energy, health, historic preservation, housing, recreation, tourism, transportation, and water resources development. As defined in the Hawai'i State Plan (section 2-10), a functional plan sets forth "the policies, programs and projects designed to implement the objectives of a specific field of activity when such activity or program is proposed, administered, or funded by an agency of the State." The twelve State functional plans were examined to determine the relationship of the proposed Hawaiian Riviera Resort project to each.

4.1 STATE AGRICULTURE FUNCTIONAL PLAN

Nearly the entire 2,344-acre resort project site is aged basalt lava that is either barren or has a sparce vegetation cover of grass and o'hia. The entire resort area is designated as Conservation by the State Land Use Commission. This area is being proposed for reclassification to an Urban designation. The 800-acre support community and 100-acre airport facility are located on land classified Agriculture by the State Land Use Commission. However, like the Conservation land, it is primarily basalt lava and is not considered suitable for cultivation or grazing. None of the land located in the Agricultural district is identifited on the ALISH (Agricultural Lands of Importance to the State of Hawaii) map of the area. Subsequently, the implementing actions of the State Agriculture Functional Plan do not pertain either directly or indirectly to the proposed project.

4.2 STATE CONSERVATION LANDS FUNCTIONAL PLAN

There are several implementing actions in the State Conservation Lands Functional Plan (Hawaii, State of, Department of Land and Natural Resources, June 1984) that are relevant to the development of a marina at the proposed project, and these are discussed below. Related discussions are also found in the section of this chapter which discusses the Conservation District.

There are no definable streams or drainage ways within the subject property. The development of the resort and its support facilities will take into account valuable on-site natural resources. With proper management and mitigative measures, urban development can be compatible with these resources.

The subject property is presently classified in the State Conservation District. A petition for reclassification to the Urban District will be filed with the State Land Use Commission.

This functional plan addresses more than officially designated Conservation District lands, however, and includes (among a lengthy list) shoreline areas under the coverage of the plan.

A(1)(c) IMPLEMENTING ACTION. 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.

This implementing action is addressed largely to DLNR, but the issue of compliance with the CZM program is relevant to any shoreline project. In conjunction with the marina project, a detailed Coastal Zone Management Assessment will be submitted to the DLNR for review. The purpose of the submittal is to present a detailed evaluation of the proposed project's relationship to the specific policies of the Coastal Zone Management program.

A(1)(d) IMPLEMENTING ACTION. **Provide for effective enforcement of rules and regulations and permit system applicable to the Conservation District.**

The proposed project will follow the rules and regulations for the Conservation District Use permit system, where applicable.

A(1)(e) IMPLEMENTING ACTION. **Review applications for use of Conservation lands to control impacts on natural and cultural resources.**

This EIS document will allow extensive review by government agencies and the public. Adequate control of impacts on natural and cultural resources can be assured through the conditions placed on the various permits/approvals which the proposed Hawaiian Riviera Resort will require.

C(3)(b) IMPLEMENTING ACTION. **Acquire and maintain historic sites for parks and other purposes.**

Nearly 300 historical sites have been located and surveyed on the subject property. Those sites deemed significant for research, interpretive or cultural value will be preserved and maintained by the Hawaiian Riviera Resort. A 300+/-acre Shoreline Openspace Corridor, within which many of these sites are located, has been established as a means of preserving the sites and providing opportunites for resort guests and local residents to view them. A 142-acre petroglyph park has been created to preserve a large area of historic and prehistoric petroglyphs discovered south of Pohue Bay in the Hawaii Ka'u Aina Resort.

C(3)(c) IMPLEMENTING ACTION. **Establish criteria and evaluate areas of public land with historic or natural resource value and establish management practices to ensure the protection of areas from further degradation.**

The Hawaiian Riviera Resort will implement provisions of a Resource Management Plan for Historic Resources as applicable to the project site. Interpretive descriptions of archaeological sites will be established on the resort property to aid the viewer in better understanding and appreciating their significance. The preservation of these sites entails a detailed management plan which will be implemented by the resort.

4.3 STATE EDUCATION FUNCTIONAL PLAN

This functional plan (Hawaii, State of, Department of Education, April 1985) presents high priority implementing actions for education. Although a public school is proposed for development in the support community, all of the actions relating to its design and operation are to be undertaken by the Department of Education. Therefore, they are not applicable to the Hawaiian Riviera Resort project.

4.4 STATE HIGHER EDUCATION FUNCTIONAL PLAN

There are no policies or implementing actions in this functional plan, prepared by the University of Hawaii (June 1984) of direct relevance to the Hawaiian Riviera Resort.

4.5 STATE ENERGY FUNCTIONAL PLAN

The State Energy Functional Plan (Hawaii, State of, Department of Planning and Economic Development, June 1984) has as an objective the promotion of energy-efficient design. This relates both to overall land use planning and to specific building design and equipment selection decisions. While specific building designs have not yet been completed, the proposed

project will adhere to energy conservation standards wherever practicable.

4.6 STATE HEALTH FUNCTIONAL PLAN

The State Health Functional Plan (Hawaii, State of, Department of Health, June 1984:5) "focuses primarily on public health programs under the jurisdiction of the State Health Department." Several of the implementing actions relate to operating Department of Health (DOH) permit/approval programs that the proposed project is subject to. These include operating the environmental impact statement process; reviewing private wastewater treatment systems; administering permit programs for discharges to the air, all surface and groundwater, and for treatment and disposal of solid wastes; reviewing plans for new sources of drinking water; and reviewing plans for air conditioning and mechanical ventilation systems for buildings that are used by the public. These topics (wastewater, air quality, water quality, potable water systems, solid waste, and approvals needed) are discussed in terms of the proposed project in various sections of the EIS. The implementing actions also express other areas of concern to the DOH, such as reuse of treated effluent, noise, and medical services, that are covered in this EIS as well. Generally, the proposed project will comply with all necessary requirements related to the Department of Health's permitting procedures.

4.7 STATE HISTORIC PRESERVATION FUNCTIONAL PLAN

Essentially all of the policies and implementing actions in the State Historic Preservation Functional Plan (Hawaii, State of, Department of Land and Natural Resources, June 1984b) are directed at State agencies, especially DLNR. The archaeological resources at the Hawaiian Riviera Resort project site have been the subject of surveys and, where appropriate, will be further evaluated prior to construction at the site. Final determination of the preservation of specific sites will result from on-going discussions between the landowner and the State Historic Sites Office of the DLNR.

The implementation of a Resource Management Plan for Historic Resources at the Hawaiian Riviera Resort project will help fulfill Objective E of this functional plan which calls for "activities which support and foster increased knowledge and understanding of...the history of Hawaii". This management plan will provide the basis for all activities related to historical and cultural sites at the the project site.

The key recommendations of the management plan will be followed where applicable to the property's archaeological sites. Preservation/interpretive plans will be worked out with the responsible State and County agencies and reflected in this plan.

4.8 STATE HOUSING FUNCTIONAL PLAN

This State functional plan summarizes the results of the Hawaii Housing Authority (Hawaii, State of, Department of Social Services and Housing, June 1984 : ii) study "to formulate a comprehensive plan for the development, operation, and management of housing within the State." Most of the policies and implementing actions apply to the government sector. However, the need for employee housing and the potential impact of the proposed hotels on economic development and population growth in the general region are all matters of acute concern. The specific alternatives for the provision of employee housing are presently the subject of on-going discussions between the Hawaiian Riviera Resort and the appropriate County agencies.

4.9 STATE RECREATION FUNCTIONAL PLAN

The State Recreation Functional Plan (Hawaii, State of, Department of Land and Natural Resources, June 1984c) has as Policy D(2) "the securing of public accesses to resources with

recreational value." A 300+/-acre Shoreline Openspace Corridor providing public access is intended to extend along the shoreline of the Hawaiian Riviera Resort from the marina to the southern boundary of the resort.

Policy E(3) of the State Recreation Functional Plan aims to: "coordinate visitor and resident recreation interests to achieve compatible recreation usage." Over 900 acres of Openspace Areas will be developed on the project site by the Hawaiian Riviera Resort. These areas will provide not only specific opportunities for passive recreational activities, but will also provide parking and comfort station facilities for people who utilize the Shoreline Openspace Corridor. Three 18-hole golf courses, a tennis center and an equestrian facility are proposed for development in the resort. A large marina, as well as a separate public boat launch, will provide new opportunities for fishing and recreational boating in the area. The provision of public access to the coastal areas will result in new opportunies for recreational diving and snorkeling among the picturesque underwater features at the southern end of the project site. An extensive bike path is proposed for development at the Hawaii Ka'u Aina Resort. In sum, the development of these facilities will facilitate greater access and a wide variety of recreational activities for visitors and residents alike.

4.10 STATE TOURISM FUNCTIONAL PLAN

The Hawai'i State Department of Planning and Economic Development (June 1984b) authored this functional plan and considers it a "guide to help coordinate the various sectors of government and private industry toward achieving statewide objectives of the Hawaii State Plan" (p. 2). The role of government in tourism is seen not only as protecting the economic health of the industry, but also as "advancing the social goals of the community" (p. 8). The policies and implementing actions which are most relevant to the private sector, and particularly to the proposed project, are those concerning physical development.

B(3) **POLICY: Encourage greater cooperation between the public and private sectors in developing and maintaining well- designed and adequately serviced visitor industry and related development.**

The construction of the Hawaiian Rivieria Resort represents a significant new development in an economically depressed area. This Environmental Impact Statement process, coupled with the detailed land use permitting process at both the State and County levels of government, will provide extensive opportunities for coordination between the public and private sectors. The outcome will be well-planned visitor destination area that will bring new vitality to the region.

B(3)(a) **IMPLEMENTING ACTION: Assure that adequate infrastructure and amenities, such as roads, water, drainage and parks, are provided through a reasonable distribution of financial responsibilities between governmental and private parties.**

All necessary infrastructure servicing the resort will be developed by the property owners, thereby significantly reducing the need for new government investment in infrastructure. The resulting services and facilities will adequately serve the needs of the new resort and its amenities.

B(3)(d) **IMPLEMENTING ACTION: Encourage the clustering of hotels and resort condominium developments to provide open space and promote energy conservation.**

The proposed land use configuration of the Hawaiian Riviera Resort will offer a distinctive variety of designs and densities. At the Hawaiian Palace Resort, visitor facilities will be clustered in two primary areas, on either side of the proposed marina village. Hotels at the Hawaii Ka'u

Aina will be generally clustered (although at a lower density than the Palace Resort) in the vicinity of the Kanonone ponds. The eventual result will be the development of 2,100 hotel units concentrated in a single self-contained and master-planned resort rather than being distributed around the entire island. This clustering of hotels and condominiums allows for a more concentrated land use and enhances energy conservation by promoting alternative transportation means such as walking or bicycling between the various facilities at the resort. Furthermore, the clustering of multiple resort facilities in a single area provides greater and varied recreational opportunites for resort visitors, thereby reducing the need for travel outside the resort boundaries.

B(3)(e) **IMPLEMENTING ACTION: Encourage the use of regional sewerage systems by hotel and visitor condominium developments rather than use of individual private systems.**

Major sewage treatment systems will be developed to serve the Hawaiian Riviera Resort. The resort and resort-residential units of the Hawaiian Palace Resort will be served by a sewage treatment system. Due to the extensive size and anticipated phasing of the Ka'u Aina Resort, two separate systems will be developed to serve its needs. Effluent from the treatment systems will utilized for golf course irrigation. Septic tanks will be utilized for low-density residential areas.

B(4)(b) **IMPLEMENTING ACTION: Ensure that new hotel and condominium projects be set back from the shoreline for access which facilitates and permits use of those areas.**

The proposed resort developments and their related amenities will be set back from the shoreline in accordance with all appropriate regulations. A 300+/-acre Shoreline Openspace Corridor along the seaward portion of the Hawaiian Riviera Resort property will provide opportunities for increased access and use of areas which have previously been limited.

B(4)(d) **IMPLEMENTING ACTION: Plan development of resorts in a coordinated manner to minimize loss of public recreational opportunities in designated visitor destination areas.**

The proposed Hawaiian Riviera Resort will provide extensive public access along the shoreline. Few, if any, public recreational opportunities will be lost; and public use of the shoreline will greatly increase with the development of a Shoreline Openspace Corridor, marina, and boat launch. Privately owned areas presently closed to public access will be opened once the first phase of project development has been completed.

D(3)(a) **IMPLEMENTING ACTION: Provide relevant information to visitors to foster their understanding of Hawaii's uniqueness in order to minimize damage of natural, historic, and archaeological resources, promote their personal safety and protection, and foster an appreciation of the contribution of Hawaii's residents to the enjoyment of the visitor's experience in Hawaii.**

The preservation of existing anchialine ponds, the preservation and identification of historic sites, and the tropical landscaping proposed for the area will all provide opportunites for visitor infomation. Detailed and informative descriptions of points of interest will be provided where applicable on the Hawaiian Riviera Resort property.

The development of a marina will enhance visitor and resident ocean-safety by providing a safe and accessible mooring area for recreational boating where none is now available.

D(3)(b) IMPLEMENTING ACTION: **Provide relevant interpretation of, and public access to, sites of archaeological significance whenever feasible, and establish a program to explain Hawaii's history and values to visitors and residents.**

The Hawaiian Riviera Resort will establish substantial interpretive programs for archaeological sites preserved in the area. Signs will provide detailed explanations of the area's history and general concepts of Hawaii's past to visitors and residents. Before plans to develop parcels are finalized, the State and County will be consulted regarding the necessity for further archaeological survey work, and/or preservation and interpretation of archaeological sites.

4.11 STATE TRANSPORTATION FUNCTIONAL PLAN

None of the policies or implementing actions in this functional plan (Hawaii, State of, Department of Transportation. June 1984) address specific developments such as the Hawaiian Riviera Resort. The overall objective of the plan is to provide for the efficient, safe, and convenient movement of people and goods. The impacts of the proposed resort development on exisiting transportation facilities in the Ka'u District, are addressed in the traffic analysis section of this document.

4.12 STATE WATER RESOURCES DEVELOPMENT FUNCTIONAL PLAN

This functional plan, prepared by the Hawaii State Department of Land and Natural Resources (June 1984d:2) "primarily affects State operations, it also involves some actions of . . . the private sector. It points out where . . . private industry coordination will be needed and . . . can help achieve water resources objectives". As the other State functional plans, it does not mandate private sector actions.

The plan presents general objectives and policies for the management of potable water supply, floodplains, agricultural water, and estuarine environments that could be considered relevant to this project. The proposed resort will develop a new water source with the appropriate infrastructure necessary to serve the entire development and will comply with all appropriate Federal, State and County regulations.

5. HAWAII COASTAL ZONE MANAGEMENT PROGRAM

The Hawaii Coastal Zone Management Act (Act 188, SLH 1977), which became Chapter 205A, Hawaii Revised Statutes, established State policies for any action affecting the coastal zone. The act established specific objectives and policies in seven broad categories. The relationship of the proposed Hawaiian Riviera Resort project to these categories of concern is discussed below.

5.1 RECREATIONAL RESOURCES

The stark, barren nature of the existing site currently affords little opportunity for recreational activities, other than hiking and offshore activities such as fishing and diving. The proposed development of a 400-slip marina at the Hawaiian Palace Resort and a public boat launch at the Ka'u Aina Resort will result in a substantial increase in the availability of ocean-related activities for guests and area residents alike. These include recreational sailing, fishing, and deep-sea diving. Additional recreational activities at the proposed resort will include three 18-hole golf courses, a championship tennis center, a polo field and equestrian facilities, bike trails, and numerous parks for active and passive recreational activites.

5.2 HISTORIC RESOURCES

The 3,244 acre project site is rich in historical resources, including nearly 300 archaeological sites. A detailed survey of these sites has been prepared and includes recommendations for treatment and/or preservation of each site. Those sites to be preserved are included in various natural features including a 142-acre petroglyph park, an Openspace Shoreline Corridor, and a variety of smaller parks and openspaces.

5.3 SCENIC AND OPEN SPACE RESOURCES

The Hawaiian Riviera Resort proposes to utilize a variety of landscape features and land uses to achieve a transition from the barren lava flows which dominate the property to the classical Hawaiian architectural design and verdant landscaping proposed for the resort. Included among these features are a petroglyph park, three 18-hole golf courses, and numerous Openspace Areas and landscaped water features. This allows the project to maximize open space amenities and protect environmentally sensitive shoreline areas. The cumulative effect of these features will be a significant enhancement of the area's open space and scenic resources.

5.4 COASTAL ECOSYSTEMS

The ecosystems of the nearshore waters and the shoreline area are not expected to be adversely affected by the development proposed for the Hawaiian Riviera Resort. A detailed discussion of the probable impacts of the proposed marina is included in this document. However, due to the narrowness of the nearshore reef, and the steep offshore slope that fronts the entire project area creating open-ocean conditions, the marina related activities will have a negligible impact upon the ocean. Due to the barren nature of the project site, no endangered or environmentally sensitive coastal vegetation has been identified. However, a number of anchialine ponds have been located along the coastline. These are all contained within the Openspace Shoreline Corridor and will be preserved for the enjoyment of guests and area residents.

5.5 ECONOMIC USES

Resort development of the subject property represents an appropriate and economically beneficial alternative land use for an area that is presently vacant and unusable. In view of the critical need for new economic growth in the Ka'u area, the Hawaiian Riviera Resort is viewed as a viable source of employment opportunities for the area's residents. As demonstrated elsewhere in this document, the proposed resort development is not expected to cause any significant adverse impacts.

5.6 COASTAL HAZARDS

The project site is identified as an area of minimal tsuanmi inundation on the Flood Insurance Rate Map (FIRM) maps for the area due to the topography and bathymetry of the region. Nevertheless, buildings will be setback from the shoreline cliffs to minimize any potental hazard from unique storm conditions. Sea Engineers, Inc. have studied this matter and have identified the extent of potential storm wave and tsunami wave runup along the coastline. All major structures have been sited inland from the inundation areas. Erosion will be controlled to avoid any impacts on coastal waters.

5.7 MANAGING DEVELOPMENT

This EIS is a tool for communicating the impacts of the proposed Hawaiian Riviera Rsort at an early stage of planning. It is intended to facilitate participation in the planning and review process. The proposed plan will require a variety of development permits before it can be

implemented. These will afford numerous opportunities for the Hawaii Coastal Zone Management Program network authorities to make recommendations for the project which will assure the proper management of coastal zone resources.

6. COUNTY SPECIAL MANAGEMENT AREA

An area along the shoreline approximately 500 feet wide has been designated as a "Special Management Area" (SMA) and is therefore subject to the SMA Rules and Regulations of the County of Hawaii. Following is a discussion of the relationship of the proposed Hawaiian Riviera Resort to the SMA guidelines in the Hawaii County Planning Commission's Rule No. 9. The guidelines are summarized and brief comments following note the extent to which the proposed project is believed to be consistent with them. The objectives and policies of the State's Coastal Zone Management Act are also discussed in the County's SMA Rule.

Guideline A.1 This guideline seeks to minimize alterations to any body of water.

The only aspects of the development project which potentially impact the ocean fronting the subject property are the construction of the marina facility and boat launch. These marine facilities will be constructed entirely inland of the certified shoreline, with the exception of the entrance channel connecting it to the ocean. However, due to the steep offshore bathymetry and relatively narrow offshore reef area, entrance channel construction will have a negligable impact upon coastal resources. Anchialine ponds located on the project site will be preserved for the benefit of resort visitors and guests.

Guidelines A.2 &3. These guidelines seek to minimize reductions in the availability and/or access to beaches and other recreational areas and shoreline areas due to development.

Due to a relative lack of access to the project site, and the generally harsh physical character of the lava flows now covering the area, recreational activities are presently limited to shoreline fishing and offshore diving. Access is presently restricted. The Hawaiian Riviera Resort will increase the availability of the shoreline by providing parks, a boat launch, and a public access path along the entire coastline of the project.

Guideline A.4. This guideline concerns the visual impacts of the proposed development.

The development of the proposed coastal resort will occur at a distance of more than five miles from Mamahola Highway, and thus will in not detract from the line of sight between the highway and the sea. Most of the structures at the Hawaii Ka'u Aina Resort will be less than four stories in height, and their visual impact will be softened by careful landscaping which will virtually conceal them within the lava-dominated landscape . The overall design of the structures and their generous landscaping will combine to present an oasis-like appearance surrounded by the barren lava fields of Ka'u as the observer comes upon them. Although designed with a higher density than the Hawaii Ka'u Aina Resort, the Hawaiian Palace Resort will have an aesthetically pleasing visual impact. The core of the resort area will be located in a large terraced area surrounding the marina, presenting the image of a Mediterranean fishing village. The terraced marina village presents a highly efficient land use configuration which will be virtually invisible from landward views due to the proposed terracing.

From the ocean, the Hawaiian Palace Resort will be framed against the sloping land extending back over five miles to the highway to an elevation of about 1,900 feet.

Guideline A.5. **This guideline aims at minimizing development that adversely affects water, scenic, or wildlife resources, or that adversely affects existing or potential agricultural uses of the land.**

The water and scenic resources of the project site are planned to be incorporated into the development and adverse impact on them should be avoided. There are no significant wildlife resources associated with the project site. A detailed discussion of the development impacts is presented within this EIS. There are no existing or potential agriculture uses associated with the project site.

Guidelines B.1,2 &3. **These guidelines state that no development shall be approved unless it has no significant adverse environmental effects, and is found consistent with Chapter 205A, HRS, the Hawaii County General Plan, the Hawaii County Zoning and Subdivision Codes, and other applicable ordinances.**

This EIS supplements an application to amend the General Plan designation for the property. It analyzes the potential of the proposed project to create adverse effects and outlines the mitigation measures that will be taken to avoid them or minimize them to insignificant levels. The plan's consistency with Chapter 205A, HRS has been discussed in this Section.

Guideline C.1 & 2. **These guidelines seek to ensure access to beaches, recreation areas, and natural reserves, and to ensure that adequate recreation and wildlife preserves are maintained.**

Access to shoreline areas will be improved by the development of a public accessway along the seaward portion of the project site. Anchialine ponds on the project site will be preserved. There are no wildlife preserves associated with the project site.

Guideline C.3. **This guideline concerns solid and liquid waste management.**

The Hawaiian Riviera Resort will develop the necessary infrastructure for the disposal of liquid waste. Solid waste will be disposed of using privately-contracted services and existing County facilities.

Guideline C.4. **This guideline seeks to minimize adverse impacts resulting from alterations to existing landforms and vegetation.**

Extensive site preparation will be necessary to develop the barren lava flows which cover the property. All appropriate precautions will be taken to minimize any adverse impacts. Due to the lack of natural drainageways, and relatively low annual rainfall in the area, offshore drainage and siltation is not anticipated to be a problem. Existing vegetation within the Hawaiian Riviera Resort development area consists primarily of sparse grasses and occasional shrubs emerging from cracks in the lava flows. Preservation of the anchialine ponds will not require construction or restoration activities due to their pristine condition.

Guideline C.5. **This guideline seeks to minimize adverse environmental or ecological impacts due to the project.**

The Hawaiian Riviera Resort is committed to minimizing adverse environmental or ecological impacts. The multi-level review and permit process that the project must undergo before it is implemented will ensure that mitigation measures are made conditions to development.

Guideline C.6. This guideline states that the proposed project must be consistent with the General Plan.

This EIS supplements an application to redesignate the subject property from Conservation to Resort on the Hawaii County General Plan.

7. HAWAI'I COUNTY GENERAL PLAN

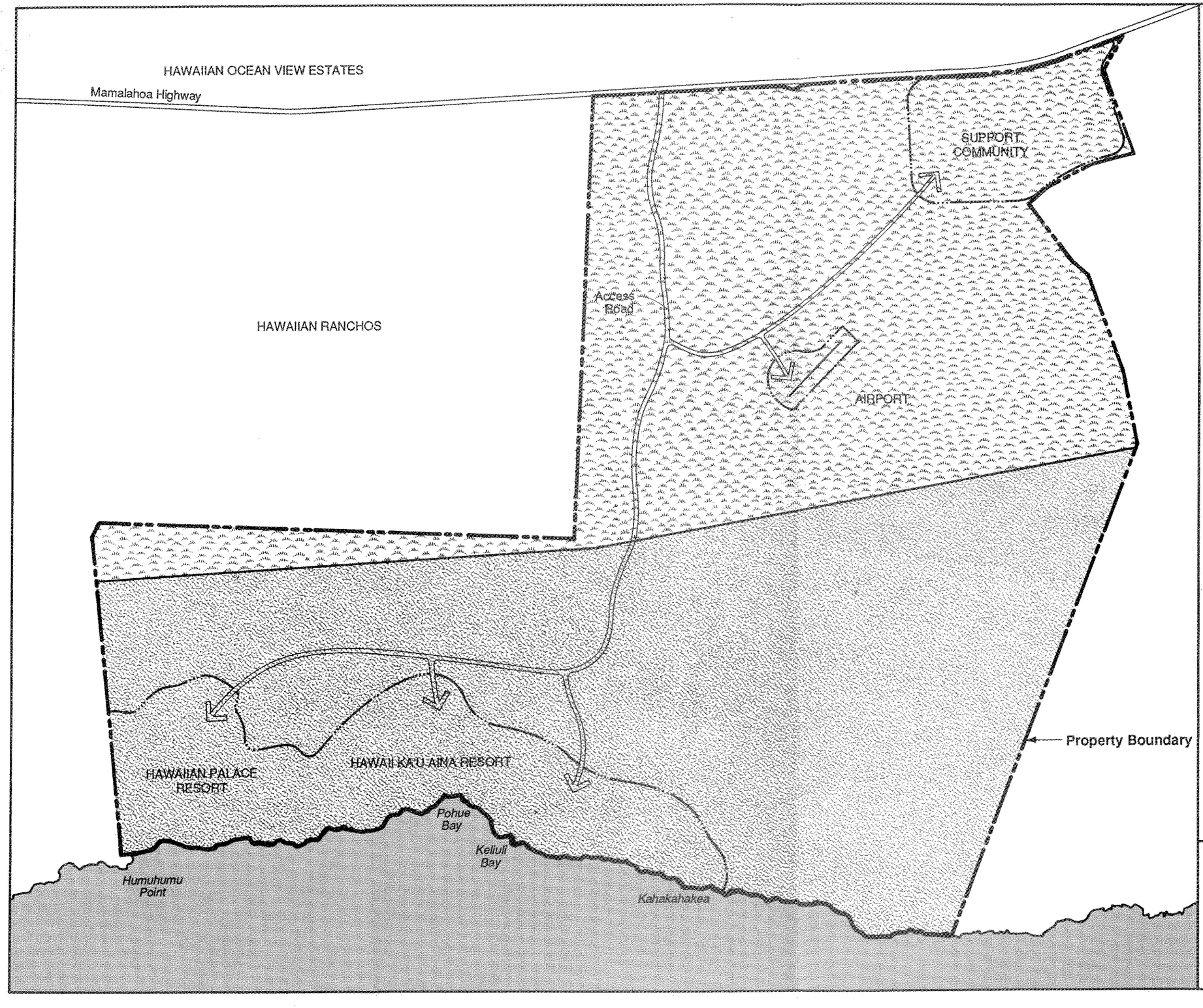
The Hawai'i County General Plan (Hawai'i, County of, 1971 as amended) contains both a set of policies and land use maps showing the location of desired land uses for the entire island. The latter are referred to as "Land Use Pattern Allocation Guide Maps" (LUPAG maps). The seaward portion of the subject property which is the site of the Hawaiian Riviera Resort's visitor facilities is designated as Conservation with a narrow region of Open Lands indicated along the shoreline. The upland portion of the property where the airport and support community will be located is designated as Extensive Agricuture. (see Figure 3.2). The Conservation designation corresponds to the State Land Use classification of Conservation.

The applicants are proposing the redesignation of a 2,300 acre area within the Conservation district to Major Resort. An Industrial designation for 100 acres is being requested to incorporate the airfiled and supporting facilities. Medium and Low Density designations are being requested for the 800 acre support community. Figure 3.3 shows the proposed General Plan designations. The applicants believe that a Resort designation will benefit the District of Ka'u as well as the entire island of Hawaii. The proposed resort's urban activities will be designed in a manner that is complimentary to the natural surroundings and compatible with them. The proposed resort is designed to be consistent with the development standard established for Major Resorts in the General Plan:

> A major resort area is a self-contained resort destination area which provides basic and support facilities for the needs of the entire development. Such facilities shall include sewer, water, roads, employee housing, and recreational facilities, etc.

The decision whether or not to grant the General Plan amendment necessary to develop the Hawaiian Riviera Resort will be based upon the criteria established in the General Plan in the form of goals and policies. The following discussion identifies the project's consistency with the goals and policies that are most applicable to the proposal. The headings used correspond to the individual elements that make up the General Plan.

In May, 1987, as part of its comprehensive revision program, the County of Hawaii published a draft County General Plan and a list of recommended changes to the Land Use Pattern Allocation Guide (LUPAG) Map. The proposed revisions are presently the subject of a series of public hearings and informational meetings being conducted around the island of Hawaii. Under the present timetable, legislative action on the Revised General Plan is not anticipated before publication of this document. In general, the recommended revisions to the General Plan text have little substantive impact upon the proposed Hawaiian Riviera Resort project. Specific policies which may affect the project are included in the discussion below. No changes have been recommended for the LUPAG Map of the Kahuku, Ka'u area.



LEGEND:

- Extensive Agriculture
- Conservation
- Shoreline Open Area

Figure 3.2

HAWAII COUNTY GENERAL PLAN LAND USE DESIGNATIONS

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

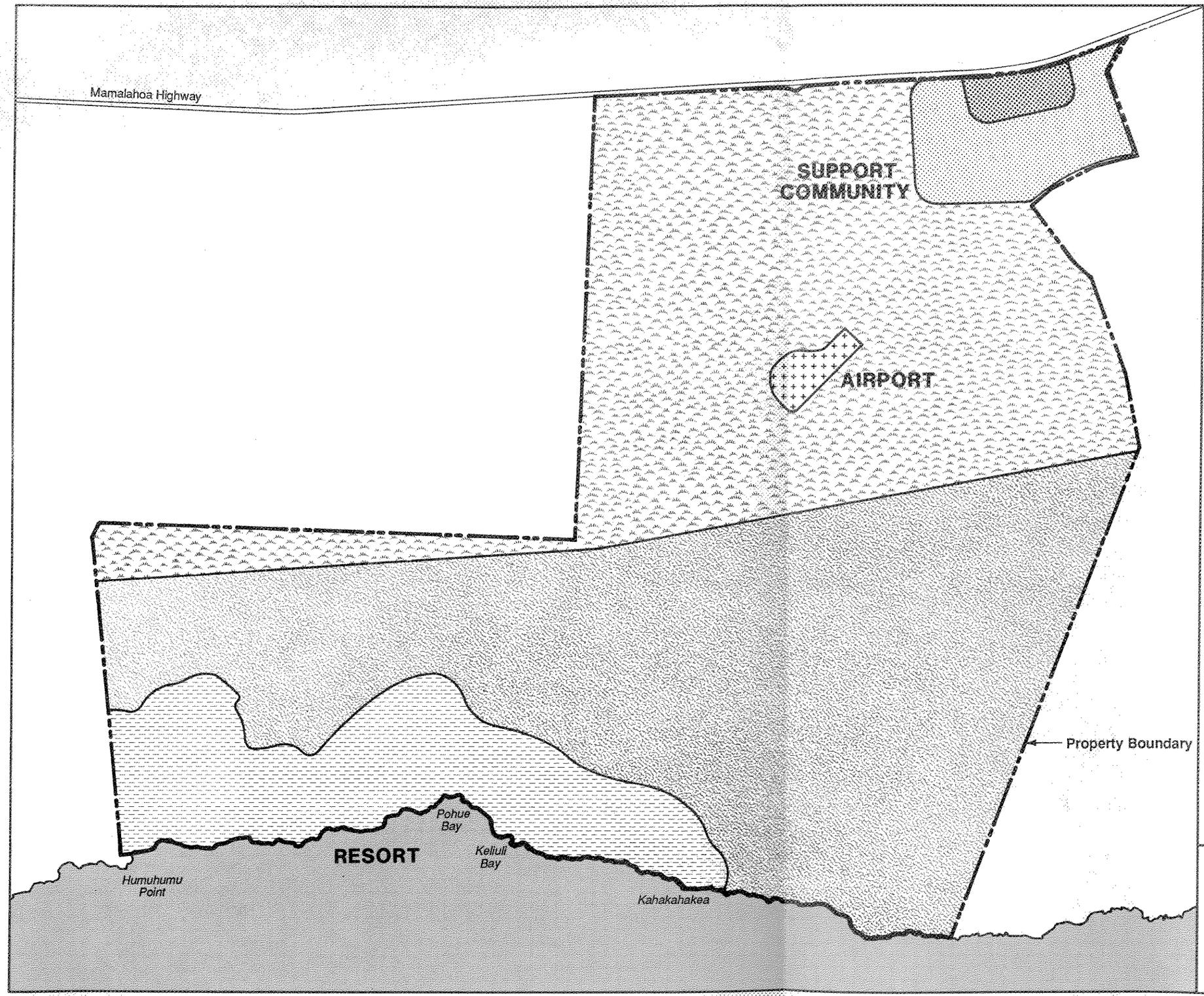
4000 2000 0 4000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987



LEGEND:

- Medium Density
- Low Density
- Industrial
- Extensive Agriculture
- Resort
- Conservation
- Shoreline Open Area

Figure 3.3

PROPOSED GENERAL PLAN LAND USE DESIGNATIONS

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

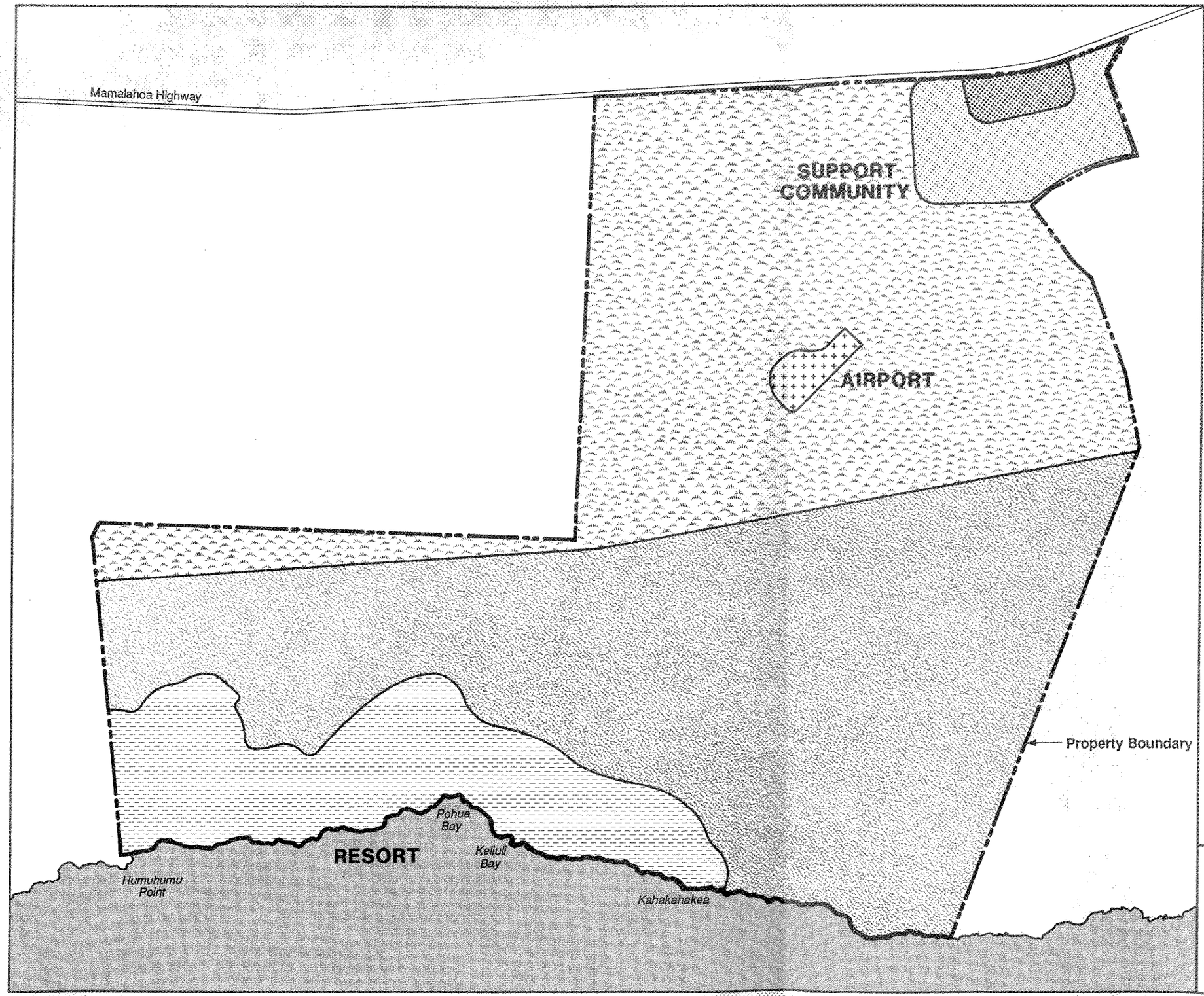
4000 2000 0 4000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987



LEGEND:

- Medium Density
- Low Density
- Industrial
- Extensive Agriculture
- Resort
- Conservation
- Shoreline Open Area

Figure 3.3

PROPOSED GENERAL PLAN LAND USE DESIGNATIONS

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

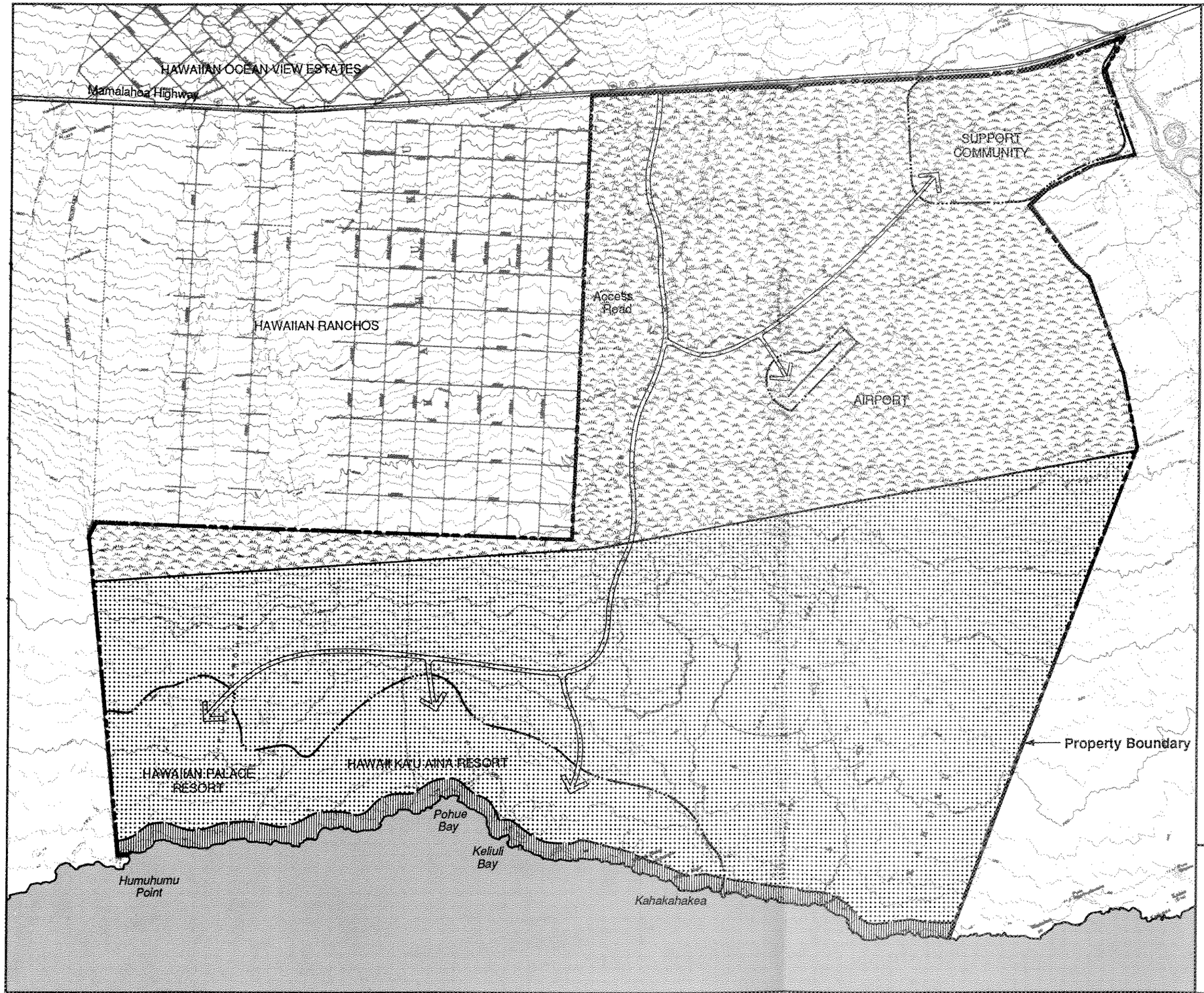
4000 2000 0 4000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987



LEGEND:

Special Management Area

ZONING

Open (O)

Agriculture (A-20)

Figure 3.4

CURRENT ZONING OF THE HAWAIIAN RIVIERA RESORT PROPERTY

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

4000 2000 0 4000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

CHAPTER IV

DESCRIPTION OF THE AFFECTED ENVIRONMENT, PROBABLE ENVIRONMENTAL CONSEQUENCES, AND PROPOSED MITIGATING MEASURES

1. PHYSICAL ENVIRONMENT

1.1 PHYSIOGRAPHY, GEOLOGY, SOILS AND CLIMATE

1.1.1 Existing Conditions

1.1.1.1 Physiography

The Ka'u Judicial District is located in the southern portion of the Island of Hawai'i and contains over 512,600 acres of land, making it about 25% larger than the entire island of Oahu. The district extends from Mauna Loa's 13,677-foot summit to the ocean, and includes the entire area between Keauhou Point to the southeast and Kamoi Point to the southwest. The Ka'u district is predominately classified as either Agriculture or Conservation land and includes two small towns, Pahala and Na'alehu. The district is accessed by a single major roadway, Mamalahoa Highway (the Hawaii Belt Road), linking it to the neighboring districts of Puna and South Kona. Ka Lae, or South Point, is located within the district and is recognized as the southernmost point in the United States.

The 3,245-acre Hawaiian Riviera Resort is situated within a 20,616 acre parcel of land located approximately 6.5 miles northwest from Ka Lae Point (South Point), on the Island of Hawaii. The proposed project consists of three separate but interrelated land use areas; a 2,345 acre resort area situated along the coastline, an 800 acre support community located on the eastern portion of the property along Mamalahoa Highway, and a 100 acre airport facility situated between the resort and the support community. The subject property is shown in Figure 4.1. The average slope of the project site is 5 to 6 percent with areas of greater slopes located in the upland or mauka portions of the proposed site. The entire property extends approximately 6.4 miles along the coast and 5.4 miles from the shoreline up to the Mamalahoa highway.

1.1.1.2 Geology

This section discusses the geology of the project site, identifies the probable impacts of development and includes specific recommendations to mitigate geologic hazards. The contents of this section have been condensed from a report, "Geological Investigation-Proposed Hawaiian Riviera Resort", prepared for this EIS by the firm of Dames & Moore. The complete report is included as an appendix to this document.

1.1.1.2.1 Regional Geology

The resort site is located along the seacoast on the southwest flank of Mauna Loa about six miles northwest of Ka Lae (South Point). The region, from Ka Lae to Kealakekua, is dominated by a number of significant features and characteristics. The general slope of the region is 3 to 5 degrees or 10 percent. Offshore, the depth of the water increases rapidly due to a steep bottom slope. Because the entire region is situated on the southwest flank of Mauna Loa, it has been subjected to extensive coverage by prehistoric and historic lava flows from Mauna Loa's Southwest Rift Zone (SWRZ), many of which have reached the ocean. Significant faults are located at both Kealakekua and Ka Lae therein defining the boundaries of this 40 mile wide geological region (Figure 4.2).

Figure 4.1

PROPOSED PROJECT AND SURROUNDING AREA

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

> Because the seaward flank of the growing volcano [Mauna Loa] is unbuttressed and sloped at a relatively steep angle, the repeated intrusion of magma into the SW rift zone often causes ground shifts on a regional scale. The inflation and deflation of the magma chamber in the rift zone causes gravitational tensional movement along the flank and causes the area between the two faults to break into large regional slump blocks. These regional blocks are moveable and have slumped downwards relative to each other. Recent geological investigation reports indicate that the slumping extends to the submarine region offshore...It should be noted that virtually all of the major slump blocks above sea level located between the two faults have been covered by lava flows. This suggests that block-faulting on a regional basis has not been active for decades or maybe centuries (Dames & Moore, 1987).

1.1.1.2.2 Site Geology

The project site is entirely covered with a'a and pahoehoe lava flows, with a predominance of prehistoric flows. The western boundary of the proposed Hawaiian Palace Resort site is located on a prehistoric a'a lava flow with an age estimated in the range of 800 to 1,000 years old. The pahoehoe lava that makes up the east portion of the Hawaiian Palace site and all of the Ka'u Aina Resort site ranges in age from 750 to greater than 1,500 years. The site's a'a flows are typical in that they have a surface of crumbly clinker underlain by a massive core of hard, dense lava. The pahoehoe flows are characteristically smoother than a'a, with many associated features including tumuli, depressions, lava tubes, blisters and voids. In addition to these two types of lava, a third type, scaly pahoehoe, has been located at the resort site and appears to be transitional between pahoehoe and a'a.

The average slope of the project site between the shoreline and the 240 foot elevation is 3 degrees or approxiamately 5 to 6 percent. The slope of the remaining property above the resort area is approxiamately 5 degrees or 8 percent.

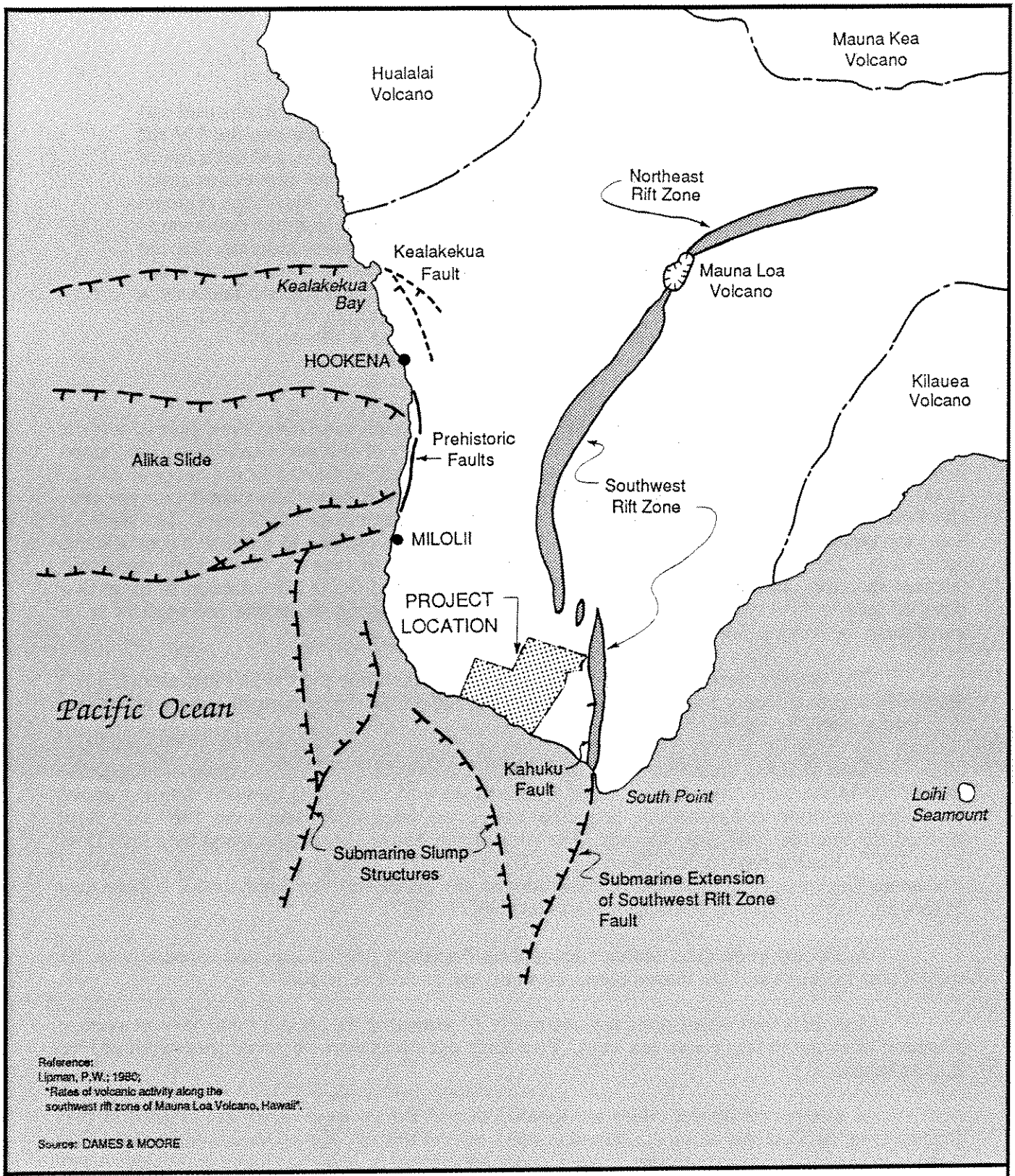
Two of seven historical lava flows recorded along the SWRF are located on or near the project site in the Ka'u Aina region. Both eruptions were characterized by vents opening above 5,000 feet elevation and remaining active for about two weeks. Although the 1887 lava flow reached the sea, the 1907 flow did not. The project site has not been threatened by a lava flow since 1907. Recent reports published by the United States Geological Survey and the Hawaii Volcanoes Observatory suggest that volcanic activity associated with the Southwest Rift Zone may be moving northward away from the project site (USGS, 1987).

Additonal geological features located on the resort project site, and especially in the coastal area include seacliffs, littoral cones, beaches, and anchialine ponds.

Sea cliffs are located along approximately 30 percent of the coastline and have an average elevation of about 30 feet above sea level. Two large sea caves were observed shoreward of Puu Kahakahakea.

A number of littoral cones are located east of Pohue Bay. They are aligned in two distinct rows; the first row along the shoreline and a second row of older cones inland from the first at the location of a former shoreline. Littoral cones are created in pairs by violent explosions when a'a lava flows enter the ocean, leaving one cone of liquified ash deposits on each side of the flow. The littoral cones are covered or surrounded by subsequent lava flows.

Several different types of beaches were identified. A white coralline sand beach is



Reference:
Lipman, P.W.; 1980;
"Rates of volcanic activity along the
southwest rift zone of Mauna Loa Volcano, Hawaii".

Source: DAMES & MOORE

10 5 0 10

SCALE IN MILES

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

Figure 4.2

REGIONAL GEOLOGY AND OFF-SITE GEOLOGICAL FEATURES

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

located at Pohue Bay. Black volcanic cinder sand beaches are located at the base of the littoral cones. Beach areas covered with basaltic and coralline, coarse sand to cobble-sized particles, have developed on pahoehoe lava flows in other areas.

Brackish water or anchialine ponds are located along the coastline of the property. Kanonone Water Hole and another large pond are located west of Pohue Bay. Several smaller ponds are located at the east end of the property. Seepage of fresh water and brackish water occurs along the entire length of the coast. Beach rock, which forms at intertidal areas where fresh water is seeping, has been identified at the eastern end of the Ka'u Aina Resort site. In other portions of the shoreline, fresh water has been observed floating at the surface of the salt water, particularly during low tide. A composite map of geological features is presented as Figure 4.3.

1.1.1.2.2.1 Ground Cracks

Ground cracks have been located along portions of the project shoreline and at some inland areas of the western area of the proposed resort. Averaging about 1.5 feet in width and up to 3 feet wide, their length varies from about 30 feet to 1,800 feet with an average length of about 1,300 feet. The cracks tend to be generally parallel with the shoreline. Most of the cracks appear to have a slight vertical offset, although some are offset up to 2 feet, that is, one side of the crack is as much as 2 feet lower than the opposite side.

1.1.1.2.2.2 Impacts and Mitigation Measures

Although the exact causes of the ground cracking is still under investigation, project geologists believe that they are related to the regional slumping discussed earlier in this section. It has been suggested that repeated prehistoric eruptions have resulted in tremendous volumes of lava entering the ocean and hardening on the steep offshore slope. The weight of this lava, and possibly the inflation/deflation cycles of Mauna Loa, may have produced the cracks at the shoreline where the landward slope of about 5 percent increases dramatically to nearly 30 percent offshore.

> Our current level of investigation effort has not yeilded sufficient data to assess the age, rate of movement, and depth of these ground cracks. Based on our knowledge of the probable ages of the pre-historic a'a and pahoehoe lava flows on site, our best guess of the age of these ground cracks may be between 300 and 1,000 years old. In 1976, U.S. Geologic Survey personnel began monitoring a geodetic control line from Na Puu a Pele located west of the site, to Puu Ki on the eastern end of the site. Within the last 11 years, the survey indicates that there has been little or no ground movement across this line. The recordable movements were very small and well within the surveying accuracy tolerance limits. Ground cracks are rather unique geological features that should be considered in resort planning. Engineering techniques are available and implementable to further quantify the physical characteristics of these cracks (Dames & Moore, 1987).

For the purposes of this document, which is general and contextual in nature, the potential hazard of movement among the ground cracks is best left to further geological analysis. As with the general threat of volcanic eruption associated with any development in the vicinity of Mauna Loa, the investment risks must be weighed against the geological frequency of a probable event. Initial considerations concerning ground cracks focus upon the siting of resort structures and facilities. Detailed geological studies of these unique features will provide both the developer and the County with useful information in making a determination as to their significance. It is believed that the extent of their potential impact is limited to the immediate area of their occurance leaving the great majority of the project site unaffected.

A geophysical and geotechnical investigation will be undertaken to determine the length, width, depth, age of the ground cracks, and rock strength adjacent to the cracks. A scope of work for this study could include the following:

1. Map the lateral extension of the cracks unde the a'a lava flows to try and establish the age relationships of the cracks to the flows. Ground penetrating radar and very low frequency electromagnetics (VLF EM) could be uses to "see" beneath the overlying flows.

2. Drill three sets of three holes straddling the cracks using both air track drilling and rock coring. The boreholes would be used for rock layering indentification, crosshole seismic velocity tests, collecting samples for age dating and for rock strength tests.

3. Install a number of monitoring devices to measure possible movement along the cracks.

4. Run laboratory tests on rock core samples in conjunction with the University of Hawaii and/or the U.S. Geological Survey to age date the lava flows.

5. Run strength tests in the laboratory on rock core samples to determine the compressive, tensile, and shear strengths of the rock. This will be important for designing the backfill to be used in the cracks.

6. Initiate readings of the monitoring devices right after installation and then repeat them every two months for a length of time that will be determined by what kind of motion is shown, if any.

7. Develop preliminary information of the design of the rock excavation program for the marina. Seismic velocity and rock strength values could be used to help select blasting and construction methods. Drill hole data could help to develop information on the rock units that will be exposed on the marina cliff faces.

8. Prepare recommendations on building and utility setbacks and exclusions, design for the backfill to be placed in the cracks, development constraints governed by the geometry, locations, stability, and movements of the cracks.

Until additional studies can be completed, it is recommended that no buildings be situated on or straddle any crack. Furthermore, no building should be sited within 500 feet from the longitudinal extension of a crack. It is also recommended that no building should be sited within twenty-five feet of the side of any ground crack. Finally, mat foundations are recommended for buildings that are near any known ground crack. Thick, coarse aggregate cushion fill is recommended under the mat foundations. Utility lines and roadways crossing the cracks will require special design details to tolerate any potential differential ground movement.

The ground cracks located in the area of the proposed marina are known to extend down to sea level. Excavation of these cracks will not impact groundwater exchange. Ground cracks located in the area of the proposed golf courses will be grouted and filled to reduce the potential for contamination of groundwater during the use of effluent from the sewage treatment plant for irrigation.

1.1.1.2.2.3 Lava Tubes and Voids

Lava tubes and voids, or air pockets beneath the surface of hardened lava flows, are common occurances in Hawaii. Collapsed lava tubes are sometimes identified by aligned circular depressions at the surface of pahoehoe flows, with which they are often associated. However, just as often there is no surface indication of their presence. Both of these features have been identified within the project area, specifically in the central area of the Hawaiian Palace site and in the vicinity of Puu Ki on the Ka'u Aina site.

1.1.1.2.2.4 Impacts and Mitigation Measures

The location of potential lava tubes and voids is presented in Figure 4.3. If undetected, lava tubes and voids can present serious problems for construction activity in areas where lava flow predominate. Heavy construction vehicles are particularily vulnerable and may generate a collapse of these underground features if driven near them. Additionally, tubes and voids that may survive the weight of construction vehicles may not be able to provide adequate support for buildings constructed over them. Therefore, early reconnaisance of these features is important. A common method of detection has been to drill at each of the heavily loaded foundation sites or areas of high construction vehicle impact. Once a tube or void is identified it can be grouted if small enough or, if close to the surface, collapsed by dynamic compaction using a heavy weight dropped from a crane. With regard to building construction, foundation structures can be relocated to the bottom of a particularily large tube or void. Generally, construction in lava tube or void areas is entirely feasible. Construction experience at a number of projects in Hawaii indicate that tubes and voids present no problems to development if properly addressed at the early stages of construction. These precautions will eliminate the potential of groundwater contamination from effluent used for irrigation seeping through unknown lava tubes.

1.1.1.2.2.5 Tumuli and Blisters

Tumuli are usually dome-shaped protrusions on the surface of pahoehoe lava flows that are composed of dense lava. However, thin crusts across the top, or large voids within them, are not uncommon. Blisters are small protrusions found frequently in lava flows. They result from the natural buckling created by the cooling lava. They tend to have thin crusts and large voids within them. Tumuli have been located in the central area of the Hawaiian Palace site and in both pahoehoe and scaly pahoehoe lavas of the proposed Ka'u Aina site. Blisters are fairly common to most lava flows.

1.1.1.2.2.6 Impacts and Mitigation Measures

Tumuli composed of dense basaltic rock may require blasting if their removal becomes necessary during construction. Hollow tumuli and blisters can be treated in much the same way as lava tubes and voids. Tumuli and blisters pose no problem to resort development so long as they are identified during early phases of construction.

If these features are thought to exist in lava flow areas where public trails may be located, appropriate warning signs should be posted to notify hikers of the danger of straying off the marked trails and possibly falling through the thin crust of a tumuli or blister.

1.1.1.2.3 External Geological Hazards

Development projects on the island of Hawaii are generally exposed to a number of geological hazards associated with the region's volcanic activity. The United States Geological

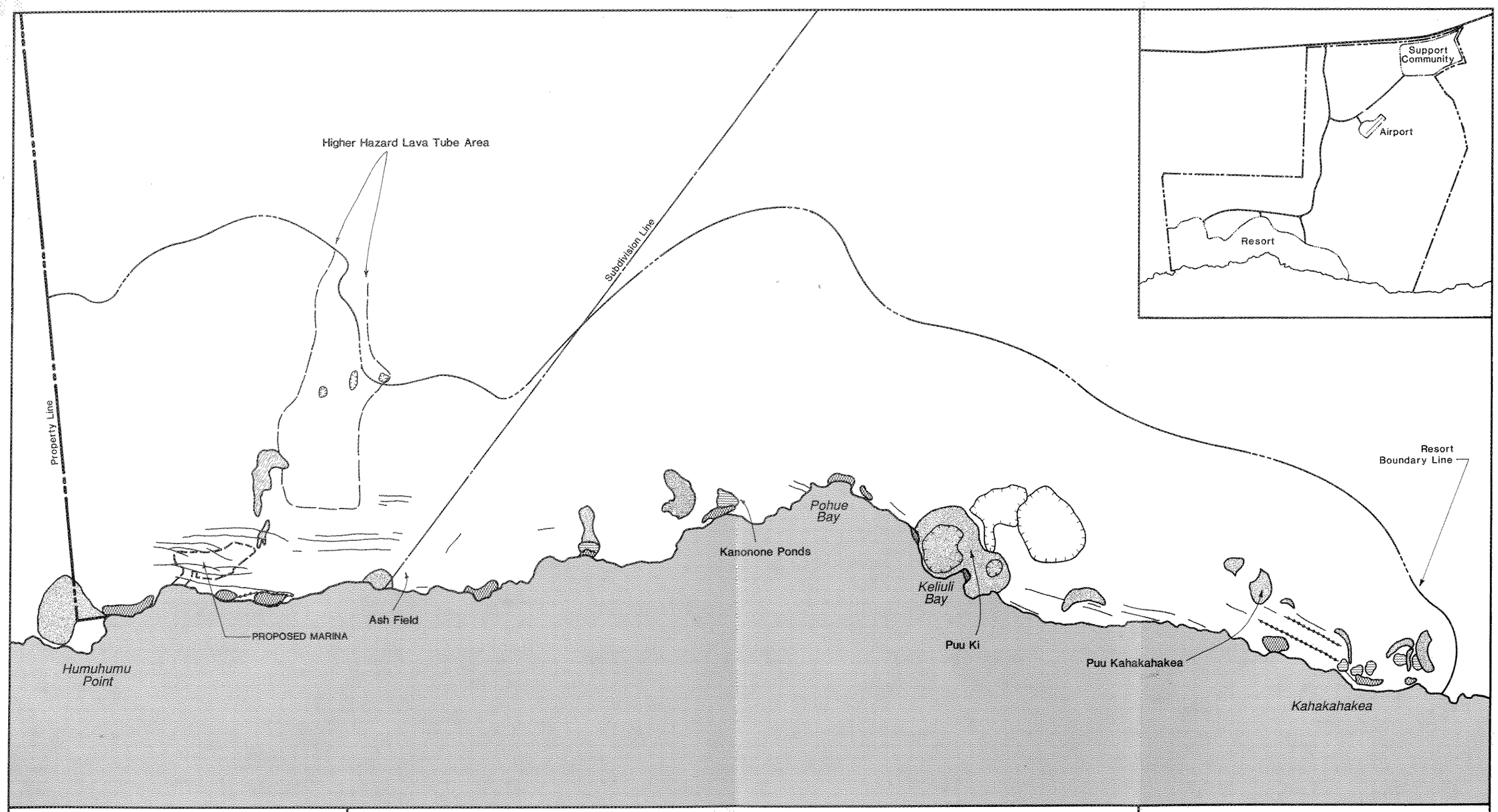


Figure 4.3

GEOLOGICAL FEATURES WITHIN RESORT PROJECT AREA

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

Survey has recently updated a 1974 publication on volcanic hazards in Hawaii with an exhaustive two volume anthology of research papers, Volcanism in Hawaii, USGS Professional Paper 1350. Included in this document is a chapter entitled "Volcanic Hazards in the Hawaiian Islands" which contains a classification map based on lava-flow coverage of different areas during specific time periods. It divides the island of Hawaii into hazard zones for various geologic conditions including lava flows, tephra, and subsidence. This section discusses these conditions that are external to the proposed development but may have an impact upon it.

1.1.1.2.3.1 Lava Flows

The proposed project area, as previously discussed, is entirely covered with prehistoric lava flows. In addition, two historical flows, 1887 and 1907, have been identified on or near the resort site. The USGS divides the island of Hawaii into nine lava flow hazard zones with Zone 1 having the highest lava flow risk and Zone 9 having the lowest. The subject property is located in Zone 2, which is defined as

> several areas that are adjacent to and downslope from the active rift zones of Kilauea and Mauna Loa and therefore subject to burial by lava flows of even small volume erupted in those rift zones...On Mauna Loa, long and voluminous lava flows have repeatedly entered the areas included in Zone 2, covering about 5 percent of those areas since 1950 and about 20 percent within historical time (USGS, 1987).

1.1.1.2.3.2 Impacts and Mitigation Measures

Given the geological history of the project site and its location on the southwest flank of Mauna Loa, it is possible that it could be exposed to the threat of a lava flow. This possibility is validated to a certain extent by the inclusion of the entire region in lava flow hazard Zone 2 by the USGS. However, it should be noted that the same report identifies a number of mitigating circumstances which may be relevant to the Zone 2 classification. First, the report states, "Abrupt changes in magnitude of hazard within a zone commonly occur along sharp topographical features, and local topograpical features in a zone may have a magnitude of hazard very different from that of the zone as a whole...Consequently, the magnitude of hazard assigned to a zone applies only to that zone as a whole, and differences within it are not shown. Such differences can best be determined by specific site studies" (USGS, 1987, p. 608). Studies pertaining to local topography are most appropriately undertaken at the detailed site design stage of the planning process. Hence, specific topographical features within the project site or on the properties located inland from the project site may have a direct impact upon the vulnerability of the proposed project to lava flow inundation.

Secondly, according to the 1987 USGS report, only seven of the thirty-two eruptions of Mauna Loa since 1832 have occured on the Southwest Rift Zone, and only two of those have impacted the project site. The report notes that "this general spatial distribution of flank eruptions will probably also characterize the future." If this is in fact a likelihood, then the great majority of future eruptions may be confined to the volcano's summit and northeast flank. As a further point of interest, the report states that "southwest rift zone eruptive loci generally migrated uprift from 1868 to 1950 (USGS, 1987, p. 567). Should this be the case, the risk of on-site lava flows at the project area may decrease. Table 8, presented below, summarizes the location of historical eruptions of Mauna Loa.

While scientific knowledge concerning the eruptive activity of volcanoes has not yet reached the point of accurate long-term prediction of events, it is becoming increasingly sophisticated in the understanding of the eruptive sequence on the short-term. This fact, together with continual refinements in the monitoring and early warning of volcanic eruptions provides

greater notice to island residents, and when combined with existing evacuation procedures significantly reduces, if not completely eliminating, any risk to area residents and visitors in the event of a volcanic eruption.

1.1.1.2.3.3 Seismic Hazards

The Island of Hawaii has been classified as seismic zone 3, on a scale of 4, according to the Uniform Building Code. The geology report prepared for this document which appears in the appendix contains detailed information of seismic events which have impacted the project area, including a chronology and summary of comparative magnitudes. In Hawaii, the majority of earthquakes are the result of magma moving at shallow depths. These events characteristically cause little damage. However, some larger scale earthquakes associated with structural readjustment within a volcano have been documented. It is conceivable that a large seismic event could cause a regional submarine slump block between Ka Lae and Kealakekua to move, which in turn may generate a local tsunami. It is also possible that the ground cracks discussed previously in this report could move in response to a major earthquake.

1.1.1.2.3.4 Impacts and Mitigation Measures

Because the proposed project is located in a relatively high risk area for earthquakes, buildings should be designed to meet the Uniform Building Code standards for Zone 3. Construction technology is presently able to design structures to withstand Zone 4 seismic events. As a point of fact, geothermal facilities at Kilauea are being currently designed at Zone 4 standards. While this may not be necessary for the Hawaiian Riviera Resort, it does demonstrate that building design can effectively mitigate seismic events.

1.1.1.2.3.5 Local Tsunami Hazards

Although tsunamis are discussed extensively elsewhere in this document, it should be noted that locally generated tsunamis are potentially more dangerous than those generated within the Pacific Basin because of the lack of warning time. Locally generated tsuanmis may result from a locally occuring earthquake or volcanic eruption. The sudden displacement of a large mass of water due to a shift in the structure of the land can create a forceful wave capable of great destruction. Because of the shoreline location of the proposed resort, tsunamis generated within the Pacific Basin as well as locally may have a direct impact upon the project site.

1.1.1.2.3.6 Impacts and Mitigation Measures

The experiences of the 1946 and 1960 tsunamis which devastated coastal areas of Hilo have demonstrated the potential disasters that could result from ignorance of the danger and poor planning. The sudden rush of water associated with a tsunami is capable of dislodging structures and battering them against those further inland. It is now recognized that adequate planning involves the creation of a buffer zone corresponding with calculated tsunami runup distances. Habitable portions of structures within tsunami inundation zones can also be elevated above projected wave heights. Figures 4.4, 4.5 and 4.6 identify the tsunami runup distances for the project area. It is recommended that no major structures are located in these areas. (Note: Table 9 on page IV-24 presents descriptions of the transect stations shown in the following figures)

Table 8: Historical Eruptions of Mauna Loa

Date Eruption Began	Duration (days) Summit	Flank	Location of Eruption
Jan. 10, 1843	<1	~90	Summit, Northeast Rift Zone, North Flank
May 1849	~15	0	Summit
Aug. 8, 1851	4	0	Summit
Feb. 17, 1852	1	20	Summit, Northeast Rift Zone
Aug. 11, 1855	<1	~450	Summit, Northeast Rift Zone
Jan. 23, 1859	<1	~300	Summit, North Flank
Dec. 30, 1865	~125	0	Summit
Mar. 27, 1868	<1	5	Summit, Southwest Rift Zone
Aug. 10, 1871	~20	0	Summit
Aug. 9, 1872	~1200	0	Summit
Feb. 14, 1877	<1	<1	Summit, North Flank
Mar. 9, 1879	<1	0	Summit
May 1, 1880	6	0	Summit
Nov. 5, 1880	0	280	Northeast Rift Zone
Jan. 16, 1887	<1	7	Summit, **Southwest Rift Zone**
Nov. 30, 1892	3	0	Summit
Apr. 21, 1896	16	0	Summit
July 1, 1899	4	21	Summit, Northeast Rift Zone
Sept. 1, 1903	<1	0	Summit
Oct. 6, 1903	61	0	Summit
Jan. 9, 1907	<1	15	Summit, **Southwest Rift Zone**
Nov. 25, 1914	48	0	Summit
May 19, 1916	0	12	Southwest Rift Zone
Sept. 26, 1919	<1	38	Summit, Southwest Rift Zone
Apr. 10, 1926	<1	14	Summit, Southwest Rift Zone
Dec. 2, 1933	17	0	Summit
Nov. 21, 1935	6	40	Summit, Northeast Rift Zone, North Flank
Apr. 17, 1940	134	0	Summit
Apr. 26, 1942	2	13	Summit, Northeast Rift Zone
Jan. 6, 1949	145	0	Summit
June 1, 1950	1	23	Summit, Southwest Rift Zone
July 5, 1975	1	0	Summit
Mar. 26, 1984	<1	22	Summit, Northeast Rift Zone

Eruptions impacting project site shown in boldface.

Source: USGS Professional Paper 1350, 1987, p.518

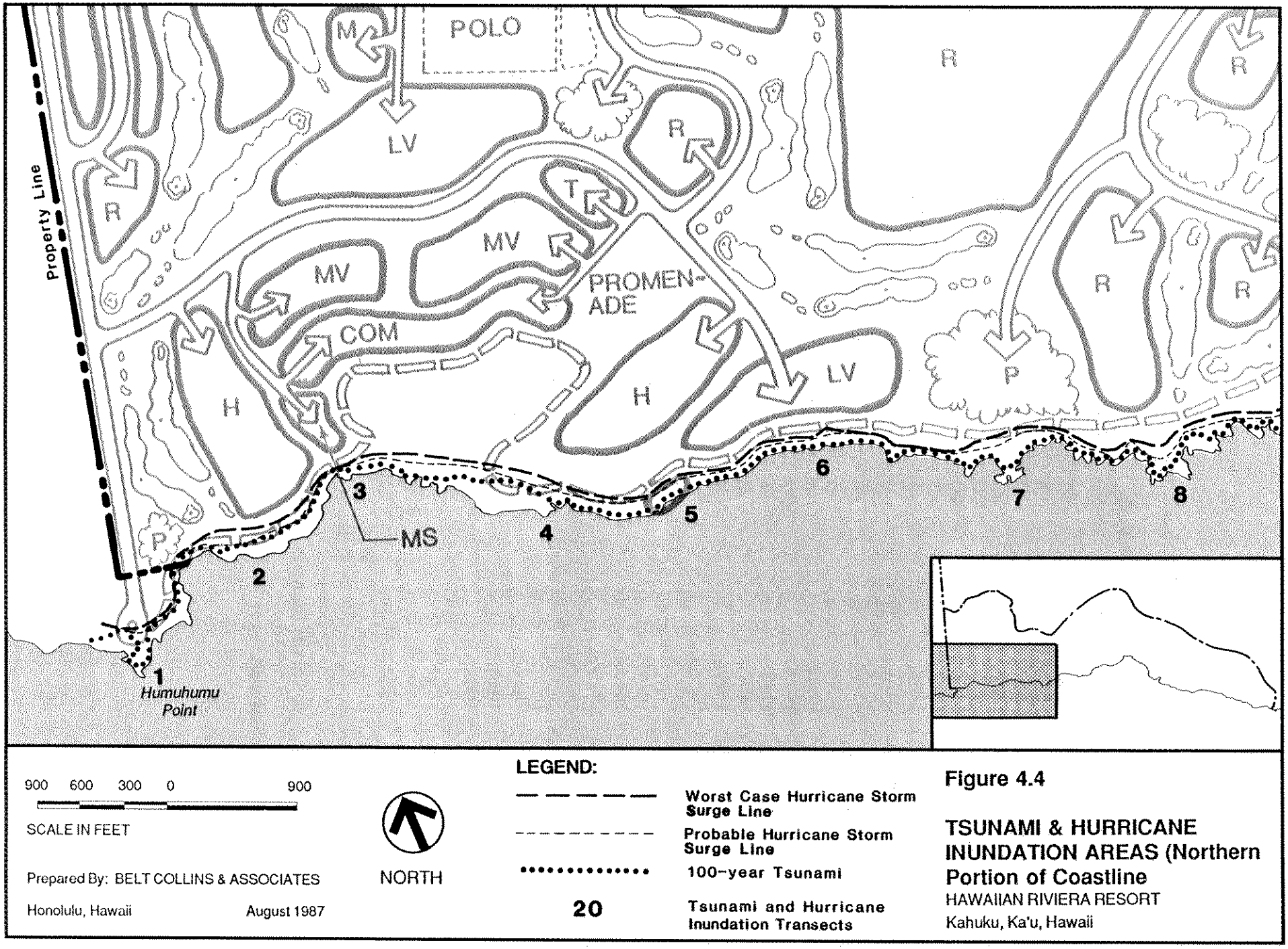


Figure 4.4

TSUNAMI & HURRICANE INUNDATION AREAS (Northern Portion of Coastline

HAWAIIAN RIVIERA RESORT

Kahuku, Ka'u, Hawaii

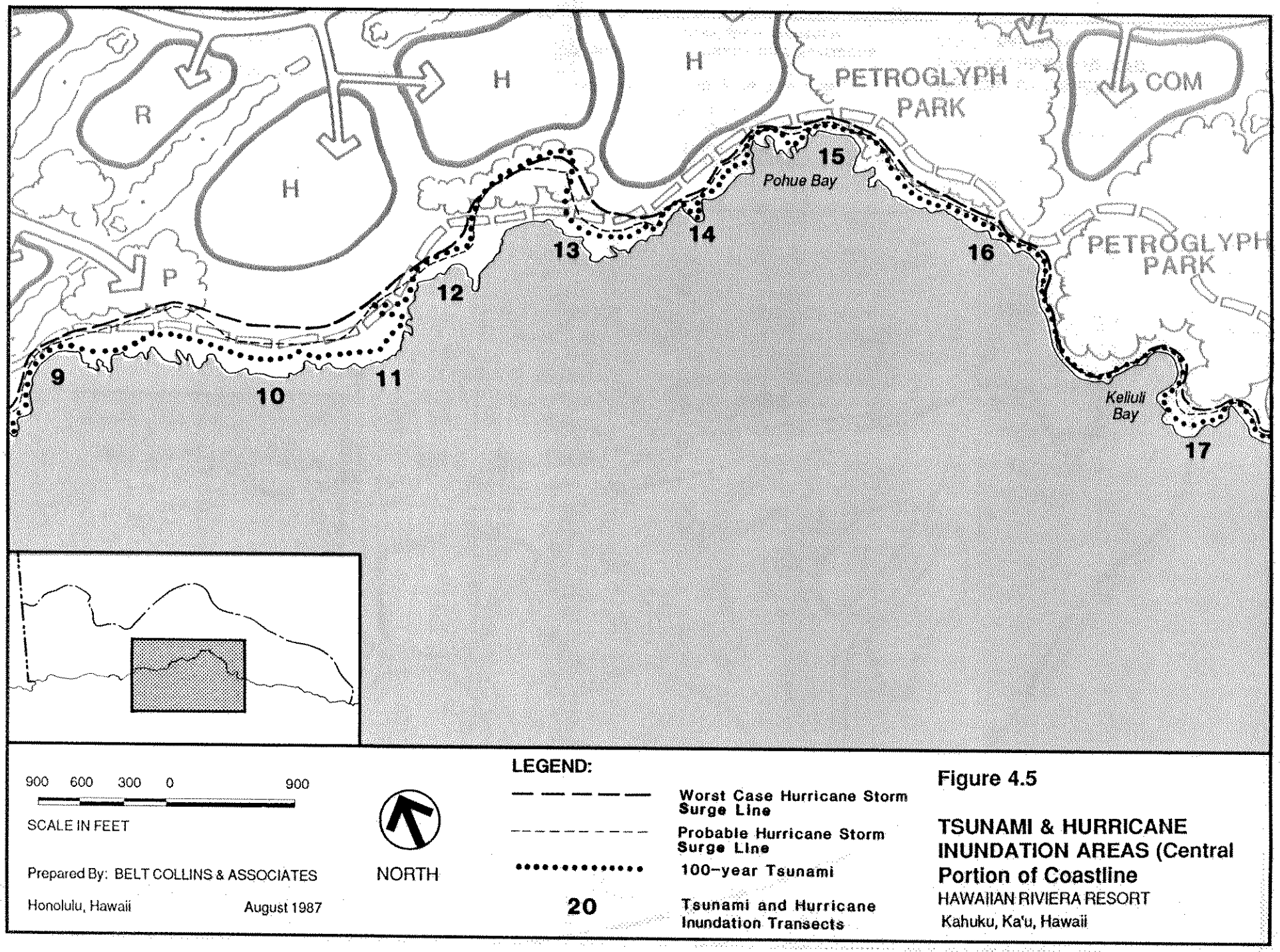


Figure 4.5

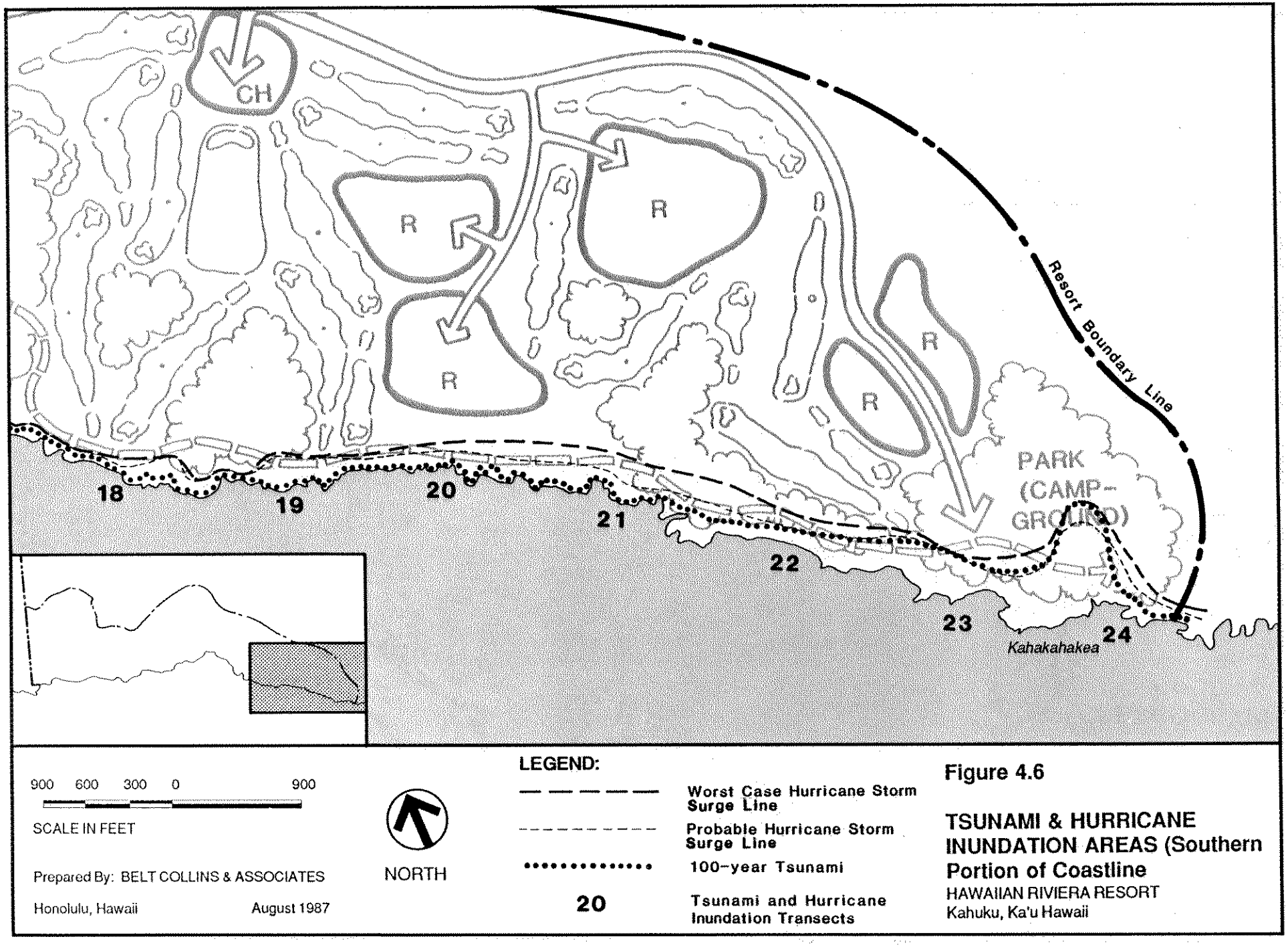
TSUNAMI & HURRICANE INUNDATION AREAS (Central Portion of Coastline

HAWAIIAN RIVIERA RESORT

Kahuku, Ka'u, Hawaii

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987



Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

Figure 4.6

TSUNAMI & HURRICANE INUNDATION AREAS (Southern Portion of Coastline

HAWAIIAN RIVIERA RESORT
Kahuku, Ka'u Hawaii

The proposed cruise ship docking facility will be specifically designed to withstand the sudden rise and impact of ocean waves or tsunamis. As discussed in Section VI of the Ocean Engineering Study in the appendix, the docking facility will hava a minimum height of 14 feet above sea level to keep the structure above potential wave heights.

1.1.1.2.3.7 Ground Subsidence

Ground subsidence can occur in four catagories according to size; the subsidence or slow submergence of entire islands, the subsidence of parts of a volcano's flanks, the settling of small areas due to the underground movement of magma, and the collapse of local geological features such as lava tubes and blisters. The subsidence of islands occurs over a time-frame that is much too great to be of significance for the purposes of this document. The underground movement of magma is usually associated with volcanic vents and rift zones, and is likewise, not of particular relevance to this document. Recognizing that subsidence of local geological features has been discussed in detail earlier in this report, the regional subsidence of volcanic flanks becomes the focus of this section.

Although the areas involved in regional subsidence can be tens of kilometers long and consist of vast areas of land, subsidence can occur suddenly and without warning. Manifesting in the form of an earthquake, subsidence can result in tilting, shaking and fracturing of the ground. Local tsunamis can be generated by regional subsidence. An example of regional subsidence took place at Kalapana, Hawaii in 1975, where the entire coastline suddenly dropped several feet in elevation causing a series of tsunamis.

1.1.1.2.3.8 Impacts and Mitigation Measures

Again, due to the location of the proposed project on the southwest flank of Mauna Loa, regional subsidence must be considered as a possible future occurance. The previously cited USGS report establishes four Hazardous Zones for subsidence and ground fractures. According to the report, the project site is located in Zone 4, the area of lowest hazard.

1.1.1.2.3.9 Miscellaneous Hazards

The project site is located far enough away from Mauna Loa vents so that other geological hazards such as ash fall, volcanic-gas emissions, and pyroclastic surges should not pose a great hazard to the site.

1.1.1.3 Soils

1.1.1.3.1 Existing Conditions

As previously indicated, the entire Hawaiian Riviera Resort property is covered with 'a'a and pahoehoe lava flows dating from 1907 to prehistoric times. The United States Department of Agriculture Soil Conservation Service (SCS) has classified four different soil and land types within the subject property (December 1973). None are agriculturally significant. Although not identified on the SCS map for the area, small pockets of sand are present at isolated spots along the shoreline fronting the property. Soil types at the project site appear in Figure 4.7.

(1) Lava Flows, 'A'a: Lava flows, 'A'a (rLV), a miscellaneous land type, has practically no soil covering and is bare of vegetation, except for mosses, lichens, ferns, and a few small 'Ohi'a trees. This rough and broken lava is a mass of hard, sharp pieces piled in tumbled heaps. According to the SCS, in areas of high rainfall, it contributes substantially to the underground

watersupply and is used as a watershed. 'A'a lava covers about half of the resort site, nearly all of the airport site and about one-fifth of the support community site, as well as about half of the remaining property which is not included in the development proposal.

(2) Lava Flows, Pahoehoe: Lava flows, pahoehoe (rLW) is a miscellaneous land type characterized by a relatively smooth glassy surface. However, in some areas the surface is rough and broken or tends to buckle. Pahoehoe lava has no surface soil covering, although transported soil tends to gather in cracks and crevices and is capable of supporting scattered 'Ohi'a trees if exposed to sufficent rainfall. This land type covers most of the remainder of the resort site and support community site.

(3) Cinder Land: Cinder land (rCL) is a miscellaneous land type consisting of bedded cinders, pumice, and ash, according to the SCS. It commonly supports some grass but tends to be too loose for use as pastureland. There are small pockets of cinder land associated with littoral cones located in the seaward portion of the resort site.

(4) Kona extremely rocky muck: This Kona Series soil (rKYD) is found at intermediate elevations of Mauna Loa and Hualalai and is characterized by 6-20% slope. Rock outcrops occupy 25-50% of the surface which is underlain by pahoehoe lava bedrock. The thin layer of soil (0-5 inches) is used mostly for pasture or watershed. There is an extremely small pocket of this soiladjacent to the highway at the upper portion of the support community.

(5) Beaches: Beaches (BH) vary in composition from fine white or black sand to coarse cobble or gravel texture. Although the SCS maps for the project site do not indicate any beaches, a small white sand beach exists at Pohue Bay and several small black sand beaches are interspersed among the shoreline cliffs which dominate the project's coastline.

1.1.1.3.2 Impacts and Mitigation Measures

Development of the Hawaiian Riviera Resort will require excavation, crushing and grading of lava. Because of the virtual lack of soil in most of the project area, no significant soil impacts due to this activity are forseen. Crushed lava provides a suitable base material for vegetation, however, imported soil will be required for some landscaped areas. The source of this soil will be located on the island of Hawai'i. Excavation of the marina and grading of the site will generate airborne dust. This is a short-term impact which is unavoidable. Due to the remoteness of the project area and the relatively barren character of the land, however, the dust will have little, if any, impact on the environment. Additionally, because the project site has no known drainageways, runoff is not considered to be a problem. Particluates generated during excavation and subsequent stockpiling and filling of lava material will not impact the water quality of offshore areas nor that of the anchialine ponds. Appropriate measures will be taken to ensure that stockpiling of excavated material will be restricted to natural depressions located well inland of the shoreline.

1.1.1.4 ALISH Classification

Three classes of agricultural lands have been established within the Agricultural Lands of Importance to the State of Hawaii (ALISH) system: (1) Prime Agricultural Land, (2) Unique Agricultural Land, and (3) Other Important Agricultural Land. None of the land within the proposed project site is classified in the ALISH system. The land is unsuitable for agricultural use. The subject property has a Land Study Bureau Overall Productivity Rating of "E", indicating poor productivity potential for most agricultural uses, as defined by the Land Study Bureau Detailed Land Classification.

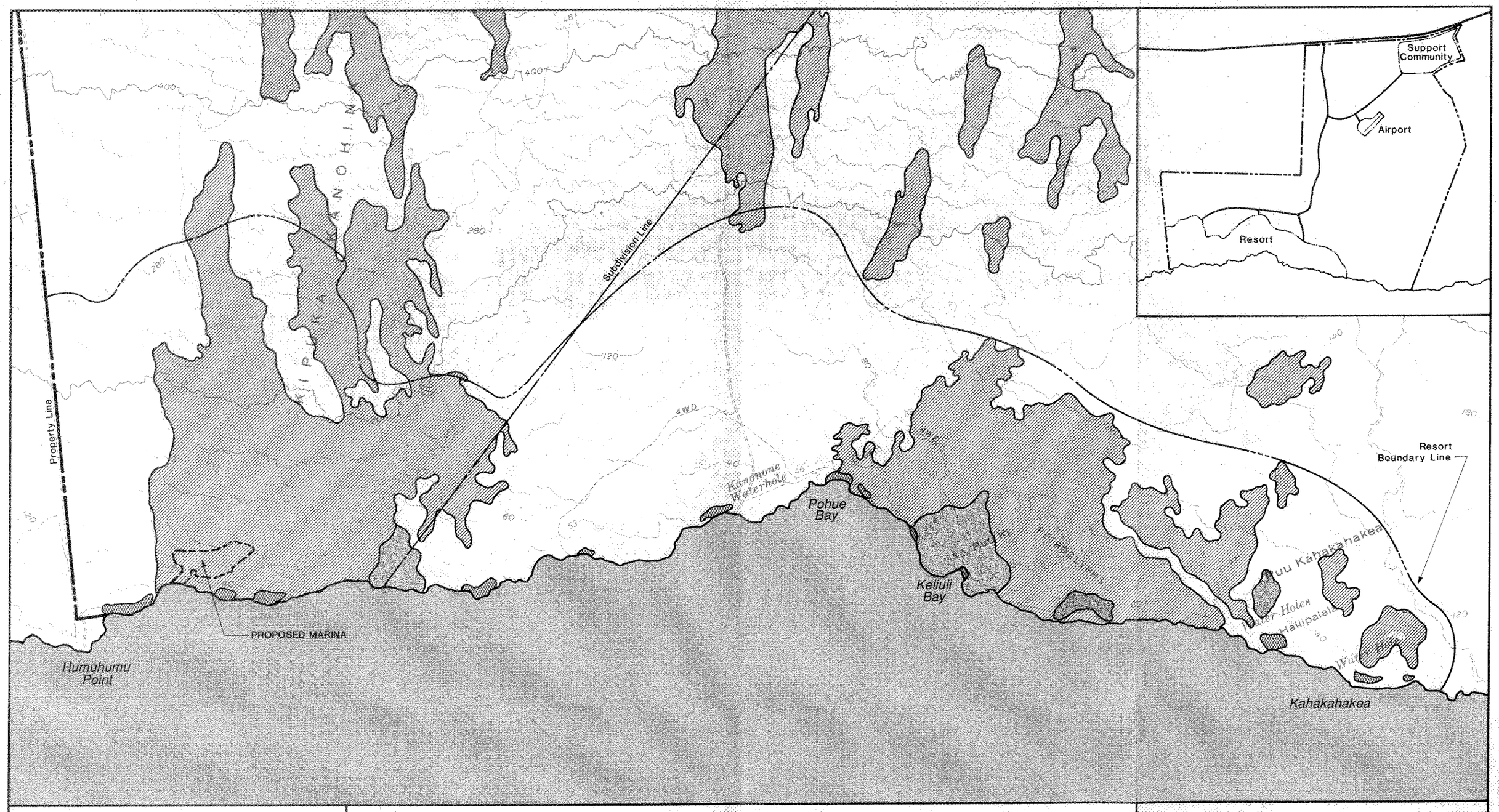


Figure 4.7

SOIL TYPES AT THE RESORT PROJECT SITE

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

1.1.1.5 Climate

Environmental conditions at Kahuku, Ka'u are similar to those along the South Kona coast. Coastal temperatures vary between 75 and 85 degrees Fahrenheit. Cooler temperatures are experienced at higher elevations. Wind direction at the project site is characterized by northeastern and east northeasterly trades well over 50 percent of the time with a mean wind speed of 14 miles per hour as measured from a central property location. Rainfall averages 30 inches per year along the coastal areas and increases to 50 inches per year at higher elevations as shown in Figure 4.8.

Development of the proposed resort will result in a substantial increase in vegetation in the project area. While this will have a noticable impact on the microclimate of the project site, it will not impact the general climate of the region. Landscaping of the project area, together with the construction of golf courses, will help to reduce the ambient temperature, particularly through the introduction of shade trees.

1.1.2 Physiographic Changes

The existing site slopes gently up from the shoreline to the property boundary, six miles inland. Some significant changes to the topography are proposed in conjunction with construction of the Hawaiian Riviera Resort. Development of the Ka'u Aina Resort will involve site grading and minimal excavation. The Hawaiian Palace Resort site will, however, require extensive excavation and fill for the construction of the proposed marina and a terraced Marina Village surrounding the marina. This will require rough grading, blading and ripping, and blasting where the dense basaltic rock resists other methods. Excavated pahoehoe lava will come out as relatively large boulders which will have to be crushed for use as fill on-site. A'a clinker material is easily excavated and crushed. However, the denser core material will require blasting techniques and will have to be further processed by mechanical crushers. Excavated material will be stockpiled on site prior to use as fill material.

1.1.3 Impact on Soils and Their Use for Agricultural Activities

The land at the project site has neither the potential for agricultural use, nor a history of agricultural productivity. The barren lava is impractical for cultivation and is not capable of sustaining a sufficient coverage of vegetation to warrant its use for grazing. Soil for cultivation is either scarce or non-existent. Therefore, development of the Hawaiian Riviera Resort will have no impact on the actual or potential agricultural productivity of the site.

However, the development of the Hawaiian Riviera Resort will create a new market in the Ka'u District for agricultural products grown in the immediate region as well as in other areas of the island. The resultant increase in demand for agricultural products such as fresh fruits and vegetables, nuts, meat and fish will have a positive effect upon the agricultural economy of Hawai'i.

1.2 TSUNAMIS AND FLOOD HAZARD

Flood Insurance Rate Maps (FIRM) for the southwestern coast of Hawaii identify the area as a region of minimal tsunami inundation. In order to determine the specific impacts a tsunami may have upon the project coastline, a detailed analysis was conducted for this report and is included as an appendix to this document. Findings of this report are summarized below.

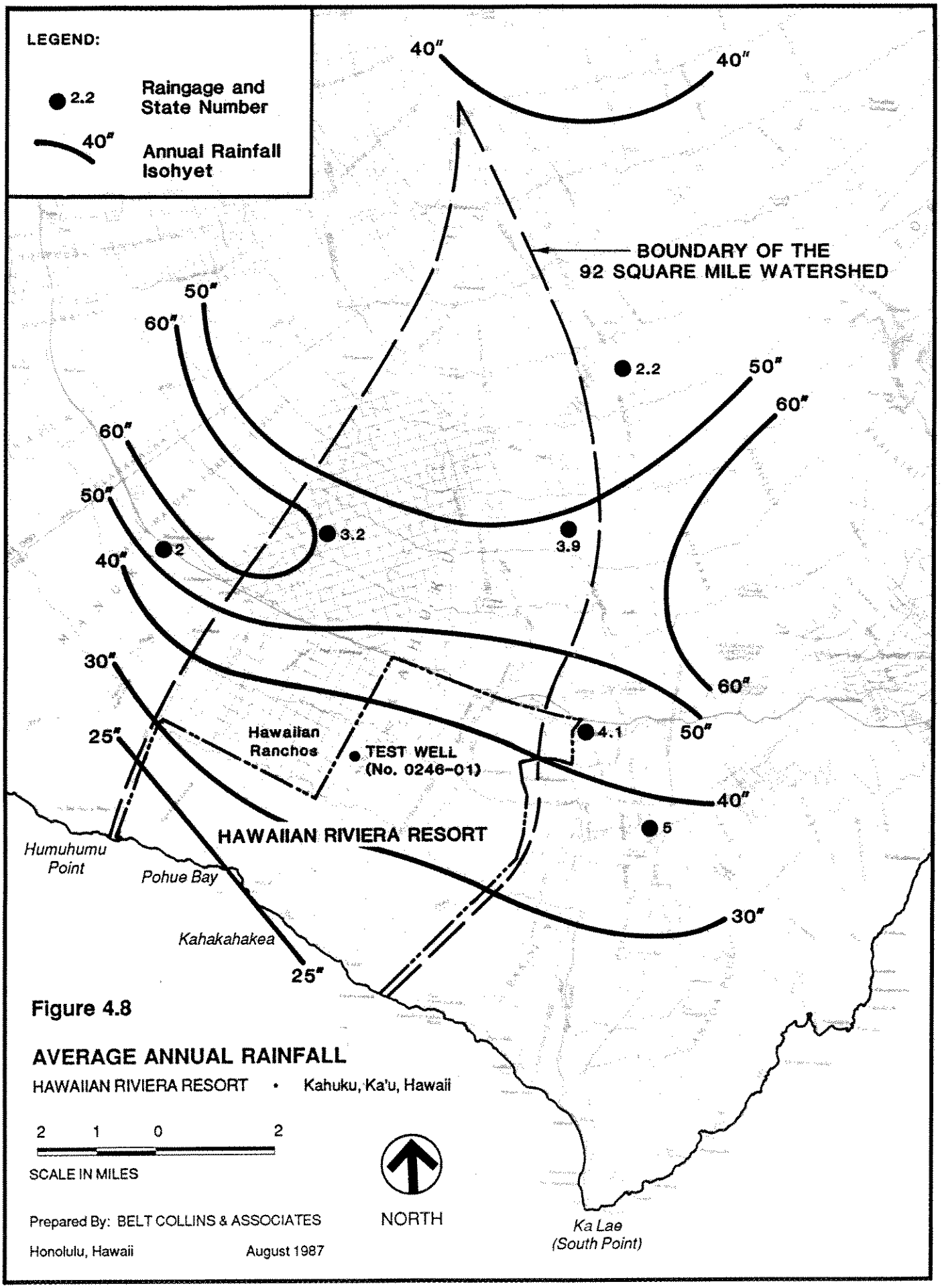


Figure 4.8

AVERAGE ANNUAL RAINFALL

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

1.2.1 Existing Conditions

The nearshore project area is characterized by rugged sea cliffs interspersed with small coastal beaches. Elevations at the shoreline vary from sea level to 20 or more feet. The subject property slopes upward with increasing distance from the shoreline. As shown in Figures 4.4, 4.5 and 4.6, the 100-year tsunami water surface elevation was determined at 24 locations along the shoreline in the project area at approximately 1,000 foot intervals beginning at Humuhumu Point at the northeast end. Most of the tsunami elevations at the selected sites do not exceed the existing land elevation 200 feet inland of the coastline, and thus are considered the final tsunami runup elevations (Sullivan, 1987). Generally, tsunami elevations vary from 9.5 to 12 feet above mean sea level (MSL) and tend to be limited by the steep coastline to inundation distances less than 100 feet inland. However, in two low-lying areas, Kanonone ponds and the extreme southeast end of the project, the predicted tsunami inundation would extend approximately 425 to 445 feet inland, respectively. Table 9 summarizes the inundation limits at the 24 data-collections points.

1.2.2 Probable Impacts

With the exception of the Kanonone ponds region to the west of Pohue Bay and the extreme southeast end of the project site, predicted tsunami inundation will have minimal impact upon the proposed resort. The Openspace Shoreline Corridor extending along the entire length of the project coastline will provide an adequate buffer for wave runup. No major structures are proposed to be located within this broad corridor, thereby minimizing the potential for wave borne debris to impact buildings further inland.

The two exceptions mentioned above are both susceptible to tsunami inundation. However, the proposed site design for the Hawaiian Riviera Resort has accommodated this potential hazard by ensuring that sufficent setback is provided to minimize the impact of a tsunami. The Kanonone pond area is to be preserved in its natual state as an "oasis-type" openspace area. Similarly, the extreme southeastern end of the resort project area is to be maintained in openspace and used as a park. No major structures will sited in either of these areas.

Tsunamis at the project site are considered to act as a rapidly rising tide. Bore-like tsunamis, which have higher flow velocities and more destructive potential than tide-like tsunamis, have historically been reported for only a few specific locations in Hawaii, and there is no reason to suspect anything other than a tide-like tsunami form at the project site. Water levels in the proposed marina during a tsunami occurance can be expected to rise to the same elevation as along the adjacent shores on either side of the marina entrance. Analysis of the natural free occillation period of the marina basin indicates that the resonant period is below about 40 seconds. This is well below typical tsunami periods of 10 to 20 minutes or longer. Thus, no resonant amplification of the tsunami wave within the marina is expected. Therefore, for the predicted 100-year tsunami water level elevation of +10 feet mean sea level (MSL), the water level will rise and flood the marina and adjacent shore to the 10-foot contour. On Figure 4.4, depicting the inundation limit, the 10-foot contour line corresponds to the approximate perimeter of the marina.

Hurricane wave runup and inundation limits along the shoreline would be unchanged by the presence of the marina.

Table 9: PREDICTED 100-YEAR TSUNAMI INUNDATION LIMITS

Location (Approx. 1000 ft intervals)	Inundation Limits Elevation (ft. MSL)	Distance Inland (ft.)
1 - Humuhumu Pt.	10	110
2	10	85
3	10	40
4	10	150
5	10	25
6	10	15
7	9.5	15
8	9.5	10
9	9.5	20
10	10	100
11	10	100
12	10	100
13	11	425
14	10	65
15	10.5	65
16	10.5	45
17	11	75
18	10.5	25
19	11	15
20	11	20
21	11.5	30
22	11.5	95
23	12	445
24 - Southeast End		

1.3 SURFACE WATER AND DRAINAGE

1.3.1 Existing Conditions

There are no streams or natural drainageways located within the boundaries of the subject property. Due to the existing topography, varying between smooth expanses of pahoehoe lava and rugged a'a rubble, no significant surface runoff occurs.

1.3.2 Probable Impacts

Development of the proposed resort project will require withdrawal of up to 2.5 mgd of potable groundwater and 3.4 mgd of brackish water via a series of new wells to be located on the property. It is anticipated that this action may have the potential of affecting the flow of groundwater to the coastline and result in an adjustment of the basal lens to this withdrawal. The impact of this activity is viewed to be relatively insignificant. New wells developed on the subject property will be sited to ensure that the long-term average groundwater withdrawal does not significantly exceed 1.0 mgd per coastal mile and result in a stable basal lens configuration. In effect, irrigation activities and the treatment of sewage generated daily at the resort will result in a return of much of the water originally extracted. The net loss will be largely attributable to transpiration.

1.4 NEARSHORE AND MARINE ENVIRONMENT

1.4.1 Existing Conditions

This summary description of the nearshore and marine environment is drawn from two separate reports prepared in conjunction with the Environmental Impact Statement process; "Baseline Assessment of the Marine and Anchialine Pond Environments in the Vicinity of the Hawaiian Riviera Resort, Ka'u, Hawaii" (Steve Dollar, 1987) and "Coastal Engineering Planning and Design Considerations for the Hawaiian Riviera Resort" (Sea Engineering, Inc., 1987). These reports are included as appendices to this document.

1.4.1.1 Coastal Morphology

The coastal region along the 4.5 mile length of the proposed development is characterized by vertical lava-formed seacliffs and sloping sand and cobble beaches. Several black sand beaches occur on the property in addition to a single well-defined white sand beach at Pohue Bay. Keliuli Bay is the only other well-defined shoreline feature consisting of a narrow steep-sided bay at the base of a cinder cone.

Underwater topography is characterized by a narrow basaltic shelf 50 to 70 feet wide terminating in a shelf break and steep sandy slope extending to abyssal depths. As a result, offshore depths greater than 200 feet occur within 100 feet from the shore. Due to the relatively young age of the island there is no true coral reef. Rather, a "coral community" is found on the narrow basaltic shelf. The edge of coral-covered shelf along much of the development shoreline is marked by steep vertical basalt cliffs. In some areas of the coastline, extensive deposits of shoreline basaltic sand enter the ocean and form a sediment layer on the nearshore "reef". Finally, in areas where lava flows have reached the ocean, unusual topographic features such as caves and arches are common.

1.4.1.2 Sand Deposits and Other Littoral Material

Sand deposits in the form of beaches occur at a number of locations within the project site as indicated in Figure 4.7 . A white corraline sand beach is located at Pohue Bay. Black volcanic cinder sand beaches are located at the base of littoral cones. During the field reconnaissance conducted in early 1987, it was observed that some of the shoreline areas (up to 200 feet inland) were covered with coarse to cobble-sized basaltic and coralline material. It is believed that these loose surface materials were deposited most likely as the result of storm wave activity. This seems to be confirmed by the determination of storm inundation areas along the coastline which correspond well with the identified deposits.

Several littoral cones are located east of Pohue Bay as shown in Figure 4.3. These features are often mistaken as cinder cones marking the site of a volcanic eruption. The cones, which at 30 to 70 feet high, are actually constructed by violent explosions caused by a'a lava flows entering the sea. Littoral cones are composed of lithified ash deposits with grain sizes varying from fine sand to cobbles, and tend to occur in pairs, one on each side of the a'a flow. At the project site, the littoral cones are aligned in two distinct rows. A row of younger cones is located along the present shoreline. A second row of older cones is aligned inland and marks the location of a former shoreline. In general, the littoral cones are covered or surrounded by subsequent lava flows.

1.4.1.3 Prevailing Waves

Deepwater waves associated with the Hawaiian Islands can be classifed by four types; northeast tradewind waves, south swells, Kona storm waves, and North Pacific swells. These waves and their general approach directions are shown in Figure 4.9. A wave is considered to be deepwater when the water depth is equal or greater than one-half the wave length.

Typical deepwater tradewind waves reach heights of 4 to 10 feet and have periods of 6 to 8 seconds. They result from strong, steady Northeast tradewinds and are most frequent between April and September, although they may be present throughout most of the year.

South swells are generated by southern hemisphere storms and are most prevalent during the months of April through October. They tend to approach the Hawaiian Islands from the south with periods of 12 to 20 seconds and heights from 1 to 6 feet.

Kona waves tend to occur as a result of intense winds associated with local fronts or low pressure systems. They can reach heights up to 10+ feet and have periods ranging from 6 to 10 seconds. Kona waves approach from the south to west, with the larger waves usually from the southwest.

North Pacific swells are produced by severe winter storms in the Aleutian area of the North Pacific Ocean and by mid-latitude low pressure areas. They may arrive at the Hawaiian Islands throughout the year but are largest and most frequent during the winter months of October through March. They typically have wave heights of 5 to 15 feet and periods of 12 to 20 seconds.

Kona waves and south swells have the greatest potential for impact to the project site because of the southerly orientation. Although tradewind waves and North Pacific swells defract around the island, only a small portion of their deepwater energy generally reaches the project site.

It has been determined that due to offshore depths and bottom slope, waves approaching the project site are not very much altered as they approach the shore. With the exception of waves from the west, which tend to decrease in height by about 30% as they approach shore, the deepwater wave heights change very little as a result of refraction or shoaling (Sullivan, 1987). This is largely due to the proximity of deep ocean water to the shoreline. Deepwater waves from the south or southwest with heights of 2 to 5 feet result in nearshore breaker heights of about 3 to 6 feet, with lower breaker heights for waves from the west. These conditions are calculated to prevail less than 10% of the time. The general offshore wave conditions are characterized by short period tradewind waves which refract and defract around South Point and propogate up the southwest coast parallel to the shore, as well as very short, steep seas generated by prevailing easterly winds of less than 4 feet in height with periods less than 6 seconds.

1.4.1.4 Storm Waves

Due to its southwestern location on the island and direct exposure to open ocean conditions, the project area is exposed to storm waves from passing tropical storms and hurricanes. According to the Army Corps of Engineers (1977), of seventeen severe storms generated during the period from 1947 to 1965, seven affected the south and/or west shores of the Hawaiian Islands. The following table provides characteristics of waves generated by these storms, as well as a January 1980 storm and Hurricane Iwa of November 1982.

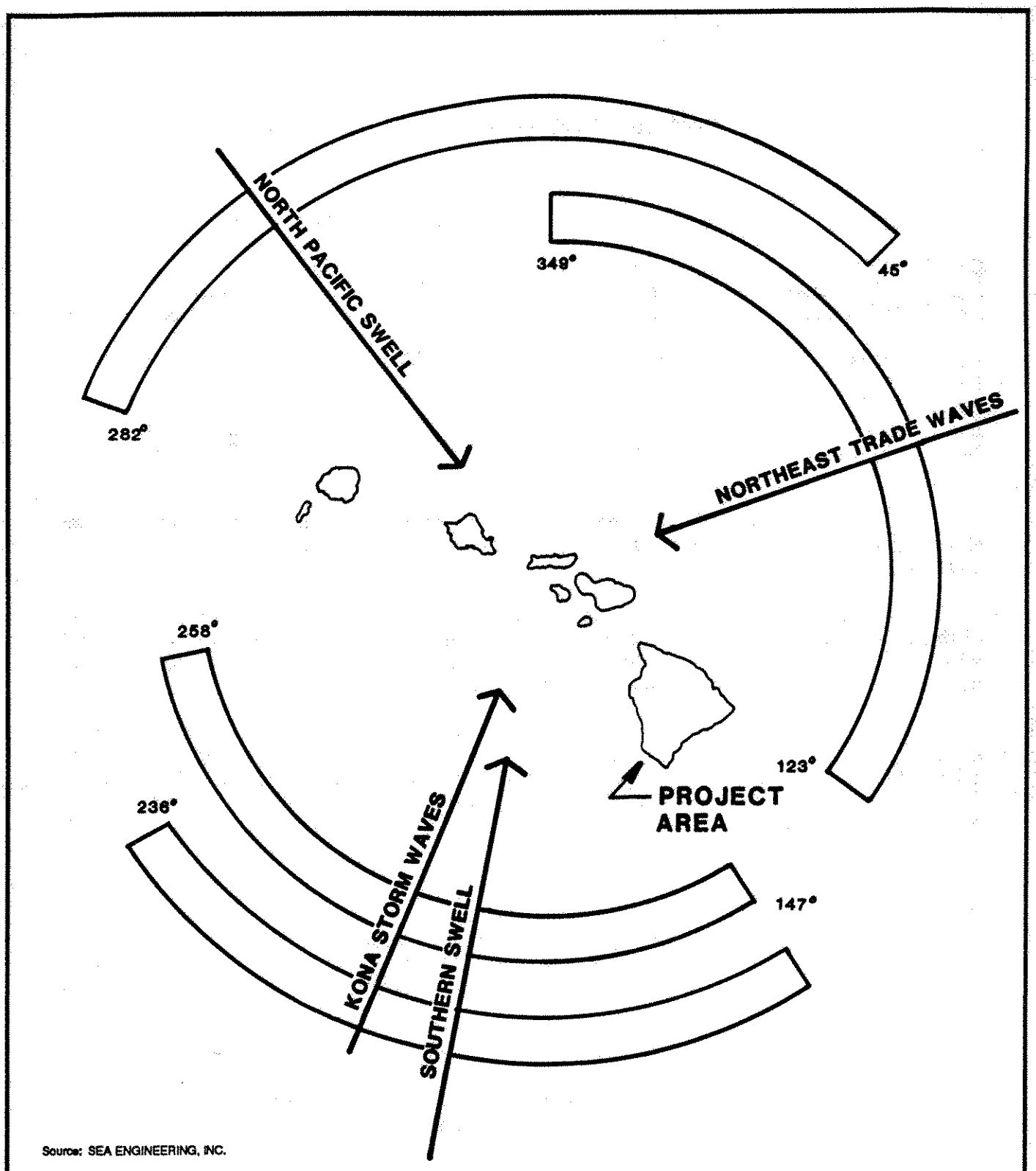


Figure 4.9

PREVAILING WAVE DIRECTIONS IN THE MAJOR HAWAIIAN ISLANDS

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

Table 10: HISTORIC STORM WAVE CHARACTERISTICS

Date	Deepwater Wave Height (feet)	Deepwater Wave Period (seconds)	Approach Direction
Dec. 20, 1955	14.8	11	West
Sept. 5, 1957 (Della)	18.9	21	West
Dec. 2, 1957 (Nina)	20.0	13	South & West
Jan. 18, 1959	14.0	10	South & West
Aug. 6, 1959 (Dot)	22.5	12	South & West
Jan. 7, 1962	13.6	11	South & West
Jan. 17, 1963	12.0	10	Southwest
Jan. 11, 1980	17.0	9	Southwest
Nov. 23, 1982 (Iwa)	14.0	14	Southwest

As discussed earlier, documented storm wave heights when compared with project site elevations provide a possible explanation for inland sand and cobble deposits identfied at specific locations of the project site.

Nearshore water level rise associated with storm activity is understood to be a function of three conditions; the astronomical tide, storm surge due to reduced atmospheric pressure and wind stress, and wave setup. For the project site, astronomical tide, atmospheric pressure and wind stress are calculated to result in a cumulative 2 foot increase in water level.

Wave setup is the largest contributing ingredient of wave runup. Generally, it is estimated that wave setup is roughly equal to 10 to 12 percent of breaker height. The specific calculation of wave setup has, for purposes of this report, been included in the numerical modeling for wave runup. Wave runup and inundation associated with probable and worst-case hurricanes have been calculated for the coastal region of the project site and have been previously shown in Figures 4.4, 4.5 and 4.6.

1.4.1.5 Prevailing Currents

No historical data concerning prevailing currents associated with the project site coastline is available. The specific methodology for determining the speed and direction of offsite currents discussed below is contained in a report by Scott Sullivan of Sea Engineering, Inc., which appears in the appendices to this document.

General characteristics of the offshore currents include:

- The prevailing currents are semi-diurnal tidal currents, with a 1 to 2 hour lag between slack tide and the current reversal.

- The predominant ebb tide current is west-southwesterly at an average speed of 9cm/sec, and directionally consistent. The predominent flood tide current is southeasterly with an average speed of 9 to 10 cm/sec, and is less directionally consistent.

- The net transport during the ebbing tide is about 4 cm/sec to the

west-southwest, and during the flooding tide is about 3 cm/sec to the south-southeast. The overall net transport away from the project area is about 3 cm/sec offshore to the south-southwest.

The configuration of offshore currents is depicted in Figure 4.10.

1.4.1.6 Ocean Water Quality

An analysis of marine chemistry measured at 13 stations at the surface and a depth of 10 feet indicates that the offshore waters are pristine ocean waters typical of the west coast of Hawaii. At all nearshore locations surface chemistry relative to subsurface areas indicates the existance of groundwater extrusion, particularily with regard to salinity, ammonia, phosphate, and total phosporus content. All other quality parameters generally fall within the most restrictive Department of Health standards for "wet" and "dry" environments (see Table 11).

1.4.1.7 Groundwater

Based on chemical analysis, on-site observations and historical data, groundwater extrusion at the project site forms a surface lens typical of the west Hawaii region. Normal volumes of groundwater extrusion in the area probably range in the area of a few million gallons per day (mgd) per linear coastal mile.

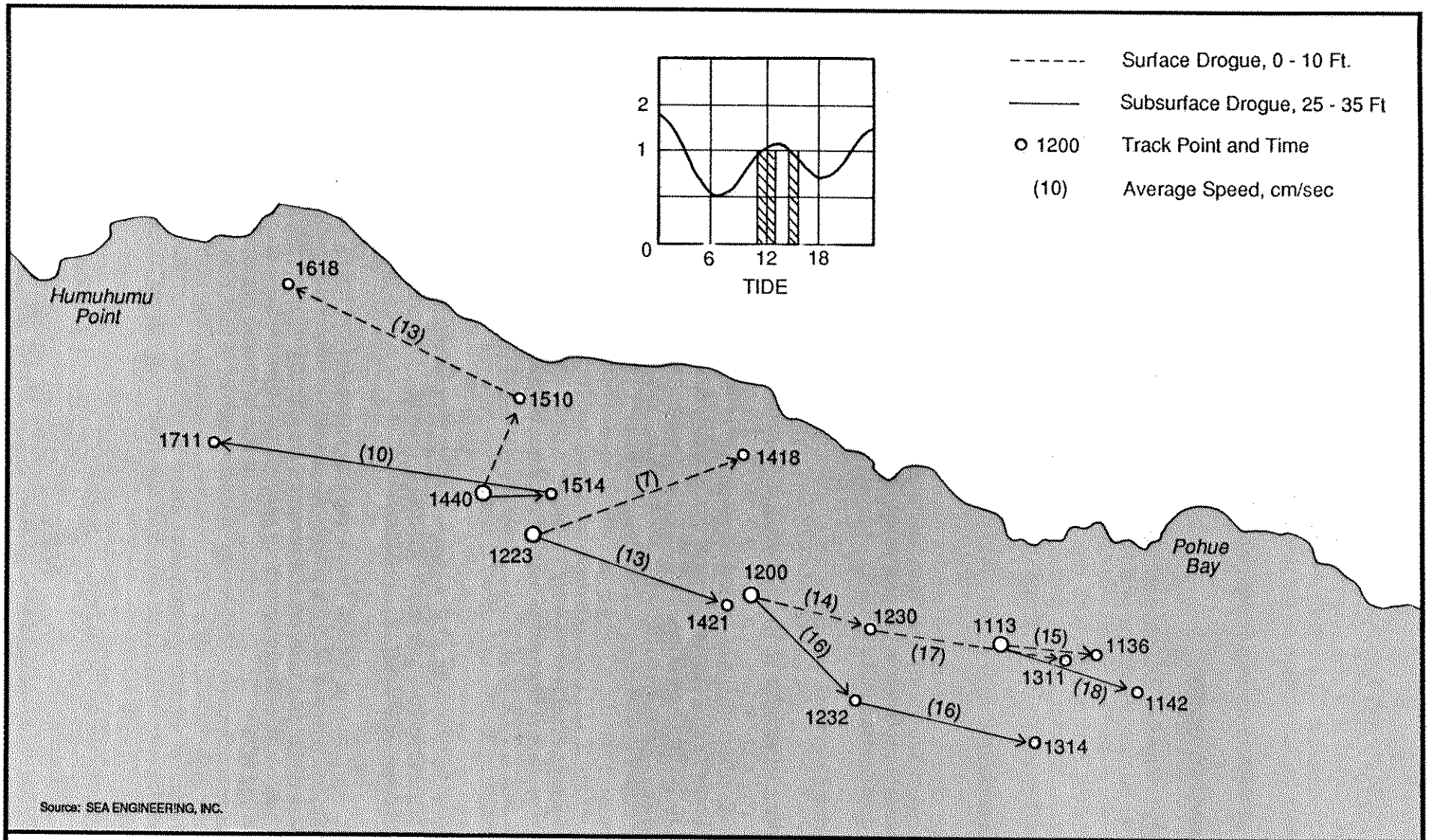
1.4.1.8 Marine Biological Community

1.4.1.8.1 General Description of Marine Biological Community

An analysis of the marine biological community was based on data gathered from 11 reef survey sites and 24 quantitative survey transects conducted in April and May, 1987. A full report of the findings is included in this document as an appendix. Findings reveal that the offshore environment is typical of West Hawaii. Much of the area off the proposed resort corresponds to a common zonation pattern. The principal variations are: the reef terrace, comprised of the P. meandrina boulder zone and the P. lobata reef bench zone is often compressed in width, and in areas where the shelf break and slope is composed of basalt cliffs and outcrops, the P. compressa zone is absent. Seventeen coral species were identified in three nearshore zones (see Figure 4.11). Coral in the nearshore zone is exposed to most of the force of breaking waves and surges. Total coverage ranges between 30% to 50% with no single species truly dominating the community. Non-coral cover consists primarily of basalt and sand.

Seaward of the nearshore zone, a narrow reef terrace characterizes the Hawaiian Riviera offshore region. The increased water depth and reduced wave scour generally results in greater proportions of coral cover on the reef bench (40%-60%).

At the seaward edge of the reef bench, the depth increases beyond 60 feet, providing the most stable environment in terms of wave stress. Although the substratum consists primarily of unconsolidated beach rubble and sand, coral settlements are able to proper where there is sufficient solid substrata. Thickets of a fragile branching species were observed to depths of 90 feet with coral coverage reaching 90% of the coral surface. Major taxa of benthic organisms other than coral are sea urchins and sea cucumbers. Particularly abundant species of sea urchins were observed at densities on the order of 30 individuals per square meter. In general, offshore benthic communities represent "an aesthetically interesting, but typical, assemblage of nearshore Hawaiian reef habitat. None of the communities represented rare or unique ecosystem components" (Dollar, 1987).



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SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

Figure 4.10

PREVAILING OFFSHORE CURRENTS (Humuhumu Point to Pohue Bay)

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

Specific criteria specified by DOH water quality standards for open coastal waters

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 Kjeldahl Nitrogen (ug N/l)	150.00* 110.00**	250.00* 180.00**	350.00* 250.00**
Ammonia Nitrogen (ug NH4-N/l)	3.50* 2.50**	8.50* 5.00**	15.00* 9.00**
Nitrate +Nitrite Nitrogen (ug [NO3+NO2]-N/l)	5.00* 3.50**	14.00* 10.00**	25.00* 20.00**
Orthophosphate Phosphorus (ug PO4-P/l)	7.00* 5.00**	12.00* 9.00**	17.00* 13.00**
Total Phosphorus (ug P/l)	20.00* 16.00**	40.00* 30.00**	60.00* 45.00**
Light Extinction Coefficient (k units)	0.20* 0.10**	0.50* 0.30**	0.85* 0.55**
Chlorophyll a (ug/l)	0.30* 0.15**	0.90* 0.50**	1.75* 1.00**
Turbidity (Nephelometric Turbidity Units)	0.50* 0.20**	1.25* 0.50**	2.00* 1.00**
Nonfilterable Residue (mg/l)	20.0* 10.0**	30.0* 15.0**	40.0* 20.0**

*"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 receiveless than three million gallons per day of fresh water discharge per shoreline mile.

Appicable to both wet and dry conditions:

pH units shall not deviate more than 0.5 units from a value of 8.1.

Dissolved oxygen - Not less than 75% saturation.

Temperature - Shall not vary more than 1 deg. C from ambient conditions.

Salinity - Shall not vary more than 10% from natural or seasonal changes considering hydrologic input and oceanographic factors.

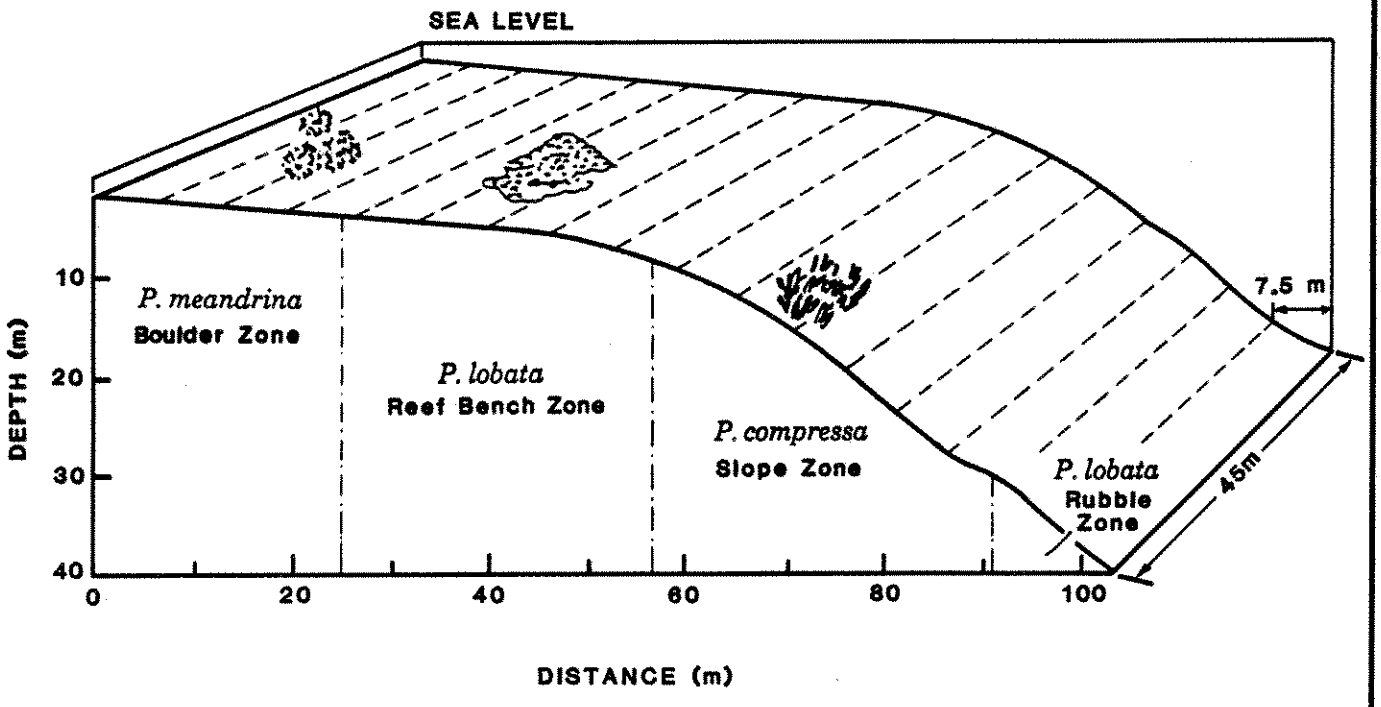


Figure 4.11

TYPICAL ZONATION PATTERNS OF WEST HAWAII NEARSHORE AREAS

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

The total number of fish species encountered on transects was 100, with individual fish encountered ranging from approximately 250 to 460. Data indicates a lower number of species and individuals at inshore transects, probably due to the less favorable physical environment caused by heavy surge from wave action and less habitat complexity from lowered coral growth. Although a rich and diverse fish community was found in all reef areas off the proposed development, there is evidence of a surprising degree of fishing pressure. Commercial trolling, shorecasting, gill netting, spearfishing, small boat fishing, opihi and lobster gathering, and tropical fish collecting are all known to occur in the area.

1.4.1.8.2 Threatened and Endangered Species

Three species of marine animals that occur in Hawaiian waters have been declared threatened or endangered by the Federal government; the green sea turtle, the hawksbill turtle and the humpback whale. Numerous small green sea turtles were observed in the nearshore region during the course of the survey, although no nesting sites were encountered on any of the beaches in the development. Hawksbill turtles are found infrequently in waters off west Hawaii, and none were sighted during the survey. Populations of humpback whale are known to winter in Hawaiian waters, however, it is not common for whales to occupy shallow nearshore waters.

1.4.1.9 Anchialine Ponds

Anchialine ponds along the coast of West Hawaii exhibit a definite successional process related to sediment characteristics, according to marine biologist Steve Dollar, whose analysis appears as an appendix to this document. Young ponds are usually simple depressions in lava with no sediment cover and no associated plant life. With the gradual accumulation of dissolved nutrients introduced by groundwater, aquatic and riparian plants, and wind-transported material, sediment layers accumulate on pond floors. Mineral crusts created by algae eventually line the bottoms of many ponds. These sediments and crusts begin to interfere with the natural flushing that results from groundwater circulation and tidal influences in anchialine ponds, by literally clogging the porous lava. As sediments deepen, plants such as sedges and rushes take root and encroach from the edges, eventually enveloping the original pond. The rate of the successional process is dependent upon exposure to light, depth, and degree of flushing. A good connection to the water table will result in sediments being regularly flushed from the pond by tidal exchange rather than accumulating on the pond floor.

A total of twenty anchialine ponds have been identified within the Hawaiian Riviera project site. They have been classified by type according to overall structure and composition of the bottom and can be summarized in four catagories. Cracks or fissures extending into the water table constitute the first type exemplifed by Pond #20 near the proposed marina. The second type are so-called A'a ponds, identified as depressions in lava rock with no significant growth of benthic macroalgae or vascular pond plants and no sediment accumulation. Seven of the ponds surveyed are classified as A'a ponds and are distributed around Pohue Bay and at the southern end of the project site. "Orange crust" ponds represent the third type. They are similar to A'a ponds except that the bottom rock is covered by orange-brown mineralized crusts of blue-green algae. This type is the most abundant on the Hawaiian Riviera project site; ten of the twenty ponds contain "orange crusts". The fourth type of anchialine ponds found at the project site are "Sediment" ponds containing layers of unconsolidated sediment up to two feet deep. Deep sediments may be anaerobic emitting the odor of reduced sulfides as well as methane bubbles from the accumualted sediment. Two ponds have been classified as "Sediment ponds". Figure 4.12 shows the general location of the anchialine ponds and Table 12 summarizes their characteristics.

Interestingly, ponds of substantially different classification sometimes occur on the

project site within a few feet of each other. One possible explanation concerns the depths of the ponds. Shallow ponds may have such effective tidal flushing action that detrital material generated by algal crusts cannot accumulate as sediments. Deeper ponds may not be as effectively flushed and can therefore retain some sediment. Once initial sediment deposition takes place, porosity of the bottom rock is reduced and residence time of the material is increased further, allowing sediment accumulation to increase.

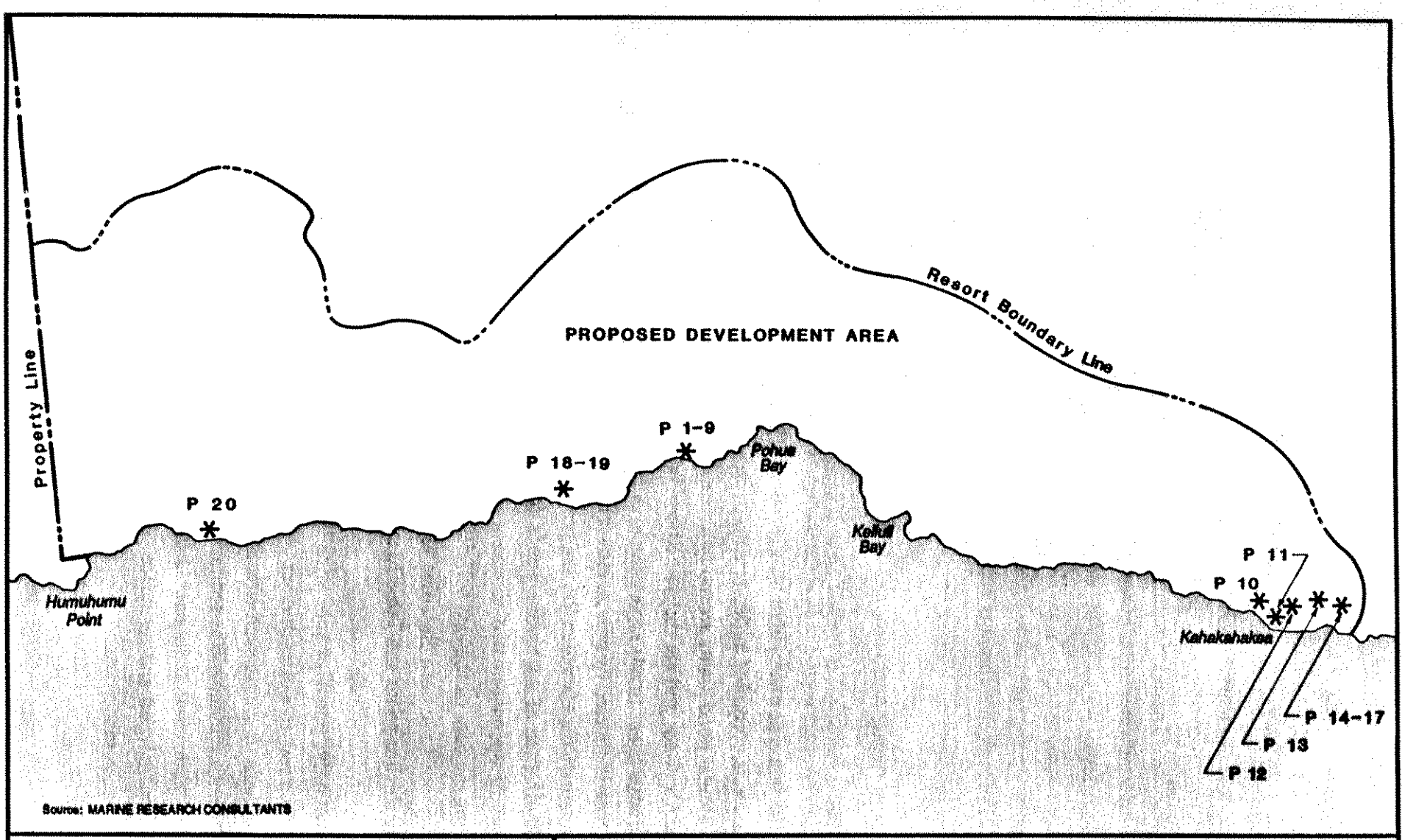
Salinities of the Hawaiian Riviera ponds ranged between 4 and 8 °/oo. Their average sailinity (5.6 °/oo) is slightly lower than the average salinity established by Maciolek and Brock (1974) for 289 ponds along the West Hawaii coast (7 °/oo). The difference reflects the low tidal stand at the project site, however, the Hawaiian Riviera ponds do not represent anomalies. Pond temperatures were consistent with characteristic temperatures for other ponds (22°-28°C). With the exception of Pond 7, none of the Hawaiian Riviera ponds appear to be in advanced stages of succession: dissolved oxygen values were close to saturation or supersaturated. The pH of all ponds is representative of "normal" pond waters, and water columns of all ponds were exceptionally clear. Even Pond 7 with a thick mat of algae totally covering the surface has a clear water column. Finally, nutrient levels of the ponds confirm the overwhelming influence of groundwater, as opposed to oceanic influence, upon the ponds.

The most ubiquitous aquatic plant groups in all Hawaiian anchialine ponds are the orange mineralized algal crusts (Schizothrix sp.) that occur in shallow, low salinity ponds. These crusts have been observed in seventeen of the twenty Hawaiian Riviera ponds. Widgeon grass (Ruppia maritima) was identified in ponds with substantial sediments. The submerged herb Egaria densa, commonly called "dense waterweed" was also found in dense aggregations in association with Ruppia in eleven of the ponds.

All four shrimp and three snail species classified by Maciolek and Brock (1974) as representative pond organisms were found to be extremely abundant in the Hawaiian Riviera ponds, with the exception that no shrimp were found in ponds #1 and #20. According to Dollar, "It is somewhat curious as to why no shrimp were observed in Pond #1 either during the day or night. This is the largest pond at the (Kenonone) "waterhole" and while it is likely to be the pond affected most by human influence (i.e. campers, fishermen, etc.) there is no obvious reason why the pond should not be inhabited by shrimp" (Dollar, 1987).

Two of the shrimp classified by Maciolek and Brock, Halocaridina rubra and Metabetaeus lohena, are considered rare, found only in anchialine areas, but are normally the most common shrimp found in ponds.

While representative pond fish, Eleotris sandwicensis, a predaceous goby, and Kuhlia sandvicensis, a silvery carnivorous fish commonly called "aholehole" were observed in some of the ponds, exotic fish were notably absent from all Hawaiian Riviera ponds. Dollar concludes that, "The observed abundance of all shrimp species, lack of exotic fish, and the relative absence of signs of modification by humans indicate that the Hawaiian Riviera pond complex is essentially pristine and has not yet been noticably affected by the activities of man" (Dollar, 1987).



2000 1000 0 2000 4000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

LEGEND:

* Anchialine Pond

Figure 4.12

LOCATION OF ANCHIALINE PONDS AT THE HAWAIIAN RIVIERA RESORT

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

Table 12: CHARACTERISTICS OF ANCHIALINE PONDS AT RIVIERA RESORT

Pond Number	Pond Type	Long Axis (feet)	Short Axis (square feet)	Area[x] (square feet)	Maximum[y] Depth (inches)
1	SEDIMENT	75	46	3000 L	60 D
2	ORANGE CRUST	28	12	730 M	28 M
3	ORANGE CRUST	56	32	1600 L	29 M
4	ORANGE CRUST	26	15	350 M	24 M
5	ORANGE CRUST	14	6	90 S	24 M
6	ORANGE CRUST	10	10	75 S	30 M
7	SEDIMENT *	68	31	2100 L	--- ---
8	A'A	25	8	160 M	19 S
9	A'A	11	3	50 S	18 S
10	A'A**	12	12	110 M	26 M
11	ORANGE CRUST	100	35	4000 L	28 M
12	ORANGE CRUST	100	9	3800 L	29 M
13	A'A	45	11	840 M	32 M
14	A'A	68	45	1800 L	35 M
15	A'A	65	60	3000 L	39 M
16	ORANGE CRUST	53	43	1800 L	41 M
17	A'A	17	14	190 M	24 M
18	ORANGE CRUST	130	30	6900 L	60 D
19	ORANGE CRUST	34	20	600 M	43 M
20	LAVA CRACK	8	5	35 S	29 M

* Pond 7 has a surface mat of slimy green algae. In order to not disturb the surface mat, the pond's depth was not measured.

** Pond 10 also has a surface mat of slimy green algae, but it only partially covers the surface allowing the depth to be measured.

x Pond size designations are based on the criteria of Maciolek and Brock (1974):
Size = Large (L), Medium (M), Small (S)

y Maciolek and Brock (1974) depth designations:
Depth = Deep (D), Moderate (M), Shallow (S)

1.4.2 Probable Impacts and Mitigation Measures

A marina and public launching ramp are the only projects planned at this time for the coastal area of the Hawaiian Riviera Resort. Potential impacts to the marine environment resulting from these construction activities as well as the indirect processes the result from activities on land are discussed below. Additionally, potential mitigation measures are presented.

1.4.2.1 Temporary Effects of Construction

Specific activities relating to the construction of the Hawaiian Riviera Resort will involve grading, vegetation removal, excavation and filling, and landscaping. Of these activities, the excavation of the proposed marina and terracing of the mauka area to create the Marina Village has the potential for the greatest impact upon the nearshore environment.

1.4.2.1.1 Temporary Effects on Ocean Water Quality

Excavation of the proposed marina will occur entirely on dry land approximately 200 feet from the existing shoreline. This phase of construction will have little or no effect on the marine enviroment. Once excavation is completed, the marina's entrance channel will be dug, connecting the ocean to the marina basin. During the breakthrough it is likely that turbidity of the nearshore waters will temporarily increase. However, due to the high energy regime of the entire coastline along the project site and the steep off-shore slope, suspended materials resulting from increased sedimentation or potential runoff from the constructon site will quickly disperse. No permanent settlement on the sea floor is expected. The deep nearshore waters will also minimize the area of the marina channel to be dredged. It is recommended, however, that monitoring studies during marina construction insure that no unforseen environmental concerns are created.

1.4.2.1.2 Effects on the Marine Biological Community

Sedimentation and runoff as a consequence of grading and construction activity has a low potential for impact to the marine biological community. The existing community structure is presently adapted to extremes in sediment stress from natural conditions. In comparision to the frequent natural sediment loading in the project area, any additional input from land-based construction activity is expected to be insignificant.

Several protected marine species may inhabit the offshore environment of the Hawaiian Riviera. Heavy equipment and blasting associated with the marina construction might create noise that could affect the behavior of whales and other marine animals. Mitigating measures for this impact could include restriction of blasting activities during the months when whales are present, and monitoring programs to ensure that mammals are not in the immediate areas during blasting.

Short term impacts on water quality due to construction activity would not be of a magnitude sufficient to affect the behavior of sea turtles that might inhabit the nearshore areas of the Hawaiian Riviera. Although access to the coastal areas will increase, the present use of sites along the coastline for fishing activities has resulted in the turtle population already being subjected to human-induced effects.

1.4.2.1.3 Effects on Anchialine Pond Water Quality and Resulting Biological Response

Construction activities at the Hawaiian Riviera Resort are not expected to substantially impact the anchialine ponds due to a number of mitigating factors. The lack of existing topsoil in the vast majority of the construction area will help to reduce the potential for particulate emmissions

from grading activities. The coarse grading and crushing of lava will generate airborne particulate matter. Any airborne particulates generated by construction activities will be characteristically of a finer quality than sediment presently identified in many of the ponds. For those ponds with a highly efficient flushing and tidal exchange, the small quantities of airborne matter that actually come in contact with the ponds will be flushed from them in the course of natural flushing. For those ponds in advanced stages of succession, the relative quantity of airborne matter will be inconsequential in comparison to the volume of existing sediment. An additional mitigating factor will be the natural wind patterns associated with the project area and the relative location of the anchialine ponds. The greatest concentration of ponds occurs at the southern and central portions of the property. However, the most significant construction activity, namely the excavation of the marina and the terracing of adjacent areas, will be located at the northern end of the property. As previously discussed, trade winds tend to wrap around South Point and blow parallel to the coast from east to west. Airborne particulates will, therefore, tend to be blown away from the majority of ponds on the site. Finally, the duration of construction activity represents but a brief episode in the timeframe of anchialine pond succession. Anchialine ponds in later stages of succession in West Hawaii have been documented as remaining relatively unchanged for periods of 50 or more years. For example, a single pond in the northern portion of the Mauna Lani Resort appears today the very same way it was described in the late 1800's. This would seem to indicate that construction activity lasting two or three years would not contribute significantly to the natural succession of a pond. As a point of fact, it has been observed that construction activities associated with the Mauna Lani Resort have had no measureable impact upon the pristine quality of the extensive anchialine pond system located nearby. It should be noted that particular measures will be taken to ensure that the construction of the proposed marina will not impact pond #20, located approximately 1,000 feet south of the marina's proposed entrance. Although pond #20 is actually a moderately deep crack, and due to the depth of the water surface below ground, it is not readily susceptible to damage. The surface area of the crack can be covered during periods of construction activity. Because of the depth of the crack, no vegetation is located around the water within it.

1.4.2.2 Permanent Impacts

Permanent impacts to the nearshore marine environment would result from two primary sources; sedimentation and runoff. As discussed above, the project site's offshore topography and general energy regime ensure that sedimentation that may be related to the proposed project will not impact the nearshore water quality to a measureable degree.

The general climate of Ka'u is relatively dry; therefore, substantial rainfall and runoff is rather unlikely. However, if analyses indicate that the proposed changes in land use and drainage patterns might result in substantial changes in nearshore water quality, additonal field surveys will be conducted to determine the best location for the discharge of drainage and to assess the significance of expected water quality with respect to marine community structure. With no natural drainage ways on the project site, rainfall is mostly absorbed into the porous rock and either percolates to the water table or is lost to transpiration.

Golf course irrigation by treated sewage effluent, fertilization and pest control are not expected to contribute to the degradation of the quality of the marine environment. Due to the unrestricted circulation of the offshore area by tidal and wind driven currents, meso-scale eddies and wave action, rapid diluting and water exchange will counteract any buildups. Residence time of a parcel of water fronting the development is probably on the order of hours, so buildup of any nutrient will not occur. Furthermore, it is believed that much of the nutrient load contained in treated sewage effluent is taken up by plants during irrigation. Chang and Young (1977) reported that 98% of the total nitrogen and 100% of the total phosphorus in effluent used on an Oahu golf course was taken up by the soil-plant surface layer. Virtually none of the nutrient load reached the

marine environment through groundwater runoff. The offshore community has, in addition, adapted to the high level of nitrogen content in existing groundwater entering the marine environment. Increased levels of nitrogen from irrigation sources will have no effect on any already nitrogen-rich environment. Lastly, the small amounts of pesticides used in golf course maintenance do not appear to be of a magnitude sufficient to leach through the soil and be carried to the ocean via groundwater extrusion and then to accumulate to the level of producing a noticeable effect.

1.4.2.2.1 Shoreline Alteration

Shoreline alteration will result from two specific components of resort construction; the entrance channel for the proposed marina at the Hawaiian Palace Resort, and the public boat launching ramp at the Ka'u Aina Resort. In both instances, the area of shoreline requiring alteration will be relatively small. Nevertheless, alteration of the shoreline in the area of the proposed marina channel and development of the inland marina may be viewed as having a positive impact upon the biological community. The newly created basin will provide settling sites for corals and other benthic organisms, with no apparent negative impacts to the offshore environment (U.S. Army Corps of Engineers, 1983).

It should be noted here that although the proposed site plan includes two lagoon swimming areas, one to be located at each side of the marina entrance, the lagoons will be constructed entirely onshore and connected to the ocean via openings at each end for circulation. The offshore bathymetry indicates that there is sufficient depth to ensure adequate circulation within the lagoons without the need for offshore channelization. The only impact, therefore, will be the actual connections to the ocean.

1.4.2.2.2 Changes to the Anchialine Ponds' Environment

The effects of increased groundwater nutrients from resort development on anchialine pond dynamics has been studied in areas similar to the Hawaiian Riviera Resort site. A 1977 study at Anaehoomalu (OI Consultants) suggests that anchialine ponds in the area of the Waikoloa Resort were impacted. Pond temperatures and salinity were slightly lower and nutrient contents were elevated. These changes are believed to be due to an increase in groundwater input resulting from resort activities. The amount of daily brackish water usage by the resort was of a similar magnitude to the amount of natural groundwater flux through the system. It is believed that such increases could decrease the contribution of seawater to the ponds, resulting in reduced salinity and temperature and increased nutrient content. However, the report emphasized that the changes did not appear to have a negative impact on the ponds. Since the ponds are not nutrient limited systems, an increase in nutrients did not tend to alter plant community growth patterns. In addition, Brock reports in 1985 that resort operation at the Mauna Lani Resort has resulted in no negative impacts to the extensive pond system. Although the chemical character of the ponds may be altered, as long as the water exchange rates are not affected, there appears to be no substantive effects on the biological communities inhabiting the environment. Dollar concludes from these sources that "Because there are no development activities planned at the Hawaiian Riviera that will affect water exchange, and because plans call for most pond systems to be preserved in their natural state, there does not appear to be any potential to influence biological structure" (Dollar,1987). A monitoring program can be implemented before construction of the resort begins to ensure that the ponds are not impacted during and after construction of the resort. Monitoring can include periodic water sampling and biota surveys.

Planning for the development should include measures to preserve the anchialine ponds and prevent the introduction of exotic species that could severely alter the biological community

structure. Exotic species are known to have a significantly greater impact upon ponds' shrimp population than native species.

1.4.2.2.3 Long-Term Changes to Ocean Water Quality and Resulting Biological Response

The biological community structure is well adapted to the extremes in sediment stress from natural conditions and will not be substantially impacted by additional sediment or runoff from the project site. Water quality is not anticipated to change substantially due to the high energy regime of the area. Increased nutrient loading due to golf-course irrigation is expected to result in a nil response from the marine biological community.

1.4.2.2.4 Changes to Shoreline Access and Recreational Use

Access to the coastline fronting the Hawaiian Riviera Resort will improve considerably with the opening of the resort. Despite current restrictions on access, fishing activity in the area is known to be high. The creation of a Shoreline Openspace Corridor along the shoreline of the resort will substantially increase access to the coastline. Although offshore recreational activities such as boating will increase due to the existance of the marina, they are expected to have minimal impact upon the shoreline. However, increased access to the coastal areas will probably contribute to greater fishing pressures being exerted in the region.

1.5 TERRESTIAL FLORA

Construction of the proposed Hawaiian Riviera Resort will involve the clearance of existing vegetation from the project sites wherever necessary and replacement with exotic grasses and landscape plants. This section identifies the existing vegetation surveyed on the subject property and discusses probable impacts and recommendations for mitigation measures.

1.5.1 Existing Conditions

As discussed above, the project site is comprised of three areas, the resort area along the shore, the airport located inland, and the support community adjacent to the Mamlahoa Highway. Lava flows of different ages dominate the landscape in all three areas of the proposed project. The makai parcel is sparsely vegetated, primarily with scrub. Along the shoreline, rocky cliffs are the predominant feature interspersed with a few sandy or coral-rubble strewn beaches. A number of anchialine ponds are located in this area. The proposed airport site is largely located on the barren 'a'a lava flow of 1887.

Because the mauka parcel (proposed support community) ranges in elevation from 1,600 to 1,960 feet and receives about 50 inches of rainfall per year, vegetation types are quite different from the drier, lower elevation makai parcels. Native plant species are more common on this parcel. A grassland-scrub community covers most of the mauka parcel. 'Ohi'a forests occur on an ancient 'a'a lava flow and a pioneer 'ohi'a community is located on the 1868 lava flow.

1.5.1.1 Survey Methods

A team of three botanists (Char & Associates) conducted a survey of flora on the project site from April 10 through April 16, 1987. Their summry findings are presented in this document as an appendix. Prior to the field survey, a search was made of the pertinent literature to identify previous botanical studies conducted in the general area. Topographical maps and recent aerial photographs of the project site were studied to determine access and terrain characteristics. Access to most of the subject area was by means of a 4-wheel drive vehicle, primarily along a number of

jeep roads which crisscross the entire parcel.

A walk-through survey method was used to gather the necessary information. Criteria such as structure, composition, and associated plant species were used in identifying and describing each vegetation type. Notes were made of the species found in each of these vegetation types; species which could not be positively identified in the field were collected for later determination in the herbarium and laboratory. Wherever possible, areas immediately adjacent to the parcels proposed for development were also surveyed as these buffer areas may be indirectly affected by the proposed development.

1.5.1.2 Summary Description of Vegetation

The distribution of vegetation types on the proposed Hawaiian Riviera Resort area is influenced by a number of environmental factors including rainfall, elevation, substrate type and age, topography, and exposure.

For the flora study, the two lower elevation parcels proposed for development of the resort and airport, respectively, are referred to as the makai parcels, and the area of the proposed support community is referred to as the mauka parcel. The makai parcels receive roughly 30 inches of rainfall per year (State of Hawaii, DLNR 1973). Elevation ranges from sea-level to about 280 feet in the proposed resort area, and from 1,100 to roughly 1,200 feet at the proposed airport. Vegetation in the makai area is generally sparce. Pahoehoe flows in this area support a mixed scrub vegetation; 'a'a flows are usually barren or support only a few scattered plants. The littoral cones, composed of cinder and ash, and the coastal cliffs and beach areas support different vegetation types.

Elevations at the wetter mauka portion range from 1,600 to 1,960 feet. The mauka portion receives 50 inches or rainfall per year (State of Hawaii, DLNR 1973). A rather dense cover of mixed grass and shrub species exists on the prehistoric pahoehoe lava flow which occupies most of the mauka parcel. Several kipukas with 'ohi'a forests are contained within the prehistoric 'a'a flows. On the 1868 flow, which is largely pahoehoe, small 'ohi'a trees, from 3 to 18 feet tall are numerous.

A total of 140 vascular plant species were inventoried during the survey of the entire Hawaiian Riviera Resort project site. Of these, 85 (61%) are introduced or exotic species; 5 (3%) are of Polynesian origin; 22 (16%) are indigenous; and 28 (20%) are endemic.

Native taxa (indigenous and endemic) make up 36% of the species inventoried and the greatest numbers and kinds of native species are found in the 'ohi'a forest vegetation type on the mauka portion (support community) of the proposed development. One candidate endangered species, Pleomele hawaiiensis, the halapepe, is found in this vegetation type, and is discussed below.

The coastal, lowland areas do not support any rare, threatened or endangered plant species. The flora is relatively undersized. Notably missing are beach naupaka (Scaevola taccada), pua-pilo (Capparis sandwicensis), hinahina (Heliotropium anomalum), and noni (Morinda citrifolia). Pohuehue (Ipomoea brasiliensis) and koali vines (Ipomoea macrantha), members of the morning-glory family, are locally abundant. Char (1986) has observed that in coastal areas which once supported a dense goat population, pohuehue is usually the only native strand species left uneaten by the goats. Grazing is believed to have resulted in the elimination of much of the variety of plant life normally found in similar coastal areas.

The vegetation on the mauka portion is composed largely of a scrub community consisting of the introduced Natal redtop (Rhynchelytrum) and the native hi'aloa (Waltheria indica var. americana), which is regarded as a weedy native species.

A detailed index of plant species identified on the project site is included as an appendix to this report. A map of the general vegetation coverage at the subject property appears as Figure 4.13.

1.5.1.3 Rare, Threatened and Endangered Species

None of the species inventoried during the flora survey conducted at the project site are officially listed endangered or threatened species which are protected by federal and state laws. There are also no species currently being proposed as endangered or threatened species. In particular, no rare, theatened or endangered species were found around the anchialine ponds existing on the project site. However, one species found on the mauka parcel is a candidate endangered species. Pleomele hawaiiensis (syn. Dracaena hawaiiensis), the halapepe, is a Category 1 candidate endangered species (U.S. Fish and Wildlife Service 1980). A Category 1 species is a taxon for which the U.S. Fish and Wildlife Service presently has sufficient information on hand to support the biological appropriateness of it being listed as an Endangered or Threatened species. Plants listed in Category 1 may be considered candidates for listing and, as such, consideration should be given them in environmental planning.

The halapepe is a freely-branching tree, up to 50 feet tall, with many, coarse, erect, main branches. Halapepe is found in the dry forests of North and South Kona and Ka'u, generally between 1,000 and 2,000 feet elevation. It reaches its best development in the dry forests of Pu'u Wa'awa'a, North Kona.

About 8 halapepe trees were found on the mauka parcel of the project site, where they occur primarily in the open 'ohi'a forest, although one plant is located in the grassland-scrub community. The plants range in size from 15 to 20 feet tall. No seedlings or juvenile plants were observed during the survey. About a dozen feral goats, as well as goat damaged vegetation, were noted during the field study. Most of the trees had just finished flowering and bore immature fruits at time of the flora survey.

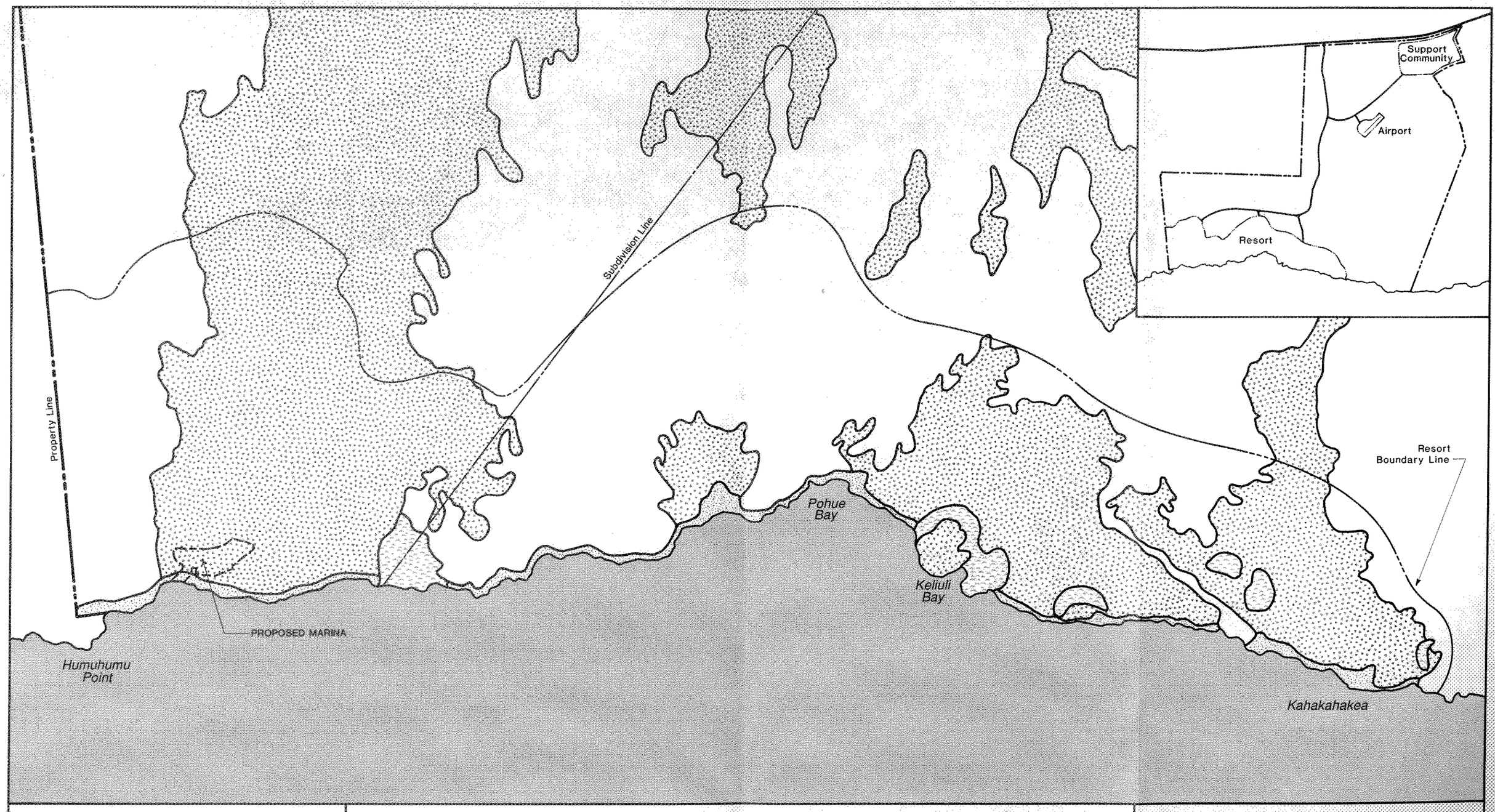
Two additional species found during this survey are listed in Fosberg and Herbst (1975). These two species also occur in the 'ohi'a forest vetegation type on the mauka parcel.

The maua (Xylosma hawaiiensis var. hillebrandii), a small tree, is considered "Depleted"; much less common over all or most of its range than formerly, the depletion is directly or indirectly the result of human activities. Only one plant was found at about 1,640 feet elevation.

Korthasella remyi, a member of the mistletoe family, is listed as "Uncertain"; insufficient information available to determine status. It is found growing on the branches of 'ohi'a trees. Neither of these two species is considered threatened or endangered by federal and/or state agencies.

1.5.2 Probable Impacts and Mitigation Measures

Construction of the proposed resort will involve clearance of the sparse vegetation from portions of the site and the importation of exotic species for use in landscaping, as well as the establishment of grass and other ground covers for the proposed golf course, polo field area, and extensive park areas. Thus, major changes in the type and distribution of vegetation can be



1000 500 0 1000 2000 3000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

LEGEND:

- Coastal Vegetation
- Scrub Community
- Cinder Land Vegetation
- No Vegetation

Figure 4.13

EXISTING VEGETATION TYPES AT THE HAWAIIAN RIVIERA RESORT

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

expected. For a majority of the project site, short-term impacts will include substantial removal of existing vegetation.

It is recommended that, wherever possible, native species already found on the project area or nearby areas should be used for landscaping. These include 'ohi'a (Metrosideros collina ssp. polymorpha), hinahina, pohuehue, pa'u-o-Hi'i-'aka (Jacquemontia sandwicensis), noni, beach naupaka, pua-pilo, naio (Myoporum sandwicense), hala (Pandanus odoratissiumus), 'ilima (Sida fallax), alahe'e (Canthium odoratum), 'ulei (Osteomeles anthyllidifolia), and pua kala (Argemone glauca). Plants introduced by the Hawaiians such as milo (Thespesia populnea), kou (Cordia subcordata), coconut (Cocos nucifera), and ti (Cordyline terminalis) are also excellent choices for landscaping.

These native and Polynesian species are adapted to the low rainfall, salt-spray and other environmental conditions characteristic of the coastal lowland. They will require very little soil and less water than the more commonly used landscape plants. In addition, as they are already found in the general region, they will not pose an "invasion threat" to the native ecosystems found on the adjoining Manuka Natural Area Reserve extending northwest from the subject property's northwest boundary.

If introduced ornamental species are utilized in landscaping, then it is recommended that only sterile, hybrid cultivars such as bougainvilleas, plumerias, hibiscus, hybrid turf grasses, etc. should be used.

The kipuka of 'ohi'a forest which lies adjacent to the 1887 Lava Flow should be preserved as it contains a number of native plant species as well as the candidate endangered species, Pleomele hawaiiensis.

Resort development in the area is expected to have beneficial long-term impacts on vegetation. Irrigation and appropriate methods of pest control will ensure a substantial increase in vegetation over the current levels and improve the project site as a habitat for plant species and some animal species.

1.6 BIRDS AND WILDLIFE

The project site of the proposed Hawaiian Riviera Resort is comprised of two substantially differing areas; the barren lava flows of the resort site and proposed airport, and the grasslands, parkland and dryland forest of the mauka area proposed for development of a residential and commercial support community. These two areas are separated by an extensive area of primarily open barren lava. This section discusses the findings of a bird and mammal survey conducted at the project site.

1.6.1 Existing Conditions

1.6.1.1 Survey Methods

Field surveys were conducted from April 10 to 12, 1987 by Phillip L. Bruner, an Assistant Professor of Biology at Brigham Young University's Hawaii Campus. Observations were made with the aid of binoculars and by listening for vocalization. Attention was also paid to the presence of tracks and scats as indicators of bird or mammal activity. Existing trails and roads were followed as well as straight line transects, where possible, so as to maximize the amount of area censused. Eight-minute counts were made at intervals of 100-200 meters and were conducted primarily in the morning and late afternoon periods. Observations of feral mammals were limited to

visual sightings and physical evidence.

1.6.1.2 Summary of Bird Population

A variety of resident endemic birds were observed in the mauka forested area of the support community, including Apapane (Himatione sanguinea), Common Amakihi (Hemignathus virens), Japanese White-eye (Zosterop japonicus), Hawaiian Hawk ('Io) (Buteo solitarius), Short-eared Owl (Pueo) (Asio flammeus sandwichensis), and Northern Cardinal (Cardinalis cardinalis). No other native resident land birds were observed during the survey.

The coastal anchialine ponds yielded no sightings of native resident waterbirds nor was there any evidence in the form of tracks or fecal droppings to indicate usage of the ponds by these birds. Brunner observes that the small size and limited number of ponds probably precludes extensive use by resident waterbirds. He believes it highly unlikely that nesting occurs at the ponds due to their small size and easy access to predators and humans.

Species of resident native land and waterbirds which could potentially occur on the property although not observed during the survey include: 'Elepaio (Chasiempis sandwichensis), Hawaiian Goose (Nene) (Nesochen sandvicensis), American Coot (Fulica americana), Hawaiian Duck (Anas wyvilliana), Black-necked Stilt (Himantopus mexicanus), and Black-crowned Night Heron (Nycticorax nycticorax).

Migratory indigenous birds observed at the site were limited to the Pacific Golden Plover (Pluvialis dominica fulva) and the Wandering Tattler (Heteroscelus incanus). The only other species likely to occur would be the Ruddy Turnstone (Arenaria interpres) and Sanderling (Calidris alba).

A total of ten species of exotic birds were observed during the field survey. These, along with a complete listing of all birds sighted, their location, and frequency are presented in a summary table in an appendix to this document. Exotic species not observed but expected to occur on the property include the Northern Mockingbird (Mimus polyglottos), Warbling Silverbill (Lonchura malabarica), and the House Sparrow (Passer domesticus).

1.6.1.3 Summary of Mammal Population

Mongoose (Herpestes auropunctatus) were observed on all days of the survery. Although none were seen, rats and mice undoubtedly occur on the property. Likewise, no feral cats or dogs were seen. Feral goats and pigs have been reported in the area and skeletal remains, scats and tracks confirmed their presence although no individuals were observed. The Hawaiian Hoary Bat (Lasiurus cinereus semotus) has been observed in the area (E. Kosaka 1987), but none were seen during the survey.

1.6.2 Probable Impacts

The forested upper mauka site provides essential resources for both native and exotic species of birds and mammals. The diversity of species as well as the total number of individuals is greatest in this sector of the project site. The coastal portions of the property provide limited resources due to the scarcity of vegetation, according to Brunner. The primary use of the anchialine ponds by birds and mammals appeared to be as sources of drinking water. Migratory birds may also feed on invertebrates found in these ponds. Kanonone Waterhole has shallow areas

suitable for foraging wading birds and is large enough to serve as a resting place for waterbirds.

Alteration of the existing habitats will result in changes in the present bird and mammal populations. Some species such as the Common Myna, House Sparrow, and Zebra Dove will very likely become more numerous. As lawns and golf courses are developed, habitat for the Pacific Golden Plover will also increase and larger numbers will occur on the property.

Native forest birds may not respond in so positive a manner to development. A loss of the forested habitat or an alteration in the kind of trees in the mauka section of the property could have irrevocable results on the present populations of Apapane and Amakihi. The significance of the ponds along the coast would appear to be related primarily to sources of drinking water which are scarce along this arid section of coastline. Resting sites and possibly limited feeding opportunities also are provided by these features. Their small size and accessibility to disturbance and predation limits their value as potential nesting sites. Mammal populations on the property may change as new habitat is created and urbanization occurs. Cats and dogs will become a more significant element in the fauna. Mongoose, rats and mice might also increase in number. It is difficult to project what impact development may have on the Hawaiian Hoary Bat population. Although this species occurs in native forest it also can be found in urban areas and thus may be fairly adaptable to a variety of conditions.

1.6.3 Mitigation Measures

It is recommended that the mauka forested areas of the property be preserved and that development be confined to open lava flows. Anchialine ponds are also recommended for preservation. These two habitats provide significant resources for bird and mammal populations.

1.7 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

1.7.1 Existing Conditions

The project area is rich in historic and archaeological resources. Although portions of the project area have been previously surveyed, the field work conducted in conjunction with this document represents the most comprehensive study of the area's archaeological resources to date.

The following sections are derived from a report prepared for the property owners by Paul H. Rosendahl, Inc. (PHRI) and presented as an appendix to this document. It should be noted that details concerning exact archaeological site locations have been deleted from the report in an effort to reduce vandalism of the sites. Legitimate research requests for more specificity should be directed to the property owners in the form of a written request.

1.7.1.1 Historical Setting

There is little historical documentation of the project site. General descriptions of the region's coastline are found in the journals of travelers during the early 19th century. However, their observations confirm only the barren, rugged coastline, the sparse vegetation and the relative absense of a permanent population. The entire region of Kahuku, Ka'u was awarded to W.P. Leleiohoku, husband of Nahienaena (the sister of Liholiho [King Kamehameha II] and Kauikeaouli [King Kamehameha III]) during the Mahele, however the subsequent distribution and use of the land has not been documented.

1.7.1.2 Previous Archaeological Work

The earliest archaeological work within the project area appears to be an excavation conducted in July 1958 by W.J. Bonk and Y.H. Sinoto (Hansen field notes: on file in Bernice P. Bishop Museum [BPBM]). They excavated Site H59 (HRHP Site 3654 *) at Pohue Bay as part of the Bishop Museum-Department of Anthropology Hawaiian Archaeological Program; however, the results of the excavation were never published.

Sometime between 1954 and 1960, during one of his field trips to Hawaii Island, J.H Cox recorded several hundred petroglyph units located in the vicinity of Pohue Bay (Cox 1970:80,82). Recorded are figures, dots, circles, abstractions, fans, crabs, ships, rubbing holes, dates, and names.

V. Hansen, in November 1962 and September 1966, and R. Green, in April 1965, both of the Department of Anthropology, BPBM, conducted preliminary surveys of the coastal portions of the Land of Kahuku in the District of Kau (field notes: on file in BPBM). They recorded a total of 33 sites, including walled house sites, cave shelters, burial platforms, trails, anchialine ponds, and petroglyphs in the vicinity of Pohue Bay and Kahakahakea.

During the summer of 1965, L. Soehren of the Dept. of Anthropology, BPBM, with National Science Foundation support, conducted archaeological excavations of two cave shelters at Kahakahakea--Sites H65 (3635) and H66 (3636) (Soehren 1965). Site H65 yielded radiocarbon dates from the fourteenth and fifth century, but Soehren rejected the latter date as too early. However, according to Kirch, based on early dates recorded for nearby South Point sites (H1), Soehren's fifth century date should not be rejected (Kirch 1985:87).

With the exception of one unnumbered site, all recorded sites were later included in an inventory of Hawaii Island sites prepared by B.P. Bishop Museum in 1970 for the Hawaii County Planning Department (Emory 1970). That inventory was based entirely on existing records in the Bishop Museum-Department of Anthropology, and did not involve any field work.

1.7.1.3 Findings of the 1987 PHRI survey

The reconnaissance survey was carried out in May and June, 1987 in accordance with the minimum requirements for reconnaissance level survey recommended as standard by the Society for Hawaiian Archaeology (SHA). These standards are currently used by the Hawaii County Planning Department and DLNR-HSS as guidelines for the review and evaluation of archaeological reconnaissance survey reports submitted in conjunction with various development permit applications.

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

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* Hawaii Register of Historic Places (HRHP) site designation system: all four-digit site numbers prefixed by 50-10-72,75- (50=State of Hawaii, 10=Island of Hawaii, 72, 75=USGS 7.5' series quad map [Puu Hou, Pohui, Hawaii])
B.P. Bishop Museum (BPBM) site designation system: all site numbers prefixed by 50-Ha-B23- (50=State of Hawaii, Ha=Island of Hawaii, B=District of Kau, 23=Lands of Kahuku).

For purposes of the reconnaissance survey, the overall project area of about 3,360 acres was divided into the following Survey Areas:

1. Immediate Coastal Zone--seaward part of main resort portion of project area, extending from the shoreline to c. 1,200 ft inland (c. 715 ac)

2. Remainder Coastal Zone--more inland part of main resort portion of project area, extending variably from c. 1,200 ft inland to a maximum of c. 5,500 ft inland (c. 1,585 ac)

3. Support Community--parcel located c. 5.5 miles inland, adjacent to and seaward of the Mamalahoa Highway (c. 800 ac)

4. Airfield--parcel located c.1.5 miles inland and adjacent to the main resort portion of the project area (c.100 ac)

5. Access Road--150-ft wide corridor extending from Mamalahoa Highway to the main resort area along the coast (c. 160 ac)

Field work included aerial and ground surveys. Volcanic glass flakes were surface collected wherever found for potential age determination.

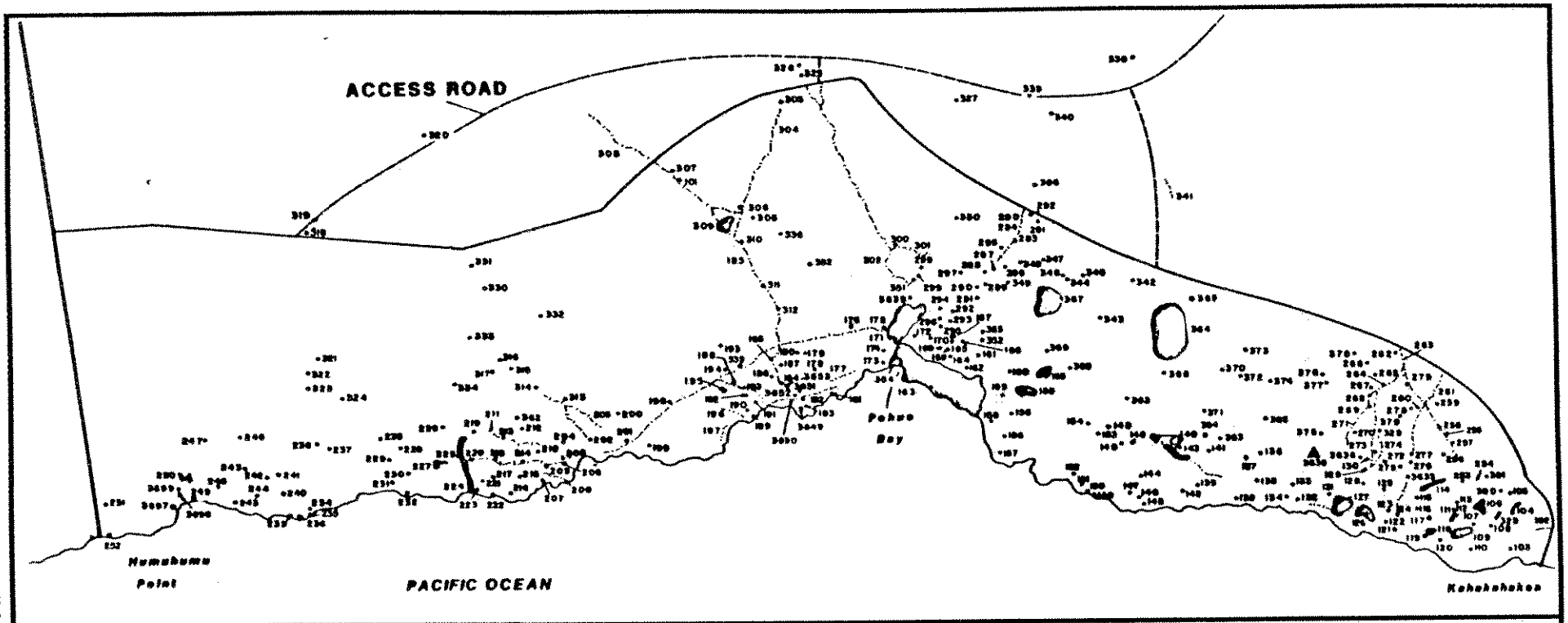
A total of 298 archaeological sites with 1,167 component features have been identified within the Hawaiian Riviera Resort project area and are presented in Figure 4.14. These sites and their component features are summarized in Appendices A and B of PHRI's Interim Report. Previous archaeological studies within the project area identified a total of 33 archaeological sites. PHRI field investigations relocated 32 of the previously identified sites and identified a total of 287 new sites. Of the 32 relocated sites, 21 are subsumed under five PHRI temporary site numbers as component features or areas. Table 13 correlates previously recorded site numbers with those assigned during the present study.

One previously recorded site was not relocated. This site, HRHP Site 3638, consists of a single upright waterworn stone associated with a concentration of coral interpreted as a small shrine (Emory 1970:14). Although the vicinity of site HRHP 3638 was surveyed, the site was not located--possibly because of its small size or because it has since been destroyed.

The archaeological sites include 166 site complexes and 132 single-feature sites. A variety of formal types are present within the sites, including C-, U-, and L-shape walls; enclosures; platforms; cairns; trails; linear and curved walls; petroglyphs; mounds; alignments; pahoehoe excavations; modified and unmodified anchialine ponds, unmodified overhangs, lava tubes, and lava blisters; and miscellaneous leveled, walled, and/or otherwise modified areas.

Approximately half of the C-shape walls, curved walls, and cairns occur in aligned pairs. C-shape or curved walls usually are open to the southwest with the cairn positioned about 4 to 5 meters to the southwest. The cairns generally have a central hole, presumably designed to support a post which in turn supported some sort of superstructure. Such sites with aligned pairs are usually situated along trails or near quarried areas a moderate distance from the coast.

Uses and functions of the sites probably included: habitation, temporary habitation, quarry, transportation (trails), water source (ponds), storage, tool preparation, recreation, religious, and rock art. A distinction between habitation and temporary habitation sites has been made. Habitation sites are believed to have been occupied on a more frequent or semi-permanent

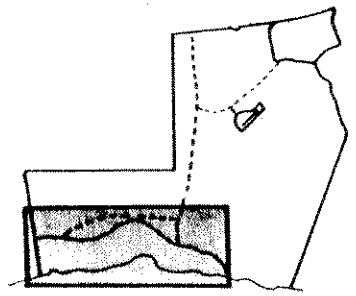


3 digit number - - PHRI temporary site number (T-)

4 digit number - - Hawaii Register of Historic Places (HRHP) site number (50-10-72)

Trail

Source: PAUL ROSENDAHL



3000 2000 1000 0 3000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

Figure 4.14

ARCHAEOLOGICAL SITES AT THE HAWAIIAN RIVIERA RESORT

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

basis than temporary habitation sites. A great majority of the sites are believed to have been temporary habitation function based on a quantification of remains at the site. In general, sites are distributed in a series of fairly dense concentrations along the coast, usually centered where anchialine ponds are present. Concentrations also correlate with older, Pohue Bay and Kipuka Kanohina lava flows and trails across the project site. To our knowledge ownership of the identified trails and roadways within the subject property rests with Palace Development Corporation and Hawaii Kau Aina Partners. This, however, does not preclude the possibility of future claims being made regarding jurisdiction or ownership. Most of the sites are believed to be prehistoric, possibly between fifth and fourteenth century ages suggesting a long period of use. The majority of the prehistoric sites in the project area are in fair to good condition, which suggests most were used late in prehistory.

1.7.1.4 Significant Assessments and Archaeological Treatments

The general significance of the archaeological resources identified during the reconnaissance survey are evaluated in terms of potential scientific research, interpretative, and/or cultural values. Research value refers to the potential of archaeological resources for producing information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization. Interpretive value refers to the potential of archaeological resources for public education and recreation. Cultural value, within the framework of significance evaluation used here, refers to the potential of archaeological resources to preserve and promote cultural and ethnic identity and values.

To facilitate outside review, general significance assessments and recommended general treatments for all identified sites are summarized in Table 14. Significance categories used in the site evaluation process are derived from the National Register criteria for evaluation, outlined in the Code of Federal Regulations (36 CFR Part 60). The Hawaii State Historic Preservation Office uses these criteria for evaluating cultural resources. Sites determined to be potentially significant for information content (Category A, Table 14) fall under Criterion D, which defines significant resources as being ones which "have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR Sec. 60.4). Sites potentially significant as representative examples of site types (Category B) are evaluated under Criterion C, which defines significant resources as those which "embody the distinctive characteristics of a type, period, or method of construction,...or that represent a significant and distinguishable entity whose components may lack individual distinction" (36 CFR Sec. 60.4).

Sites with potential cultural significance (Category C) are evaluated under guidelines prepared by the Advisory Council on Historic Preservation entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (Draft Report, August 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth" (1985:1). The guidelines further specify that, "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value" (1985:7).

Seventy sites within the project area are assessed as being significant solely for their information content and needing further data collection. For most of these sites, intensive survey-level data collection (i.e., detailed recording, surface collection, and possibly test excavation) is probably sufficient. After further data collection is completed, the site's physical preservation is not considered essential, although some level of interpretive development of selected features would be appropriate. Some sites might be considered for inclusion into landscaping. Five sites are assessed as being significant for information content and as good examples of specific site types. Further intensive-level data collection is necessary at these sites, after which

Table 13:
CORRELATION OF SITE AND FEATURE DESIGNATIONS

State	BPBM	PHRI	Comments
3612	B23-1	T-163; Fea. A	-
3613	B23-2	T-163; Fea. E	-
3614	B23-3	T-163; Fea. F	-
3615	B23-4	T-163; Fea. G	-
3616	B23-5	T-163; Fea. H	-
3617	B23-6	T-172; Fea. A	-
3618	B23-7	T-172; Fea. B	-
3619	B23-8	T-172; Fea. D	-
3620	B23-9	T-163; Fea. S	-
3621	B23-10	T-163; Fea. Y	-
3622	B23-11	T-163; Fea. T	-
3623	B23-12	T-163; Fea. U	-
3624	B23-13	T-163; Fea. Z	-
3625	B23-14	T-163; Fea. AA	-
3626	B23-15	T-163; Fea. BB	-
3627	B23-16	T-163; Fea. GG	-
3635	B23-24	-	Formerly H65
3636	B23-25	-	Formerly H66
3637	B23-26	T-131; Fea. A	-
3638	B23-28	-	Not relocated
3639	B23-27	-	-
3647	B23-40	T-140	Includes undefined portion of T-140
3649	B23-42	-	-
3650	B23-43	-	-
3651	B23-44	-	-
3652	B23-45	-	-
3653	B23-46	-	-
3654	B23-47	T-163; Fea. I	Formerly H59
3655	B23-48	T-170	Includes undefined portion of T-170
3656	B23-49	T-170	Includes undefined portion of T-170
3697	B23-57	-	-
3698	B23-58	-	-
3699	B23-59	-	-

some level of interpretive development of selected features would be appropriate.

Because they contain or may contain human burials, Site T-361, and eight other sites (see table), are assessed as being significant for their informational content, and potentially for their cultural value. Further data collection at all of these sites is necessary to confirm the presence of skeletal remains at sites, or, in the case of T-361, further data collection is necessary to determine the total number and distribution of the remains. Human remains recovered could be preserved and protected in place, or, following archaeological disinterment and physical anthropological study, they could be relocated and reinterred elsewhere.

Thirty-eight sites are assessed as being significant for information content, as a site type example, and for their cultural value. Additional data recovery is necessary at these sites; for most sites, because most of the more substantial cultural deposits unfortunately have been looted by artifact hunters, leaving little to no remaining excavatable deposit, data recovery could be adequately accomplished by an intensive survey-level data collection effort. Following data recovery, some level of interpretive development of selected features or portions of these sites, would be appropriate.

Eighteen sites, mostly trail segments, are considered to be significant for their information content, and because they are considered to have cultural value. The reconnaissance survey's data collection effort at these sites is considered sufficient, and no further work is necessary. It is recommended that these sites be preserved as is.

One hundred and fifty-eight sites, generally consisting of single features or small clusters of features and usually lacking cultural deposits and portable remains, are assessed as being significant soley for their information content and needing no further data collection. These sites have been measured, mapped, described, photographed, and plotted; data collected from them during the reconnaissance survey is considered to be sufficient, and no further work is necessary. Their preservation is not essential; however, some sites could perhaps be incorporated into landscaping.

A total of 140 sites are considered signficant at this time. All of these sites are located within the resort component of the Hawaiian Riviera.

1.7.2 Probable Impacts

Potentially all 140 significant sites will be "adversely effected" by the development and operation of the resort. This section assesses the potential adverse impacts. The following section presents a mitigation plan specifically intended to convert a situation of potentially "adverse effects" to "no adverse effects".

The primary adverse impact will be increased public access to the sites. Rosendahl has found that many sites in the coastal area have already been vandalized despite the fact that access to the region is relatively restricted. Increased public access can impact the sites in two ways; unintentional damage and intential vandalism. Due to the nature of the coastal terraine many sites tend to blend in with their surroundings. Small lava walls and cairns appear as random piles of lava rock and rubble to the untrained eye. These sites can be easily disturbed by climbing upon them or removing rocks without realizing their significance. Intentional vandalism can result from persons distrubing sites in a search for artifacts or altering petroglyphs to produce rubbings and etchings. Damage can also occur during use of caves by fishermen for temporary shelter or storage of fishing equipment.

An additional type of adverse impact can result from the accidential damage to a site during construction. Construction vehicles or personel can unintentionally destroy or damage a site during grading similar earth-moving activities. Blasting associated with construction of the proposed marina can also have an adverse impact by damaging sites with vibrations or falling debris.

Lastly, primary adverse impacts can take the form of alteration of the natural setting within which significant sites are located.

Secondary adverse impacts are associated with damage to the sites during resort operations. These impacts tend to be associated with littering in the site areas or visitors leaving designated paths to climb around site features. Vandalism in the form of grafitti or physical damage can also occur.

1.7.3 Mitigation Measures

A two-part mitigation plan has been developed to address the adverse impacts discussed above and ensure that no adverse impacts will occur at the significant sites. Part one relates to Table 14 and concerns the identification of significant sites and the development of a limited data recovery plan. Part two is intended to preserve and protect sites during construction of the resort and facilitate data recovery.

Part one of the mitigation plan involves the actual data recovery conducted by archaeologists for the purpose of both initial survey and subsequent gathering of information necessary for interpretive development of sites identified as significant. Table 14 presents this phase of the mitigation plan which constitutes a limited data recovery preservation plan. Archaeologists will conduct the additional work necessary to obtain data to be used for interpretive development. This data will provide the basis for development of a management plan for areas such as the petroglyph park, the shoreline corridor and Pohue Bay sites to be prepared during the zoning phase of the planning process.

The second stage of ensuring no adverse impacts upon the significant sites involved the preparation of the development concept plan (Figure 2.3) based upon the location of significant archaeological features presented in Figure 4.15. The results of the Rosendahl study indicated that significant sites tended to be located along the shoreline and clustered in the area of Pohue Bay, the littoral cones, and the southern portion of the property. The configuration of sites was mapped as depicted in Figure 4.15 and the development concept plan was prepared utilizing this map as well as maps of other physical constraints. Thus, the location of the petroglyph park, openspace areas, parks, golf course features, and the Openspace Shoreline Corridor were designed to accommodate all significant archaeological sites.

Uncontrolled public access to the project site will become an increasingly significant problem during construction of the proposed project. The potential for vandalism and unintentional destruction exists so long as access to the property can not be monitored. Recognizing this problem, the Rosendahl archaeological team used temporary identification tags during their field work to gather the information contained in Table 14. These tags are only intended to remain intact for a few weeks and should have alredy deteriorated by the publication of this document, thereby reducing the potential for unwanted intruders to locate and vandalize sites. In order to preserve the sites during the project's construction phase while keeping them "hidden" from possible intruders, part two of the mitigation plan was developed. During construction, entire site areas corresponding to the park, openspace areas and setbacks shown on the concept plan will be marked as restricted areas. Since these areas will require no construction activity, they can be clearly identified as

restricted areas to prevent accidential damage. At the same time, demarkation of the restricted areas will eliminate the need to tag or mark individual sites which would expose them to potential vandalism. The result will be that the identified significant sites can be protected during construction and public access can be effectively restricted.

This part of the mitigation plan will also ensure that the natural setting surrounding the sites will not be disturbed and the integrity of individual and collection sites can be preserved. The creation of restricted areas during construction will also help to eliminate potential damage from blasting. While low-impact detonation charges can be used to reduce vibration and debris fall-out from blasting, construction vehicles can also be easily restricted from certain areas, thereby reducing the risk of accidential damage or destruction.

Restricted areas to be set aside as "preserves" for significant sites will help to facilitate the development of specific plans for the upkeep, management, and control of these areas and the regulation of public access. Although public access will not necessarily be restricted, it can be effectively monitored. Interpretive methods such as a board-walk with railings and appropriate signs is an example of a way to regulate public access to sensitive areas without undermining the integrity of the area. Similar methods are used at the Mauna Lani Resort in West Hawaii and the Trail of Destruction at the Volcanoes National Park.

The concept of a cultural center is an additional example of implementing a program to provide information about an area without exposing it to excessive impacts. The cultural center would actually be a commercial area located inland from the petroglyph park. It could include shops and restaurants as well as an information center which overlooks the park area. Visitors could visit the center and learn about the sites located in the petroglyph park and other areas without having to actually walk through the park area.

The implementation of the mitigation plan will require careful and timely coordination with appropriate government agencies. Detailed plans for archaeological data recovery and for further archaeological work in the sites to be preserved will be prepared prior to any field work, and these plans will be reviewed by the State's Historic Sites Section of the Department of Land and Natural Resources as well as the County of Hawaii's Planning Department. In addition, specific preservation plans for each site to be preserved will be reviewed and approved by these same offices prior to their implementation. Finally, these two offices will verify that the archaeological plans and preservation plans are successfully executed.

Table 14.

SUMMARY OF GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS HAWAIIAN RIVIERA RESORT DEVELOPMENT PROJECT AREA

Site or Feature No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
3639	+	-	-	-	+	-	-	-
3651	+	-	-	-	+	-	-	-
3652	+	-	-	-	+	-	-	-
3697	+	-	-	-	+	-	-	-
T-104	+	-	-	-	+	-	-	-
T-107	+	-	-	-	+	-	-	-
T-108	+	-	-	-	+	-	-	-
T-110	+	-	-	-	+	-	-	-
T-112	+	-	-	-	+	-	-	-
T-116	+	-	-	-	+	-	-	-
T-118	+	-	-	-	+	-	-	-
T-122	+	-	-	-	+	-	-	-
T-123	+	-	-	-	+	-	-	-
T-124	+	-	-	-	+	-	-	-
T-125	+	-	-	-	+	-	-	-
T-128	+	-	-	-	+	-	-	-
T-129	+	-	-	-	+	-	-	-
T-134	+	-	-	-	+	-	-	-
T-142	+	-	-	-	+	-	-	-

General Significance Categories:

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

Recommended General Treatments:

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

Table 14. (cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-149	+	-	-	-	+	-	-	-
T-150	+	-	-	-	+	-	-	-
T-152	+	-	-	-	+	-	-	-
T-156	+	-	-	-	+	-	-	-
T-157	+	-	-	-	+	-	-	-
T-159	+	-	-	-	+	-	-	-
T-160	+	-	-	-	+	-	-	-
T-162	+	-	-	-	+	-	-	-
T-174	+	-	-	-	+	-	-	-
T-184	+	-	-	-	+	-	-	-
T-187	+	-	-	-	+	-	-	-
T-189	+	-	-	-	+	-	-	-
T-190	+	-	-	-	+	-	-	-
T-192	+	-	-	-	+	-	-	-
T-201	+	-	-	-	+	-	-	-
T-202	+	-	-	-	+	-	-	-
T-226	+	-	-	-	+	-	-	-
T-231	+	-	-	-	+	-	-	-
T-235	+	-	-	-	+	-	-	-
T-238	+	-	-	-	+	-	-	-
T-240	+	-	-	-	+	-	-	-
T-241	+	-	-	-	+	-	-	-
T-245	+	-	-	-	+	-	-	-
T-248	+	-	-	-	+	-	-	-
T-250	+	-	-	-	+	-	-	-
T-254	+	-	-	-	+	-	-	-
T-265	+	-	-	-	+	-	-	-
T-276	+	-	-	-	+	-	-	-
T-277	+	-	-	-	+	-	-	-
T-279	+	-	-	-	+	-	-	-
T-284	+	-	-	-	+	-	-	-
T-288	+	-	-	-	+	-	-	-
T-291	+	-	-	-	+	-	-	-
T-293	+	-	-	-	+	-	-	-
T-294	+	-	-	-	+	-	-	-
T-295	+	-	-	-	+	-	-	-
T-296	+	-	-	-	+	-	-	-
T-299	+	-	-	-	+	-	-	-
T-300	+	-	-	-	+	-	-	-
T-315	+	-	-	-	+	-	-	-
T-321	+	-	-	-	+	-	-	-
T-322	+	-	-	-	+	-	-	-
T-347	+	-	-	-	+	-	-	-
T-349	+	-	-	-	+	-	-	-
T-352	+	-	-	-	+	-	-	-
T-354	+	-	-	-	+	-	-	-
T-357	+	-	-	-	+	-	-	-

Table 14. (cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-359	+	-	-	-	+	-	-	-
T-363	+	-	-	-	+	-	-	-
T-364	+	-	-	-	+	-	-	-
T-379	+	-	-	-	+	-	-	-
Subtotal: 65	70	0	0	0	70	0	0	0
T-158	+	-	-	*	+	-	-	*
T-161	+	-	-	*	+	-	-	*
T-167	+	-	-	*	+	-	-	*
T-169	+	-	-	*	+	-	-	*
T-172	+	-	-	*	+	-	-	*
T-183	+	-	-	*	+	-	-	*
T-194	+	-	-	*	+	-	-	*
T-225	+	-	-	*	+	-	-	*
T-361	+	-	-	+	+	-	-	+
Subtotal: 9	9	0	0	9	9	0	0	9

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

3549	+	-	+	-	+	-	+	-
T-103	+	-	+	-	+	-	+	-
T-213	+	-	+	-	+	-	+	-
T-287	+	-	+	-	+	-	+	-
T-367	+	-	+	-	+	-	+	-
Subtotal: 5	5	0	5	0	5	0	5	0
3635	+	-	+	+	+	-	+	-
3636	+	-	+	+	+	-	+	-
3650	+	-	+	+	+	-	+	-
3698	+	-	+	+	+	-	+	-
3699	+	-	+	+	+	-	+	-
T-102	+	-	+	+	+	-	+	-
T-106	+	-	+	+	+	-	+	-

Table 2. (cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-109	+	-	+	+	+	-	+	-
T-117	+	-	+	+	+	-	+	-
T-121	+	-	+	+	+	-	+	-
T-126	+	-	+	+	+	-	+	-
T-127	+	-	+	+	+	-	+	-
T-130	+	-	+	+	+	-	+	-
T-131	+	-	+	+	+	-	+	-
T-140	+	-	+	+	+	-	+	-
T-155	+	-	+	+	+	-	+	-
T-163	+	-	+	+	+	-	+	-
T-166	+	-	+	+	+	-	+	-
T-170	+	-	+	+	+	-	+	-
T-171	+	-	+	+	+	-	+	-
T-173	+	-	+	+	+	-	+	-
T-175	+	-	+	+	+	-	+	-
T-185	+	-	+	+	+	-	+	-
T-188	+	-	+	+	+	-	+	-
T-199	+	-	+	+	+	-	+	-
T-203	+	-	+	+	+	-	+	-
T-204	+	-	+	+	+	-	+	-
T-206	+	-	+	+	+	-	+	-
T-208	+	-	+	+	+	-	+	-
T-211	+	-	+	+	+	-	+	-
T-215	+	-	+	+	+	-	+	-
T-224	+	-	+	+	+	-	+	-
T-227	+	-	+	+	+	-	+	-
T-228	+	-	+	+	+	-	+	-
T-230	+	-	+	+	+	-	+	-
T-239	+	-	+	+	+	-	+	-
T-355	+	-	+	+	+	-	+	-
T-386	+	-	+	+	+	-	+	-
Subtotal: 38	38	0	38	38	38	0	38	0

Table 14. (cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
3653	-	+	-	+	-	+	-	+
T-255	-	+	-	+	-	+	-	+
T-260	-	+	-	+	-	+	-	+
T-261	-	+	-	+	-	+	-	+
T-263	-	+	-	+	-	+	-	+
T-264	-	+	-	+	-	+	-	+
T-271	-	+	-	+	-	+	-	+
T-274	-	+	-	+	-	+	-	+
T-280	-	+	-	+	-	+	-	+
T-301	-	+	-	+	-	+	-	+
T-302	-	+	-	+	-	+	-	+
T-304	-	+	-	+	-	+	-	+
T-308	-	+	-	+	-	+	-	+
T-310	-	+	-	+	-	+	-	+
T-311	-	+	-	+	-	+	-	+
T-312	-	+	-	+	-	+	-	+
T-316	-	+	-	+	-	+	-	+
T-341	-	+	-	+	-	+	-	+
Subtotal: 18	-	18	-	18	-	18	-	18
T-101	-	+	-	-	-	+	-	-
T-105	-	+	-	-	-	+	-	-
T-111	-	+	-	-	-	+	-	-
T-113	-	+	-	-	-	+	-	-
T-114	-	+	-	-	-	+	-	-
T-115	-	+	-	-	-	+	-	-
T-119	-	+	-	-	-	+	-	-
T-120	-	+	-	-	-	+	-	-
T-132	-	+	-	-	-	+	-	-
T-133	-	+	-	-	-	+	-	-
T-135	-	+	-	-	-	+	-	-
T-136	-	+	-	-	-	+	-	-
T-137	-	+	-	-	-	+	-	-
T-138	-	+	-	-	-	+	-	-

Table 14. (cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-139	-	+	-	-	-	+	-	-
T-141	-	+	-	-	-	+	-	-
T-143	-	+	-	-	-	+	-	-
T-144	-	+	-	-	-	+	-	-
T-145	-	+	-	-	-	+	-	-
T-146	-	+	-	-	-	+	-	-
T-147	-	+	-	-	-	+	-	-
T-148	-	+	-	-	-	+	-	-
T-151	-	+	-	-	-	+	-	-
T-153	-	+	-	-	-	+	-	-
T-154	-	+	-	-	-	+	-	-
T-164	-	+	-	-	-	+	-	-
T-165	-	+	-	-	-	+	-	-
T-168	-	+	-	-	-	+	-	-
T-176	-	+	-	-	-	+	-	-
T-177	-	+	-	-	-	+	-	-
T-178	-	+	-	-	-	+	-	-
T-179	-	+	-	-	-	+	-	-
T-180	-	+	-	-	-	+	-	-
T-181	-	+	-	-	-	+	-	-
T-182	-	+	-	-	-	+	-	-
T-186	-	+	-	-	-	+	-	-
T-191	-	+	-	-	-	+	-	-
T-193	-	+	-	-	-	+	-	-
T-195	-	+	-	-	-	+	-	-
T-196	-	+	-	-	-	+	-	-
T-197	-	+	-	-	-	+	-	-
T-198	-	+	-	-	-	+	-	-
T-200	-	+	-	-	-	+	-	-
T-205	-	+	-	-	-	+	-	-
T-207	-	+	-	-	-	+	-	-
T-209	-	+	-	-	-	+	-	-
T-210	-	+	-	-	-	+	-	-
T-212	-	+	-	-	-	+	-	-
T-214	-	+	-	-	-	+	-	-
T-216	-	+	-	-	-	+	-	-
T-217	-	+	-	-	-	+	-	-
T-218	-	+	-	-	-	+	-	-
T-219	-	+	-	-	-	+	-	-
T-220	-	+	-	-	-	+	-	-
T-221	-	+	-	-	-	+	-	-
T-222	-	+	-	-	-	+	-	-
T-223	-	+	-	-	-	+	-	-
T-229	-	+	-	-	-	+	-	-
T-232	-	+	-	-	-	+	-	-

Table 14. (cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-233	-	+	-	-	-	+	-	-
T-234	-	+	-	-	-	+	-	-
T-236	-	+	-	-	-	+	-	-
T-237	-	+	-	-	-	+	-	-
T-242	-	+	-	-	-	+	-	-
T-243	-	+	-	-	-	+	-	-
T-244	-	+	-	-	-	+	-	-
T-246	-	+	-	-	-	+	-	-
T-247	-	+	-	-	-	+	-	-
T-249	-	+	-	-	-	+	-	-
T-251	-	+	-	-	-	+	-	-
T-252	-	+	-	-	-	+	-	-
T-253	-	+	-	-	-	+	-	-
T-256	-	+	-	-	-	+	-	-
T-257	-	+	-	-	-	+	-	-
T-258	-	+	-	-	-	+	-	-
T-259	-	+	-	-	-	+	-	-
T-262	-	+	-	-	-	+	-	-
T-266	-	+	-	-	-	+	-	-
T-267	-	+	-	-	-	+	-	-
T-268	-	+	-	-	-	+	-	-
T-269	-	+	-	-	-	+	-	-
T-270	-	+	-	-	-	+	-	-
T-272	-	+	-	-	-	+	-	-
T-273	-	+	-	-	-	+	-	-
T-275	-	+	-	-	-	+	-	-
T-278	-	+	-	-	-	+	-	-
T-281	-	+	-	-	-	+	-	-
T-282	-	+	-	-	-	+	-	-
T-283	-	+	-	-	-	+	-	-
T-285	-	+	-	-	-	+	-	-
T-286	-	+	-	-	-	+	-	-
T-289	-	+	-	-	-	+	-	-
T-290	-	+	-	-	-	+	-	-
T-292	-	+	-	-	-	+	-	-
T-297	-	+	-	-	-	+	-	-
T-298	-	+	-	-	-	+	-	-
T-303	-	+	-	-	-	+	-	-
T-305	-	+	-	-	-	+	-	-
T-306	-	+	-	-	-	+	-	-
T-307	-	+	-	-	-	+	-	-
T-309	-	+	-	-	-	+	-	-
T-313	-	+	-	-	-	+	-	-

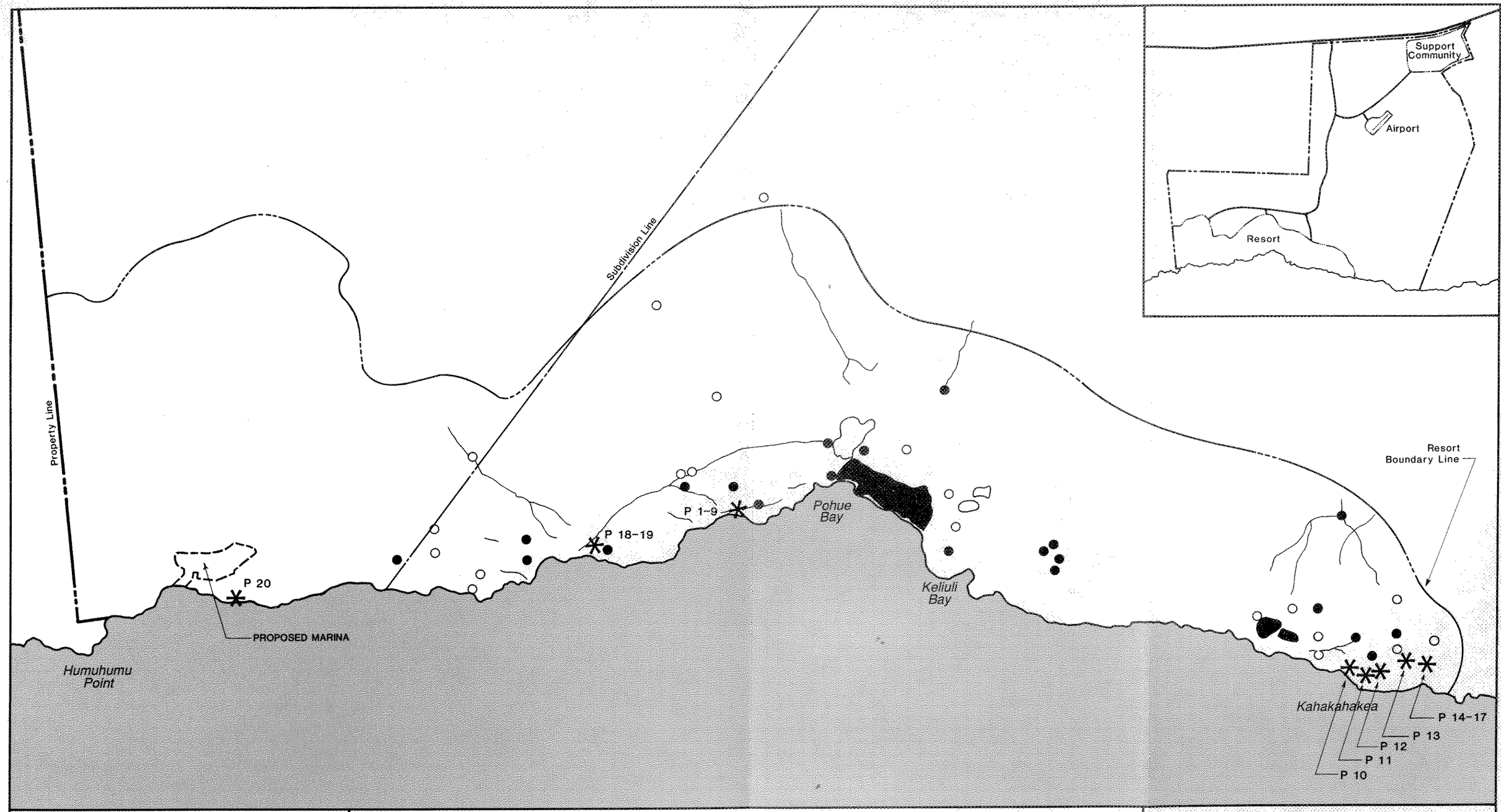
Table 14. (cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-314	-	+	-	-	-	+	-	-
T-317	-	+	-	-	-	+	-	-
T-318	-	+	-	-	-	+	-	-
T-319	-	+	-	-	-	+	-	-
T-320	-	+	-	-	-	+	-	-
T-323	-	+	-	-	-	+	-	-
T-324	-	+	-	-	-	+	-	-
T-325	-	+	-	-	-	+	-	-
T-326	-	+	-	-	-	+	-	-
T-327	-	+	-	-	-	+	-	-
T-328	-	+	-	-	-	+	-	-
T-329	-	+	-	-	-	+	-	-
T-330	-	+	-	-	-	+	-	-
T-331	-	+	-	-	-	+	-	-
T-332	-	+	-	-	-	+	-	-
T-333	-	+	-	-	-	+	-	-
T-334	-	+	-	-	-	+	-	-
T-335	-	+	-	-	-	+	-	-
T-336	-	+	-	-	-	+	-	-
T-337	-	+	-	-	-	+	-	-
T-338	-	+	-	-	-	+	-	-
T-339	-	+	-	-	-	+	-	-
T-340	-	+	-	-	-	+	-	-
T-342	-	+	-	-	-	+	-	-
T-343	-	+	-	-	-	+	-	-
T-344	-	+	-	-	-	+	-	-
T-345	-	+	-	-	-	+	-	-
T-346	-	+	-	-	-	+	-	-
T-348	-	+	-	-	-	+	-	-
T-350	-	+	-	-	-	+	-	-
T-351	-	+	-	-	-	+	-	-
T-353	-	+	-	-	-	+	-	-
T-356	-	+	-	-	-	+	-	-
T-358	-	+	-	-	-	+	-	-
T-360	-	+	-	-	-	+	-	-
T-362	-	+	-	-	-	+	-	-
T-365	-	+	-	-	-	+	-	-
T-366	-	+	-	-	-	+	-	-
T-368	-	+	-	-	-	+	-	-
T-369	-	+	-	-	-	+	-	-
T-370	-	+	-	-	-	+	-	-
T-371	-	+	-	-	-	+	-	-
T-372	-	+	-	-	-	+	-	-
T-373	-	+	-	-	-	+	-	-

Table 14. (cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-374	-	+	-	-	-	+	-	-
T-375	-	+	-	-	-	+	-	-
T-376	-	+	-	-	-	+	-	-
T-377	-	+	-	-	-	+	-	-
T-378	-	+	-	-	-	+	-	-
T-380	-	+	-	-	-	+	-	-
T-381	-	+	-	-	-	+	-	-
T-382	-	+	-	-	-	+	-	-
T-383	-	+	-	-	-	+	-	-
T-384	-	+	-	-	-	+	-	-
T-385	-	+	-	-	-	+	-	-
T-387	-	+	-	-	-	+	-	-
Subtotal: 158	0	158	0	0	0	158	0	0
Total: 298	119	179	45	73	119	179	45	28

The cumulative results of this table are presented in Figure 4.15, which maps those sites deemed as most significant based upon the above assessment.



Prepared By: BELT COLLINS & ASSOCIATES
Honolulu, Hawaii August 1987

Figure 4.15

SIGNIFICANT ARCHAEOLOGICAL FEATURES

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

2. SOCIO-ECONOMIC ASSESSMENT

2.1 INTRODUCTION

2.1.1 Background and Purpose

Palace Development Corporation and Hawaii Ka`u Aina Partnership are seeking government land use approvals for a resort community -- to be called "The Hawaiian Riviera Resort" -- in the western part of the Ka`u Judicial District on the Island of Hawaii.

This section was prepared by Community Resources, Inc. as part of the overall Environmental Impact Statement (EIS) effort required for the requested land use approvals.

2.1.2 Project Description

A complete description of the proposed project is presented in Chapter II of this document and is summarized in Chapter I.

2.1.3 Definition of Study Area

For purposes of this socio-economic assessment, the entire "study area" will consist of the judicial districts of Ka`u and South Kona (Figure 4.16).

However, it is expected that the primary impacts within South Kona would be felt only in the sparsely-populated lower (southern) part of the district -- i.e., the Miloli`i and Honomalino areas (Enumeration District 332). The upper parts of South Kona are likely to be a source of some labor supply for the resort, but little other social impact is expected to occur there.

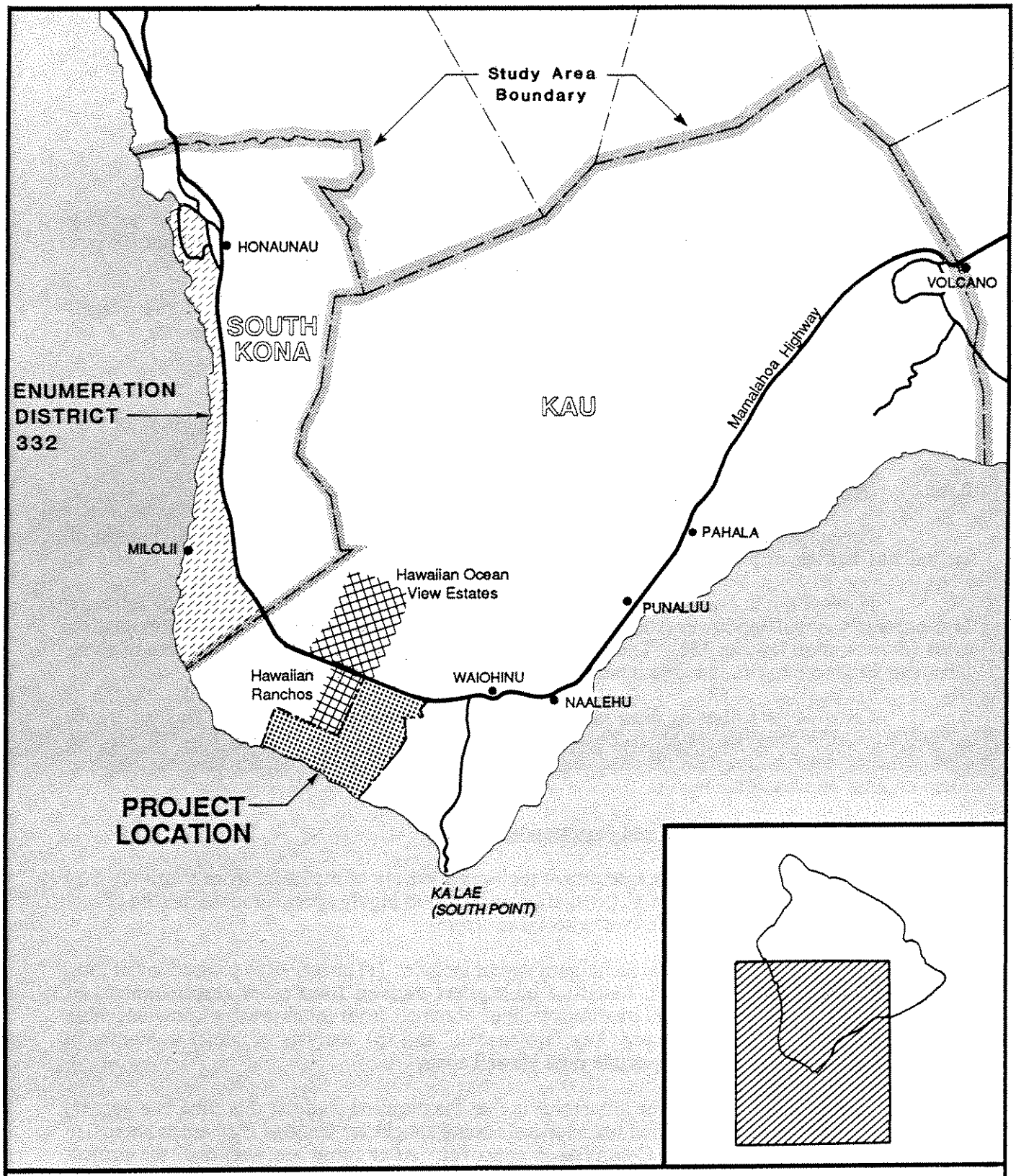
Some of the following discussion will effectively focus on Ka`u alone. This is because of (1) the low population in the Miloli`i/Honomalino area compared to that of Ka`u; and (2) the fact that Miloli`i, which is a unique area, is the focus of its own particular subsection in the socio-cultural portion of the report.

2.14 Comments on Methods and Assumptions

Socio-economic impact assessment requires a variety of methods, from relatively firm forecasts of quantifiable impacts (e.g., population and jobs) to highly speculative discussion of less tangible potential impacts (e.g., lifestyle or social structure).

Principal methodological techniques would include: (1) quantitative projections of jobs, population, and housing impacts, based on multipliers derived from other resort impacts or standard economic references; (2) qualitative input obtained from interviewing knowledgeable community and government agency "key informants;" and (3) analysis of social outcomes of similar resort development in comparable rural Hawaii areas.

A crucial assumption for this report is that the required study at this time is a general impact assessment. The present land use approvals being sought are General Plan amendments, to be followed by State Land Use Commission approval. After these are obtained, the project developers will begin planning actual project increments at a much more detailed level than has yet been done. Each project phase would then require specific zoning and Shoreline Management Area approvals, many of which would trigger subsequent EIS requirements.



8 6 4 2 0 8

SCALE IN MILES

NORTH

Figure 4.16

SOCIOECONOMIC STUDY AREA

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

Thus, the current assessment is broad in nature, since subsequent and more specific assessments will be required as more detailed project planning is undertaken.

For many types of socio-economic impacts, managing outcomes may be more important (and sometimes easier to address) than predicting them with total accuracy. This is particularly true in the present case, given the necessary level of generality. Part of the focus of this study will be on suggesting ways that areas of concern may be more carefully assessed and managed during the time between General Plan and specific zoning approvals.

On a more technical level, a variety of assumptions are required for assessing project impacts -- particularly in light of the County of Hawaii's request for a cumulative assessment (i.e., including other likely changes) and for utilization of some standard impact methodology developed by County consultants. These assumptions are discussed in detail at the end of Section 2.3 and throughout Section 2.4.

2.1.5 Scope and Structure of Report

The concept of "social impact" is a broad one, and certain topics may be judged by some people but not by others to fall within this category. The scope of this report excludes several topics which are, however, being addressed for the EIS by other consultants. These are:

- o traffic; and
- o archaeological and historical sites (although the topic of community issues relating to archaeological sites is incorporated in this report).

The remainder of this report is organized into five broad sections:

(1) Section 2.2 addresses existing socio-economic conditions, ranging from a Census-based description of the existing population to a presentation of current community issues and concerns relevant to the project.

(2) Section 2.3 discusses forces for change without the project (e.g., outlook for sugar and other resort development), along with the scenario for cumulative impact assessment.

(3) Section 2.4 presents quantifiable socio- economic impacts (jobs, population, and housing) and accompanying qualitative considerations.

(4) Section 2.5 discusses more qualitative socio-cultural impacts, including resident issues and concerns gleaned from key informant interviews; recreational impacts; contemporary significance of archaeological sites; and evidence about other social impacts (crime, family disruptions, etc.) from past Hawaii resort development.

(5) Section 2.6 will present potential mitigation and management strategies for important impact areas identified in Sections 2.4 and 2.5.

2.2.0 Existing Socio-Economic Conditions

2.2.1 Hawaii County Overview

2.2.1.1 Socio-Economic Characteristics

The Island of Hawaii contains over 4,000 square miles of land area, more than 62 percent of the State's total area. According to U.S. Census data (see tables in Section 2.4), the resident population was 92,691 in 1980. The estimated population in 1985 was 109,159, an 18 percent increase in five years (Hawaii State Department of Planning and Economic Development, 1986). Some significant trends which occurred on the island between 1970 and 1980 include:

- The County's ethnic composition changed significantly. The number of Hawaiians and part-Hawaiians as a percentage of the total population rose from 12 to 19 percent, while the percentage of Caucasians increased from 29 to 35 percent. Representation of Japanese declined from 38 to 27 percent.

- Education levels increased as the percentage of adults with four years or more of college doubled.

- The civilian labor force increased by more than 15,000 people, a growth of 58 percent.

- The resident housing stock increased by 79 percent, with an additional 15,000 year-round housing units added. Homeownership grew substantially and the proportion of substandard units declined.

2.2.1.2 Economic Trends

During most of the island's history, agriculture has been the dominant economic force. However, during the past few decades, tourism has quickly become the major factor in the economy. Total visitor expenditures reached $285 million in 1985, an increase of 60 percent just since 1981.

The production of sugar remains a significant contributor to the island's economy, even though the closing of Puna Sugar Company in September 1984 brought about an 18 percent decrease in production during 1985. The three remaining sugar producers are hoping for better price support to maintain operations and are exploring alternative activities for their lands, including macadamia nut cultivation, cattle feedlot operations, and use of sugar for other products (Jokiel, 1986).

Various diversified agricultural activities have experienced continuous growth and show great promise for the future. An overall production value of $79.1 million in 1985 constituted a 16 percent increase over 1984. About $22 million is represented by the livestock industry. The county's economy is also expected to be boosted by future expenditures in high technology. Additional observatories are under construction on Mauna Kea, and commercialized aquaculture is growing under the sponsorship of the Hawaii Natural Energy Laboratory. High technology activities will be supported by the new Hawaii Ocean Science Technology (HOST) Park in Kona. Harnessing of natural energy, from sources such as geothermal and ocean thermal conversion, could also contribute to expansion of the economy.

2.2.2 History of Study Area

Ka`u is generally acknowledged to be the first place of settlement in Hawaii, inhabited at least one thousand years ago (Kuykendall, 1966). Landfall of the first voyagers has been fixed at the South Point (Ka Lae) area, and the coastal lands near Ka Lae bear rich evidence of continuous fishing and other activity.

Captain Cook sailed along the Ka`u coast in late 1778 and early 1779, searching on Hawaii's lee side for a protected anchorage. While he was unable to find a suitable site, contacts with the native Hawaiians indicated that Ka`u supported a substantial population. A member of Cook's expedition estimated that nine percent of an island population of 150,000 resided in Ka`u, constituting about 13,500. Subsequent historians have revised the Ka`u estimate to about 10,000 in the pre-contact period (Kelly, 1969).

The Hawaiians of Ka`u lived in a subsistence economy which relied on fishing and agricultural pursuits. Early foreign observers pointed to the barrenness of coastal areas, many of which had been desolated by successive lava flows from Mauna Loa. However, above the cliffs, verdant rolling fields supported numerous farms (Kelly, 1969) and the offshore waters were considered especially abundant for fishing (Handy, 1972).

The district's relative isolation was enforced by a lack of safe landing points and by the great distance and difficulty of overland travel from Hilo and Kona. Thus, Ka`u was not greatly influenced by the presence of foreigners from the time of contact until well into the 19th century. The first missionary to the district did not settle there until 1841. Social and political changes after 1778 (such as radical shifts in class relations, consolidation of political power, changes in work patterns wrought by growth of a cash economy, and epidemics) affected Ka`u as it did the entire kingdom. Depopulation took place in Ka`u, as it did elsewhere; the 1833 missionary census estimated a native population of 5,000 to 6,000; this continued to decline to 2,210 in the census of 1853 (Ka`u Sugar Company, 1972; Kelly, 1969).

The 1860's set an economic pattern for Ka`u for the next century. While few non-Hawaiians had lived in the district before 1860, many were attracted by the trade in pulu, a brown silky fiber from the Hawaiian tree fern used for stuffing mattresses and pillows. The first foreigners cultivating sugar were observed in 1865 or 1866 (Handy, 1972). The first commercial sugar grower was established in 1868, the same year that Alexander Hutchinson founded the Na`alehu Sugar Company. Foreign labor was imported to the plantations in 1872, with the arrival of 22 Chinese workers.

Sugar growing in Ka`u expanded with the general Hawaiian sugar industry. The Hawaiian Agricultural Company was organized in 1876, and came to be controlled by its factor, C. Brewer and Company. The Hutchinson Sugar Company was established in 1884 and, through a series of mergers, by 1889 came to operate mills at Na`alehu, Honuapo, and Hilea. Ultimately, these companies merged to form Ka`u Sugar, now a division of C. Brewer's Ka`u Agribusiness Company, in 1972.

The growth of the sugar industry in Ka`u contributed to significant demographic changes in the district. Importation of Chinese labor was followed by reliance on workers from Portugal, Japan and, later, from the Phillipines. The district's population grew from 1,865 in 1872 to 3,483 in 1884; however, the Hawaiian population actually declined slightly, from 1,829 to 1,543. The later census identified 568 Chinese and 933 Portuguese, almost all affiliated with the plantations (Handy, 1972).

2.2.4.1 Population

Table 15 identifies a 1980 Ka`u population of 3,699, which represented an increase of just 8.9 percent from 1970. Population growth in this district was well below the islandwide increase of 45 percent, or South Kona's increase of 48 percent (from 4,004 in 1970 to 5,914).

While Ka`u's growth has been less than average for the Big Island, more recent data suggests that the slow growth pattern may have been reversed. State population estimates (Hawaii State Department of Planning and Economic Development, 1986) show a 1985 Ka`u population of 4,543 -- an increase of 22.8 percent since 1980. If these provisional estimates prove accurate, Ka`u is growing faster than both the island average of 18.6 percent and South Kona's estimated increase of 17.3 percent over the same period (from 5,914 to 6,937).

The principal ethnic groups of Ka`u are -- in order as of 1980 -- Filipino, Caucasian, Hawaiian or part-Hawaiian, and Japanese. The proportions of Filipinos and (particularly) Japanese declined between 1970 and 1980, while the percentage of Hawaiians and part-Hawaiians increased from 13.3 percent to 20.5 percent. The same general trends can be observed in South Kona for this time period, although there was a greater increase in the relative proportion of Caucasians. South Kona is now predominantly Caucasian or Hawaiian.

A smaller percentage of Ka`u residents was born in Hawaii than was the case for the South Kona district or for the Big Island as a whole, and considerably higher proportions were born in foreign countries (predominantly the Philippines). The Ka`u district population has been less mobile than average for the Big Island. Sixty-three percent of the residents had lived in the same house for the previous five years, compared to nearly 53 percent among all Hawaii County residents.

In both Ka`u and South Kona, average educational levels tend to equal or exceed islandwide levels.

2.2.4.2 Labor Force

In 1980, labor force participation was substantially lower for the Ka`u population aged 16 years and older, than for Hawaii County as a whole (see Table 16). While South Kona had higher-than-average participation, almost half of the Ka`u working age population -- 45.9 percent -- was not in the labor force in 1980. Other census data indicate the primary reason for Ka`u's low labor force participation rate involves lower than average participation by females, particularly women with younger children.

South Kona workers' 1980 occupational and industry profiles were roughly comparable to those for the county as a whole, although with something more of a blue-collar emphasis. However, Ka`u's involvement with the plantation agriculture economy was underscored by the heavy involvement of residents in either the agricultural or manufacturing (e.g., sugar processing) industry sectors -- more than 50 percent of the total workforce.

2.2.4.3 Family and Income Characteristics

Table 17 shows that more than 90 percent of the population of the Ka`u district lived in family households as of 1980. Typical family living arrangements (i.e., those with both husband and wife present) were only slightly less common in South Kona. The incidence of female-headed households was significantly lower for both the Ka`u and South Kona districts than for all of Hawaii County.

Table 15
Total Population and Demographic Breakdowns: County of Hawaii and Various Parts of Study Area, 1970 and 1980

	COUNTY OF HAWAII		KA'U (C.T. 212)		SOUTH KONA (C.T. 213-214)		ENUM. DIST. 332 (Includes Miloli'i)		PAHALA CDP		NA'ALEHU CDP	
	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
TOTAL POPULATION	63,468	92,053	3,398	3,699	4,004	5,914	N/A	1,181	1,607	1,619	1,014	1,168
	%	%	%	%	%	%	%	%	%	%	%	%
ETHNICITY												
Caucasian	28.8	35.0	24.7	27.0	17.7	30.0	N/A	37.7	18.6	20.2	17.7	12.3
Japanese	37.5	26.6	25.9	18.3	39.6	27.5	N/A	5.3	30.4	22.6	28.4	19.9
Chinese	2.9	1.7	2.5	1.4	0.8	0.8	N/A	0.2	1.5	1.5	2.4	1.5
Filipino	16.5	13.9	32.3	28.3	26.2	13.0	N/A	7.8	38.8	36.6	36.4	35.4
Hawaiian/part-Haw'n	12.3	18.8	13.3	20.5	14.7	23.5	N/A	46.6	9.4	15.5	13.8	26.8
Other	2.0	4.1	1.2	4.5	1.0	5.2	N/A	2.3	1.3	3.6	1.2	4.1
AGE												
Less than 5 yr.	8.6	9.1	9.2	9.9	9.0	9.8	N/A	19.5	8.5	9.4	10.0	10.8
5 - 17 yr.	27.8	21.5	30.7	23.7	29.8	20.7	N/A	33.8	30.0	25.0	32.2	26.9
18 - 64 yr.	54.4	59.2	51.7	54.7	48.9	58.8	N/A	32.0	53.3	52.3	49.9	52.9
65 or more yr.	9.2	10.2	8.4	11.7	12.4	10.6	N/A	14.7	8.2	13.3	7.9	9.4
Median age	28.9 yr	29.4 yr	27.5 yr	29.8 yr	29.7 yr	29.7 yr	N/A	27.8 yr	29.0 yr	29.9 yr	26.0 yr	27.3 yr
PLACE OF BIRTH*												
Hawaii	NC	70.5	NC	61.8	NC	71.2	N/A	70.7	N/A	67.5	N/A	65.5
Other U.S.**	NC	20.0	NC	16.1	NC	20.8	N/A	25.0	N/A	7.7	N/A	4.3
Foreign country	NC	9.4	NC	22.1	NC	7.8	N/A	4.3	N/A	24.8	N/A	30.2
RESIDENCE 5 YRS. PREVIOUS (people aged 5+)												
Same house	62.5	52.9	63.9	63.0	56.1	57.4	N/A	56.3	N/A	65.0	N/A	74.3
Same island	NC	24.9	NC	14.6	NC	22.9	N/A	37.8	N/A	15.5	N/A	19.3
Different island	NC	8.1	NC	4.6	NC	6.5	N/A	5.9	N/A	4.9	N/A	0.0
Different state	NC	11.1	NC	10.4	NC	10.7	N/A	0.0	N/A	6.0	N/A	0.0
Different country	NC	3.1	NC	7.4	NC	1.2	N/A	0.0	N/A	8.5	N/A	6.3
EDUCATION* (people aged 25+)												
Less than H.S.	53.2	43.8	54.1	32.7	48.0	23.6	N/A	33.6	N/A	37.3	N/A	45.2
H.S. graduate	31.6	27.6	20.8	38.7	24.1	46.2	N/A	39.1	N/A	38.8	N/A	36.1
Some post H.S.	7.6	14.3	17.8	14.3	21.5	17.8	N/A	21.6	N/A	13.2	N/A	10.4
College, 4+ yr.	7.5	14.3	7.3	14.3	6.3	12.4	N/A	5.7	N/A	10.7	N/A	8.3

Notes: *Figures based on 15% sample; hence, numbers represent estimate.
**Including persons born in U.S. territories, and persons born abroad or at sea to American parent/s.

"NC" = 1970 categories or bases "Not Comparable" to 1980 (1970 Census kept a "non-response" category, while 1980 Census allocated non-responses to other categories shown).
"N/A" = "Not Available" in published form.

Sources: U.S. Bureau of the Census, 1970 Census of Population and Housing--Census Tracts--Honolulu, Hawaii, PHC(1)-88; 1980 Summary Tape Files 1-A and 3-A; State of Hawaii, 1973, Community Profiles for Hawaii.

Table 16

Labor Force Size and Characteristics: County of Hawaii and Various Parts of Study Area,, 1970 and 1980

	COUNTY OF HAWAII		KA'U (C.T. 212)		SOUTH KONA (C.T. 213-214)		ENUM. DIST. 332 (Includes Miloli'i)		PAHALA CDP		NA'ALEHU CDP	
	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
POTENTIAL LABOR FORCE (aged 16+)	43,075	67,205	2,210	2,646	2,629	4,265	N/A	534	N/A	1,181	N/A	722
not in labor force	39.5%	38.7%	45.6%	45.9%	41.6%	33.8%	N/A	39.3%	N/A	44.6%	N/A	44.5%
armed forces	0.4%	0.3%	2.8%	1.5%	0.0%	0.0%	N/A	0.0%	N/A	0.0%	N/A	0.0%
civil. labor force	60.1%	61.0%	51.6%	52.6%	58.4%	66.2%	N/A	60.7%	N/A	55.4%	N/A	55.4%
CIVILIAN LABOR FORCE	25,889	41,006	1,140	1,391	1,535	2,823	N/A	324	N/A	654	N/A	401
unemployed	2.7%	7.0%	2.1%	10.8%	2.3%	5.7%	N/A	3.1%	N/A	9.9%	N/A	14.5%
TOTAL EMPLOYED CIVIL. LABOR FORCE	**25,180**	**38,150**	**1,116**	**1,240**	**1,500**	**2,682**	**N/A**	**314**	**N/A**	**589**	**N/A**	**343**
OCCUPATION												
service	16.3%	16.5%	12.5%	14.7%	16.0%	17.3%	N/A	10.2%	N/A	12.1%	N/A	11.7%
manager./profes.	NC	20.0%	NC	17.4%	NC	13.6%	N/A	6.7%	N/A	13.2%	N/A	16.6%
technical, sales & adminis.	NC	26.1%	NC	11.3%	NC	24.8%	N/A	24.8%	NC	12.7%	NC	6.7%
farm/fish/forest	NC	10.3%	NC	30.2%	NC	19.5%	N/A	22.6%	NC	31.2%	NC	38.2%
precision, cra/t, repair	NC	12.7%	NC	10.0%	NC	14.8%	N/A	22.0%	NC	13.1%	NC	7.3%
operators, fabri-cators, laborers	NC	14.4%	NC	16.4%	NC	10.0%	N/A	13.7%	NC	17.7%	NC	19.5%
INDUSTRY (selected)												
agric., forest, fish, mining	12.5%	11.2%	NC	32.6%	N/A	19.4%	N/A	23.2%	N/A	32.1%	N/A	46.1%
construction	10.6%	9.1%	36.3%	6.4%	20.4%	14.3%	N/A	15.0%	N/A	1.0%	N/A	1.5%
manufacturing	15.0%	8.3%	2.8%	18.8%	3.2%	1.2%	N/A	2.2%	N/A	30.4%	N/A	13.1%
retail trade	14.8%	17.5%	6.8%	9.8%	8.9%	18.4%	N/A	8.6%	N/A	5.1%	N/A	11.7%
financial, insur., real estate	2.8%	5.7%	1.0%	2.0%	3.5%	4.5%	N/A	13.1%	N/A	0.5%	N/A	0.0%
personal, entertain. & recreat. services	11.2%	10.9%	N/A	7.5%	N/A	15.2%	N/A	11.8%	N/A	6.0%	N/A	7.0%
health, educ, & professional	14.1%	16.7%	12.1%	15.1%	18.3%	13.1%	N/A	7.0%	N/A	18.0%	N/A	12.5%
public adminis.	6.5%	7.3%	4.6%	5.0%	3.7%	4.8%	N/A	5.1%	N/A	4.4%	N/A	0.0%
COMMUTE TO WORK												
45 minutes or more	N/A	6.0%	N/A	6.1%	N/A	6.1%	N/A	13.7%	N/A	2.7%	N/A	7.9%
mean travel (min.)	N/A	16.5 m	N/A	12.4 m	N/A	20.6 m	N/A	19.4 m	N/A	9.1 m	N/A	16.1 m

Notes: All figures based on 15% sample; hence, numbers represent estimates.
"N/A" = "Not Available" in published form. "NC" = 1970 categories or bases "Not Comparable" to 1980 Census.

Sources: U.S. Bureau of the Census, 1970 Census of Population and Housing--Census Tracts--Honolulu, Hawaii, PHC(1)-88; 1980 Summary Tape File 3-A; State of Hawaii, 1973, Community Profiles for Hawaii.

Table 17
Family Characteristics and Income Levels: County of Hawaii and Various Parts of Study Area, 1970 and 1980

	COUNTY OF HAWAII		KA'U		SOUTH KONA		ENUM. DIST. 332		PAHALA CDP		NA'ALEHU CDP	
	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
POPULATION IN FAMILIES	N/A	81,728	N/A	3,373	N/A	5,148	N/A	679	N/A	1,510	N/A	1,100
as percentage of total population	N/A	88.8%	N/A	91.2%	N/A	87.0%	N/A	81.6%	N/A	93.3%	N/A	94.2%
NUMBER OF FAMILIES	14,533	22,825	720	865	848	1,378	N/A	190	330	393	211	270
	%	%	%	%	%	%	%	%	%	%	%	%
HEAD												
Husband/wife	87.1	82.1	89.4	87.4	88.3	83.4	N/A	69.5	89.4	88.8	87.7	82.2
Male only	5.2	5.2	6.1	4.8	4.4	6.1	N/A	9.5	7.3	3.1	5.7	4.8
Female only	7.7	12.7	4.4	7.7	7.3	10.5	N/A	21.0	3.3	8.1	6.6	3.0
WITH OWN CHILDREN UNDER 18	54.4	52.7	62.5	51.3	58.3	51.5	N/A	50.0	N/A	57.2	N/A	49.3
Female head	7.7	7.4	2.6	3.9	3.4	5.4	N/A	13.7	N/A	4.3	N/A	6.3
BELOW POVERTY LEVEL	9.7	10.3	10.7	7.7	18.5	9.8	N/A	4.2	N/A	6.6	N/A	10.0
MEDIAN FAMILY INCOME	$9,750	$19,132	$8,500	$17,555	$10,000 to 11,999	$19,128	N/A	$15,870	N/A	$17,838	N/A	$17,778
NON-FAMILY HOUSEHOLDS	N/A	6,432	N/A	222	N/A	478	N/A	60	N/A	83	N/A	50
percentage below poverty level	N/A	27.8%	N/A	45.0%	N/A	27.2%	N/A	15.0%	N/A	46.0%	N/A	46.0%

Notes: All figures (except "Population in Families" and "Non-Family Households") based on 15% sample; hence, numbers represent estimates. "N/A" = "Not Available."

Sources: U.S. Bureau of the Census, 1970 Census of Population and Housing--Census Tracts--Honolulu, Hawaii, PHC(1)-88; 1980 Summary Tape File 3-A; State of Hawaii, 1973, Community Profiles for Hawaii.

Table 18

Housing Stock and Characteristics: County of Hawaii and Various Parts of Study Area, 1970 and 1980

	COUNTY OF HAWAII		KA'U		SOUTH KONA		ENUM. DIST. 332		PAHALA CDP		NA'ALEHU CDP	
	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
TOTAL YEAR-ROUND HOUSING UNITS	18,972	33,854	984	1,362	1,139	2,052	N/A	330	437	511	272	339
vacant (total)	9.0%	13.9%	9.4%	18.6%	7.2%	9.7%	N/A	17.8%	4.8%	6.6%	5.9%	5.9%
vacant for sale	N/A	1.3%	N/A	1.2%	N/A	0.3%	N/A	0.0%	N/A	0.4%	N/A	0.0%
vacant for rent	N/A	5.6%	N/A	5.0%	N/A	2.1%	N/A	2.1%	N/A	1.8%	N/A	0.9%
held for occas'l use	N/A	2.5%	N/A	1.4%	N/A	3.6%	N/A	13.3%	N/A	0.8%	N/A	0.9%
other	N/A	4.5%	N/A	11.0%	N/A	3.6%	N/A	2.4%	N/A	3.7%	N/A	4.1%
TOTAL YEAR-ROUND OCCUPIED UNITS	17,260	29,237	900	1,108	1,059	1,853	N/A	271	416	477	256	319
TENURE												
owner-occupied	56.9%	60.6%	41.4%	66.8%	36.9%	52.7%	N/A	41.7%	44.2%	69.8%	34.4%	70.5%
renter-occupied	43.1%	39.4%	58.6%	33.2%	63.1%	47.3%	N/A	58.3%	55.8%	30.2%	65.6%	29.5%
SELECTED CONDITIONS												
lacking some or all plumbing	17.2%	8.1%	20.3%	12.3%	36.9%	34.5%	N/A	52.4%	20.8%	6.5%	7.7%	1.5%
1.51 or more persons/room	6.5%	5.0%	8.7%	8.0%	13.1%	10.1%	N/A	18.8%	6.3%	7.3%	11.7%	9.7%
PERSONS PER HOUSEHOLD	3.61	3.09	3.70	3.30	3.71	3.14	N/A	3.07	3.60	3.37	3.91	3.66
MEDIAN CASH RENT (renter-occupied)	$54	$223	$33	$95	$60 to $79	$151	N/A	$104	$31	$64	$36	$122
as % of median family income	6.6%	14.0%	0.4%	6.5%	7.8% to 7.9%	9.5%	N/A	7.8%	N/A	4.3%	N/A	8.2%
MEDIAN VALUE* (owner-occupied)	$24,800	$70,300	$15,200	$42,500	$35,000 to $49,999	$102,600	N/A	$97,800	$13,000	$43,000	$11,600	$34,500
MEDIAN MONTHLY MORTGAGE* (owner-occupied)**	N/A	$371	N/A	$204	N/A	$389	N/A	$347	N/A	$194	N/A	$222
as % of median family income	N/A	23.3%	N/A	13.9%	N/A	24.4%	N/A	26.2%	N/A	13.0%	N/A	15.0%

Notes: * For 1980, median values are for non-condominium housing units.
** Figures based on 15% sample; hence, numbers represent estimates.
"N/A" = "Not Available."

Sources: U.S. Bureau of the Census, 1970 Census of Population and Housing--Census Tracts--Honolulu, Hawaii, PHC(1)-88; 1980 Summary Tape Files 1-A and 3-A; State of Hawaii, 1973, Community Profiles for Hawaii.

The study area represents a fairly even distribution of incomes. While 1980 median incomes tended to be somewhat lower than for the entire county, the incidence of poverty-level incomes was also lower, suggesting a relatively narrow distribution of incomes. The median income of South Kona residents in 1980 ($19,128) matched the county median of $19,132, while the Ka`u district median was $17,555. However, a greater percentage of South Kona families were below the poverty line (9.8 percent) than in Ka`u (7.7 percent).

2.2.4.4 Housing

In both Ka`u and South Kona, housing inventory increased more rapidly from 1970 to 1980 than did population, due in part to construction of condominiums at Punalu`u and in part to decreasing household sizes. However, average household size as of 1980 was higher than the countywide average in both districts.

Owner-occupancy of housing units was considerably higher in 1980 for Ka`u (66.8 percent) than for either South Kona (52.7 percent) or the entire Big Island (60.6 percent). The Ka`u owner-occupancy rate of 1980 was much higher than it had been in 1970, reflecting plantation and union efforts to transfer ownership of what had previously been company-owned housing stock to plantation workers.

However, substandard housing conditions, as measured by crowding or lack of plumbing facilities, was also more common in both districts. Lack of plumbing facilities is particularly prevalent in the study area's housing stock, which may be more closely related to cost and availability of public utility services than to housing quality. While 8.1 percent of Hawaii County housing units lacked plumbing in 1980, 12.3 percent of Ka`u units and 34.5 percent of South Kona homes had no plumbing.

Study area housing had relatively lower rents and value of owner-occupied units than for the Big Island as a whole. Median cash rent for renter-occupied units was $223 for the island, $151 for South Kona and $95 for the district of Ka`u. Ka`u also had a lower value of owner-occupied homes (median value equaled $42,500) than the county average of $70,300; however, the South Kona median was much higher -- $102,600.

Study area residents tend to pay lower proportions of their income for rental housing than Hawaii County residents generally. The county average housing expenditure as a proportion of income was 14 percent, compared with 9.5 percent for South Kona and 6.5 percent for Ka`u. Other than in South Kona, study area home owners also tended to pay less housing expense than the county average of 23.3 percent. The Ka`u district average for owner expenses was 13.9 percent.

2.2.5 Settlement Patterns and Community Descriptions

2.2.5.1 Overview

Most of the Ka`u and South Kona population is located around small towns which have served as centers for the study area's agricultural industries. About three quarters of Ka`u's residents in 1980 lived around the communities of Pahala and Na`alehu, each of which developed as a sugar mill town. More than half of South Kona's 1980 population was located around the communities of Kealakekua and Captain Cook in the district's northernmost area.

According to Ka`u residents interviewed for this assessment (see Section 2.5 for a description of interview methodology), the South Point road represents a dividing line in terms of

the way that many residents view the Ka`u district. People living east of South Point tend to think of the district as primarily agricultural, and identify the towns east of South Point -- Pahala, Na`alehu, and Waiohinu -- as plantation towns. People living west of South Point consist of a relatively small number of individuals scattered through several subdivisions. Many of these West Ka`u subdivision residents orient as much or more to Kona for shopping and employment as to Ka`u.

The major shift in settlement patterns that has occurred since Statehood involves the development of numerous subdivisions in both districts, particularly in Ka`u. Growth of these tracts, referred to here as "the subdivisions," resulted from actions of a number of promoters who sought to market Big Island land to Honolulu and Mainland residents as a second home or retirement site. Subdivisions in the study area share a number of similarities. Most importantly, they lack basic public services and they have a relatively low number of parcels with existing residential units.

The subdivisions themselves represented a significant departure from study area settlement patterns when they were developed in the late 1950's and 1960's. While no firm population estimates are available since 1980, it has generally been observed that residential building in the subdivisions has accelerated somewhat in recent years, although build-out rates are still very low. Early settlers in the subdivisions included a significant proportion of relocatees from the Mainland United States, mainly in the retirement age categories. More recent building is assumed by local informants to include additional retirees, as well as families employed on the Big Island and drawn to the subdivisions by the availability of inexpensive building sites.

2.2.5.2 Pahala

Although the farthest from the Hawaiian Riviera project site, Pahala is the primary community in the study area in terms of size and economic activity. Pahala is still truly a plantation town, being the location for the district's only operating sugar mill and the administrative offices for the Ka`u Agribusiness Company. It is located off the main highway and has only a small commercial area. However, it is the site of several important district facilities, including Ka`u High School and the district hospital.

Pahala's population was relatively stable during the 1970's. Between 1970 and 1980, there was only a seven percent growth in the community, ending with a 1980 population of 1,619. Filipinos maintained a sizeable proportion (36.6 percent) of the town's ethnic makeup, and as observed elsewhere throughout the island, persons of Hawaiian or part-Hawaiian ancestry increased as a percentage of the overall total population.

Other community characteristics that can be observed from U.S. Census data are:

- Over 62 percent of the labor force worked in agricultural or manufacturing industries, showing the importance of the sugar industry to the community.

- It is a very family-oriented community, as indicated by the 1980 figures showing 93 percent of its population lived in family households and 57 percent of the families still had children under 18 living at home.

According to informants, Pahala's social activities revolve largely around family and, to a lesser degree, union activities. There are few service clubs or community organizations active there.

2.2.5.3 Na`alehu

Na`alehu is the southernmost community in the United States and the closest population center to the project site. Although no longer a "plantation town" since the 1972 closure of the Hutchison Sugar Co. mill, many residents still work for Ka`u Agribusiness, and there is a lingering sense of rivalry with the Pahala community.

Na`alehu is located on the highway, and its small retail operations are well-maintained. It is the site of Ka`u's police station and social service offices. Na'alehu has a community organization which sponsors an annual July 4th rodeo and, like neighboring Waihohinu, it has an abundance of churches considering the relatively small population.

Tables presented in Section 2.4 indicate that the population of the Na`alehu Census Designated Place (CDP) grew at a faster pace (a 15 percent increase) than did the Ka`u district as a whole from 1970 to 1980, but still much slower than the islandwide growth of 45 percent. During this timeframe, the ethnic makeup of the community's residents changed, with decreases in Japanese and Caucasians as a percentage of the total population, and a sharp increase in the number of Hawaiians or part-Hawaiians from 13.8 percent to 26.8 percent. Compared to Ka`u as a whole, Na`alehu is significantly more Filipino and Hawaiian, less Caucasian.

Additional characteristics of Na`alehu residents as observed from U.S. Census data are:

- Nearly a third of the town's residents were foreign-born, although recent stability is indicated by the fact that three-quarters of Na`alehu's 1980 population had been living in the same house five years earlier.

- The 1980 unemployment rate of 14.5 percent was double the islandwide rate and highest in the study area. Nearly half (45 percent) of adult residents had less than a high school education, the largest such percentage in the study area.

- Over 70 percent of the homes in the community were owner- occupied, up from 34 percent in 1970. However, median values were particularly low and average household size was high.

2.2.5.3 Waiohinu and Subdivisions Bordering Na`alehu

According to persons interviewed for this report, much of Ka`u's recent population growth has been occurring just west and south of Na`alehu, to some extent in the tiny community of Waiohinu (about a mile closer to the Hawaiian Riviera project site than Na`alehu), but even more in the surrounding subdivisions toward the South Point area.

Specific U.S. Census data are unavailable for the town of Waiohinu. However, it is felt to be a predominantly "kamaaina" area, with many of its small population of part-Hawaiian or Oriental ancestry. It is the site of a small hotel, a County baseyard, and a general store. Waiohinu was once a larger community and was the site of the district courthouse, but growth later shifted to Na`alehu.

Subdivisions located near Na`alehu include Discovery Harbor, Mark Twain Estates, and the Green Sands subdivision. It is estimated that these subdivisions now contain perhaps 100 homes and are continuing to build out at a slow but steady pace. A County-sponsored improvement

district was initiated in 1972 to install full subdivision improvements at Discovery Harbor, which is built around a private golf course.

2.2.5.5 West Ka`u Subdivisions Near Project Site

There are several subdivisions in the West Ka`u district near the project site. The two most prominent are:

- Hawaiian Ocean View Estates, located about 15 miles west of Na`alehu mauka of the highway near the project site. This project started in 1966, and consists of 11,500 one- acre lots. There are currently about 500 homes with post office boxes, although some residents feel that the actual number of homes is probably around 700 or 800. Hawaiian Ocean View Estates has many characteristics of a functioning community such as an active community association, a community center and newsletter, and several small local restaurants.

  The population of Ocean View is predominantly Caucasian, including many retired persons (a number of whom are reportedly retired military). In more recent years, some younger and/or longtime Hawaii residents have begun moving there, attracted by low purchase prices and the cool climate and wooded terrain. However, there are no water lines, and electrical service is limited to homes at the lower elevations.

- Hawaiian Ranchos, situated west of Na`alehu adjacent to the project site and makai of the Hawaii Belt Road. The Ranchos include 1,235 parcels, each about three acres in size; approximately 32 homes have been built.

  The small population of the Ranchos subdivision is also predominantly Caucasian, and it includes a number of professional families. The terrain is somewhat less wooded than in the Ocean View Estates.

  On the makai side of the highway by the roads leading into the subdivision is a small commericial area serving both major subdivisions and featuring a general store, a gas station, a hardware store, and a few other retail and service activities.

According to community informants, West Ka`u subdivision residents historically have had relatively little interaction with East Ka`u communities. However, this is changing in recent years as more West Ka`u residents have children attending school in Na`alehu and Pahala -- approximately 100 now being bussed.

2.2.5.6 Miloli`i and South Kona Coastal Region

Miloli`i village is known for being one of the last fishing villages in Hawaii. Although it is only five miles off of the Hawaii Belt Highway, it takes about 20 minutes to maneuver the winding, unpaved road down the mountain to the village site. The village is not serviced by electrical or county water lines.

Miloli`i village is located in the South Kona district. It is about 15 miles along the coastline north of the proposed project. Key informant interviews indicate the village has about 165 residents. The men of the village operate about 30 fishing boats and fish along the shore

between Miloli`i and South Point. A small number of women work at nearby macadamia nut plantations.

Miloli`i village is discussed individually because of its unique way of life, and the use of shoreline waters off of the project site by the village residents. The village is the largest and best known of several residential pockets that exist in the South Kona district coastal region which extends from the boundary between Ka`u and South Kona, north to Kealakekua Bay. Several of these -- including a large but sparsely-populated subdivision at the entrance to Miloli`i -- are essentially vacation-home areas.

Characteristics of residents in this portion of South Kona (referred to as Enumeration District 332 in census data tables in Section 2.4) include:

- The total population in 1980 was 1,181. Of this total, 46.6 percent were of Hawaiian or part-Hawaiian ethnicity and almost 38 percent were Caucasian;
- Over 37 percent of the residents had moved to the coastal area during the previous five years from somewhere else on the island;
- In 1980, a substantially greater number of homes were occupied only on an occasional basis, and owner-occupied units amounted to only 42 percent of all occupied homes;
- The median value of homes in the area was twice the amount of those in communities in the Ka`u district;
- However, among permanent residents, there are several indicators of social disruption. Median family income was lower than for the rest of the study area, and one of seven families were characterized by single female household heads with children under 18 at home.

2.2.6 Community Issues and Concerns

This section presents an overview of general issues and concerns found among residents of the study area (particularly Ka`u). Project-specific issues are considered separately in Section 2.5.1.

2.2.6.1 General Community Needs and Priorities

Past Studies: A small sample of 74 Ka`u residents was questioned about public issues in 1983, as part of an islandwide public opinion survey commissioned by the County of Hawaii (Hawaii Opinion, 1983). The overall pattern of these Ka`u responses, as compared to islandwide results, indicates deeply divided attitudes toward possible population growth.

Ka`u residents were more likely than other Big Islanders to say that "the best thing" about living in Ka`u was open space and lack of overpopulation. On the other hand, Ka`u respondents reported deep dissatisfaction with facilities and services likely to be improved only with population growth; these included medical services, schools, affordable housing, and shopping opportunities. Additionally, Ka`u residents were as likely as those elsewhere on the island to express concerns over lack of employment and related economic opportunities.

Local dissatisfaction with services and facilities has also been reported by public officials. Elected officials report that requests from Ka`u constituents most frequently concern emergency medical services, police and fire service, high school curriculum offerings, recreational facilities, water systems for subdivisions lacking water service, and highway improvements for roads to both Hilo and Kona (personal communications, Representative Andrew Levin, August 14, 1986, and Councilman James Dahlberg, August 15, 1986 -- cited in PBR Hawaii, 1987).

Present Study: As discussed in more detail in Section 5.1, more than 90 Big Island residents -- most of them living in Ka`u or the Miloli`i area -- were interviewed in May 1987 to determine concerns about the proposed Hawaiian Riviera Resort and to help assess socio-cultural impacts.

In the course of these interviews, residents frequently mentioned concerns and issues not directly related to the Hawaiian Riviera. Several of these related to recent controversies, as discussed below in Section 2.6.2. At the more general level:

- The delivery of public services was a concern throughout the study area because of the area's isolation and the distance between communities. Informants felt that police protection and emergency medical care are particularly problematic.

- Many people focused their attention on issues related to young people. The most important need for youth was usually felt to be jobs, followed by lack of organized recreational activities.

- For many, the trade-off between a long-valued rural environment and the beneficial aspects of both economic growth (i.e., jobs) and population growth (i.e., services) was a particular dilemma. Some expressed anguish and uncertainty over the difficult choices, but others were polarized into one camp or the other.

The majority of the particular people interviewed (listed in Section 2.5.1) note that it is not possible to say whether these were representative of all study area residents) tended to feel that orderly economic development was preferable to economic stagnation. Those who disagreed had an alternative vision of Ka`u's future, one which stresses continuation of the area's rural qualities and reliance on the land and sea for family subsistence.

Development proposals such as shown below tended to divide community residents and generate angry, sometimes personal accusations. On the other hand, issues related to community services and facilities tended to unite community members.

Also, a common theme among the remarks of both "pro-" and "anti-" development residents was a feeling of being left out of decision making, of not being consulted or taken into consideration by powerful political or economic forces in both Hilo or Honolulu.

In the residential areas closest to the Hawaiian Riviera project site -- Hawaiian Ocean View Estates and Hawaiian Ranchos subdivision -- issues and concerns are similar to those elsewhere in Ka`u, with the added dimensions of substandard privately-owned roads and an older population:

- In both communities, the privately-owned road system complicates police patrols, maintenance, and liability issues. The Hawaiian Ocean View

Estates Community Association (HOVECA) has sponsored a private volunteer community patrol system, while a separate non-profit association had to be established to address liability and maintenance.

- There is no public or private water system in the area, and all homes utilize catchment systems. The recent drought has been one of the worst in the memory of West Ka`u residents, and water has become an emotional as well as practical issue for subdivision residents.

- An emergency helipad provides some relief in case of medical emergencies, but some of the older people reportedly have moved away because of long distances from health care services.

- The cost of providing electricity to rural areas is another longstanding concern. HOVECA members are looking at ways to assist Hawaii Electric Company, Inc. to lower consumer rates in the area. Only 200 homes, mostly those below the 3,000-foot elevation, are serviced by electric lines.

- Marijuana growing -- and associated crime or sense of danger to hikers or nearby residents -- was considered a major problem in the upper portions of Hawaiian Ocean View in the past, although most informants felt that this has been brought under control by recent police initiatives.

2.2.6.2 Recent Controversies

Three major issues have generated significant community interest in Ka`u over the past several years: (1) use of Hawaiian Home Lands at Kama`oa-Puueo; (2) expansion of the Punalu`u Resort proposed by C. Brewer Properties; and (3) possible development of a space launch facility ("spaceport") near South Point.

Hawaiian Home Lands: Management of Hawaiian Home Lands at Kama`oa-Puueo has been a divisive issue for many in the native Hawaiian community. Several years ago, a U.S. Army Corps of Engineers proposal to improve the Kaualana Bay boat launch ramp generated legal opposition based on feelings that non-Hawaiians should not benefit from Hawaiian Homesteads resources. More recently, tensions over Department of Hawaiian Home Lands' (DHHL's) handling of the development led to a barricading of the road to South Point by a Hawaiian community group in 1986. Generally, there was fear that the Department would allow the land to be used for non-homesteading purposes. While this option was foreclosed by a management plan adopted in 1982, further dissatisfaction was expressed about the slowness of plan implementation. Disagreement about the project concept also emerged: the DHHL management plan proposed creation of small lots (two to ten acres), while some in the community felt that individual homesteads of 20-40 acres were needed to allow for subsistence farming.

Punalu`u Resort: Expansion of the Punalu`u Resort has also created serious controversy in the study area. Supporters have stressed that a bigger resort is needed to provide jobs and support diversification of Ka`u's economic base. Opponents have expressed strong concern about many of the possible or feared impacts of C. Brewer's plan -- particularly, reduced access to the shoreline at Punalu`u Beach Park (currently the district's only sandy beach park) and possible loss of historic sites and other land with cultural value to the community. Opposition has also been expressed by Ka`u residents who characterize themselves as "urban refugees"; to them, resort expansion would destroy the rural lifestyle and openness most valued to new residents.

Spaceport: The December 1986 announcement by C. Brewer that the the company would actively solicit backers for a space launch site at Kahilipali Point touched off a major controversy in Ka`u. Backers of the spaceport have emphasized the large number of jobs that could be created in Ka`u, as well as the technological advantages of launching private space vehicles from Hawaii. An opposition group, the Citizens' Action Group of Ka`u, had already been formed in response to spaceport initiatives in 1982, and it has actively lobbied against the C. Brewer proposal. Issues raised include possible chemical pollution from launches; the safety of populated areas such as Na`alehu in the event of launch failure; the possibility that land in populated areas would be condemned or development restricted in establishing a buffer zone; C. Brewer's credibility in making an offer to donate land for a launch facility; the social change that might accompany development of a major spaceport (depending on what is actually developed); and perceptions that jobs created would require advanced technological skills and would thus not benefit the less skilled Ka`u workforce.

2.3. Forces for Change Without the Project

2.3.1 Introduction and Overview

The Hawaiian Riviera project represents a potentially significant force for social and economic change in the study area. However, many other events are occurring or may take place in Ka`u and South Kona which could also have important effects.

The purpose of this section is to identify a number of these other social forces which may bring about change, independent of the Hawaiian Riviera project. In general, changes are categorized in terms of agriculture, natural resources, tourism and homesite development.

Principal forces influencing the study area's future are changes in basic economic activities and new residential development, as follows:

- Resident population will increase substantially, independent of economic growth.

- The study area's basic agricultural industries face an uncertain future, but there are grounds to assume there will be no shutdowns; however, it is also likely they will provide few new employment opportunities.

- Most government approvals already exist for increased tourism development at Punalu`u Resort, whether or not this resort obtains additional approvals now being requested. Therefore, it may be assumed that tourism employment will increase in the study area with or without the Hawaiian Riviera Resort.

Agriculture is the largest economic activity in the study area. Production and demand is expected to be strong for local commodities, but this will probably not lead to more jobs, because:

- o growth in macadamia nut and coffee cultivation is likely to result in more acreage with about the same number of workers; and
- o sugar`s future, both statewide and in the study area, is highly uncertain.

Meanwhile, social and economic forces affecting the Big Island as a whole will contribute to population growth in the study area. In particular, more people will be attracted by:

- o Department of Hawaiian Home Lands homesteading expansion at Kama`oa-Puueo;
- o continuing in-filling of already subdivided residential land by in-migrants; and
- o attractiveness of study area homesites to workers in West Hawaii's expanding tourism industry.

The visitor industry represents the largest single potential force for change which might provide a better balance between growth in population and availability of local employment.

2.3.2 Agriculture

2.3.2.1 Sugar

The sugar industry, both statewide and in the study area, faces a highly uncertain future; shutdown of the industry is within the realm of possibility. However, for the purposes of this study, it will be tentatively assumed that Ka`u Agribusiness' sugar operations will continue at much the same employment level as at present.

If sugar continues in Ka`u, it will be because:

- o Ka`u Sugar is a low-cost, medium-yield producer. Costs are lower because of a longer growing cycle requiring less labor and the fact that sugar crops here are largely not irrigated.
- o Harvests match well the capacity of the remaining Pahala mill.

C. Brewer managers expect the company to continue in business for the foreseeable future and, while labor force is expected to remain steady, the amount of acreage cultivated may increase slightly (personal communication, Peter Moynahan, Senior Vice President for Development, C. Brewer Properties, June 25, 1987).

C. Brewer is maintaining an ongoing evaluation of the future of sugar in Ka`u. Strategic alternatives include shifting more sugar land into macadamia nuts and other crops, as well as going out of the sugar business altogether.

Sugar growers' caution is mandated by a changing and uncertain world market for the crop. Hawaiian sugar, in the view of many observers, cannot be profitable without favorable levels of Federal price support. If the state's sugar industry becomes generally unprofitable for a period of

C. Brewer is also planning a diversified agriculture subdivision project at Seamountain Farms, mauka of the Punalu`u resort. Seamountain Farms would use from 2,500 - 5,000 acres, which are now mostly fallow or in pasture use. C. Brewer's development concept involves subdivision into lots of approximately 20 acres; buyers might farm the land independently or contract with Brewer for land management with crops such as macadamia nuts.

Because ownership would appeal to wealthier investors, C. Brewer anticipates that Seamountain Farms development would most naturally follow, rather than precede, expansion of Punalu`u Resort. Project impacts are probably well into the future, since Punalu`u Resort development would not reach the kind of mass necessary to support Seamountain Farms until at least 1995 (personal communication, Peter Moynahan, Senior Vice President for Development, C. Brewer Properties, June 25, 1987). No county subdivision approvals have been sought for this project.

Cyanotech, which operates a facility for growing "biofertilizer" (algae for feeding fish grown in controlled conditions), has considered building a new plant at Honuapo to complement its operations in Kona. However, site, project financing and government approvals are still indefinite.

2.3.3 Wind Energy

The Ka`u area has one of the best wind "regimes" --patterns of constant, moderate wind -- in Hawaii, one that can be tapped to produce electric power through windmills. Kama`oa Wind Energy Partners is developing a medium-sized wind farm in the South Point area. The current project's fifty wind machines will supply about 10 percent of the Big Island's electric power.

According to a company spokesperson, Kama`oa Wind Energy hopes to double the number of wind machines in operation, if land and financing can be firmed up (personal communication, Herbert M. Lee Jr., Kama`oa Wind Energy Partners, June 18, 1987). Wind energy development is almost entirely automated, once the wind machines are in place; thus, little operational employment is generated. However, as many as 100 new construction jobs (about half filled by Big Island residents) would be created if Kama`oa Wind Energy moves forward with its plans.

2.3.4 Space-Related Activities

The idea of locating a space vehicle launch site in the Ka'u area has been discussed for a number of years. While development of a "spaceport" would be a major force for change in the study area, it should not be thought of as likely or probable until thorough study and much consideration by governmental bodies is completed.

The form and size of a future spaceport remains somewhat indefinite. Space Services, Inc., a Houston-based private concern, proposed in 1982 to build a spaceport; its proposal identified future employment of about 92 jobs, two-thirds to be filled by local residents. In 1986, C. Brewer offered to provide a 500-acre site to a private company if the firm could get a space launch program started. C. Brewer has actively solicited aerospace firms to be potential operators, and reports that estimated jobs could amount to as many as 600 or 700 (personal communication, Peter Moynahan, Senior Vice President for Development, C. Brewer Properties, June 25, 1987).

The proposed spaceport has proven very controversial, and area residents have a number of safety and social concerns. So far, C. Brewer has found no takers for its land offer. A recent statewide feasibility study by the firm of Arthur D. Little & Associates indicated that South Point is the best location for a Pacific spaceport.

No government approvals are now in place for a Ka`u space launch facility; indeed, a proposed spaceport would require its own EIS. For this reason, the current EIS will not assume the future existence of a Ka`u spaceport. (see Chapter VIII for further discussion of this matter)

2.3.5 Tourism

Resort development represents the only foreseeable source of a substantial number of new jobs in the study area. In addition to the proposed Hawaiian Riviera Resort, C. Brewer proposes expansion of its existing Punalu`u Resort, located midway between Pahala and Na`alehu.

The Punalu`u Resort area encompasses 424 acres of land within the State Urban land use district, as well as nine acres of Conservation land. Approximately 73 acres is currently developable under County zoning for resort, residential, and commercial activities. C. Brewer is now seeking several changes to County land use designations, specifically:

- Amendment to the Hawaii County General Plan to change about 38 acres from Low Density to Medium Density, and about 25 acres from Low Density to Open Area.
- Zoning changes, primarily from agricultural and open categories to resort, residential, and commercial. These changes would increase developable land area by about 156 acres.

Major components of the expanded resort would include:

- The Punalu`u Village, consisting of 330 - 770 condominium units, and retail and dining operations.
- Development of two new hotels, (1) the 325-450 room Ninole Cove Hotel, and (2) the Punalu`u Black Sand Inn, consisting of 150 to 210 rooms.
- Additional residential development, including from 1,224 to 1,836 multi-family units and from 71 to 78 single- family homes.

Support facilities at the resort would include a Visitor Center, Lagoon Club, Punalu`u Village service center, an enlarged tennis center, and health spa, along with numerous commercial and recreational amenities.

Construction is expected to begin in the early 1990's, with completion planned for the year 2005. At project completion, on- site direct employment is projected to range from 1,357 to 2,048 jobs.

Punalu`u expansion is not definite at this point. The C. Brewer proposal has aroused concern and opposition among some study area residents, who feel that the project's impacts upon neighborhood facilities, historic sites, and shoreline access need to be better studied. The environmental impact statement for the project is being redone based on recent revisions to the land use plan, and C. Brewer intends to seek needed General Plan and zoning approvals in the future.

Due to the uncertainty of future governmental approvals, Punalu`u Resort impacts

considered in this study are limited to those likely if the resort builds out to its current zoned capacity. Current zoned capacity for the 73 acres in resort zoning would produce 876 hotel units, 66 single-family residential lots, and 466 additional condominium units (personal communication, Norman Hayashi, Hawaii County Planning Department, July 21, 1987). It should be noted that this may slightly overestimate future impacts of Punalu`u Resort expansion, since actual development there has been at lower densities than permitted. Estimates of Punalu`u expansion under current zoning are used in the cumulative impact assessment analysis of Section 2.4.

2.3.6 Population Growth Independent of Economic Growth

Increasing population is likely in the study area for the foreseeable future, and its extent is likely to represent a force for social change. Contributors to this change are:

- Acceleration of Department of Hawaiian Home Lands homesteading at Kama`oa-Puueo;
- In-filling of the study area's massive residential subdivisions with new settlers; and
- Increasing location of West Hawaii resort workers into the study area.

2.3.6.1 Hawaiian Home Lands Development

The Kama`oa-Puueo area east of South Point is owned by the state Department of Hawaiian Home Lands (DHHL), which plans to use the 11,000+ acres for agricultural lease by eligible homesteaders of Hawaiian blood. The DHHL has disposed of 12 leases for pasturing (averaging 25 acres per lease) and 22 agricultural leases for subsistence farming and residential use. The agricultural leases average two acres each.

Full development of the project depends on provision of basic infrastructure, including water. According to DHHL planners, the infrastructure improvements may be in place by 1992, although this will be based on statewide priorities (personal communication, Hardy Spoehr, Planning Coordinator Department of Hawaiian Home Lands, June 5, 1987).

Current plans for Kama`oa-Puueo call for:

- Ultimate creation of more than 100 agricultural homesteads, most of which will probably be resided on by the lessee. Fifty of these homesteads could be occupied when the initial infrastructure is put in.
- Full build out of 40 to 60 pasture leases, many of which will be lived on by lessees.
- Retention of about 8,000 acres for extensive pasture use in large, ranch-size operation.

The Kama`oa-Puueo management plan acknowledges that these lands are not likely to be highly productive for intensive agriculture (Phillips Brandt Reddick,1983). Thus, many of those homesteaders practicing subsistence farming can be expected to seek cash income from employment away from the homestead.

Based on 1980 population characteristics for native Hawaiians (Alu Like and Social Science Research Institute, 1984) project development by 1992 would have an impact on study area population and labor supply:

- The 75 leases would support a population of about 300; most will have resided outside of the study area before assuming their homestead leases. DHHL indicates that none of the first lessees awarded lots had resided in Ka`u (personal communication, Hardy Spoehr, Planning Coordinator, Department of Hawaiian Home Lands, June 5, 1987).

- Of the approximately 300 new residents, over 200 would be expected to be 16 years of age or older. In DHHL's estimate, only a few will be working full-time on the homestead; most will constitute a new labor force for study area jobs.

2.3.6.2 In-Filling of Existing Subdivisions

The major existing residential subdivisions in the study area contain more than 12,000 lots. These subdivisions have few lots improved with residences, and build-out rates are estimated at less than five percent. Yet, there are a number of reasons to expect continued in-filling of these areas, and to expect that the presence of new people will contribute to social change in the study area.

Growth in estimated study area population and observations of local realtors suggest that the pace of development in the subdivisions has increased in recent years.

Substantial economic forces on the Big Island indicate that in-filling at these subdivisions can be expected to increase, independent of economic activity in the study area itself. Trends at work include:

- Accelerating resort development in West Hawaii. Maximum growth of planned and proposed projects would produce 14,051 new hotel rooms, 19,344 resort condominium units and 2,554 new single-family resort homes, according to estimates prepared for the County of Hawaii (Decision Analysts Hawaii, 1986).

- The large number of already approved and planned West Hawaii projects. These resorts, with well-known schedules and strong likelihood of completion, would total 2,560 hotel rooms, 50 resort condominiums and 15 single-family resort homes between 1988 and 1993 (Belt Collins & Associates, Ritz-Carlton EIS, May 1987, Table IV-9).

- Large numbers of new resort jobs in West Hawaii. The projects identified by Belt Collins & Associates through 1993 would create 5,241 operational jobs in West Hawaii, and another 411 jobs elsewhere on the island. (Belt Collins & Associates, May 1987, Table IV-18).

Growth in West Hawaii could greatly influence and accelerate in-filling in study area subdivisions, because:

- o New subdivision residents are reported to include a number of former Kona residents who now commute up the coast to tourism-related jobs in West Hawaii (personal communication, Betty Perriera, Realtor, May 27, 1987).

- o Study area subdivisions represent an opportunity to acquire house lots at far lower prices than prevail in Kona.

- o Continued resort growth in West Hawaii can be expected to support higher land prices in Kona and pressure on availability of rental housing.

- o Unless public-private cooperation produces substantially more affordable homes in West Hawaii, workers there will have to commute greater distances from locations (as in the study area) where affordably priced housing is available.

2.4. SOCIO-ECONOMIC IMPACTS

2.4.1 Introductory Comments

Socio-economic consultants Community Resources, Inc. (CRI) prepared the following section focusing on project impacts related to employment, labor supply, population, housing, income, public costs vs. revenue, and public services. A subsequent section deals with less quantifiable socio-cultural impacts.

These introductory comments are intended to provide the reader with an understanding of the basic approach used throughout most of the following section.

2.4.1.1 Level of Precision in Estimating Impacts

The present EIS is prepared in conjunction with requests for initial land use policy approval at a very general level. Therefore, at this stage of project planning, socio-economic impact forecasts represent initial estimates. As the developers finalize plans and seek further required approvals to develop specific portions of the project, later and updated impact figures based on more refined project information will be prepared closer in time to each actual phase of development.

The methods for estimating impacts of the nature to be discussed here -- jobs, population, housing, etc. -- involve use of mathematical equations which tend to produce exact numbers. The tables in this section will show the detailed results of these calculations.

However, the reader is cautioned that numbers produced by these calculations are actually estimates and approximations, based on project assumptions which are subject to change in the future. To underscore this point, the text of this report will discuss numbers in general, rounded terms rather than in the specific figures shown in the tables.

2.4.1.2 Assumed Project Schedule

Table 19 reproduces current developer estimates of the years in which various resort

units and other project components will come on line. The table also incorporates some consultant assumptions as to absorption schedules for condominium units, residential units, and commercial space, since these assumptions are necessary to calculate employment and population impacts.

(NOTE: In addition to what is shown on Table 19, the proposed support community would contain an ultimate 800 residential units at eventual buildout. However, the exact timing and nature of these units has not yet been determined, since this would be largely dependent on the outcome of discussions with the County government. Therefore, these are not included in Table 19.)

It should be pointed out that the proposed schedule represents an ambitious timetable. At final buildout, the resort area would have some 3,900 units, of which 2,100 would be hotel rooms. The total number of visitor units will be 3,000. The developers currently intend to bring 1,500 of these 2,100 hotel units on line in the resort's first year of operations (now targeted for 1992), along with the marina, most recreational infrastructure, and substantial commercial space.

This level of front-end development -- considered essential to the project concept, particularly for the Hawaiian Palace marina-oriented portion -- will generate substantially greater initial socio-economic impacts, both positive and negative, than if development occurred over a more extended timeframe.

Following the initial concentrated development, the current tentative schedule suggests five-year periods between opening times for the remaining hotels. During these periods, development would be limited to condominium and residential unit development, which generates less impact. As discussed further in Section 2.4.4, this spacing of later hotels would allow development of new study area labor supply through natural population increase, thus reducing overall impacts.

2.4.1.3 Requested Assumptions Regarding Other Ka`u Development

The Hawaii County Planning Department has requested that the EIS socio-economic sections consider the cumulative impacts of the proposed Hawaiian Riviera Resort, in the context of other currently approved new job-creating developments in the area.

Because such proposals as the Ka`u space center or the South Kona Farms of Kapua project have received no approvals yet, the County requested that they be omitted from the cumulative impact assessment. The space center in particular is still a highly speculative conceptual proposal which is unlikely to proceed without a substantial impact assessment process of its own.Therefore, the only additional projects to be considered in the cumulative impact assessment are those involved in future expansion of the Punalu`u Resort. The County requested that Punalu`u Resort expansion impacts be estimated according to current zoning approvals alone, and not according to the yet- unapproved C. Brewer proposal to reconfigure and slightly expand the resort-designated area.

C. Brewer Properties and its planning consultants informed CRI that there are no current estimates of job, population, or housing impacts from development of the currently-zoned land. The company regards the current configuration as economically unfeasible for actual development.

Therefore, with assistance from the County Planning Department, CRI has generated its own assumptions regarding a development schedule (and subsequent socio-economic impacts) for the currently-zoned Punalu`u Resort lands. It is emphasized that these assumptions do not reflect stated Punalu`u Resort intentions, but are made to comply with the County request.

Table 19
Assumed Hawaiian Riviera Project Development Schedule

HAWAIIAN PALACE	1992	1994*	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	BUILD OUT
Luxury Hotel	275	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
De Luxe Hotel	625	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential Villas																		
-- no. built (1)	0	250	0	0	0	0	125	0	0	0	0	0	0	0	0	0	0	0
-- no. sold (1)	0	40	40	40	30	30	30	30	30	20	20	20	20	20	5	0	0	0
Townhouses																		
-- no. built	0	75	0	0	0	105	0	0	0	120	0	0	0	0	0	0	0	0
-- no. sold	0	20	20	20	15	25	20	20	20	20	20	20	20	20	20	20	0	0
Garden Apartments																		
-- no. built	0	0	150	0	0	0	0	0	0	150	0	0	0	0	0	0	0	0
-- no. sold	0	0	35	35	35	35	10	0	0	30	30	20	20	20	20	10	0	0
Equestrian Estates																		
-- no. lots (2)	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0
-- no. sold (2)	0	0	0	0	3	3	3	3	3	1	1	1	1	1	1	1	2	9
-- no. built (2)	0	0	0	0	1	1	1	1	1	2	1	1	1	1	1	1	1	20
Fairway Homes																		
-- no. lots	0	0	0	0	60	0	60	0	0	60	0	0	44	0	0	0	0	0
-- no. sold	0	0	0	0	14	14	10	11	11	10	11	11	11	11	11	12	12	75
-- no. built	0	0	0	0	5	5	4	5	5	8	8	8	6	6	8	8	8	141
Residential Lots																		
-- no. lots	0	0	0	0	0	0	0	0	0	0	0	0	95	0	0	0	0	0
-- no. sold	0	0	0	0	0	0	0	0	0	0	0	0	15	16	7	7	7	43
-- no. built	0	0	0	0	0	0	0	0	0	0	0	0	8	8	5	5	5	65
SUBTOTAL, RESORT UNITS BUILT:	**900**	**60**	**95**	**95**	**86**	**96**	**66**	**56**	**56**	**80**	**79**	**69**	**74**	**74**	**58**	**43**	**14**	**227**
Commercial (1,000 Square Feet) (3)	38	0	0	0	12	0	0	0	0	0	0	0	0	0	5	0	0	65

Marina, Golf Course #1, and all other recreational amenities to come on-line in 1992 -- with exception of Golf Course #2, which is not expected to be developed until after 2009.

(CONTINUED)

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* No new development in 1993.

(1) For condominium projects, "no. built" from developers' schedule; "no. sold" represents CRI interpolations of market absorption estimates from market analysts Peat Marwick Main & Co.

(2) For houselots, "no. lots" from developers' schedule; "no. sold" and "no. built" represent CRI interpolations of market absorption estimates from market analysts Peat Marwick Main & Co.

(3) Commercial square footage based on market absorption estimates from market analysts Peat Marwick Main & Co.

Table 19
Assumed Hawaiian Riviera Project Development Schedule
(Continued)

	1992	1994*	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	BUILD OUT
KA'U AINA																		
High-Activ. Hotel	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Retreat Hotel	0	0	0	0	200	0	0	0	0	0	0	0	0	0	0	0	0	0
First-Class Hotel	0	0	0	0	0	0	0	0	0	400	0	0	0	0	0	0	0	0
Multi-Family																		
--no. built (1)	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
--no. rented (1)	200	-25	-25	0	0	0	0	-25	-25	0	0	0	-25	-25	0	0	-50	0
--no. sold (1)	0	25	25	0	0	0	0	25	25	0	0	0	25	25	0	0	50	0
Residential Lots																		
-- no. lots (2)	0	100	0	0	0	0	0	100	0	0	0	0	100	0	0	0	0	0
-- no. sold (2)	0	10	10	10	15	15	15	15	15	20	20	20	20	20	25	25	25	20
-- no. built (2)	0	3	3	4	6	6	6	6	6	14	15	15	10	10	17	17	16	145
SUBTOTAL, RESORT UNITS BUILT:	**800**	**3**	**3**	**4**	**206**	**6**	**6**	**6**	**6**	**414**	**15**	**15**	**10**	**10**	**17**	**17**	**16**	**145**
Commercial (1,000 Square Feet) (3)	10	0	0	0	3	0	0	0	0	22	0	0	0	0	0	0	0	5

Airport, Petroglyph Park, Golf Course #1, and all other recreational amenities to come on-line in 1992 -- with exception of Golf Course #2, which is scheduled for 1997.

TOTAL HAWAIIAN RIVIERA																		
TOTAL, RESORT UNITS BUILT:	**1700**	**63**	**98**	**99**	**292**	**102**	**72**	**62**	**62**	**494**	**94**	**84**	**84**	**84**	**75**	**60**	**30**	**372**
TOTAL COMMERCIAL (1,000 sq. ft.)	48	0	0	0	15	0	0	0	0	22	0	0	0	0	0	0	0	75

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* No new development in 1993.

(1) For Multi-Family, "no. built" from developers' schedule; negative numbers for "no. rented" indicate market analysts' estimated dates for rehabilitation of units and conversion to resort condominium for sale purposes ("no. sold").

(2) For houselots, "no. lots" from developers' schedule; "no. sold" and "no. built" represent CRI interpolations of market absorption estimates from market analysts Peat Marwick Main & Co.

(3) Commercial square footage based on market absorption estimates from market analysts Peat Marwick Main & Co.

Table 20 shows this assumed schedule, reflecting maximum development of zoned lands according to a timetable which shows hotel development in the same years as initial Hawaiian Riviera hotel development (1992 and 1997).

2.4.1.4 Use of Standardized County/DAHI Impact Assessment Methods

The Hawaii County Planning Department recently contracted with Decision Analysts Hawaii, Inc. (1986) to recommend standardized methodological approaches for estimating socio-economic impacts from West Hawaii resort development. The Department has been requesting that the Decision Analysts Hawaii, Inc. (DAHI) approach be utilized for Big Island resort EIS's unless reasons for alternative approaches could be justified.

In the course of conducting socio-economic assessments for the recent EIS's on the proposed Ritz-Carlton Mauna Lani Hotel (Belt Collins & Associates, 1987) and South Kohala Resort (forthcoming), CRI created a number of micro-computer models incorporating much of the DAHI methodology. These models are explained in detail in a technical document (Community Resources, Inc., 1987) submitted to the County in conjunction with the Ritz- Carlton EIS.

For this project, CRI has somewhat altered its impact models to reflect characteristics of the Ka`u/South Kona study area. As in previous work, the CRI models depart from the DAHI methods somewhat in regard to population and housing impacts, as discussed further in Sections 2.4.5 and 2.4.6.

2.4.2 On-Site Population

On-site population includes both visitors and permanent residents of resort condominium and single-family units, as well as employee population at the support community. The reason for addressing on-site population separately from off-site population (i.e., any additional employees and their families) is that the DAHI method requested by the County begins by calculating both on-site population and numbers of permanent jobs from a set of common assumptions about use of resort units (for visitors vs. for residents), occupancy rates, and average party size.

These basic assumptions are presented in Table 21. The following Table 22 provides an example of the exact methods for calculating resort-area population (a procedure which also produces some information required for calculating total employment, which will be discussed in a later section). Finally, Table 23 contains projected on-site population for (1) the Hawaiian Palace portion of the project; (2) the Ka`u Aina portion; (3) total Hawaiian Riviera; (4) total Ka`u resorts (i.e., including Punalu`u); and (5) the Hawaiian Riviera on-site employee population.

Results for Hawaiian Riviera: Given expected occupancy levels, the average daily population at the Hawaiian Riviera Resort would be around 4,700 people (about a third of them resort residents and the rest visitors) when the project is completely built out. The resort's full capacity at that time would be 8,000 people, if 100 percent occupancy were ever achieved. These figures apply to the resort component of the project. In addition, the support community would house an estimated 1,500 to 2,500 area workers and family members (depending on the ultimate size and nature of these units) at buildout.

According to the current development schedule, the resort's average daily visitor census in the initial year of 1992 would be about 2,200 people, plus 570 workers living on-site at the resort in the multi-family rental units. (These units would gradually be converted to condominium status, as indicated in Table 19, so that the later-year "resort residential" figures in Table 23 pertain

exclusively to non-worker residents.) While the 1992 visitor population census would already be more than half the visitor census expected at total resourt buildout, the resort resident population would develop more slowly, gradually rising from 24 percent of the resort-area population in 1992 to about 31 percent at ultimate buildout.

Cumulative Results: For all Ka`u resorts (including the assumed Punalu`u expansion at current land use approvals only), the estimated total average on-site population -- excluding workers -- would be about 6,500 at buildout, of whom 4,700 would be visitors and 1,800 would be resort residents. (The total could theoretically rise to 11,000 if 100 percent occupancy were ever achieved.)

The currently assumed development schedules would result in nearly half the ultimate visitor population -- some 2,200 on an average day -- occupying resort hotels and condominium units in 1992, the first year of operations. (It should be noted that the assumption of another hotel being developed at Punalu`u in the year 1992, when Hawaiian Riviera is assumed to open, results in a particularly strong cumulative impact for that year.) The resort resident population would develop much more gradually.

2.4.3 Employment Impacts

Resort development generates both short-term jobs (during the construction phase) and permanent jobs (during the operational phase). In addition to on-site direct jobs, employment is also generated when resorts purchase goods or services from other businesses ("indirect" employment) and when employees spend their wages in the local economy or support government jobs through taxes ("induced" employment). Note that Hawaiian Riviera support community jobs would technically be mostly "induced" rather than "direct" jobs. Visitors also generate some "off-site direct" jobs when they spend money off the resort grounds (e.g., ground or air transportation, purchasing souvenirs at the Volcanoes National Park); for construction, "off-site direct" jobs might include contractors' administrative personnel in company headquarters.

The DAHI approach ignores some of these distinctions, focusing only on islandwide total employment. However, in order to estimate how much of the islandwide employment will be located in the Ka`u/South Kona study area, CRI retains some of the distinctions in employment categories for construction jobs.

2.4.3.1 Construction Employment

The assumptions and methodology used to calculate average construction employment are generally based on the County's requested DAHI methodology. Table 24 provides a detailed example for the Hawaiian Palace portion of construction activity in the year prior to assumed resort opening in 1992. (The same figures also apply to the previous year, since the most intense construction activity would be for a two-year period.)

Table 25 provides detailed results, by year through 2009, for each portion of the Hawaiian Riviera project (including support community infrastructure but, due to uncertainties about scheduling, excluding residential unit construction at the support community); for the total Hawaiian Riviera project; and for all Ka`u resorts. It should be noted that these figures are for

Table 20
Assumed Punalu'u Resort Project Development Schedule

	1992	1994*	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	BUILD OUT
Hotel Number 1	438	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hotel Number 2	0	0	0	0	438	0	0	0	0	0	0	0	0	0	0	0	0	0
Condominiums																		
--no. built (1)	116	0	0	0	116	0	0	0	0	117	0	0	0	0	117	0	0	0
--no. sold (1)	23	47	23	23	24	23	23	23	23	23	24	23	24	23	23	24	23	47
Residential Lots																		
--no. lots (2)	35	0	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0
--no. sold (2)	7	14	7	7	7	7	7	7	3	0	0	0	0	0	0	0	0	0
--no. built (2)	2	5	2	2	3	2	2	3	2	3	3	2	3	3	2	3	3	21
TOTAL, RESORT UNITS BUILT:	**463**	**52**	**25**	**25**	**465**	**25**	**25**	**26**	**25**	**26**	**27**	**25**	**27**	**26**	**25**	**27**	**26**	**68**
Commercial	24,155 (sq. ft.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: The above assumptions were developed by CRI in response to a County of Hawaii request that the Hawaiian Riviera Resort EIS socio-economic sections consider cumulative impacts of both the Hawaiian Riviera and Punalu'u Resort, assuming that Punalu'u Resort is developed only at the capacity allowed by current zoning.

These assumptions do not reflect the plans of Punalu'u Resort or its owner, C. Brewer Properties. C. Brewer does not currently have any development plan for the property under current zoning, which the company has said would not produce an economically feasible resort. The company is seeking land use approvals for a reconfigured, somewhat expanded resort. The above figures do not apply to the proposed expansion.

The above assumed total unit counts were calculated by the Hawaii County Planning Department, based on capacity of existing zoned land. Timing and market absorption assumptions are the sole responsibility of CRI, although some features of the assumed schedule are based on C. Brewer's previously proposed schedule for an expanded resort (PBR Hawaii, 1987).

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* No new development in 1993.

(1) For condominium projects, "no. built" reflects completion of construction, while "no. sold" indicates estimate of rate that units are sold and thus begin to generate population and employment impacts.

(2) For houselots, "no. lots" reflects completion of infrastructure and availability of lots for sale; "no. sold" indicates estimated market absorption; and "no. built" indicates rate at which structures are estimated to be constructed and ready for occupancy.

Table 21
Assumptions About Ka'u Resort Unit Use, Occupancy, Party Size, and Employment Multipliers

	HAWAIIAN PALACE						KA'U AINA					
	Luxury Hotel	DeLuxe Hotel	Villas	Garden Apts./ Town-houses	Eques-trian Estates	Fairway Homes/ Resid. Lots	High-Activ. Hotel	Retreat Hotel	First Class Hotel	Multi-Family as Rentals	Multi-Family as Condos	Resi-dential Lots
PERCENT OF UNITS IN VISITOR USE	**100.0%**	**100.0%**	**15.0%**	**50.0%**	**10.0%**	**20.0%**	**100.0%**	**100.0%**	**100.0%**	**0.0%**	**50.0%**	**25.0%**
Average Party Size	1.90	1.90	2.25	2.25	2.50	2.50	1.90	1.90	1.90	0.00	2.10	2.50
Occupancy Rate (1)												
-- 1992 to 1996	61.5%	61.5%	50.0%	25.0%	25.0%	25.0%	66.5%	0.0%	0.0%	0.0%	25.0%	25.0%
-- 1997 to 2001	72.0%	72.0%	⋮	⋮	⋮	⋮	68.0%	56.0%	0.0%	⋮	⋮	⋮
-- 2002 to 2006	⋮	⋮	⋮	⋮	⋮	⋮	72.0%	65.0%	50.0%	⋮	⋮	⋮
-- 2007 on	⋮	⋮	⋮	⋮	⋮	⋮	⋮	72.0%	72.0%	⋮	⋮	⋮
On-Site FTE Jobs/Unit (2)												
1992 to 1996	1.25	1.00	0.80	0.50	0.50	0.40	1.20	0.00	0.00	0.00	0.40	0.50
-- 1997 to 2001	1.50	1.15	⋮	⋮	⋮	⋮	1.25	1.25	⋮	⋮	⋮	⋮
-- 2002 to 2006	⋮	⋮	⋮	⋮	⋮	⋮	1.30	1.50	0.65	⋮	⋮	⋮
-- 2007 on	⋮	⋮	⋮	⋮	⋮	⋮	⋮	1.60	0.90	⋮	⋮	⋮
Overall Luxury Adjustment Factor (jobs/unit, applicable to luxury hotel units only)	0.47	0.41	N/A	N/A	N/A	N/A	0.35	0.47	N/A	N/A	N/A	N/A
PERCENT OF UNITS IN PART-TIME RESIDENT USE	**0.0%**	**0.0%**	**70.0%**	**35.0%**	**50.0%**	**40.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**25.0%**	**25.0%**
Average Party Size	0.00	0.00	2.00	2.00	2.50	2.50	0.00	0.00	0.00	0.00	2.00	2.50
Occupancy Rate	0.0%	0.0%	25.0%	25.0%	25.0%	25.0%	0.0%	0.0%	0.0%	0.0%	25.0%	25.0%
On-Site FTE Jobs/Unit	0	0	0.70	0.30	0.30	0.20	0	0	0	0	0.20	0.20
PERCENT OF UNITS IN FULL-TIME RESIDENT USE	**0.0%**	**0.0%**	**15.0%**	**15.0%**	**40.0%**	**40.0%**	**0.0%**	**0.0%**	**0.0%**	**100.0%**	**25.0%**	**50.0%**
Average Party Size	0.00	0.00	2.00	2.00	2.50	2.50	0.00	0.00	0.00	3.00	2.00	2.50
Occupancy Rate	0.0%	0.0%	95.0%	95.0%	95.0%	95.0%	0.0%	0.0%	0.0%	95.0%	95.0%	95.0%
On-Site FTE Jobs/Units	0	0	0.75	0.40	0.40	0.30	0	0	0	0.03	0.30	0.30

(CONTINUED)

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(1) Represents five-year average of varying annual resort-wide hotel occupancy rates estimated for each Hawaiian Riviera Resort client by market analysts Peat Marwick Main & Co.

(2) Assumed FTE (full-time equivalent) hotel staffing ratios vary to reflect varying occupancy levels. Typical high ratios for luxury hotels are somewhat lowered here due to separate job estimates for external recreational/commercial support.

Table 21
Assumptions About Ka'u Resort Unit Use, Occupancy, Party Size, and Employment Multipliers
(Continued)

	PUNALU'U RESORT			
	Hotel No. 1	Hotel No. 2	Condo-miniums	Resi-dential Lots
PERCENT OF UNITS IN VISITOR USE	100.0%	100.0%	55.0%	0.0%
Average Party Size	1.90	1.90%	2.10%	0.00
Occupancy Rate (3)				
-- 1992 to 1996	50.0%	0.0%	50.0%	0.0%
-- 1997 to 2001	62.5%	50.0%	¦	¦
-- 2002 to 2006	72.0%	62.5%	¦	¦
-- 2007 on	¦	72.0%	¦	¦
On-Site FTE Jobs/Unit (3)				
-- 1992 to 1996	0.70	0.00	0.50	0.00
-- 1997 to 2001	0.85	0.70	¦	¦
-- 2002 to 2006	1.00	0.85	¦	¦
-- 2007 on	¦	1.00	¦	¦
Overall Luxury Adjustment Factor (jobs/unit, applicable to luxury hotel units only)	0.00	0.00	0.00	0.00
PERCENT OF UNITS IN PART-TIME RESIDENT USE	0.0%	0.0%	30.0%	75.0%
Average Party Size	0.00	0.00	2.50	2.80
Occupancy Rate	0.0%	0.0%	25.0%	25.0%
On-Site FTE Jobs/Unit	0.00	0.00	0.30	0.20
PERCENT OF UNITS IN FULL-TIME RESIDENT USE	0.0%	0.0%	15.0%	25.0%
Average Party Size	0.00	0.00	2.50	2.80
Occupancy Rate	0.0%	0.0%	95.0%	95.0%
On-Site FTE Jobs/Units	0.00	0.00	0.40	0.30

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(3) Varying occupancy rates and FTE (full-time equivalent) staffing ratios selected to produce comparability with assumptions for Hawaiian Riviera hotels.

Table 22
Example of Procedures for Calculating On-Site Population

[Source:]	Units [A: calculated from assumptions in Table 4.3]	Party Size [B: from Table 4.3]	Total Capacity [C: equals A x B]	Average Occupancy [D: from Table 4.3]	Average Population [E: equals A x B x D]
DAILY VISITORS					
High-Activity Hotel Rooms	600	1.9	1140	68%	775
De Luxe Hotel Rooms	200	1.9	380	56%	213
Multi-Family Condominiums, Visitor Use	25	2.1	53	25%	13
Residential Lots Visitor Use	4	2.5	10	25%	3
Weighted Averages:		1.91*		62.8%*	
RESORT RESIDENTS					
Multi-Family Rentals Full-Time Use	150	3.0	450	95%	428
Multi-Family Condominiums, Part-Time Use	13	2.0	25	25%	25
Multi-Family Condominiums, Full-Time Use	13	2.0	25	95%	25
Residential Lots, Part-Time Use	4	2.5	10	25%	10
Residential Lots, Full-Time Use	8	2.5	20	95%	20
TOTAL VISITORS AND RESIDENTS			1483		2113
Adjusted Islandwide Employment Multiplier	1.75 x (62.8%/65%) x (1.91/1.95) = 1.65*				

* Information calculated at this stage for later use in estimating islandwide employment impacts.

Table 23
Cumulative On-Site Population for All Ka'u Resorts, 1992 - 2009 and Build-Out

	1992	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	BUILD OUT
HAWAIIAN PALACE																		
Resort Residents:																		
Average	0	35	85	136	185	240	281	315	350	398	445	486	535	581	619	649	666	939
Total Capacity	0	88	211	334	447	573	666	747	831	935	1037	1127	1232	1332	1406	1465	1493	1950
Daily Visitors:																		
Average	1052	1064	1086	1108	1308	1331	1345	1356	1367	1386	1404	1420	1436	1453	1466	1476	1478	1505
Total Capacity	1710	1746	1821	1897	1966	2047	2093	2128	2163	2231	2298	2354	2413	2471	2524	2565	2571	2679
Total:																		
Average	1052	1099	1172	1244	1493	1571	1625	1671	1718	1784	1849	1906	1971	2034	2085	2126	2144	2444
Total Capacity	1710	1834	2032	2231	2413	2619	2759	2875	2994	3166	3335	3481	3644	3803	3930	4029	4064	4629
KA'U AINA																		
Resort Residents:*																		
Average	570	518	466	471	479	486	495	447	399	418	438	458	416	374	396	418	328	523
Total Capacity	600	556	511	519	530	539	553	514	475	501	529	558	528	497	529	559	491	763
Daily Visitors:																		
Average	758	765	772	773	1004	1004	1006	1013	1021	1482	1485	1487	1495	1504	1700	1703	1718	1741
Total Capacity	1140	1168	1196	1199	1583	1586	1590	1620	1650	2419	2428	2438	2471	2503	2514	2524	2587	2678
Total:																		
Average	1328	1283	1238	1244	1483	1490	1501	1460	1419	1900	1923	1945	1912	1877	2096	2120	2047	2264
Total Capacity	1740	1724	1708	1718	2113	2125	2143	2134	2125	2920	2958	2995	2999	3000	3043	3083	3078	3440
TOTAL HAWAIIAN RIVIERA																		
Resort Residents:																		
Average	570	552	551	607	664	726	776	762	749	816	883	943	951	955	1015	1067	994	1462
Total Capacity	600	644	722	853	977	1112	1219	1261	1306	1436	1567	1685	1760	1828	1935	2023	1983	2712
Daily Visitors:																		
Average	1810	1829	1858	1881	2311	2335	2350	2369	2388	2868	2889	2907	2932	2956	3166	3179	3196	3246
Total Capacity	2850	2914	3018	3096	3548	3632	3683	3748	3813	4650	4726	4791	4884	4974	5038	5088	5158	5357
Total:																		
Average	2380	2382	2409	2488	2976	3061	3126	3131	3137	3684	3772	3851	3883	3911	4181	4246	4191	4708
Total Capacity	3450	3558	3740	3948	4526	4744	4902	5009	5119	6086	6293	6476	6643	6803	6973	7112	7142	8069

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* The decline in resort resident population in some years is due to gradual conversions of multi-family rental units to condominium status.

NOTE: The initial 1992 "Resort Resident" population of 570 consists of workers and families in the 200 multi-family rental units, prior to their conversion to condominium status. Presumably much of this worker population could eventually relocate to the 800-unit support community. However, because the timing of support community units is not yet known, the support community population is not included in this table.

Table 23
Cumulative On-Site Population for All Ka'u Resorts, 1992 - 2009 and Build-Out
(Continued)

	1992	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	BUILD OUT
TOTAL KA'U RESORTS (Including Punalu'u)																		
Resort Residents:																		
Average	585	599	612	683	757	834	898	900	903	985	1069	1144	1169	1189	1264	1333	1276	1794
Total Capacity	631	742	852	1014	1174	1340	1478	1555	1631	1796	1962	2111	2222	2325	2463	2586	2581	3421
Daily Visitors:																		
Average*	2239	2286	2328	2364	3329	3365	3394	3426	3458	4135	4170	4201	4239	4277	4580	4606	4637	4714
Total Capacity	3709	3827	3957	4062	5374	5485	5562	5654	5746	6609	6713	6805	6924	7042	7132	7210	7307	7559
Total:																		
Average	2824	2884	2940	3047	4086	4199	4292	4326	4361	5120	5238	5345	5408	5466	5843	5939	5913	6507
Total Capacity	4340	4569	4809	5076	6548	6825	7041	7209	7377	8404	8675	8916	9146	9366	9595	9796	9887	10981

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* The decline in resort resident population in some years is due to gradual conversions of multi-family rental units to condominium status.

NOTE: The initial 1992 "Resort Resident" population of 570 consists of workers and families in the 200 multi-family rental units, prior to their conversion to condominium status. Presumably much of this worker population could eventually relocate to the 800-unit support community. However, because the timing of support community units is not yet known, the support community population is not included in this table.

Table 24
Example of Procedure for Calculating Construction Employment
(Hawaiian Palace Portion -- 1991-1992)

Employment from Resort Unit Construction

A. Statewide Employment	Units	Multi-plier(1)	Total Direct Jobs(2)
Hotel Units			
--Luxury	275	1.35	186
--Non-Luxury	625	1.00	313
Condominium Units			
--Luxury	0	1.62	0
--Non-Luxury	0	1.20	0
Single-Family Units			
--Luxury	0	2.70	0
--Non-Luxury	0	2.00	0

B. Allocation by Area	Study Area	Rest of Island	BIG ISLAND SUBTOTAL	STATE TOTAL
Direct:				
On-Site	399 (3)	0	399	399
Off-Site	10 (5)	40	50	100
(SUBTOTAL)	409	40	449 (4)	499
Indirect/Induced	57 (7)	234	291 (6)	N/A (8)
TOTAL	466	274	740	N/A

Employment from Other Facility Construction

A. Statewide Employment	Total Sq.Ft.	Costs Per Sq.Ft.	Total Costs	Total Direct Jobs(9)
Infrastructure			$3,100,000	59
Commercial	80,000	$100	8,000,000	76
Medical Center	20,000	100	2,000,000	19
Tennis Stadium	4,000	150	600,000	6
Polo/Stables	15,000	150	2,250,000	22
Golf Clubhouse	17,000	100	1,700,000	16
Golf/Polo Landscape			3,300,000	31
Miscellaneous	16,000	50	800,000	8
Marina			100,000,000	125
TOTAL				362

B. Allocation by Area	Study Area	Rest of Island	BIG ISLAND SUBTOTAL	STATE TOTAL
Direct:				
On-Site	288 (3)	0	288	288
Off-Site	8 (5)	30	38	74
(SUBTOTAL)	296	30	326 (4)	362
Indirect/Induced	43 (7)	167	210 (6)	N/A (8)
TOTAL	339	167	536	N/A

	Unit		Facility		Total
On-Site	399	+	288	=	687 (with rounding error)
Study Area	466	+	339	=	805 (with rounding error)
Island Total	740	+	536	=	1276

(1) Employment multipliers for non-luxury units are from DAHI (1986). CRI produced the adjusted luxury multipliers in a parallel manner to DAHI's 0.35 "luxury adjustment factor" for operational jobs.
(2) Statewide direct employment calculated by multiplying the number of units by the employment multiplier, then dividing by the number of years for construction to be completed (two years assumed for hotel, and one year for condo and SF units.)
(3) Assumes 80 percent of statewide direct jobs to be on-site.
(4) Assumes 90 percent of statewide direct jobs to be on-island.
(5) Assumes 20 percent of off-site direct jobs to be located in Study Area, with the remainder located in rest of island.
(6) Islandwide indirect/induced jobs assumed to be total islandwide direct jobs multiplied by 0.65. The 0.65 multiplier for on-island indirect/induced employment is from the DAHI methodology.
(7) Assumes 20 percent of indirect/induced jobs to be located in Study Area, with the remainder located in rest of island.
(8) The DAHI methodology did not provide a multiplier for calculating indirect/induced jobs on a statewide level.
(9) Statewide direct employment from other facility construction calculated at 19 jobs per $1 million value of construction, except for the marina employment which was estimated by Belt Collins and Associates.

resort construction alone. Additional construction jobs would be created off-site in the study area due to the need for new homes to house overall population growth generated by the proposed resort projects. Also, relatively small numbers of on-site construction jobs would continue to be created past 2009 through buildout of the residential homelots.

Results for Hawaiian Riviera: Adding the support community infrastructure and Ka`u Aina figures to the previously-discussed Hawaiian Palace construction jobs, construction during the peak years of 1990 - 92 would require approximately 1,100-1,300 construction workers daily on site, plus another 1,000-1,100 jobs generated or supported islandwide. These are average figures; there would be fluctuations over time, as discussed further under "cumulative results" below.

This level of construction employment during the 1990 - 92 timeframe would represent the largest single construction "boom" ever experienced on the Big Island. By comparison, average daily on-site construction for the current Waikoloa Hyatt development has been estimated at less than 700 (Belt Collins & Associates, 1987).

It must be emphasized that such figures for the 1990 - 92 Hawaiian Riviera timeframe reflect the developers' current assumptions of heavily front-ended development. In Table 25, average daily on-site construction employment for the overall Hawaiian Riviera Resort drops to around 150 in most years for the late 1990's, and to about 50 for years after 2002. These levels are associated with development of single-family homes and smaller or less luxurious resort structures. There would be some construction employment peaks in years when luxury condominiums or other structures are being developed, but these peaks are far less than the front-end peak attributable to development of infrastructure and three separate hotels.

Cumulative Results: The conservative assumption of some Punalu`u units and commercial space also developing in 1992 expectably increases the total number of construction jobs in the early 1990's -- to about 1,700 on site in 1991 - 92, another 400 in the rest of the study area, and another 1,200 in the rest of the island.

Table 25 reports average construction job figures. However, in reality, on-site employment reaches a peak in the middle part of the construction timeframe, and there are fewer workers required in the early and later stages. Based on actual data from construction of the Mauna Lani Bay Hotel (Mauna Lani Resort, Inc.), CRI modeled "construction job curves" for the assumed initial three Hawaiian Riviera hotels and one Punalu`u Resort hotel. The upper half of Figure 4.17 shows individual hotel job curves superimposed on one another, while the lower portion shows the cumulative job curve. The graphs feature only hotel employment construction -- not marina or infrastructure construction, for which job curves are not available. The graphs also indicate a "worst case" scenerio for the peak period, since they are based on the assumption that similar types of construction will be occurring at each hotel simultaneoulsy. In reality, construction scheduling could be spaced in such a manner that would allow for the various types of construction crews (i.e. framers, finish workers) to complete work at several sites over a period of time. The effect of this would be twofold: it would decrease the total number of workers actually required for construction, and; it would lessen the impact of the peak period.

2.4.3.2 Operational Employment

2.4.3.2.1 On-Site Employment

Table 26 lists estimates of on-site Hawaiian Riviera jobs related strictly to commercial and recreational activities, as opposed to being located on the grounds of hotels, resort

condominiums, or houselot developments. This portion of on-site employment would total about 600 positions when the resort opens in 1992, eventually doubling to 1,200 at final buildout. About 75 percent of such jobs would be on the Hawaiian Palace portion of the project, reflecting the project concept of concentrated commercial, entertainment, and recreational activity around the proposed marina.

Table 27 provides estimates of the cumulative on-site FTE (full-time equivalent) employment through any given year up to 2009, and at build-out. Job figures are given for each hotel, condominium, and houselot project within the various resort areas. Total job figures incorporate the commercial/recreational figures from Table 26.

Results for Hawaiian Riviera: Under the assumed schedule, some 2,300 FTE jobs would come on-line in the resort's initial year of 1992, representing half the total 4,600 jobs projected for ultimate buildout. Of these ultimate 4,600 positions, about 55 percent would be in the five hotels; 18 percent would be associated with the various condominium and resort residential units; and the remaining 27 percent would be in the various categories contained in Table 26 (commercial, recreational, security, etc.).

(NOTE: In addition to the numbers in Tables 26 and 27, the proposed support community would generate approximately 150 jobs at buildout -- about 100 in the community's commercial area and the remainder in public service agencies or recreational facilities. These jobs would technically be "induced" rather than "direct" resort jobs. Therefore, according to the DAHI methodology, they would be included in the "rest-of-study-area" jobs covered in Section 2.4.3.2.2.)

Cumulative Results: For all Ka`u resorts, including Punalu`u, the estimated total on-site FTE positions at ultimate buildout would be around 5,800, of which some 2,750 would come on-line in 1992 by the assumptions laid out at the beginning of this section.

Types of Jobs: Typically, about ten percent of hotel positions are managerial. Among staff-level employees, the largest departments are food/beverage and housekeeping, which together usually comprise more than half the positions in a given hotel. For condominium and resort residential units, positions are more heavily weighted toward housekeeping, groundskeeping, and general maintenance. Other types of on-site positions were listed in Table 26.

Wages/Salaries for On-Site Employees: Exact wages for resort staff depend to a large extent on results of union elections and collective bargaining agreements. However, to provide some indication, the median 1986 income for union workers at both the Westin Mauna Kea and the Mauna Lani Bay Hotel was about $15,100. Salaried workers (both management and office support) had a median of about $18,600 at the Mauna Lani and in excess of $21,000 at the Westin Mauna Kea. (Figures provided to CRI by hotel personnel offices for Ritz-Carlton Mauna Lani and South Kohala Resort EIS's.) These figures exclude fringes and tips, the amount and value of which are often a source of debate.

More subjective issues surrounding resort wages and working conditions -- such as adequacy of pay and worker satisfaction -- will be discussed in later sections of the EIS.

Average Daily Resort Construction Employment -- 1988 to 2009*

	1988-1989	1989-1990	1990-1991	1991-1992	1992-1993**	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999
HAWAIIAN PALACE											
On-Site	10	85	687	687	0	396	144	15	28	114	173
Rest of Study Area	7	15	118	118	0	68	25	3	5	19	30
STUDY AREA SUBTOTAL	**47**	**100**	**805**	**805**	**0**	**464**	**169**	**18**	**33**	**133**	**202**
Rest of Island	28	58	471	471	0	271	99	10	19	78	118
ISLAND TOTAL	**75**	**158**	**1276**	**1276**	**0**	**735**	**267**	**28**	**52**	**211**	**321**

	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
On-Site	13	28	296	19	19	28	28	27	27	27
Rest of Study Area	2	5	51	3	3	5	5	5	5	5
STUDY AREA SUBTOTAL	**15**	**33**	**347**	**23**	**23**	**33**	**33**	**32**	**32**	**32**
Rest of Island	9	19	203	13	13	19	19	19	19	19
ISLAND TOTAL	**24**	**52**	**549**	**36**	**36**	**52**	**52**	**51**	**51**	**51**

	1988-1989	1989-1990	1990-1991	1991-1992	1992-1993**	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999
KA'U AINA											
On Site	50	128	445	637	0	5	5	135	138	10	10
Rest of Study Area	9	22	76	109	0	1	1	23	24	2	2
STUDY AREA SUBTOTAL	**59**	**150**	**521**	**746**	**0**	**6**	**6**	**158**	**162**	**11**	**11**
Rest of Island	34	87	305	436	0	3	3	93	95	7	7
ISLAND TOTAL	**93**	**237**	**826**	**1183**	**0**	**9**	**9**	**251**	**257**	**18**	**18**

	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
On-Site	10	181	194	24	21	16	16	27	27	26
Rest of Study Area	2	31	33	1	4	3	3	5	5	1
STUDY AREA SUBTOTAL	**11**	**212**	**227**	**28**	**28**	**19**	**19**	**32**	**32**	**30**
Rest of Island	7	124	133	16	16	11	11	19	19	18
ISLAND TOTAL	**18**	**336**	**360**	**45**	**45**	**30**	**30**	**50**	**50**	**48**

(CONTINUED)

* Yearly figures beginning July 1.

** No new units are scheduled for completion in 1993.

NOTE: Figures include workers for infrastructure development at the support community. However, because the phasing of the 800 residential units is not known, employment associated with construction of these units is not included in this table.

Table 25

Average Daily Resort Construction Employment -- 1988 to 2009*
(Continued)

	1988-1989	1989-1990	1990-1991	1991-1992	1992-1993**	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999
TOTAL HAWAIIAN RIVIERA											
On-Site	90	213	1133	1325	0	401	149	150	166	123	182
Rest of Study Area	15	36	194	227	0	69	25	26	28	21	31
STUDY AREA SUBTOTAL	**106**	**249**	**1327**	**1551**	**0**	**469**	**174**	**176**	**195**	**144**	**214**
Rest of Island	62	146	776	907	0	275	102	103	114	85	125
ISLAND TOTAL	**168**	**395**	**2102**	**2459**	**0**	**744**	**276**	**279**	**309**	**229**	**339**

	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
On-Site	23	209	490	43	43	44	44	55	55	53
Rest of Study Area	4	36	84	7	7	8	8	9	9	9
STUDY AREA SUBTOTAL	**26**	**245**	**574**	**51**	**51**	**51**	**51**	**64**	**64**	**62**
Rest of Island	15	143	336	30	30	30	30	37	37	36
ISLAND TOTAL	**42**	**388**	**909**	**81**	**81**	**82**	**82**	**101**	**101**	**98**

	1988-1989	1989-1990	1990-1991	1991-1992	1992-1993**	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999
TOTAL KA'U RESORTS(Including Punalu'u)											
On-Site	128	373	1454	1761	0	409	152	329	458	127	186
Rest of Study Area	22	64	249	302	0	70	26	56	78	22	32
STUDY AREA SUBTOTAL	**150**	**437**	**1703**	**2062**	**0**	**479**	**178**	**385**	**536**	**148**	**217**
Rest of Island	88	256	996	1206	0	280	104	225	314	87	127
ISLAND TOTAL	**238**	**693**	**2699**	**3268**	**0**	**759**	**282**	**610**	**850**	**235**	**345**

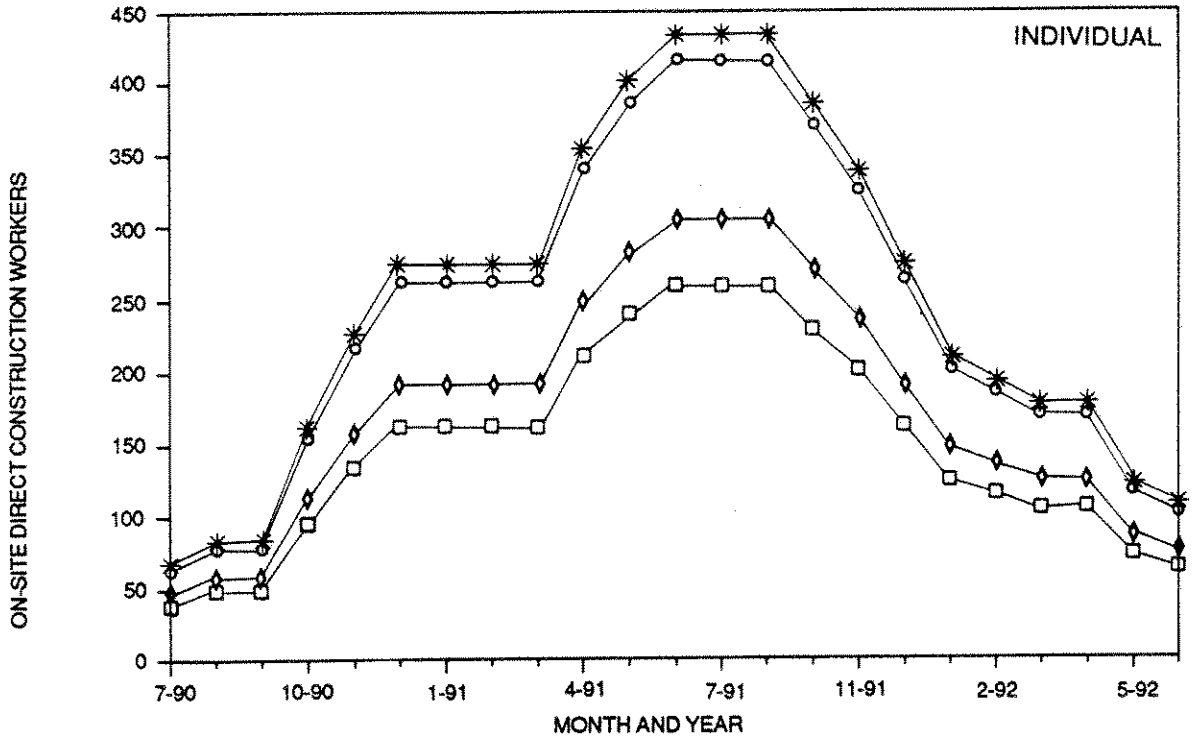
	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
On-Site	27	212	490	43	43	44	44	55	55	53
Rest of Study Area	5	36	84	7	7	8	8	9	9	9
STUDY AREA SUBTOTAL	**32**	**249**	**574**	**51**	**51**	**51**	**51**	**64**	**64**	**62**
Rest of Island	19	145	336	30	30	30	30	37	37	36
ISLAND TOTAL	**51**	**394**	**909**	**81**	**81**	**82**	**82**	**101**	**101**	**98**

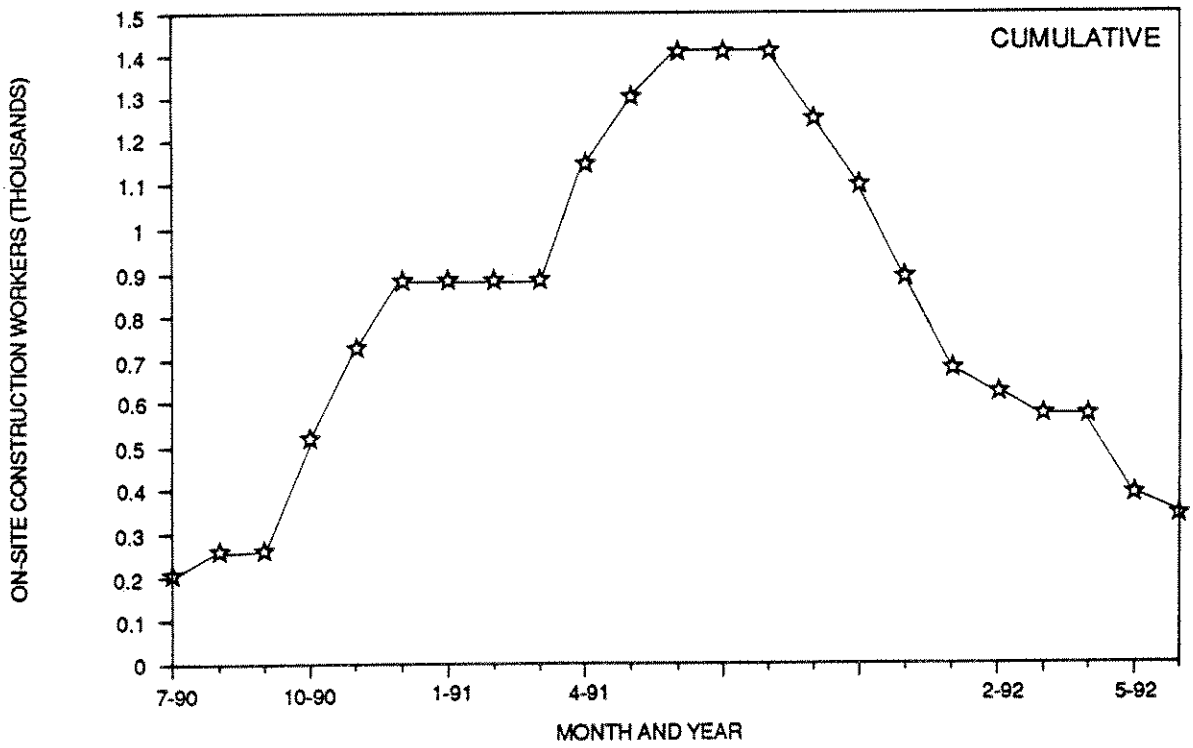
---

* Yearly figures beginning July 1.

** No new units are scheduled for completion in 1993.

NOTE: Figures include workers for infrastructure development at the support community. However, because the phasing of the 800 residential units is not known, employment associated with construction of these units is not included in this table.





LEGEND:

- □ Palace Luxury
- ✳ Palace Development
- ○ Ka'u Aina
- ◊ Punalu'u

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

Figure 4.17

INDIVIDUAL AND CUMULATIVE NUMBERS OF ON-SITE CONSTRUCTION WORKERS

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

Table 26
On-Site Jobs Related to Commercial and Recreational Activities
(Cumulative Figures)

	1992-1996	1997-2001	2002-2006	2007-2009	Build-Out
HAWAIIAN PALACE					
Commercial*	190	250	250	275	600
Marina	20	20	20	20	20
Golf #1	30	30	30	30	30
Golf #2	0	0	0	0	30
Stable	10	10	10	10	10
Tennis	10	10	10	10	10
Maintenance/Security	100	100	100	100	100
Administration/Sales	92	92	92	92	92
Cruise Ship Terminal	4	4	4	4	4
PALACE SUBTOTAL	456	516	516	541	896
KA'U AINA					
Commercial*	50	65	175	175	200
Golf #1	30	30	30	30	30
Golf #2	0	30	30	30	30
Petroglyph Park	2	2	2	2	2
Maintenance/Security	60	60	60	60	60
Administration/Sales	10	10	10	10	10
Airport	6	10	15	15	15
KA'U AINA SUBTOTAL	158	207	322	322	347
CUMULATIVE TOTAL	614	723	838	863	1243

* Commercial jobs estimated at one job per 200 sq. ft. (See Table 4.1 for assumptions about commercial space development schedule.)

(NOTE: Above figures pertain to resort components of project. The support community would generate approximately 150 additional induced jobs.)

Table 27
Cumulative Total On-Site Jobs for All Ka'u Resorts, 1992 - 2009 and Build-Out
(All Numbers Represent FTE, or Full-Time Equivalent, Positions)

	1992	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	BUILD OUT
HAWAIIAN PALACE																		
-Luxury Hotel	344	344	344	344	413	413	413	413	413	413	413	413	413	413	413	413	413	413
-DeLuxe Hotel	625	625	625	625	719	719	719	719	719	719	719	719	719	719	719	719	719	719
-Villas	0	29	58	87	108	130	152	173	195	210	224	238	253	267	271	271	271	271
-Townhouses	0	8	17	25	31	42	50	58	66	75	83	91	100	108	116	125	125	125
-Garden Apartments	0	0	15	29	44	58	62	62	62	75	87	95	104	112	120	125	125	125
-Equestrian Estates	0	0	0	0	0	1	1	2	2	3	3	3	4	4	4	4	5	12
-Fairway Homes	0	0	0	0	1	3	4	5	7	9	11	14	15	17	19	21	23	63
-Residential Houselots	0	0	0	0	0	0	0	0	0	0	0	0	2	4	6	7	8	27
-FTE Jobs From Units	969	1006	1058	1109	1316	1365	1400	1432	1464	1502	1540	1573	1608	1643	1667	1683	1687	1752
-TOTAL, incl. Non-Unit*	**1425**	**1462**	**1514**	**1565**	**1832**	**1881**	**1916**	**1948**	**1980**	**2018**	**2056**	**2089**	**2124**	**2159**	**2208**	**2224**	**2228**	**2648**
-Incremental Change	1425	37	52	52	267	48	36	32	32	38	38	34	35	35	49	16	4	420
KA'U AINA																		
-High-Activity Hotel	720	720	720	720	750	750	750	750	750	780	780	780	780	780	780	780	780	780
-Retreat Hotel	0	0	0	0	250	250	250	250	250	300	300	300	300	300	320	320	320	320
-First-Class Hotel	0	0	0	0	0	0	0	0	0	260	260	260	260	260	360	360	360	360
-Multi-Family as Rentals	6	5	5	5	5	5	5	4	3	3	3	3	2	2	2	2	0	0
-Multi-Family as Condos	0	8	16	16	16	16	16	24	33	33	33	33	41	49	49	49	65	65
-Residential	0	1	2	3	5	7	9	11	13	18	23	27	31	34	40	45	50	98
FTE Jobs From Units	726	734	743	744	1026	1028	1030	1039	1049	1393	1398	1403	1414	1424	1550	1555	1575	1623
-TOTAL, incl. Non-Unit*	**882**	**892**	**901**	**902**	**1233**	**1235**	**1237**	**1246**	**1256**	**1715**	**1720**	**1725**	**1736**	**1746**	**1872**	**1877**	**1897**	**1970**
-Incremental Change	882	10	8	1	331	2	2	9	9	460	5	5	11	11	126	5	20	72
HAWAIIAN RIVIERA TOTALS																		
-FTE Jobs From Units	1695	1740	1800	1853	2342	2392	2430	2471	2512	2895	2938	2976	3022	3068	3217	3239	3263	3375
-TOTAL, incl. Non-Unit *	**2307**	**2354**	**2414**	**2467**	**3065**	**3115**	**3153**	**3194**	**3235**	**3733**	**3776**	**3814**	**3860**	**3906**	**4080**	**4102**	**4126**	**4618**
-Incremental Change	2307	48	60	53	598	50	38	41	41	498	43	39	46	46	174	22	24	492

(CONTINUED)

* Includes job counts from Table 26

Table 27
Cumulative Total On-Site Jobs for All Ka'u Resorts, 1992 - 2009 and Build-Out
(All Numbers Represent FTE, or Full-Time Equivalent, Positions)
(Continued)

	1992	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	BUILD OUT
PUNALU'U RESORT																		
-Hotel #1	307	307	307	307	372	372	372	372	372	438	438	438	438	438	438	438	438	438
-Hotel #2	0	0	0	0	307	307	307	307	307	372	372	372	372	372	438	438	438	438
-Condominiums	10	30	40	49	60	69	79	89	99	108	119	128	139	148	158	168	178	198
-Residential	0	2	2	2	3	4	4	5	5	6	7	7	8	8	9	9	10	15
-FTE Jobs From Units	317	338	348	358	742	752	762	772	783	925	935	946	957	967	1043	1054	1064	1089
-Commercial Jobs	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
-TOTAL, incl. Non-Unit	**438**	**459**	**469**	**479**	**862**	**873**	**883**	**893**	**903**	**1045**	**1056**	**1066**	**1077**	**1088**	**1164**	**1175**	**1185**	**1210**
-Incremental Change	438	21	10	10	383	10	10	10	10	142	11	10	11	10	76	11	10	25
TOTAL KA'U RESORTS																		
-Total Resort FTE Jobs	**2745**	**2813**	**2883**	**2946**	**3927**	**3988**	**4036**	**4087**	**4138**	**4778**	**4832**	**4880**	**4937**	**4994**	**5244**	**5277**	**5311**	**5828**
-Incremental Change	2745	69	70	63	981	60	48	51	51	640	54	49	57	56	250	33	34	517

NOTE: Approximately 150 Hawaiian Riviera support community jobs are not included in this table, since these would technically be "induced" jobs.

2.4.3.2.2 Total Study Area and Islandwide Employment

Results for Hawaiian Riviera: Using as an example the total Hawaiian Riviera Resort development assumed to be on-line as of 1994, Table 28 shows the assumptions and methodology -- based on the County's requested DAHI approach -- used to calculate all Ka`u/South Kona and islandwide jobs generated by the proposed resort activities as of that year.

Table 29 then shows overall results -- as calculated by applying this DAHI-based methology -- through each year, and at buildout, for the various Hawaiian Riviera components and for the Ka`u total including Punalu`u. (Note that support community jobs would be included in the "Rest of Study Area" off-site job figures in this table.)

A few things should be noted about the DAHI methodology. First, it provides only islandwide, not regional or statewide, employment totals. The study area share of the islandwide total was calculated by the method footnoted in Table 28. The DAHI islandwide totals are not always compatible with statewide totals based on standard multipliers developed by the Hawaii State Department of Planning and Economic Development, and so no statewide figures are reported here. Second, an unpublished feature of the DAHI approach involves a "luxury adjustment factor" for hotels such as the Westin Mauna Kea or the Kona Village (in which class most of the Hawaiian Riviera hotels would be). This has been calculated for the present EIS in a manner based on general discussions with DAHI principal Dr. Bruce Plasch (personal communication, January 1987). These issues are discussed at more length in the Community Resources (1987) technical document submitted to the County Planning Department.

As indicated in Table 29, the initial 1992 operations would generate not only the 2,300 FTE positions at the Hawaiian Riviera, but also another 1,100 off-site jobs -- of which 280 are estimated to be located in the Ka`u/South Kona study area and the remainder throughout the rest of the island. At full buildout at some time in the 2010's or 2020's, the total Hawaiian Riviera Resort-related jobcount would be the 4,600 on-site FTE positions plus another 1,600 off-site jobs, of which half are expected to be located in the study area. Thus, total new Ka`u/South Kona jobs at buildout would be about 5,400.

Cumulative Results: Including the assumed Punalu`u Resort development, the 1992 jobcounts would rise to 2,750 on-site, another 350 elsewhere in the Ka`u/South Kona study area, and another 1,000 in the remainder of the island. At ultimate buildout, the figures become 5,800 on-site, another 1,300 elsewhere in the Ka`u/South Kona study area, and an additional 1,300 in the remainder of the island.

2.4.4 Labor Demand vs. Supply and Worker In-Migration

If the demand for workers living on-island or in the study area exceeds supply, it will be necessary to import workers. This section contains CRI forecasts of labor demand vs. supply and consequent needed worker in-migration.

2.4.4.1 Construction Periods

In many years, particularly the intensive initial development period of the early 1990's, the required number of Hawaiian Riviera construction workers will clearly exceed the number of construction industry workers in the Ka`u/South Kona study area (about 460 in 1980, according to U.S. Census data, although this number will have increased somewhat by the 1990's).

However, major construction activities typically draw upon an islandwide pool, with

Table 28
Example of Procedures for Calculating Total Operational Employment

Total Hawaiian Riviera Units in 1994

A. Total On-Island Employment	Units/ People	Multi-plier (1)	Jobs
HAWAIIAN PALACE			
Basic Units	916	1.61	1478
Luxury Adjustment (Luxury Hotel)	275	0.47	128
Luxury Adjustment (DeLuxe Hotel)	625	0.41	255
Non-Unit (Indirect/Induced)	456	0.30	137
Resort Residents (Indirect/Induced)	35	0.29	10
SUBTOTAL			2008
KA'U AINA			
Basic Units	613	1.71	1050
Luxury Adjustment (High-Activity Hotel)	600	0.35	210
Non-Unit (Indirect/Induced)	158	0.30	47
Resort Residents (Indirect/Induced)	518	0.29	150
SUBTOTAL			1457

TOTAL HAWAIIAN RIVIERA 2008 + 1457 = 3466 (with rounding error)

B. Allocation by Area	Study Area	Rest of Island	Island Total
On-Site	2354 (2)	0	2354
Off-Site	300 (3)	812	1112
TOTAL	2654	812	3466

(1) Multipliers for "Basic Units" calculated by procedure shown in Table 22 "Luxury Adjustments" from Table 21 "Non-Unit" multiplier of 0.30 from State DPED (average of commercial and recreational activity multipliers). "Resort Residents" multiplier from DAHI (1986).

(2) On-site employment calculated from procedures in Table 21 .

(3) Assumes 27% of off-site employment in Study Area. (Assumption is 25% in 1992, increasing by one percentage point each year to a maximum of 50% in the late 2010's.)

construction workers often commuting (or only temporarily relocating) to worksites across the island. In both 1970 and 1980, 11 percent of the Big Island's employed civilian labor force was in the construction industry. Applying this percentage to the projected 1990 workforce of 46,600 (Hawaii State Department of Planning and Economic Development, 1984) would yield an estimated 5,130 construction industry workers.

While this number exceeds the average 1990 - 92 Hawaiian Riviera on-site requirement of slightly under 2,000 workers (Table 25), it is still likely that some temporary in-migration of off-island construction workers would occur. There are several reasons for this. First, certain types of specialty work (such as finishing) require specialty workers typically based on Oahu. Site work for the marina construction would likely include many such workers, since relatively little ocean engineering projects have occurred on the Big Island. Second, there may be competing construction labor demands from other large projects.

At the present time, the only scheduled major Big Island construction projects involve the Hyatt Regency Waikoloa (to be completed in late 1988), the Ritz-Carlton Mauna Lani (under construction from 1988 to 1990), and the initial components of the South Kohala Resort (1991 to 1993). However, the latter two projects still require some government approvals, whereas it is also possible that other, already-approved projects may acquire the necessary operator interest and capital to build currently- unscheduled hotels during the next five years. Thus, in reality, it is not possible to forecast competing construction labor demands for the 1990 - 92 period, much less for the other years in which the tentative Hawaiian Riviera schedule suggests relatively high labor demand.

It may be noted that the first three Hawaiian Riviera hotels (those now assumed to be simultaneously under construction in 1990 - 92) would have a combined unit count approximately equal to that of the Hyatt Regency Waikoloa. To date, the number of off-island construction workers at the Hyatt Regency has rarely been much above 20 percent of the total. However, if the marina and other infrastructure were also under construction at the same time, as Table 19 assumes, it is likely that more than 20 percent of the on-site workers would be from off-island.

For present purposes of rough estimation, it may be assumed that about 35 percent of the 1990 - 92 on-site workers would be imported from off-island. For later hotels, when labor demand is lighter, perhaps ten to 20 percent of workers would be imported. However, this would have to be re-evaluated in later impact assessments for specific project components closer to actual construction times, when more is known about both the final Hawaiian Riviera phasing and other projects making competing labor demands.

2.4.4.2 Operational Period

Although highly dependent on the validity of assumptions being made, forecasts of cumulative labor supply vs. demand are somewhat easier to make for the operational period than for construction. This is due to (1) the absence of any substantial competing new labor demands in the study area, other than Punalu`u Resort, and (2) the recent development of computerized algorithms for modeling regional labor supply vs. demand on the Big Island (Community Resources, 1987).

As an initial step, CRI developed an age-sex cohort population projection model for the Ka`u/South Kona study area. Based on State estimates of both the 1985 total population and also civilian labor force in the study area, it was determined that population there has been increasing at a rate only about five percent in excess of that which would be predicted from natural increase alone (i.e., population growth based only on expected births minus deaths, with zero net migration).

Table 29
Cumulative Operational Employment, 1992 - 2009 and Build-Out

	1992	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	BUILD OUT
HAWAIIAN PALACE																		
Study Area																		
--On-Site	1425	1462	1514	1565	1832	1881	1916	1948	1980	2018	2056	2089	2124	2159	2208	2224	2228	2648
--Rest of Area	137	147	158	168	194	208	218	226	233	248	264	278	293	308	318	334	343	315
--SUBTOTAL	**1562**	**1609**	**1672**	**1733**	**2026**	**2089**	**2134**	**2174**	**2213**	**2266**	**2320**	**2367**	**2417**	**2467**	**2526**	**2558**	**2571**	**2963**
Rest of Island	411	399	405	412	453	463	463	458	453	461	469	473	477	481	476	480	474	315
ISLAND TOTAL	**1972**	**2008**	**2077**	**2145**	**2479**	**2553**	**2597**	**2632**	**2667**	**2728**	**2789**	**2839**	**2894**	**2948**	**3002**	**3038**	**3046**	**3279**
KA'U AINA																		
Study Area																		
--On-Site	884	892	901	902	1233	1235	1237	1246	1256	1715	1720	1725	1736	1746	1872	1877	1897	1970
--Rest of Area	146	153	152	158	193	200	208	208	207	290	300	311	312	313	384	396	390	481
--SUBTOTAL	**1030**	**1045**	**1053**	**1060**	**1426**	**1435**	**1445**	**1454**	**1463**	**2005**	**2020**	**2036**	**2048**	**2059**	**2256**	**2273**	**2287**	**2451**
Rest of Island	439	413	392	388	451	446	441	422	402	539	534	529	509	490	576	570	539	481
ISLAND TOTAL	**1469**	**1457**	**1445**	**1448**	**1878**	**1881**	**1886**	**1876**	**1865**	**2544**	**2554**	**2564**	**2557**	**2550**	**2832**	**2843**	**2826**	**2933**
TOTAL HAWAIIAN RIVIERA																		
Study Area																		
--On-Site	2309	2354	2415	2467	3065	3116	3153	3194	3236	3733	3776	3814	3860	3905	4080	4101	4125	4618
--Rest of Area	283	300	310	327	387	408	426	433	441	539	564	588	605	621	702	730	734	797
--SUBTOTAL	**2592**	**2654**	**2725**	**2794**	**3452**	**3524**	**3579**	**3627**	**3677**	**4272**	**4340**	**4402**	**4465**	**4526**	**4782**	**4831**	**4859**	**5415**
Rest of Island	850	811	797	800	904	909	904	880	855	1000	1003	1002	987	971	1053	1050	1013	797
ISLAND TOTAL	**3442**	**3466**	**3522**	**3593**	**4356**	**4434**	**4483**	**4507**	**4532**	**5272**	**5343**	**5404**	**5451**	**5497**	**5834**	**5881**	**5872**	**6211**
TOTAL KA'U RESORTS																		
Study Area																		
--On-Site	2747	2813	2884	2946	3928	3989	4036	4087	4140	4779	4832	4881	4938	4993	5244	5276	5310	5828
--Rest of Area	332	360	375	398	569	600	628	646	664	817	855	892	922	951	1064	1107	1125	1277
--SUBTOTAL	**3079**	**3173**	**3259**	**3344**	**4497**	**4589**	**4664**	**4733**	**4804**	**5596**	**5687**	**5773**	**5860**	**5944**	**6308**	**6383**	**6435**	**7105**
Rest of Island	996	973	965	974	1328	1336	1334	1312	1288	1516	1520	1518	1504	1488	1596	1593	1554	1277
ISLAND TOTAL	**4075**	**4146**	**4225**	**4318**	**5825**	**5925**	**5997**	**6045**	**6092**	**7112**	**7207**	**7291**	**7363**	**7432**	**7904**	**7975**	**7990**	**8382**

Implications are:

(1) Since it is widely believed that substantial in-migration has been taking place, it follows that there has also been substantial out-migration, such that the number of newcomers has been roughly balancing the number of residents who leave.

(2) In-migration which has been occurring in recent years apparently has little connection with economic opportunities in the area, since few jobs have been created. Explanations suggested by area residents interviewed for this EIS (see discussion of key informants in Section 2.5) include Filipino immigrants joining families, Kona hotel workers seeking cheaper housing, "urban refugees" fleeing city environments, marijuana growers, and retirees. Exact proportions are difficult to estimate, but it is clear that some (though not all) of these people represent potential additional labor force.

(3) Some out-migration is voluntary, but much is due to lack of employment opportunities, particularly for graduating high school seniors (personal communication, Jose Basque, Ka`u High School counselor, May 8, 1987). Thus, provision of new job opportunities would result in faster "natural population increase" by reducing out-migration pressures.

With this background, CRI utilized its micro-computer models to predict levels of available Ka`u/South Kona labor supply and required in-migration. Several key assumptions and methods include the following:

- It is assumed that construction workers and persons traveling to work in Kona resorts do not represent "available labor" for Ka`u resort operational employment. According to 1980 Census data, 12 percent of the total study area labor force is involved in the construction industry. This proportion was doubled, to 25 percent, to account for future South Kona new labor force entrants assumed to be captured by new West Hawaii resort development.

- It is also assumed that "full employment" will always exclude a certain portion of remaining workers who are between jobs even in the best of times -- three percent of on-island unemployed labor force participants, and ten percent of unemployed recent in-migrants.

- The County's requirement for a cumulative impact assessment requires consideration of new non-resort, as well as new resort, labor demand in the study area. However, the only non-resort job prospects currently foreseeable would be a handful of retail or government positions to service the slow "natural growth." Based on DAHI multipliers for jobs created purely by residential population growth, CRI estimates only three new study area jobs a year attributable to such growth.

- Also on the labor demand side, observed patterns of multiple jobholding at Big Island luxury resorts (Community Resources and Datametric Research, 1987) suggest that the number of workers required amounts to about 92

percent of the number of positions created.

- "Available labor" supply will consist primarily of (1) new labor force entrants from natural population increase (assuming zero net migration, as estimated from the previously mentioned age-sex cohort population projections), and also of (2) net in-migrants who will be coming to Ka`u and South Kona regardless of economic conditions, although they will ultimately require jobs to remain. For reasons described above, the second group is estimated at only five percent of the first at the present time and in the next several years. However, as Ka`u resort jobs begin to appear on the horizon, it is assumed this proportion will increase to 50 percent by 1990 and 80 percent in 1992 and thereafter. (The rise in proportion would reflect reduced out-migration, so that net in-migration is higher.)

(NOTE: The CRI labor supply/demand keeps separate account of in-migrants expected to come anyway, even before new jobs are available, as opposed to "induced" in-migrants who must be imported to fill any labor shortages created after new jobs are made available. However, the following analyses count all in-migrants supported by resort jobs -- even those projected to arrive for non-economic reasons up to one year before resort jobs come on-line -- as project "impacts." In effect, this means that some population growth which could take place anyway will be treated as a retroactive project impact, thereby possibly overstating project effects.)

- Smaller sources of labor supply -- assumed to fill demand before it would be necessary to import any additional "induced" in-migrants -- would include (1) commuters from Hilo/Puna, and (2) current study area workers voluntarily taking second jobs to supplement current incomes. (However, the CRI method allocates jobs to commuters and "moonlighters" only if labor demand exceeds other sources of available regional labor supply.) In light of the limited future East Hawaii job prospects and of 1980 Census data showing that 15 percent of all Big Island workers commute atleast 30 minutes to work (about the travel time from Volcano to Hawaiian Riviera), it will be assumed that 15 percent of the Hawaiian Riviera workforce would consist of voluntary commuters from Puna and Hilo. For the initial heavy labor demand of 1992, it will be assumed that current study area "moonlighters" would take up to five percent of new jobs, but that this would drop to one percent in future years.

Table 30 contains results of the CRI analysis for the future situation in which both new study area resort jobs (Hawaiian Riviera plus Punalu`u) and non-resort jobs are developed. Table 31 shows the assumed distribution of new jobs and, separately, of new workers (slightly fewer than new jobs, due to the multiple jobholding phenomenon).

While the exact numbers in these tables are highly dependent on foregoing assumptions, the basic principle is that more induced in-migration will be required in years when more new jobs open up. If there is a period when few new jobs are being created, a surplus of available labor will build up, and little or no induced in-migration wil be required.

Table 30 suggests that the heaviest in-migration would be required in 1992, when study area labor supply would fall short of initial resort-generated demand by some 1,650 workers. This means a need either to import 1,650 workers to the study area (as will be assumed for purposes of this EIS) or, alternatively, to have these workers involuntarily commute from place such as Hilo if insufficient housing is available for in-migrant workers. Over the next several years, resort job

growth would not keep pace with the new labor supply generated by natural population growth, but other in-migration spurts would be induced in 1997 and 2002.

Similarly, Table 31 suggests that initial resort operations in 1992 would require some 2,300 new workers who would live in the study area itself (assuming no need for involuntary commuting and excluding the voluntary commuters and current study area workers taking additional jobs). Of these 2,300 workers, about three- quarters would be in-migrant (primarily the induced in-migrants, plus a few in-migrants expected to have come over the past year anyway). In most subsequent years -- except for the projected later hotel opening dates of 1997 and 2002 -- most of the new jobs would go to available study area labor, with jobs going only to relatively small numbers of in-migrants expected to be arriving in the study area with or without economic inducement.

The exact numbers in Tables 30 and 31 are likely to prove more accurate for the earlier years than for the later years, when currently unforeseeable events could greatly alter assumptions about competing labor demands as well as supply. However, the figures provide a general picture of the overall patterns which can be expected from resort development in the study area: need for substantial in-migrant labor in years when large projects come on-line, interspersed with longer periods in which locally available labor supply is adequate to meet demand.

It should be noted that the labor supply/demand analysis assumes that most available unemployed study area workers will be qualified and motivated to fill new job openings -- whether on- site at resorts or in off-site jobs. As discussed at more length in "Socio-Economic Mitigations and Management Strategies" (Section 2.6), job training and related programs could both strengthen the basis for this assumption and perhaps further reduce the need for in-migrant workers by increasing the number of Ka`u/South Kona people entering the labor force.

The most important potential sources of labor supply among current residents which will provide "natural increase" in labor force, and/or which can be further developed to increase labor participation rates, are:

Females -- Particularly in Ka`u, the 1980 U.S. Census data indicate a much lower labor force participation rate among females in the region than among females islandwide (43.3 percent vs. 50.6 percent). Also, Ka`u's high 1980 unemployment rate was primarily a female phenomenon; the male Ka`u unemployment rate that year was virtually identical to the islandwide male rate (7.6 percent vs. 7.2 percent), but the Ka`u female rate of 16.1 percent unemployed was much higher than either the male rates or the islandwide female rate (6.7 percent). Resort development offers substantial employment opportunities to women, with 50 to 60 percent of hotel positions usually taken by females. Thus, many current female residents are likely to enter the labor force for the first time and/or to end a long search for work in the region.

Future High School Graduates -- In recent years, class sizes at Ka`u High School have varied from 50 to 70. (South Kona student are bused to Konawaena High School in North Kona.) An unpublished survey of graduating 1985 Ka`u High School seniors (data provided by Nan Yuen, Educational Specialist for Guidance and Counseling) found only 17 percent -- half the islandwide average proportion -- had plans to attend a four-year college, with another 17 percent planning to attend a two-year school. The Ka`u High School counselor (personal communication, Jose Basque, May 8, 1987) estimates that about one-half to two-thirds of each graduating class eventually returns to the Ka`u area; he believes many of those leaving have gone only as far as Kona and could well return if jobs are made available.

Other potential labor sources already residing in the study area include the elderly, the

Table 30
Labor Supply/Demand Analysis, Study Area 1988 - 1998
(excludes construction sector and some West Hawaii resort employment)

	1992	1994	1995	1996	1997	1998	1999	2000	2001
Total New Study Area Jobs									
Resort Projects	3079	94	87	85	1153	92	74	69	71
Non-Resort Projects	3	3	3	3	3	3	3	3	3
STUDY AREA TOTAL	**3082**	**97**	**90**	**88**	**1156**	**95**	**77**	**72**	**74**
Demand for Workers									
New Workers Living in Study Area	2262	89	83	81	891	87	71	66	68
Voluntary Commuters	462	0	0	0	173	0	0	0	0
Current Workers/ Moonlighting	154	0	0	0	12	0	0	0	0
TOTAL (1)	**2878**	**89**	**83**	**81**	**1076**	**87**	**71**	**66**	**68**
New Available Study Area Labor Supply									
Surplus from Past Years (2)	533	222	228	243	263	44	60	93	134
Natural Population Increase	52	53	54	56	57	57	57	60	52
Non-Induced In-Migrants	32	39	40	42	42	43	43	44	38
TOTAL AVAILABLE LABOR (2)	**617**	**314**	**322**	**340**	**361**	**145**	**161**	**197**	**224**
STUDY AREA WORKER DEMAND MINUS SUPPLY (Induced In-Migrants) (3)	**1645**	**-225**	**-240**	**-259**	**530**	**-57**	**-90**	**-130**	**-156**

(CONTINUED)

(1) Total demand for workers somewhat less than total new jobs due to multiple jobholding factor of 1.09 workers per job (Community Resources, Inc., and Datametric Research, 1987). Demand for commuters and moonlighters is assumed only if total available Study Area is not adequate to fill all new Study Area jobs.

(2) Total available labor excludes ten percent of unemployed in-migrants and three percent of other unemployed on-island workers, reflecting "full employment" assumptions. These become part of the "surplus" category for the subsequent year.

(3) Positive numbers indicate required Induced In-Migrant Workers; negative numbers indicate labor surplus and rising unemployment.

NOTE: Figures shown are incremental (new) jobs/workers for each indicated year.

Table 30
Labor Supply/Demand Analysis, Study Area 1988 - 1998
(Continued)

	2002	2003	2004	2005	2006	2007	2008	2009
Total New Study Area Jobs								
Resort Projects	792	92	86	87	85	364	75	53
Non-Resort Projects	3	3	3	3	13	1	1	1
STUDY AREA TOTAL	**795**	**95**	**89**	**90**	**98**	**365**	**76**	**54**
Demand for Workers								
New Workers Living in Study Area	613	87	82	83	90	335	70	50
Voluntary Commuters	119	0	0	0	0	0	0	0
Current Workers/ Moonlighting	8	0	0	0	0	0	0	0
TOTAL (1)	**740**	**87**	**82**	**83**	**90**	**335**	**70**	**50**
New Available Study Area Labor Supply								
Surplus from Past Years (2)	159	31	40	55	69	396	96	61
Natural Population Increase	52	53	54	54	232	19	20	19
Non-Induced In-Migrants	39	39	40	40	172	14	15	14
TOTAL AVAILABLE LABOR (2)	**250**	**124**	**133**	**149**	**473**	**429**	**130**	**94**
STUDY AREA WORDER DEMAND MINUS SUPPLY (Induced In-Migrants (3)	**362**	**-37**	**-52**	**-66**	**-383**	**-94**	**-60**	**-44**

(1) Total demand for workers somewhat less than total new jobs due to multiple jobholding factor of 1.09 workers per job (Community Resources, Inc., and Datametric Research, 1987). Demand for commuters and moonlighters is assumed only if total available Study Area is not adequate to fill all new Study Area jobs.

(2) Total available labor excludes ten percent of unemployed in-migrants and three percent of other unemployed on-island workers, reflecting "full employment" assumptions. These become part of the "surplus" category for the subsequent year.

(3) Positive numbers indicate required Induced In-Migrant Workers; negative numbers indicate labor surplus and rising unemployment.

NOTE: Figures shown are incremental (new) jobs/workers for each indicated year.

Table 31
Distribution of New Study Area Jobs and Workers
(Includes Both Resort and Non-Resort)

Distribution of New Jobs Located in Study Area	1992	1994	1995	1996	1997	1998	1999	2000	2001
Available Labor: In-Region 1 Year or More	638	85	79	77	348	67	57	56	61
Total In-Migrants	1827	12	11	11	623	28	21	16	13
Commuters	462	0	0	0	173	0	0	0	0
Current Workers/ Moolighting	154	0	0	0	12	0	0	0	0
TOTAL	**3082**	**97**	**90**	**88**	**1156**	**95**	**77**	**72**	**74**
Distribution of New Study Area Workers Living in Study Area									
Available Labor: In-Region 1 Year or More	585	78	72	71	319	62	52	52	56
Total In-Migrants	1677	11	10	10	572	26	19	15	12
TOTAL	**2262**	**89**	**83**	**81**	**891**	**87**	**71**	**66**	**68**

Distribution of New Jobs Located in Study Area	2002	2003	2004	2005	2006	2007	2008	2009
Available Labor: In-Region 1 Year or More	230	65	62	66	63	353	68	46
Total In-Migrants	437	30	27	24	36	12	9	8
Commuters	119	0	0	0	0	0	0	0
Current Workers/ Moolighting	8	0	0	0	0	0	0	0
TOTAL	**795**	**95**	**89**	**90**	**98**	**365**	**76**	**54**
Distribution of New Study Area Workers Living in Study Area								
Available Labor: In-Region 1 Year or More	211	59	57	60	57	324	62	42
Total In-Migrants	401	28	24	22	33	11	8	7
TOTAL	**613**	**87**	**82**	**83**	**90**	**335**	**70**	**50**

NOTE: Figures shown are incremental (new) jobs/workers for each indicated year.

handicapped, and the disadvantaged/ discouraged workers. While these represent small pockets on an individual basis, they may add up to important figures, and they also include some of the individuals whose employment needs may best be met by service types of work.

In terms of "in-migrants," many may originate from East Hawaii as opposed to other islands or out of state. Data from the Kohala luxury hotels (Community Resources and Datametric Research, 1987) suggest that -- of those workers who had not been living in the Kohala/Kona region a year prior to taking a hotel job there -- 40 percent came from East Hawaii, with another 25 percent from another Hawaiian island. Also, some of the "in- migrants" could in fact be returning Ka`u/South Kona residents.

2.4.5 Off-Site and Total Population Impacts

This section will focus on impacts of the resort operational, as opposed to construction, phase. While construction worker numbers are substantial for initial years, it is expected that (1) they will be temporary, and (2) much of this temporary construction-related population would be absorbed in a base camp on the project site (see Section 2.4.6).

2.4.5.1 Off-Site Population Impacts

Assumptions and Methods: The aspect of off-site population growth which can best be identified is "population supported by jobs" -- the number of workers plus other family/household members. The recent employee survey of current Big Island luxury hotels (ibid., 1987) found that hotel workers who had in-migrated in the previous five years had a relatively low household population per worker (1.46), which will be taken as the appropriate multiplier for future in-migrants. For future resort workers coming from the pool of available labor already in the study area, the multiplier used here is that recommended by DAHI -- i.e., the 1980 Census figure for Ka`u/South Kona of 2.46 people per worker. (The DAHI approach would use the 2.46 figure for all workers; the difference between CRI and DAHI approaches on population and housing will be further discussed in Section 2.4.6.2.1.)

The basic method for calculating population supported by jobs is to (1) multiply the number of required workers in various "in-migrant" or resident "available labor" categories (Tables 30 and 31) by appropriate multipliers discussed above in order to determine population impacts from cumulative development; and then (2) determine the Hawaiian Riviera Resort's share of this cumulative figure by applying the proportion of all jobs from Ka`u resorts that year created by the Hawaiian Riviera, as opposed to Punalu`u (derived from figures in Table 29). Results are given in Table 32.

Results for Hawaiian Riviera: For the initial 1,700 units to open in 1992, Table 32 indicates that islandwide jobs generated by the project would support some 6,100 people, of whom approximately 3,300 would live in the study area. About 63 percent of this population would be associated with workers who had in-migrated during the preceding year or in response to the labor demands generated by the project's initial opening. The remainder would be on-island population which, arguably, might otherwise out-migrate in the absence of new jobs.

By the year 2009, when all the project would be built out except for some single-family residential structures, the Hawaiian Riviera jobs would be supporting an islandwide population of nearly 11,000, of which 7,200 would be living in the Ka`u/South Kona study area. By this time, a majority of the study area population supported would be associated with people who had been in the region at least a year prior to beginning work at the resort.

Table 32
Cumulative Off-Site Population Impacts From Ka'u Resorts

	1992	1994	1995	1996	1997	1998	1999	2000	2001
Available Study Area Labor (1):									
In-Region 1 Year or More	1434	1618	1789	1957	2736	2880	3001	3120	3252
In-Migrants	2448	2464	2479	2494	3328	3365	3393	3414	3431
Study Area Subtotal	**3881**	**4082**	**4268**	**4450**	**6063**	**6245**	**6394**	**6535**	**6683**
--Hawaiian Palace Share (2)	1969	2071	2189	2306	2731	2843	2926	3001	3079
--Ka'u Aina Share (2)	1299	1344	1379	1411	1923	1953	1981	2007	2036
--Total Hawn. Riviera Share	**3267**	**3415**	**3568**	**3717**	**4655**	**4796**	**4906**	**5008**	**5115**
Rest of Island (1)	3291	3237	3219	3239	4427	4445	4441	1391	1339
Island Total	**7173**	**7319**	**7487**	**7690**	**10491**	**10691**	**10835**	**10926**	**11023**
--Hawaiian Palace Share (2)	3472	3545	3680	3820	4464	4606	4692	4757	4825
--Ka'u Aina Share (2)	2586	2573	2561	2579	3382	3394	3407	3390	3375
--Total Hawn. Riviera Share	**6058**	**6118**	**6242**	**6398**	**7846**	**8000**	**8099**	**8147**	**8200**

	2002	2003	2004	2005	2006	2007	2008	2009
Available Study Area Labor (1):								
In-Region 1 Year or More	3765	3905	4039	4181	4294	5089	5239	5340
In-Migrants	4017	4057	4093	4125	4172	4188	4199	4210
Study Area Subtotal	**7782**	**7962**	**8132**	**8306**	**8466**	**9277**	**9438**	**9550**
--Hawaiian Palace Share (2)	3152	3248	3334	3426	3513	3714	3782	3816
--Ka'u Aina Share (2)	2789	2828	2867	2903	2933	3318	3361	3394
--Total Hawn. Riviera Share	**5941**	**6067**	**6201**	**6329**	**6446**	**7032**	**7143**	**7210**
Rest of Island (1)	5123	5130	5125	5092	5055	5297	5288	5200
Island Total	**12906**	**13092**	**13257**	**13398**	**13521**	**14574**	**14726**	**14750**
--Hawaiian Palace Share (2)	4950	5065	5163	5266	5362	5535	5609	5623
--Ka'u Aina Share (2)	4617	4640	4663	4653	4638	5222	5250	5217
--Total Hawn. Riviera Share	**9567**	**9705**	**9825**	**9919**	**10000**	**10758**	**10859**	**10841**

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(1) For Available Study Area Labor and "Rest of Island," population computed by multiplying number of workers in various categories (see Tables 4.12 and 4.13) by 1980 Study Area population/workers ratio of 2.46 (derived from 1980 U.S. Census). For various in-migrant categories, multiplier is 1.46, as determined from Employee Survey figure for "Newcomers" (Community Resources, Inc. and Datametric Research, 1987).

(2) Based on percentages derived from calculating each component's proportion of "TOTAL KA'U RESORTS" numbers in Table 4.11.

NOTE: Figures would include support community residents among "off-site" population.

Cumulative Results: Including the assumed Punalu`u Resort projects, the total Ka`u resort-related employment coming on-line in 1992 would support 7,200 people islandwide, of whom 3,900 would be in the study area. By 2009, the various resorts together would support 14,750 people islandwide, including 9,550 in Ka`u and South Kona.

2.4.5.2 Total Population Impacts

Total Hawaii Island population impacts would include both off-site population and the average daily on-site population discussed in Section 2.4.2 ("average" figures from Table 23). These combined figures are displayed in Table 33.

Results for Hawaiian Riviera: The total islandwide resident population associated with the project -- both on-site and off- site supported by employment -- would reach about 3,800 in 1992 and a near-ultimate 8,200 in 2009. Including the average daily visitor census, the figures would increase to about 5,650 in 1992 and 11,450 in 2009.

Cumulative Results: For the combined Hawaiian Riviera and assumed Punalu`u Resort development, total islandwide resident population would increase from 7,750 in 1992 to about 16,000 in 2009. Including the average daily visitor census, the estimated islandwide population effects would begin at 10,000 in 1992 and reach nearly 21,000 in 2009.

2.4.6 Housing Impacts and Requirements

2.4.6.1 Construction Period

The major period during which construction worker housing would be of concern would be the initial 1990 - 92 construction period, during which it is assumed that the marina, three Hawaiian Riviera Resort hotels, and one Punalu`u Resort hotel would all simultaneously be under construction. During later periods, existing resort condominiums may themselves provide temporary housing for construction workers.

This discussion focuses only on the Hawaiian Riviera Resort construction workers, since it is assumed that Punalu`u Resort or any other major construction project in this time period would have to make its own provisions.

As discussed in Section 2.4.4.1, it is estimated that about 35 percent of these initial on-site construction workforce will come from off-island and require housing. Of the remaining 65 percent available on island, it is currently projected that a little under a fourth (or approximately 15 percent of the total figure) would temporarily relocate to the study area during the work week. The remainder is assumed to commute daily from homes in West Hawaii or the Hilo/Puna area. (As an example, Hawaiian Dredging and Construction Co. is currently busing workers from Hilo to the Hyatt Waikoloa job site in West Hawaii.) These percentages are estimates and should by re-evaluated at the rezoning stage when project phasing and other island construction projects are better predicted.

Based on the above assumptions, it is estimated that approximately 50 percent -- or 600 of the 1,200 daily average construction workforce for the Hawaiian Riviera in the early 1990's -- will require temporary housing. Assuming three workers per unit, an average of approximately 200 units would be required.

It is standard industry practice that when large numbers of worker housing units are required, that a base camp be established by the contractors. Given current estimates for the

Table 33
Cumulative On- and Off-Site Population Impacts From Ka'u Resorts, 1992 - 2009

	1992	1994	1995	1996	1997	1998	1999	2000	2001
HAWAIIAN PALACE									
Total Resident (includes on-site): (1)	3472	3580	3765	3956	4649	4846	4973	5072	5175
Average Daily Visitors: (2)	1052	1064	1086	1108	1308	1331	1345	1356	1367
Total Population (including visitors):	**4524**	**4644**	**4851**	**5064**	**5957**	**6177**	**6318**	**6428**	**6542**

	2002	2003	2004	2005	2006	2007	2008	2009
Total Resident (includes on-site): (1)	5348	5511	5649	5801	5847	6154	6258	6289
Average Daily Visitors: (2)	1386	1404	1420	1436	1453	1466	1476	1478
Total Population (including visitors):	**6734**	**6915**	**7069**	**7237**	**7300**	**7620**	**7734**	**7767**

	1992	1994	1995	1996	1997	1998	1999	2000	2001
KA'U AINA									
Total Resident (includes on-site): (1)	3156	3091	3027	3050	3861	3880	3902	3837	3774
Average Daily Visitors: (2)	758	765	772	773	1004	1004	1006	1013	1021
Total Population (including visitors):	**3914**	**3856**	**3799**	**3823**	**4865**	**4884**	**4908**	**4850**	**4795**

	2002	2003	2004	2005	2006	2007	2008	2009
Total Resident (includes on-site): (1)	5035	5078	5121	5069	5012	5618	5668	5545
Average Daily Visitors: (2)	1482	1485	1487	1495	1504	1700	1703	1718
Total Population (including visitors):	**6517**	**6563**	**6608**	**6564**	**6516**	**7318**	**7371**	**7263**

(CONTINUED)

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(1) Includes Island Totals from Table 32 and Average Resort Residents from Table 23

(2) From Table 23

Table 33
Cumulative On- and Off-Site Population Impacts From Ka'u Resorts, 1992 - 2009
(Continued)

	1992	1994	1995	1996	1997	1998	1999	2000	2001
TOTAL HAWAIIAN RIVIERA									
Total Resident (includes on-site): (1)	6628	6670	6793	7005	8510	8726	8875	8909	8949
Average Daily Visitors: (2)	1810	1829	1858	1881	2311	2335	2350	2369	2388
Total Population (including visitors):	**8438**	**8499**	**8651**	**8886**	**10821**	**11061**	**11225**	**11278**	**11337**

	2002	2003	2004	2005	2006	2007	2008	2009
Total Resident (includes on-site): (1)	10383	10588	10768	10870	10955	11773	11926	11835
Average Daily Visitors: (2)	2868	2889	2907	2932	2956	3166	3179	3196
Total Population (including visitors):	**13251**	**13477**	**13675**	**13802**	**13911**	**14939**	**15105**	**15031**

	1992	1994	1995	1996	1997	1998	1999	2000	2001
TOTAL KA'U RESORTS (Including Punalu'u)									
Total Resident (includes on-site): (1)	7758	7918	8099	8373	11248	11525	11733	11826	11926
Average Daily Visitors: (2)	2239	2286	2328	2364	3329	3365	3394	3426	3458
Total Population (including visitors):	**9997**	**10204**	**10427**	**10737**	**14577**	**14890**	**15127**	**15252**	**15384**

	2002	2003	2004	2005	2006	2007	2008	2009
Total Resident (includes on-site): (1)	13891	14161	14401	14567	14710	15838	16059	16026
Average Daily Visitors: (2)	4135	4170	4201	4239	4277	4580	4606	4637
Total Population (including visitors):	**18026**	**18331**	**18602**	**18806**	**18987**	**20418**	**20665**	**20663**

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(1) Includes Island Totals from Table 32 and Average Resort Residents from Table 23

(2) From Table 23

Hawaiian Riviera Resort, and given the lack of other available housing supply in the Ka`u area, it is likely that such a base camp would be required at the Hawaiian Riviera.

2.4.6.2 Operational Period

2.4.6.2.1 Timing, Attribution, and Implications of Impacts

Population and housing impacts of economic development shift over time, but little research has been done to track the nature of these shifts. For example, it is not known to what extent young, single in-migrants to resort areas settle down and raise families (thus eventually increasing population and housing effects) vs. moving away to be replaced by other young singles.

Most past EIS's have not addressed the timing question, but have calculated resort-related housing impacts in a way which implicitly assumes a short-term timeframe. There has been a traditional EIS distinction between the assumed household sizes and household formation rates of in-migrants vs. on-island available labor. It has often been assumed that some new resort workers would come from other hotels or workplaces in the study area ("regional turnover"). This would suggest that some needs for in-migrant workers and consequent housing impacts are displaced to these other workplaces, but such displaced impacts have not always been addressed.

The DAHI approach recommended by the County is implicitly long-term in nature. It assumes that all workers will have characteristics similar to the current study area population (i.e., no recognition of differences between in-migrants and current available labor). More significantly, it assumes that new housing units will be required for all employees supported by new resorts, whether or not these employees are already on-island and are thus already housed.

The housing impact analysis by CRI addresses the timing issue in the following way:

- The DAHI approach is utilized to present a picture of theoretical eventual impacts, perhaps a generation or two from now ("theoretical" because it is questionable whether 100 percent of currently available on-island labor will ever form totally new households).

- For more immediate housing impacts, CRI utilizes a procedure similar to that in past EIS's -- i.e., attributing different types of impacts to in-migrants vs. those already in the study area -- except that "regional turnover" is not ignored as in the past (i.e., if someone leaves another job in Ka`u or South Kona to work at the Hawaiian Riviera, that person's replacement and his/her housing need is counted as a Hawaiian Riviera impact).

The characteristics attributed to future in-migrants in this process are those discovered for actual recent in-migrants (people who had moved to the Big Island in the past five years) in the survey of Kohala luxury resort employees (Community Resources and Datametric Research, 1987).

The application of these figures represents an implicit major social impact of resort development in Ka`u. The survey found that the number of wage-earners per resort worker household in 1987 (2.5 overall and 2.8 for recent in-migrants) was significantly higher than the average figure suggested by 1980 Census data for West Hawaii (1.43 workers per household). (For the Ka`u/South Kona study area, the 1980 Census figure would be just 1.30 workers per household.)

It will be a point of debate whether these differences mean that resort workers must have more workers per household to survive, or whether they are taking an opportunity to gain extra incomes for the household. (It may be noted that the lower Census average figures would include retirees or others who are not strongly economically motivated, while the survey figures are based on actual working households.)

At any rate, if -- as will be assumed here -- in-migrants have more workers per household than current study area residents, they may also have more income than current residents and could somewhat bid up the cost of housing and other goods. (The likelihood of this would be largely determined by the future of the sugar plantation, since a household with one plantation worker and one or two resort workers would be more likely to have a higher and not a lower income.) On the other hand, in-migrants will require far fewer housing units per worker than will be the case for longtime residents, thereby reducing housing impacts.

For longtime residents, it is assumed that new employment opportunities for most will simply mean that more people in existing households will work -- although the average number of workers per household will probably still, as in Kohala, remain somewhat below the average for newcomers. However, a certain portion of longtime residents will form new households. While it is assumed that these new households will have the characteristics of present households (i.e., an average of just 1.30 workers) and thus generate more housing impact per worker than in-migrants, the alternative prospect is that future household life for current study area residents will be at once more fast- paced and more prosperous than at present.

2.4.6.2.2 Islandwide and Study Area Housing Impacts

Table 34 provides specific assumptions and results of the calculations for assessing housing impacts related to people supported by new jobs (whether these jobs are on-site or off-site).

Results for Hawaiian Riviera: The initial 1992 operations are projected to generate immediate demand for 690 housing units islandwide, including 560 in the Ka`u/South Kona study area. The theoretical eventual housing impact of the 1992 resort opening -- if and when all on-island workers move out of their current households and start new households with the same low number of workers per household currently observed in the study area -- would be some 2,300 units islandwide. About five out of every eight of these would theoretically be located in the Ka`u/South Kona study area.

By the year 2009, the sum of the "immediate" housing impacts to date would be about 1,100 units islandwide, 80 percent of them in the study area. (This is something of an underestimate, since delayed housing impact would by now be felt from the initial resort workers -- e.g., young previously single people starting up families and generating more housing demand. However, as earlier noted, there is little data to indicate at what rate this will actually happen.) The theoretical eventual housing impact generated by all direct, indirect, and induced employment by 2009 would be 4,050 units islandwide, 72 percent of which would theoretically be in the study area.

Cumulative Results: Including the assumed Punalu`u Resort development, the immediate demand for new housing units as of 1992 would be a little over 800 units islandwide, 80 percent of them in the study area. This would theoretically increase over a generation to nearly 2,800 units islandwide.

The sum of "immediate" impacts through the year 2009 would about 1,500 units

Table 34
Cumulative Off-Site Housing Impacts From Ka'u Resorts

	1992	1994	1995	1996	1997	1998	1999	2000	2001
IMMEDIATE									
Available Study Area Labor:									
In-Region 1 Year or More (1)	67	76	84	92	128	135	141	146	152
In-Migrants (2)	597	601	605	608	812	821	827	833	837
Study Area Subtotal	**664**	**677**	**688**	**700**	**940**	**956**	**968**	**979**	**989**
--Hawaiian Palace Share (3)	337	343	353	363	423	435	443	450	456
--Ka'u Aina Share (3)	222	223	222	222	298	299	300	301	301
--Total Hawn. Riviera Share	**559**	**566**	**575**	**585**	**722**	**734**	**743**	**750**	**757**
Rest of Island (1)	154	152	151	152	208	208	208	206	203
Islandwide Total	**818**	**829**	**839**	**852**	**1147**	**1164**	**1176**	**1185**	**1193**
--Hawaiian Palace Share (3)	396	402	412	423	488	501	509	516	522
--Ka'u Aina Share (3)	295	291	287	286	370	370	370	368	365
--Total Hawn. Riviera Share	**691**	**693**	**699**	**709**	**858**	**871**	**879**	**884**	**887**
THEORETICAL EVENTUAL (4)									
Study Area	**1737**	**1803**	**1864**	**1924**	**2607**	**2672**	**2724**	**2773**	**2823**
--Hawaiian Palace Share (3)	881	915	956	997	1174	1216	1246	1273	1301
--Ka'u Aina Share (3)	581	594	602	610	827	836	844	852	860
--Total Hawn. Riviera Share	**1462**	**1508**	**1558**	**1607**	**2001**	**2052**	**2090**	**2125**	**2161**
Rest of Island	1029	1012	1006	1012	1384	1389	1388	1372	1356
Islandwide Total	**2765**	**2815**	**2870**	**2937**	**3991**	**4061**	**4112**	**4145**	**4179**
--Hawaiian Palace Share (3)	1338	1364	1411	1459	1698	1750	1781	1805	1829
--Ka'u Aina Share (3)	998	990	982	985	1286	1289	1293	1286	1279
--Total Hawn. Riviera Share	**2336**	**2353**	**2393**	**2444**	**2985**	**3039**	**3074**	**3091**	**3109**

(CONTINUED)

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(1) Population divided by 1980 Study Area average household size of 3.20, as recommended by DAHI (1986), times assumed 15 percent household formation rate.

(2) Population divided by average in-migrant household size of 4.10, as determined from Employee Survey figure for "Newcomers" (Community Resources, Inc. and Datametric Research, 1987). For In-Migrants, a 100 percent household formation rate is assumed.

(3) Based on percentages derived from calculating each component's proportion of "TOTAL KA'U RESORTS" numbers in Table 29

(4) Based on percentages suggested by Table 32

Table 34
Cumulative Off-Site Housing Impacts From Ka'u Resorts
(Continued)

	2002	2003	2004	2005	2006	2007	2008	2009
IMMEDIATE								
Available Study Area Labor:								
In-Region 1 Year or More (1)	177	183	189	196	201	239	246	250
In-Migrants (2)	980	990	998	1006	1018	1021	1024	1027
Study Area Subtotal	**1156**	**1173**	**1188**	**1202**	**1219**	**1260**	**1270**	**1277**
--Hawaiian Palace Share (3)	468	478	487	496	506	504	509	510
--Ka'u Aina Share (3)	414	117	419	420	422	451	452	454
--Total Hawn. Riviera Share	**882**	**895**	**906**	**916**	**928**	**955**	**961**	**964**
Rest of Island (1)	240	240	240	239	237	248	248	244
Islandwide Total	**1396**	**1413**	**1428**	**1441**	**1456**	**1508**	**1518**	**1521**
--Hawaiian Palace Share (3)	535	547	556	566	577	573	578	580
--Ka'u Aina Share (3)	499	501	502	500	499	540	541	538
--Total Hawn. Riviera Share	**1035**	**1047**	**1058**	**1067**	**1077**	**1113**	**1119**	**1118**
THEORETICAL EVENTUAL (4)								
Study Area	**3292**	**3357**	**3417**	**3479**	**3539**	**3795**	**3848**	**3886**
--Hawaiian Palace Share (3)	1333	1369	1401	1435	1468	1519	1542	1553
--Ka'u Aina Share (3)	1180	1193	1205	1216	1226	1357	1370	1381
--Total Hawn. Riviera Share	**2513**	**2562**	**2606**	**2651**	**2695**	**2877**	**2912**	**2934**
Rest of Island	1601	1603	1602	1591	1580	1655	1652	1625
Islandwide Total	**4893**	**4960**	**5019**	**5070**	**5118**	**5451**	**5501**	**5511**
--Hawaiian Palace Share (3)	1877	1919	1955	1993	2030	2070	2095	2101
--Ka'u Aina Share (3)	1750	1758	1765	1761	1756	1953	1961	1949
--Total Hawn. Riviera Share	**3627**	**3677**	**3720**	**3754**	**3785**	**4024**	**4057**	**4050**

(1) Population divided by 1980 Study Area average household size of 3.20, as recommended by DAHI (1986), times assumed 15 percent household formation rate.

(2) Population divided by average in-migrant household size of 4.10, as determined from Employee Survey figure for "Newcomers" (Community Resources, Inc. and Datametric Research, 1987). For In-Migrants, a 100 percent household formation rate is assumed.

(3) Based on percentages derived from calculating each component's proportion of "TOTAL KA'U RESORTS" numbers in Table 29

(4) Based on percentages suggested by Table 32

islandwide, 84 percent of which would be in the study area. The theoretical eventual housing impact of all employment associated with all Ka`u resorts would ultimately be 5,500 units islandwide, 3,900 of them in the study area.

2.4.6.2.3 Immediate Demand by On-Site Workers and Affordability

For EIS purposes, housing demand by on-site Hawaiian Riviera workers alone is estimated at two levels: (1) total number of new units demanded, and (2) approximate number of "assisted" units for workers whose household incomes indicate difficulty in ability to afford market housing. (NOTE: The analysis is limited to more immediate demand, since the DAHI methodology does not extend to on-site workers.)

Required Numbers of Units: For EIS purposes, housing demand by on-site Hawaiian Riviera workers alone is estimated at two levels: (1) total number of new units demanded, and (2) approximate number of "assisted" units for workers whose household incomes indicate difficulty in ability to afford market housing. (NOTE: The analysis is limited to more immediate demand, since the DAHI methodology does not extend to on-site workers.) Numbers are displayed in tabular form for both Hawaiian Palace and Ka`u Aina as well as resort totals. On-site requirements and affordability are limited to Hawaiian Riviera Resort and do not attempt to describe the demand of other area projects. Table 35 provides both methods and results. Basically, the number of study area housing units required is multiplied by the percentage of study area jobs attributed to the Hawaiian Riviera Resort.

For the year 1992, the largest single demand year, a total of about 500 units would be required for the on-site workers. As depicted in Table 35, by the year 2009, the total resort is estimated to generate an on-site direct demand for about 800 units.

A common standard for gauging ability to afford for-purchase market housing is whether household incomes reach 80 percent of the median in that area. Based on the recent survey of Big Island luxury hotel employees (Community Resources and Datametric Research, 1987), between 27 and 34 percent of worker households may be expected to make less than $21,300 a year, which is the lower income limit established by the federal Department of Housing and Urban Development for a Hawaii County family of four (Hawaii Housing Authority, 1987). The 27 percent figure represents newcomer households, while 34 percent was the area average. For this analysis, it is assumed that the 27 percent proportion will most accurately reflect the early resort development years due to the large in-migration required in that time period. However, as the area matures, the rate will approach 34 percent because more of the workforce will come from the study area.

As indicated in Table 35, the currently-estimated number of such households -- i.e., those in need of some form of assistance to purchase housing -- would be 134 in 1992, with a total of 272 required by 2009.

Based on predicted employee household incomes, 73 percent of the on-site resort workers may be expected to afford units priced above $70,000 (assuming an adjustable interest rate of 7.5 percent and 30 percent of income available for housing), with 65 percent being able to afford housing priced above $93,000. Affordability as a function of interest rates is depicted in Table 36. This same 73 percent would alternatively be able to afford rents in excess of $525/month. Due to the temporal nature of interest rates and the fact that many people rent, for the purpose of this analysis it is assumed that households earning less than 80% of the median income will be in need of housing assistance. Therefore, Table 36 on the following page is provided to illustrate the temporal nature of interest rates and the problems associated with using a purchase-price standard of affordability.

Table 35
Cumulative Housing Impacts From On-Site Hawaiian Riviera Resort Workers

	1992	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
OVERALL STUDY AREA IMPACT (1)																	
--Total Hawn. Riviera	**559**	**566**	**575**	**585**	**722**	**734**	**734**	**750**	**757**	**882**	**895**	**906**	**916**	**928**	**955**	**961**	**964**
--Hawaiian Palace	337	343	353	363	423	435	443	450	456	468	478	487	496	506	504	509	510
--Ka'u Aina	222	223	222	222	298	299	300	301	301	414	417	419	420	422	451	452	451
ATTRIBUTED TO ON-SITE WORKERS																	
Percentage of Overall From On-Site Workers Alone (2)	89.0%	89.0%	88.5%	88.0%	87.0%	87.0%	86.5%	86.4%	86.0%	85.0%	85.0%	84.5%	84.0%	84.0%	83.0%	83.0%	82.5%
--Total Hawn. Riviera	**498**	**504**	**509**	**515**	**627**	**639**	**643**	**649**	**651**	**750**	**761**	**766**	**769**	**780**	**793**	**798**	**795**
--Hawaiian Palace	300	305	312	319	368	378	383	389	392	398	406	412	417	425	418	422	421
--Ka'u Aina	198	198	196	195	259	260	260	260	259	352	354	354	353	354	374	375	375
BELOW-MARKET UNITS REQUIRED FOR ON-SITE WORKERS																	
Percentage of Households Earning Less than 80% of Big Island Median Income (3)	27%	27%	27%	27%	29%	29%	29%	29%	31%	31%	31%	31%	34%	34%	34%	34%	34%
--Total Hawn. Riviera	**134**	**136**	**137**	**139**	**182**	**185**	**186**	**188**	**202**	**232**	**236**	**237**	**262**	**265**	**270**	**271**	**272**
--Hawaiian Palace	81	82	84	86	107	110	111	113	122	123	126	128	142	145	142	144	144
--Ka'u Aina	53	54	53	53	75	75	75	75	80	109	110	110	120	121	127	128	128

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(1) From Table 34

(2) Based on proportion of all new study area employment attributable to on-site workers alone (Table 29).

(3) Rationale for percentages explained in text.

The 134 worker households making less than 80 percent of the median in 1992 will find it extremely difficult to purchase traditional housing due to the lack of this housing in the area, over-extension of household credit, and lack of savings for down payment. As discussed later, some of these workers may locate in substandard housing located in subdivisions near the project. Any rentals supplied to this group would need to be in the range of $300 to $525 per month.

Characteristics and Location of Demanded Units: In order to be in keeping with the character of the Ka`u area, the predominant housing type should be single-family, with some multi-family and/or dormitory units for couples and single workers. As noted in Table 34, it is expected that in-migrants will have an average household size of 4.1, while new households created from available study labor sources will have a slightly lower average size of 3.2. This would indicate a need for a preponderance of two-bedroom units with some one- and three-bedroom units. Rental studios would be a viable option for some singles who do not wish to house-share.

With over 20,000 available vacant lots near the resort, natural market forces -- in the absence of any mitigation efforts by the Hawaiian Riviera Resort developers -- would direct housing construction to existing subdivisions. These new units would vary in quality and price, as does the current housing stock. Those units having basic infrastructure (electricity and phone) would command the highest price. However, even in these lots, water is by catchment and sewage is disposed of through individual septic systems.

Housing development in the more remote and wooded areas is likely to be substandard. This pattern of development is occurring at the Hawaiian Ocean View Estates and Hawaiian Ranchos subdivisions. One-acre lots start at $2,500 without electricity and go up to $15,000 with electricity near the Mamalahoa Highway. House prices range from less than $20,000 for a substandard dwelling to over $250,000. Many lot owners will provide seller financing.

New worker housing created for existing area residents is likely to locate around existing communities. These units will take on the single-family characteristics of the neighborhood. According to area Realtors, there are a few available vacant lots in Pahala and Na`alehu, but the numbers are insignificant compared to the number of lots in adjacent subdivisions. A precise inventory should be conducted at rezoning, with attention to price and availability of infrastructure.

At this time, the developer intends to provide a single- family support community of 800 single-family residential houselots. An initial 200 multi-family units, later to be converted to condominium use, is also anticipated for the Ka`u Aina portion of the resort area. These developments, to the extent they are price competitive and timely, could substantially reduce development in the substandard subdivision lots.

2.5.0 Socio-Cultural Impacts

2.5.1 Introductory Comments

This section addresses social impacts which do not lend themselves to numerical analysis -- impacts such as resident concerns about the project proposal itself, lifestyle changes from resort development, and effects on recreational activities.

Two basic methods have been used to produce this socio- cultural impact assessment:

(1) extensive community interviews conducted by socio-economic consultant Community Resources, Inc. (CRI) and its subcontractor,

Earthplan; and

(2) a review of information about historical impacts of resort development in other parts of Hawaii or the world.

Of the four following sub-sections -- on resident issues and concerns; recreation; current significance of historic sites; Miloli`i; and general social change -- the initial sub-sections will be based mostly on community interviews, while the extensive discussion of social change will be based primarily on evidence from other areas in which resort development has occurred.

2.5.2 Resident Issues and Concerns

2.5.2.1 Method

In the course of preparing this social impact assessment, informal interviews were held with people from the community to identify preliminary community issues related to the proposed Hawaiian Riviera Resort, as well as to supplement the published information on Ka`u with subjective resident observations.

Approximately 90 people were interviewed during May 1987, of whom over 75 actually resided or had a business in Ka`u or the Miloli`i area. (See list in Table 37) Interviewers included a multi-ethnic team of four people from socio-economic consultants Community Resources, Inc. and Earthplan.

With the help of community informants, interviewers identified and contacted community members who had knowledge of the area and/or could potentially feel affected. At the onset of the interviews, an effort was made to contact representatives of five community segments:

(1) Ka`u residents east of South Point, including townspeople of Na`alehu, Waiohinu, and Pahala;
(2) Ka`u residents west of South Point, including residents of Hawaiian Ocean View Estates, Hawaiian Ranchos, and other subdivisions;
(3) Leaders of the Miloli`i fishing village in South Kona;
(4) Organization which may have islandwide, regional, or site-specific environmental and cultural interests; and
(5) Shoreline and boat fishermen who may use nearby waters or have knowledge of other recreational use of the area.

Each person was informed that the information they provided would be summarized in the EIS and that individual conversations would remain confidential. Most people were presented with maps and project information as of May 1987. Almost all of the interviews were one-to-one meetings, with a handful of people choosing instead to meet with the interviewer in a small group.

Table 36
Maximum Housing Purchase Price

(Interest Rate vs. Income)

Monthly Income	Interest Rates 7.25%	8.25%	9.50%	10.00%	10.50%
$1,000	$36,647	$33,277	$29,732	$28,488	$27,330
$1,125	$43,519	$39,517	$35,306	$33,829	$32,455
$1,375	$57,262	$51,996	$46,456	$44,512	$42,703
$1,625	$71,004	$64,474	$57,605	$55,195	$52,952
$1,875	$84,747	$76,953	$68,754	$65,878	$63,201
$2,250	$105,361	$95,672	$85,479	$81,902	$78,574
$2,750	$132,847	$120,630	$107,777	$103,268	$99,072
$3,250	$160,332	$145,587	$130,076	$124,634	$119,570
$3,750	$187,818	$170,545	$152,375	$145,999	$140,067

NOTE: Table calculations based on 30 percent of income available for housing, $100 per month in additional housing expenses, and 30-year loan term. Standard amortization formula used for present value calculation.

Table 37: List of People Interviewed

(Note: Those interviewed provided their comments as individuals and not as representatives of their organizations. Organizational affiliations are provided only to indicate some of the networks and interests of those interviewed.)

Person	Affiliation(s)
Debbie Abreu	President, Na Ala Hele
Joseph Adviento	Agricultural lessee of Hawaiian Homestead land in Panaewa
Janna Amaral	Na`alehu resident
Kuniyoshi Arakaki	Second Vice Chair, Unit 1102, ILWU Police Commissioner
Kathy Arnold	Past President, Pahala Pre-School
Rosita Avenue	Teacher, Ka`u High School
Jose Basque	Counsellor, Ka`u High School
Chris Bengay	Ka Ohana o Kalae Punalu`u Preservation
Peterohila Bilog	Filipino Community Club Na`alehu Filipino Senior Citizens Club
Carl Bredhoff	Manager, Kahuku Ranch President, Ka`u Soil and Water Conservation District
Beverly Byouk	Chair, Historic Sites Committee, Hawaiian Civic Club Board of Directors, Hawaiian Ocean View Community Association Broker-In-Charge Bradley Properties
Anna Cariaga	President, Hawaiian Civic Club of Ka`u Ka`u Kamaaina Fishermen's Association Energy Educator for Hawaii County Economic Opportunity Council
Dante Carpenter	Mayor, Hawaii County Former Ka`u resident
Genevieve Chong	Head Start Teacher/Supervisor, Hawaii County Economic Opportunity Council
Felix Cruz	Pahala resident

Table 37: List of People Interviewed (continued)

Richard Cushnie	President, Ka`u Agribusiness
Roy Damrom	Scuba instructor
Jack Delaney	President, Hawaiian Ranchos Community Association
Dottie Delaney	Resident Hawaiian Ranchos
Bud Doty	Retired Pahala Plantation administrator
Alvin Enos	Firefighter in Ka`u Fisherman
Leina`ala Enos	Hawaiian Civic Club Na`alehu Community Club Secretary, Ka`u High and Pahala Parent Teacher Student Association
Sharon Fisher	Office manager, Hawaiian Ocean View Community Association
Anthony Freeman	Manager, Ocean View General Store Hawaiian Ranchos resident
Bradley Freeman	Manager, Ocean View General Store Hawaiian Ranchos resident
Judy Garcia	Manager, Blue Video (Ocean View business)
Mildred Galimba	Ka`u Meat Market
Robert Gomes	Police officer in Ka`u
Letitia Gonzaga	Treasurer, Filipino Catholic Club Filipino Community Club
Sam Grace	Bus driver for Miloli`i students
Pele Hanoa	Ka Ohana o Kalae Punalu`u Preservation
Nelson Ho	Regional Conservation Chair, Sierra Club
Bill Hodgins	Honomalino resident
Mary Hoffman	Treasurer and Membership Chair, Hawaiian Ocean View Community Association
Bob Hogan	Owner, Honokohau Boat Works

Table 37: List of People Interviewed (Continued)

Carol Hogan	Editor, Boating Hawaii Ocean sports writer, Honolulu Advertiser
Steve Holmes	State Conservation Chair, Sierra Club
Tom Ishimaru	Planning Commissioner
Gilbert Kahele	Pa`a Pono Miloli`i, Inc.
Earl Kameyer	Ocean View resident
Julia Kaupu	Miloli`i resident
John Kekahuna	Agricultural lessee of Hawaiian Homestead land in Maku`u
Barbara Koi	Na`alehu Community Club Roy's Fishery
Haunani Kuahuia	Miloli`i resident
Stephen Kuahuia	Miloli`i resident
Andrew Levin	Representative, Hawaii State Legislature
Kinney Louie	Board of Directors, Hilo Casting Club
Franco Longakit	Chair, Unit 1102, ILWU
Linda Lyerly	Ka Ohana o Kalae Punalu`u Preservation
Henry Makuakane	Firefighter in Ka`u Part time-hunter
H. C. McAdams	Owner, Ka`u Drive In
Jane Mochizuki	Recording Secretary, Ka`u Office, Public Welfare Division, Hawaii State Department of Human Services
Junior Molcilio	Ranch foreman, Kahuku Ranch Kona Archery Club
Irvin Molcilio	Resident, Kahuku Ranch
Masakazu Nagata	Lilly's Stand

Table 37: List of People Interviewed (Continued)

Albert Nakano	County Safety Coordinator Waiohinu resident
Ronald Napeahi	Agricultural lessee of Hawaiian Homestead land in Panaewa
Edwin Nobriga	Captain, Ka`u Police District
Roy Ogata	Hilo Casting Club
Steven Perkins	Honolulu Painting Company, Ltd., Kona office
Bill Perry	Ocean View resident Petroglyph artist
Jamie Perry	Ocean View resident Petroglyph artist
Ann Pettingill	Principal broker, H. McKee Realty Member, Ranchos Community Association
Sally Rice	Vice President, Honomalino Management, Inc.
Chickie Ritchie	Ocean View resident
Raymond Rowe	Agricultural lessee of Hawaiian Homestead land in Panaewa
Janet Rychener	President, Ka`u High and Pahala Elementary Parent Teacher Student Association Lay leader, United Methodist Church Na`alehu Community Club
Charles Sakamoto	Water Commissioner Former Chair, Unit 1102, ILWU
Kimiaki Sakata	Na`alehu resident
Takeichi Sasaki	Ka`u Meat Market Hui o Kokua o Ka`u Member, Lions Club
Juan Saladino	Secretary, Na`alehu Filipino Senior Citizens Club
Alfredo Salvador	Vice President, Na`alehu Filipino Senior Citizens Club
Richard Schultz	Manager, Daleico Ranch

Table 37: List of People Interviewed (Continued)

Florence Schultz	Daleico Ranch
Francis Self	Vice President, Hawaiian Ocean View Community Association
Joseph Serrao	Cattle rancher Former president, Na`alehu Community Club
Takumi Shirokawa	Shirokawa Motel Member, Lions Club
Lee Shirokawa	Shirokawa Motel
Skip Sigler	Ocean View resident
Jim Simpson	Chair, Citizens Action Group of Ka`u Vice President, Hawaii Island District PTA Na`alehu teacher
Carole Swangel	Board of Directors and Activity Chair, Hawaiian Ocean View Community Association
Helen Tayamen	Secretary, Unit 1102, ILWU Ka`u Civic Club
Charles Toguchi	Na`alehu Shopping Center
Tom Toguchi	Owner, Na`alehu Shopping Center Ka Ohana o Kalae Punalu`u Preservation
John Vincent	Agricultural lessee of Hawaiian Homestead land in Panaewa
Cora Walsh	Ka Ohana o Kalae Punalu`u Preservation
Ed Walsh and Doug Walsh	Ka Ohana o Kalae Punalu`u Preservation
Roy Watanabe	Administrator, Social Service Section, Public Welfare Division, Hawaii Island Branch, Hawaii State Department of Human Services
David Wells	President, Hawaiian Ocean View Community Association
Ellen Whip	Ocean View resident

Table 37: List of People Interviewed (Continued)

Dennis Wong	Ka`u shoreline fisherman
David Wrigley	Chief, Hawaii County Mental Health Community Center, Hawaii State Department of Health
Harold Yoshida	Postmaster, Pahala Secretary, Hui o Kokua o Ka`u
Kenneth Yoshida	Na`alehu resident
Elva Youngberg	Ocean View resident

2.5.2.2 Community Awareness of the Project Site

At the time of the interviews, most people interviewed had little or no knowledge of the proposed Hawaiian Riviera Resort, and most still believed that the project site was owned by Kahuku Ranch. People were aware that access to the site had been restricted for many years.

About half of those interviewed had actually visited the site at least once, although only a small portion of these people had visited the site on an ongoing basis. Most of these few had permission from Kahuku Ranch to fish, hunt, or camp on the project site, but a very few admitted to trespassing.

Based on information from the community, the site is best known and valued for its fishing grounds and pocket beaches. Few people said they visited the site for its archaeological resources. Goat hunting occurs inland. Familiar land features identified by community informants are depicted in Figure 4.18.

2.5.2.3 General Reactions to the Project

This section attempts to summarize the most important or frequently-encountered issues. Note, however, that this summary provides a "snapshot" of community reactions at a given point in time. The interviews were conducted early in the EIS process when few people knew of the project. Their input was therefore based on initial reactions to highly preliminary information.

Because the interviews were conducted for issue identification only, no attempt was made to quantify the responses.

Table 38 summarizes specific concerns, indicates the rough frequency and source of these concerns, and identifies suggestions made by community informants.

Major aspects of attitude toward the project proposal included:

(1) People were generally open to the project because of an often-expressed desire for increased regional employment and business opportunities. The most frequent recommendation was for job training of some kind for local residents so that "newcomers do not get all the good jobs." Section 5.2.4 further explores concerns related to jobs.

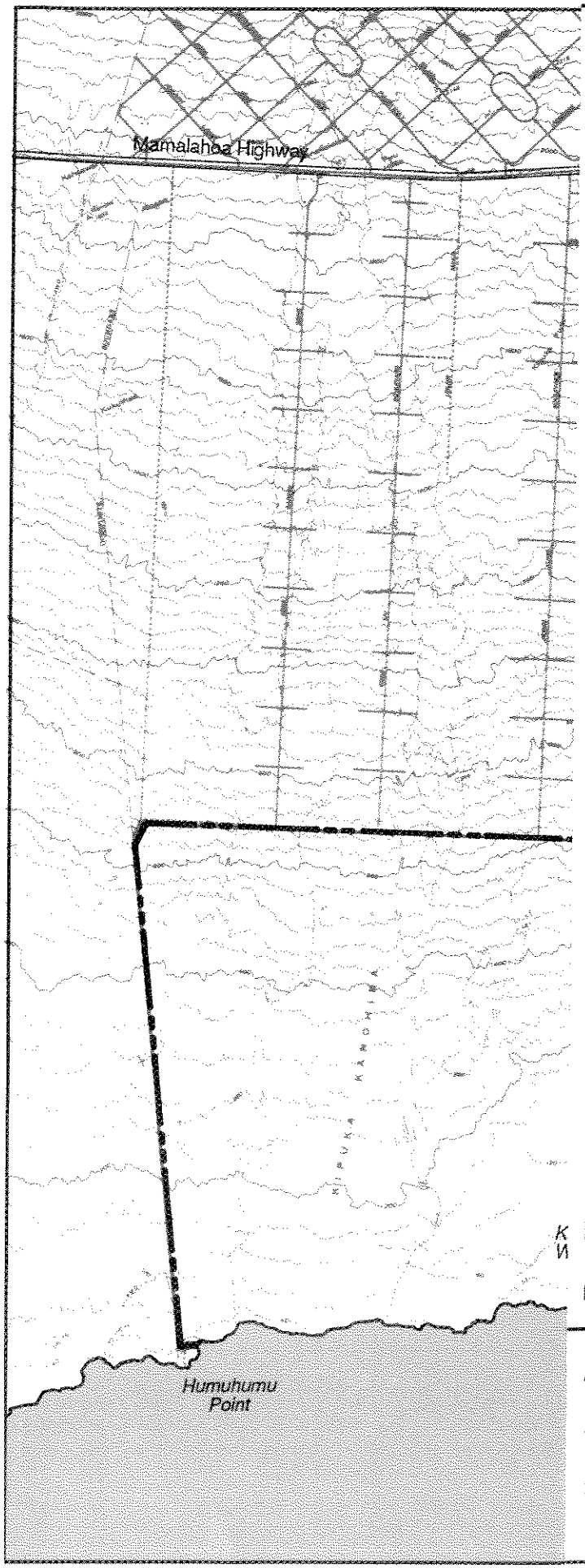

Figure 4.18

FAMILIAR LAND FEATURES ON THE HAWAIIAN RIVIERA RESORT PROPERTY

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

4000 2000 0 4000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

(2) Except for a few people who opposed any resort uses in Ka`u, no one felt that resort (as opposed to other) uses on this particular site would be inappropriate.

(3) Reactions to the proposed marina tended to be favorable, though mixed as to the public use of marina facilities. Some people felt the marina should contain a public boat ramp and other facilities. Others felt that general public accesses to public facilities should be separate from resort guest/resident access because of potential cultural incompatibilities. About five people expressed intense concern about the ecological impacts of building a marina.

(4) Other specific concerns about project components (further discussed in Section 2.5.2.6) included questions about the marina, project feasibility, support community, and airfield.

(5) Given the area's isolation and rural quality, people often mentioned a desire to "ease in" the project into current infrastructure systems to minimize disruption. There were also various suggestions to find ways to share mproved facilities with existing neighboring communities.

(6) The "opening up" of currently exclusive shoreline was often mentioned as another potential community benefit. Many people believed the project site's ocean frontage would be a welcome recreational resource for local people. Informants wanted to see access along the shoreline, as well as mauka-makai access. Further discussion on these concerns is provide in Section 2.5.3.

(7) People were generally aware of the site's principal archaeological resources, such as petroglyphs, and recommended protection of significant sites. Their concerns and awareness levels are further discussed in Section 2.5.4.

2.5.2.4 Employment and Business Potential

The project's potential for job creation drew by far the most positive reactions from those interviewed. Almost all of those interviewed felt that Ka`u and Miloli`i badly need jobs and business activity to survive, particularly in light of uncertainty about the future of sugar in Ka`u.

2.5.2.4.1 Characteristics of People Favoring Job Potential

In a very general sense, there were two types of people who favored the job-creating potential of the Hawaiian Riviera Resort:

- People who had previously taken a position favoring other Ka`u job-generating developments (Punalu`u Resort and space launch facility) also expressed support for the Hawaiian Riviera Resort for similar reasons. For them, provision of new jobs is an important cause. They believe Ka`u needs economic activity and jobs so that young people can remain in Ka`u rather than move away.

- Some opponents of these other proposed developments expressed tentative support for the Hawaiian Riviera. They said they, too, want new jobs in the area but felt there had been other and overriding concerns about the other two proposals which did not apply to the Hawaiian Riviera project. Some opponents of the other projects also indicated that they are less concerned about (and/or more favorable toward) the Hawaiian Riviera project because the project site is far from the East Ka`u population centers.

For a few informants, the perceived negative impacts of Hawaiian Riviera Resort development would outweigh positive economic effects. Generally, these people believed that Ka`u residents live in the area because of its rural character and isolation, and they felt they could survive on subsistence fishing and hunting with little need of economic development.

2.5.2.4.2 Concerns About Nature and Availability of Jobs

While people were generally in favor of jobs and increased business activity, they also expressed the following concerns:

- Ka`u residents have become suspicious of job-promising developments because they have not yet actually seen results.

- Some people fear that most jobs will ultimately go to people outside the area rather than current residents.

- Because Ka`u residents have few in-region opportunities to work in the resort industry, some fear they will not be qualified to work in new Ka`u resorts. However, most people felt that service work would match well with residents' skills and aptitudes.

- As in other rural Hawaii communities, there is a general apprehension that the higher-paying resort management jobs will go to outsiders, leaving local people with more menial and/or lower-paying jobs.

- However, very few people criticized the service characteristics of resort employment.

2.5.2.4.3 Desire for Job Training

Virtually everyone who favored the project's job-generating aspect (i.e., the vast majority of those interviewed) felt that aforementioned concerns could be addressed through effective job training -- both internally in the hotels and through general community preparation. People suggested the developer work with the school system, the labor unions, appropriate public agencies, and community organizations to prepare local residents to work in the resort industry.

In the course of conducting informant interviews, an effort was made to contact some of the people who might be involved in any resort training program. While these people sometimes responded as individuals rather than official agency representatives, they indicated their organizations would be interested in participating in a training effort. (See Section 2.6.1 for further discussion.)

Table 38

Summary of Community Issues at the
Time of the Interviews

Issue Description	Attitude Toward Issue	Frequency and Source of Comments	Community Recommendations and Suggestions
Economic Development			
Ka'u's need for jobs	Project seen as a positive partial solution to regional problem.	The most frequent issue from residents throughout the study area	Job training to optimize employment of local resident population
Recreation and Food Gathering			
1. Shoreline access	Project seen as "opening up" a shoreline currently restricted. Also seen as a positive partial solution to regional problem of too few shoreline accesses.	Raised by most of those interviewed	Public parking within walking distance to shoreline and lateral pedestrian access
2. Resident - visitor compatibility	Potential cultural differences between local resident beach users/fishers and resort clientele	Raised by many people and mostly by East Ka'u residents	Design some separation between areas open to the general public and visitor-only facilities Work with community to find ways to welcome local residents
Socio-cultural Context of Archaeological Resources	No apparent use of site for religious purposes. General feeling that significant resources should be preserved and incorporated into resort theme.	Discussed in general terms by almost all of those interviewed. About half of those interviewed had general knowledge of petroglyphs; very few knew of caves. Less than a dozen knew of specific sites and resources.	Frequent recommendations to preserve significant resources Some specific recommendations to minimize erosion and destruction of significant resources

Table 38 continued

Issue Description	Attitude Toward Issue	Frequency and Source of Comments	Community Recommendations and Suggestions
Implications of the Project Scale in this Rural Setting			
1. Public infrastructure and Services			
- Water Sources	Project can help develop water sources in West Ka'u which has no County water system	Almost all of these concerns raised by West Ka'u interviewees	Find way to share water with residents of Hawaiian Ocean View Estates and Hawaiian Ranchos
- Traffic and roadways	Safety concern because of speeding (West Ka'u) and winding roads of South Kona and Volcano Park	Not mentioned often; more frequent from West Ka'u because of current speeding; East Ka'u more concerned about increased on winding roads	Proposed airfield was seen as a partial solution because it could minimize roadway traffic
- Landfills and wastewater treatment facilities	Existing facilities already strained; concern that this project will add further pressure to these facilities	Infrequently mentioned, but strong concern from those few	Develop on-site facilities for project's own needs
- Electricity	Project seen as increasing demand for electricity, thereby helping to make more accessible and cheaper	Often raised by residents of Hawaiian View Estates and Hawaiian Ranchos	
- Police service	Project may be a "double-edged sword" -- more people may mean more police protection and more crime	Raised frequently and mostly by Hawaiian Ocean View Estates residents	

Table 38 continued

Issue Description	Attitude Toward Issue	Frequency and Source of Comments	Community Recommendations and Suggestions
Implications of the Project Scale in this Rural Setting (continued)			
2. Community Relationship to Resort Clientele and In-migrants			
- Resort clientele	Concern that existing residents will feel or be excluded from resort. Inferences based on Riviera theme and targeted "high class" clientele	Raised occasionally and mostly by East Ka'u residents	Design some separation between areas open to the general public and visitors only facilities Work with community to find ways to welcome local residents
- In-migrants	General acknowledgment that project will induce population growth (workers, families, etc.). Concerns that newer population may be more vocal, get the higher paying jobs and may try to "suburbanize" Ka'u	Concern brought up mostly by East Ka'u residents	Job training to minimize in-migration Find ways to assimilate in-migrants into existing communities
3. Trade-off: Rural qualities vs. Economic Development	Most people felt that Ka'u needed economic development, while also treasuring the rural quality they now enjoy. Most expressed willingness to trade off some of the existing qualities for economic survival.	Various degrees of tolerance for change to accommodate economic development. Most seem to feel that balance can be retained with the project.	
Concerns Related to Specific Project Components			
1. Marina	Generally approved of because of current regional lack of boating facilties	Discussed frequently by East and West Ka'u residents alike, as well as boaters	Ice, fuel and water facilities for public boating use Separation of public access and members/resort access
2. Support community	Seen as convenient employee housing because of proximity to job site. Some concern about establishing a separate new community.	So far, not a major concern in view of the resort component of the project	
3. Airfield	Generally seen as an asset because of potential for community use. Some concerns about noise, particularly that generated by helicopters	Discussed frequently, and mostly by West Ka'u residents	Provide facilities for emergency medical air transportation Allow public use of air transportation

Table 38 continued

Issue Description	Attitude Toward Issue	Frequency and Source of Comments	Community Recommendations and Suggestions
Concerns Related to Specific Project Components (continued)			
4. Project feasibility	Questions about site's physical appropriateness (water, soil, high winds, rough ocean); the magnitude of required capital for site improvements; and the European theme in a Hawaiian setting	Frequent questions, but mostly by people favoring the project	Good feasibility studies to ensure project's success
5. Ecological impacts	General desire to minimize negative environmental impacts. Specific concerns about (1) runoff into ocean (construction and long-term); (2) blasting/dredging for the marina; (3) seepage from landfills and wastewater plant into groundwater and ocean; and (4) impact on anchialine ponds	General desire to take care of environment expressed by almost all. Specific concerns infrequently, but strongly, expressed.	In general, design and operate resort conscientiously For very few people, only non-development is a "remedy"
6. Public safety and visual impacts	Questions about the vulnerability of the site to lava flows and the rough water conditions during high surf. Effect on view planes -- mostly on building height -- questioned	Safety concerns raised by many people throughout the Study Area Questions on visual impacts raised frequently by Ocean View residents	
Concerns Related to Miloli'i village	Some feeling that village is currently changing due to outside forces. Concerns more about impact on fishing grounds and how Miloli'i residents could benefit from the proposed project (e.g. employment, and indirect business opportunities, and relief of current pressure on their boat launch)	Discussed primarily by Miloli'i residents, and very infrequently by Ka'u residents (mostly because outside of district)	Find ways to optimize opportunities for Miloli'i residents

2.5.2.5 Implications of Development in Rural Setting

The rural qualities of Ka`u and South Kona were frequently discussed, in negative as well as positive terms. People talked about the driving times required for major shopping trips. Most people must travel an hour for medical services in Hilo or Kona, and some are apprehensive about efficient emergency service. Some people do not have running water or electricity. The single movie theater in the district is open only on weekends, and only one restaurant serves dinner after 7:00 p.m. There is a sense that most residents know one another; news travels quickly through the grapevine; and social networks support families in need.

Virtually all informants recognized that full build-out of a project such as the Hawaiian Riviera Resort would require resident adjustment to accommodate the project scale. For most people, these adjustments appeared to be worth making, although for a few the adjustments would destroy "what makes Ka`u."

This subsection describes regional systems which most people believed would be impacted by the scale of the proposed project.

2.5.2.5.1 Public Infrastructure and Service Requirements

Most people interviewed -- particularly those living in the subdivisions of West Ka`u -- complained about what they considered substandard public infrastructure and services. Particular concerns about resort development impacts were as follows.

Traffic and Roadways: People had difficulty envisioning any increase in traffic on the two-lane Hawaii Belt Road. Residents east of South Point were concerned that the winding roads near Na`alehu and in the Volcano National Park would be made more dangerous by increases in traffic. Residents west of South Point tended to feel that the winding road to Kona is also a dangerous one. Most people felt the proposed airfield will alleviate some of their concerns, although not all.

Water Sources: No regional water system serves the West Ka`u subdivision, and most people (including East Ka`u residents) felt the proposed Hawaiian Riviera Resort could help the community if it shared water with the Hawaiian Ranchos and Hawaiian Ocean View Estates. Very few people felt the project would "use up our water," although some were skeptical about the developer's prospects for finding an adequate on-site water supply.

Landfills and Wastewater Treatment: There was interest in how these services would be provided, considering limited regional landfills and wastewater treatment facilities. There was also strong interest in ecological implications of these facilities (see Section 5.2.6).

Electricity: People in Hawaiian Ocean View Estates and Hawaiian Ranchos were hopeful that the increased population in the area might lower their electricity rates and increase their ability to receive services.

Police Services: Residents viewed the resort's potential impacts as a "two-edged sword." On one hand, the population increase would reduce the area's isolation and therefore reduce crime opportunities dependent on isolation. On the other hand, most informants believed that more people means more crime.

2.5.2.5.2 Community Relationship to Resort Clientele and In-Migrants

Approximately half those interviewed expressed some concern about how an influx of new people -- both resort guests and in- migrant workers -- might affect the existing population. However, it may be noted that the nature of these concerns tended to be vague, and not strongly negative or positive.

Apprehensions About Resort Clientele

- The "Riviera" theme, plus the polo fields and marina, suggested "high-class" tourists and expensive facilities. Some of those interviewed feared that local residents would be excluded or would feel excluded from resort facilities, even though they might work there.

- There was some apprehension that visitors may not appreciate certain cultural differences, particularly if the visitors originate from a highly urbanized or more affluent setting. Some indicated uneasiness about fishing or picnicking near the resort guests.

Apprehensions About In-Migrant Employees

- The new people might be more vocal than current local residents and might exacerbate already existing problems between longtime residents and relative newcomers. This concern was voiced primarily by longtime residents living east of South Point.

- The new people might be more articulate and get all the higher-paying jobs.

- The new people might consist primarily of transient and/ or Mainland-originating hotel workers -- similar to the growth and changes in Kona and Lahaina in the past. Ka`u residents perceived these areas ashaving undergone tremendous social change, where the majority of current residents are recent in-migrants who came just to work in hotels.

- The influx of new people could strain community services, particularly the educational system.

- The newcomers might not be accustomed to the relatively low level of services/facilities typical of rural settings like Ka`u. They would pressure government officials and developers to upgrade services and facilities, and eventually the area would become "suburbanized."

Community Suggestions to Alleviate Social Incompatibility

- People often suggested that (1) there should be areas along the shoreline accessible to local residents, and (2) there be some buffer between visitor-only facilities and public areas.

- The most basic and frequent suggestion was to find ways to minimize the degree of in-migration. Job training was often discussed as a strategy for achieving this.

2.5.2.5.3 Trade-Off Between Rural Qualities and Economic Development

The degree to which people felt that positive aspects of the Hawaiian Riviera Resort would outweigh possible changes to the rural environment seemed strongly related to their reasons for choosing Ka`u or Miloli`i as a residence. Despite the inconveniences of isolation from other population centers, most people continue to live in Ka`u for the following reasons:

- Most residents of Pahala, Na`alehu, or Waiohinu have either lived in the area all their lives or have family who are lifetime residents. Many families have plantation roots. While these people live in Ka`u primarily because of employment, they simultaneously indicate a great appreciation for the rural qualities and a growing apprehension about limited economic opportunities for young people.

- Related to the East Ka`u longtime residents are recent immigrants from foreign countries, particularly the Philippines, who moved to Ka`u to work on the plantation.

- West Ka`u, particularly the Ocean View and Hawaiian Ranchos subdivisions, initially attracted most residents because of a combination of low land costs, pioneer qualities, physical beauty, and cool climate.

- Both East and West Ka`u have residents who moved away from an urban setting to Ka`u primarily because of its isolation from urban activities and densities.

Generally, those who live in Ka`u primarily because of employment or longtime family ties seemed cautiously open to the project because of increased job opportunities. However, they still stressed a desire to see the region retain much of its open qualities. Many community informants felt this group comprises a "silent majority" willing to make trade-offs necessary for the area's economic survival.

Those who moved to the area primarily because of low land costs and pioneer character seemed divided as to the degree to which they want to retain all the existing character. Some expressed a desire for better public services and facilities but not for increased population; others welcomed increases in both services and population so long as there is economic development.

The people least likely to accept any trade-off were those who moved to Ka`u specifically to escape urban settings. The Hawaiian Riviera Resort may be inconsistent with these people's desire for isolation from major economic and population centers.

Additionally, some native Hawaiian nationalists, few in apparent numbers but intense in their concerns, have difficulty with the idea of substantial development that would result in in-migration of large numbers of people, particularly non-Hawaiians. This difficulty seems to stem from:

- a perception that continuation of traditional Hawaiian lifestyles requires limited human population in comparison to available food sources; and

- a sense that the loss of Hawaiian culture and political control has historically been linked to alienation from the land. For them, further settlement of Ka`u lands by non-Hawaiian visitors or residents would erode any potential

for renewed Hawaiian control which might accompany gradual Hawaiian population growth and expanded agricultural use of lands of the State Department of Hawaiian Home Lands.

2.5.2.6 Concerns About Specific Project Aspects

2.5.2.6.1 Marina

Reaction to the proposed marina was generally favorable. For the most part, people cited the lack of boating facilities in Ka`u and felt this proposal would provide much-needed facilities. It was felt that the project offers both a safe boat ramp and convenient access, neither of which are currently available in Ka`u.

Boaters suggested that the marina contain ice, fuel, and water facilities accessible to the public. Some interest in public boat slips was expressed, although with little specificity as to number and type of desired slips. The major reservations about the marina were based on ecological concerns (see Section 2.5.2.6.5) and social compatibility (Section 2.5.3).

2.5.2.6.2 Support Community

People generally had little reaction to the proposed support community on the highway. There seemed to be minor concern as to where newcomers would live. Few informants had any strong feeling as to whether support/employee housing should be totally on-site or blended in with existing communities. Many suggested the employee housing be totally on-site for the sake of convenience of both employees and employers. However, others suggested that on-site housing be minimized, so there is less potential sense of separation from existing communities.

East Ka`u residents tended to suggest that employee housing be primarily in the existing Ocean View and Ranchos subdivisions, with some in Waiohinu and Na`alehu. Residents west of South Point tended to be more cautious; they wanted existing infrastructure and service problems solved before having more people move in.

2.5.2.6.3 Airfield

The proposed airfield was seen as an asset to the community only if (1) it provides facilities for emergency medical air transportation, and (2) it would be open to the public, thereby providing alternatives to Kona and Hilo airports.

Some concern was expressed about noise and safety impacts on surrounding communities, particularly impacts of any helicpater operations. A few people mentioned current problems with helicopter tours in the Hawaii Volcanoes National Park, where helicopter pilots have been accused of flying too low and generating too much noise.

2.5.2.6.4 Project Feasibility

Most of those interviewed questioned some aspect of project feasibility. Generally, because informants tended to favor the job-creating potential of the project, these questions seemed primarily intended to stimulate feasibility studies which can assure project success.

Project characteristics which raised feasibility questions were as follows:

- People asked if the site were physically appropriate for the proposed uses. They cited high winds, rough ocean waters, and lack of water system and soil for plantings.

- Given the substantial infrastructure requirements, many people also questioned economic feasibility, wondering if enough capital is available for site improvements.

- There was particular apprehension about adequacy of water sources and the high cost of developing such sources.

- There was some curiosity as to the existence of a market for the collective project recreational amenities -- golf courses, polo facilities, and marina.

- Some people questioned the chosen European theme of "Riviera," suggesting the developers should instead capitalize on qualities unique to Hawaii and the project site.

- A few people worried that Ka`u could not support both the Punalu`u and Hawaiian Riviera resort developments.

- Because of the magnitude of required capital, there were questions about the source of this capital. There were vague apprehensions about foreign investors -- and whether their interest was primarily to upgrade land values, after which the land would be sold. There was particular apprehension about sale to Japanese investors, because of perceived greater possibilities of in- migration of foreign managers.

2.5.2.6.5 Ecological Impacts

Those who expressed concern about ecological impacts directed their comments to ocean-related impacts of the following:

- Seepage of toxins into groundwater resulting from new landfills and the project's wastewater plant; it was feared this might also result in underground runoff into the ocean.

- Runoff from construction activities.

- Blasting and dredging for the marina.

- Reef destruction from erosion of artificial beaches.

- Drainage runoff from the golf course.

- General increased activity and exposure of anchialine ponds to the public.

(These concerns are addressed in appropriate sections of the EIS text.)

2.5.2.6.6 Public Safety and Visual Impacts

A few people pointed out that the project site is vulnerable to lava flows, and that its shoreline is dominated by rough waters with undertow currents. These people were concerned about the safety of resort visitors and residents. They feared that in case of an evacuation in a disaster, existing civil defense services would be inadequate to serve the magnitude of the project.

Residents of Hawaiian Ocean View Estates and Hawaiian Ranchos were concerned about the visual impacts of the proposed project. Most people warned that they did not want their view of the ocean obstructed by tall buildings. However, most people acknowledged that the distance between the mauka houses and the proposed resort is about seven miles below the Hawaii Belt Road and that visual impacts would therefore be minimal.

2.5.3 Human Recreation and Subsistence Uses of the Site

2.5.3.1 Existing Study Area Recreational Resources

2.5.3.1.1 Regional Recreational and Subsistence Uses

To establish a contest for assessing impacts of the Hawaiian Riviera Resort on recreational and food-gathering resources and activities, informants were asked about current recreational and food-gathering activities throughout Ka`u; their use of recreational facilities; and general pastimes. Following is a summary of responses:

- East Ka`u residents frequently discussed shoreline- related recreational activities. They cited shoreline and boat fishing, as well as gathering shellfish and seaweed. These activities are frequently carried out in conjunction with picnicking and camping. Swimming, body boarding, and surfing are popular, particularly with younger people. Beachcombing for glass balls was another specific pasttime related to the ocean. Many of these activities are family-oriented, and people particularly value beaches which are calm enough for children.

- East Ka`u residents generally mentioned only beaches east of South Point, although a few indicated they like to visit the coastline west of South Point because of the area's isolation.

- People west of South Point identified hiking, fishing, and swimming as favored recreational/food-gathering activities. Very vew indicated that they visit beaches east of South Point, and a number of informants said they are more inclined to go to South Kona beaches because of access and convenience.

Specific regional recreational sites often mentioned during the interviews included:

- Punalu`u Beach Park (most frequently mentioned);

- Surfing sites at Kawa (a few miles south of Punalu`u) and Ka`alu`alu (seven miles makai of Waiohinu).

- Whittington Beach Park (about four miles north of Na`alehu) has been a popular fishing and gathering place. It currently does not have potable

water, however, and the park is temporarily closed.

- The general shoreline from Waikapuna (makai of Na`alehu) to South Point was noted for beachcombing.

- Kaulana Bay and Punalu`u Bay are frequented by boaters because of their launching ramps. The other launching ramp used by boat fishermen is located in Miloli`i.

- The Road to the Sea (roughly marking the western boundary of the Hawaiian Riviera project site) is a popular public access to the shoreline, particularly for West Ka`u subidivision residents.

Fishing -- particularly pole fishing -- was the single most important ocean-related activity valued by virtually all of those interviewed. It was explained that fishing is primarily a recreational activity which can supplement store-bought food.

Thus, for many Ka`u residents, the value of fishing is more symbolic than practical or economic. Most people say that what is important about fishing is "knowing that it's there" -- having the opportunity to fish and believing that an adequate supply of fish will be available when they choose to fish. Fishing combines a sense of freedom, self-sufficiency, and a slow-paced lifestyle.

However, a major problem facing those who value fishing -- as well as those who just want to go to the beach -- is the inadequate number of public shoreline accesses in Ka`u. Competition for the few Ka`u park areas also comes from residents of Hilo and the Volcano area. Ka`u residents complain that their parks have too few parking spaces and picnic areas for the demand.

There is also a sense of threat that existing facilitites may be "taken away." Many expressed dismay over the closing of Whittington Park and it was felt that one of the major reasons for community opposition on C. Brewer's proposed Punalu`u development is a perception that the resort would "take away" public access and reduce the size of the public park.

To maintain a sense of privacy and isolation, many people are choosing out-of-the-way places where a four-wheel drive vehicle is needed to maneuver rugged terrain, and where there are no support facilities. To some, even these spots are becoming crowded.

A frequently-raised problem was the inadequate number of public boat launching areas. In spite of Ka`u's extensive shoreline, there are only three launching areas -- at Kaulana Bay on South Point, in Punalu`u Bay, and at Miloli`i'. The former is subject to rough ocean and high winds; the latter is small and inadequate for heavy use.

Scheduled improvements for the Kaulana Bay Ramp include construction of a breakwater by the U.S. Army Corps of Engineers. This would relocate the ramp approximately 100 yards towards South Point. Other improvements include building a washdown and parking area (personal communication with Ian Bernie, Big Island Boating Manager, and Dave Parsons, Hawaii State Boating Harbors Division, State Department of Transportation, June 23, 1987). These improvements are on hold, however, because of a lawsuit filed by Ka Ohana O Kalae.

2.5.3.1.2. On-Site Recreational and Subsistence Uses

Only a small portion of those interviewed visit the site on an ongoing basis, even though about half of 90 people interviewed have personally visited the site at least once. The following summarizes the comments and observations of the 20 people who claimed detailed knowledge of the site:

- The site is well known among fishermen and ocean food gatherers in Ka`u. People enjoy the area's privacy, plentiful fishing (although some claim that the coast's fishing supply has slowly been decreasing), and undisturbed camping.

- The site is accessible by two roads off the main highway. One is situated near the scenic lookout along the highway; the other is connected to an existing street in the Hawaiian Ranchos subdivision. Both roads are currently gated, and only those who receive permission from Kahuku Ranch are allowed through the gate. The site is also accessible by sea. Boaters sometimes anchor off the coast and swim in, except during periods of high waters.

- Those who "legally" frequent the site feel that the current access restrictions are necessary because of littering, vandalism and poaching by trespassers. They feel that, without these restrictions, the area's isolation and relative lack of supervision will cause further destruction of the area's natural beauty and petroglyphs.

- The few who admitted they trespassed felt justified because they only wanted to enjoy the area's resources -- including the beaches, ocean, and petroglyphs -- and there are few sites offering these. They also disapproved of evidence of vandalism.

- The coastline in the project site is used for pole fishing or shore casting for ulua and papio, and gathering opihi and a`ama crab. There is also some spear fishing for whatever is available. Divers pick up lobster along the entire project shoreline. Handline fishers catch menpachi (u`u) at night in the near shore waters off of Kahakahakea and then move out at dawn to the 400 to 600-foot depth for opakapaka and ehu. There are also some commercial tropical fish collectors who visit the area for aquarium fish.

- The most popular fishing and swimming area mentioned is Pohue Bay, which has a small pocket of white sand bordering a small sand-bottomed inlet. It is apparently a safe swimming area during calm seas and offers snorkeling opportunities. Other names that people called this area are Kahuku Beach and Glover (after James W. Glover a former owner of Kahuku Ranch) Beach. Hosaka Point, located east of Pohue Bay and fronting the summit of Pu`u Ki, is a popular ulua fishing spot.

  The only area mentioned west of Pohue Bay was Humuhumu Point located near the western boundary of the project site. Humuhumu Point is accessible by the Road-to-the- Sea, one of the few mauka-makai access routes in Ka`u. The last portion of this road is a rugged downhill slope to the sea, thus making it possible only for four-wheel drive cars to drive all

the way to the ocean. Many park their cars before this descent and walk to the ocean. Humuhumu Point has a small green sand beach which is safe for swimming in normal weather.

- Some of the handline fishers do so for commercial purposes. Except for fishers from the Miloli`i village, most of the pole and boat fishing seem primarily for recreational purposes. Fishing trips are often combined with overnight camping.

- The inland areas are primarily rough, unvegetated lava fields. These areas seem to be only infrequently used by goat and pig hunters.

2.5.3.2 Potential Impacts and Management Strategies

All of the informants were asked to provide their reaction to the proposed Hawaiian Riviera Resort relative to its impacts on recreation and food gathering activities.

Without exception, people strongly encouraged shoreline access, both mauka-makai and lateral access, with some restrictions, as follows:

- For most people, any mauka-makai access would "open up" an area previously accessible only to the few who had permission or who risked being caught trespassing. They saw this project as an opportunity for the community to have a park and more recreational opportunities, as well as "new" fishing grounds.

- For those who already frequent the site, greater access was still desirable, although these people tended to recommend controlled, rather than unrestricted, access. Because these people were generally boat or shoreline fishers, they were concerned that the increased usage of this area, particularly more fishing activities, would deplete the already decreasing supply of fish. They were also concerned that their current privacy and seclusion would be lost.

When asked what type of elements would enhance public access to the shoreline, the following were suggested:

- Public parking should be provided fairly close to the shoreline, but not at the shoreline. People felt that, while public parking should be within walking distance, there should be some setback to preserve the area's natural beauty and ecosystem.

- A few people felt that camping facilities should be made available, since there are currently so few in Ka`u.

- While comfort stations and water facilities were occasionally mentioned, there was no strong request for these facilities. It was felt that people get along without these now, and assumed that people would continue to bring whatever they need with them.

- People also encouraged lateral pedestrian access along the entire length of

the project. It was asked that paths be clearly defined and marked.

- Boaters wanted some access to the proposed marina, and suggested that the marina have facilities for ice, fuel and water available to the public. Public launching facilities within the marina was somewhat desired, although boaters themselves preferred that the public road access to the ramp be separate from the major tourist centers of activity.

Many people discussed their concern about visitor-resident compatibility. Generally it was felt that some separation of visitor and resident recreational activity was needed because of potential cultural differences. Residents claimed they would not be comfortable fishing or relaxing if they felt they were "being watched," or if there were any criticism about "our habits."

There was also some concern that some visitors would be offended by the smells and general activities of fishing. Those interviewed feared that this would lead to visitor complaints, and residents would be asked to move their activities. If this happens, eventual resentment would build up and be detrimental to visitors and residents alike.

Recommended solutions to deal with this potential incompatibility included establishing public recreation areas away from resort operations, separating the public boat ramp from the marina facilities, and providing ample visitor recreational facilities within resort areas. This way, visitors would use the public recreation areas mostly out of choice, rather than because no alternatives exist. It is more likely that those visitors who choose to use the public areas will be open to and appreciative of cultural differences.

2.5.4 Current Socio-Cultural Context of Archaeological Sites

This section discusses the contemporary socio-cultural significance of archaeological resources of the project site. Note that this discussion has a different focus than that of the archaeological study conducted by Paul H. Rosendahl, Inc. for the Hawaiian Riviera Resort. Whereas Rosendahl looks at the scientific, interpretive, and cultural values of archaeological resources, this discussion explores general community perspectives and attitudes towards these resources. This discussion does not make an evaluation as to whether or not a resource is indeed significant, but rather identifies some community feelings, or lack thereof, attached to these resources.

2.5.4.1 Community Awareness of Specific Resources

Collectively, the informants were not very familiar with the site or its resources. This may be because shoreline access is limited to those who obtain permission from Kahuku Ranch.

About half of those interviewed -- basically those who had visited the site -- had seen the on-site petroglyph field, but few were aware of its extensiveness and even fewer people mentioned on-site caves. Those who did not have first-hand knowledge of these resources either learned about them through word of mouth or assumed that the site must have some archaeological sites because of the abundance of resources at South Point, Punalu`u, and Waiahukini.

Awareness of the value of individual archaeological artifacts was limited to the half a dozen or so informants who knew the site very well and who have studied archaeological resources in general. The following is a summary of points raised about specific sites.

(1) The area most frequently mentioned was the petroglyph field. Those

who knew the area felt that the boundary (as of May 1987) of the proposed petroglyph park did not include what they felt was the most abundant area. At the time of the interviews, this area was proposed on the map as resort. (NOTE: The plans have since been modified, based on the recommendations of the Rosendahl archaeological study.)

(2) A few people described what they believed to be unique individual petroglyphs. These people interpreted the style of these petroglyphs to indicate "non-Hawaiian" cultures prior to the arrival of Hawaiians. They felt these petroglyphs may be similar to those found on Easter Island.

(3) Two areas raising concern because of potential significance were Kanaone and Kahakahakea. Kanaone is the water hole immediately north of Pohue Bay; it is somewhat of a landmark, marked by coconut trees. Pu`u Kahakahakea is a low-rise cone near the project site's southern boundary which is the site of pre-contact shelter caves, some of which were thought to contain early Hawaiian fishing implements.

(4) While few people mentioned the other cinder cones, most did not attach much significance to these pu`us. A few people suggested further study of these land forms for possible petroglyphs.

(5) Some people knew of caves, although they did not know if these were burial grounds.

(6) Some people described a shoreline trail paved with water-worn stones from the ocean.

2.5.4.2 Potential Impacts and Management Strategies

There was no indication that the site is currently used for religious purposes. Further, people did not identify any significant site-specific historic or cultural events or uses prior to Kahuku Ranch ownership. It is highly likely, then, that, from the community's perspective, the site does not have significant socio-cultural archaeological value at this time, although there is certainly a community recognition and awareness of resources.

It is noted, however, that the potential for impact exists. From a socio-cultural perspective, the management and handling of archaeological resources are often as a important as the resources themselves.

On this project, regardless of whether they had visited the site, all of those interviewed felt that the archaeological resources merited attention and care. The general feeling was that any development be sensitive to the areas most abundant with these resources, and that those resources of particular significance be protected.

All of those interviewed (with the exception of the few who did not want any development) strongly suggested that the developer (1) identify these resources and (2) take measures to protect the important ones.

The following summarizes community recommendations for the management of preserving these resources:

- o People generally supported the concept of a petroglyph park/preserve with the boundaries revised as recommended. There was a general acknowledgment that some of the resources, once identified and catalogued, would be destroyed in the siting of the resort simply because they may not be significant. As some people pointed out, "You can't save every single petroglyph."

- o Virtually all of those interviewed believed that important or significant archaeological resources -- be they heiaus, petroglyphs or caves -- should be preserved. It was generally recommended that public access to these resources be controlled to minimize vandalism and general erosion. The following were specific recommended mechanisms for controlled access.

    - potentially resource-rich areas, restrict public to designated trails. In the petroglyph field, public viewing should be primarily through guided tours.

    - Prohibit petroglyph rubbings and the use of chemicals to "enhance" the petroglyphs.

    - Conduct educational programs for visitors and residents which would explain the significance of these resources and their fragile nature.

- o It was suggested that these archaeological resources be incorporated into the resorts theme, since this would be more unique to the site's characteristics than a European Riviera focus.

A small but strongly motivated minority of those interviewed expressed strong concerns about the impact of almost all development and any resort uses on areas with cultural and archaeological resources. Because the discussions focused on general cultural survival, there was little mention of site- specific resources or extensive personal use of the site.

The core of this concern was a philosophical conviction that the undeveloped state of land in itself has traditional value in the native Hawaiian cultural system. They described the native Hawaiian kinship with land, or sense of place, as both practical and religious. Undeveloped land provides food-gathering opportunities of hunting and unlimited access to the ocean for fishing. More importantly, it embodies a sense of openness, a feeling of unobstructed oneness with natural forces.

People who held these views felt that the only preservation technique that sufficiently retained the essence of native Hawaiian culture is to leave resource-rich areas (archaeological, food gathering, etc.) untouched by development, yet accessible to people who wish to use its resources for cultural reasons.

In a related matter, a few people concerned about anchialine ponds shared the view that the only effective preservation of these ponds is avoidance. This way, the ponds' unique ecosystem would not be threatened. The value of these ponds to these people is two-fold. Anchialine ponds provide valuable biological information of a unique ecosystem, including fauna found only in these settings. Also, these ponds are "symbols of survival and evolution" in a harsh environment.

2.5.5 Relationship of the Proposal to Miloli`i Village

Because of its reputation as a unique community, and because of its relative proximity to the Hawaiian Riviera Resort project site, Miloli`i was felt to merit separate study within this socio-cultural impact assessment. It should be noted that the focus of this section is on the Miloli`i fishing village, as opposed to the extensive new subdivision about one mile north, on the road into Miloli`i village.

Miloli`i village is known as being one of the last fishing villages in Hawaii. Although it is only about five miles off of the Hawaii Belt Highway, it takes about 20 minutes of driving time to maneuver the winding secondary road down the mountain and across the lava field. The village has no electricity and no water system.

Technically, Miloli`i village is in the South Kona district. It is over 15 miles away from the western and closest Hawaiian Riviera Resort project boundary along the shore; over 11 miles of driving distance on the highway.

Miloli`i village is included in this study, however, because of (1) a recognized and unique way of life and (2) villagers' use of the site's shoreline and offshore waters.

2.5.5.1 Existing Situations and Lifestyle

Section 2.5.6 briefly discussed demographic data for Miloli`i and the surrounding South Kona coastline. This section focuses more on lifestyles, as described by residents and other informants.

According to informant interviews, Miloli`i village has about 165 residents, although a recent newspaper article estimated a population of 125 (Hoover, 1987).

According to the article, the primary source of income in Miloli'i is from fishing done by men; few or no male residents are employed elsewhere. Men in the village operate 30 fishing boats along the shore between Miloli`i and South Point.

However, some informants interviewed for this report (primarily not Miloli`i residents themselves -- e.g., social agency workers from O`ahu or elsewhere) had somewhat different observations. They felt that only a small handful of the men are full- time commercial fishermen and the rest fish only on a part-time basis. These people believed that fishing actually supplements the primary income provided by welfare assistance. And, according to Miloli`i informants, about five of the women work at the nearby macadamia nut plantation, and two women work in Kona.

Further, according to some people from Miloli`i, the apparent simplicity of the fishing-village lifestyle is also a source of problems. They felt that young people who graduate from high school have only two choices -- stay in Miloli`i (and fish or drive long distances to work) or leave Miloli`i to live with relatives (and probably never return).

Nevertheless, perceptions of poverty and substandard living conditions are relative, and Miloli`i informants did not regard themselves as poor or unfortunate. They emphasize that they live there by choice and that their ocean-dependent lifestyle is preferable to the hustle and bustle of city living. Several women pointed out that they left O`ahu to marry men who lived in Miloli`i village and they "wouldn't have it any other way."

2.5.5.2 Potential Impacts and Management Strategies

2.5.5.2.1 Issues Raised During Informant Interviews

When asked about feelings towards development in general, informants indicated two areas of concern -- impact on fishing grounds and job opportunities. The former was by far the more important and no trade-off, including jobs, seemed worth the negative impact on fishing. If the fishing grounds are destroyed, Miloli`i village residents will no longer be able to continue their lifestyle.

Those interviewed were fairly familiar with the project site. They fish the waters along the shore, particularly off Kahakahakea, where they catch menpachi, ehu, and opakapaka. They take their children to Humuhumu Point to swim at the green sand beach, and pole fish and camp along the shore when possible. They use the Road-to-the-Sea access, as well as the road in Hawaiian Ranchos.

Reactions to the proposed Hawaiian Riviera Resort were generally tentatively favorable due to increased job opportunities and the potential for a new market for fish catches. Comments and questions focused on:

- Overall impacts on regional fishing grounds both during construction (run-off concerns) and operation (increased ocean vessels and fishing activities in area), particularly as these impacts threatened existing lifestyles;
- Availability of resort jobs for their residents;
- Shoreline access; and
- Significant archaeological resources.

As stated earlier, Miloli`i village boaters fish the waters off the project site, and pole fishers use the shoreline. Informants were concerned that general and regional increased fishing activity would impact fishing catches, and that this project would exacerbate this situation.

It was stressed, however, that the concern about fishing ultimately boiled down to their ability to continue the fishing- village lifestyle. If fishing could no longer provide income, then their lifestyles would no longer be able to continue.

This apprehension was not directed primarily at the proposed Hawaiian Riviera Resort, but more towards the proposals closer to the village, such as the proposed Farms of Kapua agricultural subdivision in South Kona. More people are moving into the nearby Miloli`i subdivision, and the boat ramp continues to attract outsiders.

Concurrently, some of the informants wanted to see more job opportunities in the area. The prevailing reason for wanting jobs was to allow the young people to remain in the area. This is different from reasons stated by Ka`u residents -- Ka`u residents generally related jobs to economic development and to upgrading the area's standard of living. Miloli`i residents did not indicate a desire for more urban conveniences; instead they wanted their children to have alternatives to what exists now.

Informants strongly urged convenient public shoreline access at the Hawaiian Riviera

Resort project. They wanted to continue to use the area, and did not want to "get permission to use our ocean." Suggested facilities included parking, picnic areas, and camping facilities.

Miloli`i informants knew of caves and petroglyphs on the site and stressed the need to preserve these resources.

2.5.5.2.2 Potential Impacts on Miloli`i Village

From the informant interviews and other research during this study, it was clear that the village is not as isolated as it once was and that its lifestyle is slowly changing, as follows:

(1) Miloli`i residents are already interacting with Outsiders.

When asked about the Village's interaction with outside communities, informants indicated that the area and its residents often interact with outsiders. It was stressed that they welcome outsiders (both by the Miloli`i residents and by Ka`u residents who visit Miloli`i). The main problem seems to be that sometimes outsiders disregard residents' desires for keeping the Miloli`i village clean. The following are instances in which there is interaction with outsiders:

- The boat ramp in Miloli`i village was apparently constructed as an emergency facility three years ago, but its use is regular and ongoing. People from Ka`u, Kona, and Hilo use the ramp and, in the summer and around Christmas, the area is congested and overcrowded with cars and boat trailers parked along the road. Village residents seem to welcome the boaters, although boaters apparently do not always clean up their rubbish.

- Tourists sometimes drive down to the Village and stop at the public beach park maintained by Village residents. These interactions do not seem to raise any objections with Village residents. However, a vast increase in tourists would clearly have negative impacts.

(2) New houses may begin to be constructed in and around the Miloli`i village, as part of a pilot housing project to house displaced Miloli`i and Ho`opuloa residents.

Fifty-two acres of land, beginning roughly at the public boat ramp in Miloli`i and following the shoreline toward Ho`opuloa, were set aside for the refugees of the 1926 lava flow and their descendants. A non-profit organization called Pa`a Pono Miloli`i, Inc., was set up to coordinate the land distribution with the Department of Land and Natural Resources (Clark, 1985).

This relocation plan is actively underway, with public agencies participating with the recipients in an effort to conduct a pilot self-help housing program. There are currently 24 existing 65-year leases, but additional lease lots will soon be made available to qualified applicants. Since 1984, three homes have been built or are under construction (Flickinger, 1987). Efforts are being made to minimize dependency on county water, electricity, and sewer systems.

(3) The Miloli`i subdivision is already increasing the immediate area's population.

In 1960, 423 acres between Miloli`i village and the 1926 lava flow were developed into a

1,000-lot Miloli`i subdivision. Initially marketed as a military retirement community, the Miloli`i subdivision still has non-county standard roads, no phone service or electricity, and no running water (Cooper and Daws, 1985).

Based on information with realtors and others in the area, the subdivision is comprised of one- to two-acre lots on the hillside between the highway and the lava flats, and lots of 8,000 square feet on the lava flats. All of the lots have reportedly been sold, but occupancy is occurring very slowly. It is estimated that approximately 15 houses have thus far been built there, about half of which are full-time residences housing perhaps 40 people. As of May 1987, two more structures appeared to be under construction.

There is already much interaction between the village and subdivision residents. Village residents use the shoreline near the subdivision; subdivision residents use picnic areas and boat facilities in Miloli`i village. Occasional access problems have arisen over public use of the subdivision's private roads. When Village residents have gatherings, they invite subdivision residents.

Finally, West Hawaii resort development will put increasing housing and development pressure on lands in North and South Kona. Although Miloli`i village is somewhat isolated, it is highly likely that development pressures will eventually reach this village.

The Hawaiian Riviera Resort, then, even with its scale and magnitude, appears unlikely to affect the village's current direction of change, so long as there are no substantial increases in visitors driving through the area and disrupting daily life.

The fishing-village lifestyle is already slowly evolving by becoming more dependent on outside assistance (as in the dependence on welfare assistance and housing programs) and technology (particularly as related to fishing), and having more new people to interact with (e.g., subdivision residents).

The project could directly benefit Miloli`i residents, however, by providing much-needed employment for a range of skills and by providing business opportunities consistent with current skills -- such as setting up a fish market and/or plant nurseries for project landscaping.

Indirectly, the Hawaiian Riviera Resort could benefit Miloli`i village residents by alleviating some of the boat use of their nearby ramp. As Big Island boaters use the proposed marina, fewer will be inclined to frequent that in Miloli`i.

2.5.6 Social Change

Depending on the speed with which build-out actually occurs, resort development has the potential for substantial impacts on the social fabric of the study area (in addition to previously-discussed implications for Miloli`i alone).

Because Ka`u's experience with resort development to date has been limited to Punalu`u Resort (with only 76 condominium units, no hotels, a golf course, and a restaurant -- total employment under 100 people, many of these part-time), much of this discussion will consist of a review of tourism-related social impacts reported elsewhere in Hawaii.

The discussion will be in two broad parts: (1) forces for social change accompanying resort development; and (2) statistical indicators of community cohesion.

Since it is assumed Ka`u will experience social change from development of the expanded Punalu`u Resort with or without the Hawaiian Riviera Resort, the following impacts cannot be clearly attributed to the Hawaiian Riviera alone. Existing studies of tourism impact do not allow a clear understanding of whether development of additional resort developments greatly intensify impacts of a single resort, or whether the additional effect is very slight. For these reasons, the following discussion will be about effect of resort development in general.

2.5.6.1 Forces for Social Change from Overall Resort Development

At least six aspects of resort development have strong implications for social change:

- o resident employment in resort settings;
- o shifts in social stratification accompanying increased service-sector employment;
- o increased visitor population;
- o in-migration of full- or part-time resort residents;
- o in-migration of new workers, leading to changes in population levels or composition;
- o increased services, amenities, and exposure to the outside world.

2.5.6.1.1 Employment in Resort Settings

Some frequent concerns expressed regarding resort employment are (1) whether current area residents tend to get the initial jobs as new hotels come on-line; (2) whether longtime residents have a fair share of better jobs; (3) whether wages and working conditions are adequate; (4) family and psychological factors; and (5) worker satisfaction.

Resident Opportunities at Start-Up: As indicated in Section 2.5.1, study area residents interviewed for this report tended to support the proposal based on need for jobs, but there were questions as to whether area residents would effectively compete for jobs. While full build-out of the resort would clearly result in substantial in-migration, local study area labor supply should be able to meet a substantial part of the initial labor demand for the first phase of the project. If this did not happen for some reason, if large numbers of study area applicants were rejected in favor of in-migrants, there would be clear potential for resentment and social unrest.

There are some historic examples to justify this concern. Rapid tourism growth in both West Hawaii and West Maui resulted in many positions being filled by young Mainlanders. On Oahu's North Shore, former sugar plantation workers were not initially hired in the numbers expected by the community when the first hotel at the Kuilima resort opened in the 1970's.

However, there have been several trends in reaction to such events. First, as communities such as West Hawaii become increasingly familiar with tourism as an economic system, longtime residents absorb more of the jobs; rise to higher positions; and utilize family and friendship networks to gain job opportunities. Kona hotel personnel managers report that the proportion of Mainland-born people among their full-time workforce has been decreasing in recent years (Community Resources, Inc., 1986). In a recent survey of Kohala luxury hotels, it was

found that 63 percent of all workers were raised on the Big Island and that the largest single ethnic group consisted of native Hawaiians (Community Resources, Inc., and Datametric Research, 1987).

Second, in order to speed up this process of assuring resident employment, at least some resort developers or operators have voluntarily made efforts to train local residents prior to new hotel openings (e.g., job training programs now under design at both Kuilima and West Beach on Oahu) and/or to target area residents for hiring (e.g., the Mauna Lani Bay Hotel in South Kohala). A stated purpose of the Kuilima and West Beach programs is also to identify ways in which area residents can capture more off-site economic benefits -- i.e., ownership of or employment in new businesses away from the resort site which are stimulated by increased tourism.

The Hawaiian Riviera Resort developers have indicated a desire to work with existing agencies and community residents to design a program for job training and other measures to maximize employment/economic benefits for current Ka`u and South Kona residents. The process by which such a program will be worked out is described in the chapter on "Mitigation and Management Strategies" (Section 2.6.1).

Resident Opportunities for Better Jobs at Resorts: Most Hawaii hotels are managed by national or international chains which rotate top managers throughout the country or the world. While this can mean an exciting life career for Hawaii-born hotel managers transferred elsewhere, it can also mean that many top managers at Hawaii hotels are <u>not</u> Hawaii-born, sometimes leading to cultural misunderstandings and feelings of resentment by local workers.

At another level, there may be perceptions that some groups -- either Hawaii-born or certain ethnic groups -- tend to end up with the "worst" jobs (such as part-time or casual employment).

Two recent studies which may shed some light on these concerns are the recent Employee Survey of luxury Kohala hotel workers (Community Resources, Inc., and Datametric Research, 1987) and a Cornell University doctoral dissertation by A. M. Bouslog (1985), which utilized ten years worth of Hawaii State Health Surveillance Survey data:

- Among Mauna Lani Bay Hotel and Westin Mauna Kea workers, 55 percent of management/ supervisory personnel were raised on the Big Island. About one-half the managers had been working at a non-hotel job before taking jobs at the Kohala hotels, indicating that many mid-level management jobs require only general managerial skills rather than specialized training in hotel management.

- The 1987 Employee Survey also found that lifelong Big Island residents were slightly less likely than in- migrants to hold the so-called "best" (management) jobs, but they were also much less likely to hold the so-called "worst" (part-time/casual) jobs. These jobs often have unpredictable hours and lower pay, and transients are more likely to fill them than are longtime residents.

- The Bouslog (1985) study looked at statewide ethnic differences in "primary-sector" vs. "secondary-sector" hotel jobs (roughly equivalent to full-time vs. part-time or casual). She found that Caucasians, Japanese, and part- Hawaiians are more likely than others to hold the better jobs.

Filipinos fared the worst, with 79 percent in secondary- sector jobs. However, this is likely a function less of ethnicity than of immigrant status, since 80 percent of foreign-born employees were working in the secondary sector.

These figures are significant in Ka`u, which has a large population of Filipinos, many of whom are immigrants. However, there are various possible interpretations of the figures. The most negative would be that immigrants and/or Filipinos are being "exploited." The most positive would be that hotel employment represents an opportunity for less educated immigrants to develop work skills and experiences which will permit them over time to advance to higher rungs of the socio-economic ladder.

- Bouslog also found that, compared to other civilian industries, Caucasians and Japanese are under-represented in hotel jobs, while Hawaiians and Filipinos are over-represented. Furthermore, age distributions suggest young residents of Japanese ancestry are unlikely to hold hotel jobs, while most of the Caucasians working in hotels are young (and, possibly, transient). The implication, subject to further study, is that Hawaiians and Filipinos are the groups most likely to make hotel work a permanent career and thus to acquire seniority and the better long-range working conditions.

In small rural communities such as Ka`u, it will be particularly important to maximize the number of longtime residents in resort management/supervisory positions -- or at least to assure them of reasonable opportunity to climb a career ladder from entry-level positions as each new hotel comes on-line. This, too, will require attention to both training and cultural factors such as reluctance to exercise authority over family and friends. As noted in Section 2.6.1, the intended job training program proposed by the developers would include attention to upgrade training.

Economic Quality: Table 39 provides 1985 data on average employment and wages for various types of jobs associated with destination resorts (hotels, other services, eating and drinking places, other retail trade, and transportation), as well as plantation agriculture, with which tourism is often compared.

Some implications of this table include:

- While the sorts of service jobs commonly associated with resorts comprise more than 40 percent of Hawaii's jobs statewide and nearly 46 percent of Big Island jobs (although many such jobs would actually serve residents rather than visitors), average wages for most categories fall below the average wage for all private-sector jobs.

- Average hotel wages are relatively close to the respective statewide or islandwide averages, but wages for food-and-beverage jobs (which are often just part-time) are below 50 percent of the average private-sector wages. However, note that these figures exclude income from tips/gratuities, which can comprise a substantial portion of income for waithelp and some hotel workers.

- Wages for sugar are higher than the statewide or islandwide average, but relatively few people still work in the sugar industry statewide and there are

no prospects for increasing sugar-related jobs in Ka`u.

In addition to somewhat low average wages, hotel and other resort-related jobs are subject to seasonal fluctuations and inconvenient and/or split working hours. These problems are particularly acute for entry-level staff workers (who often start on a part-time or casual basis), since workers with seniority are less likely to be laid off in off-season and have more privileges in terms of choosing preferred working hours. As previously noted, in West Hawaii such jobs are now largely filled by newcomers or transients, due in part to disinterest on the part of longtime residents. In the Ka`u/South Kona study area, these conditions also apply to many macadamia nut picking jobs, which to date have also been filled largely by newcomers (in this case, immigrants from the Philippines).

However, it should be noted that the foregoing concerns apply to "average" hotels, and conditions are sometimes different at luxury hotels such as several of the Hawaiian Riviera Resort hotels would be. Related points regarding economic "quality" include:

- Tip income -- which represents the unknown factor in determining how well resort employees are actually compensated -- tends to be higher at luxury hotels.

- According to the Employee Survey of luxury Kohala hotel workers (Community Resources, Inc., and Datametric Research, 1987), the median overall household income of hotel workers is $25,668 per year -- which is almost identical to the County Housing Office's estimated median income for all West Hawaii residents (personal communication, Bill Moore, Deputy Director, March 16, 1987). About half the surveyed workers were the primary wage- earners in their households.

- According to figures provided by these two hotels (op. cit.), 70 to 75 percent of the workers are in full-time or management jobs, as opposed to part-time/casual. (For hotels of the Sheraton or Hilton class, as would comprise the non-luxury Hawaiian Riviera hotels, full- time workers make up 60 to 70 percent of the workforce.)

- Tourism also generates off-site employment, including support professions such as lawyers and doctors. The ratio of such off-site jobs to on-site jobs tends to be lower than for sugar plantations; however, the current issue does not involve a choice between tourism and sugar (or any other economic activity) for the Hawaiian Riviera Resort site, but rather a choice between new tourism jobs and no economic development there.

Family and Psychological Factors in Resort Work: Sociological and psychological aspects of resort employment can be categorized as either transitional (aspects related to adjustment to new forms of employment) or permanent (inherent characteristics).

Transitional: In Hawaii, relatively more attention has been paid to transitional impacts, particularly in communities undergoing a switch from plantation agriculture to tourism as the economic base -- e.g., North Kohala on the Big Island, Kilauea on Kauai, and Kahuku on Oahu. North Kohala's situation resulted in several published studies in the late 1960's and early 1970's (Cottington, 1969; Hawaii State Department of Planning and Economic Development, 1972; Smith, 1972) focusing on family and psychological impacts. It is important to note that the reported

Table 39
Average Statewide and Hawaii County Employment and Annual Wages
for Industries Associated with Resorts and Plantation Agriculture, 1985

	STATEWIDE				HAWAII COUNTY			
	Average Employment		Avg. Annual Wage		Average Employment		Avg. Annual Wage	
	no.	% of total	dollars	% of total	no.	% of total	dollars	% of total
TOTAL PRIVATE SECTOR	343,400	100.0%	$16,070	100.0%	27,963	100.0%	$13,896	100.0%
Selected Resort-Related Industries								
"Hotels, rooming houses, etc."	28,947	8.4%	$13,601*	84.5%*	3,931	14.1%	$12,056*	86.8%*
"Eating and drinking places"	40,171	11.7%	$ 7,496*	46.6%*	2,657	9.5%	$ 6,561*	47.2%*
"Other retail trade"	56,036	16.3%	$13,029	81.1%	4,889	17.5%	$11,672	84.0%
"Transportation"	23,439	6.8%	$19,508	121.4%	1,266	4.5%	$17,092	123.0%
Selected Plantation-Related Industries								
"Agriculture, forestry, fisheries:"								
-- Sugar	3,079	0.9%	$18,258	113.6%	181	0.6%	$22,200	159.8%
-- Pineapple	2,056	0.6%	$16,157	100.5%	N/A	N/A	N/A	N/A
-- Other Crops	3,061	0.9%	$13,095	81.5%	2,221	7.9%	$13,985	100.6%
"Manufacturing:"								
-- Sugar Mills	2,706	0.8%	$20,759	129.2%	662	2.4%	$23,284	167.6%
-- Pineapple canning	2,016	0.6%	$14,577	90.7%	N/A	N/A	N/A	N/A
-- Other Food Processing	4,914	1.4%	$16,867	105.0%	1,306	4.7%	$15,486	111.4%

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* Wage figures do not include tips/gratuities.

Source: Hawaii State Department of Labor and Industrial Relations, 1986, pp. 2, 3, 10.

impacts occurred before the sugar plantation shut down (although during a period when there was growing concern that a shutdown was possible, such as is now the case in Ka`u) and when the new resort jobs were being filled almost entirely by women. The Cottington study -- although based largely on anecdotes and never formally published -- received the most widespread publicity. Some of the major conclusions from her study and the others included:

- Serious marital strains (in some cases leading to divorce and/or wife abuse) attributed to husbands' jealousy over working wives' contacts with male guests, in light of the wives' new behavior patterns associated with work (see below).

- A new and improved self-image for women, including increased attention to, and pride in, personal appearance; more self-confidence; more assertiveness in family finances. Male self-image, however, suffered.

- Problems with child care and, to some extent, juvenile delinquency associated with having two working parents.

- Family financial problems associated with increased income (prior to the plantation closure). The higher incomes led many families to make down payments on expensive consumer items, and their unfamiliarity with the credit system sometimes left them unable to meet subsequent installment payments.

- Problems with supervisors of different ethnic backgrounds.

However, the Smith (1972) follow-up study suggested that the family adjustment problems were serious only in a few already- shakey marriages and that most other working wives said their families had adjusted. Similarly, interviews with community leaders in Oahu's Kahuku area (Community Resources Inc., 1985) and Kauai's Kilauea area (Belt, Collins and Associates, 1983) produced reports of only limited and temporary family disruptions when wives of ex-plantation workers there entered the resort workforce. A year-long psychiatric study in Kahuku (Young and Kinzie, 1973) found no apparent family or mental health problems during the period when women were starting initial hotel work.

In preparing the present social assessment, Community Resources, Inc. (CRI) interviewed representatives of a number of social agencies active in Ka`u -- including the Hawaii County Economic Opportunity Council (Head Start), Ka`u police, State Public Welfare Division (both Hilo and Na`alehu offices), and Pahala Pre-School.

The general consensus was that any family stresses caused by wives' initial employment would be minimal, due to (1) alleviation of existing stress through increased family income, and (2) a more liberal attitude at the present time toward working wives (indeed, many Ka`u wives already work). A few of the social agencies saw some potential for problems if wives changed their appearance and lifestyles due to resort work while husbands did not, but it was felt that a community information program could prepare families for this possibility.

Permanent: Less research, although considerable speculation, has been devoted to apparently inherent problematic aspects of resort work, including:

- Shiftwork, common for hotels and other service establishments, presents logistical problems for families with children, and it may reduce the amount

of time which husbands and wives can share at home together.

- o "Glamour-and-gossip" worksetting at some hotels may still constitute a challenge to the established values of some rural employees, and the close-knit nature of the workforce can result in gossip about even innocent smiles or flirtations between workers and guests.

- o The "servant mentality" of resort work is alleged by some social critics (e.g., Kent, 1975) to damage employees' self-esteem. However, there has been no published evidence to support this concern, and frequent interviews by CRI with resort personnel officers and union officials do not indicate that this has been a serious mental health problem.

Again, community information programs -- possibly associated with job training efforts -- could represent an appropriate social mitigation. Additionally, expanded child care and babysitting services will probably be required, since Ka`u currently has only two half-day programs (Head Start and the private nonprofit Pahala Pre-School). An expanding population will also result in need for more family-oriented social agencies, such as the Child Protective Services. Whether this need will be out of proportion to the population growth remains to be seen. Some social workers believe the Kona population boom attracted a number of people with chronic family problems from the Mainland, although it has also attracted a number of competent Mainland-trained social workers (personal communication, Roy Watanabe, Social Service Section Administrator, Hawaii State Department of Human Services, Public Welfare Division, Hawaii Island Branch, July 23, 1987).

Worker Satisfaction: In late 1986, the Council of Hawaii Hotels contracted with Strategic Information Research Corp. (1987) to survey hotel workers statewide. Selected results dealing with worker satisfaction, attitudes toward pay, and feelings about Mainland vs. Hawaii management and opportunities for promotion are presented in Table 40

In its statewide survey of hotel workers in the late 1970's, the State Tourism Office (Hawaii State Department of Planning and Economic Development, 1978) also found high levels of reported job satisfaction among hotel workers. Among Neighbor Island hotel workers, only 12 percent indicated a desire to leave the tourism industry within the following five years.

2.5.6.1.2 Service Economies and Social Stratification

A national trend in the past decade has involved a shift away from a manufacturing-based economy to a service-oriented one. In Hawaii, this shift has taken the form of lessened emphasis on plantation agriculture (which includes a significant manufacturing component, such as the milling of sugar) and increased emphasis on the visitor industry.

This nationwide shift has resulted in changes in income distribution and associated social status -- that is, more income and wealth is being concentrated among the most affluent, while the proportion of people in the low-income or low-wealth brackets has been growing. The changes have thus far not been dramatic in absolute magnitude, but the direction of change has been persistent for approximately ten years.

In a recent article in Scientific American, Thurow (1987) suggests two basic causes:

(1) increased competition from other countries in the manufacturing sector (e.g., lower sugar production and labor costs, plus more aggressive

subsidy policies), leading to a loss of middle- and upper-middle-income American jobs, particularly among males; and

(2) a rising proportion of female workers, who thus far have been more likely than men to hold lower-paid and/ or part-time jobs. Additionally, as two wage-earner families become more common, professional-class wives who go to work earn more than working-class wives, automatically increasing the total income gap.

Although Ka`u historically has experienced periods of great inequalities in income or power distribution (e.g., the ancient Hawaiian caste system or the early plantation social structure), in recent years the area has been much more egalitarian. There are few strong socio-economic class distinctions among residents.

As Ka`u follows the rest of the state into a more service- oriented economy, more social class distinctions are likely to appear -- a phenomenon which will be intensified by the presence of resort residents themselves.

This social impact must be viewed in the following context: (1) the weakened position of higher-paying sugar jobs does not represent a deliberate policy choice; (2) particularly if sugar does manage to survive for some time in Ka`u, the opportunity for resort employment means that total family income and standard of living for most current residents will continue to rise in absolute

2.5.6.1.3 Increased Visitor Population

The Hawaii State Department of Planning and Economic Development (1981), in its Tourism Plan Technical Reference Document, concludes that increased visitor population has implications for:

- o social interaction between residents and visitors;
- o perpetuation of local arts and handicrafts;
- o changes in lifestyle and standard of living;
- o erosion of "Aloha Spirit";
- o impaired resident access to coastal areas;
- o competition for public facilities and resources;
- o pressures on open space and agricultural lands;
- o cost of living and property values;
- o crime; and
- o population increases and need for employee housing.

Table 40: Hawaii Hotel Worker Attitudes Toward Their Jobs

	Agree/ Yes	Disagree/ No	No Opinion/ Don't Know	(No Response)
JobSatisfaction, Pride				
I like my job.	88	5	5	2
Most employees at my hotel don't like their jobs.	17	51	29	3
I am proud to work in the hotel business.	87	4	5	3
Most employees of this hotel have a sense of pride about their work.	71	16	9	3
Attitudes toward Pay				
I am paid fairly for the work that I do.	57	34	6	3
If I get tired of working in the hotel industry, I could easily find a job elsewhere in Hawaii that pays as well.	28	50	18	4
Local vs. In-Migrant Management				
Not enough people are promoted up through the ranks in my hotel.	46	30	20	3
Supervisors who are not from Hawaii don't understand the needs of employees who are.	55	27	15	3
More people from Hawaii should be advanced into higher managerial positions in my hotel.	65	14	17	3

(base: 5,267 statewide hotel employees)

Source: Strategic Information Research Corp. (1987) -- selected results provided by Council of Hawaii Hotels.

This menu of potential positive and negative outcomes does not indicate which effects are more frequent or more important. Nor does it indicate what aspects of the visitor population (such as level of expenditure or demographic composition) could affect the nature of social impacts.

However, social scientists have devoted considerable time to identifying factors which affect resident-visitor relations, both in Hawaii (Knox, 1979; Liu and Var, 1984) and elsewhere (UNESCO, 1976; Knox, 1978; Graburn, 1983; Kendall and Var, 1984). These studies and various Hawaii surveys (Research Associates, 1974; Public Affairs Advisory Services, 1975; Ward Research 1982) found no relationship between real or perceived direct economic dependence on tourism and attitudes toward either tourists or the visitor industry (although entrepreneurs associated with tourism were more likely to have positive attitudes).

Rather, the studies indicate that resident attitudes have more to do with factors such as perceived competition for resources (e.g., beaches and transportation facilities), displaced political resentment, age of respondents, and perceptions of how much visitors respect local residents.

In its recent review of factors affecting resident attitudes toward tourists for the developing State "Tourism Impact Management System," Coopers and Lybrand (1986) suggested that the key issue is the degree to which residents feel that tourists cause "intrusions and impingements" on resident lives, particularly in recreational or transportation/traffic situations.

As currently planned, the Hawaiian Riviera Resort will be a self-contained destination area similar to the current Mauna Kea, Mauna Lani, and Waikoloa resort areas. Research for past tourism social impact assessments (Community Resources, 1984, 1985) suggests that no more than about 15 percent of the visitor population at such resorts tours off-site in any given day. However, increased tour bus traffic jointly generated by the expanded Punlu`u Resort and by the Hawaiian Riviera attractions could increase resident awareness of visitors on the highways. And Hawaiian Riviera condominium guests would be more likely than luxury hotel visitors to rent cars and seek out nearby attractions such as the Volcanoes National Park, the black sand Punalu`u Beach Park, and the South Point Road.

While the increased visibility of visitors in Ka`u will not reach the level of West Hawaii or West Maui, there is some possibility of resident annoyance. However, a mitigating effect could be produced if off-site visitor activities are channelized into resident-operated tour or commercial activities, thereby increasing the proportion of residents who are likely to possess the positive attitudes of tourism entrepreneurs. Other potential management strategies are discussed in Section 2.6.

2.5.6.1.4 Increased Numbers of Resort Residents

As noted in Section 4, the Hawaiian Riviera Resort at build- out is projected to house an average 9,000+ resort residents (some of whom would be employees and some part-time residents).

There has been little systematic study of the social impacts of affluent full-time resort residents, such as retirees. In community interviews conducted for the Princeville Phase II EIS (Belt, Collins and Associates, 1983), it was concluded that Phase I residents of that Kauai project were initially socially isolated from surrounding communities, but then gradually began interacting with other residents through senior citizen organizations and other community affairs.

It may also be assumed that resort residents affect the political balance of the region

through (1) a more conservative philosophy on average, and (2) a desire for improved public services and facilities in their areas. Such political impacts are likely to increase gradually in the future as resort residential populations continue to grow. However, the cumulative resident population figures in Section 2.4 suggest that resort residents would comprise less than 28% of the anticipated growth in permanent population due to South Hawaii resort development, and so the direct political impacts associated with these residents are likely to remain minimal.

A more subtle and speculative cultural impact might involve the so-called "demonstration effect" of affluent people demonstrating a lifestyle of conspicuous consumption to less affluent local residents. (This would be true of both visitors and full- or part-time resort residents.) Related to this is the possibility of resentment by local residents if social class differences cause perceptions of "snobbery" on the part of Resort residents.

The potential for such impacts from tourism development has been much debated, not only in Hawaii but throughout the world. To date, little solid research has been carried out to determine whether this is a serious or just a minor concern. The proposed statewide survey of Hawaii residents within the new State "Tourism Impact Management System" offers one opportunity for such research.

2.5.6.1.5 Worker In-Migration and Related Population Change

In addition to job-related competition, other social impacts of population growth through inmigration are usually felt to consist of (1) strains on infrastructure and services (e.g., housing), with attendant social stress), and/or (2) social adjustment problems between newcomers and longtime residents (Hawaii State Department of Planning and Economic Development, 1981). However, there is frequent debate as to which of these two is more significant.

CRI has interviewed social service agency representatives throughout the state in conjunction with social impact assessments for proposed resort projects on Kauai (Belt Collins and Associates, 1983), rural Oahu (Community Resources, 1985), and West Hawaii (Community Resources, 1980, 1984, 1986). In these interviews, there was only occasional reference to serious social problems relating to conflicts between different types of people, but frequent mention of family and individual stresses resulting from population booms and associated social strains -- particularly shortage of affordable housing.

This finding is consistent with the major body of literature from outside Hawaii on sudden population growth in rural areas. For the past several decades, social scientists have been paying a great deal of attention to energy "boomtowns" in the American West. Initial studies blamed crime, mental health, and family disruption on social adjustment problems between newcomers and oldtimers (c.f., Kohrs, 1974; Cortese and Jones, 1977; Weisz, 1979; Freudenberg, 1981). However, these studies provoked serious criticism for lacking solid research techniques and being overly influenced by an anti-growth ideology (Wilkinson, Thompson, Reynolds, and Ostresh, 1982; Summers and Branch, 1984). A number of more recent studies (e.g., Bland, Orn, and Sinha, 1984; Krannich and Greider, 1984; England and Alpert, 1984) indicate that boomtown residents do have high levels of perceived dissatisfaction and some stress, but that most of this is attributable to temporary population overload of schools, housing, traffic, etc.

Based on this available indirect evidence from Hawaii and elsewhere, CRI would conclude that social adjustment problems between longtime residents and newcomers usually represent a milder although lasting social impact, while the social costs of housing shortages and other strains on infrastructure usually form the more acute but short-term impact.

However, given the small population and isolated nature of Ka`u and the Miloli`i/Honomalino area -- and given Ka`u's history of social fragmentation among communities -- social adjustment issues may represent a more serious concern in the study area than in most parts of Hawaii. Ka`u Police Captain Edwin Nobriga (personal communication, July 23, 1987) feels there is at least some potential for the sort of local-vs.-newcomer tensions and assaults which occurred in Kona during the late 1960's; however, Capt. Nobriga also believes this could be minimized or avoided through a concerted community effort to anticipate the sort of lifestyle and value differences accompanying social change.

Appropriate social impact management strategies (discussed at more length in Section 6) would include:

(1) to the extent that in-migrant workers are required, targeting recruitment toward socially compatible groups (e.g., former study area residents, people from other parts of Hawaii, etc.); and

(2) establishing long-term communication mechanisms between residents and resorts to identify any problems on which both sides can jointly work for solutions.

Additionally, housing some of the new population in the support community or in the resort area itself represents a partial mitigation, to the extent that existing communities do not have to accommodate these people within present neighborhoods.

2.5.6.1.6 Increased Services, Facilities, and Cultural Interaction

For many Ka`u residents, an increased population base will greatly improve the quality of life by leading to better services in areas such as medical, police, fire, social agencies, shopping, entertainment, restaurants, etc. And while luxury resort facilities themselves will not be affordable to most residents on a daily-use basis, residents of rural areas throughout Hawaii have at least occasionally taken advantage of fine dining, golf, and other recreational facilities -- often made available by operators to nearby residents at discount prices during off-peak times.

This is a matter of values, and some residents would place greater value on maintaining the current low population and associated lifestyle. Additionally, some of the services will not be made available until statistics indicate they are justified -- e.g., police and social service agencies usually can obtain funding for new staff positions only by demonstrating that complaints and problems exceed present resources. Thus, population growth often results in the perception of inadequate rather than improved services, at least until growth stabilizes.

The Hawaiian Riviera Resort is intended to attract patrons from around the world, bringing national and international cultural values to one of the most isolated parts of Hawaii. This will be exciting to some residents, intimidating to others.

As indicated in previous sections, one of the primary resident concerns in the study area is the lack of activities for youth, and the lack of exposure to the outside world. A resort of this nature has great educational potential for young people, so long as they actually can feel a sense of comfort, familiarity, and welcome there. For this reason, the mitigation strategies discussed in Section 6.1 place strong emphasis on interactive programs between the resort and public schools.

2.5.6.2 Indicators of Community Cohesion

To the extent that tourism causes the types of negative qualitative social impacts of which it is often accused, at least some indication should be found in statistical measures of:

- o crime data; and/or
- o juvenile arrests; and/or
- o family problems; and/or
- o individual mental health.

2.5.6.2.1 Crime Data

It has frequently been alleged that resort development is linked with crime, and some studies using Hawaii data (e.g., Fujii and Mak, 1979; Fujii, Mak, and Nishimura, 1978, 1980) have established statistical associations between some measures of tourism and reported crime. Chesney-Lind and Lind (1984) used Kauai crime data from 1978 to 1980 in order to compare victimization for visitors vs. residents. In that period of time, results varied greatly depending on the type of crime. Overall, visitors were less likely to be crime victims than residents, although they were more likely to report a few particular types of crime (robbery, rape, and larceny -- the latter usually being thefts in public settings such as beach parks).

A prior resort social impact assessment (Community Resources Inc., 1985) has extensively analyzed both the Hawaii crime- tourism studies and several studies from outside Hawaii (Pizam, 1982; Jud, 1975; McPheters and Stronge, 1974). When all the study results are presented together, no definite pattern emerges. Crimes linked to tourism in one study have no association or even a negative association in another study, although there was some weak consistency in finding links between tourism and the particular crimes of robbery, rape, and larceny. However, police in rural Hawaii areas affected by tourism -- including the Ka`u and Kohala areas -- say that the major crime impacts generated by resorts involve property crimes, primarily larceny at beach parks and other visitor attractions off-site from resort destination areas themselves.

In the recent EIS for the proposed new Ritz-Carlton at Mauna Lani (Belt Collins and Associates, 1987), CRI examined the historical relationship between crime statistics and new hotel development in the Kohala area, where development in the early 1970's may be seen as fairly comparable to Ka`u development in the present time period.

This analysis failed to show any clear relationship between new Kohala visitor units and reported crime of any type, whether total, violent, or simple larceny (theft). This does not conclusively disprove any link between crime and tourism in Kohala, since statistical relationships are complex and can be masked by other variables. However, it does illustrate that any such relationship (if it exists) is not a simple one, and that building new visitor units will not automatically lead to increased crime, except for expected increase as a function of increased population.

In Ka`u, the Punalu`u Resort opening of 1973 represented a much more limited tourism experience than the large Kohala hotels, and so it is particularly difficult to draw any conclusions from past crime data. However, Table 41 does indicate an increase in reported crime -- both

property and violent crime -- in the mid-1970's. This was followed by a plateau period and then an actual decrease in the early 1980's, when State estimates indicate substantial Ka`u population growth.

Ka`u Police Captain Edwin Nobriga (personal communication, July 23, 1987) reports that Ka`u remains a relatively low-crime area today, with few offenses reported by or against tourists. He said there have been substantial drug-related crimes in the past, particularly in the Ocean View area, although (1) these have been to some extent cleaned up by recent police action, and (2) he foresees little likely interaction between this element and resort guests, since the Ka`u drug element has consisted of motorcycle groups and others who shun social interaction. Captain Nobriga's main concern related to resort development, as earlier indicated, is the adjustment process between longtime residents and in-migrant workers.

At the same time, he notes, Ka`u has already been gaining experience in the adjustment process due to recent increases in both the Mainland newcomer and Filipino immigrant populations.

2.5.6.2.2 Juvenile Delinquency

In the Ritz-Carlton EIS (ibid., 1987), CRI also plotted Kohala visitor units against juvenile arrests in the South and North Kohala districts combined. It was found that juvenile delinquency actually dropped in the years immediately following opening of the Sheraton Royal Waikoloa and the Mauna Lani Bay Hotel, although an upturn in juvenile delinquency did occur several years later.

Ka`u's total juvenile arrests over the past 15 years (Table 41) do not indicate any clear pattern or relationship in time with the 1973 opening of the Punalu`u Resort.

In past resort social impact assessments (Community Resources, Inc., 1984, 1985), police officers from Kohala and other rural resort areas throughout Hawaii have been quoted as saying that the major implications of tourism for juvenile delinquency involve (1) increased juvenile opportunities for thefts at beach parks or other public places, and (2) creation of a "street scene" in tourist commercial areas such as Lahaina or Kailua-Kona. Compared to independent hotels in semi-urban complexes, self-contained destination areas such as the proposed Hawaiian Riviera Resort contribute relatively little to the first of these factors and even less to the second.

2.5.6.2.3 Family Problems

As noted in Section 5.6.1.1, resort employment can theoretically contribute to marital discord or child care problems. The only district-level statistics on such problems relate to child abuse and/or neglect. Table 42 shows statewide and Big Island data for child abuse/neglect since 1980 (when the State switched over to the record-keeping system currently employed).

Child abuse/neglect figures must be treated with great caution because (1) there has been a recent statewide (and national) increase in willingness to report cases, which does not necessarily mean actual increased abuse or neglect, (2) available figures may include repeated reports over time about the same families; and (3) reported cases are also partly a function of the number of

Table 41: Reported Ka`u Crime and Juvenile Delinquency Statistics

Year	Total Type I	Total Violent	Total Property	Larceny	Rape	Juvenile Robbery	Total Arrests
1970	70	11	59	38	0	0	2
1971	77	3	74	51	0	0	10
1972	99	24	75	49	0	0	4
1973	127	18	109	76	0	0	6
1974	134	23	111	90	3	2	10
1975	179	25	154	105	0	0	7
1976	162	35	127	81	0	0	16
1977	184	24	160	116	0	0	6
1978	198	38	160	118	0	0	13
1979	184	21	163	120	1	0	20
1980	188	38	150	100	2	0	8
1981	186	26	160	97	2	0	9
1982	144	20	124	72	0	0	7
1983	132	27	105	72	6	0	10
1984	125	19	106	69	1	0	8
1985	154	33	121	82	0	1	19

Notes: (1) "Type I" crimes are major violations (as opposed to "Type II" crimes, which are less serious or for which arrest policies may vary from year to year).

(2) Types of crimes shown in this table are those most often linked to tourism in social science reports.

(3) Punalu`u Resort opened in 1973.

Source: Hawaii County Police Department.

Table 42
Statewide and Study Area Child Abuse/Neglect Data, 1980 - 1985

Statewide	1980	1981	1982	1983	1984	1985
Reported:	2,104	2,358	2,681	3,631	4,378	4,234
Rate/10,000 Residents:	21.7	24.0	26.9	35.7	42.1	40.2
Confirmed:	1,061	1,134	1,379	1,620	2,181	2,336
Rate/10,000 Res.:	11.0	11.6	13.8	15.9	21.0	22.2
Hawaii Island						
Reported:	214	209	288	371	477	521
Rate/10,000 Res.:	23.0	21.5	28.8	36.0	45.0	47.7
Confirmed:	83	91	111	155	233	279
Rate/10,000 Res.:	8.9	9.4	11.1	15.1	26.0	25.6
Study Area Census Tract Reports (Confirmed Only)						
212 - Ka'u	3	3	0	2	9	14
(as % of County:)	(3.6%)	(3.3%)	(0.0%)	(1.3%)	(3.9%)	(5.0%)
213, 214 - S. Kona	7	10	6	10	34	20
(as % of County:)	(8.4%)	(11.0%)	(5.4%)	(6.5%)	(14.6%)	(7.2%)
TOTAL STUDY AREA	10	13	6	12	43	34
(as % of County:)	(12.1%)	(14.3%)	(5.4%)	(7.7%)	(18.5%)	(12.2%)

Note: Figures are for unduplicated abuse and/or neglect. However, cases reported on different days involving the same individual are listed as separate instances.

Source: Unpublished data, Hawaii State Department of Social Services and Housing. Rates per 10,000 residents calculated by Community Resources, Inc., based on County population estimates from Hawaii State Department of Planning and Economic Development (1986).

caseworkers who are present to record the reports. For example, Kona child protective social workers believe the situation there has reached crisis proportions not represented in official statistics due to lack of personnel to record all cases.

Given these caveats, it may be seen from Table 42 that there has been a sharp islandwide increase in both reported and confirmed child abuse/neglect cases from 1980 to 1985. However:

- o the Big Island rates are essentially identical to statewide rates;
- o the total Ka`u/South Kona study area's share of confirmed cases islandwide has fluctuated greatly, ranging from 5.4 percent in 1982 to 18.5 percent two years later.

Another type of family problem involves teen pregnancy. Ka`u High School records, as reported to the Child & Family Service, indicated at least 12 confirmed pregnancies a year in the mid-1980's. Most social workers interviewed by CRI believed that such youth problems can be assisted through population growth which can provide a base for better community youth recreational facilities and programs.

2.5.6.2.4 Mental Health

Theoretically, it would be possible to track mental health admissions statistics against resort unit counts for West Hawaii to determine whether any relationship exists. However, according to the Chief of the Hawaii County Community Mental Health Center (personal communication, David Wrigley, April 24, 1987), apparent recent "declines" in West Hawaii mental health caseloads actually reflects a reduced number of caseworkers and a more selective screening process. Therefore, it would be inappropriate to use the data for even tentative comparisons with tourism development in West Hawaii.

However, interviews with West Hawaii social service agencies (Community Resources, Inc., 1980, 1986) suggest that (1) any relationship between resort development and either individual or family stress probably has more to do with strains from population growth (e.g., having to "double up" in housing) than with tourism per se; and (2) newcomers are more likely than longtime residents to exhibit psychiatric symptomatology in response to stress -- partially of lack of support networks and partially because Mainland-raised individuals are culturally more likely to internalize stress while many local residents vent their frustrations externally (i.e., fights, minor crime, family arguments).

The Chief of the Hawaii County Mental Health Community Center also believes (personal communication, July 21, 1987) that additional employment opportunities will assist the overall mental health situation in the study area by providing more income and a better selection of careers to match different individual interests. He further believes that some population growth will result in final, additional justification to provide more mental health services -- e.g., a satellite clinic -- already needed in the Ka`u area.

2.5.6.2.5 Social Consequences of Unemployment

Preceding discussions of impacts from resort development and resort employment have not explicitly considered alternatives. For the Ka`u/South Kona study area, the most likely

alternative (and one which would be even more likely if the sugar plantation should fail) would be unemployment.

There have been many studies nationwide (e.g., Hollingshead and Redlich, 1958; Gurin, Veroff, and Feld, 1960; Srole, Langner, Michael, Opler, and Rennie, 1962; Bradburn, 1969; Tiffany, Cowan, and Tiffany, 1970; Brenner, 1973; Wills and Langner, 1980; Dooley and Catalano, 1979, 1980; Catalano, Dooley, and Jackson, 1981; Liem and Rayman, 1982) as well as in Hawaii itself (Frank, 1981) which basically indicate:

(1) Mental health problems are far more prevalent among the unemployed than among the employed; and

(2) Poverty is strongly associated with virtually all forms of mental illness.

Crime is a more complicated issue. While crime rates are higher in extremely poor areas, there is no apparent relationship between job loss and increased crime (Horwitz, 1984), and crime rates sometimes drop during economically troubled times.

However, in terms of family stability, other studies -- both going back to the Great Depression (Bakke, 1934, 1940; Angell, 1936; Komarovsky, 1940) and more recent (Strange, 1977; Root, 1979; Gordus, Jarley, and Ferman, 1981) -- which have demonstrated extreme negative impacts of unemployment and financial crisis on family relationships. Child abuse has also recently been linked to unemployment (Steinberg, Catalano, and Dooley, 1981).

Thus, while resort employment -- like employment in any type of industry -- may have negative as well as positive sociological and psychological aspects, these aspects would generally be less problematic than impacts of widespread unemployment.

2.6. SOCIO-ECONOMIC MITIGATIONS AND MANAGEMENT STRATEGIES

2.6.1 Purpose of EIS Socio-Economic Mitigation Discussion

The term "mitigations" refers to actions which can be taken to reduce negative impacts (or enhance positive ones), whether these actions are taken by the developer, local government, or some other party.

A purpose of this EIS is to discuss possible actions, at least in a broad and preliminary way. That is because the actual method for deciding upon mitigations usually involves negotiated conditions attached to government land use approvals (and/or government budget decisions). The function of an EIS is to discuss matters relevant to these decisions, but not to pre- determine the outcome of the political negotiating process which leads to these decisions.

It should be noted that:

(1) Government conditions and voluntary actions by resort developers are usually settled upon closer to the time of actual construction and operation. The current EIS is prepared in conjunction with requests for General Plan and Land Use Commission approvals, and the developers cannot begin construction or operation with these broad policy approvals alone. They must later seek zoning and Shoreline Management permits for specific parts of the project, and these approvals usually require further and more specific environmental and

socio-economic assessments.

Therefore, at the present time, the best way to approach socio-economic mitigations is to identify possible actions and then to suggest processes for deciding what actions should actually be undertaken. The suggested processes (particularly for job training and housing programs) are ways to come up with more definite proposals by the time that developers are ready to apply for zoning.

(2) The following suggestions represent consultant recommendations as to possible socio-economic strategies. The developers have agreed to explore the feasibility of these concepts if General Plan and Land Use Commission approvals are obtained. However, whether their final commitment is to these steps or to other alternatives will depend on a number of factors, including community and government response to the concepts.

2.6.2 Steps to Maximize Economic Benefits for Current Residents

2.6.2.1 Rationale and General Objectives

As discussed in Section 2.5, primary resident concerns to date about this project have included (1) a desire for employment opportunities, coupled with concerns that area residents might not be competitive, particularly for better jobs; (2) apprehensions that in-migrants might not only be more qualified for employment, but also cause social disruption if they have different values and different lifestyles.

Therefore, it is recommended that a program eventually be developed which has three broad objectives:

- job training and other measures to assure current residents of the best possible opportunities to be hired and to advance to the best jobs within the resort itself;

- measures to help existing agencies with ongoing efforts to aid current residents in capturing as many resort- generated business opportunities as possible (both on and off the resort site);

- since in-migration will still be required, a targeted recruitment effort (compatible with equal opportunity laws) to assure that as many in-migrants as possible are socially compatible with current residents (e.g., former Ka`u or South Kona residents wanting to come home, residents of other Big Island areas, etc.).

Based on community input to date, job training is tentatively considered the most important of these three objectives, but the other two should not be omitted.

As will be discussed shortly, many islandwide and statewide agencies already exist which can aid in these efforts. The Hawaiian Riviera Resort does not need to duplicate their programs, but simply to coordinate and facilitate them, and to make sure the services are made available where and when needed. It is expected that a very small staff could achieve these

objectives, assuming that this staff has good communication lines with the agencies to be discussed in Section 2.6.2.3.

2.6.2.2 Possible Elements of the Eventual Program

It is possible to think of many more "good ideas" than resources will support or than residents are truly interested in. Therefore, what follows is a "menu" of possibilities. The next stage in the program planning would involve discussions with community and government officials to decide which items on the "menu" have highest priority.

(1) Construction Employment/Subcontracting Liaison: The Hawaiian Riviera Resort will provide numerous construction jobs, particularly in the early years. Many Ka`u and South Kona residents, particularly males, may be more interested in these jobs than in hotel operational jobs. Also, there are many small contractors in the area. Given the magnitude of required construction, it is likely that already-qualified Ka`u construction workers will have little difficulty in finding employment. However, early action will be required if significant numbers of still-untrained Ka`u residents are to be given the chance to enter union apprenticeship programs. This requires establishing good communication lines among the Resort, the unions, and the community. Also, small local contractors must be informed of the standards expected of them if they are to compete with outside companies with whom the general contractors are more familiar and used to subcontracting with. Therefore, a key early step for any Resort program would involve learning about local construction resources and seeking ways to use them at the Resort.

(2) Operational Jobs -- Job-Specific Training: "Job-specific" training means the final detailed training for a specific job, such as bartender, front desk, etc. Individual hotels generally prefer to provide their own training, and so job- specific training may actually turn out to have a small role in any program sponsored by the Resort master developers. However, the program could still possibly be involved in (1) working with hotel management at start-up time to assure their programs are sensitive to local conditions and to advise them of the availability of local agencies which have been involved in rural Hawaii hotel start-ups before (e.g., community colleges and the Office of Employment and the State Office of Employment and Training Administration); and (2) after start-up, helping various hotels coordinate with Ka`u High School in providing work-study programs and other efforts to make sure young residents receive on-the-job training to fill vacancies created by turnover.

(3) Job Preparation Activities: "Job preparation" refers to activities which can give an area resident a better overall background, so that he/she is more likely to be hired and <u>then</u> given job-specific training by some hotel. A program sponsored by master resort developers (and/or government) would probably focus less on job-specific training and more on job preparation activities, such as:

- o initial vocational counseling and referrals;
- o remedial education in "basic skills" (English, reading/ writing, simple computations);
- o counseling in attitudes and skills needed in job interviews, such as appearance and self-presentation (NOTE: resort personnel officers at existing rural operations throughout the state say attitudinal and appearance factors are generally the major barrier to resort employment for rural-area residents);

- possibly some basic instruction in selected foreign languages, if Hawaii continues to attract more visitors from Japan and Europe, as recent trends would indicate.

(4) Contingency Programs for Retraining Agricultural Workers: Whether due to voluntary job transfers or to unexpected business closures, many current or former agricultural workers may be in the position of switching to service jobs. A plan might be in place to work with appropriate agencies to retrain former agricultural workers for fairly comparable resort-related jobs, such as construction or groundskeeping.

(5) Community Awareness and Information Activities: Many study area residents are likely already well-qualified for resort employment but may not be aware of upcoming opportunities or may lack interest due to lack of exposure or to misinformation about resort employment. Therefore, it may be important to initiate a good publicity program and to work with agencies such as Ka`u High School, the Visitor Industry Education Council, and the ILWU to distribute accurate information about the actual advantages and disadvantages of resort jobs.

(6) Advocacy for the Community with Resort Operators: Previous possible steps have involved taking information or services from the Resort to the community, but it is possible that the program should also act to some extent as a community advocate with the Resort. When hotel operations start up, the operators may not always be aware of the nature of the nearby community or the informal understandings between community and original developer. While a community advisory group (Section 2.6.5) might itself perform some of these functions, program staff could also:

- serve as liaison between various hotel personnel offices and local agencies in touch with job-seekers in order to act as a direct advocate for residents seeking jobs;

- provide new hotel managers with a thorough understanding of local community characteristics and expectations;

- additionally, work with out-of-state management to explore any ways that Western-based management practices could be modified to fit with various local cultural characteristics (e.g., greater involvement of family groups at work, group rather than individual incentive systems, etc.);

- encourage hotels -- individually or on a Resort-wide basis -- to implement Hawaiiana programs (such as those at Mauna Lani or some Maui hotels) and to educate workers about Ka`u itself, so there is a strong sense of pride. This is particularly important in connection with the Resort's archaeological sites.

(7) Employee Support Services: In order for area residents to be able to work (and/or to acquire extra training), it may be important to remove barriers by support services such as:

- Transportation Assistance: South Kona macadamia nut operations now provide direct employee transportation from Ka`u, and some South Kohala hotels help subsidize a County-run bus service used by workers.

- o Child Care: Rural Oahu resorts have recently agreed to provide land for day care centers. However, resort employees must also work afternoons and evenings, and so the greater need may prove to be coordination of babysitting services, which could be done cost-efficiently.

  It is possible that such support services could be provided by private entrepreneurs or appropriate government agencies, rather than the Resort itself. The key recommendation is that the Resort become involved in assessing needs and making sure that appropriate agencies are addressing these needs.

(8) Moving Current Residents Up to Higher Positions: Most hotels have their own in-service upgrade training programs, so that employees can climb a career ladder to supervisory and mid- management positions. And the prospect of a series of new hotel openings (at both the Hawaiian Riviera and Punalu`u resorts) suggests there will be a number of opportunities over the years for talented employees to "jump" to higher positions. However, it may be desirable to:

- o assess possible subtle barriers to such advancement (e.g., cultural reluctance to "act superior" to friends and family), so that these do not lead to study area residents feeling passed over and resentful;

- o help coordinate individual hotel upgrade training programs, possibly arranging for common classes or other outside resources which would not be cost-effective for one hotel program alone;

- o work with the University of Hawaii community college system to assure that Ka`u / South Kona residents have access to current training programs for better-paying jobs, such as sous-chefs;

- o possibly provide some scholarship assistance to qualified young study area residents interested in college training for top hotel management jobs (although there is no way to assure that such young people would necessarily return to Ka`u resorts in particular).

(9) Entrepreneurship Training and Small Business Assistance: Resort development generates opportunities for many small businesses -- on-site concessions and shops; off-site tours or other visitor-oriented services; services to hotel purchasing departments; and new businesses serving the growing residential population. Often, it is these businesses which provide area residents with some of the best opportunities for increased income; for preserving the sense of independence which many people consider part of the "Ka`u lifestyle;" and for integrating local cultural approaches to work which are harder to implement in large hotel staff settings. However, many residents may not have the background to seize these opportunities, and even existing small business people (e.g., independent commercial fishermen) may need assistance in managing and holding onto businesses which expand rapidly.

Currently, most of the state's entrepreneurship or small business programs are located in Honolulu, with a few (such as Alu Like) in Hilo. A significant element of the future program could involve assessing residents' needs and interests in this area, then arranging for periodic visits by appropriate agencies to the Ka`u and South Kona areas.

(10) Targeted Recruitment of In-Migrants: As effective full employment of current study area residents is attained, new people may move to the Ka`u area in search of jobs even without any particular recruitment effort on the part of the Resort. However, consideration may be given to targeted recruitment in the Hilo and Puna areas, since these people are (1) more likely to be socially compatible with current study area residents; and (2) possibly able to commute for a period if there are periods of housing shortages in Ka`u. The form of "targeted recruitment" would most likely be linkages with employment services and high school vocational departments. (NOTE: Such efforts should be focused on geographical and broad socio-cultural factors, as opposed to ethnic or social class distinctions. It will be necessary to make sure that such efforts are in total compliance with state and federal equal opportunity laws.)

Off-island campaigns to attract former South Hawaii residents or workers from Oahu (rather than out-of-state) represent a somewhat more tentative suggestion, since they may also attract job-seekers other than the target population. Word of mouth -- as when family or friends inform former Ka`u residents of new job possibilities at home -- may ultimately prove more effective. However, the possibility of some programs, such as active recruitment on Oahu high school or community college campuses, could merit further study.

2.6.2.3 Available Resources and Discussions to Date

As previously noted, it is expected that many program objectives could be met by <u>existing</u> agencies, so long as a coordinated effort is made to involve them and to assure that services are made available to Ka`u residents.

In the course of preparing this social impact assessment, Community Resources, Inc. touched base with several agencies and found a high degree of interest in possible participation.

- <u>Alu Like</u> provides employment training and small business assistance for native Hawaiians. Agency staff (personal communication, Carla Kurokawa, Employment and Training Coordinator, June 1, 1987) has expressed interest in becoming involved in a planning process, with particular interest in needs assessment. Staff emphasized the importance of community involvement in such a program.

- <u>University of Hawaii/Hilo, Department of Vocational Studies</u> (formerly Hawaii Community College) offers a wide range of resort-related courses at both its Hilo main campus and various West Hawaii locations. Additionally, the University's Center for Continuing Education and Community Services (CCECS) can offer in-community programs of various duration and has a history of working with Big Island employers to develop programs to meet specific employment training needs. The CCECS also has potential access to all University of Hawaii resources, including those at the Manoa campus. While concerned whether there will be enough Ka`u-area residents to justify class-size activities in the area, the University is nevertheless eager to participate in any broad planning effort (personal communication, Dr. Judith Kirkendall, CCECS Director, June 3, 1987).

- <u>State Department of Education</u>: Ka`u High School currently offers some courses and can offer others (such as food service) that are resort-related. The school's counselor (personal communication, Jose Basque, June 1, 1987) is eager to participate in an employment planning program and has indicated that high school facilities could be made available to other agencies

to provide services which the high school cannot offer.

- International Longshoremen's and Warehousemen'Union: Ka`u officers of the ILWU -- which represents sugar cane, macadamia nut, and golf course workers in the area -- are receptive to participating in a planning process, and divisional officers in Hilo have requested more information about the developers' plans.

- State Department of Labor and Industrial Relations (DLIR): DLIR's Employment Services office on the Big Island administers the federally-funded Job Training Partnership Act (JTPA) program, which funds a wide variety of job training and preparation activities for economically disadvantaged and unemployed residents. Due to limited funds, however, the only program now offered in Ka`u is the Summer Youth Employment Program. However, staff has indicated an eagerness to participate in any broad-based planning process designed to identify the area's job training needs (personal communication, Haruye Hagiwara, JTPA Coordinator, June 4, 1987).

  DLIR also administers the Statewide Transition Center system within public high schools, which provide career counseling and related services to high school students (and, on a space-available basis, to area adults). The only center currently operating on the Big Island is at Hilo High School, but the system plans to expand to serve unspecified other high schools (personal communication, Sylvia Hara-Nielson, Director, June 9, 1987).

  In its Honolulu offices, DLIR houses the Tourism Training Council, a relatively new organization intended to be a communication mechanism between government, tourism employers, and training providers. While the Council's current focus is on statewide issues, there is tentative interest in becoming involved in regional efforts such as that under consideration for Ka`u (personal communication, Sybil Kyi, Executive Director, July 20, 1987).

- Hawaii Hotel Association "Adopt-a-School" Program: Each Big Island high school except Laupahoehoe has now been adopted by at least one hotel. (Ka`u High School has been adopted by the Hotel King Kamehameha in Kona.) Each adopting hotel is responsible for development of resort- related educational and awareness activities, such as career shadowing, for students. The Big Island program is still in its early organizational stage, and hotel personnel directors are in the process of meeting with school staffs to plan activities to begin in fall 1987 (personal communication, Geordine Naho`opii, West Hawaii Coordinator, June 9, 1987).

- Visitor Industry Education Council (VIEC): The VIEC, originally created to carry out a general public relations program for the industry, has evolved so that its primary function is providing information in the schools about resort-related employment. The VIEC offers film presentations, help with career fairs and workshops, assistance in curriculum design, teacher workshops, and media information programs. The VIEC Executive

Director has indicated strong interest in possible involvement in a Ka`u program (personal communication, Lynn Cook, July 22, 1987).

- Punalu`u Resort, in its since-withdrawn EIS (PBR Hawaii, 1987), indicated a willingness to develop a plan to maximize resident employment and economic benefits. However, any possibility of a joint effort with the Hawaiian Riviera Resort would probably not be addressed until both resorts have more information about the extent of their government approvals. It may be noted that both projects have thus far utilized the same consultant for conceptual approach to a job training plan, and thus the two broad proposals have many similarities.

Additionally, it may be noted that several Oahu resorts -- Kuilima and Ko Olina (West Beach) -- are developing broad programs to assure maximal employment/economic benefits for nearby residents. The Hawaiian Riviera program would have the benefit of learning from the experiences of these pioneering programs.

2.6.2.4 Process for Arriving at a More Definite Plan

Following General Plan and Land Use Commission approvals, and prior to zoning/ Shoreline Management application, the necessary tasks involve:

- Identify mechanisms (such as a planning committee) to involve all important "stakeholders" (developer, service providers, community);
- Interview hotel operators and service providers to determine practical constraints and potential levels of commitment for involvement in a program;
- Assess community perceptions of needs and perceived barriers to employment among area residents;
- Determine preliminary priorities among the various potential elements which were discussed in Section 2.6.2.2;
- Develop a first-draft broad outline of a potential program;
- Obtain reactions from government, community, service providers, and representative hotel operators to the initial draft;
- Identify gaps in data which must be filled in final needs assessment and detailed planning;
- Produce a final program outline, along with details about any further planning and data collection yet to be completed. This outline would be completed in time for government review in conjunction with hearings on specific zoning requests. It would include a timeline and budget for all activities remaining before program implementation, and a rough timeline and budget for the program itself.

If final zoning and Shoreline Management permits are obtained, it becomes feasible to

complete the process:

- o Finalize detailed needs assessment studies and program design, including final budget and workplan;
- o Formalize a system of regular community involvement in the program;
- o Implement the plan.

2.6.3 Steps to Address Housing Impacts

2.6.3.1 Rationale and General Objectives

As discussed in Section 2.4, there will be housing-related impacts associated with both the construction and the operational phase of the resort. These impacts may be further divided into short- and long-term.

As of late July 1987, the County Planning Department has not yet established a policy as to the general direction mitigations should take. However, two broad options are available -- either (1) through the phased development of an on-site support community, as proposed by the developers of the Hawaiian Riviera, or (2) through the planned expansion of existing communities. Additionally, the County is concerned that. while people may willingly occupy housing without basic infrastructure needs, eventually they will be requesting improvement of the infrastructure at County expense.

The County has in the past had to make foreclosures necessitated by improvement districts to remedy infrastructure inadequacies. However, as discussed in Section 2.3, there is likely to be some building on the sub-standard subdivisions near the resort even if only by induced and indirect population increases.

The objective of a housing intervention program is to provide adequate housing for both construction and operational workers while ensuring that local residents are not subjected to displacement or higher housing costs. A second objective is to promote safe and County-standard housing without burdening the County capital budget.

Therefore it is recommended that a program eventually be developed which has four broad elements:

- o Construction worker housing to assure adequate housing for the workers and minimize higher housing cost impacts on local residents;
- o Housing development which evaluates and balances new construction at existing subdivisions, an on-site support community, and existing communities;
- o Infrastructure development to assure an adequate supply of residentially developable land, within existing communities and/or new developments; and
- o Housing occupancy assistance aimed at matching workers with available housing.

A successful set of housing interventions will use a variety of resources available in government housing assistance programs. A number of programs are active which can meet the needs of future resort workers. This section will discuss potential resources available; potential specifics of the program elements; and a process for arriving at a more definite plan.

2.6.3.2 Possible Elements of the Eventual Program

(1) Construction Worker Housing Program: Construction period housing needs, while potentially high, will be temporary in nature relative to operational needs. Experience in West Hawaii has shown, however, that even a limited number of non-area construction workers looking for housing can cause problems both for the workers as well as for existing residents. The exact number of needed units will depend on available housing at the time, the phasing of the construction, and the availability of on-island construction workers either from Ka`u or willing to commute from other parts of the island.

Due to the limited amount of available housing in Ka`u, some new units will need to be furnished for initial construction personnel. It is likely that the lead contractor will establish a temporary base camp for this purpose.

Subsequent construction workers could be housed in multi- family structures within the project site. These could be later used by either resort workers or by more construction workers (depending on the building schedule), and/or can be refurbished and sold to individual purchasers following completion of major construction tasks.

Additionally, it may be expected that, just as in West Hawaii, the potential for continued construction jobs in Ka`u will result in the development of some housing in existing communities and subdivisions.

(2) Housing Development Program: New housing may be expected to be built primarily at the resort support community, as expansion of existing communities, and development in nearby subdivisions. Development of additional units in existing communities or in sub-standard subdivisions will require improvements to basic infrastructure, especially water, roads, and electricity.

(a) On-Site Support Community: The Hawaiian Riviera Resort developers propose a separate on-site support community, which would mitigate population growth impacts on existing communities. Such a support community would have basic amenities to start, such as shopping and recreation, and would provide for expanded services such as police, fire, and schools as the community grows.

Early provision of competitively-priced single-family and rental housing in this support community would help to forestall or minimize speculative development of housing in substandard subdivisions.

Based on the needs and desires of West Hawaii resort workers, it may be expected that Ka`u workers will require a large percentage of single-family housing with two and three bedrooms. Multi-family units and dormitory-type housing may also be provided to meet the needs of workers who do not require single-family housing.

(b) Expansion of Existing Communities: There may be some need and desire to expand existing communities such as Na`alehu. This will be due to natural increase, in- migration of resort workers, and induced and indirect population growth as a result of the resort.

It will be desirable to continue the character of these communities into their expansion. This would mean the construction of almost exclusively single-family dwellings, as well as the provision of adequate infrastructure and support services.

(c) Development of Nearby Subdivisions: Due to the large quantity of available lots in existing subdivisions and their extremely low price (as low as $3,000), development of some of these lots is very likely. If other housing were not available, extensive development of these lots may be expected regardless of the state of their infrastructure. The quality of this development is likely to vary, just as does the existing development. This development may occur either as the result of a planned effort and/or individual speculation. As noted in Section 2.3, development of these lots is already occurring and is likely to increase due to demand from West Hawaii resort workers alone.

The planned development of lots in existing subdivisions would minimize speculative development. To the extent that improvements are made to subdivision infrastructure through one of the previously mentioned infrastructure programs, and to the extent that development of existing lots is coordinated, then undesired development of substandard or illegal structures may be minimized.

(3) Infrastructure Development Program: There are several methods of developing infrastructure. These include bonds, impact fees, improvement districts, special districts, tax increment financing, user fees, and exactions. It is somewhat premature to select a means of providing infrastructure and financing it, in the event that new infrastructure is needed. Such a determination would be part of the final process of mitigation planning discussed in Section 2.6.3.4.

(a) Bonds: The timely need for infrastructure can be mitigated through the use of government bonds tied to the revenues derived as a result of the value created in the visitor plant. The debt service on the bonds could be guaranteed by any revenue source not already committed. This may be from the hotel room tax, an increase in the real property tax for resorts, or a committed increment of the natural increase in property tax revenues. A combination of these methods may be use for different bond issues.

(b) Impact Fees: Impact fees are increasingly used throughout the country as a means of financing off-site infrastructure required for development. The local government must first select the type of infrastructure to be paid for from the fees. To be legally defensible, the infrastructure requirement must be directly caused by the proposed project, the size of the fees must be related to the size of the impact, and the fees must not

be spent to redress existing deficiencies.

(c) Improvement Districts: Improvement districts are established to permit a special tax levy on property owners who benefit form specific public improvements within the district. Hawaii State statutes permit such districts and they are used by the counties to provide special facilities not generally required in other parts of the community such as parking structures in business districts or sidewalks in residential areas.

(d) Special Districts: Special districts are essentially improvement districts with government bodies separate from the local government. As limited purpose local governments created under state enabling legislation, special districts have the authority to tax, issue bonds, and provide services within a specified area.

(e) Tax Increment Financing: In this approach, increases in tax revenues that are realized as a result of new development in a specified area are earmarked for financing public improvements or services in that area. Usually administered by a public agency, a district is defined with a specified "base line" of existing development. Improvements within the area are financed from public funds or bonds, then repaid from increasing tax revenues generated by the new development. The new development in effect pays its own way, using the community's normal tax program as the mechanism for deriving revenues.

(f) User Fees: User fees can be pledged to repay revenue bonds issued to finance new infrastructure as well as to pay for operating and maintenance expenses. The development and, to a greater extent, the maintenance of water and sewer facilities are financed this way. An advantage to this form of financing is that those who use the service are the ones who pay for it. Additionally, the costs to home owners are spread out over time and not reflected in the home price.

(g) Exactions: This form of financing public improvements takes various forms and has been popular in Hawaii. In its most common form, the form and quantity of the exaction is a politically negotiated process. Not only may the exaction be targeted at the true impacts of the development, but often they are also aimed at redressing existing deficiencies or solving community-wide problems.

(4) Housing Occupancy Program: Increasing the supply of available and moderately priced housing is necessary but not in itself sufficient to address the broader housing concern often expressed by communities: "building housing for whom?". In order to assure that resort workers will receive the benefits derived from increased supply, it may be necessary to implement coordinated programs to place workers in appropriate housing, both owner-occupied and rental.

(a) Counseling: During the construction and start-up phases of the resort, employee housing counseling may provide an efficient way of assuring adequate quarters for resort workers.

Hawaiian Dredging, in conjunction with its work on the Waikoloa

Hyatt, has retained the services of a real estate firm to find housing for its construction workers and sub-contractors. A similar approach could provide a smooth and timely integration of Ka`u construction workers into the community.

A continuation of such a program during initial staffing of the Resort would provide housing information and assistance to both newcomers to the area as well as long time residents, some of whom may be expected to want to find new housing as a result of their employment. After the start-up phase, the occasional services of a real estate agent for employees may be offered.

(b) Employee Notices: The simplest way to provide housing information is through the systematic and institutionalized use of employee notices. This may take the form of posting on the employee bulletin board or through announcements published in an employee newspaper. Employees would be encouraged to advertise for roommates or needed housing. Employees would also make other employees aware of units they have heard of. In Hawaii, this is often the best way of finding rentals before they appear in the paper. A program of this nature is best suited once the resort is in full operation and initial housing concerns of workers have been addressed.

(c) Community Development Corporation: A local community development corporation may be a useful vehicle for the coordination and development of housing as well as other community benefit generators. The exact nature of such corporations vary, but generally they are established with a widely representative board of directors, which serves on a volunteer basis, and a small paid staff. The corporation would be chartered to be tax-exempt, thus allowing gifts to it to be tax deductible as well as opening various grants closed to for-profit entities.

The basic services of the corporation could be to coordinate a community housing advisory committee; provide guidance and coordination between private housing developers; and serve as a management agency for rental housing.

2.6.3.3 Potential Resources

This section discusses several programmatic resources which may be available to assist in the production and delivery of below-market housing. These resources are included to provide an indication of the range of options which may be considered when mitigation programs are to be finalized. These resources may be available to the developer or other entities providing housing.

(1) For-Purchase Housing: Hawaii Housing Authority Act 105

(a) Description of Program: The basic thrust of the program is to provide for purchase housing to "gap-group" families. These are families

making between 80 and 120 percent of the County median income.

Within the Act 105 program, developments are built under one of several approaches. HHA may act as a developer, retaining contractors to actually build units. HHA may form a partnership with a private developer, usually a land owner, under a joint venture or development agreement. A private developer may work independently but use HHA's's exemption powers (discussed later) or low-cost financing. The last two options seem most appropriate for Ka`u. All permits are granted in 45 days.

(b) Type and Cost of Housing: Both multi-family and single-family for purchase housing are developed under Act 105. Units may be fee simple or leasehold. While rental housing has been developed under the program, its availability is uncertain due to changes in the tax law. Maximum purchase price is set by household income. At least 60 percent of the units in the development must be made available to families making less than 120 percent of the County median.

(2) Rental Housing: Farmers Home Administration Section 515 Rural Rental Housing Program

(a) Description of Program: Loans for rental housing in rural areas are available to provide living units for persons with low and moderate incomes and for those age 62 and older. Loans are primarily made to build, purchase or repair apartment-style housing, usually consisting of duplexes, or similar multi-unit dwellings. The housing must be modest in size, design, and cost, but adequate to meet the tenants' needs. Funds may be used to: buy and improve land; provide streets, water, and waste disposal systems; supply appropriate recreation and service facilities; install laundry facilities and equipment; and landscape the development. Funds may not be used for nursing, special care, or other institutional types of housing.

(b) Type and Cost of Housing: Housing units are multi- family in nature usually in duplex or apartment configuration. Rents are set by household income but may not exceed 30 percent of adjusted gross income.

(3) Owner-Built Housing: Often referred to as self help or "sweat equity," owner-built housing derives its primary subsidy from labor savings.

(a) Description of Program: Owner-built housing programs are offered by both the Oahu Self Help Housing Corporation (which despite its name is able to operate statewide) and by some private developers.

In an owner-built development, the intended occupants of the housing do the house construction themselves under the supervision of a licensed contractor. The land improvements are done professionally as is the foundation. The Oahu Self Help Housing Corporation currently

uses stick built construction (pre-cut lumber sold as a package and assembled) while private developers use a panelized construction method. (The house is factory built on the Mainland and shipped in large panels which are owner-assembled.) The panelized process would allow a custom design home to be packaged into components and assembled on the site. This would allow for integration of the below market housing into the broader development. The stick built method takes approximately ten months while the panelized method takes about one month.

(b) Types and Cost of Housing: The house price in 1987 dollars is approximately $25 to $35 per interior square foot or $25,000 to $35,000 for a 1,000 square foot house. This price is exclusive of land and infrastructure. The land and infrastructure should be kept to $25,000 to $30,000 per 5,000 square foot lot in order to deliver a house and lot for approximately $65,000. This is a goal because a Farmers Home loan (see financing section) has a maximum loan amount of $65,000.

2.6.3.4 Process for Arriving at a More Definite Plan

At the present, very general and early stage of resort project planning, it is neither possible nor feasible to present a housing mitigation plan with all specific steps completely determined. Therefore, the housing impact mitigation program starts with development of a strategy plan to forecast specific impacts and identify information to be gathered as project plans become increasingly specific. Information gathered would then be used for detailed planning and would also be reported upon in environmental impact submittals required at the zoning and permit stages of the project.

The existing community, the developer, and County government should be represented at the strategy planning stage. A community housing advisory committee might be formed, to include both residents and representatives of elements in the community who would be actively involved in carrying out the strategy plan, such as local contractors, real estate brokers, and union representatives.

Building new housing will require marshalling of resources and substantial lead time. Therefore, strategy planning and installation of trained staff to provide occupancy services should begin before construction begins on major infrastructure and visitor units, so as to mitigate construction impacts. The effectiveness of occupancy service activities for future resort workers will be enhanced by experience in placing construction workers in study area accommodations.

Steps in developing and implementing a workable plan might include: (1) completion of a strategy plan for housing and community development; (2) establishment of a housing assistance coordinator's position, and (3) creation of a community development corporation to implement study area activities. (NOTE: The latter two steps represent tentative consultant recommendations, subject to review and analysis in the strategy planning.)

(1) Housing and Community Development Strategy Plan: Strategy planning should begin after initial General Plan and Land Use Commission approvals. Plan activities should be closely coordinated with the community housing advisory committee, if it is established, and County government officials.

The products of the strategy plan might include:

- Specification of the number and timing of resort workers to be housed, housing affordability standards, and other projected need characteristics.
- Development of an on-line housing information system on local conditions and housing needs, to be used in later stages.
- Evaluation of alternative development strategies, suchas assisted infrastructure development in nearby subdivisions, expansion of the on-site support community, and targeted expansion of existing communities.
- Assessment of true need for a housing assistance coordinator and/or community development corporation (i.e., steps 2 and 3 below).
- A recommended housing strategy, detailing program steps, costs, housing targets, schedule, and compatibility with government policies generally, government housing programs generally, and resort development objectives.

(2) Housing Assistance Coordinator: Local landowners, real estate brokers, landlords, and County officials would be key reference groups for the coordinator, if the previously-discussed planning and analysis stage results in the conclusion that such a coordinator would be useful.

During the period leading to and commencing with project construction, the coordinator would work with contractors in helping to arrange rental housing for construction workers. The coordinator would also publicize the resort project, to encourage landowners and the local development community to begin project planning for new housing. The housing information system would also be maintained and updated as new data becomes available.

Occupancy services for operational workers would begin during construction with creation of a pool of landlords interested in renting to resort workers; advance housing placement for resort workers who are contracted before operations begin; and, establishment of cooperative referral and placement services with area real estate brokers and rental agents.

(3) Community Development Corporation (CDC): If judged desirable during the strategy planning, a non-profit, general purpose housing and community development corporation might then be started. Once the corporation is established, the housing assistance coordinator's activities might be brought under the corporation. Key reference points for the community development corporation would be its board of directors, to include local residents, industry and housing expert representatives, and other specialists; local landowners and developers; government housing agencies; and other non-profit housing developers such as the Big Island Housing Foundation, Pacific Housing Assistance Corporation, or the Jack Hall Memorial Foundation.

In the housing development field, the CDC could sponsor its own development projects, with a particular emphasis on market "niches" (such as multi-family and dormitory complexes) unlikely to be satisfied by the for-profit market alone. The corporation could also resource other affordable housing developers and market rate builders with waiting lists of resort employees, mortgage financing pre-qualification, and other services. The CDC could also resource the resort

developer on personnel-related programs that might stimulate market response, such as employee housing allowances, transportation, or mortgage guarantee programs.

In housing management and occupancy services, the corporation could expand upon the services begun by the housing assistance coordinator. Activities of the CDC might extend to management of rental housing both on and off of the resort site.

Community development activities of the CDC could encompass coordination of infrastructure improvement in existing communities, and acting as a developer and agent where community facilities qualify for government assistance.

2.6.4 Management-Oriented Research

For many key socio-economic impact areas, it is less important to forecast than to manage them. The effectiveness of such management actions could be improved by various applied research projects, including:

- An islandwide study of Hawaii County's unemployed and other potential labor force entrants -- their numbers, characteristics, willingness to move to other parts of the island, and factors affecting their willingness.

- An ongoing tracking system to monitor changes in the Ka`u resort and/or general workforce profiles, along with reliable information about changes in public concerns and perceived impacts.

- Survey data to provide more solid quantitative evidence about the true extent of family impacts associated with tourism or general population growth.

For the most part, such studies would be appropriately carried out by government. One possible vehicle is the "Tourism Impact Management System" which the 1986 State Legislature placed in the State Tourism Office (Department of Business and Economic Development). The initial research element of this system -- a periodic statewide survey of residents on tourism impact, with samples in particular resort areas such as West Hawaii and Ka`u -- is now under design.

2.6.5 Community Interface and Involvement

It has already been suggested that community input is necessary to design an adequate job training program. In addition, a number of potential social impact issues are likely to be mitigated (if they in fact do arise as issues) only through a process of dialogue between the community and the Resort:

- input to decisions on housing programs;

- reaction to Resort policies with implications for resident use of the area -- e.g., the marina, shoreline access, treatment of historical resources;

- airing of any issues related to Resort residents as they venture out to tour the surrounding area.

It is the nature of a resort to become fragmented over time. That is, the original developers eventually complete their work, and the final resort is comprised of a wide variety of hotel and commercial operators rather than a single entity; there is no one communication

mechanism through which community members can talk to the overall resort. However, resort operators usually participate in an Association for marketing purposes, and it is recommended that any such Association in Ka`u be active at the local community level and not just in marketing. This has been done in Kohala, where the South Kohala Resort Association includes representative of all the major resort developers and hotel operators in that region.

On the community side, one alternative might include formation of a standing advisory committee -- meeting with the Resort developer and/or Association at least several times a year -- which could provide an ongoing forum to promote regular communication between Resort and residents. Models include the Kuilima/ North Shore Strategy and Planning Committee, as well as Waianae's Military-Civilian Advisory Council. However, Ka`u should develop its own model, which might be more informal and even consist of several small groups.

Developer programs to communicate with the community through newsletters and other methods are already underway.

Other potential communication mechanisms include:

- Provision of some sort of "South Hawaii Guide" in each resort guest's room, which can help direct visitors to areas of Ka`u where their business is welcome but omit any mention of places which wish to remain isolated (perhaps such as Miloli`i);

- Community preparation of a written statement of community objectives and desires -- a non-binding document for which the chief purpose is to acquaint newly-arrived resort operators with community background and aspirations relative to the Resort.

However, the most important communication mechanisms will be activities which involve residents, particularly young people who represent future workers. Some possible examples:

- Resident use of the marina or nearby boat launch facility, as well as sale of fishermen's catch in the Resort areas, represent one obvious area.

- Occasional holiday festivals might be held on resort grounds, such as the Turtle Bay Hilton's annual July 4 celebration. Ka`u has an annual July 4 Rodeo, which might well be a visitor as well as resident attraction if held at the Hawaiian Riviera equestrian facilities.

- Most Hawaii hotels have special resident discount (or bargain price) days for resort attractions such as golf, horseback riding, and hotel dining or entertainment.

- The Resort could cooperate with school athletic departments or selected youth groups to explore the possibility of controlled use by youth of certain recreational amenities (e.g., horseback riding, tennis) at otherwise under-utilized times.

- School tours for area elementary and intermediate students would familiarize young people with the Resort long before they are thinking about jobs. Similar tours of archaeological sites could also be a regular feature of area

history, culture, or art classes.

- o Before major new facilities (hotels or recreational amenities) are opened to visitors, an "open house" can be held for the general community. Luaus or similar events would increase a sense of community involvement in the Resort and would given visitors at existing facilities a chance to meet the residents.

2.7 FISCAL IMPACTS

Development of the Hawaiian Riviera resort project will have significant economic benefits to the community. Creation of permanent jobs and consumption of goods and services by visitors will produce income throughout the island and the state of Hawaii.

2.7.1 Visitor Expenditures

Spending of visitors to the resort constitute the primary generator of economic impact. The level of visitor spending, expressed as average daily expenditures, could vary depending upon the nature of the resort and its clientele.

The impact of Hawaiian Riviera visitor spending is the change in output of businesses, measured by sales, resulting from the increase in visitor expenditures. Changes come in three forms: direct spending by visitors, indirect effects, as by the purchase of goods and services by businesses serving visitors, and induced effects, when employees or owners of visitor-oriented firms spend their earnings.

Based on estimates prepared for the DPED Input-Output Model, each dollar in visitor expenditures produces $1.73 in total sales or output (Hawaii State Department of Planning and Economic Development, 1983 and 1986).

Average daily visitor expenditures may range from about $106 to $200, depending on the profile of the particular visitor. Given this range, minimum output effects grow from $121 million in 1992 to $217 million annually at project buildout. Maximum output effects increase from $228 million in 1992 to $410 million at buildout.

2.7.2 Public Costs and Revenues

The purposes of the analysis, at this stage of general land use policy consideration, are to determine the relationship of public costs to revenues, and to identify public cost issues to be resolved as more specific plans are developed for the project.

This analysis produces a set of revenue/cost ratios for both state and county governments. It should be noted that conceptual plans for the Hawaiian Riviera Resort provide both land and buildings in a planned "Civic Center" for a number of government functions. Land and buildings provided would otherwise have to be financed from public revenues. Since the value of these public facilities are not credited to the Resort, revenue/cost ratios are somewhat conservative.

For purposes of the analysis, 1985 is the base year for determining tax revenue and other income: revenue relationships. This analysis covers public revenues received from the

following sources:

- **State revenues from visitor spending during resort operations**: This would include general excise, personal and corporate income, and other revenues from visitor spending.

- **Hotel room tax**: A state tax of five per cent of hotel room rental proceeds.

- **State revenues from resort resident income**: This would include general excise tax, personal and corporate income, and other revenues from the income of permanent resort residents.

- **General excise tax on project construction**: This would tax the value of construction put in place at the resort.

- **Corporate income tax on development activities**: This would tax that portion of construction activity that results in ordinary taxable income to the contractors.

- **Real property tax**: This would constitute the bulk of county government revenues from the project, and consist of taxation of the value of improvements constructed on the project site.

State revenues from visitor expenditures range from $4.5 million to $8.5 million in the first year of the resort's operation, and reach the $8.1 million -- $15.2 million annual range at buildout.

State hotel room tax revenues would range from about $1.1 to $2.9 million for the first year of hotel operations in 1992. Annual room tax revenues would increase to the range of $1.9 to $5.1 million by 2006.

The Hawaiian Riviera resort will become the permanent residence of a substantial number of people, whose incomes will become taxable by the state. In this analysis, "resort residents" do not include residents of the support community who are employed at the resort. It is also assumed that these resort residents are in-migrants to the state.

While it is difficult to estimate the incomes of these future residents, we have assumed an average household income of $100,000, which represents the lower limit of expected resort resident incomes used in market analysis of potential condominium and lot sales (Peat Marwick and Main, 1987). State tax revenues should amount to about $2.4 million in the first year of resort operations, increasing to $2.8 million in 1997, $3.4 million in 2002, and $5.9 million at the time of project buildout.

State tax collections on development activity would begin in 1988 -- five years before public service costs would be incurred. State collections would exceed $400,000 in 1988, and increase to almost $4.5 million in 1990, and $12.8 million in 1991. Total state revenues from development activity would exceed $62 million over the term of project development.

County property tax collections are estimated to be about $3.4 million in the year 1993, increasing to $10.1 million at project buildout.

There are two principal ways of computing the public costs per unit of populaton related

to the project: the marginal cost and average cost approaches. The marginal cost approach calculates the various specific and direct public costs deemed necessary to service a project. The average cost approach assumes that the project, in producing population impacts in terms of greater numbers of visitors, resort residents and in-migrants, will incur service costs roughly equivalent to levels currently experienced by State and County governments.

The marginal cost approach is desirable, particularly where the subject project represents a new increment of development in an area where service needs and costs are well identified. A marginal cost analysis is considerably more difficult to carry out when the precise extent of new services needed is not well defined. This is the case with the Hawaiian Riviera, where the development concept requires further refinement and where many services will be provided by the developer.

In this situation, the average cost analysis is indicated as the preferable approach. As an additional benefit, average cost analysis provides some useful data to decision-makers, which can be used as more data on public service needs becomes available. A direct comparison of average cost and public revenues will indicate the amount of surplus, i.e., revenues over costs. This surplus can be considered to be the "pool" from which defined amounts of revenue can be drawn to meet extraordinary public service needs.

Average costs are drawn from an analysis of 1985 state and county expenditures, and are expressed as per capita costs. County functions related to public safety, highways, health and sanitation, recreation and capital improvements are allocated on a de facto population basis which includes average daily visitors present. All other functions are allocated on the basis of resident population. State functions are similarly allocated, although costs related to natural resources are also allocated to the visitor population.

The analysis indicates per capita state and county costs as of 1985, according to Tax Foundation of Hawaii-compiled data (Tax Foundation of Hawaii, 1986). At the county level, services cost $566.61 per resident and $310.14 per visitor. State expenditures were $2,118.21 for each resident and $297.12 for each visitor.

The allocation of service costs to the proposed resort depends, to some degree, upon assumptions about the level of in-migration. If it is assumed that all in-migrant workers and their household dependents come from outside of Hawaii County; per capita county service costs are assessed for the entire group. If however, an assumption that 20 percent of the in-migrant workers and their dependents would move to the study area from other parts of the Big Island is used, a different level of public service costs will result. Thus, County costs range from $1.97 million to $2.24 million in 1992, depending on the population assumption used. County costs increase to the range of $2.53 -- $2.89 million in 1997; to $3.03 -- $3.45 million in 2002, and to $3.51 -- $3.93 million at project buildout.

State service costs total $3.27 million in 1992, and grow to $4.11 million in 1997, $4.93 million in 2002 and $6.41 million annually at project buildout.

2.7.3 Comparison of State Revenues and Costs

This analysis produces some very high, positive revenue/cost ratios for state services, especially in the early years of the project when construction-related revenues are highest.

Over the long term, state revenue/cost ratios remain positive, in the range of $3.00 to $4.00 in state revenue collected for each $1.00 spent on state services. At project buildout, the

revenue/cost ratio would change from $2.64 to $3.77 in revenues for each dollar in state services.

2.7.4. Comparison of County Revenues and Costs

County revenue/cost ratios, on the other hand, start out lower in the range of $2.00 in revenue collected for each $1.00 spent on county services. The County ratio rises to the 2.5 - 3.5 range in the later years of the project.

3. TRANSPORTATION FACILITIES

3.1 TRAFFIC IMPACT ANALYSIS

3.1.1 Introduction

The Ka'u region is a sparsely populated, rural agricultural area characterized by very low levels of automobile traffic. Development of the proposed Hawaiian Riviera Resort will have a significant impact upon traffic volumes. This section presents a projection of traffic volumes and impacts in South Hawaii with and without the proposed project. A traffic impact analysis of the proposed project is included as an appendix to this document.

3.1.1.1 Scope of Analysis

Because the proposed project is centrally located along the single transportaton corridor linking Hawaii county's two principal population centers, Hilo and Kailua-Kona, this analysis measures the traffic levels along the entire corridor. Although principal impacts resulting from the project are expected to occur in the Ka'u region, anticipated levels of in-migration related to project employment dictate that an analysis include all the residential areas where employees may be expected to live. Future resort employees will most likely locate in existing residential areas. Thus, fifteen traffic counting stations established by the State Department of Transportation were selected between Hilo and Kailua-Kona to provide the historical and existing traffic levels.

Population growth in the Ka'u region is expected to be affected to some degree by the proposed expansion of the existing Punalu'u Resort. Growth rates associated with the Punalu'u Resort are based upon the resort's existing zoning.

3.1.1.2 Traffic Projections

Traffic counts gathered by the State Department of Transportation betwen 1974 and 1984 were used as the basis for calculating historical and existing traffic levels. A number of assumptions were used as the basis for projecting traffic volumes:

- Vehicle registration in Hawaii County grew a rate of approximately 6% per year from 1975 to 1985. It is assumed that the future projection of 'background traffic' or traffic growth patterns not related to the project will continue at a 6% annual growth factor. Therefore, the projection of background traffic in 1992 was derived by increasing 1984 traffic levels by 48% (6% per year from 1984 to 1992).

- 1997 background traffic was derived by increasing 1984 traffic levels by 78% (6% per year from 1984 to 1997). The year 1997 was used as a second point of analysis because it represents the end of a second 5-year development phase at the project.

- Project and Punalu'u-related traffic generation was derived from proposed development schedules for the years 1992 and 1997. Traffic generation rates were based on rates published in Trip Generation, Third Edition, Institute of Transportation Engineers, 1982.

- Trips to and from commercial areas in the proposed resort are considered to be internal, that is to say, commercial trips were confined to the resort.

- Home to work trips to and from the Support Community to the project were based on the existance of an internal roadway linking the resort to the Support Community. Home to work trips to and from the Support Community to areas other than the project were distributed with 50% to Kona, 20% to the Ka'u area, and 30% to Hilo.

- For the purposes of the traffic study, occupancy rates at the Hawaiian Riviera Resort were assumed to be slightly higher than market projections indicate: 70% for hotels, 90% for Luxury Villas, 30% for single-family residential units, and 30% for multi-family units.

- Assumptions were made upon the likely places of residence for resort employees in 1992, for both the Hawaiian Riviera Resort and the Punalu'u Resort. These assumptions were based upon population growth modeling conducted by Community Resources, Inc. in conjunction with the preparation of their Socioeconomic Impact Analysis for the proposed resort, and take into account the potential availability of housing and or residential lots. Where total trips generated by the resorts in 1992 equal 100% for each resort, the distribution of those trips was:

Destination	Hawaiian Riviera Resort	Punalu'u Resort
Hilo	6%	10%
Puna	7%	15%
Pahala	10%	20%
Na'alehu	8%	20%
Honoapu	0%	10%
Waiohinu	4%	10%
Support Community	45%	0%
Hawaiian Ocean View Estates	10%	10%
Kona	10%	5%

Based on these assumption, four scenerios were developed for projected traffic impacts in addition to "without project" scenerio whch describes traffic growth from 1984 to 1992 and 1997 using an average growth rate of 6% per year. Scenerio 1 projects traffic for the year 1992 based upon Background Traffic plus Hawaiian Riviera traffic. Scenerio 2 projects traffic for 1992 based upon Background Traffic plus both Hawaiian Riviera Resort and Punalu'u Resort traffic. Scenerio 3 projects traffic for 1997 based on Background traffic plus Hawaiian Riviera traffic. Scenerio 4 projects traffic for 1997 based on Background traffic plus both Hawaiian Riviera Resort and Punalu'u Resort traffic.

The relationship between projected volumes of traffic and roadway capacity is generally referred to as "Level of Service" and defined in catagories of A - F. These catagories take into

account established speed limits. General descriptions of levels of service are:

Level of Service	Description
A	Free traffic flow, with low volumes and high speeds.
B	Stable traffic flow, but speeds beginning to be affected by traffic conditions.
C	Generally stable traffic flow, however most drivers are restricted in freedom to select their own speed.
D	Traffic flow becoming unstable, drivers have little freedom to maneuver.
E	Traffic flow is unstable, characterized by short stopages.
F	Forced flow at low speeds, lines form because of a downstream restriction.

3.1.2 Existing Conditions

3.1.2.1 Existing Roadway Conditions

A single major highway serves the Ka'u District where the project site is located. Mamalahoa Highway, FAP 11, (also referred to as the Hawaii Belt Road) is a two-lane roadway linking Hilo to Kailua-Kona via the southern portion of the island. It underwent reconstruction in 1973. Current lane width varies from eight feet to twelve feet.

Vehicular activity on the highway is distributed among three catagories; local intra-district travel by residents, local inter-district travel by residents, inter-regional travel by residents and non-residents. Daily traffic consists of four types of vehicles; private automobiles and trucks, rental cars, commercial and delivery trucks and vans, and public and private buses, including a single, circle-island public bus, school buses and tour buses.

3.1.2.2 Historic Traffic

As discussed above, the registration of motor vehicles in Hawaii County has averaged about 6% per year between 1975 and 1985. In 1975, Hawaii County had 53,124 registered motor vehicles including automobiles, buses trucks and motorcycles. Ten years later, the number of registered vehicles increased to 85,806.

3.1.2.3 Current Traffic

Current traffic volumes in the Ka'u region are characterized as being relatively small when compared to more urbanized areas. Peak hour conditions occur well into mid-morning but are exceedingly low and barely distinguishable from non-peak volumes. Afternoon peak hour volumes occur between 3 and 4pm and are similar to morning volumes.

Table 43: PROJECTED TRAFFIC IMPACTS

Traffic Station	1987 "no project" Volume	L.O.S.	1992 "no project" Volume	L.O.S.	Scenerio 1 Volume	L.O.S.	Scenerio 2 Volume	L.O.S.
Hilo-Keaau	1843	C	211	C	2351	C	2380	C
Keaau-Volcano	356	B	447	B	599	C	606	C
Volcano-Pahala	177	A	219	A	308	B	381	B
Pahala-Punaluu	200	A	252	B	402	B	532	B
Punaluu-Honoapu	229	B	288	B	438	B	597	C
Honoapu-Naalehu	229	B	288	B	438	B	568	C
Naalehu-Waiohinu	137	A	171	A	373	B	446	B
Waiohinu-S. Point	137	A	171	A	400	B	443	B
S.Point-H.Riviera	128	A	161	A	393	B	433	B
H.Riviera-H.Ocean	119	A	150	A	236	B	283	B
H.Ocean-Milolii	119	A	150	A	335	B	350	B
Milolii-Honauau	211	A	265	B	335	B	398	B
Honaunau-Cp Cook	737	C	927	D	937	E	986	E

Traffic Station	1997 "no project" Volume	L.O.S.	Scenerio 3 Volume	L.O.S.	Scenerio 4 Volume	L.O.S.
Hilo-Keaau	2780	D	2893	D	2924	D
Keaau-Volcano	538	B	776	C	855	C
Volcano-Pahala	267	B	506	B	584	C
Pahala-Punaluu	303	B	701	C	842	C
Punaluu-Honoapu	345	B	747	C	920	C
Honoapu-Naalehu	345	B	747	C	889	D
Naalehu-Waiohinu	206	A	738	C	836	C
Waiohinu-S. Point	206	A	802	C	849	C
S.Point-H.Riviera	194	A	789	C	836	C
H.Riviera-H.Ocean	180	A	601	C	674	C
H.Ocean-Milolii	180	A	533	B	561	C
Milolii-Honauau	319	B	545	B	561	C
Honaunau-Cp Cook	1115	D	1301	E	1317	E

Scenerio One = 1992, Background traffic + Hawaiian Riviera Traffic
Scenerio Two = 1992, Background traffic + Riviera and Punalu'u Traffic
Scenerio Three = 1997, Background traffic + Hawaiian Riviera Traffic
Scenerio Four = 1997, Background traffic + Riviera and Punal'u Traffic

3.1.3 Probable Impacts on Roadways and Traffic

Traffic volume projections indicate that substantial increases will occur in the immediate project area during the afternoon peak hour. Table 43 presents the results of the modeling. For those traffic stations in the immediate vicinity of the project (Support Community, Hawaiian Riviera and Hawaiian Oceanview Estates) P.M. peak hour traffic volumes are expected to increase about 26% without the proposed project by 1992 and about 51% without the project by 1997. With the proposed project, traffic volumes in the same vicinity will increase from 300% to 400%. Based on the existing capacity of the roadway, the level of service will remain between A and C. The heaviest impact of the resort development will be between South Point and the project site where traffic levels will change in 1997 to Level of Service E.

As shown in the previous table, the Level of Service for the section of roadway between Honaunau and Captain Cook is presently at level C due to the narrow lane width and numerous curves. This area is recognized as being a dangerous section of roadway at the present time and improvements will be required prior to 1992. Should these improvements occur, levels of service should improve.

3.2 MITIGATION MEASURES

Mitigation measures to reduce the impact of increased volumes of traffic in the South Hawaii area will require meetings between Ka'u resort developers and County officials to determine appropriate strategies. The intersection of the proposed access road and Mamalahoa Highway will be designed to meet the design standards of the State Department of Transportation. Developer-funded left-turn lanes, signalization, and widening of the highway may be necessary.

The construction of an internal roadway within the subject property will reduce the volume of traffic generated by the resort on Mamalahoa Highway. Internal roadways will be built to County standards. Construction of the proposed marina during the first phase of construction activity will enable it to be utilized for the shipment of construction materials to the project site by barge, thereby reducing significantly the impact of construction related vehicles on existing highways. The planned airport will also help to reduce traffic on the regional road system.

Additional mitigation measures that may be considered involve transporation system management techniques such as car pooling, employee busing and staggered work hours. These measures, along with a monitoring program, will be developed as part of an overall transportation program for the resort and are usually addressed as part of the zoning approval process.

A detailed traffic analysis addressing project related traffic generation, turning movements, intersection requirements and responsibility for road improvements will be undertaken in conjunction with the zoning approval process.

4. AIR QUALITY IMPACTS

4.1 INTRODUCTION

Because there are no existing air quality monitoring stations established by the State Department of Health in the immediate project area, data collection and monitoring of air quality was conducted by an air quality consultant for the Hawaiian Riviera Resort. The results of his findings are presented below and appear in their entirety in the Appendices to this document.

4.2 EXISTING CONDITIONS

Based upon data collected from air quality monitoring stations established at the resort coastal area and the site of the proposed airport, it has been determined that the general climate at the project area is typical of Hawaii's climate with very little seasonal or diurnal temperature variation. Monthly temperature averages vary by only about six degrees from the warmest to the coolest months of the year. Similarly, the area also exhibits the typical mauka-makai variation in annual precipitation. The proposed resort portion of the Hawaiian Riviera Resort project is relatively dry with an annual average percipitation rate of only 23 inches while the mauka area of the property (support community) averages just over 35 inches per year. General air quality is good, although visibility is affected by infrequent and unpredictable volcanic eruptions which result in the emission of fine particulates.

Wind conditions at the project site result primarily from moderate trade winds approaching the island from the northeast (Figure 4.19) A special program of on-site meteorological data collection was conducted in the project area from May to July, 1987. Results indicate that the airport area of the project was clearly dominated by east to northeast winds (greater than 71% of the time) while the coastal area showed much greater variability. General wind speeds at the project site were lower than those recorded at the permanent South Point Wind Station established by the National Weather Service (NWS). While the NWS station averaged 17.8 mph during the sampling period, the airport station averaged 14.8 mph and the project's coastal station averaged 11.0 mph (Figure 4.20).

Solar radiation was also measured at the project site. The results indicate the characteristic midday buildup of a cloud band along the southwest shores of the Big Island: at midday, about half of the solar radiation is being screened out.

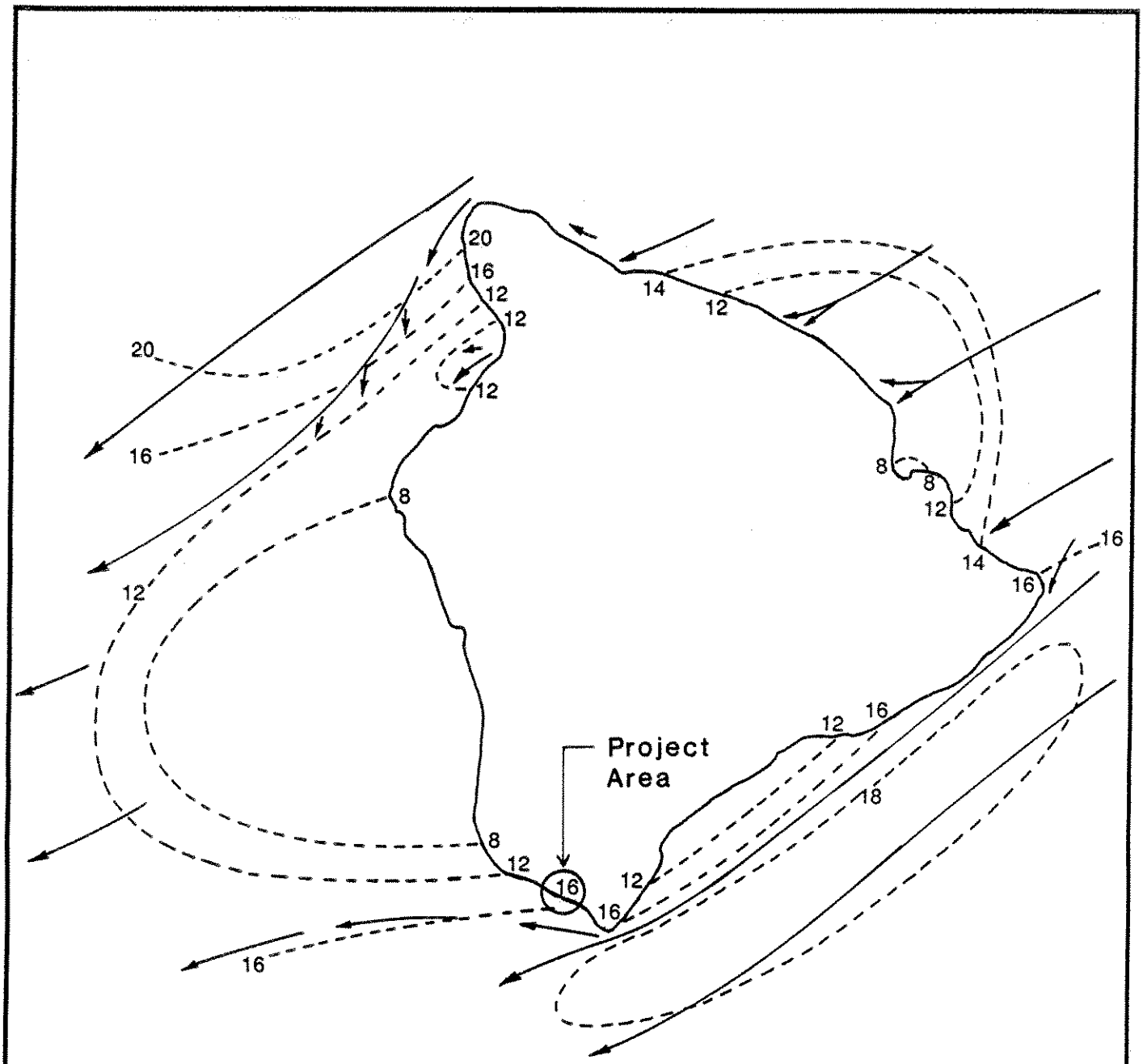
4.3 PROBABLE IMPACTS

4.3.1 Short-Term Impacts and Mitigation Measures

Short-term impacts of the project upon air quality relate primarily to project construction. The dry climate of the area and the possibility of fugitive dust from construction activity will require that adequate dust control measures be employed during the construction period. Dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. The Environmental Protection Agency estimates that twice daily watering can reduce fugitive dust emissions by as much as 50%. The soonest possible landscaping of completed areas will also contribute to a lowering of dust levels.

4.3.2 Long-Term Impacts and Mitigation Measures

The long term automotive emission factors for carbon monoxide, oxides of nitrogen, and hydrocarbons were generated by an Emissions Model as described in the air quality report in this document's appendix. Future annual emissions both with and without the proposed project were estimated for the years 1992 and 1997. The results indicate that project emissions exhibit a net decrease from 1987 to 1997 without the project. With the proposed development, emissions increase from 1987 to 1992 and then decline from 1992 to 1997. Without the proposed project, automobile traffic in the project are remains relatively unchanged. Under guidelines established by the federal motor vehicle emission control program, new cars with lower emissions will continue to gradually replace older, more polluting vehicles, resulting in a steady decrease in net emissions without the project. However, projected traffic volume increases related to the project will result in rising emissions because the increase in traffic volumes will exceed the projected decrease in per



Source: SEA ENGINEERING, INC.

Figure 4.19

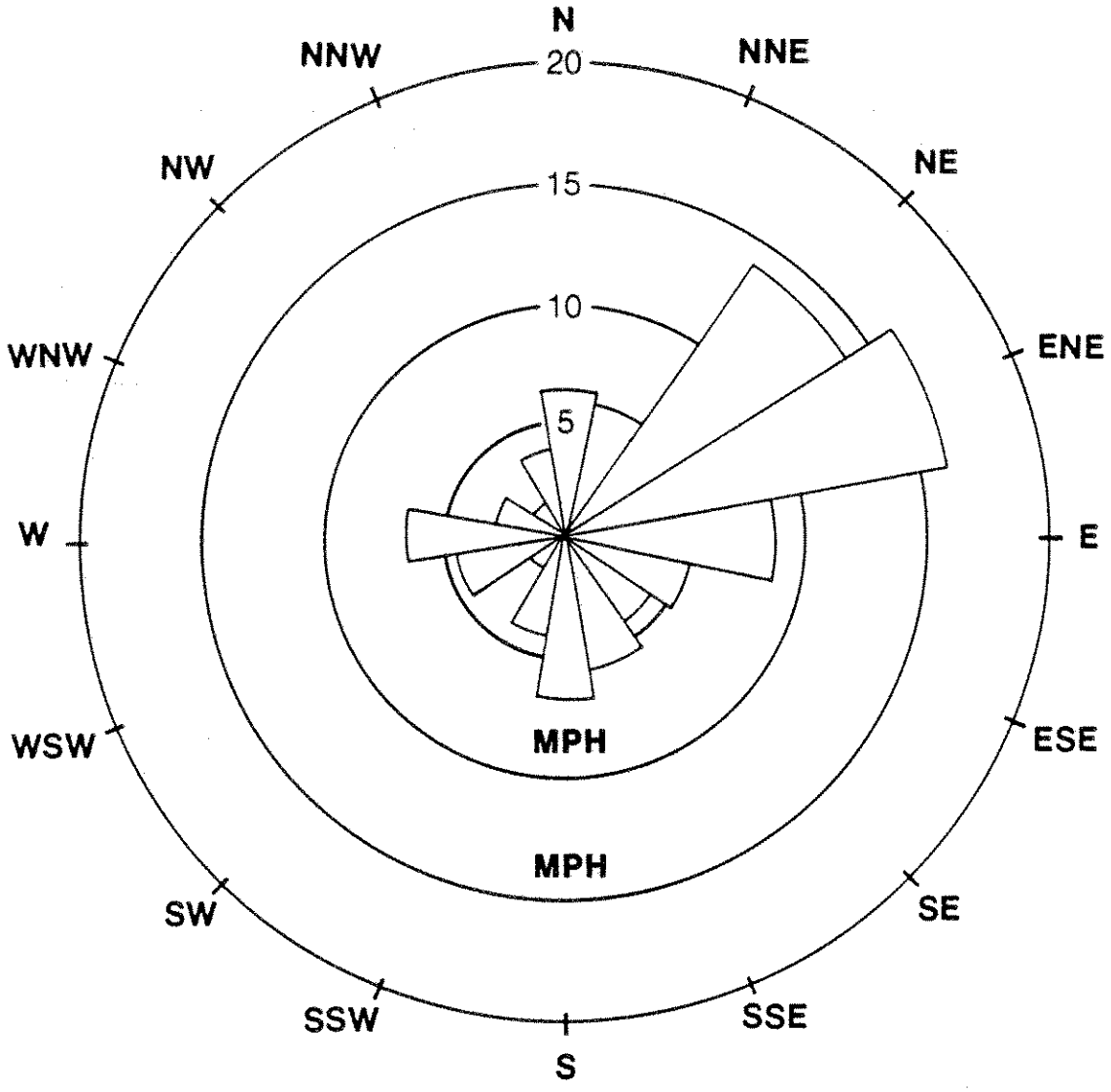
MODERATE ISLANDWIDE TRADEWIND PATTERNS

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii



Source: JIM MORROW

Figure 4.20

FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT (Hawaiian Riviera Resort Beach Site 14 May - 2 Jul 87)

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

vehicle emissions and attrition of older vehicles. In this particular case, the rate of traffic increase appears to exceed the rate of per vehicle emissions decline and old car attrition over the 1987-1992 period, but the trend reverses over the 1992-1997 period.

Long term emissions related to electrical generation and aircraft operation at the resort will result in increases to the Big Island's emission inventory, however, neither by itself is excessive.

Ambient levels of carbon monoxide along the Mamalahoa Highway, in the vicinity of the project's access road, and in the vicinity of the airport are projected to meet both state and federal ambient air quality standards through 1997.

5. NOISE IMPACTS

5.1 INTRODUCTION

Noise associated with the proposed development will be generated from two principal sources; vehicular traffic and aircraft operation. A traffic noise impact assessment has been prepared by James Morrow. It presents a full discussion of the potential short-term and long-term impacts associated with vehicular noise. An additional report assessing the noise impacts associated with the proposed airport has been prepared by Y. Ebisu & Associates.

5.2 EXISTING CONDITIONS

The subject property is entirely vacant and, as previously discussed, is dominated by a'a and pahoehoe lava flows. Consequently, there are presently no noise-generating activities occuring in the project area. In fact, the only source of noise is the ambient wind level. Traffic noise associated with the highway is extremely low due to the low level of usage as described in the section discussing traffic impacts.

5.3 PROBABLE IMPACTS

5.3.1 Short-term Construction Noise

Noise levels are expected to increase during grading and construction. The specific timing, duration and sequence of construction phases is not yet determined.

5.3.2 Mitigation Measures

Major construction activity associated with marina and hotel construction will be located approximately five miles from the Mamalahoa Highway. Residential and commercial activities located in the Hawaiian Ranchos subdivision are located generally close to the highway and, therefore, well inland from the proposed construction site. Noise from the construction site is anticipated to have little or no impact upon existing residential uses in the region.

Construction noise on-site will be mitigated to every extent possible in accordance with existing regulations and accepted construction procedures.

5.3.2 Traffic and Other Long-Term On-Site Noise

Traffic associated with the project is not expected to generate significant noise impacts. The remoteness of the project site and the relative distances between the support community and the

resort area will prevent any potential traffic noise from impacting resort residents. Construction activity at the project will result in significant increases in ambient noise over existing levels. However, because of the project's remote locations, these increases will not impact surrounding residential areas.

5.3.3 Mitigation Measures

Construction noise will be reduced to acceptable limits using standard muffling equipment on construction vehicles. Construction workers exposed to high levels of noise will be provided noise protection devices according to standard construction procedures.

Traffic noise at the Hawaiian Riviera Resort will not impact resort or support community residents due to the distance between these project components. At the resort site, central parking lots will help to restrict vehicle operation away from visitor facilities. On-site speed limits and road design will contribute to a reduction of traffic noise at both the resort sites and support community.

5.3.4 Airport Noise

At buildout of the resort, it is anticipated that approximately 20% of the resort's guests (as opposed to day visitors) will arrive by airplane or helicopter. This computes to approximately 35,500 annual aircraft operations: a takeoff or landing is each considered to be a single operation. Thus, on a daily basis, the airport is expected to experience about 48 takeoffs and 48 landings, or about one operation every eight minutes. It is further assumed that commuter traffic will consist of Cessna 402 (twin-engine propeller) aircraft and that air carrier traffic would consist of DASH 7 (four-engine turboprop) and DASH 6 (twin-engine turboprop) aircraft. Helicopter operations, projected to be about 27 operations per day. Because the airport will be privately owned, it will not be accessible to private pilots for training or recreational usage.

The Day-Night Sound Level (Ldn) noise descriptor was used to describe general aviation aircraft noise surrounding the proposed airport based upon annually averaged traffic pattern conditions of 85% east flow and 15% west flow. Ldn values represent 24-hour averages of total noise exposure resulting from air taxi and air carrier operations at points surrounding the proposed airport. Table 44 presents a summary of the operational assumptions used to generate the Ldn contours.

The assumed aircraft flight tracks are shown in Figure 4.21. Noise contours for 60, 55, 50, 45 and 40 Ldn were generated using the Federal Avialtion Administration Integrated Noise Model (FAA INM), Version 3.8. These contours are presented in Figure 4.22.

Table 44: PREDICTED DAILY OPERATIONS (7:00am - SUNSET)

Aircraft Type Type	Tradewind Departures	Tradewind Approaches	Kona Departures	Kona Approaches	Total
DASH 7	11.1	11.1	1.96	1.96	26.12
DASH 6	2.65	2.65	0.47	0.47	6.24
Cessna 402	16.09	16.09	2.84	2.84	37.86
Helicopter	11.48	11.48	2.03	2.03	27.02
TOTAL:	41.32	41.32	7.3	7.3	97.24

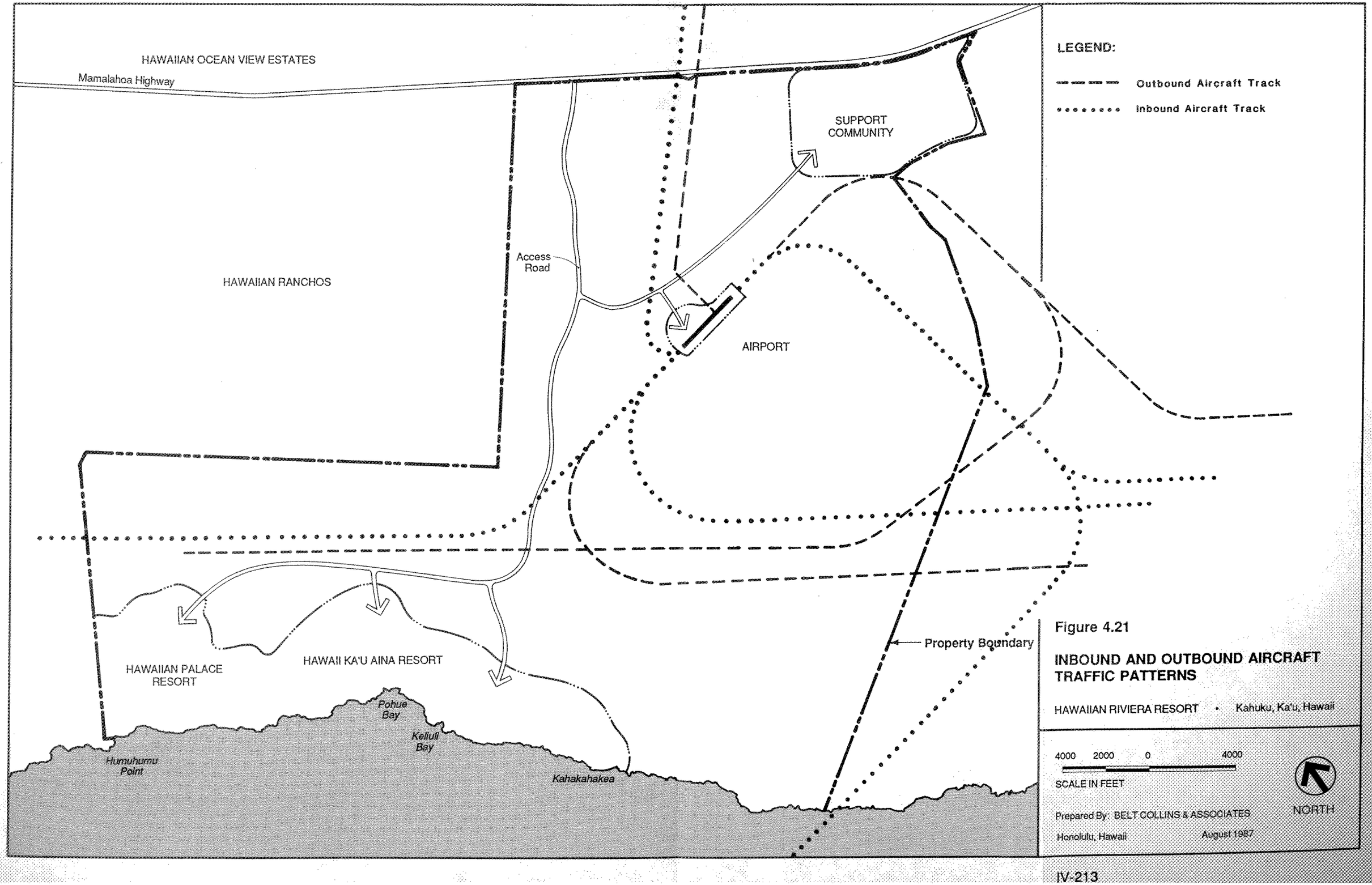


Figure 4.21

INBOUND AND OUTBOUND AIRCRAFT TRAFFIC PATTERNS

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

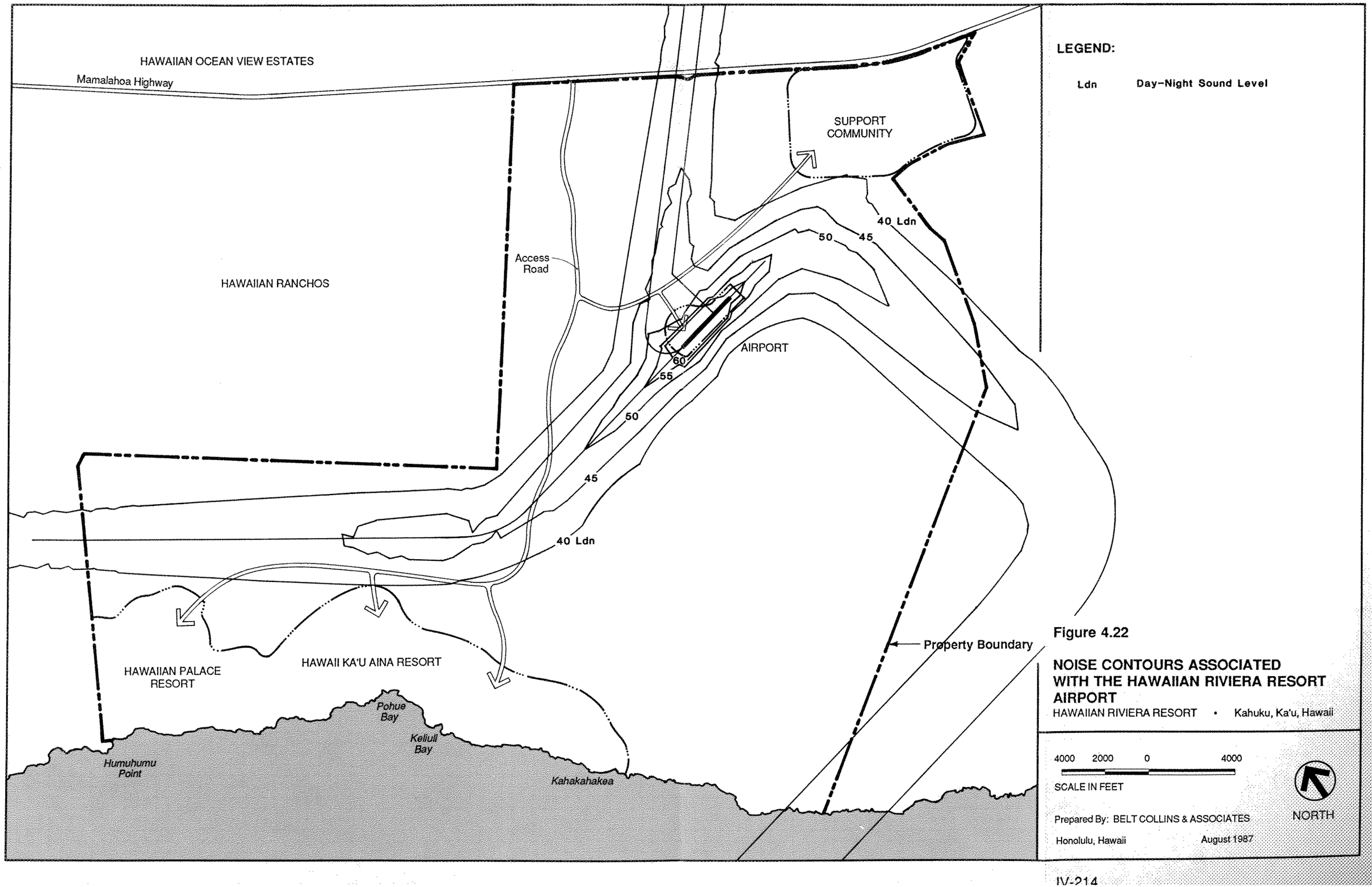


Figure 4.22

NOISE CONTOURS ASSOCIATED WITH THE HAWAIIAN RIVIERA RESORT AIRPORT

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

5.3.5 Mitigation Measures

Noise exposure contours for Ldn values less than 55 dB are not normally constructed, since the Environmental Protection Agency (EPA) and other federal agencies have identified 55 Ldn as an acceptable outdoor noise exposure level in terms of minimizing adverse health and welfare effects with an adequate margin of safety. However, contours as low as 40 Ldn were developed for this study as shown in Figure 4.22 to reflect existing low background ambient noise levels in the region, and to adjust transit flight corridors to and from the airport so as to minimize potential noise impact on existing noise sensitive properties.

The proposed location of the Hawaiian Riviera Airport was selected using two basic criteria; first, the need for a relatively level site, and second, the need to reduce potential noise impacts upon surrounding land uses. The proposed site of the airport fulfills both of these criteria. Figure 4.19 shows that the proposed airport's daily flight patterns will not impact the resort, support community, or existing residential subdivisions in the area.

6. PUBLIC SERVICES AND FACILITIES

The Hawaiian Riviera Resort, in adding to the population of the study area and inducing additional population to locate in South Kona and Ka'u to take resort jobs, will impact public facilities, services and utilities.

Precise needs of this future population will depend on the ability of the project to attract workers from the available labor component of current study area residents, and on the number and characteristics of new study area residents. Further, public service needs will also be affected by the ultimate timing of resort development, and on the trends which affect other study area employers. It is difficult, then, to predict the specific impacts the development project will have on some aspects of study area public services. More precise analysis will be required as project planning proceeds and government approvals, such as zoning and shoreline management permits are sought. However, it is possible to anticipate the types and general magnitude of service demand related to the project.

This section addresses projected needs for schools, health care facilities, parks and recreation services, water supply, sewage treatment facilities, solid waste disposal, police and fire protection, electrical power and communications, airports, and public transportation.

6.1 SCHOOLS

6.1.1 Existing Facilities

The study area is served by six public schools. In Ka`u, the Na`alehu School provides services for kindergarten through 8th grade. Enrollment at the school in 1986 was 392 students. Ka`u High/Elementary in Pahala serves the area for kindergarten through 12th grade. The 1986 enrollment was 538 students. In South Kona, Konawaena Intermediate/High School in Kealakekua provides instruction for grades 7 through 12. The school had 1,455 students in 1986. Konawaena Elementary had 597 students in 1986 attending grades kindergarten to 6th. Hookena Elementary/ Intermediate School in Captain Cook and Honaunau School each provide education from kindergarten to the 8th grade. Enrollment in 1986 was 200 and 419, respectively (Edward Matsushige, Demographer, Hawaii State Department of Education, personal communication, August, 13, 1987). According to Mr. Herbert Watanabe, District Business Specialist for Hawaii County, Hawaii State Department of Education, all schools in the study area are currently operating at capacity levels. In-migration to the study area (particularly into the Ka`u district) resulting from

the proposed project would increase the demand for educational services beyond the capacity of current facilities (personal communication, August 13, 1987).

6.1.2 Probable Impacts

Impacts on study area public schools will occur as the result of on- and off-site population growth in the region generated by the Hawaiian Riviera Resort development. The Department of Education normally does not make projections concerning future classroom requirements based on the level of information now available. Detailed information about the type of future housing units and their market range are important factors for generating projections. Based on experience, however, increases in housing as a result of resort development generate a lower than average number of school-age children relative to normal growth patterns (Matsushige, 1987).

Data previously discussed in this chapter does provide some measure for roughly estimating the impact of the proposed resort. Table 35 indicates that the cumulative housing impacts from Hawaiian Riviera Resort workers by year 2009 is approximately 964 units (this includes 795 units attributed to on-site workers and 169 units for induced/indirect workers elsewhere in the study area). Characteristics of West Hawaii resort workers show that there are an average of 1.3 children per resort worker household (Community Resources, 1987). Applying this factor to the total number of 964 units, an estimated additional 1,250 children may live in the study area as the result of the proposed project. This is considered to be a conservative estimate since induced/indirect workers are more likely to have household characteristics which resemble the general population, and would thus have a higher number of children per household.

Because of the project's location, public school impacts will largely be on services in the Ka`u area. Given the 1986 student population of 930 students at the two schools in Na`alehu and Pahala, and the estimates of potential new children in the area, the demand for school services could double in the area by year 2009.

6.1.3 Mitigation Measures

Since existing schools in the study area are operating at capacity levels, additional facilities (i.e. expansion of existing facilities and construction of new schools) will be needed in the future. By the time zoning approval for the project is being requested from the County, more detailed information will be available concerning future school requirements. This information will be provided to the Department of Education in order that funds can be requested from the Legislature to provide the necessary facilities on a timely basis. A 10 acre site for a future school will be provided in the support community.

6.2 HEALTH CARE FACILITIES

6.2.1 Existing Facilities

Two hospitals administered by the Hawaii State Department of Health are available to study area residents. Ka`u Hospital in Pahala is a 15-bed facility. Eight beds are currently reserved for long-term care patients, with the remainder used for acute care. On average, the hospital operates at near-capacity levels. A shortage of beds for long-term care patients is a frequent problem at the hospital. This is primarily due to the aging population in the rural Ka`u region, thus generating a growing need for elderly care services (Kenji Nagao, Hospital Administrator, personal communication, August 13, 1987).

In August of 1987, Ka`u Hospital instituted a new Day Hospital Program. This program provides for care of elderly and infirm individuals (people who would normally require long-term care services) during daytime hours. Following guidelines established by their physicians, patients spend eight hours a day at the hospital and the rest of the time at home. This program is intended to reduce the costs of health care to those individuals able to participate, and to increase the availability of beds to those long-term care patients who actually require institutionalizing.

Ka`u Hospital provides full emergency room facilities for residents of the area. The hospital is also one of only two hospitals on the island still responsible for ambulance services. There are no specialty doctors (i.e., pediatrician, neurologist, etc.) available at Ka`u Hospital. If a patient is brought to the facility on an emergency basis, the patient is stabilized, then transferred to hospitals in Hilo or Kona.

The Ka`u Family Health Clinic, a privately-operated facility which leases space from the Ka`u Hospital, provides out-patient care services for minor illnesses.

Kona Hospital in Kealakekua provides full health care services for the entire West Hawaii region. The hospital is currently licensed for 75 beds (Jennie Wung, Hospital Administrator, personnal communication, August 13, 1987). A total of 53 beds are used for acute care patients and 22 are for long-term care. Even though the hospital maintains an average occupancy rate of approximately 60 percent, shortages often occur during peak periods, particularly for acute care beds.

An $11 million renovation is presently planned for Kona Hospital. The project will add additional extensive care facilities, a new operating room, and other improvements which will add 5 beds to the hosital's inventory. For the future, the ability of Kona Hospital to adequately meet the health care needs of the growing regional population will depend on further expansion of the existing facility, and/or the addition of a new hospital such as is currently being discussed for the Waimea- Honokaa area.

6.2.2 Probable Impacts

The expected population growth in the study area would probably necessitate the expansion and/or new construction of health care facilities. As noted previously, health care services in the Ka`u region are increasingly becoming directed towards the needs of the elderly residents in the area. New population growth resulting from the project would most likely be younger relative to the existing population, and would thus require different types of health care services. This could be in the form of more acute care and out-patient care services.

The cost of providing additional acute care services (along with the possibility of more long-term care services) would largely fall on the Hawaii State Department of Health. Patients in the study area requiring specialized care, particularly those in the Ka`u area, must now go to Hilo, Kona, or even Honolulu for treatment. If population growth resulting from the project increases faster than health care services are provided, then more residents in the study area could be expected to seek specialized care at facilities in Kona, Hilo, or Honolulu.

One positive impact which may result from the project is that it would tend to attract medical specialists to the area, whom the present population cannot support. Then a wider variety of medical services would be available to the region's residents.

6.2.3 Mitigation Measures

The Department of Health will be kept informed of the project's development. Once the extent of growth in the region is more firmly established, planning for new facilities at the Ka`u Hospital should begin. A 3.8 acre site in Phase I of the Hawaiian Palace project is being planned for a medical facility. This facility is expected to be privately-operated and targeted for out-patient care services.

6.3 POLICE PROTECTION

6.3.1 Existing Facilities

The Ka`u police sub-station is located in the Na`alehu Civic Center. The station maintains a force of 13 officers; however, three are presently on assignment to other areas.

The 13-member force is actually considered to be barely adequate to provide the necessary service for the area. During any given month, evening service is provided only about 25 percent of the time.

Regardless of development of the Hawaiian Riviera Resort, expansion of services is considered necessary due to other potential projects in the area and the district's natural population growth (Captain Edward Nobriga, Ka`u Station, Hawaii Police Department, personal communication, July 23, 1987). A new police facility is being planned in the near future for a 10 acre site east of Na`alehu.

The South Kona police station is located at Captain Cook in the Civic Center Complex. The 24-hour station has a 81 member force. Officers from this station provide services to the major population areas of West Hawaii. Unless there is a specific call for services, officers from the South Kona station do not patrol south of the City of Refuge area. They do not service the proposed project site.

6.3.2 Probable Impacts

The development of the proposed project will increase the need for police services in the area. The new station to be constructed near Na`alehu has been planned to accommodate the population growth in the district due to other projects and natural population growth. The existing service and the proposed new station may be inadequate to service growth due to the Hawaiian Riviera project.

6.3.3 Mitigation Measures

The five acre site set aside in Hawaiian Riviera Resort master plan for a police facility is considered useful and welcome (Nobriga, July 23, 1987). A substation could be developed on the site for a total cost of $300,000 to $500,000. This substation would be considered adequate not only to serve the proposed project, but also to improve the overall services in the western part of the district.

The resort site itself will be patrolled by private security personnel.

6.4 FIRE PROTECTION

6.4.1 Existing Facilities

A two-person 24 hour fire station is located in Pahala. The station has one truck available to serve the entire Ka`u district. As of September 1987, an ambulance service will be available in the station and two extra people are expected to be assigned for emergency services. There are also volunteer back- up forces in Pahala, Na`alehu, and Hawaiian Ocean View Estates (a maximum 13 volunteer force). Except for the ambulance service expansion, there is no growth in services planned for the area.

In South Kona, the 24-hour fire station is located in Captain Cook. Fire protection and ambulance service are provided by an 18 person workforce. There is a volunteer force in Miloli`i. No expansion of services is planned for these facilities (Joseph Loyola, Fire Inspector, Hawaii County Fire Department, personal communication, August 14, 1987).

6.4.2 Probable Impacts

Existing facilities are considered inadequate to serve the proposed development. Additional firefighters and equipment will be needed to serve projected population growth in Ka`u and South Kona.

6.4.3 Mitigation Measures

An additional station located in the study area is considered necessary to adequately serve the natural population growth in the district, other projects in the area, and the proposed Hawaiian Riviera Resort (Leonard Garcia, Fire Equipment Operator, Hawaii Fire Department, personal communication, July 29, 1987). Such a station would ideally require an 18 member force (four firefighters and two ambulance drivers per shift, three shifts a day).

The Hawaiian Riviera master plan has set aside a five acre site to develop the necessary fire protection facilities to serve the project. As population growth shifts towards the western part of Ka`u, adequate use of the dedicated site could be established through further communication with the Fire Department.

6.5 WATER SUPPLY

6.5.1 Existing Conditions

County water service is not available to the resort project site. Water in the study area is provided through two systems operated by the Department of Water Supply. The South Kona System serves only the northern half of the district, while the Ka`u System ends east of the project site. (Q.Antonio, Engineer, Hawaii County Department of Water Supply, personal communication, 7/29/87).

South Kona and the western part of the Ka`u district are included in the Hawaii County Water Master Plan Hydrographic Area IV (County of Hawaii, 1980). The eastern part of Ka`u is included in Hydrographic Area III.

Area IV water supply is considered dependable. A total rainfall of 1,790 million gallons per day (mgd) has been estimated for the area by the County. The South Kona System is supplied by three wells at Keei with a total capacity of 1.58 mgd.

The system can be divided into upper and lower service areas. In the upper area, from the Keei Wells (elevation 766), the water supply is lifted by a series of booster pumps to Mamalahoa Highway (elevation 1,376 feet). Further lifting north is accomplished by a series of boosters pumps to a tank at Waipunaula (elevation 1,764 feet). Flow to the south is by gravity to Ho`okena Beach Road junction. The upper system consists of about 10 miles of 8-inch pipeline, five pump stations and seven reservoirs. The total storage capacity is 0.90 mg. The lower system comprises mostly the Honaunau Bay and City of Refuge area, which is served by 4-inch and 8-inch lines.

Area III water supply is also considered reliable. The estimated sustainable yield of 110 mgd is confined to groundwater sources. The total rainfall within this area is approximately 2,340 mgd. Although rain is abundant above Pahala, stream yields are minimal due to the quick percolation of flows into highly permeable lava. The Waiohinu-Na`alehu-South Point system includes Haao Springs, the Mountain House Tunnel Spring, and a deep well in Na`alehu. Water from the Mountain House Tunnel is piped to Haao Springs and from there distributed to South Point, Waiohinu and Na`alehu via separate systems. The closest system to the project site is the South Point system, installed during World War II by the Army, which services the ranch land predominant in this area.

Groundwater supply in the area is sufficient to serve the proposed development. Up to three miles inland from the coastline, groundwater is considered brackish. However, at an altitude of 1,200 to 1,500 feet the water supply is appropriate for urban use (Ed Sakado, Geologist, Division of Water and Land Development, Hawaii State Department of Land and Natural Resources, personal communication, August 17, 1987).

6.5.2 Probable Impacts

No impacts to the existing facilities will occur due to direct project demand in the resort, residential, and support community. However, increased population associated with employment at the project will lead to increase water demand in the study area. This indirect impact will be part of an overall increased demand generated by other resort, residential, and commercial developments in Ka`u and South Kona. To meet this demand, water sources, storage and delivery systems are expected to be developed by public agencies and private users.

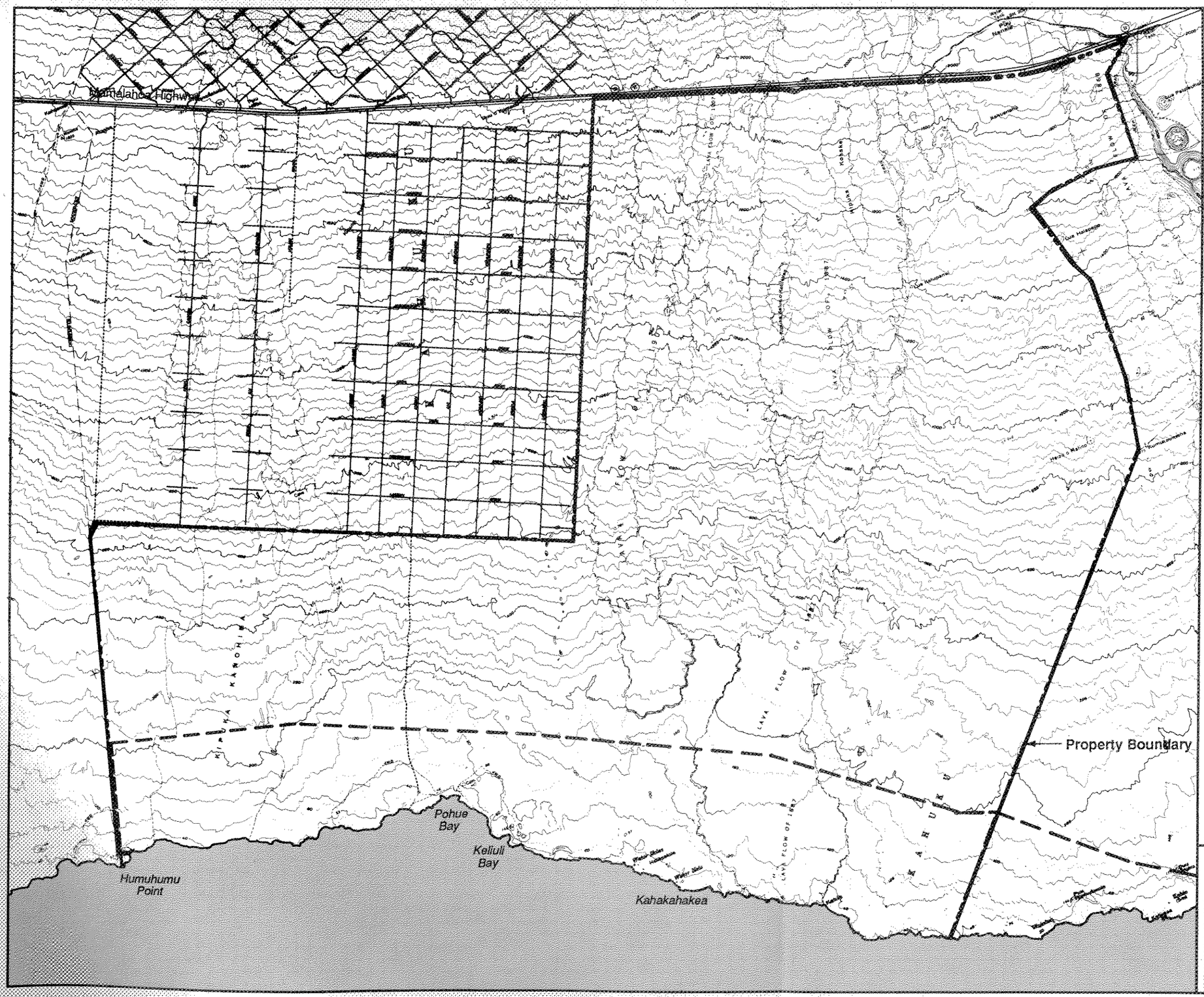
6.5.3 Mitigation Measures

The project will develop its own water system to serve the proposed development. Hawaiian Riviera Resort is not expected to affect the regional water supply due to the abundant resources available in the area and the current and expected low levels of demand from other sources.

6.6 WASTE WATER TREATMENT AND DISPOSAL

6.6.1 Existing Facilities

There are presently no publicly or privately-owned wastewater treatment facilities in the area of planned development. Wastewater generated from the Hawaiian Riviera Resort will be collected, treated, and disposed at three privately-owned and operated wastewater treatment facilities. Users will be assessed a monthly sewer charge to pay for the operating and maintenance expenses associated with the collection and treatment system. The treated wastewater will be utilized primarily for golf course irrigation. The support community will utilize individual wastewater systems (cesspools) for collection and disposal of their wastewaters.



LEGEND:

— — — Underground Injection Control (UIC) Line

Figure 4.23

LOCATION OF STATE'S UNDERGROUND INJECTION CONTROL (UIC) LINE

HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

4000 2000 0 4000

SCALE IN FEET

NORTH

Prepared By: BELT COLLINS & ASSOCIATES

Honolulu, Hawaii August 1987

6.6.2 Probable Impacts

The quantity of wastewater generated by the Hawaiian Palace Resort is expected to be 0.70 million gallons per day (mgd) for Phase 1 and will ultimately reach 1.05 mgd. The quantity of wastewater generated by the Hawaii Ka'u Aina Resort is expected to be 0.40 mgd for Phase 1 and will ultimately reach 0.63 mgd. The Hawaii Ka'u Aina Resort will employ two wastewater treatment plants because of the length of development as it stretches along the coastline. The Hawaiian Palace Resort will require one wastewater treatment plant.

The wastewater will be collected and transported to the three wastewater treatment facilities for secondary treatment and disposed/reused as golf course irrigation water. The wastewater infrastructure facilities will be constructed and operated entirely through private funds. The wastewater facilities will be designed to meet all County, State, and Federal water quality and public health standards. Therefore, potential public health problems and the threat of contaminating groundwater, surface water, and coastal water associated with inadequately treated or improperly disposed wastewater is expected to be negligable.

When effluent is not needed for golf course irrigation, injection wells drilled on the oceanside of the State's Underground Injection Control (UIC) Line, shown in Figure 4.23 will be used. This location assures that potable groundwater resources are protected from potential contamination of injected fluids. The State's UIC regulations are found in Chapter 23 of Title 11, Administrative Rules.

6.6.3 Mitigation Measures

Since all developers must show evidence of provisions for safe and reliable sewage treatement plants or individual systems before being issued a permit to operate, review by the County and/or the State Department of Health can assure that any necessary mitigation measures are made as conditions to the permit. Another control the County has which could mitigate impacts would be to discourage scattered new subdivisions which would require many small wastewater package plants. If new development is clustered and shares a smaller number of plants, there could be more supervision and control of sewage treatment and disposal.

In order to reduce potential hazards from the use of effluent for golf course irrigation, the effluent will be diluted with brackish water before use on the golf courses. Use of effluent should not impact residential areas or public uses located near golf courses due to the design and alignment of the course. As a standard design practice, residences are set back a minimum of 150 feet from the center line of a fairway. Although, at this general stage of planning a determination has not been made regarding the method of irrigation (spray or drip), all necessary precautions will be taken to minimize health and safety hazards for surrounding land uses, people, and the groundwater system.

6.7 SOLID WASTE DISPOSAL

6.7.1 Existing Facilities

The existing refuse facilities in the area of the planned resort consists of a transfer station in Waiohinu which is located approximately eight miles from the Resort's main access road. The County presently trucks the collected refuse to the Kailua landfill on a once per week schedule. Discussions with the County indicate that large additional volumes of solid waste would severely stress the present system. The County has no plans to establish a landfill in the Ka'u District at the present time.

6.7.2 Probable Impacts

Phase 1 of the proposed Hawaiian Riviera Resort developments is expected to generate approximately 22 tons per day, and ultimately, 40.5 tons per day would be generated. Solid waste estimates were based on resident/overnight visitor population generating 4 pounds per capita-day and employee/day visitor population generating 1.33 pounds per capita-day.

The proposed Hawaiian Riviera Resort will require an additional compactor-transfer station to handle the volume of solid waste projected to be generated. The present transfer station at Waiohinu will not be able to accommodate this additional volume of solid waste. Refuse will be collected by private contractors who also will transport the collected and compacted solid waste to a landfill in either Kona or Hilo. The limited life of the Kailua landfill may result in the solid waste being taken to Hilo's landfill.

The impact of the volume of solid waste generated from the proposed resort development will affect the life of the landfill used to dispose of this waste. At the present time, the Kona area generates approximately 60 to 75 tons per day of solid waste (Galen Kuba, Civil Engineer Planner, Hawaii Department of Public Works, personal communication, August 14, 1987). The resort's Phase 1 solid waste loading to a landfill is expected to consume approximately one acre of land per year assuming a density of 1,000 pounds per cubic yard and an effective solid waste depth of 10 feet. The ultimate development would consume approximately 2 acres per year under the same assumptions. The County's Solid Waste Master Plan should be amended to incorporate these additional loadings to determine landfill requirements.

The County is presently searching for a new landfill site to replace the Kailua landfill. An area in Waikoloa is under consideration.

6.7.3 Mitigation Measures

There is little that resort developers can do to reduce the per capita solid waste generation rate, particularly with regard to the secondary growth rate that would be stimulated by their activities. Theoretically, the County could influence this generation rate through regulations regarding recycling and packaging. Practically, however, there are few things they could regulate and even fewer that could be enforced. Thus, the primary issue concerning solid waste generation is the manner of disposal. Both Hawaii County and the City and County of Honolulu are presently reviewing the potential for garbage-to-energy facilities as an alternative to landfills.

6.8 POWER AND COMMUNICATIONS

6.8.1 Existing Facilities

Both telephone and electrical service are available to the project site from lines running along Mamalahoa Highway.

The nearest Hawaiian Telephone service center is located in Na`alehu. Capacity in local lines emanating from Na`alehu are sufficient to accomodate existing demand (Rodney Kealii, Chief Engineer, Hawaiian Telephone, personal communication, August 18, 1987).

Power for the resort site would be provided by the Hawaii Electric Light Company (HELCO), which maintains 69 KV transmission lines along the highway. HELCO also maintains a 12 KV capacity distribution line along the highway, which links its South Point substation with the Kealia substation in Kona. The South Point substation is already near capacity, and is drawing

about 80 percent of its power for existing demand in the region.

6.8.2 Probable Impacts

The Hawaiian Riviera Resort itself will be a significant consumer of power and communications services. Additional study area population will create demand for more local service hookups.

Representatives of the telephone company anticipate few problems in meeting projected demand. However, they have identified certain facilities that will be needed on the project site; provision will need to be made for utility services as resort physical planning proceeds.

In the case of electricity, HELCO indicates that the substantial level of projected islandwide growth means that additional generating capacity will be required (Melvin Yamaki, Planning Engineer, Hawaii Electric Light Company, personal communication, August 19, 1987). Because HELCO maintains a continuous islandwide power grid, the scale of new development is more important than the specific location of the growth. However, mindful that growth in West Hawaii is anticipated to exceed that in East Hawaii, HELCO is seeking to increase generating capacity in the Kona area (Yamaki, 1987).

The proposed development will ultimately require a load of 39 megawatts. This load will require off-site work by HELCO to install additional generation in Kona and transmission line(s) from Hilo. The on-site work will require at least three 69 KV transmission lines, a major substation and 12 KV distribution lines.

6.8.3 Mitigating Measures

In order to service the project site, Hawaiian Telephone will require installation of transmission poles or underground lines from the highway to a new service center to be constructed in the resort. A site of about 400 square feet would need to be set aside, preferably near the center of the development. Specific service plans should be discussed with Hawaiian Telephone as more precise site plans are formulated.

Electrical service will require construction of distribution lines from the highway to the resort site. Choice of overhead or underground configuration will be made by the property owner. HELCO will need distribution lines, dedication of a service easement from 100 to 150 feet in width along the distribution lines' right-of- way; and provision for a substation site within the project of approximately 30,000 square feet. Depending on ultimate sizing, the property owner could expect to pay at least $2 million for needed improvements, although a portion of this would be recovered once electrical service begins at the site (Yamaki, 1987).

Alternatives to fossil fuel-based electrical generation will need to be evaluated for their potential to mitigate the impact of the electrical demand from the resort. These alternatives include wind power, geothermal and OTEC. The HELCO will need to evaluate the feasibility and reliability of these alternatives.

6.9 AIRPORTS

6.9.1 Existing Facilities

There are no major or secondary airports located in the study area. The Hawaii State Department of Transportation operates two major airports on the island: the General Lyman Airport

in Hilo, and the Ke-ahole Airport in Kailua-Kona. The General Lyman Airport is capable of handling large, wide-bodied aircraft such as 747's and DC-10's. Current plans are to upgrade the Ke-ahole Airport in order to also handle larger types of aircraft.

6.9.2 Probable Impacts

No impacts will be experienced in the study area since no facilities are in existance. The proposed airport has been sited to minimize noise impacts upon surrounding residential areas. The proposed project is not expected to have any adverse impacts on major airports on the island since these facilities are designed to accommodate future growth in the County.

As presented in Table 44, approximately 27 of the 97 daily aircraft operations projected for the Hawaiian Riviera's regional airport will involve helicopters. Since these aircraft will be based at the regional airport, they will have no direct impact on General Lyman Field or Keahole Airport. Deducting these flights from the total annual aircraft operations projected for the regional airport results in about 26,000 annual aircraft operations. About 46%, or 11,885 operations will involve DASH 6 and DASH 7 type aircraft. Because these aircraft will most likely be associated with existing or future commuter services, it is probable that the flights will orinate from a variety of airfields located on Oahu, Maui and Hawaii.

The result will be that approximately 32 flights per day (18 planes landing and taking off) of DASH 6 and DASH 7 aircraft will be originating from 4 or 5 different airfields. The remaining aircraft are allocated for planning purposes as Cessna's and would probably be based at the regional airport. The cumulative impact of these various operations upon other airports on the Island of Hawaii will be relatively minor.

6.9.3 Mitigation Measures

Mitigation measures include the siting of the regional airport to reduce impacts on surrounding communities and residential areas and the scheduling of flights during daylight hours.

6.10 PUBLIC TRANSPORTATION

6.10.1 Existing Service

There is presently no public transportation service to the vicinity of the project site. Portions of the study area are serviced by the County bus system. Originating from Hilo each morning, a public bus operates as far as Waiohinu. The bus returns to Hilo in the afternoon. Originating from Kona, services extends south only to the Kealia-Ho`okena area.

6.10.2 Probable Impacts

An increased demand for County bus service may occur from resort workers and additional population generated by the proposed project. This may be due not only to individuals living in the study area, but also from workers who commute from outside the area as described in Section 2.4.4.

6.10.3 Mitigation Measures

Depending on future demand, current County bus service may require expansion to include the project site. This would include services originating in both Hilo and Kona. However, work schedules of on-site employees may necessitate the need for a private bus service similar to

those currently in operation at other resort areas in West Hawaii.

7. RECREATIONAL FACILITIES

7.1 EXISTING CONDITIONS

Ka`u has three recreational sites of statewide significance: Hawaii Volcanoes National Park, Kilauea State Recreation Area and the Manuka State Botanical Park.

The Ka`u district has several active land-based parks, and a number of resource-based recreational facilities. Community parks and school yards provide recreational opportunities to a variety of residents. Facilities include gyms, tennis courts and community centers. Those of particular interest include:

- Two 18-hole golf courses serve local residents, the Volcano Golf Course and Punalu`u Resort Golf Course. Although privately owned, these courses are open to the public.

- Shoreline recreational activities are limited to Punalu`u Beach Park and Whittington Beach Park. There is a County beach pavilion at Punalu`u used by district residents for picnics and gatherings. Sightseeing and fishing are popular in the South Point area.

- The Department of Hawaiian Home Lands has an undeveloped 28.8 acre site at Kama`oa for future development.

Several County parks and recreational facilities are located in South Kona. Greenwell Park has a lighted ballfield, the Yano Memorial Community Center, and tennis and volleyball/ basketball courts. Other recreational facilities include lighted basketball and volleyball courts at Ho`okena School . Additional county sites are maintained at Honaunau Boat Ramp, Honaunau Rodeo Arena, Kona Swimming Pool, and the Kona Scenic Subdivision Park.

County resource-based facilities include Honaunau Boat Ramp, and Ho`okena, Manini Point, Napo`opo`o, and Miloli`i Beach Parks. Miloli`i Beach Park has facilities for swimming, picnicking, camping, and fishing. Other resource-based facilities include South Kona Forest Reserve (hiking trails), Manuka State Park (pavilions, restrooms, picnic area and hiking trails), Kealakekua Bay State Underwater Park, and Hikiau Heiau Historic Site. South Kona's only Federal facility, the City of Refuge National Historical Park, offers interpretive trails, fishing, swimming, snorkeling, diving, and picnicking.

There are three boat launching areas in the study area: Kaulana Bay at South Point, Punalu`u Bay, and Miloli`i (used by local boat fishermen). Existing launching facilities are felt to be working at capacity (See Section 2.5.3.1.1). Planned improvements for the Kaulana Bay facility include construction of a breakwater by the U.S. Army Corps of Engineers (this would relocate the ramp about 100 yards towards South Point), and construction of a washdown and a parking area (Ian Bernie, Hawaii Boating Manager, Harbors Division, Hawaii State Department of Transportation, personal communication, July 23, 1987).

7.2 PROBABLE IMPACTS

In general, the existing study area parks and resource-based recreational facilities are considered adequate to service existing demand. Impacts generated by the resort component of the

proposed development are expected to be minimal due to its self-contained nature.

However, combined with the continued development of nearby subdivisions, increased population associated with employment at the project will result in an additional use of study area facilities.

The project should have a minimal impact on the use of Miloli`i beach park, which is highly valued by local residents. Manuka Bay beaches are considered better and are open to the public (Ronald Okamura, Deputy Director, Hawaii County Department of Parks and Recreation, personal communication, July 29, 1987).

The project will have impacts upon the Manuka Forest Reserve. Access to the reserve is limited to an access road from the north and the "Road to the Sea" which extends from Mamalahoa Highway to the shoreline between the reserve and the Hawaiian Riviera Resort property. Improvements planned for the Road to the Sea and a public access park and parking lot at the shoreline will result in greater numbers of people using the roadway and shoreline area. However, because the Hawaiian Riviera shoreline will include improved beach areas and a variety of parks and public access points, it will serve as the key attraction area for beach goers in the region. Thus, despite the increased number of people visiting the area, most will be attracted to the improved beach areas. Additionally, the coastline along the Manuka area is quite rugged with many portions virutally inaccessable. This terraine will also discourage people from utilizing the area.

Due to the existing remoteness of Manuka and its poor access, the forest reserve is sparsely used. Because no improvements will be made to the Manuka access roads, this situation should not change substantially with the opening of the resort. Although the public will be able to stop along the improved Road to the Sea and enter the Manuka area on foot, it is not anticipated that this will generate any significant impacts upon the area. The generally rugged terrain permits the casual hiker to range only about a quarter of a mile into the forest reserve area. Although the more adventurous person may choose to do this, most people will tend to utilize more accessable areas. Visitors and guests of the resort will not be likely to enter the Manuka area and will, instead, be attracted to the recreational opportunities at the resort.

7.3 MITIGATION MEASURES

The Hawaii County Department of Parks and Recreation has a target standard of five acres of developed park for every 1,000 resident population. There is enough developable land within the project site to accomodate the park needs of support community residents and in-migrant operational workers.

The project may also include an on-site boat launching facility to accomodate increased demand for such a facility. In general, the project is expected to increase and improve recreational opportunities for area residents by opening currently inaccessible shoreline areas for public use.

Recreational and resource-based facilities of islandwide significance may also be enhanced by the project. The proposed petroglyph park may become a matter of some interest to resort visitors as well as island residents.

Impacts to the Manuka Forest Reserve area will be mitigated in two general ways. First, information about the forest reserve can be provided at the Hawaiian Riviera's proposed Cultural Center. This will help to inform people about the significance of the area and the importance of maintaining its pristine character. Potential hikers can be informed of the hiking conditions and acceptable hiking practices that will minimize impacts to the area. Second, improvements made to

the shoreline area of the Hawaiian Riviera and the extensive historical and archaeological attractions at the resort will tend to attract visitors and the general public to the Hawaiian Riviera rather than the Manuka area.

8. VISUAL IMPACTS

8.1 VISUAL CHARACTER OF THE PROJECT SITE

The project site is entirely covered with a'a and pahoehoe lava flows, both prehistoric and historic. The a'a flows appear as masses of black rubble, largely devoid of vegetation, and entirely untraversable. The pahoehoe flows appear to have a relatively smooth, flat surface characterized by rope-like twists and swirls of lava. Tumuli, or domes of lava appear as small hills, can be seen in some areas of pahoehoe flows. Sparse vegetation, usually consisting of a few strands of grass, shrubs, or a small cluster of ohi'a trees, is evident on portions of the property, although, for the most part, it is barren. The 20,000 acre subject property extends from Mamalahoa Highway nearly six miles downslope to the sea. Leaving the highway and traveling southwest down the access road through a portion of the Hawaiian Ranchos subdivision, the slope seems gradual until the vacant lots of the subdivision give way to the rolling heaps of lava. From the vantage point of the southwestern boundary of the subdivision, the subject property appears as a vast, inhospitable desolate area. Continuing down the access road, the slope steepens for a few miles and then gradually levels off approaching the coastal area. The coastline is accessible by a few jeep trails running parallel to the shoreline. It appears to be an assortment of a'a and pahoehoe lava interspersed with areas of sand or cinders. Littoral cones dot the southeastern portion of the project site. At the shoreline, the lava ends in sea cliffs ranging from a few feet to twenty or more feet in height. A few sand or cobble beaches interrupt the otherwise inaccessible cliff areas. A single notable feature along the coastline is Pohue Bay; a tiny cove with a white sand beach surrounded by scattered coco palms and lush green vegetation. Upon closer examination, it is evident that the vegetation gains its sustenance from a series of anchialine ponds a short distance west of the bay.

8.2 EXPECTED VIEWS OF THE RESORT FROM THE HIGHWAY AND SHORELINE

From Mamalahoa Highway the resort portion of the project will be unable to be seen. This is largely due to the level topography on the ocean side of the highway. The shoreline of the subject property does not become visible until the observer enters the Hawaiian Ranchos subdivision. From that point, the coastline is nearly six miles away and considerably downslope.

The central portion of the Hawaiian Palace Resort, including the marina, hotels and marina village will remain concealed from the upland viewer. The marina village will be terraced into a slope behind the marina, and thus, from the upper regions of the property, the terraces and the marina below will not be seen. The only evidence of the resort will be the landscaped home sites, golf course, polo field, and equestrian facilites which extend inland behind the terraced village. The cumulative impact of these facilities will convey a sense of a low-density, spacious residential area.

The Hawaii Ka'u Aina Resort is planned at a much lower density than the Hawaiian Palace Resort, and will therefore, have even less of a visual impact. It is unlikely that any of its facilities will be visible during the day, although some of the golf course fairways and homesite landscaping may be visible. It is expected that lights from the resort may be visible at night from portions of the upland subdivisions. However, the resort will be concealed from views along the Mamalahoa Highway.

From the shoreline, the Hawaiian Palace Resort will take on the appearance of a moderately dense Mediterranean fishing village cut into the hillside behind a spacious marina. On either side of the marina, along the coastal area, a single hotel will be seen, giving the appearance of a spacious entranceway to the marina. A wide prominade will be visible extending inland from the southern portion of the marina and will appear as a busy, bustling center of activity.

Beginning at the marina and traveling south, a wide Openspace Corridor will wind its way along the shoreline to the southern property boundary, about four miles away. As the viewer leaves the Palace Resort, the activity of the resort will quickly give way to the quiet, timeless beauty of stark lava formations. A public accessway will meander among anchialine ponds surrounded by lush vegetation, appearing as tiny oases amidst the barren lava. Approaching the Hawaii Ka'u Aina Resort, the viewer will come upon a series of low rise, terraced buildings that emerge from their surrounding vegetation behind Pohue Bay. These three or four-story hotel facilities will be the largest structures on the property. Beyond them, single story cabana-like structures, similar to those of Kona Village, will provide further evidence of resort activity. Continuing onward, the public accessway will come up a rich variety of ancient Hawaiian archaeological sites located within the Openspace Corridor. The traveler may choose to continue or stop to explore one of the many park areas that provide a moment of respite. An extensive Petroglyph park will be but one of the many attractions along the remainder of the accessway. The cumulative impact of the Ka'u Aina resort from the shoreline will be that of a low density, spacious, landscaped area.

8.3 MITIGATION MEASURES

The visual impact of the proposed resort will be minimized by the design concepts of the resort components. The Hawaiian Palace Resort's major focus is the marina and its surrounding facilities. Utilizing the design of a terraced village area behind the marina, moderate densities will be distributed within a large area but concealed from views by surrounding terraces of land. The Ka'u Aina Resort's low-density and spacious character will minimize visual impacts by restricting building heights to the heights of surrounding palms. For both resort components, the natural topography and its variations in elevation will assist in shielding or concealing resort facilities or features from view.

Although precise building heights have not yet been determined, resort development in the coastal areas will not require taller buildings to take advantage of ocean views. The Hawaiian Riviera property is one of the very few locations along the entire south Hawaii coastline that affords excellent views of the ocean from inland areas. Thus, oceanside development will be restricted to relatively low-heights so as to not interfere with views from inland areas.

CHAPTER V

ALTERNATIVES TO THE PROPOSED PROJECT

1. INTRODUCTION

Alternatives to the proposed project which could feasibly attain the objectives of the action -- even though more costly -- are described in this section. An evaluation of the environmental benefits, the costs, and the risks of the proposed action and each alternative is also provided. Project alternatives fall into three general catagories; reduced scale, alternative use, and no development. None of the alternatives are able to meet the objective of establishing a resort community and employment center for the Ka'u area.

With the exception of the no-build alternative, any development of the now-vacant subject property will result in generally similar environmental impacts to the surrounding area, differing only in magnitude of impact.

2. REDUCED SCALE ALTERNATIVES

2.1 INTERMEDIATE RESORT AREA

According to the Hawaii County General Plan, an Intermediate Resort Area is "a self-contained resort destination area which provides basic and support facilities for the needs of the entire development on a smaller scale than a major resort area." The maximum allowable visitor units are 1,500 rooms. Maximum allowable acreages include 45 acres for resort use and 320 acres for residential use. The Intermediate Resort standards are roughly 50 percent smaller than those of a major resort area.

Given the overall size of the subject property, 20,616 acres, its relative isolation, and the present lack of public services and facilities, a primary motivating factor in determining the scale of the proposed Hawaiian Riviera Resort was to create a resort large enough to produce an acceptable return on the substantial investment necessary to provide the required services and facilities. The barren lava predominating the project site necessitates abnormally high site development costs. Additionally, the siting of the resort facilities in close proximity to the property's greatest asset, its ocean frontage, results in construction activities being located nearly six miles from the nearest public roadway. These factors together dictate that the scale of the proposed facility must be sufficent to generate adequate revenues to meet the costs of site development and return a reasonable profit to investors.

The development of the Hawaiian Riviera Resort at an Intermediate Resort scale would require a reduction by nearly half of the total visitor units proposed without any appreciable reduction in infrastructure costs. A decision to develop at the Intermediate level could result in an increase in the actual number of residential units per acre. Higher residential densities would manifest as either taller buildings or less open space, both conditions that could undermine the quality of life and character of the resort.

The scale of the overall resort must take into account the relative competitiveness of the visitor industry. Resorts located along the West Coast of Hawaii, as well as on Maui or Oahu, all provide the added attraction of close proximity to neighboring facilities. Thus, the visitor is provided the benefit of a alternate entertainment and recreational opportunities. This is not the case in Ka'u. The proposed resort is comparatively isolated from other resort areas. To become competitive with those areas, it must be of a sufficient size to provide the visitor with a variety of

on-site recreational activities.

A reduction in the scale of the proposed resort would have a substantial impact upon the labor force requirements for the facility and the economic impacts on the surrounding area. A smaller sized resort will result in less in-migration to the area. However, due to the relatively small size of the existing population, even an Intermediate Resort would generate more demand for employment than natural increase in the area's population could accommodate. Thus, as discussed above, a reduction in scale would result in the same relative impacts, only less.

2.2 MINOR RESORT AREA

The General Plan provides that this type of resort is appropriate where the land area is limited or insufficient to develop a self-contained resort. Given the extensive land resources at the subject property, as well as the infrastructure costs described above, this alternative is inappropriate for the entire project.

The designation of the subject area as either an intermediate or minor resort area would result in a relative decrease of environmental impacts over those generated by a major resort designation. Smaller scale resorts would generate lower on-site population resulting in less demand for potable water, energy and supportive infrastructure. However, while the scale of the infrastructure would be somewhat reduced, the demand for the supportive infrastructure would not change significantly. Access roads, sewer and drainage systems, a potable water system, and waste disposal would still be required. The impacts of public access to the presently inaccessible shoreline would not be reduced. Anchialine ponds and archaeological sites in the area would be subjected to relative increases in exposure to the general public over present levels, although not to the extent of exposure created by a resort with a larger on-site population.

3. ALTERNATE USES

Alternative land uses for the subject property have been considered but were found to be inappropriate given the property's location and size. Following is a brief discussion of the feasibility of alternate land uses.

3.1 AGRICULTURE

The subject property is entirely covered by pahoehoe and a'a lava flows and is, therefore, inappropriate for agricultural use.

3.2 COMMERCIAL

The property cannot be successfully developed with commercial activities for the simple reason that the Ka'u region contains insufficient resident population to support a large commercial development.

3.3 INDUSTRIAL

In addition to the lack of population necessary to sustain the operation of an industrial park or development, the remoteness of the property makes the alternative infeasible. The nearest harbors are located at Hilo and Kailua-Kona. The cost of shipping raw materials and/or finished products would be prohibitive in a competitive marketplace.

3.4 RESIDENTIAL

This alternative would provide for the subdivision of a portion or all of the subject property in large residential estate lots. Each lot would be owned and developed independently. However, extensive site development costs would require the lots to be very expensive and would limit their marketability. With an inventory of over 20,000 residential lots in the Ka'u disrict already, and over 95 percent undeveloped, the addition of a new residential subdivision similar to those already in existence would not be appropriate.

3.5 RECREATION

The development of the project site for recreation activities might be appropriate given the vastness of available land and the existence of archaeological resources. However, the remoteness of the site would require a significant investment in basic infrastructure needed to make the site accessable. Anticipated revenues from solely recreational activities would not be sufficient to pay for the cost of such development. Additionally, the lack of a sufficient population base in the Ka'u District to support the development of recreational resources may be prohibitive. The subject property is far too large for the present or projected population of the area. Finally, the barren character of the property would require that a high degree of landscaping be undertaken to render any recreational activity such as a park or playing field usable. The infrastructure needed for such an endeavor, including water, is not presently available.

4. NO BUILD ALTERNATIVE

Preserving the area in its natural state will provide no economic benefits to the surrounding area. The identified need for new employment opportunities in the Ka'u district and new economic growth will continue to go unmet until some significant form of development in the area occurs. Environmental conditions would be maintained. Access to the shoreline resources would continue to be restricted, however, and the recognized need to manage and protect the archaeological resources in the area would continue to be unmet.

5. COMPARATIVE EVALUATION

The following table presents a comparative evaluation of the identified alternatives and demonstrates the different benefits, costs, and risks associated with each action. None of the alternatives meet the objective of establishing an economically viable resort offering the unique amenities necessary to attract the new visitor market targeted by the Hawaiian Riviera Resort.

Table 45: EVALUATION OF ALTERNATIVES

	PROPOSED DEVELOPMENT	INTERMEDIATE RESORT	MINOR RESORT	AGRICULTURE	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	RECREATION
BENEFITS:								
EMPLOYMENT	O	O	•	•	•	•	•	•
INCOME GENERATION	O	O	•	•	•	•	•	•
TAX REVENUES	O	O	•	•	•	•	O	•
RECREATION FACILITIES	O	O	•	•	•	•	X	O
PUBLIC ACCESS	O	O	•	X	X	X	X	O
O = positive impact								
• = minimal impact								
X = possible negative impact								
COSTS:								
PUBLIC INFRASTRUCTURE	•	O	O	X	X	X	X	•
COMMUNITY SERVICES	•	O	X	X	X	X	X	X
ENVIRONMENTAL RESOURCES	•	O	X	X	X	X	X	X
HOUSING	•	O	X	X	X	X	X	X
O = high cost								
• = medium cost								
X = low cost								
RISKS:								
ARCHAEOLOGICAL RESOURCES	X	X	X	O	•	•	O	•
COASTAL RESOURCES	X	X	X	X	X	X	X	•
GROUND WATER QUALITY	X	X	X	O	X	X	X	X
O = high risk of damage								
• = medium risk of damage								
X = low risk of damage								

CHAPTER VI

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The principal long-term benefits of the proposed General Plan amendment include the productive use of an otherwise barren and undevelopable land area, the preservation and protection of anchialine ponds and archaeological sites, as well as increased interpretive opportunities, the preservation and maintenance of the coastal area, the maintenance of open space and scenic vistas both within and around the resort, and a significant increase in public access. Private funding of the necessary infrastructure, including a region-serving airport may also be viewed as a long-term benefit because it avoids the allocation of public funds. The development of the proposed marina will provide possibly the greatest long-term benefit by making available a new safe harbor to all boaters in Hawai'i's southern waters at no cost to the County or State.

The land will be committed to long-term uses, including hotel, commercial, residential, industrial and recreational developments. Additionally, portions of the shoreline will be altered by the creation of a channel leading to the marina and small channels linking artificial beach and lagoon areas, all developed inland of the existing shoreline. The sum of these developments will be the irreversible transformation of barren lava fields to a variety of urban uses. However, the relative size of the proposed project is insignificant when compared to the vastness of the region within which it will be located. Due to the remoteness of the subject property, a present lack of infrastructure including roads, potable water, and electricity prevents the land from being developed for alternate uses. As indicated in this document, agricultural activities are not economically feasible on the property. All other more intense uses of the land require a substantial investment in infrastructure which would greatly exceed any eventual income derived from the ultimate use of the land. Thus, the scale of the project must be sufficient to offset the cost of the necessary infrastructure. This document has demonstrated that the development of the area as a resort community is an appropriate use of the land.

Development of the Hawaiian Riviera Resort is not expected to pose any long-term risks to health or safety. In order to provide a desireable, attractive, and competitve resort destination with greatly improved public access, the resort's developers are particularly mindful of the need to eliminate any potential risk to the resort's visitors, residents and guests.

The creation of an Openspace Shoreline Corridor along the resort's coastal area satisfies multiple purposes. It will greatly enhance public access to the area, while providing a means of preserving existing archaeological sites and anchialine ponds, as well as establishing an appropriate setback for buildings and thereby mitigating the impacts of storm wave inundation. The beach or lagoon areas created inland of the existing shoreline will provide users with a safe alternative to open ocean swimming.

Other benefits derived from the proposed development include the long-term employment opportunities for the residents of the area as well as the residents of the entire island. The provision of public facilities for the use of area residents including a fire station and on-site medical facility will greatly enhance the quality of life in the region.

Finally, the in-migration to the region resulting from the proposed resort is believed to result in significant population growth for Ka'u. The effects of this growth have been evaluated in this document and it has been determined that the benefits of the proposed development adequately offset the potentially negative impacts of population growth.

CHAPTER VII

CONSIDERATION OF OFFSETTING GOVERNMENTAL POLICIES

By the very existence of a complex system of land use policies, plans, goals, objectives and controls at both the State and County levels of government, development proposals requiring land reclassification are often faced with inherent contradictions and conflicts within the land use regulatory system. As has been previously discussed, the proposed Hawaiian Riviera Resort is generally consistent with applicable Hawaii County General Plan goals, policies and standards, except those which this action is proposing to amend. It has also been found to be consistent with the intent of the Hawaii State Plan objectives concerning increased and diversified employment opportunities and improved living standards for Hawaii's people.

Although no significant adverse environmental impacts are expected to result from development of the proposed Hawaiian Riviera Resort, a number of social and economic impacts have been identified including significant population growth and potential in-migration, accompanied by increasing volumes of traffic and a greater demand for housing and related public services. While the infrastructure required to service the entire project will be largely provided by the project developer, it must be recognized that development of this scale will have impacts upon the regional system of roadways and airport facilities. An analysis of the impact of the project on government expenditures versus the benefits of the resort in terms of government revenues indicates a favorable cost/benefit ratio for the State and County. This may help to offset the resort's potential negative impacts upon regional infrastructure. As indicated in Section 2.4.7 of Chapter IV, government revenues versus per capita costs of public services result in a very positive ratio of $3.00 to $4.00 of state revenue and $2.00 to $3.50 of county revenue for each dollar spent on state services.

Ultimately, the process of government approval must consider the relationship of the Hawaiian Riviera Resort to the current County policy focusing resort development in West Hawaii and the subsequent policy implications. A comprehensive review of the County General Plan indicates that although a variety of goals and objectives concerning the provision of new public facilities for the Ka'u district are presently contained in the document, their implementation has yet to occur, primarily due to limited County resources. This has been a painful reality for a district faced with a steady decline in its sole income-producing industry, agriculture. Government policies calling for the continued support of agriculture have not had a positive impact upon the region's out-migration of youth and exceedingly high level of unemployment. Without substantial public investment in facility improvements such as a long awaited harbor, airport, and medical facilities, new business has been unwilling to locate in Ka'u. The distance from major growth areas has been viewed as being prohibitive. The growth of thirty-year old residential subdivisions has stagnated. And yet, the district is rich in natural resources including its vast acreage, its rugged coastline and the dominating features of Mauna Loa.

The Hawaiian Riviera Resort will offer the Ka'u District a bright economic future. As demonstrated in Chapter II, the project's market assessment reveals a surprisingly strong potential for growth, independent of development in West Hawaii. The creation of a unique resort community that is fully self-contained targets at least two existing world markets that are vastly under-served by existing Hawaiian resorts. Access to these markets will provide the incentive for economic development that is expected to become self-perpetuating. The keys to this growth are the developer's commitment to the construction of a world-class marina, major recreational and cultural facilities, a region-serving airport, an entire Support Community for resort employees and the necessary public facilities including a school, a medical facility and a police/fire facility, all

integrated into a single, master-planned resort community.

This unique commitment of private fiscal resources for the benefit of an entire region constitutes the basis for re-evaluation of State and County policies and for the land-use amendments being sought. It is believed that the proposed project will benefit the region, the County of Hawaii, and the entire State without sacrificing the rich resources of Ka'u. Careful planning will provide adequate mitigation for possible adverse impacts and ensure a desired physical and social environment that meets the needs of the residents of Ka'u and all Hawaii's people.

CHAPTER VIII

UNRESOLVED ISSUES, AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

1. UNRESOLVED ISSUES

The General Plan Amendment and State Land Use Commission Boundary Amendment which this environmental impact statement accompanies are two of several permit applications which must be approved before construction of the Hawaiian Riviera Resort can begin. Other permit applications are listed later in this section.

Several issues raised by the proposed project remain to be resolved. They fall into two catagories; those issues that require a greater level of detail or specificity to be appropriately defined, and those issues which cannot be fully evaluated until development actually occurs. However, it is expected that all the issues presented below can be resolved without undue difficulty through mitigation measures. The most significant issues are presented below.

1.1 ISSUES REQUIRING GREATER LEVEL OF DETAIL

The proposal to amend the Hawaii County General Plan and the State Land Use District Boundary to show a resort community at Kahuku, Ka'u, is relatively general in nature. Government approval of these applications is ultimately a policy-level decision that must address issues and concerns at the conceptual stage or "front-end" of the land use planning process. Potential environmental, social and economic impacts relating to the actual physical siting of the project have been identified and discussed in this document. However, because the project proposal is presented at a conceptual level, project details such as specific architectual design, construction methods and implementation strategies have not yet been determined, nor are they required at this stage of the process. Thus, although an exhaustive attempt has been made to identify and resolve potential issues relating to the development proposal, some remain unresolved until planning for the Hawaiian Riviera Resort reaches the design stage, specific impacts can be quantified, and detailed strategies prepared to meet the challenges as they may arise.

1.1.1 Geologic Constraints

Geologic features associated with the extensive lava flows which cover the subject property, including ground cracks, lava tubes and tumuli, must be further measured and evaluated to determine their potential impact upon specific components of the proposed project. A geological report has been prepared to address these features and is included as an appendix to this document. This report has concluded that in all cases the geological constraints will not prohibit the project from being built, but rather, may affect the siting of specific project components. Project geologists concur that the extent of individual features can be quantified and that existing engineering technology can resolve any site design issues. However, resolution will not occur until further studies are completed.

1.1.2 Employee In-Migration

The proposed size and development phasing of the Hawaiian Riviera Resort is anticipated to result in a greater demand for employees than the study region is presently capable of supplying. However, the extent of in-migration to the Ka'u region is contingent upon a number of factors exogenous to the project proposal. These include the likelihood of permit approval and the

implementation of development schedules for construction projects in West Hawaii, the availability of housing supply outside of the study area and the willingness of potential employees to commute, the provision of public transportation serving the study area, and the future success of agricultural and resort endeavors in the Ka'u district. Most of the issues related to the potential incidence of in-migration concern the economc future of Hawaii County and policy responses of government officials. Thus, the impacts of in-migration cannot be fully resolved until its dynamics are better understood and government policy issues are decided.

1.1.3 Location of Off-Site Population Growth and Facilities

As with employee in-migration, the issues related to population growth outside of the subject property and the funding and construction of public facilities necessary to accommodate that growth cannot be fully resolved until a number of government policy issues are reconciled. Decisions concerning the allocation of public funds for infrastructure and public services to meet the anticipated growth are contingent upon, among other things, the conclusion of the current General Plan Revision program. Whether the Hawaiian Riviera Resort is included as an integral part of this policy update program may, in itself, contribute to the manner in which this issue is resolved.

1.1.4 Employee Housing

The provision of employee housing is an issue common to virtually all neighbor island resort proposals. In most instances, resorts are proposed in rural areas with an insufficient supply of housing to meet the demand of the potential employee population. However, unlike many other planned resorts, the Hawaiian Riviera has the benefit of an abundant supply of land within its boundaries to accommodate at least a portion of its labor force. The creation of a fully-serviced 800-unit Support Community has been proposed by the property owners as a means of addressing this critical issue. Furthermore, 200 units of multi-family housing are proposed for development within the Hawaii Ka'u Aina Resort and are intended to built early enough to house construction workers employed in the development of the resorts' initial phase. Additional housing demands are anticipated to be met by the gradual development of the nearby vacant subdivisions such as the Hawaiian Oceanview Estates and Hawaiian Ranchos. Final determination of how the matter of employee housing will be resolved ultimately lies in the hands of the County. Negotiations with County officials will help to determine how the provision and phasing issues related to employee housing will be resolved.

1.1.5 Traffic

As a rural area, Ka'u presently experiences relatively low volumes of vehicular traffic. The development of the Hawaiian Riviera Resort will have a significant increase upon the volume of traffic in the region. The need for improvements to roadways around South Hawaii is a system level function related to both regional and islandwide growth. The allocation of public funds for roadway improvements is contingent upon priorities established by County lawmakers. While the Hawaiian Riviera Resort will be responsible for transportation facilities within the resort property, as well as the Resort entance and access road, decisions concerning future roadway off-site improvements and alternate forms of public transportation must be resolved at the County and State level.

1.1.6 Water Resource Development

The proposed project cannot be constructed without adequate water to meet the needs of its guests, residents, visitors and facilities. A hydrology report prepared for this study and

included in the appendix identifies the existence of adequate water resources. A preliminary design of the water system is provided in Figures 2.3 and 2.4, based upon the projected population and facility requirements of the resort. Wells will be located in intervals along the 1000 foot elevation , as well as along the highway. As additional test wells are drilled, concerns over the specific number of wells and and siting of water lines will be resolved. Once permit approvals for the project are received, water resource development will commence.

1.1.7 Space-Related Activities

The only official document providing substantive information concerning potential space-related activities in the Ka'u area is the Arthur D.Little report entitled, Evaluation of the Potential for Space-Related Activities in the State of Hawaii, published in August 1987. Any assessment of impacts must be based upon the data and facility descriptions contained in the report. After a careful reading of the Little report, it has become apparent that the potential relationship of the Hawaiian Riviera Resort to frequently discussed space-related activities in the Ka'u area will be difficult to evaluate for a number of reasons listed below. Once a detailed enviromental impact statement is prepared for the proposed space related activities, a complete evaluation of its relationship to the proposed resort can be undertaken. At the present time, the property owners of the proposed resort feel that their project and space-related activities which may be planned for the Ka'u region can exist in a mutually beneficial relationship.

1. The Little report presents an Action Plan regarding initiatives which the State of Hawaii should undertake if it desires to be involved in the space industry. Contained in this plan are nine recommendations; eight non-launch related activities and one launch related activity. Table VII-1 on page VII-2 of the Little report contains a comparative analysis of the advantages which the major Hawaiian Islands have for these eight non-launch space-related activities. A summary of this table on page VII-3 concludes that the Hilo, Waimea and Kona areas "seem to be the most promising" for non-launch activities on the Island of Hawaii.

   It would appear from this statement that there would be no direct physical impacts of the proposed resort upon non-launch activities. However, it is not possible to determine the level of financial commitment which may be required from the State and/or the County for non-launch activities.

   While most of the non-launch related activities are private-sector oriented, and thus, will not require a large initial commitment of funds from government sources, one recommendation may be potentially significant. The proposal to establish some type of space-theme park may impact State and County capital expenditures. It may also impact the employment market on the Island of Hawaii if it were to be located there. Table V-1 on page V-27 presents a summary of employment impacts associated with space development activities. Although the baseline employment outlook for 1995 for the development options totals only 30 new jobs, the eventual impact of non-launch related activities on potential new employment could range from 1,250 to 1,850 jobs, with a space theme park accounting for about 80% of the potential growth in employment. However, as stated on page V-30, "the regional impact of this development will depend on its location". Clearly, the space theme park would have a significant impact upon the employment needs of the proposed resort if it were located in the Ka'u region and if it were to be built during the phase one period of the proposed resort's development.

2. The Little report does not contain a site specific recommendation for the location of a space launch facility. Although the report contains a map of possible sites (Figure VII-5 on page VII-20) on the Island of Hawaii, the area shown extends from the southern boundary of the Volcanoes National Park to South Point and is presented at a scale which makes an assessment of the actual boundaries of the areas under consideration difficult. An evaluation of physical impacts which the proposed resort may have upon a space launch facility, and correspondingly, a space launch facility may have upon the proposed resort necessitates that the physical locations of both the proposed facilities be known.

   An additional consideration is the potential expansion of the facility. A potential expansion area may have impacts as significant as those of an initial blast zone and noise hazard zone, because with expansion of the facility the parameters of the blast and noise hazard zones might also change.

3. The Little report does not discuss the specific direction of launch for expendable launch vehicles (ELV) from a Ka'u site. Although a discussion of threshold criteria is presented on page IV-3 of the report and the direction of launch is characterized as "an eastwardly direction", a map of the Kennedy Space Center operations on page IV-5, entitled Areas of Restriction Associated with KSC Operations, depicts launch directions to the east ranging from 15° to 160°. If these launch directions are similar for a Ka'u site, an ELV could be launched in a direction anywhere from almost due north to almost due south. The direction of launch will effect the designation of a downrange safety zone.

   In addition, there is no discussion of the impact which the tradewinds of the Hawaiian Islands may have upon the direction of launch. It cannot be determined from the report whether the direction of launch is fixed or is flexible, dependent upon prevailing wind conditons.

4. It is not possible to determine the potential impact of a blast zone and noise hazard zone associated with a launch site upon surrounding land uses, due to the lack of specificity regarding the location of the proposed launch site. Therefore, the potential impacts of these zones upon the proposed resort, and the potential impact of the resort upon these zones cannot be evaluated. While a radius of up to three miles for a blast zone is discussed on page VII-13 and a noise zone of up to five miles (for Titan rockets) is discussed on page VII-39, there is no discussion of the effects which Hawaiian tradewinds may have upon these zones. Additionally, it is not possible to determine the impact of launch activities upon the Mamalahoa Highway. For a significant portion of the proposed launch area between Volcanoes National Park and South Point, the highway is aligned within three miles of the coastline, and presumably within a potential blast zone or buffer area. The report does not discuss the impact of a proposed ELV launch upon highway activity. If the highway were to be closed during periods of launch activity, it could have a direct impact upon the proposed resort. The statement on page VII-16 that, "The on-shore area from which public access would be restricted during launch depends on the type of vehicle, launch azimuth, and other factors" does not directly address this issue. Nevertheless, we believe that improvements which may be made to existing infrastructure in relation to the proposed space facility may have a positive and beneficial impact upon the proposed resort.

5. The potential social and economic impacts of a space-related activity in the Ka'u area and its relationship to the proposed resort cannot be evaluated without specific knowledge of the type and size of the facility. We would expect that the labor pool for a launch facility might be quite different than the labor pool for a resort. However, with no specific information, we are at a loss to evaluate the impacts of a launch facility upon the local and regional labor pool. On the other hand, a space-related theme park might draw its workers from the same labor pool as the proposed resort. Without a specific proposal for the location of such a park, however, we can not determine if it would impact the potential labor pool for the resort. Nor can we determine the temporal relationship between the opening of such a facility and the opening of the resort. With only a finite labor pool on the Island of Hawaii, the proposed resort and launch facilities might have to compete for labor if both facilities were to open in the same general timeframe.

In view of these factors, we are unable to fully explore the potential impacts and interrelationships of a major resort area in the Ka'u area with a proposed space-related activities in the Ka'u area. Without a site-specific proposal and knowledge of the type of facility being considered we would be limited to offering broad generalizations. Thus, we cannot adequately assess the impacts of space-related activities at this time.

The property owners of the Hawaiian Riviera Resort recognize that a space-related facility in the Ka'u District may have a beneficial impact upon the proposed resort in terms of its contribution to economic growth in the area. We eagerly await the preparation of an environmental impact statement and would respectfully request that we are kept informed of its progress. We would also request that the Palace Development Corporation and the Hawaii Ka'u Aina Partners, co-owners of the subject property, be included as consulted parties during the EIS process.

1.2 ISSUES CONCERNING QUANTIFICATION OF ACTUAL DEVELOPMENT IMPACTS

As opposed to issues requiring greater detail or information, the issues discussed below remain unresolved at this stage of the planning process because the actual outcome cannot be fully known until development occurs.

1.2.1 Impact of Shoreline Modifications Upon Water Quality

The potential impacts of shoreline modifications associated with construction of the marina entrance channel, swimming lagoon flushing channels, and the Oceanliner docking terminal have been fully explored in this document and in two technical studies prepared for the Hawaiian Riviera Resort, a baseline assessment of the marine environment and an engineering evaluation of ocean and shoreline conditions. Although both of these documents have projected no significant adverse impacts associated with offshore water quality, precise mitigation programs and monitoring schedules cannot be developed until the actual zoning of the property is determined, the design of the resort facilties is approved, and construction schedules are developed.

1.2.2 Impact of Shoreline Modifications Upon Marine Species

The impacts of shoreline modifications upon marine species is believed to be negligible based upon a detailed study of the issue conducted for this EIS. However, the actual impacts will be unknown until construction begins and the effects of operations can be monitored.

1.2.3 Archaeological Site Preservation

The subject property has been found to be rich in archaeological sites, particularly along the coastline of the proposed resort. An exhaustive study of these sites includes a recommendations for the preservation of significant features. Two issues concerning archaeological site preservation remain unresolved. The first issue concerns the potential discovery of new sites during construction on the property. Obviously, resolution must be addressed at the time of construction, and any such sites will be appropriately dealt with as encountered. The second issue involves the potential impact of increased public access to preserved sites once construction of the resort is completed. The preparation of a mitigation or management plan to implement the preservation of significant sites and their long-term maintenance and upkeep will contribute to the resolution of this issue.

2. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Development of the Hawaiian Riviera Resort will entail the construction of numerous resort facilities and the subsequent alteration of existing land forms. The siting of a major marina and terracing of a nearby village area will involve the excavation of approximately 6 million cubic yards of lava rock. Much of this excavated material will be used as fill material in facility and infrastructure foundations. This land form alteration constitutes an irreversible and irretrievable commitment of physical resources. Additionally, potable water resources underlying the subject property will be developed for use at the resort. While this resource is renewable, the physical act of obtaining the water will alter the existing groundwater discharge patterns associated with the project coastline. Archaeological resources that are determined to be not appropriate for preservation will be surveyed for data recovery prior to removal.

The natural lava terrain of the 20,000 acre parcel will be largely preserved, except for those areas developed for resort, commercial, residential, or facility use. For these altered areas, extensive landscaping will enhance the site. Impacts upon existing coastal vegetation will be minimized. Although landscaping is not necessarily an irreversible action, it will have a long-term impact upon the project area by helping to lower ambient temperatures and providing new sources of water which will, in turn, have a positive impact upon the attractiveness of the site for bird populations.

CHAPTER IX

PARTIES CONSULTED AND THOSE WHO PARTICIPATED IN THE PREPARATION OF THE EIS

1. CONSULTED PARTIES

The notice of availability of the EIS Preparation Notice (EISPN) for the Hawaiian Riviera Resort was published in the OEQC Bulletin by the Office of Environmental Quality Control on February 23, 1987. The agencies, organizations, and individuals listed below were sent copies of the EIS Preparation Notice (EISPN) with the Environmental Assessment (EA) and were asked to comment on the project. Everyone believed to have an interest in the project or who request consulted party status was included in the mailing. Those who responded to the request for comments are marked with an asterisk (*) and copies of the correspondence with them are reproduced in Chapter X.

Federal Agencies

* U.S. Army Engineering Division
  U.S. Department of Agriculture, Soil Conservation Service
* U.S. Department of Commerce, National Marine Fisheries Service
* U.S. Department of Energy, Pacific Site Office
  Family Support Administration
  Food & Drug Department
  Health Care Financing Administration
  Public Health Service
  Office of Hearings and Appeals
* U.S. Department of Housing and Urban Development
* U.S. Department of the Interior, Fish and Wildlife Service
* U.S. Department of the Interior, Water Resources Division, Geological Survey
  U.S. Department of Labor, Occupational Safety & Health Administration
* Federal Aviation Administration
  U.S. Department of Transportation, U.S. Coast Guard
  U.S. Environmental Protection Agency

State Agencies

  Department of Accounting and General Services, Division 0f Public Works
* Department of Agriculture, Board of Agriculture
* Department of Budget and Finance
* Department of Defense, Hawaii Air National Guard
* Department of Education
* Department of Hawaiian Home Lands
* Department of Health
* Department of Labor and Industrial Relations
  Department of Land and Natural Resources
* Department of Planning and Economic Development
* Division of Public Works
  Department of Social Services and Housing
* Department of Taxation
* Department of Transportation
* Office of Environmental Quality Control
* Office of the Governor

* Office of Hawaiian Affairs
* University of Hawaii at Manoa

Congressional Representatives

The Honorable Daniel K. Inouye, United States Senate
The Honorable Spark M.Matsunaga, United States Senate
The Honorable Daniel K. Akaka, United States House of Representatives
The Honorable Patricia Saiki, United States House of Representatives

State Legislators

The Honorable Richard Henderson, State Senate
The Honorable Richard M. Matsuura, State Senate
The Honorable Malama Solomon, State Senate
The Honorable Virginia Isbell, State House of Representatives
* The Honorable Andrew Levin, State House of Representatives
The Honorable Mike O'Kieffe, State House of Representatives
* The Honorable Wayne Metcalf, State House of Representatives
The Honorable Harvey S. Tajiri, State House of Representatives
The Honorable Dwight Takamine, State House of Representatives

County Agencies

* Planning Department
Department of Public Works
* Department of Parks and Recreation
* Department of Water Supply
Department of Research and Development
* Fire Department
Office of Housing and Community Development
Division of Industrial Safety
Civil Defense Agency
Department of Finance
Hawaii Redevelopment Agency
* Police Department

County Elected Officials

The Honorable Dante K. Carpenter, Mayor
* The Honorable James L.K. Dahlberg, County Council
* The Honorable Frank De Luz, III, County Council
The Honorable Takashi Domingo, County Council
The Honorable Robert Herkes, County Council
The Honorable Lorraine Jitchaku-Inouye, County Council
* The Honorable Russel S. Kokubun, County Council
The Honorable Merle K. Lai, County Council
The Honorable Spencer Kalani Schutte, County Council
The Honorable Stephen K. Yamashiro, County Council

Public Utilities

Gasco, Inc. - Hawaii Division
Hawaii Electric Light Company, Inc.
* Hawaiian Telephone Company

Community Organizations and Other Public Interest Groups

Big Island Business Council
Hawaii Hotel Association, Hawaii Chapter
* Life of the Land
* Moku Loa Group, Hawaii Chapter Sierra Club
Hawaii Island Chamber of Commerce
Hawaii Visitors Bureau
Kona-Kohala Chamber of Commerce
Japanese Chamber of Commerce
I.L.W.U.
Hawaii Island Board of Realtors
Ka'u High School
Ka'u Hospital
Na'alehu Elementary School
Ka'u Historical Society
Portuguese Chamber of Commerce
Hilo Hawaii Visitor Industry Association
* Audobon Society, Hawaii Chapter
Hawaiian Civic Club of Ka'u
Ka Ohana O Kalae
Na'alehu Community Club
Pahala Community Association
Ka'u Lions Club
Volcano Community Association

Telephone calls were received from the following persons regarding the proposed project. They have all been included as consulted parties:

Reed Flickenger, West Hawaii Today
Wendy McAllister, DHM Planners
Ed Matsusigi, Department of Education
Charlene Lau, Social Security Administration
John Naughton, National Marine Fisheries Service
Frederick Gross

2. ORGANIZATIONS AND INDIVIDUALS WHO ASSISTED IN THE PREPARATION OF THIS EIS

The Environmental Impact Statement was prepared for the Palace Development Corporation and Hawaii Ka'u Aina Partners by Belt Collins & Associates with input provided by subconsultants. Site design for the Palace Resort was produced by Larry Helber of Helber, Hasterts & Kimura. Belt Collins & Associates produced the site design for the Hawaiian Ka'u Aina Resort. The following persons were involved in the preparation of the EIS:

Belt Collins & Associates

James R. Bell	-	Principal in Charge
Richard H. Van Horn	-	Project Manager
Lee William Sichter	-	Editor/Principal Writer
Ed Iida	-	Contributor/Civil Engineer
Thomas Nance	-	Contributor/Hydrologist
Karon Uyechi	-	Cartographer
Audrey Chun	-	Cartographer
Cary Kondo	-	Contributor/Civil Engineer

Subconsultants

Susan Kawamoto (Peat Marwick & Main)	-	Market Analysis
John Knox (Community Resources, Inc.)	-	Socio-Economic Impacts
Paul Rosendahl (Paul Rosendahl, Inc.)	-	Archaeology
Scott Sullivan (Sea Engineering, Inc.)	-	Ocean Engineering
Steve Dollar (Marine Research Consultants)	-	Marine Biology
S.K. Djou (Dames & Moore)	-	Geology
Winona Char (Char & Associates)	-	Flora
Phillip Bruner	-	Fauna
James Morrow	-	Air Quality
Yoichi Ebisu	-	Noise Impacts

CHAPTER X

COMMENTS AND RESPONSES RECEIVED DURING THE EIS PREPARATION NOTICE COMMENT PERIOD

The agencies and individuals listed in Chapter IX were all sent copies of the Enviornmental Impact Statement Preparation Notice (EISPN) with the Environmental Assessment (EA) and a transmittal letter requesting comments. Copies of the EISPN and the transmittal letters sent to these organizations and individuals are reproduced along with copies of our responses to them. The following table summarizes all letters received (including phone calls) and displays them in two catagories; substantive and non-substantive. Substantive letters raised specific concerns while non-substantive letters expressed either "no comment" or simply requested to be included as consulted parties. Letters appear in the same order as they are listed in Table 46.

NAME/AGENCY OF RESPONDENT	DATE OF LETTER	DATE OF BCA RESPONSE	CONTENTS: NON-SUBSTANTIVE	CONTENTS: SUBSTANTIVE	WRITER'S TOPIC OF CONCERN:
MICHAEL GRAVES/UH	3/18/87	4/28/87	X		
WILLIAM GRAHAM/LOL	3/16/87	"	X		
BEVERLY BYOUK	3/20/87	"	X		
JACK DELANEY/HAW.RANCHOS C.A.	3/21/87	"	X		
SHARON FISHER/HAW OCEAN VIEW EST.	3/24/87	"	X		
YUKIO TAKEMOTO/STATE B&F	4/6/87	"	X		
V.B. ANDERSON	4/8/87	"	X		
REPRESENTATIVE ANDREW LEVIN	4/7/87	"		X	NEEDS A SOCIO-ECONOMIC IMPACT ANALYSIS
H. WILLIAM SEWAKE/COUNTY WATER	4/8/87	"		X	MINIMUM WATER SYSTEM REQUIREMENTS
PATRICIA ENGELHARD/COUNTY PARKS	4/8/87	"	X		
WAYNE CARVALHO/COUNTY POLICE	4/13/87	"	X		
DAVID WELHOUSE/FAA	4/13/87	"		X	AIRFIELD MUST MEET ALL FAA STANDARDS
JERRY MATSUDA/HAW. AIR NAT'L GUARD	4/15/87	"	X		
REPRESENTATIVE WAYNE METCALF	4/15/87	"	X		
JOHN LEWIN/STATE DOH	4/10/87	"	X		
FRANCIS SMITH/COUNTY FIRE	4/16/87	"		X	PROJECT SHOULD INCLUDE FIRE STATION FACILITIES
JOHN SHUPE/U.S. ENERGY DEPT.	4/13/87	"		X	RECOMMENDS ENERGY CONSERVATION DESIGN
					AND SOLAR WATER HEATING
TEUANE TOMINAGA/STATE PUB. WORKS	4/13/87	"	X		
DERRICK UYEDA/HAWAIIAN TEL	4/10/87	"		X	TELEPHONE SERVICE REQUIREMENTS
ERNEST KOSAKA/US FISH &WILDLIFE	4/10/87	"		X	ANCHIALINE PONDS, MARINE LIFE, FLORA & FAUNA
ROGER ULVELING/STATE DPED	3/23/87	"		X	CZM PROGRAM REQUIREMENTS & EIS REQUIREMENTS
RICK WARSHAUER	3/24/87	"		X	WATER, FLORA & FAUNA, PROJECT DESIGN, MARINA
					DESIGN, GEOLOGICAL HAZARDS, LIABILITY, SEWAGE
EARL NELLER	2/13/87	"		X	WANTS COPIES OF ALL ARCHAEOLOGICAL REPORTS
MAE MULL/HAW.AUDUBON SOCIETY	4/12/87	"		X	LAND USE DESIGNATIONS, FLORA & FAUNA
CHARLES TOGUCHI/STATE DOE	4/14/87	"		X	EXISTING SCHOOLS ARE OPERATING AT CAPACITY
REED FLICKINGER/WEST HAWAII TODAY	phone call	"	X		
WENDY McALLISTER/DHM PLANNERS	phone call	"	X		
ED MATSUSIGI/STATE DOE INFO. SYS.	phone call	"	X		
CHARLENE LAU/SOCIAL SECURITY ADM.	phone call	"	X		
JOHN NAUGHTON/MARINE FISHERIES	phone call	"		X	PROJECT IMPACTS ON HAWKSBILL TURTLE
FREDERICK GROSS	phonecall	"	X		
DEBORAH ABREU/NA ALA HELE	4/20/87	"	X		
JOSHUA AGSALUD/GOVERNOR'S OFFICE	4/20/87	"	X		
KAMAKI KANAHELE/OHA	4/21/87	"		X	ANCHIALINE PONDS, HISTORIC SITES & TRAILS,
					FLORA & FAUNA, SHORELINE ACCESS
ILIMA PIIANAIA/STATE DHHL	4/24/87	"		X	ADEQUATE FRESH WATER & NEW EMPLOYMENT SOURCE
EDWARD HIRATA/STATE DOT	4/22/87	"		X	TRAFFIC IMPACT ANALYSIS REPORT REQUIRED
MARIO RAMIL/STATE DLIR	4/24/87	"		X	EMPLOYMENT OPPORTUNITIES
NELSON HO/SIERRA CLUB	4/27/87	5/5/87		X	WATER, GEOLOGICAL HAZARDS,ANCHIALINE PONDS, AIRCRAFT
					CULTURAL AND HISTORIC RESOURCES
KISUK CHEUNG/DEPT. OF THE ARMY	4/27/87	"		X	FIRM MAPS
COUNCILMEMBER FRANK DE LUZ III	4/27/87	"	X		
SUZANNE PETERSON/DEPT. OF AGRICULTURE	4/28/87	"		X	VARIOUS AGRICULTURAL-RELATED IMPACTS
DOYLE GATES/MARINE FISHERIES	4/29/87	"		X	ENDANGERED SPECIES, RECREATIONAL RESOURCES, BASELINE,
					SECONDARY IMPACTS, ENVIRONMENTAL PROTECTION PLAN
ERNEST KOSAKA/FISH & WILDLIFE	4/29/87	"	X		FOLLOW UP FROM PREVIOUS LETTER
RICHARD KAHLE/TAX DEPARTMENT	4/29/87	"	X		
WILLIAM MEYER/DEPT. OF INTERIOR	5/1/87	5/7/87	X		
JOHN LEWIN/DEPT. OF HEALTH	4/29/87	"		X	AIR & WATER QUALITY, SEWAGE TREATMENT, POTABLE WATER
CALVIN LEW/DEPT. OF HOUSING/URB.DEVEL.	5/6/87	"	X		
COUNCILMEMBER RUSSELL KOKUBUN	5/20/87	5/26/87	X		SOLID WASTE DISPOSAL, SCHOOLS, PROTECTED SPECIES, TRAILS
					SATELLITE LAUNCHING FACILITY, AIRFIELD, GEOLOGICAL HAZARDS
COUNCILMEMBER JAMES DAHLBERG	4/15/87	"		X	

University of Hawaii at Manoa

Department of Anthropology
Porteus Hall 346 • 2424 Maile Way
Honolulu, Hawaii 96822

March 18, 1987

Mr. Richard H. Van Horn
Belt, Collins and Associates
606 Coral Street
Honolulu, HI 96813

Dear Mr. Van Horn:

I am in receipt of the February 23, 1987 issue of the OEQC Bulletin that lists preparation notices for EIS. You have filed a notice for the Hawaiian Riveria Resort, Kahuku, Ka'u, Hawaii. As the Chair of the Peer Review Committee of the Society for Hawaiian Archaeology, I am requesting that I be placed on the list of individuals to be consulted for this project. Accordingly, I will plan to review the Draft and Final copies of the EIS as they become available.

Please let me know if you have any questions regarding my participation in this process. I can be reached at the address above.

Sincerely,

Michael W. Graves

MWG:en

AN EQUAL OPPORTUNITY EMPLOYER

BELT COLLINS & ASSOCIATES
Planning · Landscape Architecture
606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
Hawaii • Singapore • Australia • Colorado • Hong Kong

April 28, 1987
87-867

Mr. Michael W. Graves
Department of Anthropology
University of Hawaii at Manoa
Porteus Hall 346
2424 Maile Way
Honolulu, Hawaii 96822

Dear Mr. Graves:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of March 18, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

As requested, your name has been placed on the mailing list as a consulted party and you will receive Draft and Final copies of the EIS.

Sincerely,

Richard H. Van Horn

RHVH:lws

LIFE OF THE LAND

March 16, 1987

Mr. Richard H. Van Horn
Belt Collins & Assoc.
606 Coral Street
Honolulu, HI 96813

Dear Mr. Van Horn,

I write to request that Life of the Land, Big Island Chapter, be a consulted party in the preparation of the EIS for the proposed Hawaiian Riviera Resort in Kau.

At this time we do not have any specific comments on the issues to be addressed.

Thank you.

William Graham, Big Island Rep.
Life of the Land
P. O. Box 155
Hawi, HI 96719

250 S. Hotel St. Rm. 211 Honolulu, Hawaii 96813 Tel. 521-1300

BELT COLLINS & ASSOCIATES
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Hawaii • Singapore • Australia • Colorado • Hong Kong • Guam

April 28, 1987
87-868

Mr. William Graham
Big Island Representative
Life of the Land
P.O. Box 155
Hawi, Hawaii 96719

Dear Mr. Graham:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of March 16, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

As requested, the Big Island Chapter of Life of the Land will be included as a consulted party and you will receive Draft and Final copies of the EIS.

Sincerely,

Richard H. Van Horn

RHVH:lws

March 20, 1987

MAR 2 3 1987

Richard H. Van Dorn
Belt, Collins and Associates
606 Coral Street
Honolulu, HI 96813

Dear Mr. Van Dorn,

Per the request for a major resort designation by your clients, Hawaiian Riviera Resort, Palace Development Corporation and Hawaii Ka'u Aina, I would like to request that I be included as a consulted party.

My request is for the following reasons: As a longterm resident of the area, I have a personal interest in the growth of this area; as broker in charge of a real estate office located in the immediate area, I have strong professional reasons for wishing to keep in touch with all development; and, finally, as Chairman of the Historical Sites Committee of the Hawaiian Civic Club of Ka'u, I have a responsibility to the club to be aware of all development in this area.

I thank you in advance for your cooperation.

Sincerely yours,

Beverly Byouk

R Van Horn

P. O. Box 6353
Captain Cook, HI 96704

(808)929-9688

BELT COLLINS
& ASSOCIATES
Engineering · Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 · Phone (808) 521-5361 · Telex BELTH 7430474 · Fax (808) 538-7819
Hawaii · Singapore · Australia · Colorado · Hong Kong · Saipan

April 28, 1987
87-869

Ms. Beverly Byouk
P.O. Box 6353
Captain Cook, Hawaii 96704

Dear Ms. Byouk:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your letter of March 20, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

As requested, you have been included as a consulted party and you will receive Draft and Final copies of the EIS.

Sincerely,

Richard H. Van Horn

RHVH:lws

MARCH 21st 1987

MR. RICHARD H. VAN HORN
BELT COLLINS AND ASSOCIATES

DEAR SIR:

I am president of a bonified organization know as HAWAIIAN RANCHOS COMMUNITY ASSOCIATION. We are the organized body that hanldde the bussiness of the property owners for this subdivision. We felt some what slighted when we heard that we had not been mentioned on the ENVIRONMENTAL ASSESSMENT AND NOTICE OF PREPARATION OF AN ENVIROMENTAL IMPACT STATEMENT. I do know both Mr. Charles Chidiac of Palace Development and I do know Mr. Walter Witte and Mr. Thomas Boden of HAWAII KAU' AINA and allthree of these gentlemen told me that we would be informed when this EIS study would be out, know all we want is to be kept abreast of any and all changes in the area,we are very concerned as you might note, we are the bordering propertys. I think if you might contact anyone of these three gentlemen they will vouch for me and our reequest to rec' this information. I would like to have our organization put on your mailing list to keep us current of any and all activity that will come from this. Please send all information to BOX 6352 CAPT. COOK HI. 96704. We do thank you and wish the best of success on these two projects.

MAHALO

JACK DELANEY PRESIDENT
HAWAIIAN RANCHOS COMMUNITY ASSOCIATION

JJD/
copies to TOM BODEN
CHARLES CHIDIAC
WALTER WITTE
FRANCIS KNOCKEMOTO attorney
SALLY GALLUP attorney
SECRETARY: Files

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& ASSOCIATES
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April 28, 1987
87-870

Mr. Jack Delaney, President
Hawaiian Ranchos Community Association
St. Rt. P. O. Box 6070
Captain Cook, Hawaii 96704

Dear Mr. Delaney:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of March 21, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

As requested, your organization has been included on the mailing list as a consulted party and you will receive Draft and Final copies of the EIS. Additionally, you will be contacted by members of the project team during the course of the impact studies.

Sincerely,

Richard H. Van Horn

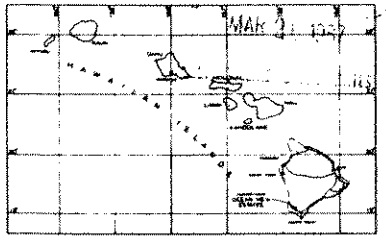
RHVH:lws

HAWAIIAN OCEAN VIEW ESTATES
COMMUNITY ASSOCIATION, INC.

HOVECA INC

Star Route Box 6016

CAPTAIN COOK, HAWAII 96704



March 24, 1987

Richard H. Van Horn
Belt, Collins, & Assoc.
606 Coral Street
Honolulu, HI. 96813

Dear Mr. Van Horn,

We understand that your firm will be handling any business and communications which deal with the proposed new development in Ka'u. The Riveria development will have a direct affect on our subdivision as we encompass over 10,000 one acre lots above highway 11.

We would like to be put on your mailing list and advised of any proposed plans or development so close to our subdivision.

Thank you for your cooperation with our community association.

Sincerely,

Sharon Fisher
Office Manager

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& ASSOCIATES
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April 28, 1987
87-871

Ms. Sharon Fisher, Office Manager
Hawaiian Ocean View Estates
Community Association, Inc.
St. Rt. P. O. Box 6016
Captain Cook, Hawaii 96704

Dear Ms Fisher:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of March 24, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

As requested, your organization has been included on the mailing list as a consulted party and you will receive Draft and Final copies of the EIS. Additionally, you will be contacted by members of the project team during the course of the impact studies.

Sincerely,

Richard H. Van Horn

RHVH:lws

John Waihee
GOVERNOR

HAWAII PUBLIC EMPLOYEES HEALTH FUND
EMPLOYEES' RETIREMENT SYSTEM
PUBLIC UTILITIES COMMISSION
OFFICE OF THE PUBLIC DEFENDER

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
STATE CAPITOL
P.O. BOX 150
HONOLULU, HAWAII 96810-0150

Yukio Takemoto
DIRECTOR

Robert P. Takushi
DEPUTY DIRECTOR

DIVISIONS:
BUDGET, PLANNING AND MANAGEMENT
ELECTRONIC DATA PROCESSING
FINANCE

April 6, 1987

Mr. Dick Van Horn
Belt, Collins & Associates, Inc.
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Thank you for the opportunity to comment on your proposed development of the Hawaiian Riviera Resort at Kau, Hawaii. We have no comments to make at this time.

Sincerely,

YUKIO TAKEMOTO

BELT COLLINS & ASSOCIATES
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Landscape Architecture
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April 28, 1987
87-872

Mr. Yukio Takemoto
Department of Budget and Finance
State Capitol
P.O. Box 150
Honolulu, Hawaii 96810-0150

Dear Mr. Takemoto:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 6, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

APR 8

V.B.Anderson
6102 Oak Hill Ave.
Los Angeles,Ca.90042

Re:Hawaiian Riveria Resort

Sirs:
Please send info. concerning Hawaiian Riveria Resort. I am interested in a wise investment.

Is development in progress and what and when is scheduled?

Will greatly appreciate your comprehensive answer.

Mahalo,

V.B.Anderson

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& ASSOCIATES
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April 28, 1987
87-573

Mr. V.B. Anderson
6102 Oak Hill Avenue
Los Angeles, California 90042

Dear Mr. Anderson:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your letter of April 8, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

The proposed project is presently in the conceptual stages of development. A variety of consultant studies have been commissioned to address various components of the project, including water development, shoreline impacts, social impacts and economic feasibility. Once these studies have been completed, they will provide the basis for the preparation of a Draft Environmental Impact Statement. Only after the DEIS is adequately reviewed by government and private agencies and individuals, and a Final EIS is prepared, reviewed and approved, will the project proceed into the development stage. At that point, a number of development permits must be procured before actual construction can begin.

Your name has been added to the mailing list and you will receive copies of the Draft and Final EIS documents for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

Speaker
DANIEL J. KIHANO
Vice Speaker
EMILIO N. ALCON
Majority Leader
TOM OKAMURA
Majority Floor Leader
PETER K. APO

DISTRICT REPRESENTATIVES

1st - ANDREW LEVIN
2nd - HARVEY S. TAJIRI
3rd - WAYNE METCALF
4th - DWIGHT Y. TAKAMINE
5th - VIRGINIA ISBELL
6th - MIKE O'KIEFFE
7th - MARK J. ANDREWS
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41st - TOM OKAMURA
42nd - CLARICE Y. HANDA-HOLT
43rd - DAVID Y. IGE
44th - LEONE Y. KANESHIRO-FUSCHAS
45th - MILNER S. SHEN, M.D.
46th - PAUL T. OSHIRO
47th - MIKE CROCKER
48th - HENRY (HANK) PETERS
49th - PETER K. APO
50th - EDWARD K. KANOHO
51st - HERBERT T. KAWAKAMI

Majority Staff
Minority Staff

HOUSE OF REPRESENTATIVES
THE FOURTEENTH LEGISLATURE
STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

April 7, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Thank you for your letter dated March 31, 1987, concernin the Hawaiian Riviera Resort.

My primary concerns with respect to the project are the social impacts of such a large development.

I hope they will be adequately addressed in the EIS.

Very truly yours,

ANDREW LEVIN
Representative
First District of Hawaii

AL:sml

BELT COLLINS & ASSOCIATES
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April 28, 1987
87-874

The Honorable Andrew Levin
Representative, First District of Hawaii
State of Hawaii
State Capitol
Honolulu, Hawaii 96813

Dear Representative Levin:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 7, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

A socioeconomic impact analysis is being done for the project. The results of the study will be included in the EIS. A copy of the Draft EIS will be sent to you for review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII
25 AUPUNI STREET • HILO, HAWAII 96720

April 8, 1987

Mr. Dick Van Horn
Belt, Collins & Associates
606 Coral Street
Honolulu, HI 96813

ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
HAWAIIAN RIVIERA RESORT
TAX MAP KEY 9-2-01:72
KAHUKU, KA'U, HAWAII

Thank you for the opportunity to comment on the subject document.

In accordance with the County of Hawaii Subdivision Code, a water system meeting the minimum requirements of the Department of Water Supply shall be provided. Requirements of other government agencies, including the State Department of Health and State Department of Land and Natural Resources, shall also be complied with.

Minimum water system requirements will include the following:

1. Provide a water system capable of delivering water at adequate pressure and volume under peak-flow and fire flow conditions. The system shall be to dedicable standards and shall include, but not be limited to, the following:

   a. The development of a minimum of two (2) deep well sources, one of which shall be a standby unit.

   b. The construction of storage facilities.

   c. The installation of necessary booster pumps (two pumps minimum per station).

   d. The installation of a chlorination system and control systems.

   e. The installation of necessary piping.

   f. The installation of service outlets to each lot.

2. Submit a water master plan for the entire development.

3. Submit source data.

4. Submit a source protection plan.

5. Submit a water system construction plan for review and approval.

6. Provide a written agreement assuring that each lot owner will be provided with water, which is to be attached to the deed for each lot. Submit the agreement for our review and approval.

7. The developers should get approval from the Department of Health as to the potability of the water for domestic purposes.

8. Comply with the applicable requirements of the Department's Rules and Regulations.

H. William Sewake
Manager

QA

BELT COLLINS
& ASSOCIATES
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April 28, 1987
87-875

Mr. H. William Sewake, Manager
Department of Water Supply
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Sewake:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 8, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

Specific details of the water delivery system is contingent upon an analysis of the two existing wells adjacent to the property. The extent of potable water resources which may be available for the project have not yet been determined. It is intended that the water delivery system will meet all applicable County standards and requirements.

The proposed project's water demand and supply will be addressed in more detail in the Draft EIS. A copy of the draft document will be provided to you for review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

Dante K. Carpenter
Mayor

Eugene N. Tiwanak
Managing Director

Patricia G. Engelhard
Director

Ronald Okamura
Deputy Director

DEPARTMENT OF PARKS & RECREATION
COUNTY OF HAWAII

... ASPUNI STREET • HILO, HAWAII 96720 • TELEPHONE 961-8311

April 8, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, HI 96813

Subject: EIS Preparation Notice for Hawaiian Riviera Resort,
Ka'u, Hawaii
TMK: 9-2-01:72

Dear Mr. Van Horn:

We have reviewed the subject report and would be interested in public shoreline access provisions.

We appreciate the opportunity to review the preparation notice and look forward to review and provide input as detailed plans are developed for public access.

Thank you.

Sincerely,

Patricia Engelhard
Director

PE:GM:ai

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& ASSOCIATES
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April 28, 1987
87-876

Ms. Patricia Engelhard
Department of Parks and Recreation
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Ms. Engelhard:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your letter of April 8, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

A detailed discussion of provisions for public access to the proposed project will be included in the Draft EIS. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

POLICE DEPARTMENT

COUNTY OF HAWAII
349 KAPIOLANI STREET
HILO, HAWAII 96720

OUR REFERENCE

YOUR REFERENCE

GUY A. PAUL
CHIEF OF POLICE

WAYNE G. CARVALHO
DEPUTY CHIEF

April 13, 1987

Mr. Dick Van Horn
Belt, Collins & Associates
606 Coral Street
Honolulu, HI 96813

RE: Environmental Impact Statement Preparation Notice (EISPN)
Hawaiian Riviera Resort, Kau, Hawaii

The County EISPN and supporting Environmental Assessment was reviewed and from the police standpoint, we foresee no adverse effect from the requested land use.

GUY A. PAUL
CHIEF OF POLICE

Wayne G. Carvalho
WAYNE G. CARVALHO
DEPUTY CHIEF OF POLICE

EWN:gs

cc: Hawaii County Planning Department

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April 28, 1987
87-877

Mr. Wayne G. Carvalho
Deputy Chief of Police
Police Department
County of Hawaii
349 Kapiolani Street
Hilo, Hawaii 96720

Dear Deputy Chief Carvalho:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 13, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

U.S. Department
of Transportation
**Federal Aviation
Administration**

AIRPORTS DISTRICT OFFICE
BOX 50244
HONOLULU, HI 96850-0001
Telephone: (808) 541-1243

April 13, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Horn:

We have reviewed the Environmental Impact Statement Preparation Notice for the proposed Hawaiian Riviera Resort in Ka'u, Hawaii. We have no specific comments regarding the EIS but note that a Notice of Landing Area Proposal, FAA Form 7480-1, must be filed prior to airfield construction. Also, the airfield should meet all FAA standards.

Thank you for the opportunity to review this notice.

Sincerely,

David J. Welhouse
Airports Engineer/Planner

Henry A. Sumida
Airports District Office Manager

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& ASSOCIATES
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April 28, 1987
87-878

Mr. David J. Welhouse
Federal Aviation Administration
Airports District Office
P.O. Box 50244
Honolulu, Hawaii 96850-0001

Dear Mr. Welhouse:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your letter of April 13, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816

ALEXIS T. LUM
MAJOR GENERAL
ADJUTANT GENERAL

DANIEL S. C. AU
HIENG
DEPUTY ADJUTANT GENERAL

HIENG

APR 15 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Environmental Impact Statement Preparation Notice
for Hawaiian Riviera Resort, Kau, Hawaii

Thank you for providing us the opportunity to review the above subject project.

We have no comments to offer at this time regarding this project.

Yours truly,

Jerry M. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

Enclosure

cc: Hawaii County Planning Dept.

BELT COLLINS
& ASSOCIATES
Engineering · Planning
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April 28, 1987
87-879

Major Jerry M. Matsuda
Hawaii Air National Guard
Department of Defense
State of Hawaii
Office of the Adjutant General
3949 Diamond Head Road
Honolulu, Hawaii 96816

Dear Major Matsuda:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 15, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

RICHARD A. KAWAKAMI
EMILIO N. ALCON
TOM OKAMURA
PETER K. APO

DISTRICT REPRESENTATIVES
1st - ANDREW LEVIN
2nd - HARVEY S. TAJIRI
3rd - WAYNE METCALF
4th - DWIGHT Y. TAKAMINE
5th - VIRGINIA ISBELL
6th - MIKE O'KIEFFE
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- TES ISHIHARA JR
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42nd - CLARENCE T. HANDA/SATO
43rd - DAVID D. DAI
44th - LEONIE Y. YAMAMURA-JENSEN
45th - MILNER S. MIZUNO, SR.
46th - PAUL T. OSHIRO
47th - MIKE GABBARD
48th - HENRY HAYNES PETERS
49th - PETER K. APO
50th - EZRA R. KANOHO
51st - RICHARD A. KAWAKAMI

Majority Leader
Majority Floor Leader

HOUSE OF REPRESENTATIVES
THE FOURTEENTH LEGISLATURE

STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

April 15, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Thank you for your letter of March 31, 1987, regarding the Environmental Impact Statement Preparation Notice for Hawaiian Riviera Resort, Kau, Hawaii.

I appreciate your giving me the opportunity to have my concerns addressed; however, none come to mind at this time. Please be assured that I will contact you if any concerns should arise at a later time.

With warm personal regards.

Sincerely,

WAYNE METCALF
Hawaii State Representative
Third District

WM:mn

BELT COLLINS
& ASSOCIATES
engineering · Planning
Landscape Architecture

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April 28, 1987
87-880

The Honorable Wayne Metcalf
Representative, Third District
State of Hawaii
State Capitol
Honolulu, Hawaii 96813

Dear Representative Metcalf:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 15, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

John Waihee
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

DIRECTOR
TELEPHONE NO.
548-6915

April 10, 1987

Mr. Dick Van Horn
Belt, Collins and Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Subject: Preparation Notice for Hawaiian Riviera Resort, Kau, Hawaii

The impacts disclosed in the preparation notice are of greatest concern to us. They should be covered in sufficient detail in the draft EIS. We have no additional comments at the present time.

Thank you for providing us the opportunity to review this preparation notice.

Sincerely,

John C. Lewin, M.D.
Director of Health

BELT COLLINS
& ASSOCIATES
Planning · Engineering
Landscape Architecture

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April 28, 1987
87-881

Dr. John C. Lewin, Director
Department of Health
State of Hawaii
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Lewin:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 10, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

DUANE K. CARPENTER
MAYOR

HAWAII COUNTY FIRE DEPARTMENT
466 KINOOLE ST, HILO, HAWAII 96720
PHONE: 935-2978

FRANCIS E. SMITH
FIRE CHIEF

DON COLOMA
DEPUTY FIRE CHIEF

April 16, 1987

Mr. Dick Van Horn
Belt, Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Thank you for providing us an opportunity to comment on the proposed Hawaiian Riviera Resort, Ka'u, Hawaii. The Fire Department has no objections to the proposal. Presently, district fire protection is provided by volunteer fire fighters located at Ocean View Estates. They are supplemented by paid fire fighters from Pahala and other volunteers from Discovery Harbor Subdivision in Waiohinu, and Naalehu Town. Because of its isolated location, Hawaii County Fire Department recommends that all residential and commercial structures be protected by automatic sprinkler systems.

Long-range plans should also include provisions that the development provide future permanent fire station facilities (i.e., site, building, and equipment).

Should the County be the intended operator, the site shall be located centrally in order that both the development and adjacent communities benefit equally.

Sincerely,

Francis E. Smith

FRANCIS E. SMITH
FIRE CHIEF

FES/mo

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...gineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
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April 28, 1987
87-882

Mr. Francis E. Smith
Fire Chief
Hawaii County Fire Department
466 Kinoole Street
Hilo, Hawaii 96720

Dear Chief Smith:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 16, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

Specific recommendations concerning existing or proposed fire station facilities will be addressed in the Draft EIS. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

UNITED STATES
DEPARTMENT OF ENERGY

P.O. BOX 50168
HONOLULU, HAWAII 96850

April 13, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

EISPN for Hawaiian Riviera Resort

Thank you for sending me a copy of the above EISPN. I reviewed it with interest. There will be no major concerns of the U.S. Department of Energy on this project which will cause you problems.

Because of the magnitude of this project, however, combined with the probable upward trend in the cost of oil in the early 1990's, I would be remiss if I did not encourage you to use effective energy conservation design and practices wherever possible. You may also wish to consider solar water heating at this high insolation site -- both for economy and for PR benefit.

Best wishes for a successful project.

Sincerely,

John Shupe

John W. Shupe, Director
Pacific Site Office

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& ASSOCIATES
Engineering • Planning
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April 28, 1987
87-883

Mr. John W. Shupe, Director
Pacific Site Office
United States Department of Energy
P.O. Box 50168
Honolulu, Hawaii 96850

Dear Mr. Shupe:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 13, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

Recommendations concerning energy conservation design and practices will be included in the Draft EIS. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
DIVISION OF PUBLIC WORKS
P. O. BOX 119, HONOLULU, HAWAII 96810

RUSSEL S. NAGATA
COMPTROLLER

KEN KIYABU
DEPUTY COMPTROLLER

LETTER NO. (P)1312.7

APR 17 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Subject: EIS Preparation Notice
Hawaiian Riviera Resort, Kau, Hawaii

We have reviewed the subject document and have no comments to offer.

Very truly yours,

TEUANE TOMINAGA
State Public Works Engineer

EM:jk

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Engineering · Planning
Landscape Architecture

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April 28, 1987
87-884

Mr. Teuane Tominaga
State Public Works Engineer
Division of Public Works
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Tominaga:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 13, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

HAWAIIAN TEL GTE

[illegible] 4249
[illegible] Hawaii 96720
[illegible] (808) [illegible]

April 7, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Dick Van Horn:

Hawaiian Riviera Resort, Kau, Hawaii - Environmental Impact Statement (EIS)

Thank you for including Hawaiian Telephone Company to participate in providing input into the preparation of your EIS for the above development.

We have the following comments relating to Hawaiian Telephone Company providing telephone services to your proposed development:

1. Our existing facilities is located on the Hawaii Belt Road approximately 5 miles away and must be extended from that point into development.

2. Developer must provide an underground system along the proposed roadway to the development or provide Hawaiian Telephone Co. easements for a joint poleline along the proposed roadway within the development.

3. For planning purpose, we will require an easement covering about 400 sq. ft. to house our substation somewhere in your development. The actual size of the easement will be dependent on what is required to adequately serve the development and can be worked out at a future date.

The installation of aerial telephone facilities may contribute to the environmental impact of the development.

If you have any questions, please call Kenneth Tanaka, Supervising Engineer, at 935-9459.

Sincerely,

Derrick M. Uyeda
Island Manager Hawaii

cc: R. [illegible]

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April 28, 1987
87-885

Mr. Derrick M. Uyeda
Island Manager - Hawaii
Hawaiian Telephone Company
P.O. Box 4249
Hilo, Hawaii 96720

Dear Mr. Uyeda:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 10, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

Matters relating to telephone service and facilities for the proposed resort will be addressed in the Draft EIS. A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P O BOX 50167
HONOLULU, HAWAII 96850

ES
Room 6307

APR 6 1987

Mr. Richard H. Van Horn
Belt, Collins, and Associates
606 Coral Street
Honolulu, Hawaii 96813

Re: General Plan Amendment Application and Environmental Impact Statement Preparation Notice, Hawaiian Riviera Resort, Ka'u, Hawai'i

Dear Mr. Van Horn:

We received the referenced application and Preparation Notice on March 23, 1987 and were unable to meet the March 25, 1987 deadline for comments because of other priority responsibilities. We would appreciate the inclusion of our comments into the Draft Environmental Impact Statement (EIS).

The proposed 3,200-acre development includes seven resort sites, eighteen residential communities, three 18-hole golf courses, parks, a major marina, a commuter airfield, an industrial support area, and an 800-acre support community.

The Service's primary concerns with the proposed development are the following:

a. There are several anchialine ponds and fissures located within the project site (Brock and Maciolek, 1974) (enclosure 1). We are concerned about potential adverse impacts to these resources from filling or dredging activities, degradation of groundwater quality, withdrawal of groundwater, and introduction of alien aquatic species.

b. Nearshore fishery resources, coastal water quality, endangered humpback whales (Megaptera novaeangliae), and threatened green sea turtles (Chelonia mydas) may be adversely impacted by construction and operation of a marina, construction of and discharge from an ocean sewage outfall, drainage of stormwater runoff, and nutrient loading from golf course leachate into coastal waters.

c. The endangered Hawaiian bat (Lasiurus cinereus semotus) and its habitat, and candidate endangered plants which may inhabit the project site, may be affected by the construction and operation of a major resort development.

The following Service recommendations should be addressed in the Draft EIS:

a. The Preparation Notice states that the "applicant intends to preserve significant ponds in the project area and to incorporate them into the resort plan where possible." We consider anchialine ponds to be Resource Category 1 wetlands (U.S. Fish and Wildlife Service Mitigation Policy, Federal Register Vol. 46, No. 15, January 23, 1981); we will unconditionally discourage development proposals that adversely affect wetlands (Wetland Protection Policy, Habitat Resources Policy No. 11, October 22, 1985). We recommend that all ponds be preserved within the project area and that adequate buffers be included to protect the biological and physico-chemical integrity of the anchialine ponds and fissures. Since the project is in the conceptual stage only, we believe avoidance of all anchialine ponds and fissures from filling can be successfully accommodated within future project designs.

b. Detailed biological surveys of anchialine ponds and fissures should be conducted within the project site. The surveys should include night collections and should describe the biological and water quality conditions of all ponds and fissures within the project area. Additional long-term studies of the biota and water quality of these ponds and fissures may be necessary to adequately describe baseline conditions. We recommend a habitat protection program for anchialine ponds and fissures be developed based on these long-term studies.

c. Surveys of nearshore fishery resources and water quality within the project area should be conducted. We recommend the applicant contact the National Marine Fisheries Service and State Division of Aquatic Resources for information on potential impacts to endangered humpback whales, threatened green sea turtles, and commercial and recreational fishery resources in surrounding coastal waters. We will provide detailed comments on potential impacts of construction and operation of a marina and resort facilities on nearshore fishery resources and endangered marine species during the Draft EIS stage.

d. Botanical surveys should be conducted to identify candidate endangered plant species that may occur within the project area.

e. Surveys should be conducted to determine the use of the project area by the endangered Hawaiian bat. Hawaiian bats have been observed within this coastal region (Sam Gon III, pers. comm.).

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

f. Endangered and migratory waterbird use of Kanonone Waterhole, a palustrine open water wetland, should be determined. This is one of the few wetlands found along this arid coastline.

The proposed project encompasses a relatively isolated coastal region with high natural resource values for anchialine ponds and nearshore fishery resources. The high level of development proposed for this section of coastline may not be compatible with the protection and maintenance of these coastal resources. For further information, please contact Andy Yuen (541-2761) of my staff.

We appreciate the opportunity to comment.

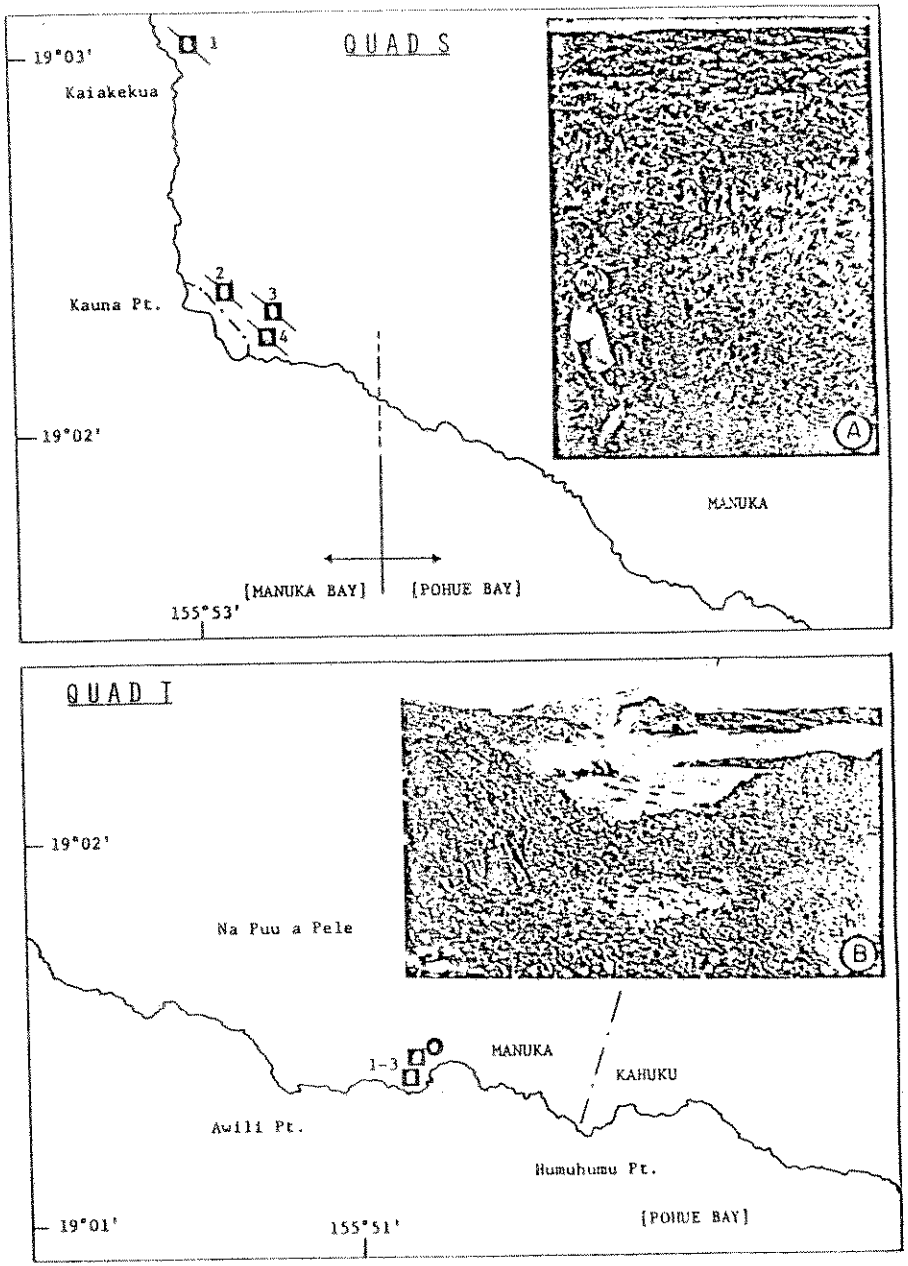
Sincerely,

William R. Kramer

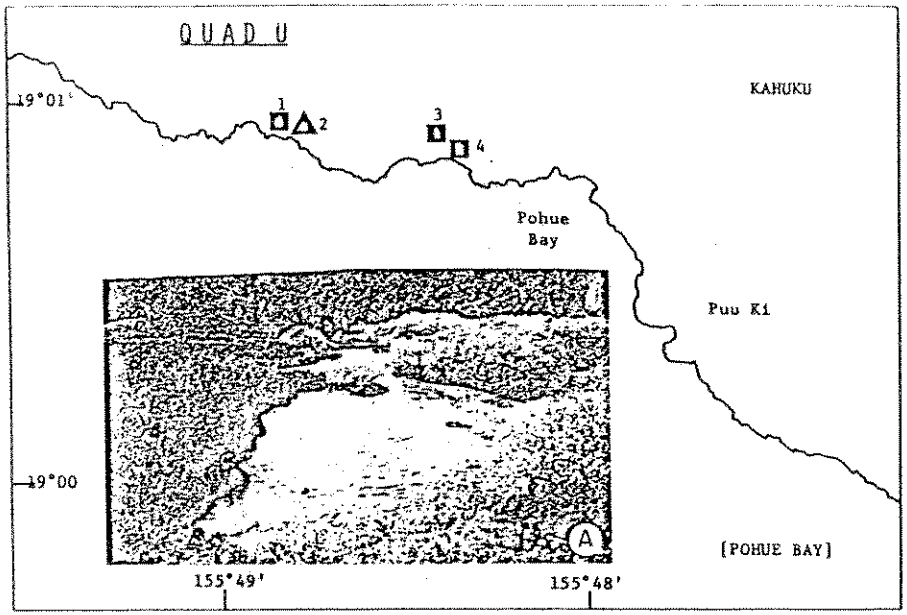
for Ernest Kosaka
Project Leader
Office of Environmental Services

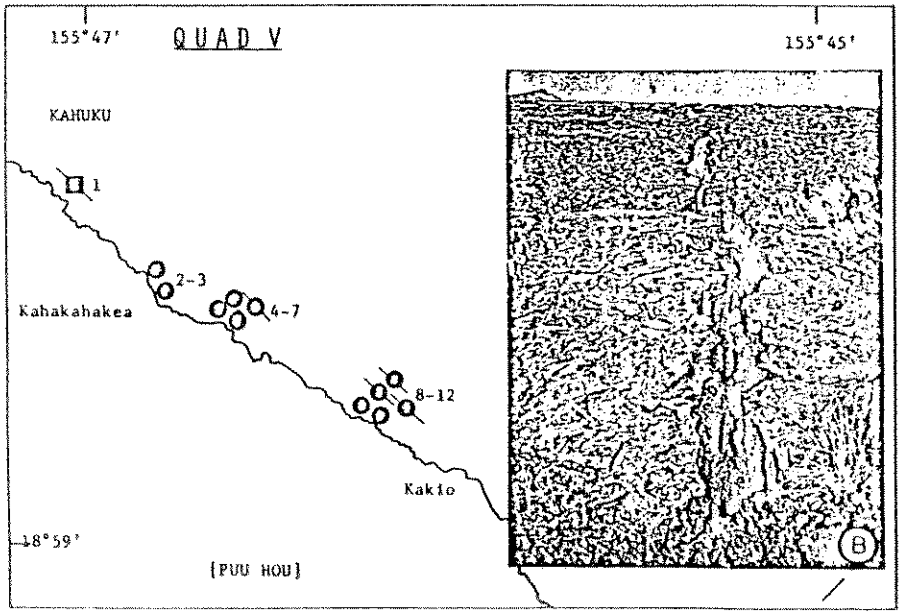
Enclosure

cc: Planning Department, Hawaii County
ARD, FWS, Portland, OR (AFWE)
Land Use Division, DPED
CE, Operations Branch
EPA, San Francisco
NMFS - WPPO
TNC, Hawaii
CZM, DPED
HCFRU
DLNR



Enclosure 1. Source: Maciolek, J.A. and R.E. Brock. 1974. Aquatic Survey of the Kona Coast Ponds, Hawaii Island. UNIHI-SEAGRANT-AR-74-04





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Hawaii · Singapore · Australia · Colorado · Hong Kong · Guam

April 28, 1987
87-886

Mr. Ernest Kosaka, Project Leader
Office of Environmental Services
Fish and Wildlife Service
U.S. Department of the Interior
300 Ala Moana Boulevard
P.O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 10, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

Your concerns on the potential adverse impacts to shoreline resources and endangered species will be addressed in the Draft EIS. Dr. Steven Dollar is presently preparing a baseline assessment of the marine environment at the project site, which will address potential impacts due to shoreline modification and project construction and operation. Also, Belt Collins & Associates will prepare an engineering evaluation of ocean and shoreline conditions at the project site. The results of these and other related studies will be included in the EIS.

Thank you for your detailed comments concerning anchialine ponds and project impacts upon marine life, and endangered flora and fauna. Please be assured that every attempt will be made to preserve anchialine ponds on the project site. In addition, detailed studies concerning endangered flora, fauna, and marine life are presently being conducted at the project site. Project impacts upon endangered species identified on site will be fully addressed in the EIS.

A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:hws

DEPARTMENT OF PLANNING
AND ECONOMIC DEVELOPMENT

KAMAMALU BUILDING, 250 SOUTH KING ST, HONOLULU, HAWAII
MAILING ADDRESS: P.O. BOX 2359 HONOLULU, HAWAII 96804 • TELEX: 7430250 HIUPED

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
MURRAY E. TOWILL
DEPUTY DIRECTOR
BARBARA KIM STANTON
DEPUTY DIRECTOR

DIVISIONS
BUSINESS AND INDUSTRY DEVELOPMENT DIVISION
ENERGY DIVISION
FOREIGN-TRADE ZONE DIVISION
LAND USE DIVISION
PLANNING DIVISION
RESEARCH AND ECONOMIC ANALYSIS DIVISION

OFFICES
ADMINISTRATIVE SERVICES OFFICE
INFORMATION OFFICE

Ref. No. P-6141

March 23, 1987

Mr. Richard H. Van Horn
Belt, Collins and Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Subject: Environmental Assessment and Preparation Notice for Hawaiian Riviera Resort, Ka'u, Hawaii

We have reviewed the Environmental Assessment (EA) and Notice of Preparation of an Environmental Impact Statement (EISPN) for the subject property and offer the following comments.

Project Description

More details should be provided on the anticipated uses within the 100-acre industrial area. The EISPN states that the 100 acres will incorporate a small commuter airfield and supporting facilities. Acreage comparisons with other commuter airports will be helpful.

Similarly, more details are required for the 800-acre support community. These include an identification of the uses, population characteristics, number of housing units, and associated services and facilities to be provided. The EA/EISPN is not specific as to whether the support community will be developed by the applicant. If public services and facilities are required to support the community, they should be identified. The capability of the public sector to provide these services and facilities should also be explored.

The draft EIS should indicate ownership of land on a map depicting the new subdivisions and the development concept map should be enlarged to improve clarity.

Description of the Affected Environment

From an islandwide perspective, the draft EIS should address the impacts of the proposed Hawaiian Riviera Resort Area on the numerous existing and proposed resorts of the Kona-Kohala coast. The need and timing of this resort should also be discussed in this context.

The impact of the proposed development on the existing and planned residential communities/areas in the Ka'u District should also be explored. In a district characterized by a small, widely dispersed population, the predominance of agricultural activities, and a rural setting, this proposed project could have major environmental and social impacts on the existing community. The draft EIS should fully discuss social impacts upon existing Ka'u communities, including demographic changes, community support or opposition and efforts to hire personnel from the local labor force. The District's existing supply of vacant Urban land available for residential uses should also be discussed.

Should any elements of the proposed project be contingent on the establishment of a proposed space port, a detailed assessment of this potential interrelationship should be provided in the draft EIS. Possible conflicts with a space port should also be assessed. A discussion of the proposed space port should be included as part of the description of surrounding uses.

The draft EIS should define the term "support housing" and should indicate the number of these units planned. If definite figures are not available, a range should be provided.

Plans for the phasing of development, specifically concerning the airport, marina and support housing units should be delineated. Conceptual plans for "future expansion" areas should be discussed. This will assist planning for necessary public facility improvements. The location of proposed on-site public facilities should be identified, including the proposed sewage treatment plant and water development facilities.

Coastal Ecosystems

The CZM objective for coastal ecosystems seeks to protect valuable resources and minimize adverse impacts. The EA indicates a biological survey will be conducted. We suggest an assessment of the potential impacts on terrestrial flora and fauna, avifauna, endangered marine species (turtles/whales) and coastal ecosystem communities, such as the anchialine ponds and nearshore reefs.

Potential impacts on coastal water quality should be fully discussed, including those which result from alteration or fill of anchialine ponds, excavation of the marina, import of soil cover, development of cesspools for single-family residences, use of fertilizers, pesticides, and treated sewage effluent on landscaped areas, and construction of shoreline structures.

The EA indicates, "No nutrient enrichment or bacterial contamination of the coastal waters is likely to occur from subsurface seepage of the (treated wastewater) effluent due to the nutrient uptake by plants and the distance inland at which irrigation would occur." The draft EIS should

substantiate this finding, especially in consideration of the several golf course fairways which are located immediately inland from the shoreline, as depicted on the EIA development concept map.

Recreational Resources

The Coastal Zone Management (CZM) Program objective for recreational resources is to provide coastal recreational opportunities accessible to the public. The draft EIS should describe existing recreational uses of the area including sandy beaches, swimming areas, snorkeling or diving areas, and fishing areas and anticipated impacts on them. Provisions for public access to and along the shoreline should be described, including plans for public park areas, parking, comfort stations, and public access ways. Private roadways to be secured should be clearly identified. Allowance for the public's use of new recreational facilities such as the marina should also be discussed as well as any anticipated ocean-related commercial activities.

Historic Resources

The CZM objective for historic resources is to protect, preserve, and, where desirable, restore significant natural and man-made historic and pre-historic resources. The draft EIS should discuss the findings of the proposed archaeological survey and plans for mitigation measures.

Scenic and Open Space Resources

Relative to the objective to protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources, the draft EIS should describe how shoreline structures will be designed (height and bulk) and located to minimize the alteration of natural landforms and views to and along the shoreline. The location and number of hotel, multi-family, and single-family units should be clearly identified. This information is not provided in Table 1, Land Use Program, nor in the development concept map. For example, it is not clear whether the equestrian estates will be composed of single- and/or multi-family units.

The County of Hawaii General Plan designates Pohue Bay as a "Natural Beauty Area." The draft EIS should discuss efforts to maintain or enhance this area's aesthetic qualities.

Coastal Hazards

The CZM objective for coastal hazards is to reduce hazards to life and property from tsunami, storm waves, stream flooding, erosion and subsidence. We note the project site is situated in an area subject to subsidence (see Volcanic Hazards on the Island of Hawaii, U.S. Geological Survey Open File Report 74-239). The hazards associated with this portion of the island in general, and with this ahupua'a specifically should be

identified. Of particular concern are the volcanic hazards, including lava inundation, earthquakes, earth cracks or faults and subsidence or uplifting.

Economic Uses

The CZM objective of economic uses encourages development in suitable locations. The draft EIS should discuss the need for the marina and airport facilities and whether the project would be viable without these facilities. It should also discuss other siting alternatives which were considered.

Hawaii State Plan

The draft EIS should discuss the relationship of the proposed project to the Hawaii State Plan (Chapter 226, HRS). This review should at the minimum discuss the relationship of the proposed project to the following: Population (Section 226-5, HRS), Visitor Industry (Section 226-8, HRS), Physical Environment (Sections 226-11 thru 226-13, HRS), Facility Systems (Sections 226-14 thru 226-17, HRS) and Socio-cultural (Sections 226-19, 226-20, 226-23 and 226-25, HRS). Among the relevant Priority Guidelines, the following should be examined: Economy (Section 226-103(b), HRS), Population Growth and Land Resources (Section 226-104(b), HRS) and Affordable Housing (Section 226-106, HRS). The State Functional Plans should be reviewed to determine relevance to your project and important relationships should be discussed in the draft EIS.

Thank you for the opportunity to review and comment on the subject project.

Sincerely,

Roger A. Ulveling

cc: Helber, Hastert & Kimura, Planners
Office of Environmental Quality Control

BELT COLLINS
° ASSOCIATES
Engineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
Hawaii • Singapore • Australia • Colorado • Hong Kong • Saipan

April 28, 1987
87-887

Mr. Roger A. Ulveling, Director
Department of Planning and Economic Development
State of Hawaii
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Ulveling:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of March 23, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Following are comments on the concerns raised, in the order that they appear in your letter:

Project Description Specific information concerning the proposed land use activities contained within the Hawaiian Riviera Resort will be presented in the EIS. As various consultant reports are completed, the relationship between proposed land uses and their associated public services and facility needs will be determined. All appropriate land use classifications, tenure information and development proposals will be presented in clear, detailed graphics in the Draft EIS.

Description of the Affected Environment The economic and social impacts of the proposed resort will be fully discussed in the EIS, both from a site-specific and a regional perspective. The firm of Peat Marwick Mitchell & Company will be preparing an extensive economic analysis of the project. Community Resources, Inc. has been contracted to conduct the necessary Social Impact Assessments. These studies will include analysis of existing and proposed developments in the general region impacted by the Hawaiian Riviera Resort. Specific recommendations concerning employee or "support housing" will be presented in the document.

Coastal Ecosystems The development of the proposed marina at the Hawaiian Riviera Resort will require a number of coastal development related permits, including a CZM Assessment. All CZM objectives will be fully addressed in the assessment, as well as in the EIS. Project related impacts upon coastal water quality are being evaluated by Mr. Steven Dollar, P.h.D., and will be thoroughly discussed in the Draft EIS.

Recreational Resources Existing and proposed recreational activities associated with the project area will be presented in the Draft EIS. Included in the discussion will be a detailed evaluation of existing and proposed public access to the shoreline.

Historic Resources Archaeological surveys of the project area are presently being conducted by Mr. Paul Rosendahl, P.h.D.. His findings and recommendations for site recording and preservation will be included in the EIS.

Scenic and Open Space Resources As proposed, a majority of the Hawaiian Riviera Resort will be a relatively low-intensity development which will utilize open spaces to enhance a leisurely retreat environment. Specific information concerning the number and type of residential and resort units, as well as other land use activities will be presented in detail in the EIS. Also included in the document will be a discussion of efforts to enhance the beauty of Pohue Bay.

Coastal Hazards Hazards to life associated with natural events such as tsunami, storm waves, flooding, erosion, subsidence, earthquakes and volcanic inundation are presently being identified and evaluated by the consultant firms of Dames & Moore and Sea Engineering, Inc.will be discussed in detail in the document.

Economic Uses As part of the above mentioned economic analysis, the need for the resort, marina and related activities will be addressed. Siting alternatives for proposed land uses are presently being evaluated and will be presented in the Draft EIS.

Hawaii State Plan The relationship of the proposed development to the goals, objectives, policies and priority guidelines of the Hawaii State Plan will be discussed. In addition, the project's relationship to State Functional Plans, as well as, County plans will be evaluated.

A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

Box 192
Volcano, Hawaii 96785

24 March 1987

Mr. R. H. Van Horn
Belt, Collins and Assoc.
606 Coral St.
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

I would like to be a consulted party in the preparation of the EIS being assembled by your firm for the Hawaiian Riviera Resort at Kahuku, Kau. Accordingly, there are some questions I would like to see addressed in the EIS.

1) Scale and nature of the whole development. It appears from the OEQC notice that the 20,616 ac. lower Kahuku parcel is being subdivided into three parcels (3,200 ac., 3,125 ac., 14,291 ac.) for different aspects of the development complex. The 3,200 ac. parcel (15.5 % of the total) is being considered initially for resort development, containing 5 resort hotel sites, three 18-hole golf courses, a marina, 3,000 accommodation units and residential areas, if I have understood correctly. The various impacts on the region of this 3,200 ac. development can only be assessed in the context of the complete development plan of the whole 20,616 ac. parcel now being subdivided. To consider the 3,200 ac. development alone is insufficient.

2) Water resources. Any development of this part of the island has been stymied because of lack of water. Most residences catch rainfall and the nearest county water system is inadequate to meet current needs—domestic users occasionally are restricted in amounts of water and the small Discovery Harbour golf course is frequently brown. Considering (a) the low annual rainfall of the 3,200 ac. site (less than 30 in.), (b) the relatively low maximum rainfall mauka (50-60 in.), (c) the impermeable volcanic dikes of the Mauna Loa Southwest Rift zone separating the development site from the groundwater of wetter Ka'u, and (d) the fact that the nearest well to the north (Okoe) is brackish, I cannot see where you can expect to find either enough local groundwater that is potable, or an existing developed system which you can tap into. What do you plan to do?

3) Water needs. What is the peak usage of potable water at full development (20,616 ac.) for resorts, residences, etc.? What is the peak amount required by three golf courses and other irrigated portions of the landscaping? This project water requirement should take into account not only the low rainfall of the area, but also the much more important "saturation deficit" water requirements of the vegetation and occasional droughts and frequent extended dry periods which increase irrigation needs enormously.

4) Geological hazards. The project area is directly downslope of an active portion of the Southwest Rift Zone of Mauna Loa. Just 11-12 miles directly uplope on the rift is a cluster of cinder cones of a number of eruptive vents, including those which sent the 1907 flows and the 1897 flow into the project area. This location of jeopardy is why the area is included in the second most

hazardous zone for lava innundation on the island in the recent report by Mullineaux, Peterson and Crandell ("Volcano Hazards in the Hawaiian Islands", 1987, in U.S.G.S. Professional Paper No.1350). Also included in this hazard zone is the separate Puna region now being innundated by lava flows from Kilauea. They also point out that the volcanic "hazards" exist to varying degrees in different areas, but that the "risk" is something that is provided by the location and degree of development, and that proper land-use planning avoids putting development in hazardous areas in order to minimize the risk. These points and concerns need consideration.

5) Liability and Consequences. Who bears the financial and legal liability if any development in the project area is damaged or destroyed by geologic hazards such as lava flows: the developer, the investors, the visitors, the State and County zoning and planning agencies and commissions, or the insurance companies? If during periods of drought the development's water system is not adequate to meet domestic needs, does the resort curtail its use, do nearby county water systems get tapped, or is there a private supply available? Who is required supply the water?

6) Impacts on Neighbors. At full development and usage, what are the total numbers of workers, visitors and residents planned for the 20,616 ac.? How many locals reside in the adjoining (within ten miles) subdivisions and rural agricultural areas? What are the real property taxes paid by these neighbors now, and how much will they rise when the development (a) gets approval,and (b) is developed to half capacity, and (c) when fully developed? As many of the area residents are retired or have low incomes, how will the development affect their cost of living, eg, taxes and local costs of goods and services (higher prices in resort areas)? What is the current highway usage, and what is the proposed load anticipated by the development? Will the resort rent cars (how many?)? What effects will the development have on the adjoining Manuka Natural Area Reserve (eg. fires, exotic plants and animals, vandalism, degradation of wilderness values, biocide drift, etc.)? From what communities will medical, fire fighting, police, refuse and postal services be provided? How many megawatts of power will the fully developed project require, and where will it come from? During construction, how many workers will there be, where will they be obtained and where will they live? During operations of the full development, how many workers will there be of each job type, where will they be recruited and where will they live?

7) Sewage and Effluents. How much sewage will be generated by the full development? How will it be collected? How and where will it be processed? What will be the chemical characteristics of the effluent, and where and how will it be disposed of? Will the released effluent be prevented from entering the brackish groundwater or the ocean? What will be the chemical nature and range of daily volumes of infiltrated irrigation water. What will the effects of this water be on anchialine ponds, and near-shore waters when the infiltrated water enters the basal flow of brackish water and seeps into the ocean at the shore? Will the coastal currents carry the effluent-enriched seepage toward or away from the Natural Area Reserve coast? What guarantee is there that Class AA water standards at the project's near-shore waters will not be exceeded?

8) Marina. How will the marina be protected from the devastating effects of storm waves, to which the Kona-Ka'u coastline is quite vulnerable? The boat-launching ramp at nearby Ka Lae was twice built and twice destroyed by these waves.

9) As most of the project area is sparsely vegetated lava flows, where will the soil be obtained to use in golf course construction and landscaping? What will be the impacts of soil removal on the source area's vegetation?

10) Existing biological and cultural resources. What is the exact nature of the biological and cultural resources on the property and how will they be impacted? What do the native plant communities consist of and are there any uncommon plants in them? What is the nature of the anchialine pond ecosystem on the 20,616 ac.? Do the large lava tubes on site contain native cave organisms or archeological remains?

Thank you very much for accepting these concerns for inclusion in the EIS, and I am looking forward to your addressing them.

Sincerely,

Rick Warshauer

Rick Warshauer

cc: Rep. Andy Levin
Rep. Virginia Isbell
Sen. Richard Henderson

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& ASSOCIATES
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April 28, 1987
87-888

Mr. Rick Warshauer
P.O. Box 192
Volcano, Hawaii 96785

Dear Mr. Warshauer:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of March 24, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Following are comments on the concerns raised, in the order that they appear in your letter:

Scale and Nature of the Whole Development The proposed Hawaiian Riviera Resort will encompass a 3,200 acre portion of a 20,616 acre parcel. The proposed subdivision of the 20,616 acre parcel will not create lots which correspond to the land use components of the project; the resort, the airport, and the support community. Rather, the large parcel is being subdivided into three lots to more accurately reflect ownership. As proposed in the subdivision plan, the resort component will be situated on portions of all three subdivided lots, while the airport and support community will both be located within a portion of a single lot. Thus, for purposes of review, the proposed subdivision should not be viewed as a land use plan. The three components of the resort project are dispersed within the 20,616 acre parcel for practical and aesthetic reasons. Consequently, although the resort project consists of three separate components, they are being master-planned as a carefully integrated system. An important aspect of the masterplan is the open space which will be preserved among the three components. As proposed, the masterplan does not call for the eventual urbanization of vacant land between the resort, airport and support community components. This land is intended to be retained in its current Agriculture or Conservation designation.

Water Resources The development of the Hawaiian Riviera Resort is contingent upon the successful location of adequate potable water resources to serve the project. Project consultants will address the subject of potable water availability and their findings along with their recommendations will be included in the Draft EIS.

Water Needs Peak usage of potable water at the Hawaiian Riviera Resort cannot be accurately determined until all consultant reports have been completed and the specific design of the resort's facilities is determined. The Draft EIS will include a full and detailed assessment of projected water usage.

Geological Hazards The recent USGS publication cited in your letter provides the most current information to-date concerning hazard and risk zones associated with Kilauea and Mauna Loa volcanoes. Although the report shows the project area to be located within Zone 2, it cautions the reader that "...the magnitude of hazard assigned to a zone applies only to that zone as a whole, and differences within it are not shown. Such differences can best be determined by specific site studies"(Volcanic Hazards in the Hawaiian Islands, USGS Professional Paper 1350, p.608). For this very reason, the firm Dames & Moore is conducting a detailed geological study of the project site in order to better understand the degree of potential hazards. Their findings and recommendations will be included in the EIS.

Liability and Consequences The matter of liability will be fully addressed in the EIS. It would be premature to discuss the complexities of the law herein. Project attorneys are reviewing the matter.

Impacts on Neighbors You have raised a variety of questions here that involve extensive detail which is not yet available. The numerous consultant studies that are presently being done for the project will provide the level of detail necessary to answer specific data questions. The Draft EIS will present a full and detailed description of the physical, social, economic and environmental impacts of the project. In any case, the nearest neighbor is approximately three miles away from the proposed resort development.

Sewage and Effluents As discussed above, specific details relating to the project and its infrastructure will be developed once consultant studies have been completed. The cumulative result of the various studies will provide sufficient information to enable project planners to design the project appropriately. Preliminary thoughts are that treated effluent will be used for golf course irrigation.

Marina The information collected by the project's ocean engineering consultant, Scott Sullivan of Sea Engineering, Inc., will enable project designers and engineers to determine the appropriate configuration for the marina that will mitigate the effects of seasonal storm waves. The result of the ocean engineering analysis will be included in the EIS.

Soil Based upon the experience of resort development in South Kohala/North Kona, it has been determined that crushed lava rock provides an excellent medium for golf course development and landscaping. Little, if any, soil will need to be imported to the project site.

Existing Biological Studies establishing the existing baseline for flora and fauna at the project site are presently being completed. These reports will provide the basis for evaluating the potential impacts of the planned resort. In addition, assessments of on-shore and off-shore marine conditions are being undertaken. The findings and recommendations of these various studies will be included in the EIS.

A copy of the Draft EIS will be sent to you for comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

Box 641
Honolulu, HI. 96809
February 13, 1987

Mr. Richard H. Van Horn
Belt, Collins and Associates
606 Coral St.
Honolulu, HI. 96813

Dear Mr. Van Horn:

SUBJECT: HAWAIIAN RIVIERA RESORT, KAHUKU, HAWAI'I
TMK: 9-2-01: 72

I am an archaeologist working in the Office of Hawaiian Affairs, and it is important to me to be well informed regarding current projects in Hawaiian archaeology. As archaeological resources are subject to state and federal laws, I anticipate that archaeological studies will be required for the above undertaking, which is in an area likely to contain significant archaeological resources. If possible, please send me a copy of any archaeological studies sponsored by the proposed undertaking, including preliminary reports, reconnaissance survey reports, comprehensive survey reports, salvage excavation reports, monitoring reports, data recovery plans, research designs, and cultural resources management plans. Mahalo for your help.

Aloha,

Earl Neller

Earl Neller

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April 28, 1987
87-889

Mr. Earl Neller
P.O. Box 641
Honolulu, Hawaii 96809

Dear Mr. Neller:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your letter of February 13, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Mr. Paul Rosendahl, P.h.D. is serving as the project's archaeological expert. He is presently conducting a survey of the project site. For copies of Mr. Rosendahl's reports, please submit a written request to Mr. Thomas A. Bodden, Partnership Manager, Hawaii Kau Aina, P.O.Box 719, Kihei, Maui 96753.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

For the Protection of Hawaii's Native Wildlife

HAWAII AUDUBON SOCIETY

April 12, 1987

P.O. BOX 22832
HONOLULU, HAWAII 96822

P. O. Box 275
Volcano, HI 96785

Mr. Richard H. Van Horn
Belt, Collins and Associates
606 Coral Street
Honolulu, Hawaii 96813

Re: Preparation Notice for the Environmental Impact Statement (EIS) for the Proposed Hawaiian Riviera Resort, Ka'u, Island of Hawaii

Dear Mr. Van Horn:

Thank you for your letter of April 7 inviting the Hawaii Audubon Society to send to you the environmental concerns we may have about the proposed resort development of a 3,200-acre parcel along the shoreline of the Kahuku ahupua'a on the Kona side of the South Point peninsula. Your preparation notice says that the self-contained resort community will contain up to 3,000 accomodation units included in five resort hotel sites, numerous residential sites, three 18-hole golf courses, a petroglyph park/preserve, other park and open area amenities, and a major marina.

Your notice does not identify the existing land use classification, but apparently it is not Urban, since you have petitioned the County Planning Commission for a General Plan amendment, and you are requesting Major Resort land use designation.

The following biological surveys of the area should be conducted by qualified biologists with in-depth knowledge and field experience with native Hawaiian biota: terrestrial and aquatic botanical surveys, terrestrial and aquatic invertebrate surveys, and an ornithological survey. The region to be covered in a comprehensive manner by the surveys should include off-shore waters, in-shore waters, the shoreline, all coastal ponds and all terrestrial habitats within the 3,200-acre parcel and within extensive buffer zones surrounding the parcel that will be affected by intensive urban development.

The impacts of the resort on native ecosystems or vegetation communities should be described and evaluated. Survey biologists should demonstrate their competence to adequately evaluate the development's impacts on native Hawaiian plant and animal communities.

Maps with elevational gradients should clearly delineate vegetation zones, rare plant communities, coastal ponds and sites frequented by native waterbirds and land birds -- all in relation to proposed construction sites and other development amenities.

Your notice says that "Macdiek and Brock (April 1974) observed water fowls, representative molluscs and crustaceans in ponds on the subject property" (p.12). The EIS should provide complete accounts of previous findings related to the region that are available in the biological literature.

Sincerely yours, Mae E. Mull

Mae E. Mull
Island of Hawaii Representative

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April 28, 1987
87-890

Ms. Mae E. Mull
Island of Hawaii Representative
Hawaii Audubon Society
P.O. Box 275
Volcano, Hawaii 96785

Dear Ms Mull:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your letter of April 12, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

The State Land Use Classification of the subject property is Conservation and Agriculture. Detailed maps showing existing and proposed land use designations will be included in the Draft EIS. In addition, the findings and recommendations of the project's consultants studying flora and fauna at the project site will also be presented. We will send you a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

JOHN WAIHEE
GOVERNOR

CHARLES T. TOGUCHI
SUPERINTENDENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

April 14, 1987

Mr. Dick Van Horn
Belt, Collins & Associates, Inc.
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

SUBJECT: Environmental Impact Statement Preparation
Notice for Hawaiian Riviera Resort, Ka'u, Hawaii

Our review of the proposed project indicates that the student enrollment generated by the development will be as follows:

School	Grade	Approximate Enrollment
Na'alehu Elementary/Intermediate	K-8	220-350
Ka'u High	9-12	80-150

Na'alehu Elementary/Intermediate School and Ka'u High School are operating at capacity and funding will be needed for additional classrooms to accommodate the added student enrollment.

Should you require any clarification, please call Mr. Richard Inouye at 737-4743.

Sincerely,

Charles T. Toguchi

Charles T. Toguchi
Superintendent

CTT:dk

cc Hawaii District
OBS

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

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April 28, 1987
87-891

Mr. Charles T. Toguchi
Superintendent of Education
Department of Education
State of Hawaii
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Mr. Toguchi:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 14, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

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April 28, 1987
87-892

Mr. Reed Flickinger
West Hawaii Today
P.O. Box 789
Kailua-Kona, Hawaii 96745

Dear Mr. Flickinger:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your phone call concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

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April 28, 1987
87-893

Ms. Wendy McAllister
DHM Planners
1188 Bishop Street, Suite 2405
Honolulu, Hawaii 96813

Dear Ms. McAllister:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your phone call of March 9, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Your name has been added to our list of consulted parties and we will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

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& ASSOCIATES
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April 28, 1987
87-894

Mr. Ed Matsusigi
Information System Services Branch
Department of Education
State of Hawaii
1390 Miller Street, Room 314
Honolulu, Hawaii 96813

Dear Mr. Matsusigi:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your phone call concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Preliminary calculations indicate that the resort project will eventually generate approximately 800 permanent families. We will refine this estimate in the Draft EIS. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

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April 28, 1987
87-895

Ms. Charlene Lau
Social Security Administration
P.O. Box 50067
Honolulu, Hawaii 96850

Dear Ms. Lau

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your phone call of April 9, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

BELT COLLINS
& ASSOCIATES
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April 28, 1987
87-896

Mr. John Naughton
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear Mr. Naughton:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your phone call of April 14, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Your concerns about the Hawkbill turtle have been relayed to our marine consultant, Mr. Steven Dollar, and will be fully addressed in the Draft EIS. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

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& ASSOCIATES
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April 28, 1987
87-897

Mr. Frederick Gross
P.O. Box 51
Waialua, Hawaii 96791

Dear Mr. Gross:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your phone call concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

Na Ala Hele
P.O. Box 1572
Kealakekua, Hi

HONOLULU HI 886
PM
96750
APR
1987

RECEIVED
APR 2
BELT, COLLINS & ASSOCIATES

Mr. Richard Van Horn
Belt Collins & Assoc.
606 Coral St.
Hon. Hi. 96813

4-20-87

Dear Mr. Van Horn:

Please send us the Draft EIS for the "Hawaiian Riviera Resort" Kau, Hi.:

Na Ala Hele
P.O. Box 1572
Kealakekua, Hi.
96750

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& ASSOCIATES

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April 28, 1987
87-898

Ms. Deborah Chang Abreu, President
Na Ala Hele
P.O. Box 1572
Kealakekua, Hawaii 96750

Dear Ms. Abreu:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your organization's letter of April 20, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

EXECUTIVE CHAMBERS
HONOLULU

JOHN WAIHEE
GOVERNOR

April 20, 1987

Mr. Dick Van Horn
Belt, Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Thank you for your letter of March 31, 1987, regarding the environmental impact statement preparation notice for the proposed Hawaiian Riviera Resort at Kau, Hawaii. We have shared your letter with the appropriate state agencies.

Sincerely,

JOSHUA C. AGSALUD
Administrative Director

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April 28, 1987
87-899

Mr. Joshua C. Agsalud
Administrative Director
Office of the Governor
State of Hawaii
Hawaii State Capitol
Honolulu, Hawaii 96813

Dear Mr. Agsalud:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 20, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
1600 KAPIOLANI BLVD., SUITE 1500
HONOLULU, HAWAII 96814
(808) 548-8960

April 21, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawai'i 96813

Dear Mr. Van Horn:

Subject: Environmental Impact Statement Preparation Notice
for the Proposed Hawaiian Riviera Resort, Ka'u, Hawai'i

Thank you for the opportunity to comment on the Environmental Impact Statement Preparation Notice for the proposed Hawaiian Riviera Resort at Ka'u, Hawai'i.

The Office of Hawaiian Affairs' Land and Culture Divisions have reviewed the Environmental Assessment for the proposed project and wish to offer the following comments at this time.

1. Location Map:

We suggest that you include a map in the DEIS which marks the location of the proposed resort in relation to local geographical features such as 'Awili Point, Pohue Bay, and Kahakahakea. It was difficult to identify the specific location of this project on the basis of geographical markers noted on the maps included in the Environmental Assessment.

2. Biological Survey:

We suggest that a complete biological survey be completed and appended to the Draft Environmental Impact Statement (DEIS). The DEIS should indicate whether any rare or endangered species were found within the project area. Any effects which the project may have upon them should also be discussed in detail.

3. Anchialine Ponds:

We suggest that a complete water quality and biological survey of each pond on the site be conducted. The survey report should be appended to the DEIS.

Again, the DEIS should indicate whether any rare or endangered species were found within the ponds and any effects which the project may have upon them should also be discussed in detail.

The DEIS should indicate whether and how the anchialine ponds will actually be incorporated into the resort design. It should also discuss whether all of the ponds will be preserved and if not, identify specifically which will be destroyed.

We suggest that a map which identifies the locations of ponds found within the project area be included in the DEIS.

4. Archaeological Sites:

The project is located within a coastal area known to contain a number of well preserved archaeological sites. An archaeological survey of the project area should be conducted prior to the release of the DEIS. A copy of the final survey report should be appended to the DEIS. The DEIS should indicate which sites will be preserved and in what manner. The DEIS should also state specifically which sites will be destroyed or altered. These steps are necessary to insure that the public is granted a meaningful opportunity to review and comment upon this project during the DEIS process.

Selected sites should be nominated to the National Register of Historic Places. Moreover, we suggest that wherever possible all sites be preserved and integrated into the project design. If sites must be altered or destroyed however, they should be carefully studied through scientific excavation prior to any alteration.

Please send this office ten copies of all archaeological reports sponsored by this project, including preliminary reports, draft reports, survey reports, excavations reports, monitoring reports, and cultural resources management plans.

5. Ancient Trails:

The County of Hawai'i's "Inventory of Public Shoreline Access" indicates that there are at least four ancient trails which may lie within the project area. The four are: the Road to the Sea, the Ancient trail to Puu o Kamaoa, the Ancient trail from Pohue Bay to Kakio, and the Ancient trail and Jeep road from Kaupuaa to Kipuka Kanohina.

The DEIS should indicate which trails are located within the project area and discuss in detail the impact which the project will have upon them.

6. Shoreline Access:

Shoreline within the project area is currently utilized for fishing, gathering, and camping. The DEIS should discuss the impact of the proposed resort upon access to the shoreline for these purposes. In particular the DEIS should identify where the developers plan to locate public facilities such as parking, walkways, and restrooms. We strongly suggest that a map which marks the locations of public facilities in relation to the shoreline be included in the DEIS. The availability of such a map for reference purposes renders the public's opportunity to review the environmental impacts of such a project a good deal more meaningful.

If you should have any questions please contact Leslie Pyun from our Land Division or Buddy Neller from our Culture Division at 946-2642.

Sincerely yours,

Kamaki A. Kanahele, III
Administrator

KAK:LP

cc: Palace Development Corporation
Hawai'i Ka'u Aina
Hawaii County Planning Department
Office of Environmental Quality Control

BELT COLLINS
° ASSOCIATES
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April 28, 1987
87-900

Mr. Kamaki A. Kanahele, III
Administrator
Office of Hawaiian Affairs
State of Hawaii
1600 Kapiolani Blvd., Suite 1500
Honolulu, Hawaii 96814

Dear Mr. Kanahele:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 21, 1987 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Following are comments on the concerns raised, in the order that they appear in your letter:

Location Map The precise configuration of the proposed resort and its relation to topographical and geographical features will be provided in the Draft EIS. All appropriate land use classifications, tenure information and development proposals will also be presented in clear, detailed graphics.

Biological Survey and Anchialine Ponds Complete biological surveys of the flora and fauna at the project site are presently being completed by project consultants. The results of their findings, as well as their recommendations, will be included in the Draft EIS. The potential impacts of the resort upon biological resources will be fully addressed. Included in these studies will be a detailed evaluation of anchialine ponds at the project site.

Historic Resources and Ancient Trails Archaeological surveys of historic sites and trails in the project area are presently being conducted by Mr. Paul Rosendahl, P.h.D.. His findings and recommendations for site recording and preservation will be included in the Draft EIS. Regarding your request for multiple copies of all archaeological reports, please direct a written request to Mr. Thomas A. Bodden, Partnership Manager, Hawaii Kau Aina, P.O. Box 719, Kihei, Maui, 96753.

Shoreline Access Existing and proposed recreational activities associated with the project area will be presented in the Draft EIS. Included in the discussion will be a detailed evaluation of existing and proposed public access to the shoreline. All appropriate maps will be presented in the document.

A copy of the Draft EIS will be sent to you for your review and comment.

Sincerely,

Richard H. Van Horn

RHVH:lws

RECEIVED

JOHN WAIHEE
GOVERNOR OF HAWAII

DISTRICT OFFICES

WEST HAWAII OFFICE
P. O. BOX 125
KAMUELA, HAWAII 96743

EAST HAWAII OFFICE
160 BAKER STREET
HILO, HAWAII 96720

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

BELT, COLLINS & ASSOCIATES

DISTRICT OFFICES

MAUI OFFICE
P. O. BOX 22
KAHULUI, MAUI 96732

MOLOKAI OFFICE
P. O. BOX 198
HOOLEHUA, MOLOKAI 96729

KAUAI OFFICE
P. O. BOX 332
LIHUE, KAUAI 96766

April 24, 1987

Mr. Dick Van Horn
Belt Collins and Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Thank you for your letter of March 31, 1987, with its enclosed Environmental Impact Statement Preparation Notice for the Hawaiian Riviera Resort in Ka'u, Hawaii.

The resort development is of interest to the department as we do have lands nearby at South Point.

Of particular interest will be the project's ability to generate employment opportunities for residents in the area. The projected number and types of employment offered should be addressed by your Environmental Impact Statement.

Additionally, an appropriate freshwater supply will be critical to this project. Water development in the area, also, is of concern to the department as we are reviewing how best to provide water to our lands at South Point.

These are primary concerns. I look forward to reviewing your completed EIS for this project.

If you have any questions, please contact Mr. Bob Fletcher of our Planning Office at 548-8785.

Sincerely,

Ilima A. Piianaia, Chairman
Hawaiian Homes Commission

IAP:HS:dhk

BELT COLLINS
& ASSOCIATES
Engineering · Planning
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April 28, 1987
87-901

Ms. Ilima A. Piianaia
Chairman
Hawaiian Homes Commission
State of Hawaii
P.O.Box 1879
Honolulu, Hawaii 96805

Dear Ms. Piianaia:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 24, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Your concerns about appropriate freshwater supplies for the project and new employment opportunities for the area will both be addressed in detail in the Draft EIS. We will provide you with a copy of the DEIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

JOHN WAIHEE
GOVERNOR

RECEIVED
BELT, COLLINS & ASSOCIATES

DIRECTOR
EDWARD Y. HIRATA

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN Y. KOCHI

IN REPLY REFER TO
STP 8.1988

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

April 22, 1987

Mr. Dick Van Horn
Belt Collins and Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

EIS Preparation Notice
Hawaiian Riviera Resort, Kau, Hawaii

A Traffic Impact Analysis Report (TIAR) must be prepared for the subject development and submitted to our Highways Division for review.

The TIAR should address the effects of the traffic generated by the proposed development on our highway facility. It should also identify any mitigation measures necessary including the possible need to widen the highway section fronting the development.

All plans for work within the State highway right-of-way must have our approval and the developer will be responsible for the cost of the required improvements therein.

We appreciate this opportunity to provide comments.

Very truly yours,

Edward Y. Hirata
Director of Transportation

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& ASSOCIATES

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April 28, 1987
87-902

Mr. Edward Y. Hirata
Director of Transportation
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hirata:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 22, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. A detailed Traffic Impact Analysis will be included in the Draft EIS. We will provide you with a copy of the DEIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

RECEIVED

BELT, COLLINS & ASSOCIATES

John Waihee
GOVERNOR

Mario R. Ramil
DIRECTOR

Sharon Y. Miyashiro
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS
830 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

April 24, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

This is in response to your letter of March 31, 1987, regarding the Environmental Impact Statement Preparation Notice for Hawaiian Riviera Resort in Kau, Hawaii.

A substantial number of workers will be needed during the construction phase and later during the operational period of this project. If adequate transportation and affordable housing, factors that affect job desirability especially in remote areas, can be provided, the Hawaiian Riviera Resort could be a major source of jobs for many job seekers, especially those residing in the Kau District. The department will be happy to assist in recruiting job applicants to fill any opening through its various employment and training agencies.

Thank you for providing us the opportunity to review the environmental impact statement preparation notice. If there are any questions regarding this matter, please call Frederick Pang, Chief of our Research and Statistics Office at 548-7639.

Sincerely,

Mario R. Ramil
Director

BELT COLLINS & ASSOCIATES
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April 28, 1987
87-907

Mr. Mario R. Ramil, Director
Department of Labor and Industrial Relations
State of Hawaii
830 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Ramil:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 24, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

RECEIVED

MOKU · LOA · GROUP
SIERRA CLUB • HAWAI'I CHAPTER

Mr. Dick Van Horn
Belt Collins and Assoc.
606 Coral St.
Honolulu, Hi 96813

April 27, 1987

Re: Environmental Impact Statement Prep. Notice for Hawaiian Riviera Resort, Ka'u, Hawaii

Dear Mr. Van Horn,

Thank you for addressing a copy of the Prep notice to our volunteer group. We are very concerned about developments along the coast of our islands.

Our concerns are as follows:

LACK OF WATER FOR THIS PROJECT

We note in the Prep. notice that a non-potable water well was dug. The rapid increase in salinity of the water seems to indicate a very thin fresh water lens, and a water source that may not sustain a large development.

We feel that the developers should drill and demonstrate an adequate water supply for the whole project before proceeding with permitting process.

GEOLOGIC HAZARDS TO THE PROJECT

We note that lava flows from 1887 and 1907 have covered portions of the subject property.

EARTHQUAKES should be discussed in the DEIS. One of the strongest and most destructive quakes (greater than magnitude 7 on Richter scale) happened in 1868 very close to the proposed development. "It caused widespread and locally major damage across the entire island, triggered a destructive mudflow near the community of Pahala, and was accompanied by a devastating tsunami. The combined effects of this earthquake claimed 40-50 lives." Chapter 22 Volcanic Hazards in the Hawaiian Islands of the U.S. Geological Survey's Professional Paper 1350 (1987).

A geologic hazards risk-assessment analysis should be conducted for this project. Since 1983 our organization has watched the residents of Royal Gardens suffer loss and hardship due to the on-going Kilauea eruptions.

Mauna Loa just erupted in 1984 and is a long way from dormancy. We would not want to see the residents, guests and workers of the proposed development suffer from a similar fate.

IMPACTS TO THE ANCHIALINE RESOURCES

We are very concerned about developments destroying or degrading intact anchialine pond systems. A full study on the location, quantity and quality of the ponds should be a part of the DEIS. We ask that plans be made to avoid destroying any intact ponds.

IMPACTS TO THE CULTURAL/ARCHEOLOGICAL RESOURCES

We are concerned about the loss of cultural sites due to development. An archeological report describing sites and discussing their importance should be a part of the DEIS.

The criteria for "significant sites" and "non-significant sites" should be spelled out in the DEIS.

IMPACTS FROM COMMUTER AIRCRAFT AND HELICOPTERS

Please describe the anticipated volume of air traffic and the impacts of noise generated. The Hawaii Volcanoes National Park is already experiencing a degredation of wilderness values due to air overflights and the Club wants to minimize and regulate air traffic in this area.

Enclosed is a copy of a letter written by Mr. Rick Warshauer. We wish to append it to our comments and request it be responded to in the DEIS.

Thank you for the opportunity to comment.

Nelson Ho
for the Conservation Committee, Moku Loa Group
Sierra Club

P.O. BOX 1137 · HILO · HAWAII · 96721

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& ASSOCIATES
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May 5, 1987
87-964

Mr. Nelson Ho
Moku Loa Group, Sierra Club
P.O.Box 1137
Hilo, Hawaii 96721

Dear Mr. Ho:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 27, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Following are comments on the concerns raised in the order that they appear in your letter:

Lack of Water for the Project The development of the Hawaiian Riviera Resort is contingent upon the successful location of adequate potable water resources to serve the project. Project consultants will address the subject of potable water availability and their findings along with their recommendations will be included in the Draft EIS.

Geological Hazards to the Project The recent USGS publication cited in your letter provides the most current information to-date concerning the hazard and risk zones associated with Kilauea and Mauna Loa volcanoes. Although the report shows the project area to be located within the second most hazardous zone on the island, it cautions the reader that "...the magnitude of hazard assigned to a zone applies only to that zone as a whole, and differences within it are not shown. Such differences can best be determined by specific site studies." (Volcanic Hazards in the Hawaiian Islands, USGS Professional Paper 1350, p.608). For this very reason, the firm of Dames & Moore is conducting a detailed geological study of the project site in order to better understand the degree of potential hazards. Their findings and recommendations will be included in the EIS. Although it is not possible to predict the location or potential magnitude of a future earthquake at a specific location, structures can be designed to withstand moderate tremors. The consultant's findings and recommendations will provide the basis for determining the most suitable design for any structures built at the project site.

Impacts to the Anchialine Resources A detailed evaluation of anchialine ponds on the project site is presently being conducted by the project's marine consultant, Steven Dollar, as part of an overall baseline study of marine resources (on-shore and off-shore). The results of his study will be included in the Draft EIS

Impacts to the Cultural/Archaeological Resources Archaeological surveys of historic and cultural sites in the project area are presently being conducted by Paul Rosendahl, Ph.D.. His findings and recommendations for site recording and preservation will be included in the Draft EIS. Determinations regarding 'significant' and 'non-significant' sites are usually made by the Historic Sites Office of the Department of Land and Natural Resources. A continuing dialoge between the project consultants and the staff of the Historic Sites Office is a standard component of the EIS process.

Impacts from Commuter Aircraft and Helicopters Specific information regarding frequency of use and location and configuration of flight patterns will be provided in the Draft EIS. Noise impacts from the air traffic will be fully addressed.

Letter from Mr. Rick Warshauer We have previously received Mr. Warshauer's letter and his name has been placed on our list of consulted parties for the Draft EIS, as has yours. Nevertheless, thank you for bringing the letter to our attention.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:

April 27, 1987

RECEIVED
APR
BELT, COLLINS & ASSOCIATES

Mr. Dick Van Horn
Belt, Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Thank you for the opportunity to review and comment on the EIS Preparation Notice for Hawaiian Riveria Resort, Kau, Hawaii. The following comments are offered:

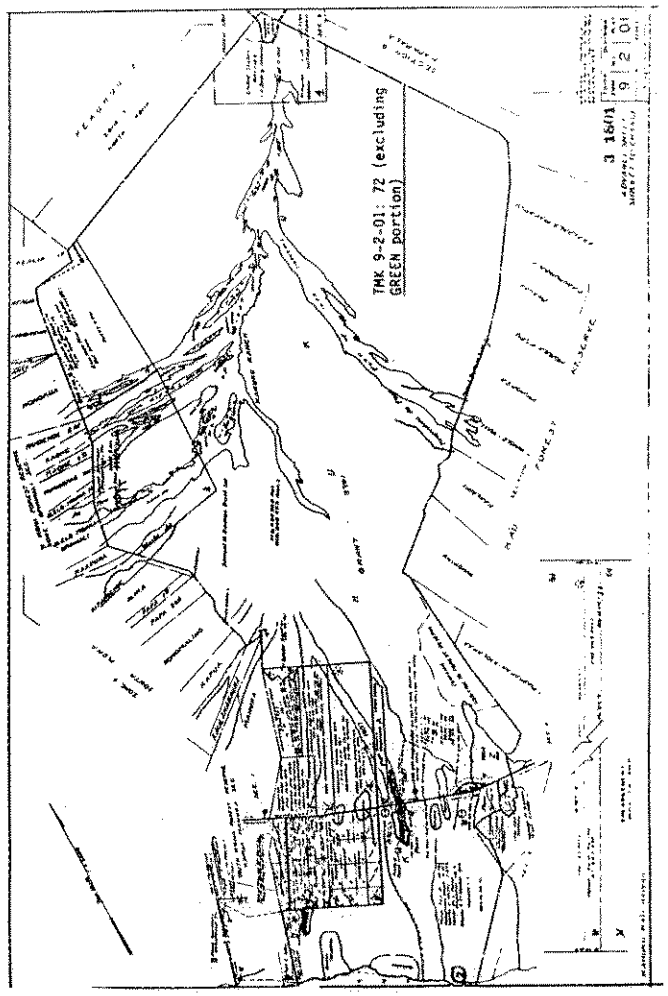
a. A Department of the Army permit is required for the proposed marina and any anticipated filling of anchialine ponds. Any future correspondence and coordination regarding the project should be directed to Operations Branch (telephone: 438-9258).

b. The parcel identified by tax map key 9-2-01:72 is shown on the the enclosed tax map for Kahuku/Kau area on the island of Hawaii. According to the Flood Insurance Study for the County of Hawaii, the parcel is located in an area of minimal tsunami inundation.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Enclosures



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May 5, 1987
87-965

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Building 230
Ft. Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your letter of April 27, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

The specific configuration of the proposed marina will be determined upon completion of various engineering studies presently being conducted. All required permits will be obtained prior to construction of the facility.

Thank you for the information concerning the current flood zone designation for the project site.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

FRANK DE LUZ III
Councilman

COUNTY COUNCIL
County of Hawaii
Hawaii County Building
Hilo, Hawaii 96720

April 27, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

This is to acknowledge receipt of the county's EISPN and supporting Environmental Assessment for Hawaiian Riviera Resort, Ka'u.

This is an important development and it will definitely be beneficial to the district of Ka'u.

If I can further assist you in anyway, please feel free to contact me.

Sincerely,

Frank De Luz III
COUNCILMAN

BELT COLLINS & ASSOCIATES
Engineering • Planning
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May 5, 1987
87-966

The Honorable Frank De Luz III
Councilmember
County of Hawaii
Hawaii County Building
Hilo, Hawaii 96720

Dear Councilmember De Luz:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 27, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

JOHN WAIHEE
GOVERNOR

SUZANNE D. PETERSON
CHAIRPERSON, BOARD OF AGRICULTURE

TADASHI TOJO
DEPUTY TO THE CHAIRPERSON

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822-0159

April 28, 1987

Mr. Dick Van Horn
Belt Collins and Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Subject: Environmental Impact Statement Preparation Notice (EISPN) for Hawaii Riviera Resort, Ka'u, Kona, Hawaii; TMK: 9-2-01: por. 72
Area: approximately 3,200 acres

The Department of Agriculture has reviewed the subject EISPN and offers the following comments.

According to the project description, the applicants (Palace Development Corporation and Hawaii Ka'u Aina Partnership) propose to develop a major resort on the subject property. The EIS will be in support of a request for a major resort designation for the development in the Hawaii County General Plan.

It appears from the project description thaat the proposed resort uses and the airstrip are situated in the State Conservation District and the 800-acre support community is in the State Agricultural District.

The Draft EIS should include discussion on the following issues:

- Fully describe the project area's characteristics according to the Soil Conservation Service Soil Survey for the Island of Hawaii (December, 1973), the Land Study Bureau Detailed Land Classification for Hawaii (November, 1965), and the Agricultural Lands of Importance to the State of Hawaii (ALISH) system (January, 1977).

- Identify any existing agricultural operations in the affected parcel or surrounding parcels and the potential impacts that the proposed project will have on these uses.

- Describe the potential of establishing viable alternative agricultural uses on the project site.

- Address the impact on agriculture in the surrounding area resulting from the withdrawal of groundwater necessary to meet the needs of the proposed project.

- Describe how the proposed project conforms to the State Agriculture Functional Plan and its objectives and policies.

We will provide further comment upon our receipt and review of the Draft EIS.

Sincerely,

Suzanne D. Peterson

SUZANNE D. PETERSON
Chairperson, Board of Agriculture

cc: Hawaii County Planning Department
OEQC
DPED
LUC

BELT COLLINS
& ASSOCIATES
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May 5, 1987
87-967

Ms. Suzanne D. Peterson
Chairperson
Board of Agriculture
State of Hawaii
1428 South King Street
Honolulu, Hawaii 96814-2512

Dear Ms. Peterson:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your letter of April 28, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. The issues identified in your letter concerning soil characteristics, existing agricultural activity, potential agricultural uses, groundwater withdrawl, and conformance of the project to the State Agricultural Functional Plan, will be fully addressed in the Draft EIS.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

RECEIVED
BELT, COLLINS & ASSOCIATES

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region • Western Pacific Program Office
2570 Dole St. • Honolulu, Hawaii 96822-2396

April 29, 1987 F/SWR1:JJN

Mr. Dick Van Horn
Belt, Collins, and Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Subject: Environmental Impact Statement (EIS) Preparation Notice, Hawaiian Riviera Resort, Ka'u, Hawaii.

The National Marine Fisheries Service (NMFS) has received the subject EIS Preparation Notice for the proposed Hawaiian Riviera Resort, Ka'u, Island of Hawaii. We understand the developers, Palace Development Corporation and Hawaii Ka'u Aina Partnership, are preparing an EIS in support of a request for a major resort designation for the development in the Hawaii County General Plan. The following comments are offered for your consideration in preparing the Draft EIS.

NMFS is greatly concerned with the recent ongoing and proposed development occurring along the Kona, Kohala, and Ka'u coastlines of the Island of Hawaii. We feel the cumulative effects of these activities may have serious adverse impacts on the unique anchialine/tidal pond and nearshore coral reef habitats for which this region is noted. Consequently, we concur with the preparation of an EIS for the proposed development.

NMFS is particularly concerned with the developers' proposal to construct a 21 acre marina. We feel the marina and associated entrance channel may have a considerable impact on the nearshore environment. In addition, we feel the practicality of a marina in this area should be further assessed. The waters along the Kona Coast between Kauna Point and South Point are not typical "Kona" or lee waters such as found further north along this coast. During tradewind conditions the waters off the proposed resort become quite rough and potentially dangerous for small craft.

The shoreline in this region, although quite remote, has become popular with shore casters targeting on Hawaii's well known inshore big game fish, the white ulua (Caranx ignobilis.) Impacts on this recreational fishery from the development should be determined and included in the EIS.

NMFS biologists have visited the area in the past, primarily during research cruises assessing coastal populations of the endangered humpback whale (Megaptera novaeangliae). Humpback whales commonly occur along the project coastline inshore of the 100 fathom isobath. Impacts on this endangered species from construction and operation of the marina must be assessed.

In addition to the humpback whale, the threatened green turtle (Chelonia mydas) and the endangered hawksbill turtle (Eretmochelys imbricata) are known to occur along this coast. NMFS biologists have observed concentrations of green turtles in nearshore waters south of the project off Puu Kaimuuwala and at the north end of the project in the Humuhumu Point area. The small sand beaches along the Ka'u and Puna coastlines of Hawaii have been found to contain important hawksbill turtle nesting sites. On February 11, 1979 a turtle nesting pit was found at the south end of the small beach at Pohue Bay. It should be determined if this area is consistently used as a turtle nesting site.

In general terms, this agency's concerns are outlined below and should be addressed in the project EIS.

1. Existing use of coastal waters off the proposed resort by subsistence, commercial and recreational fishing interests, including opihi and limu gatherers, divers, dive charter operators, and shoreline fishermen.

2. Baseline information on the conditions of the reef immediately offshore from the project area; i.e. live coral coverage and species diversity, reef fish and macro-invertebrate abundance.

3. Mapping of coastal habitat types, i.e. live reef, dead reef, boulder and sand substrates; and specific location, size and condition of any anchialine ponds on the property.

4. Importance of coastal waters and beach areas to threatened and endangered species, including the seasonally occurring humpback whale and green and hawksbill turtle.

5. Potential secondary impacts from the project, i.e. leaching of nutrients from golf courses and landscaped areas into coastal waters, artificial lighting on nearshore waters, increased ocean recreation by resort guests, and increased fishing pressure created by improved beach access.

NMFS strongly suggests that the developers prepare a "Resource Management" or "Environmental Protection Plan" to assure protection of aquatic and terrestrial species and their habitats in the proposed project area.

At the present time we are coordinating a site inspection with a project consultant charged with assessing baseline conditions of anchialine ponds and the nearshore environment fronting the proposed project site. Any new information concerning resources for which NMFS has a responsibility will be forwarded as soon as possible for use in preparing the EIS.

We appreciate the opportunity to comment on the proposed Hawaiian Riviera Resort project at this early pre-EIS stage. Should you require additional information please contact Mr. John Naughton of my staff. We look forward to receiving a copy of the Draft EIS as soon as it becomes available.

Sincerely yours,

Doyle E. Gates
Administrator

cc: F/SWR, Terminal Is., CA
F/M4, Washington, D.C.
Corps of Engineers, Honolulu
FWS, Honolulu
EPA, Region 9 (P-5)
Hawaii State Div. of
Aquatic Resources
County of Hawaii,
(Mr. Lono Lyman)

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& ASSOCIATES

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May 5, 1987
87-968

Mr. Doyle E. Gates
Administrator
National Marine Fisheries Service
Southwest Region, Western Pacific Program Office
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear Mr. Gates:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 29, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Following are comments on the concerns raised in the order that they appear in your letter:

Construction of a 21-acre Marina Project related impacts upon the nearshore environment are being evaluated by Mr. Steven Dollar, Ph.D., and will be fully addressed in the Draft EIS. The information collected by the project's ocean engineering consultant, Scott Sullivan of Sea Engineering, Inc., will enable project designers and engineers to determine an appropriate confirguration for the marina that will minimize impacts on the nearshore environment. A complete baseline assessment of the offshore conditions along the project site will be presented in the Draft EIS.

Impacts on Recreational Fishery Development of the proposed project will require a number of coastal development-related permits. Impacts on both on- and off-shore recreational activities, including fishing and food-gathering, represent an important part of the permit review process and consequently will be fully addressed at a number of stages during the project review, including the EIS.

Impacts on Endangered or Threatened Species Once baseline studies of the coastal waters have been completed, the potential impact of the project upon the humpback whale, green and hawksbill turtles can be fully assessed. Consultants' findings and recommendations will be presented in the EIS. The baseline studies will include an analysis of reef conditions and coastal habitat types, as well as anchialine ponds on the project site. The discussion of potential impacts will include an evaluation of potential secondary impacts.

Resource Management or Environmental Protection Plan The preparation and review of an Environmental Impact Statement provides extensive opportunities to address and define the mitigation of impacts upon the environment. The State of Hawaii's Department of Land and Natural Resources is the duly-authorized custodian of all public lands classified as Conservation, including off-shore areas and near-shore anchialine ponds. It is fully within the perview of the Department to establish specific management areas for the protection of resources deemed to be environmentally-sensitive. To date, no such designations have been made for anchialine ponds on the project site or for its off-shore areas. At this writing, we are not yet fully aware of the extent of environmentally-senstive shoreline resources at the project site. Once baseline reports have been completed, consultation with the appropriate agencies will begin and a determination can be made regarding resource management alternatives.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P O BOX 50167
HONOLULU, HAWAII 96850

RECEIVED
BELT, COLLINS & ASSOCIATES
ES
Room 6307

APR 29 1987

Mr. Richard H. Van Horn
Belt, Collins, and Associates
606 Coral Street
Honolulu, Hawai'i 96813

Re: Environmental Impact Statement Preparation Notice, Hawaiian Riviera Resort, Ka'u, Hawai'i

Dear Mr. Van Horn:

The Service's recommendations presented in our April 7, 1987 letter to you should be discussed in the Draft Environmental Impact Statement for the proposed Hawaiian Riviera Resort.

We appreciate the opportunity to comment.

Sincerely,

Ernest Kosaka
Project Leader
Office of Environmental Services

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Save Energy and You Serve America!

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May 5, 1987
87-969

Mr. Ernest Kosaka
Project Leader
Office of Environmental Services
Fish and Wildlife Service
300 Ala Moana Boulevard
P.O.Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 29, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. As was discussed in our letter of April 28, 1987, the concerns raised in your previous letter (April 7, 1987) will be fully addressed in the Draft EIS.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TAXATION
P.O. BOX 259
HONOLULU, HAWAII 96809

RICHARD F. KAHLE, JR.
DIRECTOR OF TAXATION

GARY S. MIKI
DEPUTY DIRECTOR

April 29, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Re: Environmental Impact Statement Preparation Notice
for Hawaiian Riviera Resort, Kau'u, Hawaii

We have no comments to offer with respect to the economic, social and environmental consequences of your plans to develop a major resort area in the Ka'u District on the Island of Hawaii.

Very truly yours,

Richard F. Kahle, Jr.
RICHARD F. KAHLE, JR.
Director of Taxation

RFK-LJN-MAD:pac

BELT COLLINS
& ASSOCIATES
606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
...gineering • Planning
Landscape Architecture
Hawaii • Singapore • Australia • Colorado • Hong Kong • Saipan

May 5, 1987
87-970

Mr. Richard F. Kahle, Jr.
Director of Taxation
Department of Taxation
State of Hawaii
P.O.Box 259
Honolulu, Hawaii 96809

Dear Mr. Kahle:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of April 29, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

RECEIVED
MAY - 4 1987
BELT COLLINS & ASSOCIATES

May 1, 1987

Mr. Dick Van Horn
Belt Collins and Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Subject: Environmental Impact Statement Preparation Notice for Hawaiian Riviera Resort, Ka'u, Hawaii

The Hawaii District Office of the U.S. Geological Survey, Hawaii District, has reviewed the subject EISPN and has no comments on the proposed development.

Sincerely,

William Meyer
District Chief

Enclosure: Subject EISPN

Copy to: Hawaii County Planning Department

BELT COLLINS & ASSOCIATES
Engineering · Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 · Phone (808) 521-5361 · Telex BELTH 7430474 · Fax (808) 538-7819
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May 7, 1987
87-987

Mr. William Meyer
District Chief
Water Resources Division
Geological Survey
U.S. Department of the Interior
P.O.Box 50166
Honolulu, Hawaii 96850

Dear Mr. Meyer:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of May 1, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

JOHN WAIHEE
GOVERNOR OF HAWAII

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

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EPHSD

April 29, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Subject: Environmental Impact Statement Preparation Notice (EISPN) for Proposed Hawaiian Riviera Resort, Kau, Hawaii

Thank you for allowing us to review and comment on the subject EISPN. The following are our recommendations which should be addressed.

Air Pollution

The EIS should include the potential impact on the ambient air quality as a result of the increase in vehicular activity from the proposed project and all other projects which were previously approved but have not started construction. Projections on the increased traffic volume and the impact on the ambient air quality should be for the associated corridors, roadways, and highways. The results should be compared to the State and Federal ambient air quality standards. Should a potential violation be determined, the EIS should address the mitigating actions which shall be implemented.

Water Pollution

The EISPN indicates that the resort hotels and residences will be located along the open space corridors of the golf course fairway that will be irrigated with the treated wastewater. This will create health and safety concerns if spray irrigation is to be used that should be addressed. Some type of buffer area should be addressed including degree of wastewater treatment, wind speed and direction if spray irrigation is to be used and perhaps drip irrigation along the fringe areas of habitation.

Wastewater Disposal

The proposed project must meet the requirements of Act 282, SLH 1985 and Act 302, SLH 1986 for the treatment and disposal of sewage generated by the proposed project.

Drinking Water

The proposed Hawaiian Riviera Resort consists of up to 3,000 units in five resort hotels, residential sites, three golf courses, a petroglyph park, and marina. Since there is no existing water supply system in the area, development of new water sources will be necessary to support this resort.

Section 11-20-29 of Chapter 20 requires all new sources of potable water serving public water systems to be approved by the Director of Health prior to their use to serve potable water. Such approval is based primarily upon the satisfactory submission of an engineering report which adequately addresses all concerns as set down in Section 11-20-29. The engineering report must be prepared by a registered professional engineer and bear his or her seal upon submittal.

Section 11-20-30 requires that new or substantially modified distribution systems for public water systems be approved by the Director of Health. Such approval depends upon the submission of plans and specifications for the project prior to construction and the demonstration that the new or modified portions of the system are capable of delivering potable water in compliance to all maximum contaminant levels as set down in Chapter 20 once the distribution system or modification is completed.

The proposed water system should be described in the EIS as fully as possible. Potential contamination of groundwater from this resort should also be fully addressed in the EIS.

Should there be any questions regarding Chapter 20, Title 11, Administrative Rules, please contact the Drinking Water Program at 548-2235.

JOHN C. LEWIN, M.D.

cc: DHO, Hawaii

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& ASSOCIATES
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May 7, 1987
87-988

Mr. John C. Lewin, M.D.
Director of Health
Department of Health
State of Hawaii
P.O.Box 3378
Honolulu, Hawaii 96801

Dear Mr. Lewin:

**Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

Thank you for your letter of April 29, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Your concerns about the project's potential impact on air and water quality, its treatment and disposal of sewage, and the quality of potable water supplied to the project will all be addressed in the Draft EIS. The appropriate air and water quality studies will be prepared. In addition, all necessary permits will be obtained for the project.

We will provide you with a copy of the DEIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

U.S. Department of Housing and Urban Development
Honolulu Office, Region IX
300 Ala Moana Blvd., Room 3318, Box 50007
Honolulu, Hawaii 96850-4991

87-91

May 6, 1987

Mr. Dick Van Horn
c/o Collins & Associates
606 Coral Street
Honolulu, HI 96813

Dear Mr. Van Horn:

SUBJECT: Environmental Impact Statement Preparation Notice (EISPN)
for Hawaiian Riveira Resort, Kau, Hawaii

We have reviewed the subject document that identifies the issues that will be addressed in the Draft EIS for the Hawaii Riviera Resort. The proposed action will develop up to 3,000 accommodation units at five resort hotel sites, a number of residential sites, three 18-hole golf courses, a petroglyph park/ preserve, and marina and other park and open space uses on 3,200 acres of land in the Kau district of Hawaii.

We do not have any additional concerns that should be addressed in the Draft EIS but look forward to reviewing the Draft EIS.

Sincerely,

Calvin Lew
Director
Community Planning and
Development Division, 9.2C

cc:
9C James

BELT COLLINS & ASSOCIATES
engineering · Planning
Landscape Architecture

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May 7, 1987
87-1007

Mr. Calvin Lew
Director
Community Planning & Development Division
Honolulu Office, Region IX
U.S. Department of Housing and Urban Development
300 Ala Moana Blvd., Room 3318, Box 50007
Honolulu, Hawaii 96850-4991

Dear Mr. Lew:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of May 6, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

RUSSELL S. KOKUBUN
Councilman

COUNTY COUNCIL
County of Hawaii
Hawaii County Building
25 Aupuni Street
Hilo, Hawaii 96720

May 20, 1987

Mr. Dick Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Thank you for allowing me to review and comment on the EIS Preparation Notice for the proposed Hawaiian Riviera Resort in Kau, Hawaii. I am requesting that the EIS address the following questions and concerns:

Solid Waste Disposal

Solid waste will probably be disposed of at either the Pahala or Kailua-Kona sanitary landfill. It is assumed that neither facility will be capable of handling the anticipated increase in volume of solid waste. Therefore, the present landfill may need to be expanded or a new site may need to be developed.

The EIS should address this problem and offer suggestions as to how it may be mitigated.

Schools

The schools in Naalehu and Pahala will be greatly impacted by an increase in enrollment due to population growth. How is this issue addressed?

Protected Species

The endangered green turtle and Hawaiian Hawksbill turtle frequent the Punaluu coastline for foraging, breeding and nesting. The EIS should determine whether these species of turtles also frequent the coastline of the proposed project. If they do, the EIS should contain detailed plans for protecting these species and their habitat.

King's Trail

The "King's Trail" is very visible in certain parts of Kau. The EIS should determine whether or not it exists on the subject property.

Satellite Launching Facility

There is a possibility that Kahilipali Point in Kau may be selected as the site of a satellite launching facility. Several years ago, South Point was considered a possible site. If a launching facility is ever developed on the Big Island, chances are that it will be located in Kau.

The EIS should evaluate the impact that such a facility will have on the proposed development.

Commuter Airfield

The EIS should provide additional information about the proposed airfield. Will it be a private landing field or will it be available to the public.

Geologic Hazard

The EISPN touches on possible tsunami inundation. Is there a possibility that the proposed project may also be threatened by lava flows? The U. S. Geological Survey has identified "zones of overall relative risk" associated with volcanic activity on the Island of Hawaii. The areas are classified into six zones, "A" through "F" with risk increasing from "A" to "F". The EIS should provide more information on geological hazard as it pertains to the proposed project.

Parties To Be Consulted For The Preparation Of The EIS.

The Na Ala Hele should be included in the list of Public Interest Groups. Their mailing address is:

Na Ala Hele
P. O. Box 1572
Kealakekua, Hawaii 96750

Sincerely,

Russell S. Kokubun
COUNCILMAN

BELT COLLINS
& ASSOCIATES
606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
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May 26, 1987
87-1112

The Honorable Russell S. Kokubun
Councilmember
County of Hawaii
Hawaii County Building
Hilo, Hawaii 96720

Dear Councilmember Kokubun:

Environmental Impact Statement (EIS)
for the Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of May 20, 1987 concerning the Environmental Impact Statement Preparation Notice and Environmental Assessment for the above project. Your concerns about solid waste disposal, schools, protected species, Hawaiian trails, the satellite launching facility, the airfield, and geological hazards will all be addressed in the Draft EIS as you requested.

With regard to your request that Na Ala Hele be included in the list of Public Interest Groups, please be informed that on April 28th, we responded to a request for similar status from the organization. It will be included in our list of consulted parties.

We will provide you with a copy of the Draft EIS for your comment and review.

Sincerely,

Richard H. Van Horn

RHVH:lws

CHAPTER XI

COMMENTS AND RESPONSES RECEIVED DURING THE DRAFT EIS COMMENT PERIOD

The agencies and individuals listed in Chapter X were all sent copies of the Enviornmental Impact Statement and a transmittal letter requesting comments. Copies of comment letters received along with copies of our responses to them are provided in this chapter.

JOHN WAIHEE
GOVERNOR

EMPLOYEES' RETIREMENT SYSTEM
HAWAII PUBLIC EMPLOYEES HEALTH FUND
OFFICE OF THE PUBLIC DEFENDER
PUBLIC UTILITIES COMMISSION

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
STATE CAPITOL
P.O. BOX 150
HONOLULU, HAWAII 96810-0150

YUKIO TAKEMOTO
DIRECTOR

ROBERT P. TAKUSHI
DEPUTY DIRECTOR

Thomas I. Yamashiro
Deputy Director
DIVISIONS:
BUDGET, PLANNING AND MANAGEMENT
ELECTRONIC DATA PROCESSING
FINANCE
Telecommunications

September 25, 1987

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

This is in response to the Draft Environmental Impact Statement (EIS) for the proposed Hawaiian Riviera Resort located in Kahuku, Ka'u, Hawaii. The EIS has been forwarded to this office for review by the Office of Environmental Quality Control.

Thank you for the opportunity to comment on the proposal; however, we have no comments to make at this time.

Sincerely,

YUKIO TAKEMOTO

cc: Mr. Richard H. Van Horn

BELT COLLINS
& ASSOCIATES

Engineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430[illegible] • Fax (808) 538-7819

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December 15, 1987
8533.1902/87-2307

Mr. Yukio Takemoto, Director
Department of Budget and Finance
State Capitol
P.O. Box 150
Honolulu, Hawaii 96810-0150

Dear Mr. Takemoto:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated September 25, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

(P)1819.7

SEP 2 5 1987

Mr. Albert Lono Lyman
Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

Subject: Draft Environmental Impact Statement
Hawaiian Riviera Resort
Kahuku, Kau, Hawaii

We have reviewed the subject document and have no comments to offer.

Very truly yours,

TEUANE TOMINAGA
State Public Works Engineer

EM:jk
cc: Mr. Richard H. Van Horn

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

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December 15, 1987
8533.1902/87-2308

Mr. Teuane Tominaga
State Public Works Engineer
Division of Public Works
Department of Accounting & General Services
P.O.Box 119
Honolulu, Hawaii 96810

Dear Mr. Tominaga:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated September 25, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO

5090
Ser N5B/2305
28 SEP 1987

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
HAWAIIAN RIVIERA RESORT

The Draft EIS for the Hawaiian Riviera Resort has been reviewed and we have no comments. Since we have no further use for the EIS, it is being returned to the Office of Environmental Quality Control.

Thank you for the opportunity to review the Draft.

Sincerely,

T. L. FERRIER
Captain, U.S. Navy
Chief of Staff

Enclosure

Copy to:
Mr. Richard H. Van Horn
Belt, Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Office of Environmental Quality Control

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

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December 15, 1987
8533.1902/87-2309

Capt. T.L. Ferrier, Chief of Staff
Department of the Navy
Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860-5020

Dear Captain Ferrier:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated September 28, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

Vernon B.Anderson
6102 Oak Hill Ave.
Los Angeles,Ca.90042
Sept.28,1987

Mr.Albert Lono Lyman,Director
County of Hawaii Planning Dept.
25 Aupuni Street
Hilo,Hawaii 96720

Dear Sir:
I have studied my copy of the Environmental Impact Statement for Hawaiian Riviera Resort,at Kahuku,Ka'u Hawaii.

I have found that the proposed development is in keeping with the high criteria for proper development within the State of Hawaii.

As a property owner in the adjacent Hawaiian Ranchos,I feel that this development will be beneficial.

I therefore request Hawaiian Riviera Resort be accepted as proposed.

Very Truly Yours,
Vernon B Anderson
Vernon B.Anderson

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

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December 15, 1987
8533.1902/87-2310

Mr. Vernon B. Anderson
6102 Oak Hill Avenue
Los Angeles, Ca. 90042

Dear Mr. Anderson:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated September 28, 1987 and to thank you for participating in the review process for the above project.

With regard to your expressed concern about the future availability of potable water, the matter will depend in great part upon the successful development of potable water wells in the 2000 foot elevation region of the subject property. As stated on Page II-16 of the Draft Environmental Impact Statement, "To the extent that water supply produced by (the Hawaiian Riviera) well systems exceeds the needs of the resort, it is intended that the excess supply will be made available for use by neighboring residential areas."

Very truly yours,
R. H. Van Horn
Richard H. Van Horn

RHVH:lws

Vernon B.Anderson
6102 Oak Hill Ave.
Los Angeles,Ca.90042
Sept.28,1987

Mr.Richard H. Van Horn
Belt,Collins & Associates
606 Coral Street
Honolulu,Hawaii 96813

Dear Sir:
Please find enclosed a copy of letter sent by me to Planning Dept.

Thank you for sending a copy of Environmental Impact Statement.

Hawaiian Riviera Resort appears to be of high standard,my one hope being that Hawaiian Ranchos will obtain in the process of your development an adequate and steady water supply.

I would greatly appreciate your response.

Very Truly Yours,
Vernon B.Anderson
Vernon B.Anderson

BELT COLLINS
& ASSOCIATES
606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
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December 15, 1987
8533.1902/87-2533

Mr. Vernon B. Anderson
6102 Oak Hill Avenue
Los Angeles, Ca. 90042

Dear Mr. Anderson:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated September 28, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,
Richard H. Van Horn

RHVH:lws

UNITED STATES
DEPARTMENT OF ENERGY

P.O. BOX 50168
HONOLULU, HAWAII 96850

September 28, 1987

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr.Lyman:

I have scanned the impressive Draft EIS for the Hawaiian Riviera Resort, and have no comments to add.

The copy of the EIS will be returned to the Office of Environmental Quality Control.

Best wishes with the project.

Sincerely,

John Shupe

John W. Shupe, Director
Pacific Site Office

cc: R. H. Van Horn ✓

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

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December 15, 1987
8533.1902/87-2311

Mr. John W. Shupe, Director
Pacific Site Office
United States Department of Energy
P.O.Box 50168
Honolulu, Hawaii 96850

Dear Mr. Shupe:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated September 28, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

RECEIVED
SEP 30 1987
BELT, COLLINS & ASSOCIATES

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816-4495

September 29, 1987

Engineering Office

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

Hawaiian Riviera Resort
Kahuku, Ka'u, Hawaii

Thank you for providing us the opportunity to review the above subject project.

We have no comments to offer at this time regarding this project.

Yours truly,

signed

Jerry M. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

cc: Mr. Richard H. Van Horn,
Belt, Collins & Associates

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture
606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
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December 15, 1987
8533.1902/87-2312

Major Jerry M. Matsuda
Hawaii Air National Guard
Construction & Engineer Officer
State of Hawaii
Department of Defense
Office of the Adjutant General
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Dear Major Matsuda:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated September 29, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

POLICE DEPARTMENT

COUNTY OF HAWAII
349 KAPIOLANI STREET
HILO, HAWAII 96720

GUY A. PAUL
CHIEF OF POLICE

WAYNE G. CARVALHO
DEPUTY CHIEF

OUR REFERENCE

YOUR REFERENCE

October 1, 1987

Mr. Richard H. Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

RE HAWAIIAN RIVIERA RESORT
DRAFT ENVIRONMENTAL IMPACT STATEMENT
KAHUKU, KA'U, HAWAII

The above application has been reviewed and from the police standpoint, we foresee no adverse effect from the requested land use.

GUY A. PAUL
CHIEF OF POLICE

cc: Ka'u Police

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
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December 15, 1987
8533.1902/87-2313

Mr. Guy A. Paul
Chief of Police
County of Hawaii
349 Kapiolani Street
Hilo, Hawaii 96720

Dear Chief Paul:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated October 1, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH.lws

HN WAIHEE
OVERNOR

CHARLES T. TOGUCHI
SUPERINTENDENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

ICE OF THE SUPERINTENDENT

October 5, 1987

Mr. Albert L. Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

SUBJECT: Hawaiian Riviera Resort

Our review of your proposed housing project indicates that it may generate the following additional enrollment in our area schools:

SCHOOL	GRADE	APPROXIMATE ENROLLMENT
Naalehu Elem./Inter.	K-8	300 - 400
Ka'u High School	9-12	100 - 150

Schools at all levels in this service area are operating at capacity. Budgeting for additional classrooms will be necessary to accommodate the anticipated growth at both schools.

Please note that we have adjusted the enrollment figures slightly upwards since the current draft EIS shows an increase in housing units.

Please keep us informed of any changes.

Sincerely,

Charles T. Toguchi
for Superintendent

CTT:jl (MRI)

cc E. Imai, OBS
A. Garson, Hawaii Dist.
R. Van Horn, Belt Collins

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

John Waihee
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

Marvin T. Miura, Ph.D.
DIRECTOR
TELEPHONE NO.
546-6615

SUPT. ____
DEP. ____
ASST. ✓
P. R. ____

OBS + other
Appl Action
due 11/2

September 22, 1987

Dear Reviewer:

Attached for your review is an Environmental Impact Statement (EIS) that was prepared pursuant to Chapter 343, Hawaii Revised Statutes and Chapter 11-200, Administrative Rules, EIS Rules:

TITLE: *Hawaiian Riviera Resort*

LOCATION: *Kahuku, Ka'u, Hawaii*

CLASSIFICATION: *Applicant Action*

Your comments or acknowledgments of no comments on the EIS are welcomed. Please submit your reply to the accepting authority or approving agency:

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Please send a copy of your reply to the proposing party:

Mr. Richard H. Van Horn
Belt, Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Your comments must be received or postmarked by: *November 9, 1987.*

If you have no further use for this EIS, please return it to the Office of Environmental Quality Control.

Thank you for your participation in the EIS process.

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819

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December 15, 1987
8533.1902/87-2314

Mr. Charles T. Toguchi
Superintendent of Education
State of Hawaii
Department of Education
P.O.Box 2360
Honolulu, Hawaii 96804

Dear Mr. Toguchi:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated October 5, 1987 and to thank you for participating in the review process for the above project. We will be most pleased to keep your office informed as this project proceeds through the planning process.

Very truly yours,

Richard H. Van Horn

RHVH:lws

US Department
of Transportation
**Federal Aviation
Administration**

AIRPORTS DISTRICT OFFICE
BOX 50244
HONOLULU, HI 96850-0001
Telephone: (808) 541-1243

October 6, 1987

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

We have reviewed the Draft Environmental Impact Statement for the proposed Hawaiian Riviera Resort in Kahuku, Ka'u, Hawaii.

We have no comments except to reiterate that a Notice of Landing Area Proposal, FAA Form 7480-1, must be filed prior to any airfiled construction.

The Draft EIS is returned to Mr. Richard Van Horn with a copy of this letter.

Sincerely,

David J. Welhouse
Airport Engineer/Planner

Henry A. Sumida
Airports District Office Manager

cc:
Richard Van Horn w/encl.

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

December 15, 1987
8533.1902/87-2315

Mr.David J. Welhouse
Airport Engineer/Planner
Airports District Office
Federal Aviation Administration
P.O.Box 50244
Honolulu, Hawaii 96850-0001

Dear Mr. Welhouse:

**Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii**

This is to acknowledge receipt of your letter dated October 6, 1987 and to thank you for participating in the review process for the above project. We understand that a Notice of Landing Area Proposal, FAA Form 7480-1, must be filed prior to any airfield construction and the Final EIS has been revised to reflect this.

Very truly yours,

Richard H. Van Horn

RHVH:lws

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS
830 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

MARIO R. RAMIL
DIRECTOR

SHARON Y. MIYASHIRO
DEPUTY DIRECTOR

October 6, 1987

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

The Department of Labor and Industrial Relations has received the Draft Environmental Impact Statement for the proposed Hawaiian Riviera Resort. We realize the impact such a large project like the Hawaiian Riviera Resort would have on demands for human resources during both the construction and operational phases. The department would be happy to assist in the recruitment of applicants to fill any job demand through our various employment and training agencies.

Thank you for providing us the opportunity to review the draft EIS.

Sincerely,

Mario R. Ramil
Director

cc: Richard H. Van Horn,
Belt, Collins & Associates

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

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December 15, 1987
8533.1902/87-2316

Mr. Mario R. Ramil, Director
Department of Labor and Industrial Relations
State of Hawaii
830 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Ramil:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated October 6, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

Mr. Jeffrey P. Noble
2904 Corte Jardin
La Costa,Ca. 92009
Oct. 8, 1987

Mr. Richard H. Van Horn
Belt,Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Sir:

I have studied the Hawaiian Riviera Resort Env. Impact Statement that my uncle Vernon B. Anderson has acquired from you. I am a property owner in Hawaiian Ranchos and believe that your development will be good for H.R.

I have written a letter to Mr. Albert Lono Lyman,Co. of Hawaii Planning Dept. advising him to adopt your development as presented.

Very Truly Yours,

Jeffrey R. Noble

BELT COLLINS
& ASSOCIATES
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December 15, 1987
8533.1902/87-2317

Mr. Jeffrey R. Noble
2904 Corte Jardin
La Costa, California 92009

Dear Mr. Noble:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated October 8, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

COPY

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII

25 AUPUNI STREET • HILO, HAWAII 96720

October 9, 1987

TO: Mr. Albert Lono Lyman, Planning Director

FROM: H. William Sewake, Manager

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
SEPTEMBER 1987
HAWAIIAN RIVIERA RESORT
KAHUKU, KA'U, HAWAII

We have no additional comments to the subject document.

H. William Sewake

H. William Sewake
Manager

QA

cc - Mr. Richard H. Van Horn

... Water brings progress...

BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

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December 15, 1987
8533.1902/87-2318

Mr. H. William Sewake, Manager
Department of Water Supply
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Sewake:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated October 9, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

OFFICE OF

GLEN WINTERBOTTOM

Kau Homesteader,

Following in the Footsteps of Henry David Thoreau, (1817-1862).

No. 27 Poha Street.

Mailing Address: Post Office Box W.

Naalehu, Kau, H. I. October 13, 1987

(96772) U. S. America

Mr. Dick Van Horn
Belt, Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Reference: Hawaiian Riviera Resort DEIS

Dear Mr. Van Horn:-

I just received a copy of the above-referenced massive Draft Environmental Impact Statement prepared by your firm, which was mailed to me on October 9 by Mr. Ben Tsukazaki, a member of the Developers' Big Island planning team (a copy of the letter accompanying the DEIS is enclosed). Mr. Tsukazaki had agreed to forward me a copy of the upcoming Hawaiian Riviera Impact Statement on August 19.

In view of my somewhat untimely receipt of this 2⅔-inch thick document, I would like to respectfully request that the period for public review and comment be extended a minimum of two weeks past the current expiration date of November 7. I believe that an extended comment period would also benefit the community at large and is warranted by the scope of the project in question, the length and complexity of the subject DEIS, and the fact that residents of this rural district have two other major development proposals to consider at this time.

Thanking you for your kind attention to my above request, I remain

Yours Respectfully,

Glen M. Winterbottom

GLEN M. WINTERBOTTOM

Copies of this correspondence sent to:
Mr. Ben Tsukazaki
State Office of Environmental Quality Control
State Representative Andrew C. Levin
Hawaii County Council

"The greatest fine art of the future will be the making of a comfortable living from a small piece of land." - ABRAHAM LINCOLN

Menezes, Tsukazaki & Yeh
ATTORNEYS AT LAW

100 Pauahi Street Suite 204 Hilo, Hawaii 96720
Telephone: (808) 961-0055 FAX (808) 969-1531

October 7, 1987

Glen Winterbottom
P.O. Box W
Naalehu, Hawaii 96772

Re: Hawaiian Riviera Resort.

Dear Glen:

Please find enclosed the Draft Environmental Impact Statement that I had earlier agreed to send to you. Please share this with other interested members of the Punalu'u Preservation Committee.

I believe the period for public review and comment expires on or about November 7, 1987. We would appreciate having your comments as soon as you can get them to us. As we have discussed, your comments should be sent to Belt Collins & Associates at 606 Coral Street, Honolulu, Hawaii 96813.

Please feel free to call me or our other Big Island planning team members, Sidney Fuke (969-1522) and Vern Yamanaka (935-9766), if you should need further information or have any comments outside the scope of the EIS.

We look forward to receiving your comments on the DEIS.

Very truly yours,

MENEZES, TSUKAZAKI & YEH

Ben

R. BEN TSUKAZAKI

RBT:kyl

Enclosure

cc: Sidney Fuke
Vern Yamanaka

BELT COLLINS
& ASSOCIATES

Engineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819

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October 22, 1987
8533.1902/87-2105

Mr. Glen M. Winterbottom
P.O. Box W
Naalehu, Ka'u, Hawaii 96772

Dear Mr. Winterbottom

Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of October 13, 1987 regarding the Draft Environmental Impact Statement (DEIS) for the above project.

As established by the OEQC, the official comment period for the DEIS ends on November 9, 1987. There are no provisions under the present law (Act 187, 1987) for extension of the comment period. Accordingly, you should meet the November 9th deadline if you wish to make formal written comments on the DEIS.

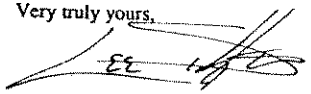
The review of the DEIS is part of a process that began in February, 1987 with the publication of the Environmental Assessment for the project. Since then, a total of 49 private individuals and public agencies requested that they be included as Consulted Parties. The preparation of the document was completed on September 20, 1987. Distribution began on September 23rd in conjunction with publication of the Notice of Availability by the Office of Environmental Quality Control (OEQC) on September 23rd. In addition to 60 government agencies, including the Naalehu Library, identified by the OEQC, copies of the document were also sent to each Consulted Party on September 23rd. All recipients were advised to respond by November 9th. Once their comments are received, I and other members of the project's planning team will begin to address the various questions, suggestions, and concerns that may be raised.

However, the opportunity to comment on the project is not limited to the individuals and agencies discussed above. A complimentary DEIS was sent to you by Mr. Tsukazaki to afford the Punalu'u Preservation Committee and you an opportunity to review information about the proposed project and to share your input with us. In addition, the project planning team will be holding a series of public information meetings to discuss the project with area residents. The first meeting is tentatively proposed for the evening of October 29. Although a location has not yet been determined, notice of the meeting will appear in local newspapers prior to October 29. We will also attempt to notify you directly.

While an extension of the deadline for comments is not possible, I do not believe that this will constrain anyone from commenting on the project. Our team is personally interested in receiving comments during the course of review of the DEIS. Should you or any individual interested in the project wish to discuss specific concerns, I can be contacted at the above address or by phone at 521-5361. I assure you that all comments received whether by official response, phone call, informal comment, or oral comment at a public meeting, will be considered by the planning team in the course of preparing the Final EIS during the remaining days in November, 1987.

Finally, the preparation of the Environmental Impact Statement represents the beginning of a long and detailed planning process. The EIS is required as part of a proposed amendment to the Hawaii County General Plan. The General Plan amendment process will also provide adequate opportunity for comment, as will the subsequent applications for zoning and related development permits. We welcome and appreciate your participation in this entire process.

Very truly yours,



Lee William Sichter

COPY

EXECUTIVE CHAMBERS
HONOLULU

JOHN WAIHEE
GOVERNOR

October 13, 1987

Honorable Albert Lono Lyman
Planning Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

Subject: Draft Environmental Impact Statement (DEIS),
Hawaii Riviera Resort, Kahuku, Kau, Hawaii

This letter acknowledges receipt of the subject environmental impact statement, dated September 23, 1987. Thank you for the opportunity to review the document.

Sincerely,

JOSHUA C. AGSALUD

cc: Mr. Richard Van Horn

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819
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December 15, 1987
8533.1902/87-2320

Mr. Joshua C. Agsalud
Executive Assistant to the Governor
Executive Chambers
State Capitol
Honolulu, Hawaii 96813

Dear Mr. Agsalud:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated October 13, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TAXATION
P.O. BOX 259
HONOLULU, HAWAII 96809

RICHARD F. KAHLE, JR.
DIRECTOR OF TAXATION

DEPUTY DIRECTOR

October 14, 1987

Mr. Richard H. Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Mr. Van Horn:

Re: Draft Environmental Impact Statement - Hawaiian Riviera Resort, Kahuku, Ka'u, Hawaii

We have reviewed your draft environmental impact statement for the proposed Hawaiian Riviera Resort. To date, we have no comments to make concerning the tax revenue impact of this project.

Thank you for the opportunity to comment on this environmental impact statement.

Very truly yours,

Richard F. Kahle Jr.

RICHARD F. KAHLE, JR.
Director of Taxation

RFK-LJN-MAD:pac

BELT COLLINS
& ASSOCIATES

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819

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December 15, 1987
8533.1902/87-2321

Mr. Richard F. Kahle, Jr.
Director of Taxation
State of Hawaii
P.O.Box 259
Honolulu, Hawaii 96809

Dear Mr. Kahle:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated October 14, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

HAWAIIAN TEL GTE

Hawaiian Telephone Company
P.O. Box 4249
Hilo, Hawaii 96720
Telephone (808) 935-9477

Oct. 16, 1987

Mr. Albert Lono Lyman
Director-Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii; 96720

Subject: Hawaiian Reviera Resort Draft Environmental Impact Statement, Kahuku, Kau, Hawaii

Thank you for the oppurtunity to review the EIS draft for the above development. At this time, Hawaiian Tel-GTE has no comments to offer on this EIS.

Should you have any questions, please call me at 935-9459.

Yours truly,

Kenneth Tanaka

Kenneth Tanaka
Supervising Engineer-Hi

cc: R. Van Horn, Belt, Collins & Assoc.
A. Okinaka, HTC
D. Tanouye, HTC

BELT COLLINS & ASSOCIATES

Engineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819

Hawaii • Singapore • Australia • Hong Kong • Saipan

December 15, 1987
8533.1902/87-2322

Mr. Kenneth Tanaka
Supervising Engineer, Hawaii
Hawaiian Telephone Company
P.O.Box 4249
Hilo, Hawaii 96720

Dear Mr. Tanaka:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated October 16, 1987 and to thank you for participating in the review process for the above project.

Very truly yours,

Richard H. Van Horn

RHVH:lws

Ka'u's resident population by 1992, assuming no additional development is approved, and would place upward pressure on land values, and thus taxes, throughout this district and in adjoining sections of South Kona. Further, the Developers have acknowledged that the project would have "a significant impact upon traffic volumes" in this district, and "has the potential for substantial impacts on the social fabric of the study area".

In view of the long-range negative implications of exponential population growth in the presently isolated District of Ka'u, I have proposed the following ammendment to the Hawaii County General Plan:

> (2) Add to ECONOMIC, KA'U, Profile, Courses of Action a passage reading, "The County shall use it's regulatory powers to promote a policy of slow, rational population growth in Ka'u to protect current residents from being overwhelmed or displaced by in-migrants and to preserve the district's slow-paced, rural way of life." Rationale: this policy is absolutely imperative to avert a significant deterioration in Ka'u's quality of life as has occured in west Hawaii and on Oahu and Maui, where exponential population growth has created an insatiable demand for further growth to provide the spiraling population with desperately needed housing, basic services and employment opportunities.

The foregoing proposal has gained some initial support from "mainstream", i.e. non-activist, members of the Ka'u community (see Exhibits "B" through "E" attached hereto). Obviously, the primary means by which county planners could moderate population growth in this district would be by denying approval for proposed development projects, such as the subject Hawaiian Riviera Resort, which because of their size or nature would encourage excessive in-migration.

The inadvisability of allowing large-scale development to occur in areas subject to swift lava inundation should be readily apparent to anyone familiar with the recent destruction of homes and infrastructure in the Kalapana vicinity. Government officials should bear in mind that it is the general public which ultimately pays, through higher insurance rates and taxes, for costly planning mistakes like Royal Gardens Subdivision, which is apparently in the same volcanic hazard zone as the Hawaiian Riviera site.

Another worrisome aspect of resort development in Ka'u District on such a massive scale would be the creation of an unwise dependence on the fortunes of a single employer engaged in a business known for it's susceptibility to economic downturns. Making the situation even more precarious would be the necessity of the proposed resort to compete for clientele with similarly-appointed luxury developments along the length of the Kona-to-Kohala coastline; although the Developers claim otherwise, there is not a single ammenity to be offered at the Hawaiian Riviera Resort which won't be duplicated or surpassed elsewhere on the Big Island.

Planners should also recognize the desirability of retaining an undeveloped buffer zone between the traditional plantation/ranching communities of eastern Ka'u and the much newer Kona-oriented subdivision communities located in the western part of the district. According to maps in the subject DEIS, the proposed resort's support community would urbanize much of the open land between the aforementioned subdivisions and Kahuku Ranch headquar-

ters, which marks the imaginary boundary of east Ka'u for many residents.

Needless to say, long-term planning for the District of Ka'u which focuses only on preservation of historic and natural resources, while ignoring legitimate concerns about a lack of economic opportunities in this area, will not be acceptable to a majority of district residents.

As appealing as it might sound to some individuals, self-sufficiency for a large percentage of Ka'u's population is neither practical or achievable in today's complicated world.

Some form or forms of intensive agriculture able to supplant the current beleaguered cultivation of cane sugar would present an ideal solution for Ka'u District's economic uncertainties, but no viable replacement for sugar has been identified to date.

At my request, the County Planning Department revised a Draft General Plan course of action supporting the fishing industry in Ka'u to include support for "other ocean based industries, and aquaculture" as well. A large-scale aquaculture project was once planned for South Kona's Kapua region, so it is entirely possible that this growing industry has future potential in Ka'u District, although only a small algae farming operation has been suggested for this area so far.

Another proposed General Plan course of action relating to economic diversification in the District of Ka'u was not approved by the Planning Department, but is presently before the County Council for consideration:

> (5) Add to ECONOMIC, KA'U, Profile, Courses of Action a passage reading, "The County should encourage and assist whenever possible the establishment of small-scale cottage industries and family-operated enterprises in the area." Rationale: promotes diversification and stabilization of Ka'u's economy through human-scale entrepreneurial activities.

So where does this leave County planning officials and Ka'u residents? Must huge projects like the proposed Hawaiian Riviera Resort and a space launching facility/theme park be embraced in spite of their potential for severely degrading this district's quality of life? Is there no middle ground between massive Kona-style development and economic stagnation?

Not necessarily. There is one variant of the visitor industry that would be entirely appropriate for the as-yet unspoiled District of Ka'u and which, if properly developed and managed, could provide gainful employment for area residents until such time as alternative agricultural endeavors come into being. For as urban growth throughout the State of Hawaii continues to compromise more and more of the qualities that originally attracted visitors to the Hawaiian Islands—natural beauty, serenity, uniqueness, aloha spirit—the feasibility of retreat-type visitor accomodations increases correspondingly.

Although a majority of today's tourists seem to prefer the pseudo-Hawaiian atmosphere and frenetic activities of Waikiki and similar resort destinations statewide, it is undeniable that a growing minority are becoming disillusioned by the steady transformation of Hawaii Nei into "Anyplace, U.S.A."

Imagine then, an entire district where time has, to a certain extent, stood still. Where there is no traffic, no ur-

ban blight and no environmental deterioration. Where innumerable historic and prehistoric sites remain virtually unchanged and thousands of acres of undeveloped land invite hiking, exploring, research, swimming and horseback riding.

The raw materials for lasting prosperity without harmful consequences plainly exist today in the Great and Majestic District of Ka'u—the only question is whether anyone has the foresight and skill to forge such fragile components into a workable concept while they still exist...and without destroying them in the process.

VII.
CONCLUSION

Based on the foregoing, it is plain that development of a major destination resort on Kahuku's hazard-prone coastline would not be consonant with sound planning, nor would it be in the best long-term interests of current residents of the District of Ka'u.

Therefore, the Developers should be discouraged from expending any further resources on the proposed Hawaiian Riviera Resort.

Respectfully submitted on this 9th day of November, 1987.

Glen M. Winterbottom
GLEN M. WINTERBOTTOM

Of any place I have been in the world, this deserted coast has brought me closest to the basic forces of nature.
Bob Krauss, Wm. Ellis II article

'Resorting' of Maui

The residents of Maui 12 to 15 years ago made a decision. They allowed their island to be "resorted" by the great corporations of the world.

"Massive amounts of money" will be brought to the island . . . there will be jobs for all . . . roads will be improved . . . residents will have beach access . . . everyone will be well-off. Such great promises!

Massive amounts of money are brought to Maui, but the cream goes to investors on the Mainland, or to Japan, or to Saudi Arabia, etc. That's how corporations work.

There are jobs for many: chefs, waiters, hostesses, entertainers, and some token management jobs. However, the cost of living has increased so dramatically that the net effect on the financial quality of life can hardly be positive.

Roads have improved, but they are already overly congested and their maintenance costs will increase significantly in the future from such heavy use.

Beach access is allowed — if you can find a parking spot.

Everyone is not well-off. A prosecutor with the County of Maui told me that I "would be shocked" if I knew the tragic extent of poverty on the island of Maui. Could this be the foundation of the large increase in the theft, burglaries and larceny crimes this year — so many poor seeing so many wealthy?

There used to be Hawaiian hospitality as residents shared this great island treasure with others. Now it is a cattle call . . . a stream of tourists stretching human tolerance to the limit.

Next up, Lanai, Molokai, etc. What will be the decision of the residents today?

G. BOYNTON
Kula

The Honolulu Advertiser, October 1, 1986

EXHIBIT A

August 28, 1987

Hawaii County Council
County Building
Hilo, Hawaii 96720

Dear County Council,

I was born in Ka'u and have lived here all my life, except for military service. I worked as a cowboy for Hawaiian Ranch Co. and Parker Ranch Ka'u Division, and currently am Manager of Kawaihae Ranches' cattle and feedlot operations in Ka'u.

The purpose of this letter is to state my support for the 12 County General Plan ammendments proposed by Glen M. Winterbottom of the Punaluu Preservation Committee, including a slow population growth policy for Ka'u, a two-story height limit for hotels in this district, and redesignation of Punaluu makai of Highway 11 to an Open Space Recreation Area.

These are common sense proposals that could help us avoid the mistakes made on Oahu, Maui and in Kona. I visit Honolulu on business occasionally, and am disgusted by the traffic and congestion there. Kona will be that way a few years down the line. It just doesn't make any sense to keep on repeating the same errors over and over again.

I realize that Ka'u District needs more employment opportunities, especially for the young people who want to stay. Instead of going off half-cocked, however, it would be better for government officials, private industry and community members to work together to identify and promote activities that will generalte such employment without radically altering the simple, country way of life that I think most long-time Ka'u residents enjoy.

One final note: I would be interested to know why the County's high-paid planning "experts" didn't come up with proposals like those previously mentioned. Something is wrong when Glen Winterbottom, who didn't even go to college, has to do their work for them.

Thank you,

Leighton Freitas

Leighton Freitas
Naalehu
Ph: 929-9941 (home)
929-9211 (work)

EXHIBIT B

TLC Unlimited
Prompt Professional Service

TENDER LOVING CARE OF YOUR HARD EARNED DOLLARS AND BURDENSOME PAPERWORK
P O BOX 370 - PAHALA, HAWAII 96777
(808) 928 8961

September 1, 1987

Hawaii County Council
County Bldg., Aupuni St.
Hilo, Hawaii 96720

Dear County Council,

I was born on Kauai, and lived in the Waikiki/Kapahulu area of Oahu until moving to the District of Ka'u 11 years ago. I am a self-employed small business owner. My husband was born here in Ka'u and has farmed and fished in this district since childhood.

The reason I am writing is to let you know we are in support of the 12 County General Plan Amendments proposed by Glen M. Winterbottom, including a two-story height limit for hotels in this district and redesignation of Punalu'u makai of Highway 11 to an Open Space Recreation Area.

So far, four proposals have been approved in whole or in part by the Planning Department, which establishes the validity of these ideas.

These proposals could help avoid the same mistakes made on Oahu, Maui and in Kona. I recently visited Honolulu and was very disturbed by the overcrowding and traffic there. I don't want to see the District of Ka'u turned into another CONCRETE JUNGLE.

I do realize that Ka'u District needs more job openings, but feel that the intended plans for Punalu'u's Special Management Area are too overwhelming. Everyone in the Ka'u community should work together with private industry and government officials to identify projects that will benefit this region economically, while still preserving the lifestyle I believe most residents want. Seems to make more sense than to go to such a large and expansive type of project which will either be sold off within a short period of time or become deserted due to an inability to become productive and pay the overhead involved.

These are some of the things which should be considered NOW, due to all the developments built statewide which sounded so good initially and then ended up either struggling to avoid bankruptcy or displacing long-time residents in the area.

Sincerely,

June Domondon

June Domondon
Pahala, Hawaii
Ph.: 928-8961

EXHIBIT C

Sept. 20, 1987

County Council
County Building
Hilo, HI 96720

Dear County Council,

I was born and raised in Holualoa, but have lived in the District of Kau for over 59 years now. Before retiring I worked at various jobs in C. Brewers' Naalehu and Pahala plantations, and also as a cowboy for their ranch which was then called Kaalualu Ranch. I also helped build the first good road to South Point under Roosevelts' W.P.A. program.

There is not too many people who know Kau better than I do, which is why I agree with my son, Leighton Freitas, who wrote to the newspaper last month saying that it does not make any sense to repeat the same mistakes made in Kona. So I am requesting that the County Council approve Glen Winterbottoms' 12 General Plan ideas which just might help this district before it is too late to do anything.

All you Kau people who like to hunt and fish and use the beachs here had better wise up before you get crowded right out. Look who owns all the good land and fancy houses in Kona now. You know darn well it is not the working people who were there in the beginning. I know I could never afford to live in Kona again.

Also, I would like to say that any kind of a rocket launching site in Kau would be dangerous to the people of the Big Island and the fishing grounds. Look at what happened to the rocket the Onizuka boy from Kona was traveling on. Sure we need jobs for the sugar workers and the kids who want to stay, but why do they want to shove these huge projects down our throats that will only benefit the developers and the mainland people who will come for all the technical jobs and end up owning this district?

I have known Glen Winterbottom for almost 10 years now and he has better ideas than all those money grubbing Big Shots and college boys put together. I say give his ideas a try at least.

Thank You,

Joe Freitas
Naalehu
Phone: 929-7428

EXHIBIT D

October 11, 1987

Hawaii County Council
County Building
Hilo, Hawaii 96720

Dear County Council,

I was born in Pahala and have lived in Ka'u all my life. My great-great grandfather Luther Macomber came to this District in 1850. I work at the County's Kailua Landfill during the week and return home on weekends.

I agree with Leighton and Joe Freitas that we should back Glen Winterbottom's 12 General Plan Proposals, which might help us avoid the problems of Kona. Some of these proposals are 1) A slow, rational population growth plan for Ka'u, 2) A two-story height limit for hotels, and 3) Listing Punaluu makai of Highway 11 as an Open Space Recreation Area.

I am not against new jobs for Ka'u residents and former residents who want to return, but I don't support huge projects that will bring in thousands of new people and cause traffic congestion, pollution and high land and rent costs. Kona is already a mess. We have a hard time keeping up with all the rubbish produced there. Its too late to do anything for Kona, but we can at least learn from the mistakes.

Its the County's responsability to protect longtime residents and our District from being taken advantage of, and I hope they will do their job.

Thank You,

Ernest M. Breithaupt
Waiohinu
Ph: 929-7436 or 326-1180

EXHIBIT E

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

606 Coral Street, Honolulu, Hawaii 96813 • Phone (808) 521-5361 • Telex BELTH 7430474 • Fax (808) 538-7819

Hawaii • Singapore • Australia • Hong Kong • Saipan

December 15, 1987
8533.1902/87-2319

Mr. Glen M. Winterbottom
P.O.Box W
Naalehu, Kau, Hawaii 96772

Dear Mr. Winterbottom:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 10, 1987 and to thank you for participating in the review process for the above project. Following are responses to your comments in the order they appear in your letter.

Visual Character

Conceptual renderings of the Hawaiian Riviera Resort will be prepared in conjunction with the design stage of the planning process. The preparation of the EIS was requested by the County of Hawaii as a requirement for the submittal of a General Plan amendment. The designation of the project area as a major resort does not require conceptual renderings of the proposed resort structures.

Due to the low-rise character of the resort, we do not anticipate that it will be visible from the Ka Lae National Historic Site during daylight hours, although some lights may be visible at night.

Fishing Resources

The 400-slip marina proposed at the Hawaiian Riviera will provide moorage for sailboats as well as fishing boats. As a point of fact, only a very small number of commercial fishing boats are expected to be moored at the marina. The character of the marina would be comprimised by the existance of a sizeable fishing fleet. In addition, the marina is not intended to be designed as an "industrial harbor". Thus, very few of the support facilities required by commercial vessels will be available. Nevertheless, some charter boats will be available for use by residents of the resort and surrounding area. However, we do not believe that the existence of charter fishing vessels at the proposed marina will result in a significant depletion of fishing resources in the area. As has been the practice of major fishing tournaments in past years, tagging rather than taking has become an acceptable practice in sport fishing. It is to everyone's disadvantage if the fishing resources are seriously depleted.

Degradation of the Coastal Area

Preservation of the coastal area in its natural state is a prime objective of the proposed development. The resort's livelihood is based in part upon the natural beauty the coastline. The property owners are commited to preserving the beauty of the shoreline area. It is possible to provide increased access to an area without degrading it. The creation of an extensive Openspace Shoreline Corridor along the entire length of the project's coastline will enable to visitors and

residents to experience the natural beauty of the area, including the rugged shoreline, the anchialine ponds and the archaeological sites. A management plan for the maintenance, regulation, protection and management of the coastal area will be developed in conjunction with future requests for rezoning of the property.

Inadequate Boat Launching Facilities

The matter of a proposed boat ramp at Kaulana Bay is presently the subject of extended litigation. The location of the ramp on Hawaiian Homestead property and the resulting issue of general access to the ramp may not be readily settled in the courts. Thus, we can not assume the ramp's availability at some future date.

Kaulana Bay is located approximately thirty miles by road from Miloli'i and is not easily accessible due to the roadway conditions as well as its windward location. The proposed facility at the Hawaiian Riviera would provide a more accessible alternative for area residents including the resident's of Miloli'i.

Population Growth

The DEIS contains an extensive and frank discussion of the potential impacts of the proposed resort upon population growth in the Ka'u area. Chapter 343, Hawaii Revised Statutes requires that an analysis of a proposed project's social impacts be presented in its environmental impact statement. Included in the DEIS is what we believe to be the most comprehensive social impact assessment that has been completed to date for a development project in Hawaii. The purpose of this assessment is to begin to identify ways in which the negative impacts of population growth in the area can be effectively and appropriately mitigated. The property owners are commited to addressing the impacts of this growth.

Housing

The subject of the proposed resort's impact upon housing in the Ka'u region is discussed in great detail in the document (see pages IV-134 to IV-159). As stated in the report, continuing development in the West Hawaii area will impact in-filling of vacant lots in Ka'u independent of the development of the Hawaiian Riviera. However, the precise effects which this in-filling may have upon property taxes in Ka'u is unknown. We do expect property values to appreciate as new development occurs in the Ka'u region. With about 20,000 vacant lots in the Ka'u district distributed over a wide area, it is not possible to predict where in-migrants may actually choose to live, and thus, how property values in various areas will be affected.

As to the Hawaiian Riviera, the population projections presented in the DEIS indicate that about 560 new homes will be needed in Ka'u to meet the housing demand created by the opening of the proposed resort. This amounts to less than 5% of the total number of lots in the nearby subdivisions. It should be noted that the vacant lots average between three to five acres, and a single lot could accommodate from six to twenty homes. Thus, it would seem that the Hawaiian Riviera would not have the level of impact suggested in your letter. Nevertheless, as discussed in the DEIS, the property owners intend to fully address the issues of employee housing and the demand for new housing supplies that may be created by in-migration to the Ka'u region.

As discussed in the report, growth in Ka'u will most likely occur with, or without the proposed project. However, the prices associated with new housing resulting from this growth and their subsequent rental rates will ultimately be influenced by a single factor; improvements to

infrastructure in the major subdivisions. Without water and electricity, development in the subdivisions may tend to be sporadic with little change in prices. The property owners of the proposed project have no control over the in-filling of areas due to development in West Hawaii and its effect on property values. Consequenty, while the housing demands associated with the Hawaiian Riviera will be addressed by its developers, it is not possible to predict how existing property owners in Ka'u will react to new growth and what the impacts on property taxes and rents may be.

Finally, the matter of costs of employee housing in the support community is has not yet been determined and cannot, therefore, be discussed in the DEIS.

Government Services

Twenty-five years of experience has taught both the government and the private sector a great deal about resort development in the State of Hawaii. Since the rapid development of Waikiki in the 1960's and Kaanapali in the 1970's, government has come to recognize the importance of requiring infrastructure and public facilities and services sufficient to meet the projected needs of the development. The private sector has become much more responsive to addressing government's concerns. This is particularily true for resort development in undeveloped, non-urban areas.

As pointed out in your letter, the Hawaiian Riviera Resort will require potable water, roadways, drainage systems and sewage treatment systems, as well as a variety of public facilities to meet the needs of its residents and visitors. Without these systems, the resort cannot be built. The DEIS fully identifies the extent of the infrastructure required and discusses in detail how the identified needs will be met.

Natural Hazards

The property owners of the Hawaiian Riviera Resort project recognize that lava hazards may exist, just as they exist for other portions of the Island of Hawaii including Ka'u, South Kona, Puna and the entire city of Hilo. Despite impressive advances in the short-term prediction of volcanic eruptions, scientists are not yet able to make accurate long-term predictions. No one knows when Mauna Loa will next erupt or where the outbreak of lava may occur. We do know that Mauna Loa last erupted in 1984 and that the South West Rift Zone (SWRZ) has erupted seven times during the period from 1843 to 1950.

The recently published 1987 USGS Professional Paper 1350, Chapter 22, Volcanic Hazards in the Hawaiian Islands, discusses hazard zones for lava flows on the Island of Hawaii. In Chapter 19 of the same Professional Paper the author notes that "Southwest rift zone eruptive loci generally migrated uprift from 1868 to 1950 (Lipman, 1980). Eruptive loci on the northeast rift zone have shown no such longitudinal distribution pattern, but have instead shown a strong tendancy for southward migration with time, especially in the 20th century" (page 567). The author, Lockwood, is referring here to southward movement along the northeast rift zone. He continues, "Although volumetrically more than 90 percent of historical lava flows have moved down the north side of the northeast rift zone (emphasis added), future flows will preferentially flow down the south flank if the southward migration of eruptive vents continues" (p.569). Figures included on the same page show the dates and locations of eruptions along the northeast rift zone indicating the tendancy for eruptive loci movements southward on the northeast rift zone. The southern flank of the northeast rift zone is that portion of Mauna Loa upon which Kilauea is situated; nearly fifty miles northeast of the project site. Admittedly, lava flows from two of the seven eruptions within the South West Rift Zone have reached the project site. However, we believe that the age of these

flows (1887 and 1907), and the fact that the remaining five eruptions have all produced flows impacting areas in South Kona at progressively greater distances from the project site demonstrates the validity of Lockwood's assessment. Furthermore, the Volcanic Hazards Report suggests that "the hazard on Mauna Loa decreases progressively downslope from its summit and rift zones across zones 2 and 3" (p.609-610). Thus, we feel that the development of the Hawaiian Riviera Resort along the Kahuku coastline should not be restricted on the basis of potential lava flow inundation.

While the volcanic hazard zones delineated in the report, Volcanic Hazards in the Hawaiian Islands, are noteworthy for their documentation of historical events, we do not believe that they constitute a legitimate basis for the creation, implementation and enforcement of restrictive policy. This is largely due to the methodological limitations presented at the outset of the report:

> "The hazard-zone maps distinguish areas in which the general level of hazard is different from that of adjacent areas. However, the level of hazard can vary considerably within any hazard zone, either gradually or abruptly. Direct volcanic hazards, for example, decrease in magnitude gradually across zones away from active vents. For such hazards as lava flows, the frequency with which a specific site is affected decreases with increasing distance...(s)uch gradational changes in the hazard may extend across an entire zone. Abrupt changes in magnitude of hazard within a zone commonly occur along sharp topographical features, and local topographical features in a zone may have a magnitude of hazard very different from that of a zone as a whole...(c)onsequently, the magnitude of hazard assigned to a zone applies only to that zone as a whole, and differences within it are not shown. Such differences can best be determined by specific site studies.
>
> The change in degree of hazard across most zone boundaries is gradual rather than abrupt, and it may be apparent only over a distance of a few kilometers or more. Boundaries between many zones are approximations that serve chiefly as guidelines to show that a difference in hazard does exist and to facilitate descriptions of the zones. Although adjacent hazard zones are separated on the maps by single lines, changes in the degree of hazard across most zone boundaries are so gradational that they might better be shown by numerous lines or a continuous change in shading." (page 607-608)

A restriction on development in certain hazard zones has implications for other areas of the Island of Hawaii including the districts of Ka'u, South Kona, North Kona, and Puna. The city of Hilo is equally vulnerable to lava flow hazards. We believe that lava flow hazards are a factor which all development in proximity to Mauna Loa should take into account, but that the proximity alone should not constitute the basis for land use restrictions.

A basic issue which is properly addressed in an EIS is to what extent potential impacts can be mitigated. The DEIS fully discusses issues concerning seismic hazards, and tsunami and storm wave inundation and offers specific mitigation measures.

Long-Range Planning Considerations

Your letter states that given the historical significance of archaeological sites on the subject property, "their selective preservation as mere adjuncts of a bustling modern destination resort,

tourist attractions if you will, would not be consonant with enlightened planning, which recognizes the intrinsic value of such remains being left as much as possible in the context of their entirety and natural surroundings." The archaeological sites identified on the subject property have been studied by archaeologist Paul Rosendahl, whose extensive report is included in DEIS. His report includes a detailed analysis of both the cultural and scientific significance of each of the sites and a rating system which includes a determination as to their individual value for preservation.

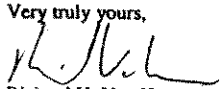
Without a concentrated effort to include these sites within the development of the resort, they would probably suffer further degradation and vandalism. Rosendahl reports that many of the sites have already been disturbed, partially destroyed and vandalized. Despite the fact that the area they are located within is private property, the isolation and remoteness of the sites has probably contributed to their partial destruction. The proposed management plan for these sites represents a concentrated effort by the property owners to not only save them, but in many instances to actually restore them to their former integrity. We believe that by making these valuable sites available to the public we might contribute to the general appreciation, understanding and respect of these symbols of our collective heritage.

As discussed in the DEIS, the archaeological sites recommended by Rosendahl for preservation are virutally all included in the Openspace Shoreline Corridor and the Petroglyph Park. Both of these areas are described as being preserved in their natural state with a minimal amount of physical disruption. The intention is to allow both the visitor and area resident to view these sites and, more importantly, to appreciate their historical and cultural signficance through a detailed information and management plan that would present the sites along with appropriate informational signs. The creation of a 140+ acre Petroglyph Park is not a proposal to develop and landscape an area into something alien to its surroundings. Rather, it is the designation of an area that will be preserved in its natural state for the benefit of all who may visit. Finally, although the Openspace Shoreline Corridor will open the coastal area to general public access, it will also provide opportunites for education and cultural appreciation which do not presently exist, and in a manner that can ensure the security of the sites.

With regard to your concerns about a buffer area around the resort, we would point out that the full development of the Hawaiian Riviera Resort will constitue urbanization of less than 16% of the Hawaiian Riviera property. Thus, the concept of a buffer is already a intregal part of the proposed resort's development plan. We might also point out that the strip of land between the proposed support community and Kahuku Ranch is owned by a third party and already creates a natural buffer between the proposed community and the neighboring ranch.

Again, thank you for commenting on the proposed project.

Very truly yours,



Richard H. Van Horn

lws

LIFE OF THE LAND

NOV 10 1987

BELT COLLINS & ASSOCIATES

November 8, 1987

Mr. Richard Van Horn
Belt Collins & Assoc.
606 Coral Street
Honolulu, HI 96813

Dear Mr. Van Horn;

Here are our brief further comments with regard to the draft EIS for the Hawaiian Riviera Resort, located in Kau, Hawaii.

1) In regards to the need for the project (section I-3), you cite the lack of job opportunities at present. You provide a figure of 2300 new jobs on-site as well as 1000 off-site jobs for the first phase of development (section I-7).

Obviously this level of employment generation is greatly in excess of the available workforce, as you readily acknowledge elsewhere. Since other recent plans for Kau, such as the Punaluu Resort and space-related proposals will also more than satisfy the employment needs, should you not qualify the need for employment to be contingent on a lack of development elsewhere in Kau?

2) The EIS rules and regulations (Title 11, chapter 200) require "A rigorous exploration and objective evaluation of the environmental impacts of all reasonable alternative actions, particularly those that might enhance environmental quality or avoid or reduce some or all of the adverse environmental benefits, costs, and risks ...." In light of this requirement, we believe that the cursory treatment of the smaller scale alternatives is not satisfactory in your EIS. It is understood that the smaller scale alternatives are economically not as appealing as the preferred plan.

HRS Chapter 343-1 states "It is the purpose of this chapter 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." Thus, in considering alternatives, the reduced environmental costs of a smaller scale project should be fairly balanced against the greater economic value of a large scale project.

Thank you for our draft copy and this opportunity to comment.

Sincerely,

Bill Graham
LOL Big Island representative
P. O. Box 155
Hawi, HI 96719

cc: Al Lyman, County of Hawaii

19 Niolopa Place, Honolulu, Hawaii 96817 Tel 595-3903

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December 15, 1987
8533.1902/87-2332

Mr. Bill Graham
Life of the Land
P.O.Box 155
Hawi, Hawaii 96719

Dear Mr. Graham:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 8, 1987 and to thank you for participating in the review process for the above project. Following are responses to your concerns in the order they are presented in your letter.

Employment Opportunities

The employment projections contained in the DEIS were developed using a computer model which accommodated all known factors affecting employment, including the timing of other development projects in the Ka'u area. Specifically, each one of the projections contained in the report is made with and without the Punalu'u Resort in an effort to demonstrate both the individual and cumulative impacts of the Hawaiian Riviera Resort.

As to the development of space-related facilities, although the DEIS has been revised to include a discussion of this matter, we are unable to discuss the implications of such a development in anything but the most broad-brush terms. There is presently no available information which indicates the location or size of such activities. The often-quoted Little report presents a discussion of space-related activities in the Ka'u area in only regional terms. It concludes that a medium-sized launch facility might result in the creation of about 100 jobs, while a space theme park could generate over a thousand jobs. However, there is simply no information provided about the likelihood of a medium-sized launch facility being built in the area or the timing of the facility's construction. Futhermore, the Little report concludes that the Hilo, Waimea and Kona areas would be the most likely candidates for a theme park. Therefore, all we can say at this point in time is that 100 jobs related to a medium-sized launch facility would have no appreciable impact upon the resort, largely due to the technical nature of the jobs, the likelihood that the necessary technicians would need to be imported to the launch facility from areas outside of Ka'u, and the recognition that the facility will probably not be completed before the opening of the proposed resort.

The final EIS has been revised to reflect your concerns about the reduced environmental costs of a smaller scale resort project.

Very truly yours,

Richard H. Van Horn

lws

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

RECEIVED
NOV 10 1987
BELT, COLLINS & ASSOCIATES

November 9, 1987
RE:0477

Mr. Albert Lono Lyman, Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

Draft Environmental Impact Statement
Hawaiian Riviera Resort
Kahuku, Ka'u, Hawaii

The above cited document proposes the construction of two resort developments, a regional airport and a support community in the Ka'u District on the island of Hawaii. The resort area will consist of the Hawaiian Palace Resort and the Hawaii Ka'u Aina Resort, including five hotels, three 18 hole golf courses, a 400 slip marina, a petroglyph park, an equestrian facility, a boat launch ramp and other recreational amenities. The development will be sited on 2,344 acres along the coast in the Ka'u region from Humuhumu Point to an area just east of Kahakahakea Point. This review was prepared with the assistance of Richard Brock, Hawaii Institute of Marine Biology; P. Bion Griffin, Anthropology; Jon Matsuoka, Social Work; Edwin Murabayashi, Henry Gee, and Yu-Si Fok, Water Resources Research Center; and Steven Armann, Environmental Center.

Social

The social impact assessment section of this Draft EIS covers important socio-economic issues very thoroughly. However, although issues such as employee housing and family problems are identified, mitigating strategies to solve or lessen these impacts are not discussed. In view of the magnitude of this resort development, mitigation plans to lessen the social impacts should be thoroughly developed.

Throughout Section 2.5.2.3, generalized statements are made regarding the public's attitude toward the resort. We are aware, as the statement on page IV-168 indicates, that "the interviews were conducted for issue identification only,...." However, a quantified approach is appropriate in order that generalizationd such as "some", "few", "most", "many", and "frequently" have meaning. We believe the final document should include a more statistically rigorous analysis of the public's attitude.

The data on page IV-215 are questionable considering the work load and number of staff workers at the Social Services offices in the area. Statistics of child abuse and neglect noted in Table 42 of the Draft EIS are believed to underestimate actual cases. It is our understanding that social workers in the Kona area are overworked, which may contribute to some cases not being reported.

This Draft EIS refers to a social assessment methodology developed for the Hawaii County Department of Planning by Decision Analysis Hawaii Incorporated for assessments of resort developments. We are unfamiliar with this methodology and would appreciate receiving a copy of the approach to assist us in future reviews.

Water

In general, this Draft EIS treats the subject of fresh water supply in a cavalier and desultory fashion, particularly in view of the responses to numerous Preparation Notice of EIS comments asserting the contingency (pages II-16-II-18) of the Hawaiian Riviera Resort development on successful location of adequate fresh water resources. Sections 7.5-7.7 are very confusing regarding the exact amount of water needed. Page II-16 list non-potable water requirements at 2.94 mgd and page II-18 lists its use at 3.6 mgd. The 3.6 mgd figure is misleading because .7 mgd of this will be potable water. Furthermore, neither figure corresponds to estimates of water supply requirements in Appendix I which place the ceiling at 5.2 mgd at full development. It would help to update Table 5 to include such headings as total water withdrawals, irrigation use, and amount of effluent reuse (page II-18 states that irrigation water will be augmented with treated effluent). Also, better data on regional hydrology as well as competing demand for water from neighboring developments are needed to assess the adequacy of the drainage basin recharge for the projected water use levels.

Anchialine Ponds

Considering other resort developments which have implemented anchialine pond management, it appears that this development will not adversely impact the ponds. We wish to reiterate (page IV-44) that exotic species do have a greater impact on anchialine pond environments than do native species. Therefore, any management plan should be designed to control the introduction of exotic species.

General

Given that recent volcanic flows have reached this area, we believe it would be appropriate for property sellers to inform future residents and buyers of the potential for lava to destroy their property.

Thank you for the opportunity to review this Draft Environmental Impact Statement. We hope our comments will be helpful.

Yours truly,

John T. Harrison, Ph.D.
Environmental Coordinator

cc: Richard H. Van Horn,
Belt, Collins and Associates
L. Stephen Lau
Richard Brock
Henry Gee
P. Bion Griffin
Jon Matsuoka
Edwin Murabayashi
Yu-Si Fok
Steven Armann

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December 15, 1987
8533.1902/87-2333

Mr. John T. Harrison, Ph.D.
Environmental Coordinator
Environmental Center
University of Hawaii at Manoa
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Mr. Harrison:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 9, 1987 and to thank you for participating in the review process for the above project. Following are responses to your comments in the order they appear in your letter.

Social Impacts

We concur with your statement that "mitigation plans to lessen the social impacts should be thoroughly developed." The Draft EIS contains twenty pages of potential mitigations (pages IV-218 to IV-239). We believe that the extensive discussion of social impacts and the resultant mitigations recommended in the text fully meet the requirements of Chapter 343. In fact, we believe that the social impact section of the DEIS is the most extensive treatment of this subject to date in an EIS in Hawaii. Although we recognize that a study of this size results in a uncommonly long document, we feel that the information contained in it establishes a significant baseline which, to some degree, helps to justify the abnormal lenght and detail.

To our knowledge, environmental impact statements in Hawaii and elsewhere rarely contain a "...statistically rigorous analysis of the public's attitude." One reason is that public opinion is fluid and dependent on available information at the time the comment is made. A purpose of the EIS process is to provide the public with information sufficient to allow the formation of informed opinions.

Your comments on the child abuse data presented on page IV-215 of the DEIS are already reflected in the text (see pages IV-214, IV-216).

Your request for a copy of the methodology developed by Decision Analysts Hawaii, Inc. for the Hawaii County Department of Planning has been forwarded to that office (see attached letter).

Water

The DEIS has been revised to clarify the amounts of water needed and the information presented in Table 5.

Although the initial test data indicates that there is a relatively thin lens of groundwater in the vicinity of the test well, the project hydrologist believes that there is sufficient quantity to provide the volume of water necessary for the resort. Calculations of the potential well capacity are based upon an analysis of the amount of watershed located above the potential well sites.

Water wells are proposed for siting at an approximate elevation of 2000', five miles inland from the coastline and nearly two miles further inland than the test well. The project hydrologist concludes in his report, contained in the appendix of the DEIS, that the chloride content of the groundwater will reduce in relationship to distance from the ocean and elevation. Additional test wells will be required by the property owners prior to the beginning of construction. The results of the tests will be used to validate or revise the scale of development as necessary.

Of approximately 12,000 residential lots contained in the unimproved Hawaiian Ranchos and Oceanview Estates subdivisions located within the project's regional watershed, only about 5% have been developed with residential dwellings. To our knowledge, all existing dwellings in the area rely upon catchment for potable water. Thus, there is no competing demand for groundwater.

Anchialine Ponds

The preservation and management of the anchialine ponds will recognize that the introduction of exotic species is to be controlled.

General

Maps of the area included in the DEIS, as well as maps generally available to the public, include notations reflecting the dates of lava flows in the area.

Very truly yours,

Richard H. Van Horn

lws

JOHN WAIHEE
GOVERNOR

RUSSELL N. FUKUMOTO
Acting Executive Director

STATE OF HAWAII
Department of Business and Economic Development
Housing Finance and Development Corporation
P. O. BOX 17907
HONOLULU, HAWAII 96817

IN REPLY REFER TO:

87:PLNG/4837JT

November 9, 1987

RECEIVED
NOV 12 1987
BELT, COLLINS & ASSOCIATES

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Re: Environmental Impact Statement (EIS) for the Proposed Hawaiian Riviera Resort

Dear Mr. Lyman:

We have reviewed the draft EIS for the proposed Hawaiian Riviera Resort and have the following comments.

1. a. We have projected that approximately 2,760 housing units will be required if the proposed project is developed. Of this, nearly 2,330 units would need to be affordable to non-managerial employees. Furthermore, about 1,800 of the total units (and, 1,560 of the affordable units) would be required by 1992.

   b. The employee housing standard established in the General Plan of the County of Hawaii is a maximum of one employee unit to every two hotel units. Based upon this ratio, a maximum of 1,050 employee housing would be needed.

   c. It appears that the developer plans to provide 700 employee units, of which 600 units appear to be targeted to non-managerial employees. Moreover, 540 of the total units will be in place by 1992.

      In comparing (1) the projected housing unit requirement attributable to the proposed development; (2) the maximum number of units that the county may require the developer to provide; and (3) the number

of units the developer is proposing to provide, it is evident that many resources must be pulled together to fill the projected housing need. Dialogue between all concerned parties (i.e., the developer, the County Office of Housing and Community Development, and the Housing Finance and Development Corporation) should begin early on so that this very important employee housing issue can be resolved.

2. The draft EIS assumes that the Ka'u spacesport will not be developed. However, since the development of such a facility is relatively high on the list of State priorities, we recommend that the developer contact the Department of Business and Economic Development, Special Projects Branch, for more information.

3. The proposed project area is located in lava flow hazard Zone 2 (on a scale of 1 to 9, with 1 have the highest lava flow risk). Although "Madam Pele" is the only one who knows for sure the probability of the project being impacted by lava flows, we believe that more detailed studies may be needed in this area.

Thank you for the opportunity to comment. Should you have any questions, please contact Debra Luning of my staff at 848-3322.

Sincerely,

RUSSELL N. FUKUMOTO
Acting Executive Director

cc: Mr. Richard H. Van Horn
Belt, Collins & Associates

BELT COLLINS
& ASSOCIATES
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December 15, 1987
8533.1902/87-2334

Mr. Russell N. Fukumoto
Acting Executive Director
Housing Finance and Development Corporation
Department of Business and Economic Development
P.O.Box 17907
Honolulu, Hawaii 96817

Dear Mr. Fukumoto:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

Thank you for your letter of November 9, 1987 regarding the above project and for your participation in the DEIS comment process. Following is a response to your comments in the order they appear in your letter.

We are pleased to note that your projections for total cumulative housing units required by the project are similar to those provided in the DEIS. The actual phasing of development at the resort will be the determining factor concerning employee housing needs. As discussed in numerous places in the document, 800 units are proposed for the Support Community and will be developed in conjunction with the phasing schedule for the proposed resort. We agree that dialogue should begin at an early stage of the development process among all concerned parties to ensure that the issue of employee housing is fully addressed. The EIS has been required by the County of Hawaii's Planning Department as a submittal with an amendment for a General Plan designation. Once the document is approved by the Department, discussions concerning employee housing could commence.

Representatives of the property owners have meet with the State Planning Director to discuss matters related to space-related facilities proposed for the Ka'u region. The EIS has been revised to include a discussion of these proposed facilities. Additional discussions will be held with all appropriate State and County agencies.

As discussed in the recent U.S.G.S report, Volcanic Hazards In the Hawaiian Islands (Professional Paper 1350, Chapter 22, 1987), the volcanic hazards zones are general designations that may vary in degree of hazard across a zone, based upon actual topographic features. As further studies are undertaken in conjunction with the architectual design of the resort's facilities, the actual siting of structures will be determined.

Very truly yours

Richard H. Van Horn

lws

JOHN WAIHEE
GOVERNOR

MARVIN T. MIURA, Ph.D.
DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

November 9, 1987

RECEIVED
NOV 13 1987
BELT, COLLINS & ASSOCIATES

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, HI 96720

Dear Mr. Lyman:

SUBJECT: Draft Environmental Impact Statement for the Hawaiian Riviera Resort, Kahuku, Ka'u, Hawaii

The Office of Environmental Quality Control has reviewed the subject environmental impact statement (EIS) and offers the following comments for your consideration:

1. At buildout of the resort, it is anticipated that approximately 20% of the resort's guests will arrive by airplane or helicopter at the proposed regional airport. This computes to approximately 35,500 annual aircraft operations, the majority of which will begin or end at either General Lyman Field or Keahole Airport. What will be the impact on these two facilities due to the development of the regional airport at the resort? Will there be any conflict regarding flight schedules and patterns?

2. The possibility of locating a space launch site in the South Point area is briefly mentioned in the document. However, it is also stated that the EIS will not assume the future existence of a Ka'u spaceport. Any decisionmaking regarding this project should consider the possibility of a future spaceport and therefore, a more thorough discussion of the impact of having a space facility in the area of the resort should be included in this EIS.

3. Section 2.14 (page IV-75), discusses assumptions that were made in completing the socio-economic impact assessment. This section states that each of the project increments would require specific zoning and Shoreline Management Area approvals, many of which would trigger subsequent EIS requirements. Can it be assumed that subsequent EISs will be prepared to address some of the unresolved issues?

Thank you for providing this office the opportunity to comment on the subject document. Should you have any further questions, please contact Faith Miyamoto at 548-6915.

Sincerely,

Marvin T. Miura

Marvin T. Miura, Ph.D.
Interim Director

Faith Miyamoto

Faith Miyamoto
Planner

cc: Mr. Richard H. Van Horn
Belt Collins & Associates

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December 15, 1987
8533.1902/87-2337

Mr. Marvin T. Miura, Ph.D.
Interim Director
Office of Environmental Quality Control
State of Hawaii
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Mr. Miura:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 9, 1987 and to thank you for participating in the review process for the above project. Following are responses to your comments in the order they appear in your letter.

Aircraft Operations

As presented in Table 44 on page IV-256 of the DEIS, approximately 27 of the 97 daily aircraft operations at the Hawaiian Riviera Resort's regional airport will involve helicopters. Since these aircraft will be based at the regional airport, they will have no direct impact on General Lyman Field or Keahole Airport. Deducting these flights from the total annual aircraft operations results in about 26,000 annual aircraft operations. About 46%, or 11,885 operations will involve DASH 6 and DASH 7 type aircraft. Because these aircraft will most likely be associated with existing or future commuter services, it is probable that the flights will originate from a variety of airfields located on Oahu, Maui, and Hawaii.

The result will be that approximately 32 flights per day (18 planes landing and taking off) of DASH 6 and DASH 7 aircraft will be originating from 4 or 5 different airfields. The remaining aircraft, for planning purposes, are allocated as Cessna's and would probably be based at the regional airport. The cumulative impact of these various operations upon other airports on the Island of Hawaii will be relatively minor.

Space Launching Site in South Point Area

The final EIS has been revised to include a discussion of space-related activities in the Ka'u region.

Subsequent Environmental Impact Statements

As further information becomes available concerning the design and siting of specific project components the EIS will need to be supplemented or revised. Because the present EIS has been prepared in conjunction with a General Plan amendment, it will require some revisions during later stages of the planning process.

Very truly yours,

Richard H. Van Horn

lws

JOHN WAIHEE
GOVERNOR

SUZANNE D. PETERSON
CHAIRPERSON, BOARD OF AGRICULTURE

TADASHI KOJO
DEPUTY TO THE CHAIRPERSON

RECEIVED
NOV 12 1987
BELT, COLLINS & ASSOCIATES

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822-0159

November 9, 1987

MEMORANDUM

To: Mr. A. Lono Lyman, Director
Planning Department, County of Hawaii

Subject: Draft Environmental Impact Statement (DEIS) for
Hawaii Riviera Resort
Palace Development Corporation and Hawaii Ka'u Aina Partnership
TMK: 9-2-01: por. 72 Ka'u, Hawaii
Acres: approx. 3,200

The Department of Agriculture has reviewed the subject DEIS and finds that it adequately addresses most of our concerns to the EIS Preparation Notice for the subject project. There are, however, two issues that need clarification.

Information on the Soil Conservation Service Soil Survey and Agricultural Lands of Importance to the State of Hawaii classification system as they apply to the project site are included in the DEIS, but not references to the Land Study Bureau Detailed Land Classification. The subject property has a Land Study Bureau Overall Productivity Rating of "E", indicating poor productivity potential for most agricultural uses.

Also, the potential impact on agriculture in the surrounding area, resulting from the withdrawal of groundwater from the existing and proposed wells located west and north of the project site, should be discussed.

Thank you for the opportunity to comment.

Suzanne D. Peterson

SUZANNE D. PETERSON
Chairperson, Board of Agriculture

cc: Mr. Richard H. Van Horn, Belt Collins and Assoc.
OEQC
DBED
LUC

BELT COLLINS
& ASSOCIATES

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December 15, 1987
8533.1902/87-2335

Ms. Suzanne Peterson, Chairperson
Board of Agriculture
State of Hawaii
P.O.Box 22159
Honolulu, Hawaii 96822-0159

Dear Ms. Peterson:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 9, 1987 and to thank you for participating in the review process for the above project. The final EIS has been revised to reflect your comments concerning the Land Study Bureau Detailed Land Classification for the subject property.

The withdrawal of groundwater for the proposed resort will not impact surrounding agricultural uses. The water wells proposed for the Hawaiian Riviera Resort will be tapping an extremely deep water source (approximately 2,000 feet) which is not economically practical for agricultural development purposes. Existing agricultural activities in the Ka'u region do not rely upon or utilize this water source for their operations.

Very truly yours,

Richard H. Van Horn

lws

COUNTY OF HAWAII

PLANNING DEPARTMENT

25 AUPUNI STREET • HILO, HAWAII 96720
(808) 961-8288

DANTE K. CARPENTER
Mayor

ALBERT LONO LYMAN
Director

TIM LUI-KWAN
Deputy Director

RECEIVED
NOV 12 1987
BELT, COLLINS & ASSOCIATES

November 9, 1987

Mr. Richard H. Van Horn
Belt Collins & Associates
606 Coral Street
Honolulu, HI 96813

Dear Mr. Van Horn:

Comments - Hawaiian Riviera Resort Draft EIS

We have reviewed the subject draft EIS and provide you with the following comments:

1) The analysis does not include the traffic to be generated by the support community. The analysis does include the support community as one site that would be receiving traffic from the resorts during peak hours; however, the support community will also be generating other traffic during that time. Since the support community is a part of the application for a General Plan Amendment it should be covered in the traffic analysis in the same manner as the resorts.

2) A general six percent growth seems rather sketchy since the traffic load growth has been different for the various links shown. However, given the general nature of the study perhaps this level of analysis is sufficient at this time.

3) The scaling down of the growth to three percent is not appropriate in this case. The report argues that the proposed project will incorporate some of the expected growth and thus to count the normal growth and the project growth would be double counting to an extent. In this case, there won't be development of several alternative sites in the area which would otherwise develop should the subject project not proceed. The logic would be more applicable to the North Kona area where development of a site may preclude development of other sites on a competitive basis.

4) The growth rates need to be calculated on a compounded basis so that three percent over eight years would be 26.4 percent, not 24 percent, and over thirteen years would be 46.9 percent, not 39 percent.

Any revision resulting from the above points would likewise change the traffic loads projected and the respective levels of service.

5) Chapter I, Page I-13:

The kind of medical facility which will be built should be discussed more fully. A Certificate of Need could be required from the Department of Health.

No County well permit is required.

Underground injection control requirements have not been considered.

6) Chapter II: - The cultural center discussed on page II-5 is not shown on page II-6.

7) Chapter II, Page II-13: What is Department of Land and Natural Resources' interest in access to the site?

8) Chapter II, Page II-18: High altitude surface water is discussed as a source of irrigation. Its collection and distribution is not discussed.

9) Chapter II, Page II-19: It is debatable whether the County of Hawaii's landfill or solid waste system can handle the projected 40 tons per day. Some alternatives need to be discussed.

10) Chapter III, (Section 7.12 Land Use) Page III-40 to -41): The "floating zone" concept applies to Retreat Resort designations and not Major Resort designations.

11) Chapter IV, (Figure 4.4) Page IV-14): The Tsunami & Hurricane Inundation Map reflects the existing situation. Further discussion needs to be included as to how these hazard areas will be changed once the proposed marina is constructed.

12) Chapter IV, Page IV-104: Reference is made to the Arthur D. Little feasibility study and that it indicated that South Point is the best location for a Pacific Spaceport. The report actually indicated that a portion of eastern Ka'u coastline (approximately 18 or more miles) is suitable. The Kahilipali Point site itself is not at South Point and it is somewhat misleading to keep referring to the proposed spaceport location as the South Point area.

13) Chapter IV and Table 36, Page IV-158): The assumptions used to calculate those in need of assistance to purchase housing is inconsistent. Looking at Table 36, there is a substantial difference depending on what interest rate is been used.

14) The projected 39MW/day projected requirement for electricity is in the neighborhood of 39% of today's consumption. The increase is significant and the impacts from the additional generation need to be addressed. Is HELCO able to handle this?

15) The projected 46 takeoffs and 46 landings at the new airport is quite significant. These seem to equal that of Hilo's and Kona's today. Impacts should be discussed in greater detail.

16) Not all of the maps are of the same base, as such, it was difficult to make comparisons.

17) The Dames and Moore "Geological Investigation, Proposed Hawaiian Riviera Resort" report recommended additional studies to quantify the physical characteristics of the ground cracks which generally parallel the coast. The report also indicated that the exact causes of ground cracking are still under investigation. In view of a recent ruling by the Environmental Quality Council regarding adequacy of information contained in the appendixed reports, we would suggest that you seek clarification from that office as to whether additional information is likely to be needed at this stage.

18) Historic/Cultural Resources. Given the large number of sites, 1,167 separate features comprising 298 designated sites, and its density along the project's coastline, the DEIS should provide a more detailed discussion of the project's probable impacts on the identified resources. While the DEIS proposes to alter over one-half (1/2) of the total sites with no further archaeological work recommended, there is no discussion of the mitigation measures considered. Although the DEIS mentions (P. III-23) the implementation of a Historic Resource Management Plan for the project, none is attached or further described in the DEIS. The DEIS does mention the development of an interpretive program, however, it does not provide specific guidelines or criteria for such a program.

The DEIS does not address the issue of whether title of any of the trails or roadways identified within the project are held by the State of Hawaii. If the limited historical study done of the project area included an archival search of old maps, this should be noted in the attached study together with such findings, if any.

Should you have any questions on our comments, please feel free to contact our office.

Sincerely,

ALBERT LONO LYMAN
Planning Director

KK/RN/VKG/BN/TLK

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December 15, 1987
8533.1902/87-2336

Mr. Albert Lono Lyman, Planning Director
Hawaii County Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 9, 1987 and to thank you for participating in the review process for the above project. Following are responses to your comments in the order they appear in your letter.

Traffic

The Traffic Impact Analysis has been revised to include impacts generated by the Support Community and the Final EIS has been revised to include these changes.

The projected rate of growth for the Ka'u District has been increased to 6% for the purposes of the Traffic Study and the Final EIS has been revised to reflect this change.

Chapter I, Page I-13

Table 1 has been revised as suggested in your letter.

The residents of the Ka'u area and the property owners agree that an emergency medical facility would be particularly beneficial to the district. However, the actual decision to develop such a facilty is contingent upon a number of considerations including facility size and design, timing and funding. The development of the proposed emergency medical facility will require meetings between the property owners and the staff of the Emergency Medical Services Branch of the State Department of Health, as well as representatives of Hawaii County, Kona Hospital and Ka'u Hospital. No detailed information concerning the facility is presently available.

The discussion of wastewater treatment facilities in Section 6.6 has been revised to reflect your concerns.

Chapter II

The Cultural Center is proposed to be located within the Commercial area mauka of the Petroglyph Park in the Ka'u Aina Resort.

Chapter II, Page II-13

Access to the site from Mamalahoa Highway was required to be located outside of Hawaiian Ranchos subdivision by the Department of Land and Natural Resources as a condition to subdivision approval.

Chapter II, Page II-18

High altitude surface water is not being considered as a source of irrigation at this time. The reference has been deleted from the text.

Chapter II, Page II-19

The text of the EIS has been revised to reflect your concerns.

Chapter III, Page III-40 to -41

The text of the EIS has been revised to reflect your concern.

Chapter IV, Page IV-14

The text of the EIS has been revised to reflect your concern.

Chapter IV, Page IV-104

The text of the EIS has been revised to reflect your concern.

Chapter IV, Page IV-158

The text of the EIS has been revised to reflect your concern.

Electricity Requirement

We recognize that the energy requirement for the resort represents a signficant increase in electrical generation on the Island of Hawaii. The text has been revised to reflect your concerns. The ability of HELCO to handle the projected load increase will depend, in part, upon the feasibility of utilizing alternate energy technologies presently being developed in the Ka'u, Puna and Kona areas, including wind power, geothermal and OTEC.

Airport Activity

The text has been revised to reflect your concerns.

Scale of Maps

The overall size of the subject property and the location of the three project components, the resort, airport and support community, within that property creates a difficult mapping problem. We experimented with different scales and base maps and discovered that the use of certain base maps depended upon the nature of the information or data being displayed. For example, the archaeological map (Figure 4.14) was purposefully kept at a very large scale in order to reduce the potential for individual sites to be easily located by artifact collectors. The tsunami inundation maps (Figures 4.4, 4.5 and 4.6) required an entirely different scale and base map because the significance of the three separate contour lines would be lost at a larger scale, and if they were taken out of the context of the proposed land uses. Finally, although oversized fold-out maps would

probably solve most of the base map and scale problems, the cost of reproduction and the additional bulk they would add to the document made it prohibitive to utilize them.

Geological Report

The staff of the Office of Environmental Quality Control has indicated that the recent ruling of the Environmental Council concerning the adequacy of information contained in appendixed reports is largely contextual in nature, relating to the completeness of information in the reports rather than to the evaluation of specific details. We are advised by the OEQC that if the additional geological information is needed for siting individual buildings and is a matter of a few feet one way or another, then the OEQC sees no problem with the adequacy of the geological report. However, if the information needed will result in the relocation of buildings in terms of miles from the cracks, then the OEQC would have a problem with the completeness of the report. According to the OEQC, if buildings were to be relocated in terms of miles, then impact on view planes, archaeological features and natural forms would change substantially from what is presently being discussed, resulting in a significantly different set of circumstances which consulting parties would not have had the opportunity to review. However, if it is just a matter of feet, then the present impact statement would not be comprimised.

With regard to your concern, we recently requested Dames and Moore to provide us with more specific information concerning appropriate horizontal setbacks from cracks on the subject property. Attached for your review is a letter from Dames and Moore dated December 15, 1987 which amends their geological study by recommending a 25-foot setback for buildings to be sited on either side of the ground cracks. With this additional information, we believe that we are in full compliance with the intent of the recent Environmental Council ruling.

Historical/Cultural Resources

The impacts and mitigations portion of the archaeology section has been revised to address your concerns. The Historic Resource Management Plan discussed in the DEIS will be developed once the data recovery is completed for those sites identified for further work in the DEIS. The management plan will provide the means for coordinating and implementing an interpretive program for those sites recommended for preservation. Thus, although the management plan is discussed in the EIS, it has not yet been prepared. Nevertheless, the stated intention to prepare such a plan demonstrates the developers' commitment to complying with the goals and objectives of the State Historic Preservation Functional Plan.

Trails

All trails and roadways located on the subject property are owned by the current property owners. The Final EIS has been revised to include a statement to this effect.

An archival search of readily available literature and documentary sources was conducted by the archaeological team for the project, as called for in the project's scope of work. As discussed on page 2 and 3 of the archaeologists' report included in the EIS appendix, the specific tasks contained in the scope of work for the consultant's study were approved by Virginia Goldstein of your department. Page D-1 of the consultant's study further elaborates upon the type of documentary sources which were reviewed. These sources included, "...descriptive accounts, land records, and cartographic sources". Finally, the references cited on page D-16 of the report include registered maps located at the State Survey Division of the Department of Land and Natural Resources. As to findings of the archival search, page D-12 notes that "very little in the way of specific information could be uncovered in traditional or historical literature relative to the project site".

Very truly yours,

Richard H. Van Horn

lws
enclosure

DAMES & MOORE A PROFESSIONAL LIMITED PARTNERSHIP
1144 10TH AVENUE, SUITE 200, HONOLULU, HAWAII 96816 (808) 735-3565

December 15, 1987
15742-001-11

Belt, Collins & Associates, Inc.
606 Coral Street
Honolulu, Hawaii 96814

Attention: Mr. Richard Van Horn

Subject: Clarification of Building Set Back Requirements
Proposed Hawaiian Riviera Resort
Ka'u, Hawaii, Hawaii
TMK: 9-2-01: Portion 72
For Palace Development Corporation and Ka'u Aina Partnership

Gentlemen:

At the request of Mr. Richard Van Horn, we are submitting this letter to amend our report "Geological Investigation, Proposed Hawaiian Riviera Resort, Ka'u, Hawaii, Hawaii, TMK: 9-2-01: Portion 72, for Palace Development Corporation and Ka'u Aina Partnership" dated July 29, 1987, Page 18, Section 4.3 "RECOMMENDED RESORT PLANNING GUIDELINES TO MITIGATE GEOLOGICAL HAZARDS". Second and third paragraphs to read as:

"For the siting of permanent habitable buildings, we recommend that:

1. No building should straddle any crack,

2. No building should be sited within 500 feet from the longitudinal extension of a crack,

3. No building should be sited within 25 feet prallel distance from any crack."

Respectfully submitted,

DAMES & MOORE
A Professional Limited Partnership

S. K. Djou, P.E.
Partner (Ltd.)

SKD:mjo(4364A/0331A:15742-001-11)

cc: Helber, Hastert & Kimura Planners
Attn: Mr. Lawrence Helber
Palace Development Corporation
Attn: Mr. Charles Chidiac
Ka'u Aina Partnership
Attn: Mr. Thomas Boddam

RECEIVED
NOV 30 1987
BELT, COLLINS & ASSOCIATES

Kawika Monfort
Box 589
Honaunau 96721

Sirs,

I am writing to urge you to disallow the proposed project known as "Hawaiian Riveria" on grounds that it is grotesquely unsuited for the peaceful Ka'u - South Kona lifestyle, and that further it directly jeopardises a major facet of that lifestyle, namely the fisherman.

According to the EIS, 85% of the 400 slip marina is earmarked for tourist fishing, that is, charter boats. I ask you to try to imagine, or to consult with someone who can imagine, the impact of 350 charter boats on the fragile fishing grounds from South Point to Milolii.

Every family in Milolii will be directly affected and some forced to leave if the waters from which they harvest their food is suddenly choked with outside boats, larger, faster, and more equipped than their own.

I would remind you that the state government has taken great pains, to the extent of passing legislation, to protect the ohana of Milolii and to ensure its survival. This one giant resort, bringing in an additional 15,000 to 20,000 people to the district, would ensure Milolii's demise.

The rumor is that the lebanese backer for this project hopes to eventually introduce gambling, hence the name. Do we need this ?

BELT COLLINS & ASSOCIATES
Engineering · Planning
Landscape Architecture

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December 15, 1987
8533.1902/87-2519

Mr. Kawika Monfort
P.O.Box 589
Honaunau, Hawaii 96721

Dear Mr. Monfort:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter and to thank you for participating in the review process for the above project.

The property owners of the proposed Hawaiian Riviera Resort are very much concerned with the potential impact which the resort may have upon fishing in the region. We recognize that increasing public access to a previously inaccessable coastal area may result in an increase in fishing activity in the area. However, there are simply no plans to devote 85% of the proposed 400 slips in the marina to use by fishing or charter boats. Page II-14 of the DEIS states "Primary emphasis for berthing will be on boats 25 to 50 feet in length (85% of the total capacity)." The DEIS does not state that these slips will be devoted to use by charter boats. Thus, we do not agree that the resort will jeopardize the lifestyle of the Milolii area, as suggested in your letter. Although some commercial fishing activity will be included in the proposed marina, the great majority of slips will be devoted to sailboats and recreational vessels. A commercial fishing-oriented marina would not be compatible with the character of the resort. While some charter boats may be available for the benefit of resort guests, and a fish market will probably be included in the marina's general commercial area, there is no intention to dedicate the marina to intensive use by a commercial fishing fleet.

It is particularily important to distinguish between sport fishing and commercial fishing. We do not believe that the existence of charter fishing vessels at the proposed marina will result in a significant depletion of fishing resources in the area. As has been the practice of major fishing tournaments in past years, tagging rather than taking has become an acceptable practice in sport fishing. It is to everyone's disadvantage if the fishing resources are seriously depleted. We do not believe that a sound conservation ethic must preclude economic development. A locally-owned charter fishing boat operating out of the proposed harbor represents economic growth for the community. The charter fishing is regulated by both the Coast Guard and the Harbors Division of the State Department of Transportation. Visitors can experience the thrill of sport fishing without necessarily impacting the fishing resources of the region.

Very truly yours,

Richard H. Van Horn

lws

JOHN WAIHEE
GOVERNOR OF HAWAII

RECEIVED
NOV 19 1987
BELT, COLLINS & ASSOCIATES

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

ALBERT K. LANDGRAF
DEPUTY

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

NOV 18 1987

DOC. NO.: 1904E

Honorable Albert Lono Lyman, Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

SUBJECT: Hawaiian Riviera Resort Draft Environmental Impact Statement (EIS)

Thank you for the opportunity to comment on the Hawaiian Riviera Resort Draft EIS. Our Historic Sites Section had several concerns and recommendations and so their comments were extensive. The full text of their divisional review is shown below.

Historic Sites Concerns:

We have reviewed the primary text on historic preservation in the Draft EIS (Chap. 4, Sect. 7) as well as the archaeological report (App. E) and ancillary EIS text on historic sites in Chapters 1, 2, 3, and 8.

Existing Conditions

We believe it is likely that all historic sites have been found in the project area -- totalling 298 sites. Also, sufficient information seems to have been gathered to evaluate their significance.

Section 1.7.1.4. of Chapter 4 in the Draft EIS does not clearly present significance evaluations, because they are mixed with some mitigation measures. However, we agree with the clear significance evaluations presented in Table 14. We agree 158 sites are "no longer significant" and need no further work. (We would appreciate having field maps and photographs of these sites submitted to our Historic Sites Section for deposit in the State's Inventory of Historic Places. This will ensure that the former significant information in these sites is adequately archived.)

Importantly, only 140 sites are still considered significant at this time. This point should be very clearly made in the EIS at the end of Section 1.7.1.4., because only these 140 sites need impact assessment and potential mitigation! This conclusion is not made, making it difficult for the public and the accepting agency to easily perceive how many sites are significant.

Impacts to the Significant Historic Sites

No impact assessment is in the Draft EIS, despite the title of Chapter 4, Section 1.7.2. Apparently, all 140 significant sites are in the resort area. Potentially, all will be "adversely effected" by direct or indirect resort developments. The intent is to convert the "adverse effect" to "no adverse effect" with a proper mitigation plan, which includes preservation and archaeological data recovery components. Section 1.7.2 must present just this kind of statement. Also, for clarity, we believe that 1.7.2. should only cover impact assessments -- a common practice in EIS documents.

Mitigation Measures

The mitigation measures must clearly indicate what mitigation approach will be taken for each of the 140 significant historic sites. Currently, two possibly conflicting plans seem to be presented in the Draft EIS. Also, the mitigation measures do not include specific provisions for outside review by governmental historic preservation agencies -- vital to ensure proper mitigation is carried out. We cannot endorse the mitigation measures until these problems are resolved.

Presently, it is very difficult to determine the applicant's mitigation plans. They are not all presented in one section in Chapter 4; some are in Section 1.7.1.4. (mixed with significance assessments under Existing Conditions) and others in Section 1.7.2. and others in Table 14. Then other bits of additional information (not in Chapter 4) are in Chapters 1, 2, 3, and 8. We strongly urge that the full mitigation measures be presented in Chapter 4 a separate section which would be 1.7.3.

Two possible mitigation plans appear in this Draft EIS, and they may be different. One plan is presented in Table 14 and in the text under Section 1.7.1.4. If Table 14 is the applicant's general mitigation plan, we agree with it. The 70 sites significant solely for their information content are

slated for archaeological data recovery, and this is an acceptable approach to handle these sites. The other 70 significant sites are itemized for preservation. 26 are slated for "preservation as is" and 44 for interpretive development. Except for 18 trails, all are slated for more archaeological work, to enhance interpretation. This recommendation is also acceptable to our office.

The other plan is indicated by several references in the Draft EIS to a Shoreline Setback Park, a Petroglyph Park and a Lava Park with historic sites to be preserved in each (pp. I-7, II-5, III-11, -16, -17, -22, -28, -37, IV-61). We could find no listing of sites to be included in each park. These parks may actually preserve sites slated for data recovery in Table 14, and they might not include sites slated for preservation and thus may not preserve them. This problem needs clear resolution.

Whichever plan is correct, three statements should conclude the mitigation measures, clarifying governmental agency review to ensure adequate mitigation is carried out. Without such a commitment, there is no assurance that specific mitigation plans will be adequate or acceptably executed. The statements should make reference to the following:

1. Detailed plans for archaeological data recovery (a data recovery plan) and for further archaeological work in the sites to be preserved will be prepared prior to any field work, and these plans will be reviewed and approved by the State's Historic Sites Section and the County of Hawaii's Planning Department.

2. Specific preservation plans for each site to be preserved will be reviewed and approved by the State's Historic Sites Section and the County of Hawaii's Planning Department.

3. These two offices will verify that the archaeological plans and preservation plans are successfully executed.

Last, there appears to be an additional mitigation measure that is not included in Chapter 4, Section 7. Page I-7 of the Draft EIS states "a cultural center will be developed at the Ka'u Aina resort to further enhance the historical and archaeological significance of the area". Page II-5 says this center will provide "tour and information services related to the petroglyph park, prehistoric fishing sites, ...". This is a mitigation measure and should be discussed in Chapter 4, Section 7.3. Also, given the Punalu'u Resort's

cultural center, it might be less useful to have multiple cultural centers and perhaps more useful for developers to join forces to have a small museum built for Ka'u which can house archaeological collections from these developments and elsewhere in Ka'u and have small exhibits -- thereby benefitting local citizens and visitors alike.

Recommendations

The intent to do the correct things seem to be present, but we do not believe that this Draft EIS acceptably covers all historic preservation conerns. We believe that the Draft EIS does not analyze the impacts to significant sites, nor is a clear mitigation plan with governmental checks included. These problems need to be corrected in the Final EIS. Also, we believe that the text in Chapter 4, Section 7, could be reorganized for clarity. Additionally, the short sections in the other chapters should be revised based on the above comments.

Our other concerns are from the Recreation Section:

A large parcel of State-owned land, Manuka, adjoins the northwest site of the subject parcel. This State-owned land has limited recreation opportunities, particularly along the shoreline and would be made much more accessible by the subject project. The Draft EIS does not identify recreation resources involving cultural and natural features or opportunities for recreation activities and interpretation of features associated with these resources. The project's impact on these resources with the subject area and adjoining shore area lands should be addressed. Public access and use of shoreline areas and proposed shoreline facilities should also be clarified.

and from our Division of Aquatic Resources:

The proposed 300-acre Shoreline Openspace Corridor should be described in greater detail in the Final EIS including specifics on public access, parking provisions, restrooms and showers, and other amenities that would enhance public shoreline recreation.

The planned development of a 400-slip marina at the Hawaiian Palace Resort and a public boat launch at the Ka'u Aina Resort would result in a substantial increase in the availability of ocean-related activities for guests and area residents alike. The Final EIS should present a monitoring program that would identify potential impacts on aquatic resources during the marina/boat ramp construction and other proposed shoreline modifications, evaluate the effects of

sedimentation on nearshore resources, and describe measures which would prevent or control fuel leaks, spills, and accumulation of trash in the marina and nearshore waters. We concur that monitoring studies and implementation of appropriate mitigation measures during marina construction and operation should ensure that no unforeseen environmental concerns are created. Further comments on the proposed marina may be appropriate when additional information is provided. A blasting plan should be provided the Department for review when details are completed.

Precautions to be taken to prevent blowing, leaching or flowing of eroded soils, petroleum products, fertilizers, pesticides and other potential contaminants associated with this development into the anchialine ponds or coastal waters also needs to be addressed in the Final EIS.

Thank you for taking our concerns into consideration.

Very truly yours,

WILLIAM W. PATY, Chairperson
Board of Land and Natural Resources

cc: Belt, Collins and Associates

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December 15, 1987
8533.1902/87-2454

Mr. William W. Paty, Chairperson
Board of Land and Natural Resources
P.O.Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 18, 1987 and to thank you for participating in the review process for the above project. Following are responses to your comments in the order they appear in your letter.

Historic Sites

The final EIS has been revised to reflect your comments concerning historic sites.

Manuka Forest Reserve

The final EIS has been revised to reflect your comments.

Shoreline Openspace Corridor

The specific components of this area including public access, parking provisions, restrooms, showers, and other amenities are appropriately addressed at the zoning stage of the planning process. Site-specific facility designs have not yet been prepared. Once general plan approvals are obtained, design details will be undertaken.

Marina and Boat Ramp Impacts

As recommended on page 35 of the Baseline Assessment of the Marine Environment in the Vicinity of the Hawaiian Riviera Resort by Steve Dollar, included in the appendix of the DEIS, monitoring studies or programs will be implemented during the construction of the marina and boat launching ramp. Dollar discusses in detail the potential impacts of construction on aquatic resources and evaluates the effects of sedimentation. The actual procedures for periodic monitoring of conditions in the marina and offshore areas will be dictated by State Health Department and State Harbors Division regulations.

Contamination of Anchialine Ponds and Coastal Waters

This matter is fully addressed on pages IV-41 and IV-42 of the EIS.

Very truly yours,

Richard H. Van Horn

lws

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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P. O. BOX 50167
HONOLULU, HAWAII 96850

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NOV 30 1987
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ES
Room 6307

NOV 19 1987

Mr. Albert Lono Lyman, Director
County of Hawaii Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Re: Draft Environmental Impact Statement for the Hawaiian Riviera Resort, Kau, Hawaii

Dear Mr. Lyman:

We have reviewed the referenced Draft Environmental Impact Statement (EIS) and offer the following comments for your consideration.

General Comments

This Draft EIS describes the proposed amendment to the County of Hawaii's General Plan to change the land use designation from Conservation to Major Resort for the coastal resorts and from Extensive Agriculture to Medium Density, Low Density, Industrial, and Open Space for other sections of the project.

Specific Comments

a. Page III-4. Approximately 20 anchialine ponds have been identified within the project site. The Draft EIS states that "Wherever practicable, these ponds will be preserved for the benefit of the resort's guests and visitors." Since construction is expected to begin in the early 1990's, there is ample planning time to avoid siting any structures or facilities on anchialine ponds within the project site. We recommend that all ponds be preserved within the project area and that adequate buffers be included to protect the biological and physico-chemical integrity of the anchialine ponds.

b. The native forest that contains the candidate endangered tree Pleomele hawaiiensis and native forest birds should be protected from development. Since construction will not begin for several years, the proposed support community could be designed to avoid damaging these resources. We recommend that the support community be constructed on open lava fields to avoid impacting native forest habitats.

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Summary Comments

The construction of the marina, small boat launching ramp, cruise ship terminal, artificial beaches, swimming lagoons, and the placement of any fill in anchialine pools may require permits from the Department of Army. We anticipate that project-specific environmental assessments will be prepared for these shoreline modifications.

We recommend that the Conservation designation be retained around the anchialine ponds and buffer areas and Kanonone Waterhole within the project area. The size of the buffer area around the anchialine ponds depends on the topography of the area, proposed surrounding uses of the land, and the affected biological resources. My staff is available to assist in determining the size of the buffer areas.

We appreciate this opportunity to comment.

Sincerely,

Ernest Kosaka

Ernest Kosaka, Field Supervisor
Environmental Services
Pacific Islands Office

cc: CE, Operations Branch
NMFS - WPPO
CZM, DBED
Land Use Commission
DLNR

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December 15, 1987
8533.1902/87-2518

Mr. Ernest Kosaka, Field Supervisor
Environmental Services
Pacific Islands Office
Fish and Wildlife Service
United States Department of the Interior
P.O.Box 50617
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 19, 1987 and to thank you for participating in the review process for the above project. Following are responses to your comments in the order they appear in your letter.

Page III-4

The anchialine ponds are intended for preservation. Most of the ponds are located with an Openspace Shoreline Corridor proposed for the seaward portion of the project. The remaining ponds are situated in areas that have been designated as park or openspace in the Development Concept Plan for the project.

Native Forest

The native forest that contains the candidate endangered tree Pleomele hawaiiensis is located within a kipuka near the Support Community. This kipuka is intended to be fully preserved.

Shoreline Structures

Environmental assessments will be prepared for all shoreline structures proposed for the resort.

Very truly yours,

Richard H. Van Horn

lws

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

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IN REPLY REFER TO:

STP 8.2465

November 9, 1987

Mr. Albert Lono Lyman, Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Lyman:

Draft Environmental Impact Statement
Hawaiian Riviera Resort
Kahuku, Ka'u, Hawaii

We have the following comments concerning the proposed resort development:

1. One page IV-246: We should ask for clarification of the statement in the last paragraph that "There is sufficient right-of-way to allow for expansion to four lanes." We feel that the existing right-of-way may not be sufficient for a 4-lane divided highway. If additional right-of-way is needed, the developer should be required to dedicate the additional land.

2. On page IV-249: The Traffic Impact Analysis should identify mitigation measures for the development's Access Road/Mamalahoa Highway Intersection.

   We will require a fully channelized intersection and street lighting at the intersection. We may also require traffic signals and left-turn lanes for future traffic conditions. Therefore, the developer should install the required ductlines to accommodate this future need.

3. We will require a written confirmation from the developer, assuring us that they will be monitoring the traffic situation at this development's Access Road/Mamalahoa Highway Intersection periodically to determine if any additional future traffic improvements are needed and that the developer, at the appropriate time, will provide these improvements at their expense.

4. Presently, the existing highway is under the jurisdiction of the County of Hawaii. However, because it is scheduled to be transferred to the State under Phase III of the State's Federal-aid Systems Plan, it is essential that any improvement made along this segment of Mamalahoa Highway meets the design standards of the State DOT's Highways Division.

5. The proposed Airport facility needs to be coordinated with our Airports Division for licensing if it is to be used commercially.

6. We recommend the planned public boat ramp include the following:

   a. A breakwater to protect the facility from the ocean elements.

   b. A properly designed ramp in terms of width, length, slope, toe depth, trailer maneuvering area, car/trailer parking and washdown areas, lighting, etc.

We appreciate this opportunity to provide comments.

Very truly yours,

Edward Y. Hirata
Director of Transportation

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December 15, 1987
8533.1902/87-2520

Mr. Edward Hirata
Director of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hirata:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 9, 1987 and to thank you for participating in the review process for the above project. Following are responses to your comments in the order they appear in your letter.

Page IV-246

The text of the final EIS has been revised to reflect your concerns.

Page IV-249

The text of the final EIS has been revised to reflect your concerns.

Monitoring Program

A specific monitoring program will be developed at the design stage of the planning process.

Design Standards

Any improvements made to Mamalahoa Highway will be in full compliance with the design standards of the State Department of Transportation.

Airport Facility

The proposed regional airport will be developed in coordination with the State Department of Transportation and the Federal Aviation Administration.

Public Boat Ramp

The property owners will coordinate the development of the public boat ramp with the State Department of Transportation to ensure that all concerns are met.

Very truly yours,

Richard H. Van Horn

lws

Hawaii Electric Light Company, Inc. • PO Box 1027 • Hilo HI 96721-1027

CUST
H-W/G

December 3, 1987

Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Attention: Mr. Richard H. Van Horn

Gentlemen:

Subject: Environmental Impact Statement Preparation Notice
Hawaiian Riviera Resort, Kahuku, Ka'u, Hawaii

This is to confirm our telephone conversation regarding the electrical requirements.

It appears that if this development should occur in its entirety, a load of 39MW will have a major impact on HELCO's System. This load will require off-site work by HELCO to install additional generation in Kona and transmission line(s) from Hilo. The on-site work will require at least three 69KV transmission lines, a major substation and 12KV distribution lines.

HELCO requires that the developer provide a substation lot and make a contribution for the construction of the on-site electrical work. The developer is requested to open a service request with HELCO at least two years in advance of this project. This is to allow HELCO sufficient lead time to upgrade the off and on-site work to accommodate the load. Plans showing service locations, estimated KVA load and roadways are required for this work.

Please call me at 969-0323, if you have any questions.

Very truly yours,

Melvin S. Yamaki
Electrical Engineer
Planning Division

MSY:ts

cc: C. Nagata
M. Bradley

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December 15, 1987
8533.1902/87-2521

Mr. Melvin S. Yamaki
Electrical Engineer
Planning Division
Hawaii Electric Light Company, Inc.
P.O.Box 1027
Hilo, Hawaii 96721-1027

Dear Mr. Yamaki:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated December 3, 1987 and to thank you for participating in the review process for the above project. The property owners will work closely with your company to ensure all concerns are adequately addressed. We recognize the volume of impact the proposed project will have upon the HELCO system and wish to establish a close working relationship with your company over the coming years.

Very truly yours,

Richard H. Van Horn

lws

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December 15, 1987
8533.1902/87-2579

Mr. James O. Juvik, Ph.D.
College of Arts and Sciences
Social Sciences Division
University of Hawaii at Hilo
1400 Kapiolani Streeet
Hilo, Hawaii 96720-4091

Dear Mr. Juvik:

Draft Environmental Impact Statement
Proposed Hawaiian Riviera Resort,
Kahuku, Ka'u, Hawaii

This is to acknowledge receipt of your letter dated November 7, 1987 and to thank you for participating in the review process for the above project. Following are responses to your comments in the order they appear in your letter.

We do not agree with your assessment of the project's impacts with regard to infrastructure needs. The project developers are commited to providing the necessary services and facilities including the water distribution system, the sewage treatment plants, the roadways, parks, public accesses, airport, emergency medical facility, and marina. Improvements to the Mamalahoa Highway fronting the resort entrance will also be funded by the developer. An 800-acre support communtiy for employee housing, complete with commercial shopping area, is also proposed by the developer. As discussed on page IV-243 of the DEIS, the cost benefit ratio for the project is over 3:1 for the State and about 2:1 for the County. This means that for every dollar spent by the state on the project, over three dollars will be received in revenues. Thus, given the extent of developer-funded infrastructure and the postive cost-benefit ratio of the project, we feel that the proposed project will not adversely impact residents through increased taxes and fees as your letter states.

We are somewhat surprised by your statement that the potential for adverse socio-economic impacts associated with the project has been "downplayed". The DEIS has been required by the County as a component of a General Plan amendment. Chapter VIII of the DEIS, which you refer to in your letter, is devoted soley to a discussion of the those impacts which will require greater detail and more specific design proposals than are appropriate at this conceptual level of the planning process. In effect, it is only a summary of significant issues. The actual analysis is presented in Chapter IV. This chapter contains what may be the most extensive social impact analysis prepared to date for an EIS in Hawaii. The 167-page social impact analysis section devotes 109 pages to the discussion of socio-economic impacts and over 20 pages to the discussion of mitigation measures and strategies. A careful reading of this section will reveal the depth of analysis and the intent of full disclosure.

We believe that there is a compelling public interest associated with the proposed project. Public expenditures for long needed services and facilities have been lacking in Ka'u. Traditionally, the County's expenditures on capital improvements projects have focused on the

island's population centers of Hilo, Kona, and Waimea, thereby relagating the district of Ka'u to a relatively low priorty status. This is to be expected, given the extensive size of the Ka'u district and its small population. Without a strong initiative from the private sector, it is likely that this condition will continue. The proposed Hawaiian Riviera Resort provides a mechanism for bringing many services and facilities to the district which the County is hard-pressed to provide.

Finally, your statements regarding the quality of Dr. Steve Dollar's study of the project site's anchialine ponds seem to be more of a personal attack on Dr. Dollar than a comment on the DEIS. If the DEIS were recommending the removal of some or all of the ponds, your comments might be appropriate. However, the DEIS is recommending that all the ponds be preserved in their natural state, as discussed on page IV-44. Dr. Dollar's report contains the same recommendation (see page 44 of his baseline report included in the DEIS appendix).

There is currently no published or documented evidence that resort development per se causes negative impacts to pond ecosystems or changes in groundwater characteristics beyond the level of natural variability in pond ecosystems. On the contrary, ponds that are adversely impacted by human activities (trashing and introduction of exotic species) occur in undeveloped areas far from existing resorts. It is, therefore, probable that development of the planned resort will ensure the continued maintenance of the pristine pond conditions by preventing destructive activities of human intervention.

Dr. Dollar has conducted studies for twenty-five environmental impact statements and we have found his work to be consistent with our professional standards. We would note that the point of contention in your letter seems to relate to the matter of an appropriate methodology for assessing impacts on anchialine ponds. Obviously, you disagree with Dr. Dollar's methodology. However, we do not think it approprate to enter into a protracted critique of his methodology at this point in the planning process, especially in light of the fact that all of the ponds are intended for preservation. To our knowledge, his methodology has never been challenged by an accepting or reviewing agency.

Unfortunately, the Maciolek report was released by the County Planning Department in October 1987, three months after Dollar's report was completed and a month after the Hawaiian Riviera DEIS was published. We, therefore, could not have included an assessment of the Dollar report based upon Maciolek's findings in the DEIS. Nevertheless, we would now fully concur with the Maciolek's recommendation that a standardized methodology and sampling intensity be developed and implemented. Such standards would surely be welcomed by all investigators charged with characterizing anchialine pond systems and would probably help to eliminate methodological challenges. As to your specific charges concerning Dr. Dollar's work on Awake'e, we would recommend that you contact Dr. Dollar directly. We can only comment that it is our understanding that the Final EIS for Awake'e was approved in March of this year.

Very truly yours,

Richard H. Van Horn

lws

CHAPTER XII

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APPENDIX A

Air Quality Impact Analysis

AIR QUALITY IMPACT ANALYSIS

HAWAIIAN RIVIERA RESORT

August 9, 1987

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AIR QUALITY IMPACT ANALYSIS

HAWAIIAN RIVIERA RESORT

1. INTRODUCTION

The Palace Development Corporation/Hawaii Ka'u Aina Partnership proposes to build a major resort on a 20,616-acre parcel near the southern tip of the Island of Hawaii. The proposed project consists of the Hawaiian Palace Resort, the Hawaii Ka'u Aina Resort, a support community, and a regional airport. These components of the project will cover some 3,244 acres leaving the remaining 17,372 acres in their natural state. By 1997, the resort areas are expected to include 3,000 hotel units and 927 residential units. The support community is planned for 800 residential units.

The purpose of this report is to assess the impact of the proposed development on air quality both on a local and regional basis. The overall project is clearly an "indirect source" of air pollution as defined in the federal Clean Air Act [1] since its primary association with air pollution is due to its inherent generation of mobile source, i.e., motor vehicle and aircraft, activity. Much of the focus of this analysis therefore is on the project's ability to generate traffic and the resultant impact on air quality. Air quality impact was evaluated for existing (1987) and future (1992 & 1997) conditions.

A resort project such as this also has off-site impacts due to increased demand for electrical energy which must be met through the combustion of some type of fuel. This combustion process also results in pollutant emissions to the air which have been addressed.

Finally, during construction of the various buildings and facilities air pollutant emissions will be generated due to vehicular movement, grading and general dust-generating construction activities. These impacts have also been addressed.

2. AIR QUALITY STANDARDS

A summary of State of Hawaii and national ambient air quality standards is presented in Table 1 [2, 3]. Note that Hawaii's standards are not divided into primary and secondary standards as are the federal standards.

Primary standards are intended to protect public health with an adequate margin of safety while secondary standards are intended to protect public welfare through the prevention of damage to soils, water, vegetation, man-made materials, animals, wildlife, visibility, climate, and economic values [4].

Some of Hawaii's standards are clearly more stringent than their federal counterparts but, like their federal counterparts, may be exceeded once per year. It should also be noted that in April, 1986, the Governor signed amendments to Chapter 59 (Ambient Air Quality Standards) making the state's standards for particulate matter and sulfur dioxide the same as national standards. In the case of particulate matter, however, this uniformity did not last long. On July 1, 1987, the EPA revised the federal particulate standard to apply only to particles 10 microns or less in diameter (PM-10) [5], leaving the state once again with standards different than the federal ones.

In the case of the automotive pollutants [carbon monoxide (CO), oxides of nitrogen (NOx), and photochemical oxidants (Ox)], there are only primary standards. Until 1983, there was also a hydrocarbons standard which was based on the precursor role hydrocarbons play in the formation of photochemical oxidants rather than any unique toxicological effect they had at ambient levels. The hydrocarbons standard was formally eliminated in January, 1983 [6].

The U.S. Environmental Protection Agency (EPA) is mandated by Congress to periodically review and re-evaluate the federal standards in light of new research findings [7]. The last review resulted in the relaxation of the oxidant standard from 160 to 240 micrograms/cubic meter (ug/m^3) [8]. The carbon monoxide

(CO), particulate matter, sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) standards are currently under review, but final action has not been taken yet [9].

Finally, the State of Hawaii also has fugitive dust regulations for particulate matter (PM) emanating from construction activities [10]. There simply can be no visible emissions from fugitive dust sources.

3. EXISTING AIR QUALITY

While there are no continuous air monitoring stations in the immediate project area, it seems safe to assume that present air quality is good most of the time since there are no large stationary sources in the vicinity, and the area is virtually without urban development so that mobile source activity is not yet a serious problem. The nearest State Department of Health air monitoring station was located some 40 miles north at Kailua-Kona. Recent data from that station are summarized in Tables 2 and 3.

These data suggest that the State's standards are being met for sulfur dioxide and total suspended particulates. Unfortunately, the two principal automotive pollutants, carbon monoxide and oxides of nitrogen, are not monitored on the Island of Hawaii. NO_2 was last measured in 1975 and at that time ranged <5 - 29 ug/m^3 with an average of 16 ug/m^3 in Hilo.

It should be noted, however, that the worst air pollution episodes experienced in Hawaii County are due to the infrequent and unpredictable volcanic eruptions. While volcanic emissions are somewhat variable and have not been fully characterized, it is well known that visibility is affected by the presence of fine particulates resulting directly from volcanic activity as well as secondarily from forest fires caused by lava flows. In addition there are substantial increases in the ambient concentrations of mercury and sulfur dioxide.

Measurements of sulfur dioxide taken during the January, 1983 eruptive phase, for example, indicated 24-hour concentration as high as 982 ug/m^3 at the Volcano Observatory and 654 ug/m^3 in Hilo. Sulfur dioxide and particulate measurements made during January and March, 1983 in Kona and Hilo are presented in Table 4. Despite the volcanic activity, concentrations were relatively low on most of the days that measurements were made. The low levels may be explained by the infrequent monitoring and variable wind directions.

Analysis of the airborne particulate matter during the eruption revealed some rather interesting results as unusually high concentrations of selenium, arsenic, indium, gold, and sulfur were found along with strikingly high concentrations of iridium [11].

4. CLIMATE & METEOROLOGY

4.1 Temperature & Rainfall. The project area is typical of Hawaii's climate with little seasonal or diurnal temperature variation. Monthly temperature averages vary by only about 6 degrees from the warmest months (July and August) to the coolest (January and February) [12].

The area also exhibits the typical mauka-makai variation in annual precipitation. Twenty-six to 43-year rainfall records indicate that the makai portion of the development area is relatively dry with an annual average of only 22.9 inches while the mauka portion averages 35.5 inches per year. Monthly means range from 3.5 inches in January to 0.5 inch in July on the makai side and 4.9 and 1.9 inches, respectively, on the mauka side. Table 5 also includes a summary of these precipitation data.

4.2 Surface Winds. A special program of onsite meteorological data collection was conducted in the project area during the May - July, 1987 period [13]. Two 10-meter instrumented towers were erected, one at a makai location and one in the vicinity of the proposed airfield. The locations of these towers are depicted in Figures 1 and 2.

Summaries of the wind direction and speed data collected at those sites are presented in the form of wind roses in Figures 3 and 4. The AIRPORT site (Figure 3) was clearly dominated by east to northeast winds (>71%) while the BEACH site (Figure 4) showed much greater variability. Wind data from the National Weather Service (NWS) South Point Station (Figure 5) during the same time period revealed the same predominance of east-northeast winds as observed at the AIRPORT site. However, when these data were compared with a full year (Apr 85 - Apr 86) of data from the NWS South Point Station (Figure 6), it was evident that easterly winds were in fact under-represented during the approximately 2-month sampling period. Review of the May - July, 1985 data indicated the same high percentage of easterly winds as occurred annually thereby further verifying that the May - July 1987 data were not representative and should be adjusted by an increased percentage of easterly winds.

Wind speeds at the project site were lower than at the NWS South Point station which averaged 17.8 mph during the sampling period. The AIRPORT site averaged 14.8 mph and the BEACH site was 11.0 mph. The mean wind speed during the sampling period at the NWS South Point station was higher than the 1985 annual mean of 14.8 mph suggesting that in the long term winds at the project site should also be somewhat lower. Winds also tend to diminish as one moves inland as well. Data from the South Kona NWS Cooperative Observer station (Figure 7) indicate calm winds 34%

of the time and an annual average wind speed less than 6 mph. Thus the mauka sections of the property, e.g., the "Support" Community, should be little affected by strong winds.

4.3 Solar Radiation.

The BEACH site tower also included a silicon pyranometer for measuring solar radiation in the 0.4 - 1.1 micrometer range. The results, depicted in Figure 8, indicate the characteristic midday buildup of a cloud band along the southwest shores of the Big Island. This is evidenced by the disparity between the maximum possible and the mean solar radiation in the figure. It indicates that at midday, about half of the solar radiation is being screened out. Typically, morning hours are relatively clear, but the increasing cloud cover shields much of the incoming radiation from late morning until sunset.

5. INDIRECT SOURCES

5.1 Highways and Traffic

The principal highway serving the area is the Mamalahoa Highway. For most of its length it is a two-lane rural highway with lane widths of 10 - 12 feet. Only in the Hilo area is it a 4-lane divided highway. The Hawaiian Riviera Resort will have to construct an access road from its development to the Mamalahoa Highway.

Existing and projected peak-hour traffic data used in this analysis were provided by Belt, Collins and Associates [14], and are based on historical traffic counts along Mamalahoa Highway and traffic generation factors for the resort facilities. The traffic analysis reflected a regional approach and identified impacts along 13 segments of Mamalahoa Highway from Hilo around South Point to Kailua-Kona.

5.2 Airfield

A small regional airport with a single ENE-WSW oriented runway will be constructed about 4 miles from the shoreline above the Hawaiian Ka'u Aina Resort. The airfield will operate only during daylight hours with an estimated 35,484 annual aircraft operations [15]. The following types of aircraft are expected to be typical of airport use:

Aircraft	No. Engines	Type Engine	Average Daily Opns	Max Hourly Opns
DASH-7	4-engine	turboprop	26.1	4
DASH-6	2-engine	turboprop	6.2	4
Cessna 402	2-engine	piston	37.9	2
Bell 206	1-engine	turboshaft	27.0	4

6. LONG-TERM IMPACT

6.1 Emission factors. Automotive emission factors for carbon monoxide (CO), oxides of nitrogen (NOx), and nonmethane hydrocarbons (NMHC) were generated for calendar years 1987. 1992, and 1997 using the Mobile Source Emissions Model (MOBILE-3) [16]. To localize emission factors as much as possible, the September, 1986 age distribution for the City & County of Honolulu [17] was input in lieu of the national statistics normally used.

Emission factors for the aircraft engines were obtained from EPA publications [18,19].

6.2 Mesoscale Analysis.

6.2.1 Motor Vehicles. A mesoscale or regional impact analysis based on annual emissions was performed as one means of evaluating the impact of the proposed project. Using the aforementioned emission factors and traffic projections, it was possible to estimate future annual emissions both with and without the proposed project in 1992 and 1997. Emissions of the principal automotive pollutants were computed for each link identified in the traffic impact report.

6.2.2 Electrical Generation. The estimated 52 million kilowatt hours of annual electrical demand by the ultimate development will necessitate the generation of electricity by power plants. Currently, West Hawaii is primarily served by a number of diesel generators located at Hilo Electric Light Company's (HELCO) Keahole facility. For the purposes of this analysis, it was assumed that power would be met by that power station and thus emissions estimates were based on the burning of diesel fuel [20].

6.2.3 Aircraft. Aircraft operations at the proposed regional airport will also generate emissions and these have also been estimated based on the previously cited emission factors and estimated number of annual operations.

6.2.4 Results. The results of the highway emissions analysis are summarized in Tables 7 - 9. They generally indicate that without the project emissions would steadily decline over the 1987 - 1997 period. With the project, emissions exhibit a net increase from 1987 to 1992, but then decline again from 1992 to 1997. This phenomenon can be seen more clearly in Figures 9 - 11 which depict total emissions. Note that nitrogen oxides do not show as sharp decline after 1992 as do carbon monoxide and non-methane hydrocarbons.

The results of the diesel generator and aircraft emissions analysis are combined in Table 10. Diesel generators are well known significant emitters of oxides of nitrogen and this is further evidenced by the results. Aircraft operations contribute relatively small amounts of the major pollutants with the exception of carbon monoxide which is over 100 tons per year.

6.3 Microscale Analysis.

6.3.1 Modeling Methodology. While emissions analyses as reported above are one means of evaluating a project's impact, it is generally more important to estimate the ambient impact since standards are expressed as ambient concentrations, and it is the ambient concentrations to which living things are exposed. Computer modeling is normally employed to generate these ambient concentration estimates, most commonly with non-reactive pollutants. This is due to the complexity of modeling pollutants which undergo chemical reactions in the atmosphere and are subject to the effects of numerous physical and chemical factors which affect reaction rates and products. For projects involving motor vehicles as the principal air air pollution source, carbon monoxide is normally selected for modeling because it has a relatively long half-life in the atmosphere (about 1 month) [21], and it comprises the largest fraction of automotive emissions.

The EPA guideline model CALINE-3 [22,23] was employed to estimate maximum 1-hour CO concentrations at receptor locations 10 - 30 meters from the source during the worst-case PM peak hour traffic. Worst case meteorological conditions were selected accordingly.

Because of the time of day of the analysis (PM peak hour), the low level of urbanization in the area which would otherwise contribute to a "heat island" effect and increased turbulence, and the usual afternoon cloud cover, a neutral atmosphere (Pasquill-Gifford Class "D") [24] and 1 meter per second (m/sec) wind speed were assumed as worst case meteorological conditions. A background CO level of 0.1 milligrams/cubic meter (mg/m3) was also assumed due to the lack of urbanization in the area.

Preliminary modeling with 10, 20, 30, and 45 degree wind-road angles indicated that the 20 degree angle would produce the maximum pollutant concentrations; thus, this angle was input to the CALINE-3 model. Had peak traffic occurred in the early morning hours (6:00 - 8:00 a.m.), a more stable (P-G Class "F") would have been input. In this case, the resort community is not typified by that early morning work trip.

6.3.2 Roads & Highways. Because of the regional approach of the traffic impact report, a microscale analysis of the same 13 highway links was performed. One-hour carbon monoxide

concentrations were estimated at 10 meters from each highway leg. Emission factors used were based on speeds ranging from 20 to 45 miles per hour which were in turn selected in accordance with the level of service (LOS) on each leg.

A separate analysis of the intersection of the project access road with the Mamalahoa highway was also conducted. An array of receptors were placed at 10, 20, and 30 meters from the highway and the access road.

6.3.3 Regional Airport. Since the most significant potential impact of aircraft on groundlevel carbon monoxide concentrations occurs during ground operation modes, i.e., taxi-idle, takeoff, and landing, the airfield was modeled as a single line source using the CALINE-3 model and the previously described emission factors, worst case hourly operations and meteorology.

6.3.4 Results. The results of these computations, presented in Table 6, indicate low 1-hour carbon monoxide concentrations all of which are below the state standard of 10 mg/m3.

7. SHORT-TERM IMPACT

The principal source of short-term air quality impact will be construction activity. Construction vehicle activity will

increase automotive pollutant concentrations along Mamalahoa Highway as well as in the vicinity of the project site itself. Because of the relatively low existing traffic volumes, the additional construction vehicle traffic should not exceed road capacities although the presence of large trucks can reduce a roadway's capacity as well as lower average travel speeds.

The site preparation and earth moving will create particulate emissions as will building and on-site road construction. Construction vehicles movement on unpaved on-site roads will also generate particulate emissions. EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons/acre per month of activity may be expected under conditions of medium activity, moderate soil silt content (30%), and a precipitation/evaporation (P/E) index of 50 [25].

Although there is little or no soil on the project site, the soil that is brought in may well have a silt content greater than the 30% cited above. This in conjunction with the semiarid local climate (P/E Index = 24) in the makai portion, suggests a potential for even greater fugitive dust emissions.

8. DISCUSSION AND CONCLUSIONS

8.1 Microscale Analysis. The 1-hour concentration estimates along free-flow segments of all of the links studied as well as near

the project access road intersection and near the airport runway all indicated compliance with federal and state 1-hour standards under both current and projected traffic conditions.

Compliance with the federal and state 8-hour standards can also be inferred from these concentration estimates simply because all the 1-hour estimates were lower than the 8-hour standards and it is therefore statistically impossible for the 8-hour averages to exceed the standards.

8.2 Mesoscale Analysis. The mesoscale analysis indicates that the projected increases in traffic volume over the 1987 - 1992 period will result in a net increase in emissions. Since the federal motor vehicle emission control program [26] depends on new cars with lower emissions gradually replacing older, more polluting vehicles, the reason for rising emissions is that the projected increase in traffic volumes exceeds the projected decrease in per vehicle emissions and attrition of old vehicles. In this particular case, the rate of traffic increase appears to exceed the rate of per vehicle emissions decline and old car attrition over the 1987 - 1992 period, but the trend appears to reverse over the 1992 - 1997 period.

The difference between pollutants is due to different standards and compliance dates for each thereby resulting in different

rates of improvement. Thus, carbon monoxide and non-methane hydrocarbons have a steeper slope after 1992 than oxides of nitrogen which decline almost imperceptibly.

The electrical generation and aircraft operations associated with the proposed project will contribute additional increments of emissions to the Big Island's inventory, the former at another location and the latter in the project area. Neither by itself is excessive.

These emissions estimates may be compared to the 1980 county emissions inventory in Table 11 in order to provide some perspective on their significance.

8.3 Short-Term Impact. Since as noted in Section 7, there is a potential for fugitive dust due to the dry climate and fine soils, it will be important for adequate dust control measures to be employed during the construction period.

Dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. The EPA estimates that twice daily watering can reduce fugitive dust emissions by as much as 50%. The soonest possible landscaping of completed areas will also help.

8.4 Conclusions. Based on the foregoing analysis, the following conclusions may be drawn:

- The proposed project will result in increased air pollutant emissions due to its inherent traffic generation ability, its airport operation, and its requirement for electrical power;

- On an island-wide basis project-related traffic will contribute to an initial increase in emissions of carbon monoxide, nitrogen oxides, and hydrocarbons over the 1987-1992 period followed by a decline over the 1992 - 1997 period;

- Ambient levels of carbon monoxide along the Mamalahoa Highway, in the vicinity of the project's access road, and in the vicinity of the airport are projected to meet both state and federal ambient air quality standards through 1997; and

- Due to the dry climate and fine soils in the area, dust control measures during construction will be important to prevent violations of state fugitive dust standards.

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T A B L E S

TABLE 1

SUMMARY OF STATE OF HAWAII AND FEDERAL
AMBIENT AIR QUALITY STANDARDS

POLLUTANT	SAMPLING PERIOD	FEDERAL STANDARDS PRIMARY	FEDERAL STANDARDS SECONDARY	STATE STANDARDS
1. Total Suspended Particulate Matter (TSP)	Annual Geometric Mean	75	60	60
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	260	150	150
2. PM-10	Annual	50	50	--
(micrograms per cubic meter	Maximum Average in Any 24 Hours	150	150	--
3. Sulfur Dioxide (SO2)	Annual Arithmetic Mean	80	--	80
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	365	--	365
	Maximum Average in Any 3 Hours		1,300	1,300
4. Nitrogen Dioxide (NO2)	Annual Arithmetic Mean	100		70
(micrograms per cubic meter)				
5. Carbon Monoxide (CO)	Maximum Average in Any 8 Hours	10		5
(milligrams per cubic meter)	Maximum Average in Any 1 Hour	40		10
6. Photochemical Oxidants (as O3)	Maximum Average in Any 1 Hour	240		100
(micrograms per cubic meter)				
7. Lead (Pb)	Maximum Average in Any Calendar Quarter	1.5		1.5
(micrograms per cubic meter)				

TABLE 2

AIR MONITORING DATA
KONA, HAWAII
1986

Total Suspended Particulates (TSP)

24-Hour Concentration (ug/m3)

MONTH	SAMPLES	MINIMUM	MAXIMUM	MEAN
Jan 86	5	4	16	13
Feb 86	5	6	26	15
Mar 86	5	9	20	14
Apr 86	4	10	15	13
May 86	5	12	17	13
Jun 86	5	12	20	15
Jul 86	5	13	25	18
Aug 86	5	18	28	22
Sep 86	*	*	*	*
Oct 86	*	Station Shut Down		*
Nov 86	*			*
Dec 86	*	*	*	*
ANNUAL	39	4	28	16

SOURCE: Department of Health

TABLE 3

AIR MONITORING DATA
KONA, HAWAII
1986

Sulfur Dioxide (SO2)

24-Hour Concentration (ug/m3)

MONTH	SAMPLES	MINIMUM	MAXIMUM	MEAN
Jan 86	5	<5	<5	<5
Feb 86	5	<5	<5	<5
Mar 86	5	<5	<5	<5
Apr 86	4	<5	<5	<5
May 86	5	<5	<5	<5
Jun 86	5	<5	<5	<5
Jul 86	5	<5	12	6
Aug 86	5	<5	<5	<5
Sep 86	*	*	*	*
Oct 86	*	Station Shut Down		*
Nov 86	*			*
Dec 86	*	*	*	*
ANNUAL	38	<5	12	<5

SOURCE: Department of Health

TABLE 4

SPECIAL AIR MONITORING DATA
KONA & HILO, HAWAII
1983

	24-Hour Concentrations (ug/m3)			
	Kona		Hilo	
Date	SO2	TSP	SO2	TSP
08 Jan 83	---	---	654.7	22.6
09 Jan 83	---	---	447.7	30.6
12 Jan 83	27.0	23.4	0.6	6.9
14 Jan 83	12.0	22.2	----	----
19 Jan 83	----	----	12.2	17.6
20 Jan 83	18.9	----	----	----
04 Mar 83	4.4	39.1	32.9	53.6
05 Mar 83	0	28.4	----	30.1
07 Mar 83	----	----	0.6	37.0
08 Mar 83	0	11.9	0.6	27.5
10 Mar 83	0	12.8	21.3	38.5
11 Mar 83	----	----	0	28.2

Notes: SO2= sulfur dioxide
TSP= total suspended particulates

SOURCE: Department of Health

TABLE 5

PRECIPITATION DATA
HAWAIIAN RIVIERA RESORT AREA

MONTH	MAKAI(1)	MAUKA(2)
Jan	3.5	4.8
Feb	1.7	2.8
Mar	2.9	3.0
Apr	1.5	2.4
May	0.8	2.0
Jun	0.5	1.9
Jul	0.8	2.3
Aug	0.8	2.7
Sep	0.7	2.1
Oct	1.2	2.8
Nov	2.3	3.2
Dec	2.6	3.4
Mean:	22.9	35.5

NOTES: 1. State Station No. 3.00, South Point Corral 26-year record.

2. State Station No. 5.00, Kamaoa-P Ranch, 43-year record.

TABLE 6

Estimated Maximum 1-Hour CO Concentrations
1987 - 1997

No.	Links	CO Concentration (mg/m3) 1987	1992	1997
1	Hilo-Keaau	1.9	1.4	1.0
2	Keaau-Volcano	0.5	0.6	0.5
3	Volcano-Pahala	0.3	0.4	0.3
4	Pahala-Punaluu	0.3	0.5	0.6
5	Punaluu-Honoapu	0.4	0.7	0.6
6	Honoapu-Naalehu	0.3	0.6	0.6
7	Naalehu-Waiohinu	0.2	0.4	0.5
8	Waiohinu-S. Point	0.2	0.4	0.5
9	S. Point-Support	0.2	0.4	0.5
12	H. Riviera-H. Ocean	0.2	0.2	0.3
13	Haw. Ocean-Hilolii	0.1	0.1	0.2
14	Hilolii-Honaunau	0.2	0.2	0.2
15	Honaunau-Cpt Cook	1.0	1.2	1.1
	Hawaiian Riviera Access - Mamalahoa Highway Intersection	0.3	0.9	1.4
	Regional Airport Runway	n/a	0.1	0.1

Conditions:
Receptor distance = 10 m
Wind speed = 1 m/sec
Wind/road angle = 20 deg
Stability = "D"
Background CO = 0.1 mg/m3
Traffic volume = PM peak hour

TABLE 7

Estimated Annual Emissions
of Carbon Monoxide

No.	Link	Annual Emissions (T/yr)				
			w/o Project		w/Project	
		1987	1992	1997	1992	1997
1	Hilo-Keaau	1081	734	482	759	512
2	Keaau-Volcano	493	394	259	544	426
3	Volcano-Pahala	330	265	173	507	399
4	Pahala-Punaluu	68	55	36	120	109
5	Punaluu-Honoapu	67	54	35	120	102
6	Honoapu-Naalehu	64	55	42	116	115
7	Naalehu-Waiohinu	46	40	30	112	132
8	Waiohinu-S. Point	13	11	9	32	39
9	S. Point-Support	44	37	29	108	135
12	H. Riviera-H. Ocean	100	85	66	197	227
13	Haw. Ocean-Milolii	112	96	74	151	160
14	Milolii-Honaunau	341	292	224	386	372
15	Honaunau-Cpt Cook	589	505	387	551	460
		3349	2623	1847	3703	3190
	Percent change: (from 1987)		-21.7	-44.8	+10.6	-4.7

TABLE 8

Estimated Annual Emissions
of Nitrogen Oxides

No.	Link	Annual Emissions (T/yr)				
			w/o Project		w/Project	
		1987	1992	1997	1992	1997
1	Hilo-Keaau	183	152	125	157	133
2	Keaau-Volcano	83	81	67	112	110
3	Volcano-Pahala	56	55	45	105	103
4	Pahala-Punaluu	12	11	9	25	28
5	Punaluu-Honoapu	11	11	9	25	26
6	Honoapu-Naalehu	8	8	7	17	18
7	Naalehu-Waiohinu	6	6	5	16	21
8	Waiohinu-S. Point	2	2	1	5	6
9	S. Point-Support	5	5	4	15	21
12	H. Riviera-H. Ocean	12	12	10	28	35
13	Haw. Ocean-Milolii	14	14	11	22	25
14	Milolii-Honaunau	43	42	35	55	58
15	Honaunau-Cpt Cook	73	72	60	79	72
		508	470	389	660	656
	Percent change: (from 1987)		-7.4	-23.4	+29.9	+29.1

TABLE 9

Estimated Annual Emissions
of Non-Methane Hydrocaarbons

No.	Link	Annual Emissions (T/yr) w/o Project 1987	1992	1997	w/Project 1992	1997
1	Hilo-Keaau	195	123	88	127	94
2	Keaau-Volcano	89	66	48	91	78
3	Volcano-Pahala	60	44	32	85	73
4	Pahala-Punaluu	12	9	7	20	20
5	Punaluu-Honoapu	12	9	6	20	19
6	Honoapu-Naalehu	10	8	6	17	16
7	Naalehu-Waiohinu	7	6	4	16	18
8	Waiohinu-S. Point	2	2	1	5	5
9	S. Point-Support	7	5	4	15	19
12	H. Riviera-H. Ocean	16	12	9	28	31
13	Haw. Ocean-Mililii	18	14	10	22	22
14	Mililii-Honaunau	54	42	31	55	51
15	Honaunau-Cpt Cook	93	72	54	79	64
		576	411	300	578	511
	Percent change: (from 1987)		-28.7	-47.9	+0.3	-11.3

TABLE 10

Estimated Annual Emissions of Criteria
Pollutants Due to Electrical Generation
and Aircraft Operations

SOURCE	Emissions (T/yr) CO	NOx	THC	SOx	PM
Diesel Generators	195	897	72	60	64
Aircraft	114	6	60	2	4

Notes: CO = carbon monoxide
NOx = nitrogen oxides
THC = total hydrocarbons
SOx = sulfur oxides
PM = particulate matter

TABLE 11

EMISSIONS INVENTORY
COUNTY OF HAWAII
1980

SOURCE CATEGORY	EMISSIONS (Tons/Year) TSP	SOx	NOx	CO	HC
Steam Electric Power Plants	262.9	3232.9	1308.9	65.9	21.8
Gas Utilities	0.0	0.0	11.5	0.0	0.0
Fuel Combustion in Agricultural Industry	2251.7	995.8	798.0	0.0	7.3
Refinery Industry	0.0	0.0	0.0	0.0	0.0
Petroleum Storage	0.0	0.0	0.0	0.0	391.9
Metallurgical Industries	0.0	0.0	0.0	0.0	0.0
Mineral Products Industry	1080.1	13.6	11.5	0.0	0.0
Municipal Incineration	0.0	0.0	0.0	0.0	0.0
Motor Vehicles	262.9	177.3	3048.5	42177.3	4035.4
Construction, Farm and Industrial Vehicles	40.0	31.8	453.5	1515.7	152.4
Aircraft	5.7	4.5	45.9	1449.8	174.2
Vessels	11.4	90.9	63.2	65.9	29.0
Agricultural Field Burning	1800.2	0.0	0.0	20627.3	2445.9
TOTAL IN TONS PER YEAR:	5715	4547	5741	65902	7258

SOURCE: State of Hawaii
Department of Health

F I G U R E S

FIGURE 1.
Meteorological Sampling Sites

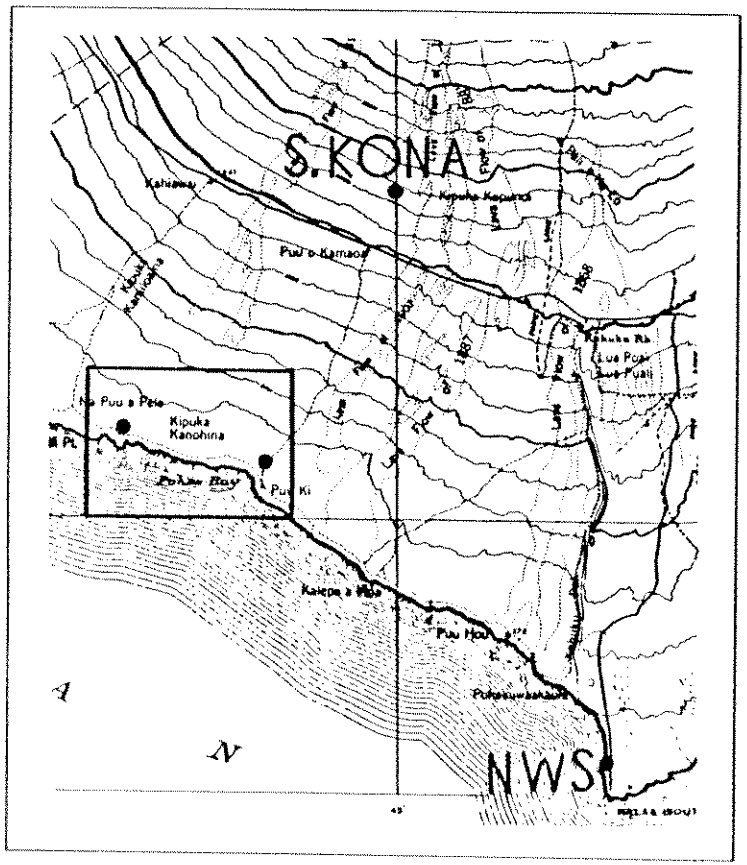


FIGURE 2.
Hawaiian Riviera Resort
Meteorological Sampling Sites

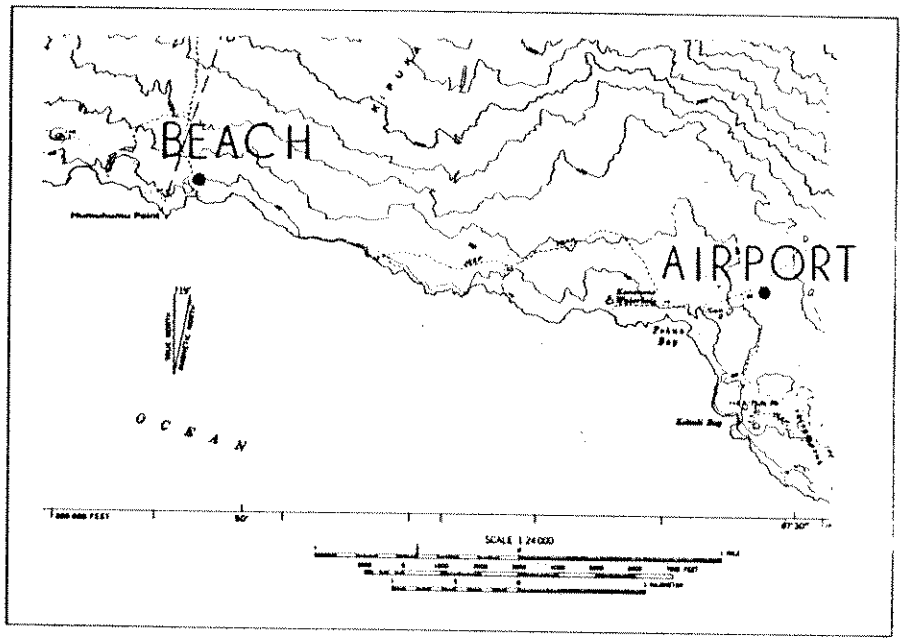


FIGURE 3
Frequency Distribution of Wind Direction in Percent
Hawaiian Riviera Airport Site
14 May–21 Jul 87

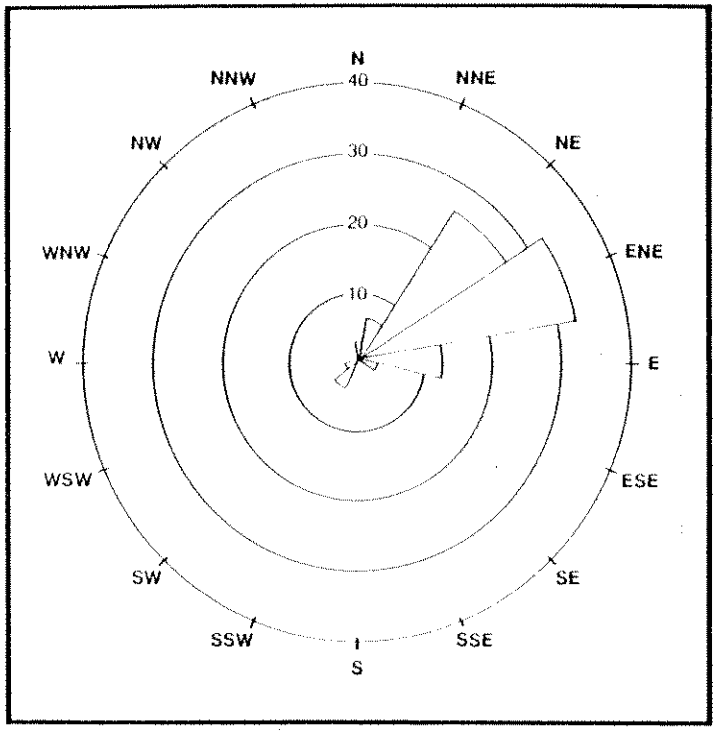


FIGURE 4
Frequency Distribution of Wind Direction in Percent
Hawaiian Riviera Resort Beach Site
14 May–2 Jul 87

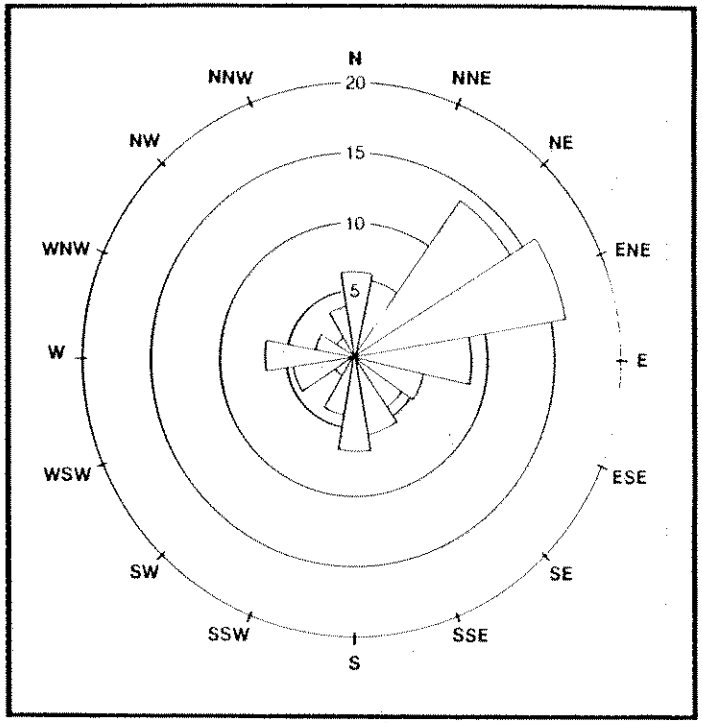


FIGURE 5.
Frequency Distribution of Wind Direction in Percent
NWS South Point
14 May – 21 Jul 87

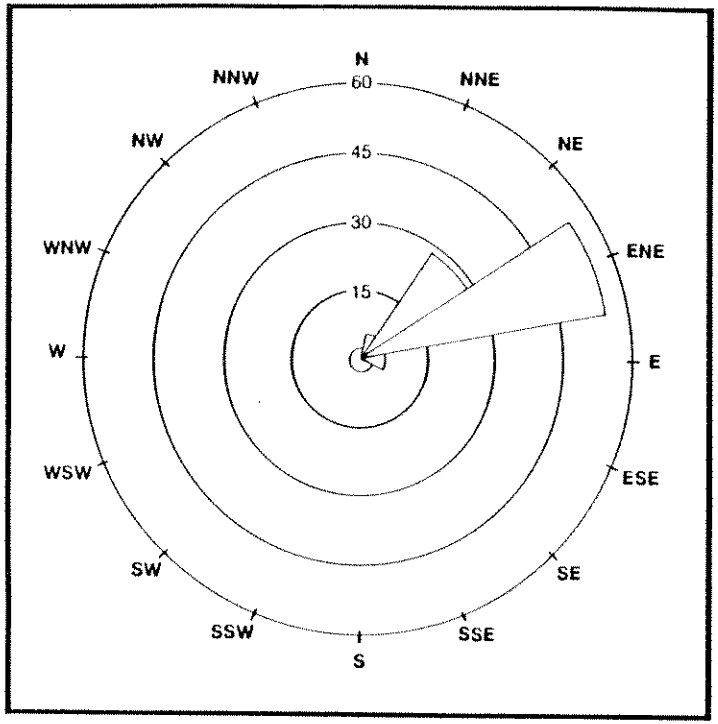


FIGURE 6.
Frequency Distribution of Wind Direction in Percent
NWS South Point
Apr 85 – Apr 86

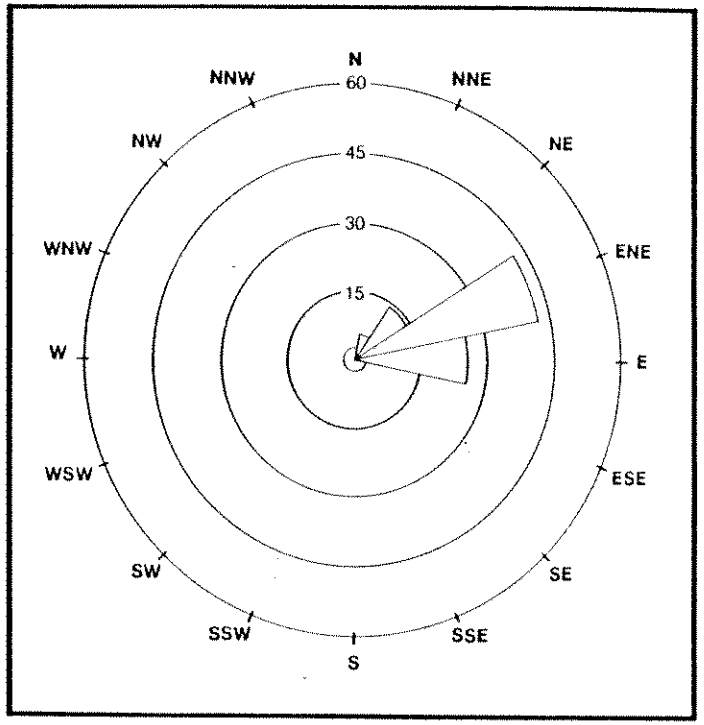


FIGURE 7
Frequency Distribution of Wind Direction in Percent
South Kona Cooperative Observer Site
Jan–Dec 80

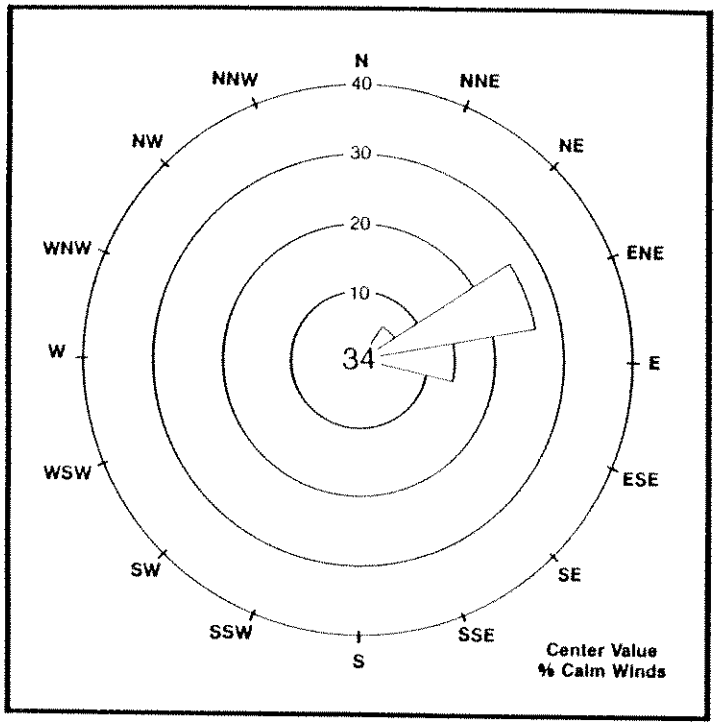


FIGURE 8
Hawaiian Riviera Resort Beach Site
Diurnal Solar Radiation

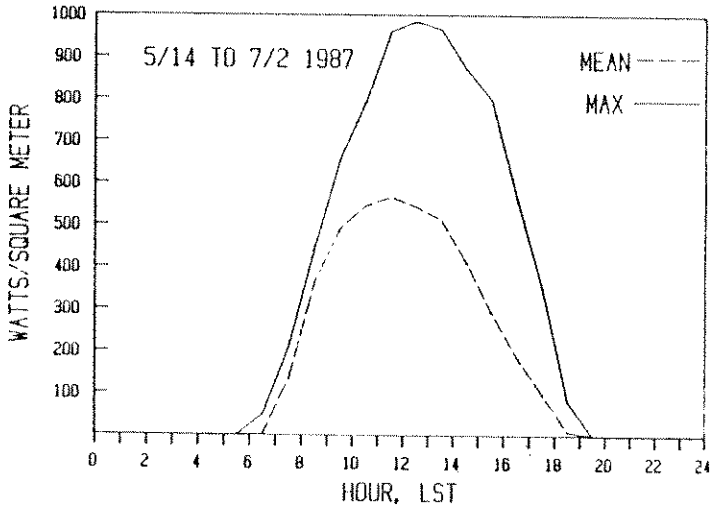


FIGURE 9

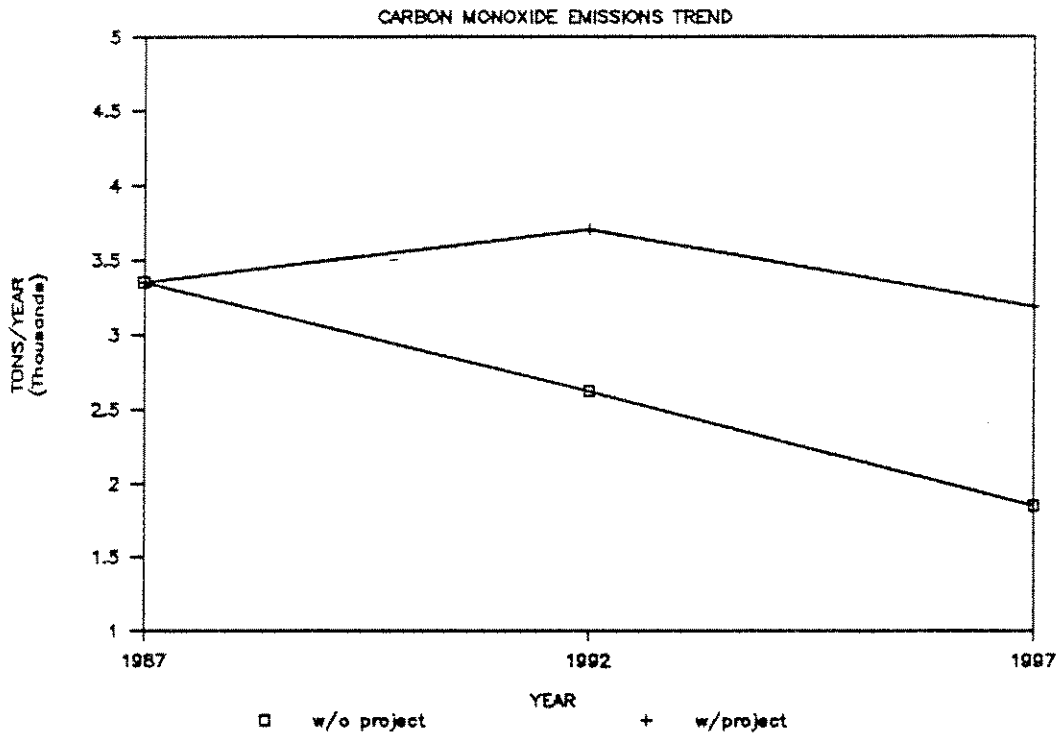
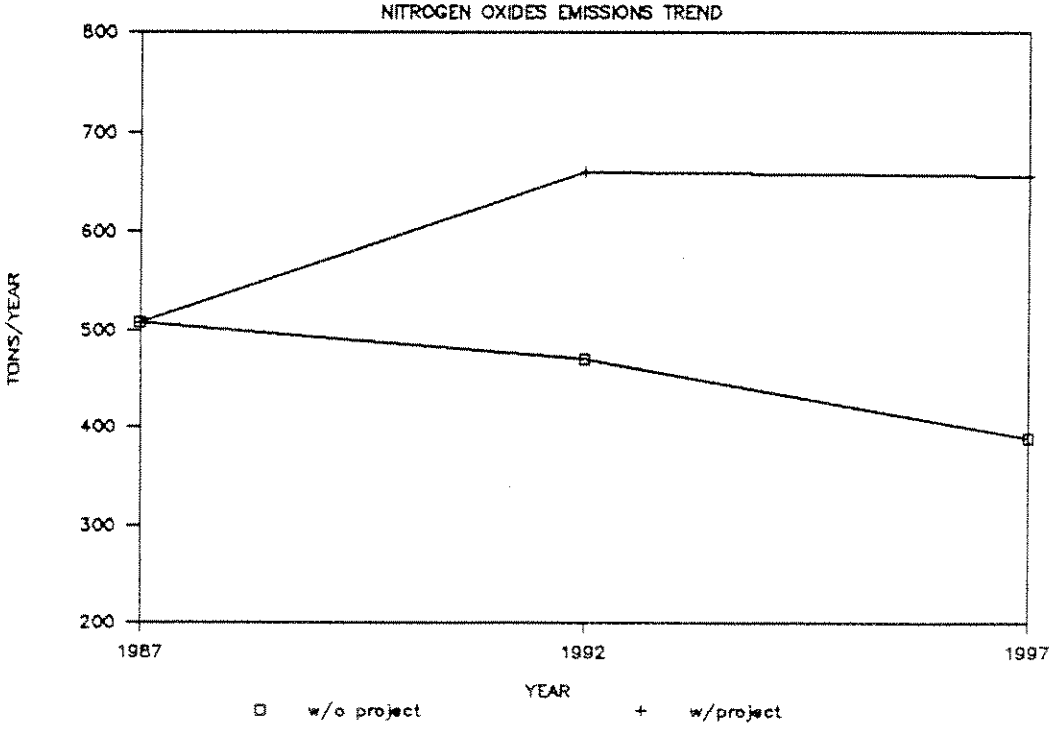


FIGURE 10



APPENDIX A

FIGURE 11

FINAL REPORT

METEOROLOGICAL DATA FOR HAWAII RIVIERA RESORT

by

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AUG 3 1987

This is the final report on meteorological data collected between May 14 to July 21, 1987 for the Hawaiian Riviera Resort project on the Big Island of Hawaii.
The South Point area of the Big Island is shown in Fig. 1. The project area, shown in Fig. 2, is outlined in Fig. 1 which also gives the location of two neighboring wind sites referred to in this report. the National Weather Service (NWS) site at South Point and a site in South Kona manned by a NWS cooperative observer. Two sites in the project area (Fig. 2) called AIRPORT and BEACH, were instrumented with 36 ft meteorological towers for sampling wind speed and direction. At the BEACH site solar radiation was also measured.

Instrumentation.

Wind speed: Maximum #40 anemometers with signal conditioning. The anemometers were wind tunnel calibrated prior to installation. The readings should be accurate to within 0.2 mile per hour (mph).

Wind direction: NRG #200 potentiometer vanes. Vane orientations were checked on several occasions and directions should be accurate to within five degrees. All directions given in this report are true north.

Solar radiation: Licor Li200S Silicon Pyranometer. This instrument measures radiation flux between 0.4 and 1.1 microns. The data are given in watts/square meter (W/m2). The sensor was calibrated against Hawaii's standard prior to installation and should be accurate to within 10 %.

Recording: Campbell Research Inc CR-21 data loggers and cassette recorders. These fourteen bit digital devices are much more precise and accurate than the instruments and their drift negligible. Power to the system was supplied by rechargeable 6 and 12 volt batteries. Data were sampled every ten seconds by the logger which, for every hour, recorded: day, time, mean wind speed, wind speed standard deviation, maximum wind speed, last direction reading and, for the solar sensor, hourly mean flux.
Two months of data were to be collected at each site beginning mid May this year. At the last tape pick up on July 14, 1987 we found that vandals had destroyed the BEACH site tower and only seven instead of eight weeks of data could be collected at this site. To compensate for the lost

of one week of data at the BEACH site an additional week was sampled at the AIRPORT site. This site is operational but will be taken down if continued monitoring is not desired.

Data presentation.

Plots of all the hourly data were given in three preliminary reports submitted earlier.

Tables: One year's summary from the South Point NWS site, which is used for long term comparison, is given in Table 1 as percentages in sixteen direction and ten speed classes. Direction percentage totals do not necessarily add up to 100% because of round off errors. Table 2 presents, in the same format, data from this site for the ten weeks the AIRPORT site operated (May 14 to July 21, 1987). The AIRPORT site data for this period are listed in Table 3. Table 4 contains NWS South Point data for the seven weeks the BEACH site ran (May 14 to July 2, 1987) and Table 5 the corresponding data from the BEACH site. Table 6 lists, using slightly different speed classes, one year of data from the South Kona site.

Figures: The AIRPORT directional data are plotted in Fig. 3 by ten degree sectors and the BEACH data in Fig. 4. Directions from NWS South Point site for the project period are shown in Fig. 5 and, for the year used for comparison (May 1985 to May 1986), in Fig. 6.

Discussion of results.

A major question in short term collection of weather data is whether the sample is representative of long term conditions. To answer this question, period data from the NWS South Point site - Table 2 and Fig. 5 - were compared with one year of data from the site - Table 1 and Fig. 6. This comparison showed that easterly winds were considerably under represented during the survey period - only 4.6% as compared with 25% during the year used.
To see if this is mainly a seasonal effect, wind data from the same period in 1985 as that of the project are plotted in Fig. 7. The figure shows this not to be the case as the period in 1985 had the about same fraction of easterly wind as the whole year.
In order to investigate what the winds were at the AIRPORT site during the 4.6% of easterlies at the NWS site, Fig. 8 and Fig. 10 were constructed. Fig. 8 shows that, during the 35 hours NWS had winds between 90 and 100 deg. half of the time the AIRPORT experienced winds from about the same direction and winds from SW - W during the other half. During the 29 hours the NWS site had wind between 90 and 100 deg. the AIRPORT reported mainly SW directions (Fig. 10). Thus, for long term conditions, it seems that easterly winds at the AIRPORT site (Table 3) should be increased by some 5% and SW - W winds by some 15 % reflecting a 20% deficiency of easterly winds during the sampling period.

Continued operation of the site is recommended to verify this adjustment.

One of the purposes of the data collection was to recommend a runway orientation at the AIRPORT site. If e.g. a runway was oriented between 60 and 70 deg then 71.2% of the time winds would be within +/- 35 deg of the runway (Table 3). If above recommended adjustment is included the percentage might rise to 75%. In this case the runway should have a more easterly orientation may be between 70 and 80 degrees.

Another purpose of the study was to characterize the wind conditions from a resort development point of view. The South Point area is known for its strong winds and a major wind power project is situated there. This wind maximum is caused by trade wind streamlines compacting as the airflow is forced south to pass the Big Island. In lee of the islands, trades decrease in intensity and directions become more diverse as shown in Tables 2 through 5 and Figs. 3 to 5. The AIRPORT had a survey mean wind speed of 14.8 mph but would, in the long run, probably have lower wind as the NWS South point site had 2.5 mph higher survey winds (Table 2) that normal (Table 1). The BEACH site had a relatively uniform direction distributions with an even lower survey mean speed of 11 mph. Long term conditions would probably see one to two mph lower speeds.

The two measurement sites were both close to the ocean. Further east toward the mountains wind speeds should decrease as demonstrated by the wind summary from South Kona in Table 6. It therefore seems that strong winds will not a problem for the proposed development.

The mean diurnal solar radiation flux is plotted in Fig. 9. This figure, which also includes maximum radiation representative of cloud less conditions, shows the middays buildup of the characteristic cloud band along the SW shores of the Big Island. While morning hours are relatively clear, a cloud cover will shield against the hot sun from about 10 am most of the time. This cloud cover will persist until sunset.

TABLES

PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED

Location: NWS SOUTH POINT SITE ANNUAL SUMMARY
Period of Summary: APRIL 1985 to APRIL 1986
Elevation: 188m MSL Instrument Height: 10m AGL

SPEED-mph / DIRECTION	1-3	4-7	8-12	13-18	19-24	25-31	32-38	39-46	47-54	>54	Percent	MEAN WIND SPEED
N	0.3	0.9	0.4	0.1	0.0	---	---	---	---	---	1.8	6.5
NNE	0.2	1.5	2.3	0.0	0.2	0.0	0.0	---	---	---	4.2	8.5
NE	0.2	1.9	9.9	1.0	0.1	0.0	---	---	---	---	13.9	9.9
ENE	0.1	1.3	6.6	18.3	12.8	3.4	0.2	---	---	0.0	41.9	17.1
E	0.1	0.4	2.7	9.9	9.4	2.4	0.1	---	0.0	---	25.0	18.1
ESE	0.0	0.4	0.8	0.6	0.0	---	---	---	---	---	1.8	10.6
SE	0.1	0.2	0.3	0.0	---	---	---	---	---	---	0.6	7.3
SSE	0.0	0.1	0.1	---	---	---	---	---	---	---	0.3	6.6
S	0.0	0.1	0.0	---	---	---	---	---	---	---	0.2	6.2
SSW	0.1	0.2	0.1	---	---	---	---	---	---	---	0.4	5.8
SW	0.0	0.2	0.1	---	---	---	---	---	---	---	0.3	6.1
WSW	0.2	0.5	0.3	0.0	0.0	---	---	---	---	---	0.9	6.5
W	0.1	0.6	0.4	0.1	0.0	---	---	---	---	---	1.2	7.4
WNW	0.1	0.5	1.1	1.5	0.6	0.1	---	---	---	---	3.9	13.6
NW	0.1	0.8	0.7	0.2	0.1	0.1	---	---	---	---	1.9	9.7
NNW	0.2	0.8	0.2	---	---	---	---	---	---	---	1.2	5.2
VARIABLE	---	---	---	---	---	---	---	---	---	---	*	---
CALM	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.8	-----
	1.8	10.7	26.1	32.6	27.4	6.8	0.3	0.0	0.0	0.0	100.0	14.8

Total Number of Hourly Data: 8302

* Winds with unknown direction were not used to compute direction frequency

Table 1. Percent frequency of wind directions and speed at NWS South Point site between April 1985 and April 1986.

PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED

Station: NWS SOUTH POINT SITE — SURVEY SUMMARY
Period of Summary: MAY 14 TO JULY 21, 1987
Elevation: 18M MSL Instrument Height: 10m AGL

SPEED-mph / DIRECTION	1-3	4-7	8-12	13-18	19-24	25-31	32-38	39-46	47-54	>54	Percent	MEAN WIND SPEED
N	0.3	1.0	0.7	---	---	---	---	---	---	---	2.7	6.3
NNE	0.1	1.0	3.6	0.3	---	---	---	---	---	---	4.9	8.7
NE	0.1	0.9	4.7	13.7	6.9	0.8	---	---	---	---	27.2	16.0
ENE	---	0.8	1.6	16.3	25.2	9.9	0.8	---	---	---	54.6	20.8
E	---	0.3	1.6	2.3	0.4	0.1	---	---	---	---	4.6	13.0
ESE	0.1	0.2	0.9	0.2	---	---	---	---	---	---	1.4	8.0
SE	---	0.1	0.5	---	---	---	---	---	---	---	0.5	9.5
SSE	---	0.3	0.2	0.1	---	---	---	---	---	---	0.7	8.6
S	---	---	0.1	---	---	---	---	---	---	---	0.1	9.2
SSW	---	0.2	0.3	---	---	---	---	---	---	---	0.5	7.2
SW	0.1	0.1	0.2	---	---	---	---	---	---	---	0.5	6.2
WSW	0.1	0.3	0.5	---	---	---	---	---	---	---	0.8	7.4
W	---	0.2	0.1	0.1	---	---	---	---	---	---	0.3	8.1
WNW	0.1	---	---	---	---	---	---	---	---	---	0.1	3.4
NW	0.2	0.3	0.2	---	---	---	---	---	---	---	0.7	5.9
NNW	0.3	0.2	---	---	---	---	---	---	---	---	0.5	3.8
UNKNOWN	---	---	---	---	---	---	---	---	---	---	*	----
CALM	----	----	----	----	----	----	----	----	----	----	0.1	----
	1.3	6.6	15.1	53.8	32.5	10.7	0.8	0.0	0.0	0.0	100.0	17.3

Total Number of Hourly Data: 1552

* winds with unknown direction were not used to compute direction frequency

Table 1. Percent frequency of wind direction and speed at NWS South Point site during the 1987 survey.

PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED

Station: AIRPORT SITE - RIVIERA PROJECT — SURVEY SUMMARY
Period of Summary: MAY 14 to JULY 21, 1987
Elevation: 3m MSL Instrument Height: 10m AGL

SPEED-mph / DIRECTION	1-3	4-7	8-12	13-18	19-24	25-31	32-38	39-46	47-54	>54	Percent	MEAN WIND SPEED
N	---	0.9	1.5	0.5	0.1	---	---	---	---	---	3.0	9.7
NNE	---	1.6	2.7	1.7	0.3	0.1	---	---	---	---	6.4	11.1
NE	---	1.6	6.6	10.6	6.3	0.9	---	---	---	---	25.9	15.3
ENE	---	2.6	6.6	12.5	9.2	1.6	---	---	---	---	32.4	15.8
E	---	1.1	2.7	4.9	3.0	0.2	---	---	---	---	12.0	15.1
ESE	---	0.5	1.0	0.8	0.1	---	---	---	---	---	2.5	10.9
SE	--	0.4	0.6	0.5	0.1	---	---	---	---	---	1.6	11.4
SSE	---	0.4	0.5	1.0	0.1	---	---	---	---	---	1.9	12.0
S	---	0.4	0.8	0.3	--	---	---	---	---	---	1.5	10.0
SSW	---	0.8	1.1	0.2	---	---	---	---	---	---	2.2	8.3
SW	--	0.4	2.2	1.6	0.2	---	---	---	---	---	4.4	12.0
WSW	---	0.5	0.9	0.8	0.1	---	---	---	---	---	2.3	11.1
W	--	0.6	0.2	0.1	0.1	---	---	---	---	---	0.9	8.4
WNW	---	0.5	0.3	0.2	0.1	---	---	---	---	---	1.0	9.5
NW	--	0.7	0.6	---	--	--	---	---	---	---	1.3	7.7
NNW	---	0.7	0.2	0.1	---	---	---	---	---	---	1.0	6.7
UNKNOWN	---	---	---	---	---	---	---	---	---	---	*	----
CALM	----	----	----	----	----	----	----	----	----	----	0.0	----
	0.0	17.4	39.5	35.7	14.6	2.7	0.0	0.0	0.0	0.0	100.0	14.0

Total Number of Hourly Data: 1673

winds with unknown direction were not used to compute direction frequency

Table 2. Percent frequency of wind direction and speed at the Airport site of the Riviera project.

PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED

Station: NWS SOUTH POINT SITE — SURVEY SUMMARY
Period of Summary: MAY 14 TO JULY 2, 1987
Elevation: 18m MSL Instrument Height: 10m AGL

SPEED-mph / DIRECTION	1-3	4-7	8-12	13-18	19-24	25-31	32-38	39-46	47-54	>54	Percent	MEAN WIND SPEED
N	0.4	2.3	1.0	---	---	---	---	---	---	---	3.7	6.3
NNE	0.1	1.1	3.9	0.1	---	---	---	---	---	---	5.1	8.4
NE	0.2	0.7	4.6	13.9	6.5	0.9	---	---	---	---	26.8	15.9
ENE	---	0.8	1.4	15.0	31.4	18.4	1.1	---	---	---	58.1	21.0
E	---	0.5	1.0	3.0	0.4	0.1	---	---	---	---	5.0	13.7
ESE	0.2	0.3	1.3	0.3	---	---	---	---	---	---	2.0	8.8
SE	---	0.1	0.6	---	---	---	---	---	---	---	0.7	9.5
SSE	---	0.5	0.3	0.2	---	---	---	---	---	---	0.9	8.6
S	---	---	0.1	---	---	---	---	---	---	---	0.1	9.2
SSW	---	0.3	0.4	---	---	---	---	---	---	---	0.6	7.2
SW	0.2	0.2	0.3	---	---	---	---	---	---	---	0.6	6.2
WSW	0.1	0.4	0.7	---	---	---	---	---	---	---	1.2	7.4
W	---	0.3	0.1	0.1	---	---	---	---	---	---	0.5	8.1
WNW	0.1	---	---	---	---	---	---	---	---	---	0.1	3.4
NW	0.3	0.4	0.3	---	---	---	---	---	---	---	0.9	5.9
NNW	0.4	0.3	---	---	---	---	---	---	---	---	0.6	3.8
UNKNOWN	---	---	---	---	---	---	---	---	---	---	*	----
CALM	---	---	---	---	---	---	---	---	---	---	0.1	----
	1.8	8.8	16.7	32.5	38.3	11.4	1.1	0.0	0.0	0.0	100.0	16.9
										Total Number of Hourly Data:		1888

* Winds with unknown direction were not used to compute direction frequency

Table 4. Percent frequency of wind direction and speed at NWS South Point site during the 1987 survey.

PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED

Station: BEACH SITE - RIVIERA PROJECT — SURVEY SUMMARY
Period of Summary: MAY 14 to JULY 2, 1987
Elevation: 3m MSL Instrument Height: 10m AGL

SPEED-mph / DIRECTION	1-3	4-7	8-12	13-18	19-24	25-31	32-38	39-46	47-54	>54	Percent	MEAN WIND SPEED
N	0.2	1.4	3.8	1.5	0.3	---	---	---	---	---	6.3	10.6
NNE	0.6	1.4	1.7	1.3	0.8	0.1	---	---	---	---	5.8	11.3
NE	0.5	1.9	3.8	4.3	3.8	1.8	---	---	---	---	13.7	14.5
ENE	0.5	1.5	4.2	4.2	3.6	1.1	---	---	---	---	16.1	14.8
E	0.7	2.5	2.2	2.2	0.8	0.5	---	---	---	---	8.8	11.2
ESE	0.7	2.4	1.5	0.7	0.1	---	---	---	---	---	5.3	7.5
SE	0.3	2.9	0.7	0.4	0.1	---	---	---	---	---	4.4	7.5
SSE	0.4	1.9	1.8	0.9	0.9	---	---	---	---	---	6.8	10.3
S	0.4	1.7	2.1	1.6	1.2	---	---	---	---	---	7.8	11.7
SSW	0.6	1.4	0.8	1.3	0.5	---	---	---	---	---	4.5	10.3
SW	0.1	0.8	0.8	0.3	---	---	---	---	---	---	1.9	8.6
WSW	1.1	0.9	1.9	0.8	---	---	---	---	---	---	4.7	8.3
W	0.2	1.6	3.2	1.7	---	---	---	---	---	---	6.7	9.9
WNW	0.3	1.0	1.5	0.3	---	---	---	---	---	---	3.0	8.3
NW	0.6	0.7	0.2	---	---	---	---	---	---	---	1.9	5.7
NNW	1.0	1.0	1.2	0.3	0.2	---	---	---	---	---	3.7	7.4
UNKNOWN	---	---	---	---	---	---	---	---	---	---	*	----
CALM	---	---	---	---	---	---	---	---	---	---	0.8	----
	8.1	25.7	38.4	31.2	11.3	2.7	0.8	0.8	0.8	0.8	100.0	11.8
										Total Number of Hourly Data:		1182

* Winds with unknown direction were not used to compute direction frequency

Table 5. Percent frequency of wind direction and speed at the Beach site of the Riviera project.

PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED

Station: SOUTH KONA NWS COOP, OBS. ANNUAL SUMMARY
Period of Summary: JANUARY 1988 to DECEMBER 1988
Elevation: 988m MSL Instrument Height: 6m AGL

SPEED-knots / DIRECTION	1-5	6-10	11-15	16-20	21-24	25-31	32-38	39-46	47-54	>54	Percent	MEAN WIND SPEED
N	8.5	---	---	---	---	---	---	---	---	---	8.5	---
NNE	1.4	---	---	---	---	---	---	---	---	---	1.4	---
NE	4.5	1.2	---	---	---	---	---	---	---	---	5.7	---
ENE	17.4	6.9	1.3	0.1	---	---	---	---	---	---	25.7	---
E	8.2	4.9	0.5	---	---	---	---	---	---	---	13.6	---
ESE	2.0	0.6	---	---	---	---	---	---	---	---	2.6	---
SE	0.9	---	---	---	---	---	---	---	---	---	0.9	---
SSE	0.6	---	---	---	---	---	---	---	---	---	0.6	---
S	1.2	---	---	---	---	---	---	---	---	---	1.2	---
SSW	1.3	---	---	---	---	---	---	---	---	---	1.3	---
SW	1.8	0.4	---	---	---	---	---	---	---	---	2.2	---
WSW	2.4	0.3	---	---	---	---	---	---	---	---	2.7	---
W	2.3	0.4	---	---	---	---	---	---	---	---	2.7	---
WNW	1.7	0.3	---	---	---	---	---	---	---	---	2.0	---
NW	1.2	0.3	---	---	---	---	---	---	---	---	1.5	---
NNW	0.8	---	---	---	---	---	---	---	---	---	0.8	---
UNKNOWN	---	---	---	---	---	---	---	---	---	---	*	---
CALM	34.4										34.4	
	40.2	15.3	1.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	---
												1275

* winds with unknown direction were not used to compute direction frequency

Table 6. Percent frequency of wind direction and speed at South Kona NWS cooperative observer site 1/1988 to 12/1988. Note: different speed classes and knots instead of mph.

FIGURES

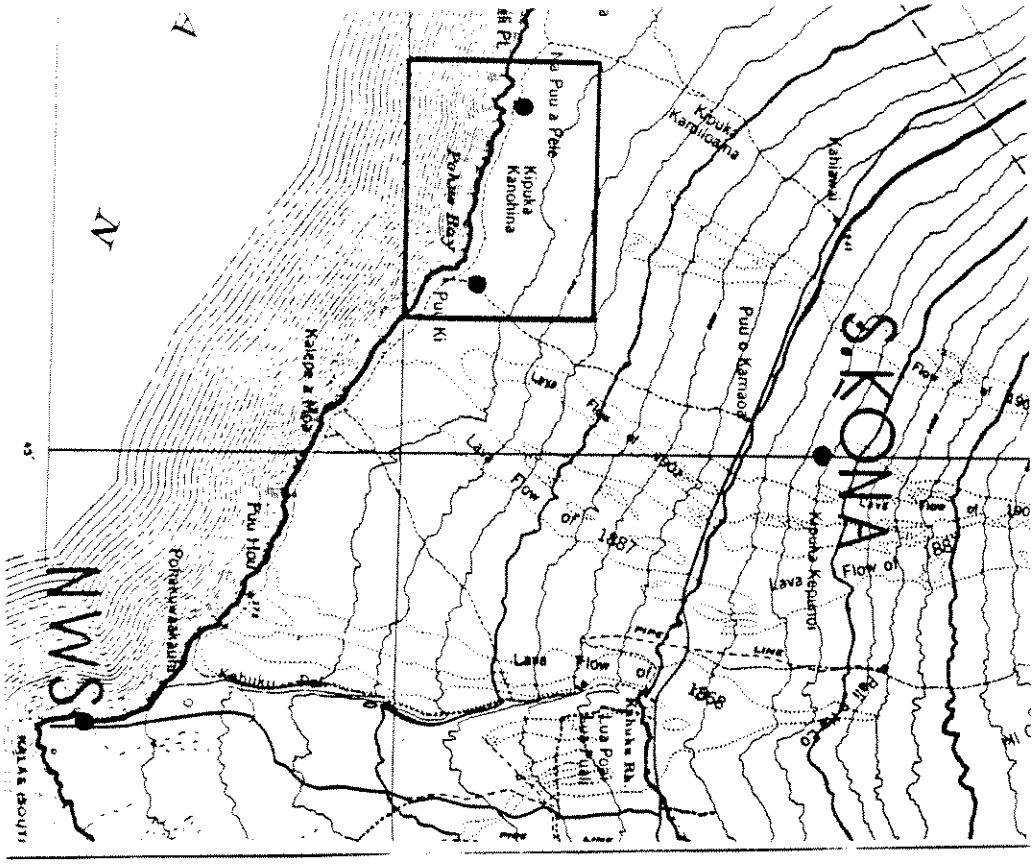

Fig. 1 The South Point area of the Big Island of Hawaii. Two wind sites and the area in Fig. 2 are shown.

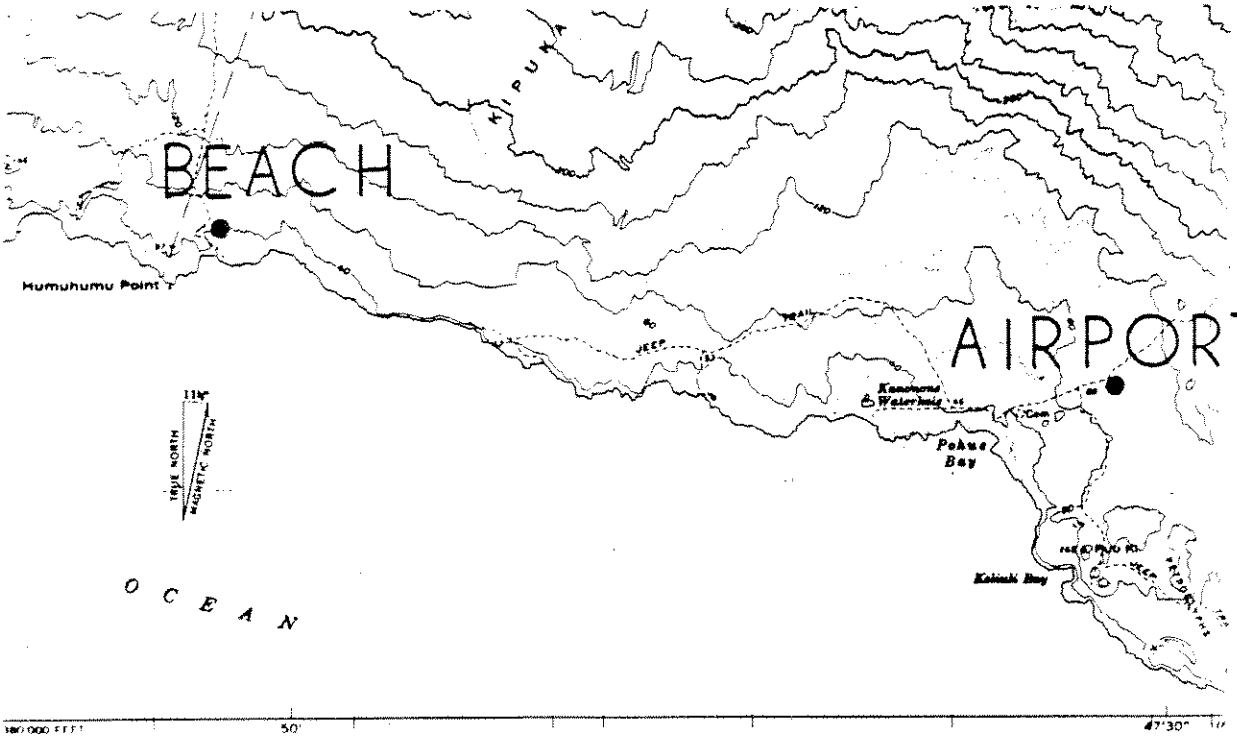

Fig. 2 Project area with the two monitoring sites used.

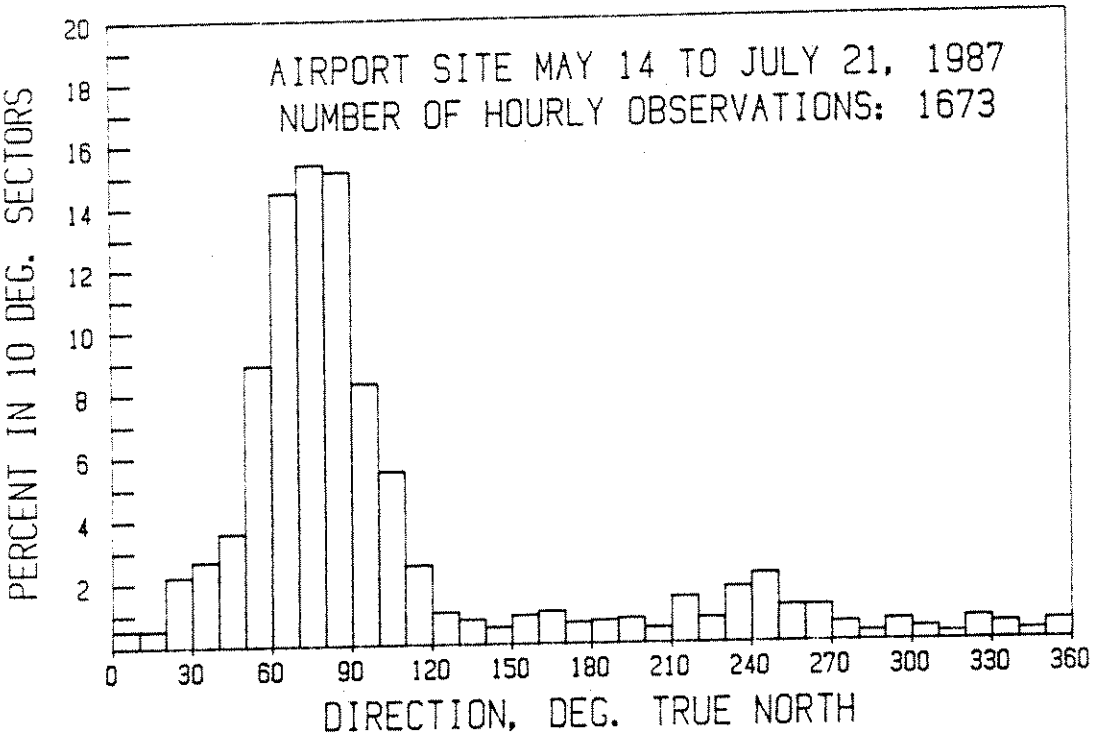

FIG. 3 DIRECTION HISTOGRAM FOR THE AIRPORT SITE

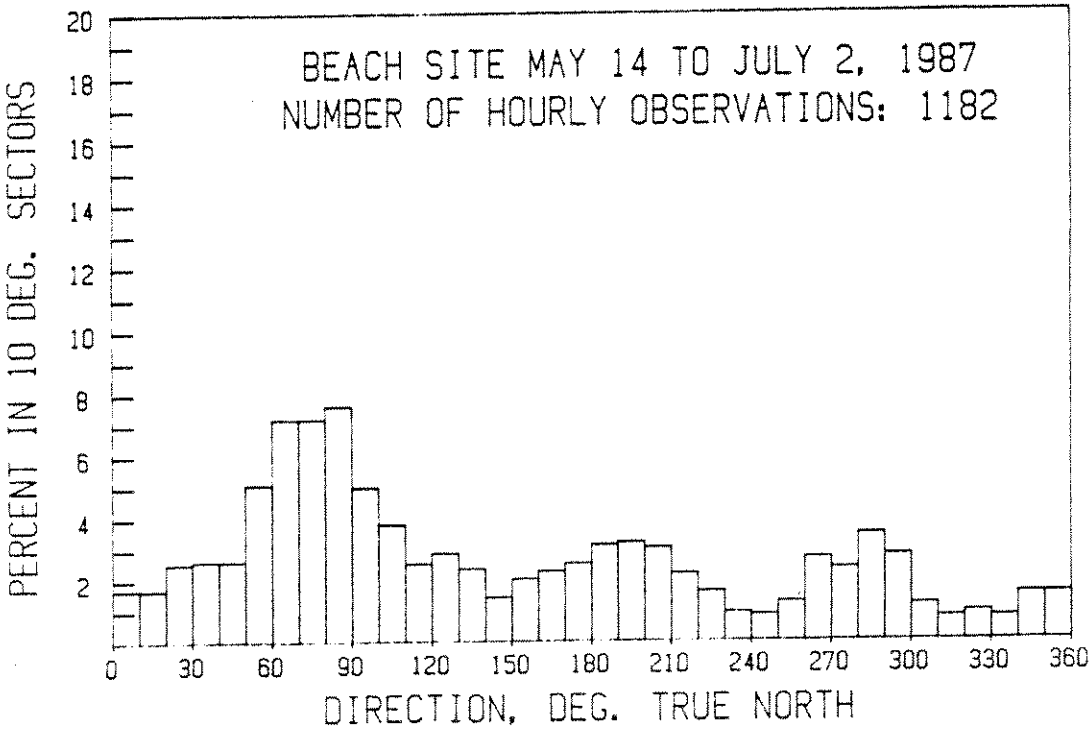

FIG. 4 DIRECTION HISTOGRAM FOR THE BEACH SITE

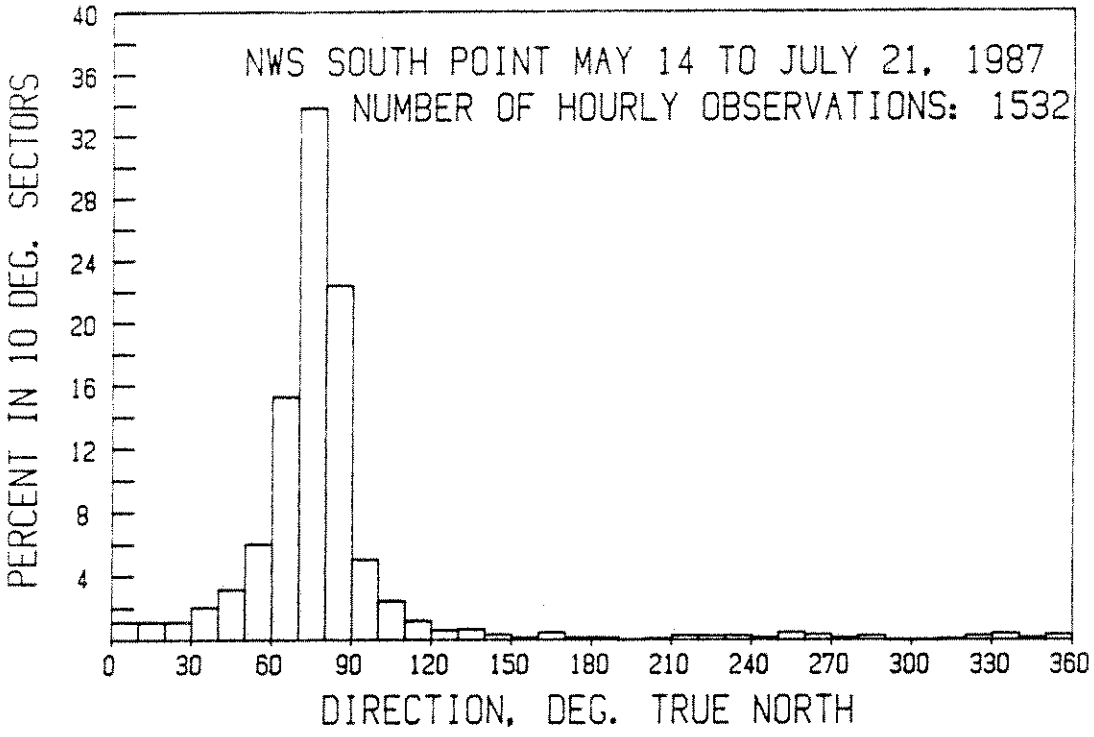

FIG. 5 DIRECTION HISTOGRAM FOR NWS SOUTH POINT SITE

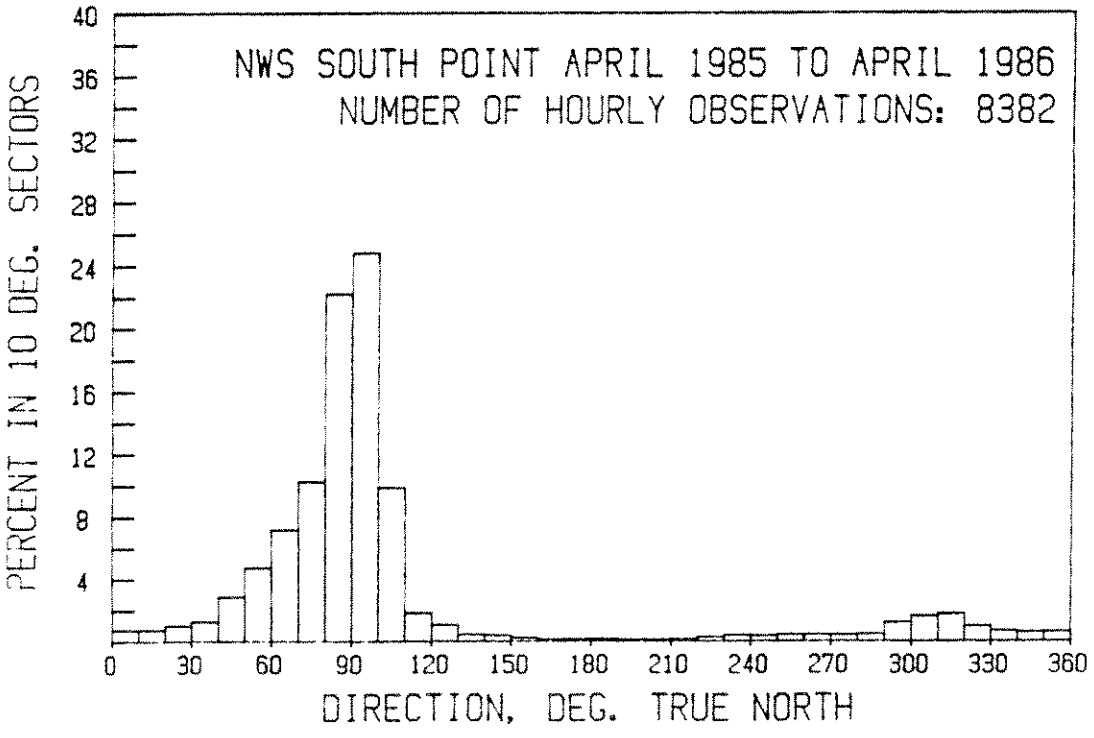

FIG. 6 ONE YEAR DIRECTION HISTOGRAM FOR NWS SOUTH POINT

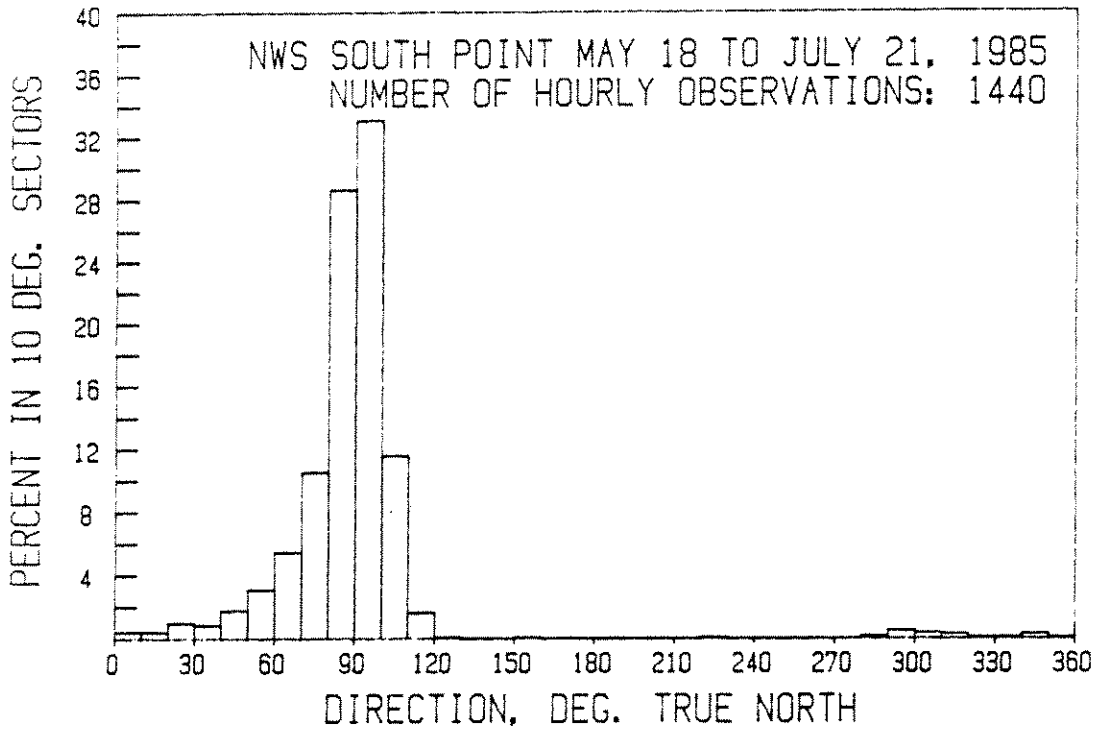

FIG. 7 MAY-JULY 1985 DIRECTION HISTOGRAM FOR NWS SOUTH POIN

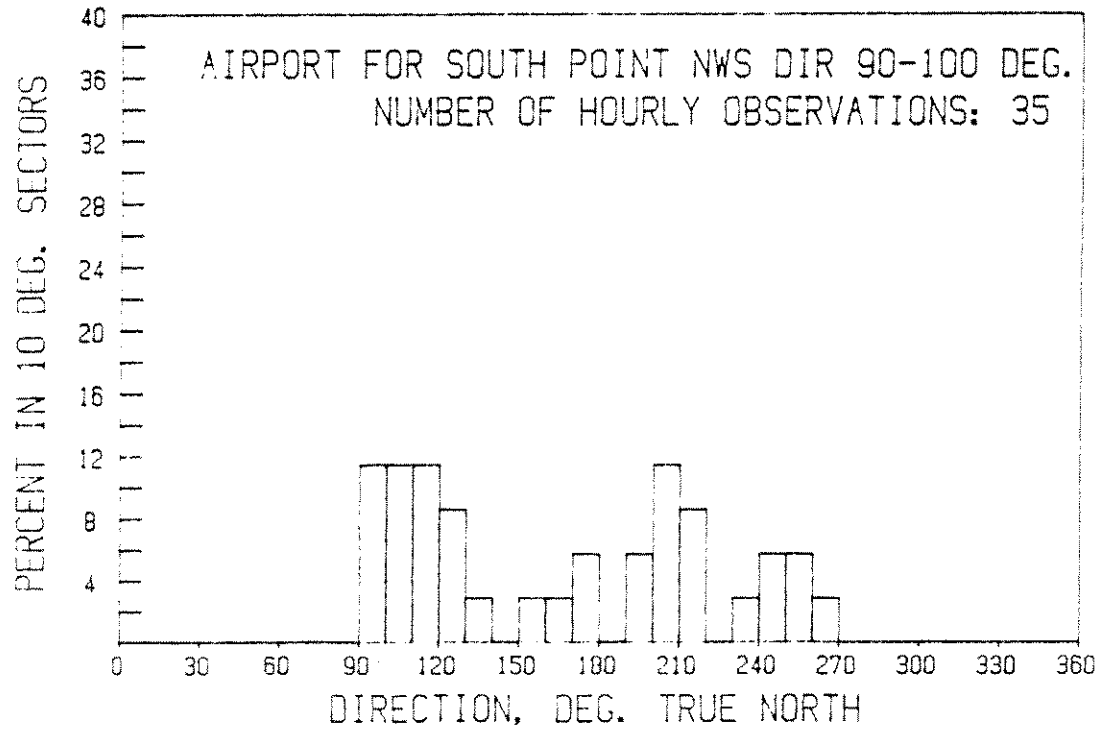

FIG. 8 AIRPORT DIRECTION HISTOGRAM FOR NWS S.P. 90-100 DEG.

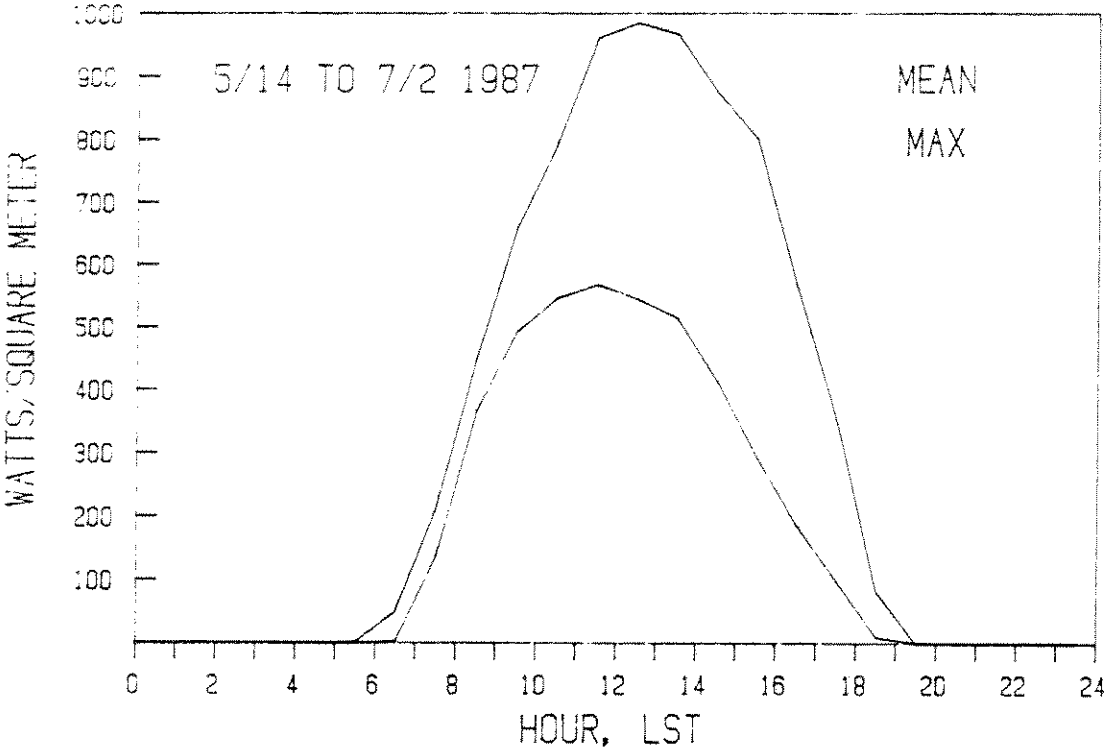

FIG. 9 DIURNAL SOLAR RADIATION AT THE BEACH SITE

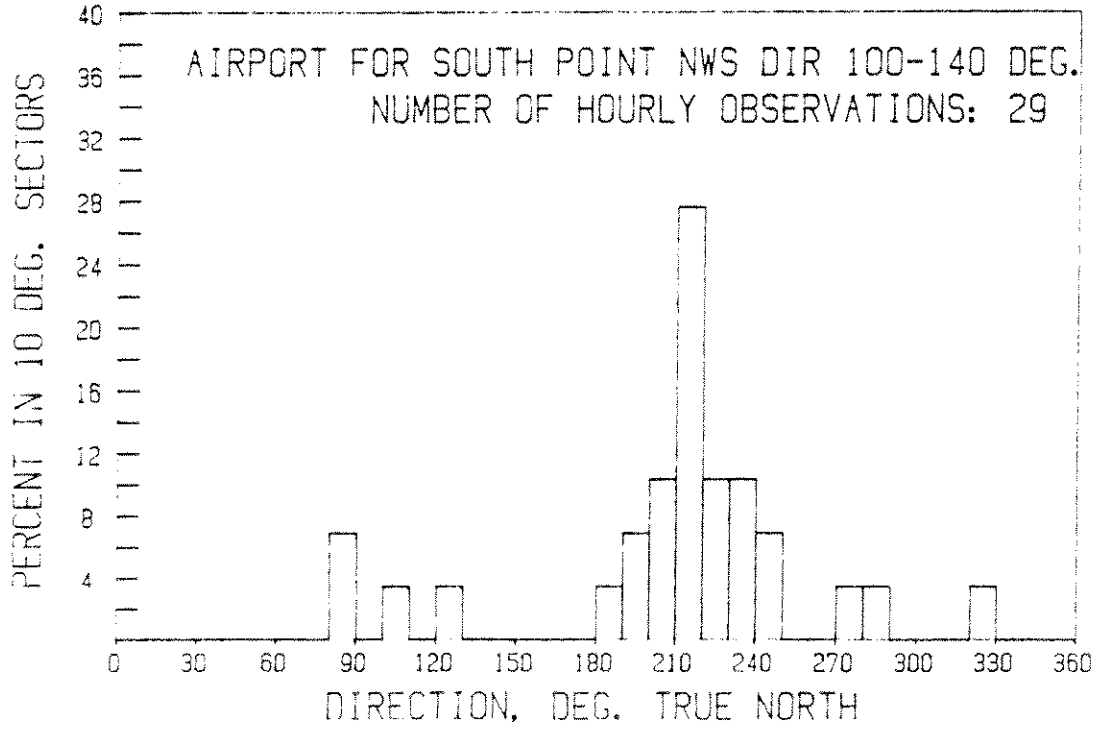

FIG. 10 AIRPORT DIRECTION HISTOGRAM FOR NWS S.P. 100-140 DE

APPENDIX B

Avifaunal and Feral Mammal Survey

AVIFAUNAL AND FERAL MAMMAL SURVEY OF HAWAIIAN RIVIERA RESORT PROPERTY AT KA'U, HAWAII

Prepared for

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By

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20 April 1987

AVIFAUNAL AND FERAL MAMMAL SURVEY OF HAWAIIAN RIVIERA RESORT PROPERTY AT KA'U, HAWAII

INTRODUCTION

The overall purpose of this report is to summarize the findings of a preliminary bird and mammal field survey conducted on the 10-12 April 1987 at Hawaiian Riviera Resort Property, Ka'u, Hawaii. References to pertinent literature as well as unpublished reports and personal communication with biologists and others familiar with the area are provided in order to give a broader view of bird and mammal activity at the site. A brief discussion of habitat preferences as determined in part by the field survey and from a number of published sources (Berger 1972, Hawaii Audubon Society 1984, Pratt et al. 1987) as well as unpublished studies conducted in similar habitat elsewhere on the island (Bruner 1986a, 1986b) is included. Finally, the report provides some suggestions as to the possible changes in the faunal communities that may occur following development along with recommendations regarding the preservation of key habitats.

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 density of each species and where possible within the constraints of the available time determine the degree and purpose to which the site is utilized by each species.

3- Compare these findings with published and unpublished data.

4- Assess the possible changes in the bird and mammal communities that might occur as a result of habitat alteration due to the proposed development.

GENERAL SITE DESCRIPTION

Two quite different sites were investigated during the field survey. The makai section of the property is comprised of barren lava flows with a few small anchialine ponds, referred to as "waterholes" on most topographic maps, and a limited margin of coastal strand vegetation. Kanonone "waterhole" is the largest of these ponds and is surrounded by a

few coconut and pandanus trees along with some India Pluchea (Pluchea indica). The mauka section of the property between 1400-2000 feet elevation contains a mixture of grassland, parkland and dryland forest. Between these two sites lies an extensive area of primarily open barren lava.

Weather during the course of the survey was warm with occasional cloudy periods and strong (15-30 mph) NE tradewinds.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. Attention was also paid to the presence of tracks and scats as indicators of bird or mammal activity. Existing trails and roads were followed and where physically possible straight line transects were made so as to maximize the amount of area censused within the time available. (see Fig.1). At intervals of 100-200m along these roads and transects eight minute counts were made of all birds seen or heard. These counts as well as observations made between count stations provide the basis from which population estimates were obtained. Walking surveys and eight

minute counts were conducted primarily in the morning and late afternoon periods when birds were most active and detectable. These data also contributed to an understanding of habitat preferences and usage of the site.

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 density and distribution.

Scientific names used herein follow those given in the recent American Ornithologist's Union Checklist (A.O.U. 1983) and Hawaii's Birds (Hawaii Audubon Society 1984).

RESULT AND DISCUSSION

Resident Endemic (Native) Birds:

Apapane (Himatione sanguinea) -
A single Apapane was observed foraging in a flowering Ohia. (Metrosideros collina) located along the western boundry of the mauka site at an elevation of approximately 1800 feet. No other sightings of this species were made on subsequent days of the survey. It is likely that this patch of forest receives

limited use by Apapane due to its relatively low elevation and isolation from other such forested areas. Suitable resources do appear, however, to be available to support a viable Apapane population if such were to become established. A probable limiting factor, however, would be the potential for mosquito borne diseases present at this elevation (van Riper et al. 1982).

Common Amakihi (Hemignathus virens) -
Amakihi were observed in small numbers (average of 2 on eight minute counts) in the mauka section of the property. They foraged among the Ohia blossoms and gleaned among the leaves. Call notes and short burst of song were helpful in locating individuals. On two occasions chasing behavior between two Amakihi was observed. The relatively low elevation of the site and its potential threat of mosquito born disease as well as its isolation appears to not be a limiting factor for this species of native forest bird. The notable abundance of Japanese White-eye (Zosterop japonicus) at this site might be a negative influence on the size of the present Amakihi population due to competition for limited resources. An instructive study could profitably be conducted in this patch of forest to examine this question.

Hawaiian Hawk ('Io) (Buteo solitarius) - On the morning of the final day of the survey (12 April) a single dark phase 'Io was seen soaring above the forest on the eastern edge of the mauka project site. The sighting of this species was not unexpected as the manager of Kahuku Ranch had earlier (10 April) mentioned that he had seen hawks occasionally around the ranch. This species is confined to the island of Hawaii and is typically more common along the Hamakua Coast and in the Kohala mountains (Hawaii Audubon Society 1984, Pratt et al. 1987).

Short-eared Owl (Pueo) (Asio flammeus sandwichensis)- Pueo are diurnal as well as nocturnal and hence are fairly easily observed. They forage over grassland and forest on all the main Hawaiian Islands (Hawaii Audubon Society 1984). One Pueo was observed on the third day of the survey (12 April) in the mauka section of the project site at an elevation of approximately 1800 feet. It was first seen sitting in a large Ohia tree and then due to intense mobbing by Japanese White-eye and Northern Cardinal (Cardinalis cardinalis) it flew off to the east in the general direction of Kahuku Ranch. This species and the introduced Barn Owl (Tyto alba) were reported to be common in the area by the manager of Kahuku Ranch.

No other native resident land birds were observed

during the survey. The coastal "waterholes" yielded no sightings of native resident waterbirds nor was there any evidence in the form of tracks or fecal droppings to indicate usage of the ponds by these birds. The small size and limited number of ponds probably precludes extensive use by resident waterbirds. It is likely though that some limited use of the ponds does occur perhaps as a resting site and for some feeding. It is highly unlikely, however, that nesting occurs at these ponds due to their small size and easy access to predators and humans. Migratory shorebirds on the other hand do utilize these ponds (see following section on migratory birds).

Species of resident native land and waterbirds which could potentially occur on the property although not seen on this survey include: 'Elepaio (Chasiempis sandwichensis), Hawaiian Goose (Nene) (Nesochen sandvicensis) Twenty four Nene were released by the State of Hawaii Fish and Wildlife Service on Kahuku Ranch property according to the ranch manager. American Coot (Fulica americana alai), Hawaiian Duck (Anas wyvilliana), Black-necked Stilt (Himantopus mexicanus knudseni) and Black-crowned Night Heron (Nycticorax nycticorax).

Migratory Indigenous (Native) Birds:

Pacific Golden Plover (Pluvialis dominica fulva) - A total of six plover were recorded over the three day field survey. This small number is not unexpected given the paucity of suitable habitat, short grass fields and tidal flats or mudflats. Johnson et al. (1981) and Bruner (1983) have shown that plover are extremely site-faithful on their wintering grounds and many establish foraging territories which they defend vigorously, hunting primarily for insects and to a lesser degree marine or fresh water invertebrates. 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. Under present habitat conditions the plover population in this area will not likely change significantly over present levels. Probably less than a dozen plover occur on the property based on the current field survey.

Wandering Tattler (Heteroscelus incanus) - A total of five tattler were recorded during the field survey. This number would be about what could be expected given the amount of suitable foraging sites. Tattler generally forage alone and prefer rocky intertidal zones where they seek small fish and

invertebrates. No studies similar to those conducted on Pacific Golden Plover by Johnson et al. (1981) and Bruner (1983) have been attempted on Tattler to see whether or not they are site-faithful or territorial on their winter foraging grounds. Some incidental observations by S. Conant (pers. comm.) in the Leeward Hawaiian islands indicate that perhaps some individuals do return to the same spots each winter. Myers et al. (1981) found that varying environmental conditions influenced site-faithfullness and territoriality in the Sanderling.

No other migratory birds were recorded during the survey. The only other species likely to occur would be the Ruddy Turnstone (Arenaria interpres) and Sanderling (Calidris alba).

Exotic (Introduced) Birds:

A total of ten species of exotic birds were observed during the field survey. Table One show the relative abundance and general habitats utilized by these species. Japanese White-eye were easily the most abundant species on the property. Gray Francolin (Francolinus pondicerianus) were noticeably less abundant than on surveys conducted along the Kona Coast (Bruner 1984a, 1984b). The lack of Kiawe (Prosopis sp.) thickets, a preferred habitat, may be

one of the reasons for the noticeable differences in relative abundance. Erckel's Francolin (Francolinus erckelii), Chuckar (Alectoris chukar), and Wild Turkey (Meleogris gallopavo) are known to occur in the area (Schwartz and Schwartz 1949, Berger 1972). Two "wild" turkey were observed foraging around the yard like barnyard fowl at the ranch manager's residence at Kahuku Ranch. Although not recorded the following exotic species could also be expected to occur on the property: Northern Mockingbird (Mimus polyglottos), Warbling Silverbill (Lonchura malabarica), and House Sparrow (Passer domesticus) the latter species was seen around the buildingsat Kahuku Ranch but not in the actual survey sites.

Feral Mammals:

Mongoose (Herpestes auropunctatus) were seen on all days of the survey. Scats were also observed. Although no trapping was conducted in order to investigate their relative abundance visual evidence would seem to indicate that they are reasonably common. No rats or mice were observed but undoubtedly do occur on the property. Feral goats and pigs are reported from this area (van Riper and van Ripper III 1982). Skeletal remains, scats and tracks confirmed their presence although no individual were observed.

Likewise no feral cats or dogs were seen. The Hawaiian Hoary Bat (Lasiurus cinereus semotus) has been reported in the area (E. Kosaka 1987). The Kahuku Ranch manager reported seeing bats on a number of occasions and even found a specimen impaled on a barbed wire fence at the ranch. Despite efforts to observe bats on two separate nights none were seen during the course of the field survey. The strong winds which prevailed during the survey may have influenced prey availability which in part may explain why no bats were observed. Our knowledge of this endangered species is limited. Long term studies into the distribution, ecology and natural history of this species are still lacking (Tomich 1974, 1986).

CONCLUSIONS AND RECOMMENDATIONS

Conclusions drawn from a three day field survey should not be viewed as definative statements but merely as an indication of general conditions. Populations may vary throughout the year due to available resources and reproductive success. Species which are migratory will quite obviously be a part of the ecological 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. Thus only long term surveys can provide the insights necessary to acquire both a broad view as well as more definative perspective of the bird and mammal populations in a particular area. However, when brief field studies are coupled with data gathered from other similar habitats the value of the conclusions drawn are significantly increased.

In terms of broad conclusions relative to bird and mammal activity on the project site the following are offered:

1- The forested upper mauka site provides essential resources for both native and exotic species of birds and mammals. The diversity of species as well as total number of individuals is greatest in this sector of the site.

2- The coastal portions of the property provide limited resources due to the scarcity of vegetation. The primary use of the anchialine ponds by birds and mammals appeared to be as sources of drinking water. Migratory birds such as Wandering Tattler and Pacific Golden Plover may also feed on invertebrates found in these ponds.

3- Kanonone Waterhole has shallow areas suitable for foraging wading birds like migratory shorebirds, stilt and night heron. It is also large enough to serve as a resting and perhaps to a limited degree a feeding site for waterbirds like Hawaiian Duck, Coot and migratory ducks.

4- Mongoose were common particularly in the upper forested sectors. The Hawaiian Hoary Bat occurs in small numbers along the southern and Kona Coast. This species nests solitarily. Many areas regarding the natural history of this species remain to be studied. Questions such as how site-faithful are local populations, as well as what habitat characteristics are likely to attract them are presently unknown. Whether bats will become more common at this site or will decrease in number as a result of changes in habitat brought about by development remains to be seen. Too little is known about the natural history of this species to accurately predict the effect the proposed development might have on this species abundance. However, the fact that the Hoary Bat occurs on developed property elsewhere on the Kona coast (Brumer 1984c) might indicate that it is not restricted from foraging in an area simply because of urbanization.

Possible Impacts of Development:

Alteration of the existing habitats will result in changes in the present bird and mammal populations. Some species such as Common Myna, House Sparrow, Zebra Dove (Geopelia striata) and Spotted Dove will very likely become more numerous. As lawns and golf courses are developed habitat for Pacific Golden Plover will also increase and this species will also occur in larger numbers on the property. It is hard to conceive of Japanese White-eye becoming more abundant but as the open lava flows are developed and landscaped new habitat will allow for an expansion of the population in this species as well. Native forest birds may not respond in so positive a manner to development. Apapane and Amakihi are more generalized in their habits than other members of their subfamily (Drepanidinae) and this may in part be a reason to their relative success where more specialized species in the taxon have become either extaille or extinct. A loss of the forested habitat or an alteration in the kind of trees in the mauka section of the property could have irrevocable results on the present populations of Apapane and Amakihi. The significance of the waterholes along the coast would appear to be related primarily to sources of drinking water which are scarce along this arid section of coastline. Resting sites and possibly limited feeding opportunities

also are provided by these waterholes. Their small size and accessibility to disturbance and predation limits their value as potential nesting sites. Mammal populations on the property may change as new habitat is created and urbanization occurs. Cats and dogs will become a more significant element in the fauna. Mongoose, rats and mice might also increase in number. As noted earlier it is difficult to project what impact development may have on the Hawaiian Hoary Bat population. Only long term monitering and censusing could potentially answer this question. Although this species occurs in native forest it also can be found in urban areas and thus may be fairly adaptable to a variety of conditions. Obviously much more work needs to be done on the life history of this species before definitive statements can be made.

Recommendations:

1- Protect the mauka forested areas of the property and where possible confine the development to presently open barren lava flows. The maintenance of this patch of native forest in as natural a state as possible will add to the beauty of the entire project. Well designed footpaths

could provide limited access to the forest enabling residents and perhaps visitors an opportunity to view a piece of "natural Hawaii". At the same time the integrity of the habitat could be maintained for the benefit of the native flora and fauna.

2- Preserve the waterholes along the coastal section of the property so that they can continue to provide refuge and a source of water to migrants and resident waterbirds . Kenonone Waterhole is particularly important in this regard due to its larger size and more diverse array of habitats.

3- Prevent contamination of these waterholes by siltation and chemicals used on adjoining property. Such contamination would obviously reduce the value of these waterholes to the fauna that rely on them.

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20 April 1987

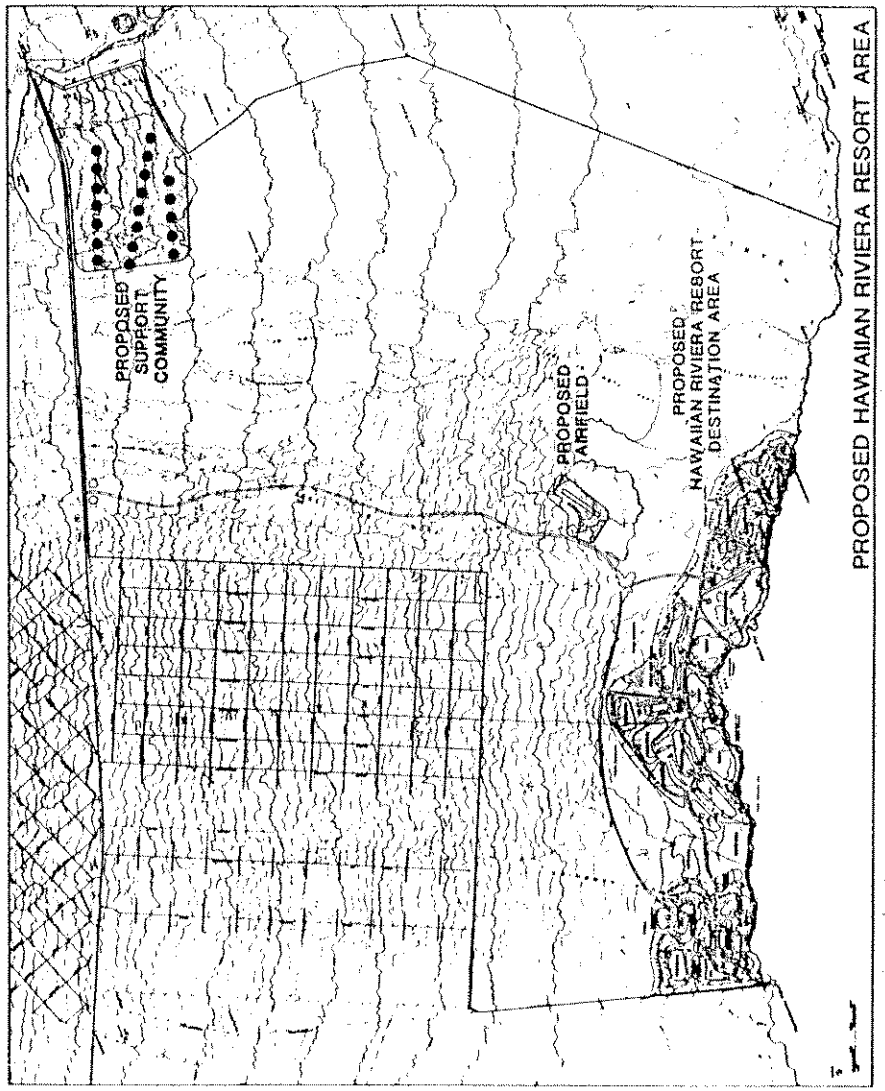

Fig. 1 Project area, Kaʻū, Hawaiʻi. ●●● = Transects

TABLE 1

Relative abundance and general habitat preferences of exotic birds at Hawaiian Riviera Resort Property, Ka'u, Hawaii.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*	HABITAT*
Gray Francolin	Francolinus pondicerianus	U = 2	P,B
Black Francolin	Francolinus francolinus	R = 1	P,B
Spotted Dove	Streptopelia chinensis	U = 2	P
Zebra Dove	Geopelia striata	U = 3	P
Common Myna	Acridotheres tristis	U = 4	P,B
Japanese White-eye	Zosterops japonicus	A = 41	B,P
Northern Cardinal	Cardinalis cardinalis	C = 6	B
Eurasian Skylark	Alauda arvensis	U = 3	G
House Finch	Carpodacus mexicanus	U = 2	P
Nutmeg Mannikin	Lonchura punctulata	A = 12	P,B

* (See page 19 for key to symbols)

KEY TO TABLE 1

RELATIVE ABUNDANCE = Number of times observed during walking survey or frequency on eight-minute counts in appropriate habitat.

A = Abundant (ave. 10+) (Number which follows is an average of all survey days)

C = Common (ave. 5-10) " "

U = Uncommon (ave. less than 5) " "

R = Rare (Recorded only once during survey)

HABITAT = Area most frequented. Order of most preferred or utilized begins at left.

G = Grassland

P = Parkland (grass and scattered Ohia trees)

B = Brushy/forested ravines

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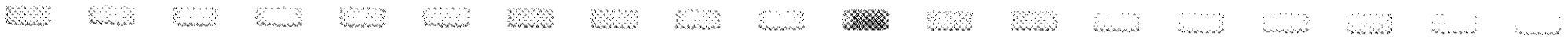
APPENDIX C

Baseline Assessment of the Marine and Anchialine Pond Environments



BASELINE ASSESSMENT OF THE MARINE AND ANCHIALINE POND ENVIRONMENTS IN THE VICINITY OF THE HAWAIIAN RIVIERA RESORT, KA'U, HAWAII

PREPARED FOR

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JULY 1987

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FINAL REPORT

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INTRODUCTION

The Palace Development Corporation and the Hawaii Ka'u Aina Partnership are in the planning stages of a joint development known as the Hawaiian Riviera Resort. The proposed project, located within the Ka'u Judicial District approximately 7 miles from Ka Lae (South Point), consists of extensive visitor destination areas based around the Hawaiian Palace Resort on the northern portion of the property, and the Hawaii Ka'u Aina Resort located on the southern sector. In addition, a support community and regional airport will be integral with the resort development. The combined resort area is situated on 2,300 acres along approximately 4.5 miles of coastline, extending southeast from Humuhumu Point to an area just east of Kahakahakea Point, and northeast to approximately the 200-foot elevation contour (see Figure 1).

A central focal point of the resorts will be the shoreline and natural attributes of the Pacific Ocean. Coral reefs and other marine environments are often some of the most valuable aesthetic and recreational features of coastal tropical and subtropical resort communities. In addition, brackish water pools separated from direct contact with the ocean, termed "anchialine ponds," that occur on the Hawaiian Riviera property constitute unique coastal features in Hawaii that are inhabited by rare organisms. The importance of these aquatic environments requires careful evaluation regarding the potential for

degradation that might arise during construction, and the ensuing operation, of coastal resort developments.

In April and May 1987, a comprehensive baseline survey was conducted to characterize the marine environment offshore of the entire 4.5 miles of shoreline bordering the proposed Hawaiian Riviera Resort. Thirteen water chemistry stations, and 11 reef survey stations were established in a manner that can serve as permanent benchmark stations for future monitoring programs (see Figure 1). In addition, 20 anchialine ponds that occur on the property were identified and surveyed. Aspects of the environments that were investigated include the physiographic structure, water chemisty, biotic community structure, degree of natural environmental stress, and current human-induced stress. Based on these findings it was possible to assess the potential for impacts to the aquatic environments that might result if resort development proceeds, and also to evaluate the potential that the marine environment affords in terms of recreational features.

OBJECTIVES

Environmental data can serve to identify areas that may be particularly susceptible to man-induced stresses, or conversely, particularly resistant to such stresses. Comparison of the magnitude of natural environmental impacts to anticipated anthropogenic (man-induced) stresses can serve to put into perspective the ultimate effects of the activities of man. With these considerations in mind, the overall purpose of this report

is to present a descriptive and quantitative picture of the marine environment and associated biotic communities, and to evaluate the effects that the planned Hawaiian Riviera Resort will have on this environment.

A specific objective of the baseline assessment is to gather information that describes the natural physico-chemical structure of the aquatic systems. Because shoreline modification such as marina construction, and activities such as golf course irrigation and fertilization, present potential for alteration of natural chemical parameters, establishment of such a baseline is important. Chemical data corresponding to the specific criteria set forth in the State of Hawaii, Department of Health, Water Quality Standards (Chapter 54 of Title 11) have been used, in part, to establish the physico-chemical baseline.

Another objective of the environmental assessment is to establish quantitative baseline information to accurately depict the community structure of the indigenous populations inhabiting the marine and pond environments. Marine community structure can be defined as the abundance, diversity, and distribution of stony and soft corals; other attached benthic fauna and flora such as algae and sponges; motile benthos such as echinoderms, molluscs, and crustacea; and pelagic species such as reef fish and sea turtles. This information will serve to identify any living marine resources that may be of significant commercial or recreational value, or that represent rare or unique ecological features that may be especially susceptible to human-induced stress.

The emphasis of this report is not, however, directed at an

extensive compilation of lists of organisms inhabiting the area or extensive tabulation of chemical measurements, as is often the case with environmental assessments. Rather, emphasis is placed on characterizing the aquatic environments as integrated communities under the influence of specific physio-chemical processes. Describing the cause and effect relationship of these processes in shaping biotic community structure is the major intent of the survey.

With these ideas in mind, permanent baseline stations or "benchmarks" were established in order to allow monitoring of the same stations in the future. This provision is in accordance with the aforementioned State of Hawaii "Water Quality Standards", which specify that permanent benchmark stations be established for monitoring of marine biological communities. Water quality standards shall be deemed met if time-series surveys of benchmark stations indicate no relative changes in the relevant biological communities, as noted by biological community indicator organisms which may be applicable to the specific site.

In the context of time-series surveys, the most useful biological assemblages for direct evaluation of environmental impacts to the offshore marine environment are benthic (bottom-dwelling) communities. Because benthos are generally long-lived, immobile, and intimately affected by exogenous input of sediments and other potential pollutants, these organisms must either tolerate the surrounding conditions within the limits of adaptability or die. As members of the benthos, stony corals are of particular importance in nearshore Hawaiian environments.

Corals contribute a large portion of the reef biomass and their skeletal structures are vital in providing a complex of habitat space, shelter, and food for other species. Since corals serve in such a keystone function, coral community structure is considered the most "relevant" group in the use of reef community structure as a means of evaluating past and potential impacts associated with land development. For this reason, and because alterations in coral communities are easy to identify, observable change in coral population parameters is a practical and direct method for obtaining the information that is required to meet existing environmental regulations.

In addition, because they comprise a very visible component of the nearshore environment, detailed investigations of reef fish assemblages are presented.

METHODS

Water Quality

Water quality was evaluated at 13 stations offshore of the development (see Fig. 1). Stations 12 and 13 served as offshore control stations located approximately 0.5 miles from the shoreline. The other 11 stations were located on the reef terrace which extended from the shoreline for a distance of approximately 100 to 200 feet offshore in water depths ranging from 15 to 60 feet. Water quality parameters evaluated were the nine specific criteria designated for open coastal waters in S11-54-06 of the Water Quality Standards. These criteria include: total Kjeldahl nitrogen, ammonia nitrogen, nitrate + nitrite, orthophosphate

phosphorus, total phosphorus, light extinction coefficient, chlorophyll *a*, nephelometric turbidity, and nonfilterable residue. Four nonspecific criteria, dissolved oxygen, pH, salinity, and temperature were also recorded.

Water samples for nutrient analysis were taken in 125 milliliter (ml). acid-washed polyethylene bottles. These samples were filtered through glass fiber filters in the field and immediately placed on ice. Analysis for ammonium, nitrate + nitrite, and orthophosphate, were conducted using standard techniques on a Technicon autoanalyzer. Total nitrogen and phosphorus were analyzed in a similar fashion following persulfate digestion. Kjeldahl nitrogen was calculated as the difference between total nitrogen and nitrate + nitrite. All nutrient analyses were conducted by the Analytical Services Laboratory, Honolulu, Hawaii.

Water for other analyses was collected in 1 liter polyethylene bottles and kept chilled until analysis. Turbidity was determined on 60 ml subsamples fixed with HgCl to terminate biological activity, and kept refrigerated until turbidity was measured on a Turner Designs nephelometer (No. 40) and reported in nephelometric turbidity units (NTU).

Chlorophyll *a* was measured by filtering 300 ml of water through glass fiber filters; pigments were extracted and assessed fluorometrically. Non-filterable residue (NFR) was assessed gravimetrically on the residue of 1 liter of filtered water. Salinity was determined using a AGE Model 2100 laboratory salinometer with a readability of 0.0001 $^{o}/_{oo}$.

In-situ field measurements included light extinction

coefficient (Li-cor integrating quantum radiometer photometer), dissolved oxygen (YSI Model 58 meter with a readability of 0.01 milligrams per liter (mg/l), and pH (Cole-Parmer digisense millivolt meter with a readability of 0.001 pH units).

Marine Community Structure

All field work was conducted from a 26 foot boat. Several methods were employed in the collection of qualitative and quantitative data. Qualitative reconnaissance surveys covering the entire 4.5 miles of coastal area fronting the development parcel were conducted by slowly towing a diver behind the boat, and by swimming from shore throughout Pohue Bay. These surveys were useful in making relative comparisons between areas, identifying any unique or unusual biotic resources, and providing a general picture of the physiographic structure and benthic assemblages occurring throughout the region of study.

Following the preliminary survey, 11 quantitative transect sites were selected offshore of the development area (see Figure 1). All site locations were accurately determined and recorded using a hand-bearing compass and triangulation sightings of distinguishable landmarks. At each site, line transects were conducted at areas deemed representative of the community which corresponed to the three generalized major West Hawaii reef zones. Each transect is designated by the station location and the depth. For example Transect "1-20" is located at Station 1 in 20 feet of water.

Transects were 200 feet long and were oriented parallel to

the shoreline. The ends and center of each transect were permanently marked for possible future monitoring studies by pounding steel stakes into the substrate (see Plate 1). A surveying tape was laid out over the reef surface parallel to depth contours between the two end marker stakes. An aluminum quadrat frame with dimensions of one meter by two-thirds meter was sequentially placed over ten random marks on the transect tape so that the tape bisected the long axis of the frame. At each quadrat location a color photograph recorded the segment of reef area enclosed by the quadrat frame. In addition, a diver with knowledge of the taxonomy of resident species visually estimated the percent cover and occurrence of organisms and substrata types within the quadrat frame. Only macrofaunal species greater in size than approximately 2 centimeters were noted; no attempt was made to identify and enumerate cryptic species dwelling within the reef framework, or nocturnal species that inhabit the reef surface only at night.

Following the period of field work, quadrat photographs were projected onto a grid and units of bottom cover for each species and bottom type were calculated. This information was combined with the in-situ cover estimates and the combined assessment provided the data base for the benthic community structure analysis. Species diversity was calculated using the Shannon-Wiener Index, and can be equated with the equitability, or dominance, of distribution of the species occurring on each transect.

The practical advantages of photo-transects are numerous;

most species can be easily and accurately identified from transparencies, and the transparencies provide a permanent record for subsequent time-series comparisons. Also, photo-quadrat sampling is rapid and efficient with respect to time and data collected- - an important consideration under conditions where underwater time is restricted by cost, and depth.

Quantitative assessment of reef fish community structure was conducted in conjunction with the benthic surveys. As the transect tape was being laid along the bottom, all fishes observed within a band approximately six feet wide along the transect path were identified to species and enumerated. Care was taken to conduct the fish surveys so that the minimum disturbance by divers was created, ensuring the least possible dispersal of fish. Only readily visible individuals were included in the census. No attempt was made to seek out cryptic species or individuals sheltered within coral.

Anchialine Ponds

Location of all anchialine ponds was determined by walking the entire development shoreline and coastal zone. Each pond was numbered and classified according to pond type. In some instances where a group of ponds was connected, the point of division into separate ponds was somewhat arbitrary.

The length and width of each pond was measured with a tape measure, and area was calculated based on the closest geometric shape. Pond depth (to rocky bottom) was measured with a yardstick.

Several chemical parameters of pond water were measured in-situ. Dissolved oxygen was measured with a Yellow Springs Instruments Model 58 meter and polarographic probe, with a readability of 0.01 mg/l. pH was measured with a Cole-Parmer model 5985-00 meter (operated in the millivoltage (mv) mode) and a Sensorex S-200 electrode (precision - 0.3 mv or 0.006 pH units). Temperature was measured with a thermistor operating in conjunction with the pH meter. Salinity was measured with a hand-held refractometer (American Optical Corp. Model 10419) readable to 1 part per thousand. Pond water samples for nutrient analysis were collected and analyzed in a manner identical to ocean water samples.

Pond biota was assessed by inspecting each pond and noting conspicuous fauna and flora. Representative organisms of unidentified species were collected and returned to Honolulu for identification. Ponds were disturbed as little as possible during collections so any organisms that inhabit the sediment column might have been overlooked. All ponds were surveyed during daylight hours. In addition representative ponds were inspected at night to ensure that all species groups present were observed.

RESULTS AND DISCUSSION

Marine Water Chemistry

Thirteen water chemistry parameters specified by the State of Hawaii, Department of Health, Water Quality Standards

were measured at the surface and a depth of 10 feet at each of the 13 stations (see Table 1). In order to compare water chemisty parameters measured in the present survey to state standards, DOH specific criteria are presented in Table 2.

Results of water chemistry analyses indicate that the offshore waters represent pristine ocean waters typical of the west coast of Hawaii. At all nearshore stations surface salinity is decreased relative to the subsurface sample, while nitrate shows the opposite trend. These patterns indicate a nearshore influence from groundwater extrusion which forms a surface lens that is typical of the West Hawaii region. Ammonia, phosphate, and total phosphorus show slightly greater concentrations in the surface relative to deep samples, which is consistent with the slight increase in these species in groundwater relative to ocean water. Kjeldahl nitrogen shows no such pattern and is relatively consistent in concentration through the water column. Likewise Kjeldahl nitrogen at the inshore stations (1 to 11) is similar to the ocean control stations (12 and 13), while nitrate + nitrite, phosphate and ammonium concentrations throughout the entire water column at the inshore stations are elevated in comparison to the ocean controls.

All other water quality parameters show no indication of influence from land or groundwater efflux.Parameters which indicate degree of water clarity (light extinction, chlorophyll *a*, and non-filterable residue) indicate lack of particulate matter throughout the water column at all nearshore and control stations. Qualitatively, these results are reflected in the exceedingly clear appearance of the waters off the proposed

development.

Dissolved oxygen concentrations at all stations are close to 100% saturation, while pH is within the normal range of seawater (8.1 to 8.2). Likewise, water temperature of 24-25 ^{o}C. is considered normal for the area. In general, all water quality parameters fall within the most restrictive DOH standards for both "wet" and "dry" environments (see Table 2).

Offshore Physical Setting

While the physical setting of the offshore region varies somewhat throughout the length of the development, there is a typical descriptive pattern for the entire region. The shoreline consists of either vertical sea cliffs formed when lava flows reached the sea, or sloping sand and cobble beaches. Several black sand beaches occur on the property while Pohue Bay is the only well-defined white sand beach. Keliuli Bay is the only other well-defined shoreline feature consisting of a narrow steep-sided bay at the base of a cinder cone.

Underwater topography is characterized by a narrow basaltic shelf terminating in a shelf break and sharp sandy slope devoid of most biota that extends to abyssal depths. A characteristic of most of the offshore area is the paucity of reef flat or intertidal shallows, as most of the coastline drops off to a depth of 10 to 15 ft. at the shoreline. Such topography is advantageous for construction of marinas because the need for offshore excavation of channels is eliminated or greatly reduced.

A relatively unique feature of the development area is the

narrowness of the nearshore reef platform and proximity of the slope drop-off the the shoreline. In many areas the nearshore platform is only 50 to 70 feet wide, and within 100 feet of the shoreline the offshore slope reaches depths greater than 200 feet The nearshore terrace is the major site of early reef development and provides the settling surfaces for reef corals, which comprise the dominant benthic biota. Near the shoreline in areas where lava flows have reached the ocean, unusual topographic features such as caves and arches are common. The edge of the nearshore reef terrace along much of the development shoreline is marked by steep vertical basalt cliffs. In areas such as Station 4 extensive shoreline deposits of basaltic sands enter the ocean and form a sediment layer on the nearshore reef. Table 3 summarizes the physical characteristics of each of the station locations. Plates 2 through 7 show representative characteristics of the offshore areas that are described above.

A final point in regard to the physical structure of the marine environment is that in general, the geologically young age of the island of Hawaii limits the development of true "coral reefs." Rather, the majority of offshore benthic ecosystems are "coral communities". The distinction is that, for the most part, corals are growing on substrata composed of basaltic rock, rather than on calcareous rock of organic origin. Examination of Table 4 shows that most of the non-coral substrata encountered on transects off the Hawaiian Riviera is basalt or sand, rather than limestone.

Benthic Community Structure

Qualitative survey swims were conducted over the entire offshore area as a means of characterizing the reef community structure. In addition, 24 quantitative survey transects were conducted at the 11 reef survey sites. Benthic community survey data are summarized in Table 4. Survey transects were selected to characterize the dominant zonation patterns of biota, primarily reef corals and reef fish communities. Coral cover ranged from about 4% to 87% and 17 coral species were encountered on transects.

The majority of the offshore environment fronting the proposed Hawaiian Riviera consists of the "typical" West Hawaii nearshore zonation scheme which has been described in detail by Dollar (1975, 1982). This zonation pattern is formed in response to the range of natural variability of environmental stress over the different regions of the environment. Three zones, each characterized by a distinctive substratum type, depth range, range of physical conditions, and single dominant coral species make up the coral community. Figure 2 shows a diagrammatic representation of the West Hawaii coral community structure. In general, benthic zonation patterns off the Hawaiian Riviera are similar to the typical regime.

The most shoreward zone is comprised of the seaward continuation of the basaltic shoreline cliffs and boulder terraces. Owing to the shallow depth and proximity to the shoreline, this region receives most of the force of breaking waves and surge. Very close to the shoreline, these forces are so

extensive that corals and other macroorganisms are essentially absent. Several meters offshore, however, coral cover can be considered extensive. Pocillopora meandrina, a sturdy hemispherical branching species is the dominant coral colonizer of the nearshore terrace. This species rapidly colonizes newly cleared surface, has a small adult colony size of short densely packed branches. This species is adapted to settle in areas too harsh, in terms of wave scour and physical abrasion, for other species. It is commonly found growing on the vertical walls of the sea cliff and boulders near the shoreline. The shallowest transects (15-20 foot depths) at all of the Hawaiian Riviera survey stations traversed such a Pocillopora meandrina-boulder zone (see Plates 7). It can be seen in Table 4 that with the exception of Station 8, total coral cover in the shallow nearshore zone ranged from about 30% to 57%. Besides P. meandrina, it can be seen that 16 other coral species occurred in the boulder zone. Because of the physical rigor of this region, no coral species truly dominates the community, and species diversity is relatively high (Shannon-Wiener Index of 1 to 1.3, see Table 3). Non-coral cover consisted primarily of basalt and sand. At Station 8, located within Keliuli Bay, the boulder covered bottom is inhabited by relatively few coral colonies, probably as result of increased wave forces in the narrow entrance to the Bay.

Seaward of the edge of the shallow surge zones, the bottom is predominantly a flat basaltic terrace, interspersed with lava extrusions and sand channels. The reef terrace normally varies from about 200 to 400 feet wide, with a depth range of about 20

to 50 feet. As mentioned above, however, a characteristic of the Hawaiian Riviera offshore region is a very narrow reef terrace. The major "reef-building" zone occurs on the flat areas of the offshore bench inshore of the deep slope. The dominant coral in this region is Porites lobata which assumes a variety of growth forms depending on the substrata. The most common growth forms are flat encrusting plates or inverted cone-shaped structures (see Plates 1 and 9). The largest number of "minor" species is found in the reef bench zone. Because of increased water depth and distance offshore, reduced wave scour generally results in greater proportions of coral cover on the reef bench. Transects 1-40, 2-30, 3-55, 4-50, 7-30, 10-45, and 11-30 traversed typical Porites lobata-reef bench environments. It can be seen in Table 4 that coral cover in the P. lobata-reef building zone ranges from about 40% to 60%, and generally had the highest number of coral species per transect at each station.

Typically, at the seaward edge of the reef bench, the slope of the bottom increases and substratum consists primarily of unconsolidated rubble and sand. These deeper parts of the reef bench and the upper reef slope (below about 60 feet in depth) provide the most stable environment in terms of destructive force from wave stress. In such areas of minimal wave stress where there is enough solid substrata for coral settlement to take place, the fragile branching species Porites compressa (commonly called "finger coral") dominates bottom cover. Porites compressa, often covers the reef slope in the form of dense interconnected thickets that extend to a depth of approximately

90 feet and can extend for many square meters (see Plates 10 and 11). Coral cover in areas of these thickets is the highest on the entire reef; at transect 1-60, coral covers approximately 90% of the reef surface. Because coral cover is dominated by a single species in this zone, species diversity is lower than in either of the shallower zones (Shannon-Wiener Index of 0.6 to 0.8, see Table 4). These zones, however, are highly susceptible to severe damage from breaking waves. Observations of damaged P. compressa thickets is evidence that an area has recently been subjected to the impact of large breaking waves. Only slight damage, however, was observed at any of the locations in the Hawaiian Riviera nearshore zones, indicating that the area is not heavily stressed by long-period swells (see Plate 11).

Other deep reef areas that do not represent areas favorable for P. compressa thickets generally have relatively low coral cover. Sandy expanses near the reef drop-off are usually devoid of living coral cover (see Plate 7), while deep rock outcrops are usually inhabited by small colonies (see Plate 8). Below the lower limit of coral growth, bottom cover consists of white sand.

The major taxa of benthic organisms, other than corals, occurring on the Hawaiian Riviera reef terrace are sea urchins (Echinoidea) and sea cucumbers (Holothuroidea). By far the most abundant urchins are the two species that bore into limestone surfaces, Echinometra matheai and Echinostrephus aciculatus. In the reef terrace zones, densities of these urchins are often on the order of 30 individuals per square meter. Less abundant, but ubiquitous across the entire reef, are the larger species of urchins, Tripneustes gratilla, Echinothrix diadema, and

Heterocentrotus mammillatus.

Most common of the sea cucumbers are the species Holothuria atra and H. mauritiana, which occur mainly in the P. lobata-reef terrace zone. Sea stars, predominantly Linkia spp. also were observed sporadically over the entire nearshore region.

Marine flora encountered was dominated by encrusting calcareous algae which covers bared basalt and limestone surfaces and the non-living parts of coral colonies. The most common forms of encrusting algae were Porolithon spp. and Peyssonellia rubra which grows on the bottoms of P. compressa branches.

Frondose benthic algae are conspicuously rare on the reefs of West Hawaii. Several plants were observed, however, off the Hawaiian Riviera. These included the brown algae Turbinarea ornata and Padina spp. None of the algal communities associated with early successional stages of recolonization following denudation of substrate by wave action were observed.

The design of the reef survey was such that no cryptic organisms or species living within interstitial spaces of the reef surface were enumerated. Since this is the habitat of the majority of mollusks and crustacea, detailed species counts were not included in the transecting scheme. However, no dominant communities of these classes of biota were observed during the reef surveys at any of the study stations.

As a whole, the benthic communities offshore of the proposed Hawaiian Riviera development represent an aesthetically interesting, but typical, assemblage of nearshore Hawaiian reef

habitat. None of the communities represented rare or unique ecosystem components.

Reef Fish Community Structure

A rich and diverse fish community, typical of West Hawaii, was found in all reef areas off the proposed development. This community has been described in detail by Hobson (1974). The total number of species observed on transects was 100; on a single transect species number ranged from 25 to 46, while individual fish encountered on transects ranged from 254 to 468 (see Table 5). Inshore transects (less than 20 feet deep) tended to have both fewer species and total individuals, resulting in a lower overall species diversity. The lower number of inshore fishes is probably a result of the less favorable physical environment caused by heavy surge from wave action and less habitat complexity from lowered coral growth.

Several representative groups of reef fish were especially abundant on the Hawaiian Riviera transects. Algal-feeding acanthurids were the most numerous single group of fishes observed. At depths greater than 30 feet, the species Zebrasoma flavescens (yellow tangs), and Ctenochaetus strigosus (orange eye) were particularly abundant. At shallower sites, Acanthurus nigrofuscus were predominant. One large school of approximately 300 individuals of Naso lituratus was observed near the innermost transect of Pohue Bay (transect 7-15).

Planktivorous damselfishes, principally of the genus Chromis, were also abundant. The species C. agilis and C.

verator predominated at the outer edge of the reef shelf and into deeper water over the reef slope, whereas C. vanderbilti was the dominant species in shallower water.

The triggerfishes Melanichthys niger and M. vidula were commonly seen congregating in the water column. In terms of numbers of individuals, however, the most abundant fish observed throughout the survey were large swarms of the fan-tailed filefish, Pervagor spilosoma. Literally thousands of these fish were encountered. Indeed, the ubiquitous presence of these small fish was a distraction during the process of conducting transect counts and no attempt was made to estimate their actual abundance.

Juvenile reef fishes were most abundant at the deeper transect sites in area of Porites compressa. The lattice structure formed by this coral provides a sheltered refuge for small fish. Juveniles belonged mostly to the family Acanthuridae (surgeonfishes), with representatives from the familes Labridae (wrasses), Mullidae (goatfishes), and Chaetodontidae (butterfly fishes).

In areas where coral rubble was abundant, common fishes included the angelfish (Centropyge potteri), and several wrasses, notably Pseudochilinus tetrataenia and P. octotaenia. A large school of opelu (Decapterus macarellus) was encountered in midwater off the deep reef slope. A few large kahala (Seriola dumerillii) were also noted in the deeper regions of the reef.

Although the coastline along the project area harbors an abundant and diverse fish fauna, it is also apparent that the area is subjected to a surprising degree of fishing pressure

considering the remote location of the site. Although many individuals of the introduced blue-spotted grouper (Cephalopholus argus) were seen, size and abundances of fishes considered good "food fish" clearly indicated heavy fishing pressure. Relatively few carangids (i.e. jacks, papio) were sighted, although several small omilu (Caranx melampygus) were sighted in inshore areas. Similarly, the scarcity of larger goatfishes and parrotfishes indicates that these species are impacted by fishermen. Inspection of rocky ledges and coral heads revealed fair numbers of squirrelfish, but less than would be expected in an unfished area. Few lobster were observed, although several shells were seen. It appeared that the larger fish were more abundant towards the southern end of the property. Although limpets were large and abundant along particularly rugged parts of the coastline, substantial harvesting of this commercially valuable species had clearly occurred in areas which were accessible by land.

Fishing pressure is exerted in several forms. A large commercial trolling vessel was observed consistently working the coastline off the proposed development at about the depth of the drop-off. Although the target species was probably ono (Acanthocybium solandri), reef fish such as jacks are also susceptible to this type of fishing. Jacks are also the target species of fisherman casting from shoreline cliffs. Several parties of shore fisherman camped on the cliffs north of Pohue Bay were observed during the course of the present survey .

Significant spearfishing activity almost certainly occurs at

reef sites easily accessible from the shoreline, such as Pohue Bay, and the beach fronting the "waterhole". Parrotfishes and larger surgeonfishes in these areas were especially wary of divers. Commercial fishermen are also known to work this area of coastline by setting gill nets in shallow areas and traps in deeper areas. Small boat fishermen are also reported to work the area at night during periods of calm weather using small feather lures to catch squirrelfish (mempachi).

Although a group of tropical fish collectors was observed working near Pohue Bay it appears that the development area has been subjected to only limited collection of reef fishes for sale to aquarium hobbyists. It is felt by many that this fishery has had a noticeable effect on fish community structure in areas near Kailua-Kona. The sighting of very valuable species such as Chaetodon tinkeri, as well as an abundance marketable species such as tangs (Zebrasoma flavescens, Naso litturatus, and Acanthurus achilles) suggest that the remote location and sea conditions have deterred commercial collectors from concentrating in the Ka'u area.

Threatened or Endangered Species

Three species of marine animals that occur in Hawaiian waters have been declared threatened or endangered by Federal jurisdiction. The threatened green sea turtle (Chelonia mydas) occurs commonly along the Ka'u and Puna Coast and is known to feed on selected species of macroalgae. The endangered hawksbill turtle (Eretmochelys imbricata) is found infrequently in waters off west Hawaii. Numerous small green sea turtles were observed

in the nearshore region during the course of the survey. No nesting sites, however, were encountered on any of the beaches in the development.

Populations of the endangered humpback whale (Megaptera novaeangliae) are known to spend the winter months in the Hawaiian Islands. In general, however, it is not common for whales to occupy the very shallow nearshore areas that are the focus of this survey.

Anchialine Ponds

Anchialine ponds are shoreline pools without surface connection to the sea that contain water of measurable salinity. Salinity oscillates with tidal rhythm owing to inland extension of the oceanic water table. Such ponds are known to occur around the world in lavas and elevated fossil reefs. In the Hawaiian Archipelago, anchialine ponds exist almost exclusively along the shorelines of west Hawaii and southwest Maui. The term "anchialine" originates from the Greek "anchialos" meaning near the sea (Holthuis 1973).

Pond basins are related to structural and depositional features in shorelines formed from relatively young lava flows. Basalts formed from cooled lava are too porous to support ponded water above sea level; as a result all anchialine ponds are located close to the shoreline in low lying areas where surface depressions intersect the water table. Such depressions are usually simple depositional features in a'a' and fractures or collapsed bubbles in pahoehoe. In areas with elevations greater

than several meters above sea level, ponded water is found only in deep fissures or uncommon voids in lava structures.

Comparison of anchialine ponds along the coast of West Hawaii reveals a definite successional process related in large part to sediment characteristics. Young ponds are usually simply depressions in lava with no sediment cover and no associated plant life. Because pond waters are high in dissolved nutrients owing to the groundwater, aquatic and riparian plants, as well as wind-transported material gradually cause sediment layers to accumulate on the pond floors. In particular, algae form distinctive mineral crusts that line many ponds. Deposited sediment fills voids in the pond bottom, thereby restricting circulation and tidal flushing. The longer residence time of water in the depression promotes further organic production and increased sediment deposition. As sediments deepen, emergent plants such as sedges, rushes, and grasses take root and succulents and vines encroach from the edges, eventually enveloping the original pond. In the final stages of senescence, deposition of organic material completely fills the basin and forms a marshy region of vegetation. The rate of the successional process is dependent on exposure to light, depth, and degree of flushing. With good connection to the water table, sedimenting particles are flushed from the pond by tidal exchange rather than accumulating on the pond floor.

While anchialine ponds represent a relatively unique Hawaiian ecosystem, it is only in the last 15 years that comprehensive inventories of ponds have been assembled. Resort

development along the coast of West Hawaii has raised concerns over the continued existence of the anchialine pond environments. A survey conducted by Maciolek and Brock (1974) described the location, environmental characteristics, and biota of 318 ponds on the west coast of the Island of Hawaii. This survey remains the most comprehensive investigation of Hawaiian ponds ard serves as a principal reference for the present survey.

Pond Identification

Figure 1 shows the locations of all 20 ponds located along the Hawaiian Rivera coastline. Pond #20 is located near the northern border of the proposed development, adjacent to the proposed marina site. Ponds 1 through 9 and 18-19 were within the central part of the property. The complex of ponds 1-9 comprise the area known as the "waterhole," and represents the most substantial pond ecosystem on the property. Ponds 10 through 17 were located near the southern boundary, and constitute a complex of relatively young ponds in recent lava flows.

Pond identification numbers designated in the present Hawaiian Riviera survey can be compared with designations presented by Maciolek and Brock (1974) (see Tables 6 and 7). All ponds identified in the present survey, with the exception of Pond #20, were also identified by Maciolek and Brock.

In the present survey, anchialine ponds are classified by type according to overall structure and composition of the bottom (see Table 6). Cracks or fissures that extend deep enough into the water table to retain brackish water are considered as one

type of pond. Pond 20 is composed of a small body of water at the bottom of a lava rift displacement at the northern end of the property.

"A'a" ponds are depressions in lava rock with no significant growth of benthic macroalgae or vascular pond plants and no sediment accumulation. These ponds represent the youngest phase of pond development. Seven of the ponds surveyed were classified as A'a ponds (# 8, 9, 10, 13, 14, 15 and 17).

"Orange crust" ponds are similar to a'a ponds except that the bottom rock is covered, at least in part, by orange-brown mineralized crusts of the blue-green algae Schizothrix sp. This pond type was the most abundant type in the Hawaiian Riviera complex; 10 of the 20 ponds contained "orange crusts" (2, 3, 4, 5, 6, 11, 12, 16, 18, 19).

"Sediment" ponds contain bottom layers of unconsolidated mushy sediment up to 2 feet deep. Sediment appears to consist mainly of the calcareous and organic residue of Schizothrix, other pond plants, and debris from shoreline vegetation. Deep sediments may be anaerobic emitting the odor of reduced sulfides, as well as bubbles of methane that rise from the sediment surface. While several of the ponds had small accumulations of sediment, Pond #1 was the only "true" sediment pond encountered. One pond (#7) contained a surface mat of slimy green algae that appears to be an alternate growth form of Schizothrix and probably contained a thick sediment layer.

It is somewhat perplexing why one pond contains a substantial sediment layer, while another pond, only several feet away, can be completely devoid of sediment. As described above, the best

hypothesis is that shallow ponds are flushed so effectively by tidal action that detrital material generated by the algal crusts cannot accumulate as sediments. Deeper ponds, with a somewhat longer residence time are not as effectively flushed, and can retain some of the algal detritus as sediment. Once initial sediment deposition takes place, porosity of the bottom rock is reduced and residence time is increased further, allowing sediment accumulation to increase.

Using the same criteria for size that was employed by Maciolek and Brock (1974), 4 Hawaiian Riviera ponds can be classed as "small" in size (less than 105 square feet), 7 as "medium" (105-1056 square feet) and 9 as "large" (greater than 1056 square feet). Four of the Hawaiian Riviera ponds are classed as "shallow" (less than 19 inches deep), 13 ponds are "medium" (19 to 58 inches deep), and 2 ponds are classed as "deep" (greater than 58 inches deep) (see Table 6). Plates 12 to 24 show representative ponds and the characteristics that contribute to the classification scheme.

Pond Water Chemistry

Chemical parameters of pond water including salinity, temperature, pH, dissolved oxygen, turbidity and nutrient concentrations are shown in Table 8. While it is recognized that pond water chemistry parameters fluctuate at several time scales, it was beyond the scope of the present baseline survey to ascertain the absolute values of temporal fluctuation caused by diurnal tidal cycles, direct rainfall, insolation, wind, and

seasonal changes in groundwater discharge. Rather, pond chemical parameters were used to establish if the Hawaiian Riviera ponds fit within the "average" ranges of West Hawaii anchialine ponds, or if they represent anomalous environments.

Salinities of all Hawaiian Riviera ponds ranged from 4 to 8°/oo. Salinities were measured at low tide so it can be expected that these values represent the low end of the range of tidal variation in ocean water dilution. Salinity can be expected to oscillate with the tidal cycle; at high tide salinity will be maximized owing to greatest inland excursion of seawater. There was a slight horizontal gradient in salinity with the ponds closest to the shoreline having the highest salinity, while the ponds farthest from the coastline had the lowest salinity. At the time of this survey none of the ponds appeared to have vertical profiles in salinity, probably as a result of high rates of mixing from wind shear.

Maciolek and Brock (1974) found that the average salinity of 289 ponds not directly connected to the ocean was 7°/oo; average salinity of the Hawaiian Riviera ponds was 5.6°/oo. The slightly lower average for the Hawaiian Riviera ponds reflects the low tidal stand, but it is apparent that the Hawaiian Riviera ponds do not represent anomalies.

Water temperatures in Hawaiian Riviera ponds ranged from 22.8 to 26.6 °C. All measurements were made on an overcast day, so solar heating of ponds was minimized. Generally ponds farthest from the coastline and ponds with no sediment were cooler, apparently owing to higher rates of groundwater turnover.

Maciolek and Brock (1974) recorded characteristic temperatures between 22 and 28°C; a range very similar to the Hawaiian Riviera range. As with salinity, none of the Hawaiian Riviera ponds appear to represent an anomalous situation, and the entire pond system can be considered average.

Dissolved oxygen values indicated that all ponds were close to saturation or supersaturated. High oxygen levels are probably the result of photosynthetic activity in the ponds with lush plant growth and aeration by wind stirring. Spot sampling of oxygen concentrations at night indicated that the ponds did not become anoxic after dark. Ponds in advanced stages of succession with thick accumulations of organic material, often have anoxic water columns as a result of organic metabolism. Such depleted oxygen concentrations can prevent macro-organisms from occupying the ponds. With the exception of Pond 7, which was completely covered by a layer of green algae, none of the ponds in the Hawaiian Riviera complex appeared to be in this stage as evidenced by the consistent high concentrations of dissolved oxygen.

pH of all ponds was similarly representative of "normal" pond waters. The range of pH (8.1-8.4) indicates that metabolic activity is not generating CO_2 to an extent that the water column can be considered uninhabitable by pond organisms.

Inspection of Hawaiian Riviera ponds indicated that water columns in all ponds were exceptionally clear. Even pond #7, which was totally covered on the surface with an algal mat, had a clear water column. Turbidity measurements ranged from 0.16 to 0.89 NTU, with an average of 0.27 NTU. These low turbidity

values also indicate that pond water columns are largely devoic of suspended sediment and planktonic organisms.

State of Hawaii Department of Health Water Quality Standards exempt anchialine ponds from meeting specific water quality criteria, which include dissolved inorganic nutrient concentrations. However, because nutrient levels may change as a result of development, a set of baseline data was collected from the ponds (see Table 8). The dominant trend in nutrient characteristics is that concentrations of nitrate + nitrite ($NO_3^- + NO_2^-$) and silica (Si) is high, while orthophosphate (PO_4^{3-}) and ammonium (NH_4^+) is low. This pattern indicates the overwhelming contribution of groundwaters to the nutrient concentrations of pond waters compared to oceanic influence. Groundwaters are characteristically high in nitrate and silica, and lower in orthophosphate and ammonium, while oceanic waters are typically very low in nitrate (see Table 2). It is important to note that although pond nutrient concentrations are high, water column plankton production is relatively low. While nutrients are not limiting, phytoplankton growth is inhibited, probably by rapid turnover of the water column. This characteristic of most anchialine ponds is an important consideration in evaluating the effects of shoreline development on pond ecosystem function.

Anchialine Pond Biota

Anchialine pond biotic communities are characterized by a rather unique assemblage of organisms of relatively low species

diversity. Maciolek and Brock (1974) listed 55 species of "closed" pond organisms (not directly connected to the ocean), and considered 27 species "common" in Kona coast ponds. Table 9 lists the dominant species found in each of anchialine ponds located on the Hawaiian Riviera property.

Pond Flora

Many of the ponds were surrounded by dense vegetation consisting of grasses, trees, shrubs and vines. Specific identification of these plants is not included in the report. The most ubiquitous aquatic plant groups in all Hawaiian anchialine ponds are the orange mineralized algal crusts (Schizothrix sp.) that occur in shallow, low salinity ponds. Schizothrix crusts were observed in 17 of the 20 Hawaiian Riviera ponds (see Plates 13, 23, 24,and 25).

Ponds with substantial sediments contained the vascular plant Ruppia maritima, commonly known as widgeon grass. Ruppia roots in the sediment, and forms clusters that may be exposed at low tide. The submerged herb Egaria densa, commonly called "dense waterweed" was also found growing in dense aggregations in association with Ruppia (see Plates 2 and 25). These rooted plants occurred in 11 of the Hawaiian Riviera ponds.

Pond Fauna

Maciolek and Brock (1974) identified 55 species and species groups from ponds not in direct contact with the ocean. Nine of the more common animals were considered "representative species," that comprise the major pond community components. Typically,

the most abundant fauna of anchialine ponds are mollusks (snails), crustaceans (shrimp) and fish. Maciolek and Brock (1974) classify four shrimp, three snails, and two native fish as being "representative" pond organisms. Two of the shrimp species, Halocaridina rubra and Metabetaeus lohena are considered rare, found only in anchialine areas, but are normally the most common shrimp found in ponds. Halocaridina rubra is a minute red shrimp, commonly called "opae'ula" that is herbivorous and is especially common in ponds with extensive plant growth (see Figure 25). Metabetaeus lohena is also a small red shrimp but is larger than, and predaceous on H. rubra. The other two shrimp species, Palaemon debilis, a medium-sized transparent species commonly called "opae'huna" or "glass shrimp", and Macrobrachium grandimanus, a native prawn species called "opae oehaa" are found in estuaries and streams as well as anchialine ponds. All four species of shrimp, especially Halocaridina, were extremely abundant in all of the Hawaiian Riviera ponds except #1 and #20. It is somewhat curious as to why no shrimp were observed in Pond #1 either during the day or night. This is the largest pond at the "waterhole" and while it is likely to be the pond affected most by human influence (i.e. campers, fishermen, etc.) there is no obvious reason why the pond should not be inhabited by shrimp.

The three representative snails, Assiminea sp., Melania sp., and Theodoxus cariosa, are typically found in tide pools and anchialine ponds, especially on the undersides of rocks, were ubiquitous in the Hawaiian Riviera pond system. No hydroids or other invertebrates were observed.

Representative pond fish, Eleotris sandwicensis, a predaceous

goby and Kuhlia sandvicensis, a silvery carnivorous fish commonly called "aholehole", were observed in only several of the ponds. It is noteworthy that exotic fish species (topminnows, tilapia, and guppies) were not observed in any of the Hawaiian Riviera ponds. These introduced species, which can complete their life cycle within the ponds, appear to be much more effective predators of shrimp than native fish. Pond complexes which contain these exotic fish species often are devoid of shrimp, owing to intense predation.

Comparison of the present faunal inventory of the Hawaiian Riviera ponds with the inventory compiled by Maciolek and Brock (1974) shows very similar species assemblages. Schizothrix and Ruppia were more abundant in the present survey, as were Theodoxus and Assiminea. Both surveys found Halocaridina ubiquitous, while native fish species were rare, and exotic fish were absent.

The observed abundance of all shrimp species, lack of exotic fish, and the relative absence of signs of modification by humans indicate that the Hawaiian Riviera pond complex is essentially pristine and has not yet been noticably affected by the activities of man.

CONCLUSIONS AND RECOMMENDATIONS

The ultimate purpose of baseline surveys is to estimate the potential for impact to environments from shoreline development. Implementation of the proposed action would involve grading,

vegetation removal, new construction and other changes to the existing environment on land. Plans for constuction of a marina are the only anticipated shoreline modification activity planned at this time. Therefore, potential impacts to the aquatic environments must be considered from either directly changing the structure of the shoreline or by indirect processes that results from activities on land.

Marina Construction

The major activity that could potentially cause alteration of the marine environment is construction of the planned marina. Construction practices for this type of structure usually involve excavation behind a shoreline berm followed by breakthrough of the berm to create an entrance channel. Because excavation of the marina basin will take place in an area that is presently dry land, this phase of construction will have little or no effect on the marine environment. During the breakthrough phase it is likely that turbidity of nearshore waters will be temporarily increased. Similar events that have created such turbidity plumes in Hawaii have not resulted in any measurable long term or irreversible changes to water quality or marine community structure (Dollar, 1986, 1987). Owing to the high energy regime of the coastline throughout the entire project area, dispersion of suspended materials will be rapid and no permanent settlement on the sea floor is expected.

The deep nearshore waters will minimize the area required to be dredged to create a safe marina entrance. A ten-year monitoring program of Honokohau Harbor, a similarly constructed

marina in Kona, has shown that the basins create increased settling sites for corals and other benthic organisms, with no apparent negative impacts to the offshore environment (U.S Army Corps of Engineers, 1983). In the long run, creation of a marina at the Hawaiian Riviera will likely result in a similar positive impact on the environment. It is recommended, however, that monitoring studies during marina construction insure that no unforeseen environmental concerns are created. Such monitoring programs should also be instituted for other shoreline modification activities that may be planned at a later date, such as creation of swimming lagoons and artificial beaches.

Sedimentation

A potential indirect impact parameter is increased sedimentation from wind or runoff as a consequence of grading and changes in land use. With respect to alteration to the marine community offshore of the Hawaiian Riviera from increased sedimentation, the existence of locally high regions of sand cover points to a low potential for impact. Corals and other reef organisms are capable of removing sediment suspended by natural phenomena, up to threshold levels of deposition where cleaning mechanisms are overwhelmed and organisms become buried. Community structure is presently adapted to extremes in sediment stress from natural conditions. Organisms that do occur in the region are therefore capable of withstanding the stress associated with large natural sediment loads. In comparison to the frequent natural sediment loading within the study area, any additional input from land resulting from construction activity

would be insignificant.

Several other scenarios around the Hawaiian Islands can also be drawn upon to estimate the potential for impact from sedimentation at the Hawaiian Riviera. In particular, a study conducted at Princeville, Kauai (Grigg and Dollar, 1980) compared the reef environments off the completed phase of the resort with the environments off an area of pristine coastline. The hypothesis tested during this comparison was that increased sedimentation from exposure of soil during construction caused some modification of the coral reef environments offshore. Results of the survey showed that, if anything, the coral environments were better developed off of the existing Princeville development that was subjected to increased runoff than off the unperturbed parcel. Even though the resort construction might have temporarily increased suspended sediment loads, this increase would have been insignificant in comparison to the natural sediment loads to which the reef communities are already pre-adapted. Therefore, the hypothesis was rejected that developmental alteration of land for Princeville construction, and by inference for similar developments such as the Hawaiian Riviera, could result in offshore impacts to the marine environment.

In addition, while it is generally accepted that sedimentation is a major source of impact on coral reefs throughout the world, several studies show that Hawaiian reefs may be significantly more resistant to heavy sediment loads than other reef areas. Results of surveys conducted at French Frigate

Shoals (Dollar and Grigg, 1981) following the inadvertent grounding of a freighter and subsequent dumping of 2000 tons of a fine-grained mineral clay indicated that there was no damage to the reef corals and associated communities except where the organisms were actually buried by clay deposits for greater than a two-week period. Another study, conducted in Hilo Bay where natural sediment loads are very high and water is extremely turbid, reported that the dominant bottom cover consisted of nearly solid living coral -- a condition rarely found under even the most "optimal" conditions (Dollar 1985).

Runoff

As with sedimentation it is not expected that runoff during construction would provide any negative stimulus to the marine environment. The climate of the Ka'u district is one of the driest in the Hawaiian Islands; therefore substantial rainfall during construction is rather unlikely. However, in the event of heavy rainfall, the porous nature of the lava and soil ground cover is such that sheet flow carrying suspended sediment toward the ocean is highly unlikely. Rather, most rainwater that would enter the ocean as runoff would do so following percolation through the surface rock layers to the water table, followed by groundwater extrusion at the shoreline.

Normal volumes of groundwater extrusion in Ka'u probably range in the neighborhood of 3-6 million gallons per day (mgd) per mile, and has been shown to cause a surface lens during periods of calm weather. The increase to the volume of groundwater extrusion and resulting change in water chemistry

owing to changes in shoreline characteristics is likely to be insignificant. For a development on the south Kohala coast at Waikoloa, it was estimated that the annual discharge of stormwater runoff is roughly equivalent to the the amount of groundwater which enters the ocean each day (U. S. Army Corps of Engineers 1985). Therefore, the only major effect of rain during the period of grading might be to significantly decrease the amount and distribution of airborne dust--a circumstance that would have to be considered a beneficial side effect.

At this time no estimates exist of how drainage patterns might be changed as a result of the development plans. There appear to be no areas offshore of the Hawaiian Riviera boundaries where marine systems have been adversely affected by runoff to date. It is expected that this would remain the case. However, if analyses indicate that the proposed changes in land use and drainage patterns might result in substantial changes in water quality, additional field surveys will be conducted to determine the best location for the discharge of drainage and to assess the significance of expected water quality with respect to marine community structure.

Golf Course Irrigation, Fertilization, and Pest Control

Hawaiian Riviera Resort plans call for construction of golf courses that will probably be irrigated and fertilized with treated sewage effluent. The potential for impacts to the aquatic ecosystems owing to possible increases in rates of nutrient loading must be considered. When subjected to substantial

increases in nutrients, the response of some marine and freshwater systems is termed "eutrophication," and consists of increased growth of a portion of the community that is able to directly utilize the nutrients (phytoplankton), generally at the expense of normal community integrity. The overall result of this process is usually a degradation of environmental quality.

At the Hawaiian Riviera, it is anticipated that no such impacts will occur for several reasons. Most importantly, the unrestricted circulation of the offshore zone by tidal and wind-driven currents , meso-scale eddies, and wave action promotes rapid dilution and water exchange. Residence time of a parcel of water fronting the development is probably on the order of hours, so buildup of any nutrient is unlikely.

Another reason that the marine environment will probably show no effects as a result of golf course irrigation is that much of the nutrient load is taken up by the vegetation on the golf course. Chang and Young (1977) report that on a golf course on Oahu irrigated with treated sewage effluent 98% of the total nitrogen and 100% of the total phosphorus was taken up by the soil-plant surface layer. Chemical processes that account for the uptake include incorporation into plant biomass, cation exchange, fixation and adsorption on the soil, biological oxidation and denitrification. The important aspect of the study conducted on the Oahu golf course is that essentially none of the nutrient load reached the marine environment through groundwater runoff. While the underlying substrata on the Oahu course may differ from substrata at the Hawaiian Riviera, the soil mantle, where most of the chemical uptake and adsorption takes place

should be similar at the two locations. Murdoch and Green (1987) also investigated the influence of golf course irrigation and pesticide application to nearshore marine waters. After 23 years of operation, material used to fertilize the golf course at the Westin Mauna Kea Resort could not be detected in the ocean.

Another factor that accounts for the lack of potential for impact is the secondary level of sewage treatment commonly used by resort develpments for irrigants and fertilizers. Studies done at several of the ocean discharges on Oahu (Dollar, 1987) show that intentional discharges of greater volumes of secondary sewage into marine environments caused no detrimental effects whatsoever. In fact, the impacts that have been reported all can be considered beneficial since they result in increased fish populations, apparently in response to increased particulate food and shelter due to the outfall structure. Coral communities have also been documented to increase near the outfalls because diffuser structures provide settling sites that appear to be superior to natural sites.

A final consideration is the relatively high levels of nitrogen presently entering the marine environment through groundwater extrusion. Marine communities are therefore pre-adapted to high nitrogen loads. More importantly, the added nutrients are rapidly mixed during periods of intense water motion so virtually no buildup in nutrient concentration persists. In fact, there are currently no reports in the scientific literature of detrimental impacts to reef communities directly caused by increased nutrient loads. Based on these

observations, it is probable that even if malfunctions in sewage plants cause discharge directly into the ocean, there will be little or no effect to water quality or biotic communities.

Potential for negative alteration to marine ecosystems owing to pesticides and herbicides also seems to be nil. It has not been found necessary to utilize substantial quantities of pesticides on golf courses in Hawaii, and only very small applications of herbicides are periodically made to the greens (N. Bustamente, Mauna Lani Resort, personal communication). Such small quantities do not appear to be of a magnitude great enough to leach through the soil and lava, be carried to the ocean via groundwater extrusions, and then bioaccumulate to the point of producing a noticeable effect.

Effects to Anchialine Ponds

The effects of increased groundwater nutrients from resort development on anchialine pond dynamics must also be considered. OI Consultants surveyed anchialine ponds at Anaehoomalu in 1977 and 1984, before and after construction of the Waikoloa Beach Resort. Comparison of the salinity, temperature, and nutrient levels suggested that there were effects to the ponds. In the post-development survey ponds were approximately 1.5° C cooler, and 1.5 °/oo less saline. Average concentrations of NO_3^-, PO_4^-, and NH_4^+ in 1984 exceeded the 1977 averages by 98%, 55% and 134%, respectively.

It appeared that increased nutrients and decreased salinities were the result of increased input to the groundwater from resort activites. The amount of brackish water used daily by

the resort is of a similar magnitude to the amount of natural groundwater flux through the system, indicating that effects could be detectable. Such increases could decrease the contribution of sea water to the ponds, resulting in the observed changes. While the report concludes that there are measureable changes owing to resort operation, subsequent analysis of the experimental design (i.e disregard for matching tidal phase during sampling) indicate that changes attributed to golf course influence must be accepted cautiously.

OI Consultants emphasize, however, that the measured differences in water quality conditions did not have a negative impact on pond biota. Ambient pre-development nutrient concentrations were higher than concentrations which generally limit or control plant growth, which can control the character of an aquatic system. Ponds cannot be viewed as nutrient limited systems. An additional supply of nutrients to a plant community that is not nutrient limited does not result in any growth response. Rather than nutrient levels, it appears that it is rapid flushing characteristics that limit the development of planktonic communities in the ponds.

Besides the Waikoloa study, Brock (1985) reports no negative impacts to anchialine ponds that are surrounded by the Mauna Lani Bay Hotel, several condominium complexes, and a golf course. Although the chemical character of the ponds might be altered, as long as water exchange rates are not affected, there appears to be no substantive effects on the biological communities inhabiting these environments.

Because there are no development activities planned at the Hawaiian Riviera that will affect water exchange, and because plans call for most pond systems to be preserved in their natural state, there does not appear to be any potential to influence biological structure.

Potential Effects to Protected Species

As mentioned in the Results, there are several protected marine species that may inhabit the offshore environment. Heavy equipment and blasting used for marina construction might produce noise that could affect behavior of whales and other marine mammals. Mitigating measures for this kind of effect would include restriction of blasting activities during the months when whales are present, and monitoring programs to ensure that mammals are not in the immediate area during blasting.

Short term changes in water quality resulting from construction would also not be of a magnitude to affect the behavior of sea turtles that might inhabit the reefs off the Hawaiian Riviera. Increased access to the shoreline, once the development is constructed, might affect resident turtles because these animals often do not remain in areas frequented by humans. However, because the beaches on the development area are presently being used as recreation sites on a regular basis (especially Pohue Bay), any human-induced effects to turtle populations have probably already occurred. The potential for additional impact must be considered very slight, especially because there is abundant habitat space along the Kona coast.

All of the shrimps and snails considered as "rare" or "unique" by Federal Agencies were abundant in the Hawaiian Riviera anchialine ponds. Planning for the development should include measures to preserve the ponds and prevent introduction of exotic species that could severely alter the biological community structure. As discussed above, the potential for chemical alteration presents little danger to the biological communities, because these communities are pre-adapted to high nutrient loads and fluctuating salinity.

SUMMARY

The aquatic environments in the vicinity of the proposed Hawaiian Riviera Resort have been characterized and compared to other areas of Hawaii. Marine water quality can be considered pristine with no measurable effects from any man-induced influences. A nearshore surface lens reflects the influence of groundwater efflux that typifies the entire West Hawaii coastline. The structure of abundant and diverse coral communities fits a three-zone pattern influenced primarily by the degree of destructive force of wave impact, depth of water, and substrata type. The major unique characteristic of the reef environment fronting the Hawaiian Riviera is the narrow reef terrace and steep nearshore drop-off. A diverse assemblage of reef fish is also found, but appear to show the effects of fishing pressure.

The marine envrionments do not represent unusual commercial resources, and do not appear to be the special habitat of rare,

endangered or protected species. From an aesthetic and recreational point of view, when sea conditions are appropriate to allow safe nearshore activity, the area appears to provide an attractive site for snorkeling, diving and fishing.

Presently, the anchialine ponds exist in a pristine state, and do not reflect any man-induced influences. These conditions can be maintained during and after construction with the proper planning. If such steps are taken, the pond environments can provide an important natural attraction for the development, while at the same time maintaining high environmental quality.

The potential for direct impacts to the aquatic communities as a result of development of the Hawaiian Riviera appears to be very small. None of the developmental activities appear to have the potential to induce changes in physio-chemical water quality parameters of a magnitude sufficient to cause changes in biological community structure. Marine environments are routinely subjected to stresses that can be much more destructive than the incremental changes that could result from any development activity. Pond communities are not nutrient limited, so increased nutrient level resulting from resort activities would probably have no adverse affect.

If some unexpected event related to development activities does occur, the resulting alterations to marine community structure would probably be reversible and recovery rapid once the stress factor is mitigated. Tolerance to such changes appears to already be part of the physiological range of the community.

It can be concluded that as long as the normal reasonable steps are taken in construction practices and operational procedures for the golf course and sewage treatment systems are carefully maintained, there should be no adverse impacts to the marine environments. However, the baseline marine biological studies were implemented in such a way that replicate surveys conducted in subsequent years can show actual changes in marine and pond community structure. Regardless of how unlikely, there is always the potential for an unexpected event. If any development practices cause changes in physical-chemical parameters which lead to changes in environmental integrity, these effects could be quantified through time-series surveys. Therefore, it is recommended that the planners of the Hawaiian Riviera utilize the benchmark stations by incorporating into their long-range plans subsequent marine surveys. If, and when, development construction near the shoreline commences, it would be a prudent action to initiate a monitoring program at that site during the activity. With such an ongoing program, it would be possible to quickly pinpoint any detrimental processes as they happen and remedy the situation before significant or irreversible environmental damage occurs.

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FIGURE 1. Map showing location of proposed Hawaiian Resort Development of southwest coast of island of Hawaii. Locations of offshore water chemistry and biological community structure study stations are shown. Anchialine pond locations are designated with a "p".

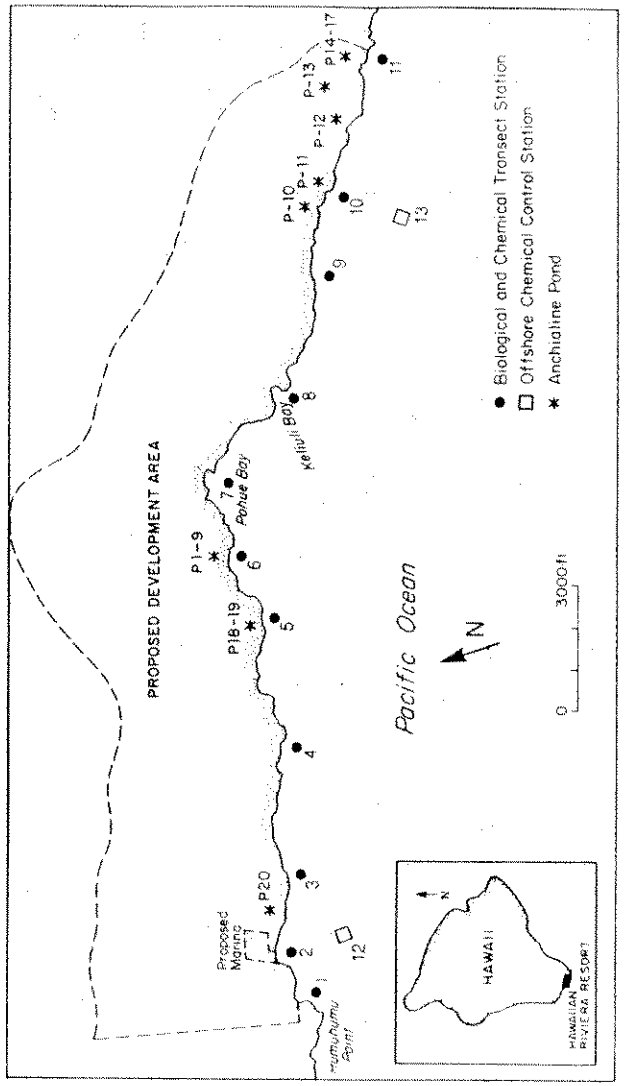

FIGURE 2. Diagram showing typical zonation pattern of nearshore areas of west Hawaii. Much of the area off the proposed Hawaiian Riviera Resort corresponds to this zonation pattern. The principal variations are: 1) the reef terrace, comprised of the P. meandrina boulder zone and the P. lobata reef bench zone is often compressed in width, and 2) in areas where the shelf break and slope is composed of basalt cliffs and outcrops, the P. compressa zone is absent.

TABLE 1. Water chemistry parameters measured off proposed Hawaiian Riviera Resort. S refers to surface samples, B refers to deep (3 m) samples. For station locations see Figure 1.

STATION	TOTAL KJELDAHL NITROGEN (ug N/L)		AMMONIA NITROGEN (ug N/L)		NITRATE + NITRITE NITROGEN (ug N/L)		ORTHO-PHOSPHATE PHOSPHORUS (ug P/L)		TOTAL PHOSPHORUS (ug P/L)		LIGHT EXTINCTION COEFFICIENT (k units)		CHLOROPHYLL * (ug/L)		TURBIDITY (Chemistry Turbidity units)		NON FIL. DES (mg
	(um)	(us)	(um)	(us)	(um)	(us)	(um)	(us)	(um)	(us)	(um)	(us)	(um)	(us)	(um)	(us)	
15	7.24	101.36	0.27	3.28	0.38	5.32	0.48	14.88	0.77	23.87	0.20		0.13		0.21		
10	9.18	128.52	0.36	5.04	0.20	2.80	0.24	7.44	0.55	17.05	0.13				0.54		
25	6.98	97.72	0.22	3.08	1.13	15.82	0.24	7.44	0.59	18.29	0.12		0.16		0.17		
20	6.31	88.34	0.18	2.52	0.41	5.74	0.17	5.27	0.48	14.88	0.09		0.12		0.53		
35	6.92	96.88	0.25	3.50	0.29	4.06	0.17	5.27	0.52	16.12	0.24		0.10		0.17		
30	6.40	89.60	0.20	2.80	0.29	4.06	0.15	4.65	0.47	14.57	0.10		0.12		0.36		
45	6.02	84.28	0.20	2.80	0.38	5.32	0.23	7.13	0.56	17.36	0.25		0.05		0.30		
40	6.01	84.14	0.22	3.08	0.44	6.16	0.16	4.96	0.49	15.19	0.10		0.16		0.36		
55	6.18	86.52	0.25	3.50	0.64	8.96	0.19	5.89	0.48	14.88	0.99		0.13		0.16		
50	5.53	77.42	0.20	2.80	0.35	4.90	0.16	4.96	0.51	15.81	0.13		0.12		0.45		
65	5.62	78.68	0.13	1.82	0.46	6.44	0.13	4.03	0.44	13.64	0.31		0.12		0.17		
60	7.26	101.64	0.25	3.50	0.26	3.64	0.15	4.65	0.52	16.12	0.20		0.15		0.40		
75	6.06	70.84	0.25	3.50	1.54	21.56	0.19	5.89	0.46	14.88	0.35		0.16		0.22		
70	6.36	89.04	0.38	5.32	0.76	10.64	0.23	7.13	0.52	16.12	0.14		0.16		0.58		
85	6.28	73.92	0.25	3.50	0.29	4.06	0.17	5.27	0.44	13.64	0.15		0.07		0.25		
80	5.34	74.76	0.20	2.80	0.32	4.48	0.16	4.96	0.49	15.19	0.09		0.19		0.57		
95	6.56	77.84	0.13	1.82	0.38	5.32	0.13	4.03	0.45	13.95	0.03		0.14		0.41		
90	5.19	72.66	0.20	2.80	0.23	3.22	0.15	4.65	0.51	15.81	0.06		0.12		0.37		
105	4.63	64.82	0.18	2.52	0.55	7.70	0.12	3.72	0.39	12.09	0.15		0.18		0.40		
100	4.90	68.60	0.22	3.08	0.23	3.22	0.13	4.03	0.47	14.57	0.08		0.13		0.40		
115	6.69	93.66	0.36	5.04	0.49	6.86	0.15	4.65	0.41	12.71	0.25		0.05		0.59		
110	5.51	49.14	0.27	3.78	0.44	6.16	0.15	4.65	0.41	12.71	0.11		0.13		0.84		
125	7.52	105.28	0.13	1.82	0.17	2.38	0.15	4.65	0.49	15.19	0.29		0.10		0.19		
120	6.47	90.58	0.19	2.52	0.17	2.38	0.16	4.96	0.49	15.19	0.12		0.12		0.49		
135	4.64	64.96	0.20	2.80	0.00	0.00	0.11	3.41	0.45	13.95	0.27		0.07		0.36		
130	5.19	72.66	0.20	2.80	0.06	0.84	0.12	3.72	0.44	13.64	0.08		0.09		0.39		

TABLE 1 (cont.)

STATION	Dissolved Oxygen (% sat.)	Dissolved Oxygen (mg/l)	Salinity (ppt)	pH	Temperature (deg. C)
15	105.1	7.07	34.510	8.160	25.3
10	102.6	6.96	34.512	8.176	24.9
25	98.5	6.66	32.588	8.251	24.9
20	99.3	6.73	34.296	8.217	24.7
35	97.6	6.65	34.383	8.194	25.0
30	99.0	6.72	34.475	8.176	24.6
45	97.1	6.62	33.804	8.157	24.9
40	97.0	6.65	34.472	8.191	24.6
55	97.0	6.28	34.071	8.196	24.6
50	96.7	6.60	34.567	8.208	24.6
65	99.4	6.74	33.487	8.145	24.5
60	97.3	6.66	34.116	8.211	24.4
75	93.3	6.36	32.432	8.215	25.2
70	95.2	6.51	34.051	8.174	24.4
85	93.8	6.45	33.901	8.247	24.4
80	95.9	6.57	34.055	8.191	24.3
95	95.4	6.55	33.897	8.288	24.4
90	95.6	6.56	34.452	8.154	24.4
105	96.1	6.54	34.413	8.218	24.3
100	96.5	6.57	34.531	8.179	24.5
115	95.7	6.57	34.504	8.231	24.3
110	97.3	6.68	34.520	8.168	24.3
125	97.2	6.64	34.519	8.191	24.8
120	95.9	6.56	34.509	8.194	24.6
135	92.1	6.33	34.645	8.274	24.4
130	95.2	6.53	34.651	8.171	24.3

TABLE 2. Specific criteria specified by DOM water quality standards for open coastal waters

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 Kjeldahl Nitrogen (ug N/l)	150.00* 110.00**	250.00* 180.00**	350.00* 250.00**
Ammonia Nitrogen (ug NH4-N/l)	3.50* 2.50**	8.50* 5.00**	15.00* 9.00**
Nitrate +Nitrite Nitrogen (ug [NO3+NO2]-N/l)	5.00* 3.50**	14.00* 10.00**	25.00* 20.00**
Orthophosphate Phosphorus (ug PO4-P/l)	7.00* 5.00**	12.00* 9.00**	17.00* 13.00**
Total Phosphorus (ug P/l)	20.00* 16.00**	40.00* 30.00**	60.00* 45.00**
Light Extinction Coefficient (k units)	0.20* 0.10**	0.50* 0.30**	0.85* 0.55**
Chlorophyll a (ug/l)	0.30* 0.15**	0.90* 0.50**	1.75* 1.00**
Turbidity (Nephelo-metric Turbidity Units)	0.50* 0.20**	1.25* 0.50**	2.00* 1.00**
Nonfilterable Residue (mg/l)	20.0* 10.0**	30.0* 15.0**	40.0* 20.0**

*"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 receiveless than three million gallons per day of fresh water discharge per shoreline mile.

Appicable to both wet and dry conditions:

pH units shall not deviate more than 0.5 units from a value of 8.1.

Dissolved oxygen - Not less than 75% saturation.

Temperature - Shall not vary more than 1 deg. C from ambient conditions.

Salinity - Shall not vary more than 10% from natural or seasonal changes considering hydrologic input and oceanographic factors.

TABLE 3. Description of physical setting at each of the offshore study stations. For station locations, see Figure 1.

STATION NUMBER	DESCRIPTION
1	Located off black sand beach at base of cinder cone. Shallow area nearshore subjected to breaking waves, bottom composed of basalt boulders. Mid-depths (30 ft) flat basaltic terrace with high coral cover of P.lobata. Deep reef marked by moderate shelf break with high cover of P. compressa thickets. Very little sand throughout entire reef area. Probably the best example of classic west Hawaii zonation pattern of all Hawaiian Riviera stations.
2	Located off proposed marina site. Majority of site similat to Station 1 with the exception of large sand channels running perpendicular to shoreline. Large scatterd heads of P. lobata on sand at 60 to 90 foot depths.
3	Located off sheer shoreline cliff. Nearshore zone composed of barren boulders broken off from cliff face. Reef terrace very narrow and marked by steep cliff escarpment into deep water; sloping sand drop-off and P. compressa zone absent.
4	Located off shoreline area covered with thick deposit of black crystalline basalt sand. Nearshore reef also covered with fine black sediment layer. Terrace and drop off structure similar to Station 3.
5	Located off shoreline sand and rubble berm fronting ponds 18 and 19. Shoreline formed from sheer basalt cliff with boulder bottom extending across reef terrace and over dropoff. Very narrow reef zone.
6	Located off waterhole pond complex. Inshore areas composed of shallow reef flat extending up to black sand and rubble beach fronting ponds. Reef terrace consists of relatively flat basalt pavement and scattered boulders. Abundant coral rubble indicates this area is subjected to substantial wave forces. High cover of P. compressa on deeper parts of reef slope.

TABLE 3 (cont.)

STATION NUMBER	DESCRIPTION
7	Located off Pohue Bay. Inshore area composed of wide, flat pavement covered with a layer of black sediment and flat encrustations of coral. Beyond bay mouth numerous wide white sand channels occur. Deeper areas predominantly sand and rubble.
8	Located inside of Keliuli Bay. Reef floor composed entirely of basalt boulders on bed of black sand. Coral cover very limited.
9	Located off rubble sand beach typical of southern portion of property. Shallow reef composed of flat basalt shelf that is exposed to force of breaking waves. Outer terrace composed of basalt boulders and outcrops on flat reef surface. Boulder cover continues downslope, interspersed with P. compressa thickets.
10	Similar to station 9.
11	Similar to station 9.

TABLE 4. Percent cover of coral species on benthic transects off Hawaiian Riviera.
For transect locations see Figure 1.

SPECIES	TRANSECT	1-20	1-40	1-60	2-15	2-30	3-20	3-55	4-20	4-50	5-20	5-40	6-20	6-50	7-15	7-30	7-
Porites lobata		21.0	24.8	18.4	27.7	48.5	3.0	25.5	15.8	25.7	18.9	28.9	11.8	15.4	23.5	28.9	9
Porites compressa			24.2	65.9	0.4	8.2		14.5		12.5	25.8	9.9		21.2		3.1	6
Porites brighami												1.0					
Porites (Synarea) convexa																	
Pocillopora meandrina		22.9	5.0	2.6	15.8	8.6	33.1	6.8	10.2	4.3	6.2	2.2	13.0	0.9	4.3	8.6	2
Pocillopora eydouxi																	
Montipora verrucosa		0.2	5.9		5.9	4.0	3.0	0.4	6.1	3.1		0.6	1.3	1.0	6.1	3.3	0
Montipora patula		8.4	0.4		2.6	0.6	5.7		8.1						2.4	4.5	0
Montipora flabellata															1.3		
Pavona duerdeni			0.3			2.3		0.2	0.4						1.6		
Pavona varians		1.3			1.8	0.7			0.4				4.2	0.2	1.2	0.3	
Pavona (Pseudocolumnastrea) pollicata																	
Cyphastrea ocellina																	
Leptastrea purpurea					0.2	0.2		0.2	0.8	0.2							
Fungia scutaria								0.1									
Palythoa tuberculosa		3.5				0.2	9.6	0.3	2.9	0.1		0.1		0.3			
Anthelia edmondsoni																1.0	
NON-CORAL COVER																	
Limestone		8.7	12.1	13.1	18.4	20.0	15.5	3.6	4.6	12.1	18.6	17.3	11.8	15.0	30.3	7.6	8
Basalt		34.0	24.6		26.2	6.7	30.1	48.0	24.0	40.3	20.8	34.1	42.1	18.1	27.3	3.6	
Sand			2.7		1.0	8.2			26.7	1.7		7.0			1.8	38.9	41
Rubble											9.7			27.9	1.8		30
NUMBER OF CORAL SPECIES		9	6	3	7	9	5	8	8	6	3	6	4	6	7	7	
PERCENT CORAL COVER		57.3	60.6	86.9	54.4	73.3	54.4	48.0	44.7	45.9	50.9	42.7	36.3	39.0	48.4	49.9	19
CORAL SPECIES DIVERSITY		1.29	1.22	0.64	1.26	1.15	1.16	1.10	1.62	1.12	0.97	0.92	1.14	0.94	1.35	1.30	1.

TABLE 4. (cont.)

SPECIES	TRANSECT	8-20	9-15	9-60	10-15	10-45	11-15	11-30	11-50
Porites lobata		1.6	5.4	22.1	15.8	15.8	7.4	36.7	20.7
Porites compressa				35.0		5.0		11.8	24.8
Porites brighami									
Porites (Synarea) convexa			0.2						
Pocillopora meandrina		1.4	19.4	3.4	11.6	1.2	6.4	2.9	2.6
Pocillopora eydouxi			3.9		1.4		8.1	0.2	
Montipora verrucosa		0.7	2.0	1.2	0.1	1.3	1.0	1.3	
Montipora patula			2.3	0.8		0.7	2.4	1.1	
Montipora flabellata							0.2		
Pavona duerdeni									
Pavona varians			1.3	0.7			0.2	0.8	0.1
Pavona (Pseudocolumnastrea) pollicata			0.2						
Cyphastrea ocellina			0.1						
Leptastrea purpurea									
Fungia scutaria						0.1			0.1
Palythoa tuberculosa			12.8		3.4		9.1	0.7	0.3
Anthelia edmondsoni									
NON-CORAL COVER									
Limestone		0.8	3.8	10.0	5.4	11.4	0.4	2.2	9.7
Basalt		61.0	48.6		62.2	59.6	65.2	38.4	33.7
Sand		34.5		1.0					
Rubble				26.8		4.9	6.0	3.9	
NUMBER OF CORAL SPECIES		3	10	6	5	5	8	9	6
PERCENT CORAL COVER		3.2	47.6	63.2	32.3	32.3	34.8	55.5	56.6
CORAL SPECIES DIVERSITY		1.05	1.61	1.03	1.11	1.11	1.60	1.06	0.90

TABLE 5. Reef fish species abundance on Hawaiian Riviera transects. For station locations, see Figure 1.

TRANSECT NUMBER	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	7	8	9	9	10	10	11	11	11
DEPTH	15'	40'	60'	10'	30'	25'	55'	20'	40'	45'	50'	15'	60'	12'	30'	60'	15'	10'	60'	10'	40'	10'	30'	60'
MURAENIDAE																								
Gymnothorax eurostigma					1						1										1		1	
G. flavimarginatus							1									2					1			
CHANIDAE																								
Chanos chanos			2																					
AULOSTOMIDAE																								
Aulostomus chinensis		1	2			1	2		2	1	1		2		1								1	
FISTULARIIDAE																								
Fistularia petimba					1					1				1		1								
HOLOCENTRIDAE																								
Myripristes amoena									1				8						1					
M. berndti						4	2												5		20			
EPHIPPIDAE																								
Euphrosyne bigibbus						5	6	11									4	14	8					
CIRRHITIDAE																								
Cirrhitops fasciatus	2				2	2		1		2	1	3									5	3	1	
Cirrhitus pinnulatus		1		1	1	2	1		2			1		1		1	2	1					1	1
Paracirrhites arcatus	1	2	3	2	2		3	1	2	3	3	3	4	2	2	2		2	5	2	2	2	2	1
P. forsteri						1			1			1	2						1	2	2		1		
MULLIDAE																								
Mulloidichthys flavolineatus												6				5	4							1
Parupeneus pleurostigma											1													
P. multifasciatus	4	12	9	6	4	4	16	9	8	8	9	6	6	5	4	7	7	4	8	3	13	6	6	1
P. bifasciatus			1					2		1	2	2	2							2	1			1
P. cyclostomus						2									2	1							1	
SERRANIDAE																								
Cephalopholis argus		2	3			1	1		2	2	5		2					1	1		2		1	1
CARANGIDAE																								
Caranx melampygus							1	2								1			1					
LUTJANIDAE																								
Lutjanus kasmira		5					7	1			1					1			4		2			
L. fulvus																								
Monotaxis grandoculis		3	1				1		2				2		2							1		
LETHRINIDAE																								
Monotaxis grandoculis								1		2					7				1					

TABLE 5. (cont.)

TRANSECT NUMBER	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	7	8	9	9	10	10	11	11	11
DEPTH	15'	40'	60'	10'	30'	25'	55'	20'	40'	45'	50'	15'	60'	12'	30'	60'	15'	10'	60'	10'	40'	10'	30'	60'
CHAETODONTIDAE																								
Chaetodon lunula						2			1				1		2				10				2	9
C. quadrimaculatus		3		3	1	2	2	2		2	1	4		2	2		4	2		1			3	
C. ornatissimus		1	2	2	3		4	1		1	4	2	2	2	2	3							1	
C. ephippium																		1						
C. unimaculatus				1	1				2							2		1				2		
C. multicinctus	4	10	6	9	13	6	8	6	6	7	6	7	8	4	8	7		8	5	3	9	6	6	7
C. reticulatus	2	2																						
C. fraseri			1				2			2														1
C. kleinii							2			1						2								
C. auriga	1	1																1						
C. lineolatus																					1			
Forcipiger flavissimus	3	7	8	1	8	9	3	5	6	4	7	1	4	3	3	6	2	4	6		4	7	7	7
Heniochus diphreutes																								
Hemitaurichthys thompsoni											3					4		4	35					
POMACANTHIDAE																								
Centropyge potteri		3		3	3		5		6	3	2		3		3	2			4		5		3	4
Holacanthus arcuatus																							1	
POMACENTRIDAE																								
Abudefduf abdominalis							8											10						
Plectro. johnstonianus			3	2	3		2			2	2			1	3			2	2		7		3	2
P. leucopomus				3								4		4						9				
Stegastes fasciolatus						2		4									3	3			5			
Chromis ovalis		50	120	3	3		90		36	5	50	3	10			8	65		75		41		20	19
C. hanui		11	18	8	8		6		5		8		14			5	12		16		10			17
C. vanderbilti	110	20		65	100	55	10	30	50	30	5	80		18	95		26	37		41	15	29	15	
C. agilis											10													
C. verator							10				18				6						30			
																			10		10		8	14
LABRIDAE																								
Novaculichthys taeniourus													2											
Cheilinus unifasciatus		1	2				2				3				1	3					1		1	1
C. bimaculatus			2										1											
Pseudocheilinus octotaenia		1	2				2		3	3	3		1		2	1		1	1		3			1
P. tetrataenia											1		1						3		4		2	1
Bodianus bilunulatus			1																				1	
Coris gaimard	1	2		1	1	2	2	3	4	3	1		2			2						1	1	3
C. flavovittata		1								2					2			3	1	1	1		1	
Anampses cuvier																		2						
Thalassoma duperrey	21	12	8	16	17	10	5	9	17	7	7	23	14	13	12	16	2 12	33	11	15	12	12	13	5
T. trilobatum												2								1				
T. ballieui		1	2	1	1				1		3		4			3			1		6		1	3
Gomphosus varius	2	2	3			2	2	1	4	1							4		3			6	5	
Labroides phthirophagus			2							2	2		1		2				1					4
Macropharyngodon geoffroy															1									
Pseudojuloides cerasinus							1						1			1								
Stethojulis balteata				2																				
Halichoeres ornatissimus			2	3	3	2	2	3	2	2	2	1	4		2	3	1	1	1	2	5	1	9	1
SCARIDAE																								
Scarus sordidus	1	2	3	1	1	4			2	2	2	1	3					5	4					
S. perspicillatus	1	1	1					1										3	1				1	
S. psittacus	1	1	1	1	1	1	2	1			1	1		2	2			2	1	1				
S. rubroviolaceus						2	1	1		1	3					1		2	1	1				
Juvenile Scarus	1	3	3			4			5		4	3		6	4		2	4	3	10	3	2	3	1

Table 6. Hawaiian Riviera anchialine pond classifications and dimensions. Pond size and depth designations are based on the criteria of Maciolek and Brock (1974): Size - Large (L), Medium (M) and Small (S); Depth - Deep (D), Moderate (M), and Shallow (S).

POND NUMBER	POND TYPE	LONG AXIS (ft.)	SHORT AXIS (ft.)	AREA ($ft.^2$)	MAX. DEPTH (in.)
1	SEDIMENT	75	46	3000 (L)	60 (D)
2	ORANGE CRUST	28	12	730 (M)	28 (M)
3	ORANGE CRUST	56	32	1600 (L)	29 (M)
4	ORANGE CRUST	26	15	350 (M)	24 (M)
5	ORANGE CRUST	14	6	90 (S)	24 (M)
6	ORANGE CRUST	10	10	75 (S)	30 (M)
7	SEDIMENT SURFACE MAT	68	31	2100 (L)	-
8	A'A	25	8	160 (M)	19 (S)
9	A'A	11	3	50 (S)	18 (S)
10	A'A SURFACE MAT	12	12	110 (M)	26 (M)
11	ORANGE CRUST	100	35	4000 (L)	28 (M)
12	ORANGE CRUST	100	9	3800 (L)	29 (M)
13	A'A	45	11	840 (M)	32 (M)
14	A'A	68	46	1800 (L)	35 (M)
15	A'A	65	60	3000 (L)	39 (M)
16	ORANGE CRUST	53	43	1800 (L)	41 (M)
17	A'A	17	14	190 (M)	24 (M)
18	ORANGE CRUST	130	30	6900 (L)	60 (D)
19	ORANGE CRUST	34	20	600 (M)	43 (M)
20	LAVA CRACK	8	5	15 (S)	19 (S)

TABLE 5. (cont.)

Table 7. Comparative pond identification designations for the present Hawaiian Riviera anchialine pond survey and Maciolek and Brock survey (1974).

Hawaiian Riviera Pond Survey #	Maciolek and Brock Survey #
Ponds 1 - 9	U-3,4
Pond 10	V-1
Ponds 11 - 12	V-2,3
Ponds 13 - 17	V-4-7
Pond 18	U-2
Pond 19	U-1
Pond 20	Unidentified

TABLE 8. Water chemistry parameters for 20 anchialine ponds located on the site of the proposed Hawaiian Riviera Resort. For pond locations, see figure 1.

POND NUMBER	SALINITY (o/oo)	TEMPERATURE (deg. C.)	OXYGEN (mg/l)	OXYGEN (% sat.)	pH	TURBIDITY (nephelometric turbidity units)	ORTHO-PHOSPHATE PHOSPHORUS (uM)	NITRATE + NITRITE NITROGEN (uM)	AMMONIUM NITROGEN (uM)	SILICA (uM)
1	5	25.9	8.35	108	8.12	0.25	0.26	38.21	0.51	410.5
2	5	25.2	10.35	130	8.54	0.89	0.37	27.69	1.06	420.5
3	5	25.0	8.59	108	8.24	0.28	0.63	44.22	0.14	465.6
4	5	25.0	8.30	102	8.23	-	-	-	-	-
5	5	24.9	8.30	104	8.38	-	-	-	-	-
6	4	26.1	8.71	109	8.39	0.22	0.54	48.31	0.68	420.5
7	5	26.5	9.60	119	8.40	-	-	-	-	-
8	5	25.2	9.54	119	8.36	0.26	0.59	51.32	0.56	520.7
9	5	24.4	8.31	103	8.34	-	-	-	-	-
10	6	23.8	8.76	107	8.27	0.16	0.76	50.50	0.16	460.6
11	6	24.3	8.86	109	8.25	0.18	0.62	43.67	0.49	480.7
12	8	23.2	8.22	99	8.17	0.18	0.79	51.32	0.18	450.6
13	5	23.5	8.82	102	8.32	0.16	0.74	62.11	0.45	465.6
14	6	23.1	8.56	103	8.28	0.17	0.75	62.38	0.49	445.5
15	6	22.8	8.65	104	8.27	0.26	0.72	63.46	0.20	460.6
16	6	23.6	8.45	104	8.28	0.31	0.90	57.08	0.69	450.6
17	-	-	-	-	-	-	-	-	-	-
18	6	25.2	10.25	129	8.21	0.24	0.30	19.77	0.66	480.7
19	6	26.6	10.05	127	8.24	-	-	-	-	-
20	7	23.4	6.80	85	8.27	-	0.86	13.09	0.16	515.7

TABLE 9. Occurrence of common organisms in Hawaiian Riviera anchialine ponds. "X" indicates organism presence, "-" indicates organism absence.

	Plants		Mollusks			Crustaceans					Fish	
POND NUMBER	*Schizothrix* sp.	*Ruppia maritima* *Egaria densa*	*Melania* sp.	*Assiminea* sp.	*Theodoxus cariosa*	*Metabetaeus lohena*	*Halocaridina rubra*	*Palaemon debilis*	*Macrobrachium grandimanus*	*Meteptograpsis* sp.	*Kuhlia sandvicensis*	*Eleotris sandwicensis*
1	X	X	X	X	X	-	-	-	-	X	X	X
2	X	X	X	X	X	-	X	-	-	-	-	-
3	X	X	X	X	X	X	X	X	-	-	-	-
4	X	X	X	X	X	X	X	X	X	X	-	-
5	X	-	X	X	X	X	X	X	X	X	-	-
6	X	-	X	X	X	X	X	X	X	-	-	-
7	X	-	X	X	X	-	X	-	-	-	-	-
8	-	-	X	X	X	-	X	-	-	-	-	-
9	X	-	X	X	X	X	X	X	X	-	-	-
10	X	-	X	X	X	-	X	X	X	-	-	-
11	X	X	X	X	X	X	X	X	X	-	-	-
12	X	X	X	X	X	X	X	X	X	-	-	-
13	X	-	X	X	X	X	X	X	-	-	-	-
14	X	X	X	X	X	X	X	X	X	-	-	-
15	X	X	X	X	X	X	X	X	-	-	-	-
16	X	X	X	X	X	X	X	X	X	-	-	-
17	-	-	X	X	X	X	X	-	-	-		
18	X	X	X	X	X	X	X	X	X	X	X	-
19	X	X	X	X	X	X	X	X	X	X	X	-
20	-	-	X	X	X	-	-	-	-	-	X	

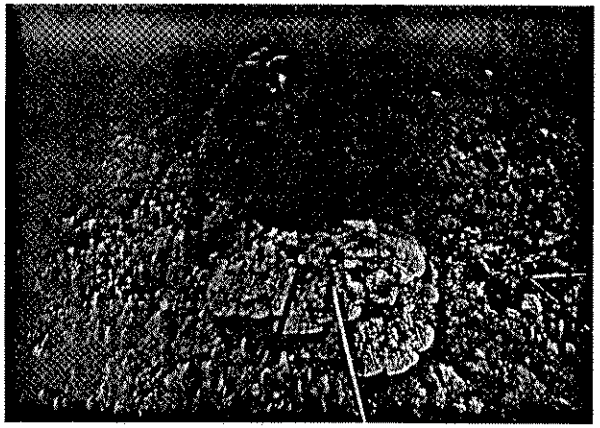

PLATE 1. Diver pounding steel stake into reef substrata to mark beginning of biological community structure transect 1-40. Transect tape can be seen in the center foreground. Large coral colony in center of photograph is Porites lobata. Notice extreme clarity of water and high percentage of living coral bottom cover.

PLATE 2. Typical area of basaltic boulders covering the nearshore area off much of the Hawaiian Riviera Resort. Light colored area at top center is foam from a wave breaking against the shoreline cliff. Notice barren nature of boulders with respect to colonizing organisms. Water depth is approximately 15 ft.

PLATE 3. View of boundary of boulder zone and edge of reef building zone at proposed marina site (Station 2). Corals in foreground (P. lobata and P. compressa) are growing at the edge of the reef terrace. Seaward extension of shoreline cliff can be seen in background. Water depth is approximately 15 ft.

PLATE 4. Diver laying transect tape over basaltic pavement at station 1-20. Predominant coral species is Pocillopora meandrina which commonly grows as short-branched hemispherical colonies.

PLATE 5. Basaltic outcrop at edge of edge of reef terrace at Station 10. Such structures are common along the entire length of the Hawaiian Riviera offshore environment. Numerous fish in the water column are fantailed filefish (Pervagor spilosoma), which occurred in very dense aggregations thoughout the study area. Water depth is approximately 60 ft.

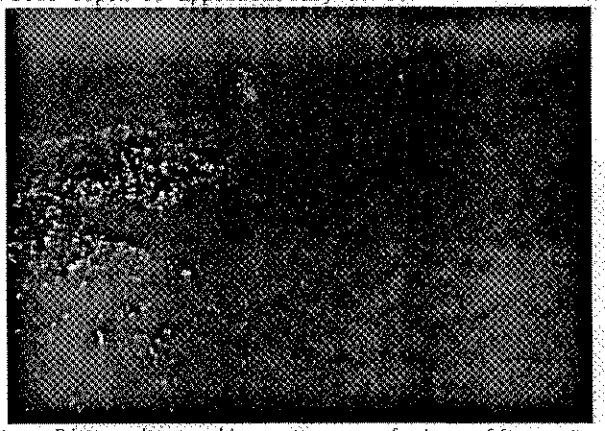

PLATE 6. Diver descending over reef dropoff at Station 3. Dropoff is composed of sheer cliff of solid basalt that extends down to a depth of about 90 ft. Water depth at top of cliff is 60 ft. In areas where such cliffs occur P. compressa slope zone is absent. Such topographic features make for spectacular underwater scenery and enhance the potential for recreational diving.

PLATE 7. Diver swimming up sand slope at edge of reefdrop off at station 7 outside of Pohue Bay. In areas where sand predominates on reef slope coral cover is reduced owing to lack of solid material for planulae settlement. Water depth is approximately 60 ft.

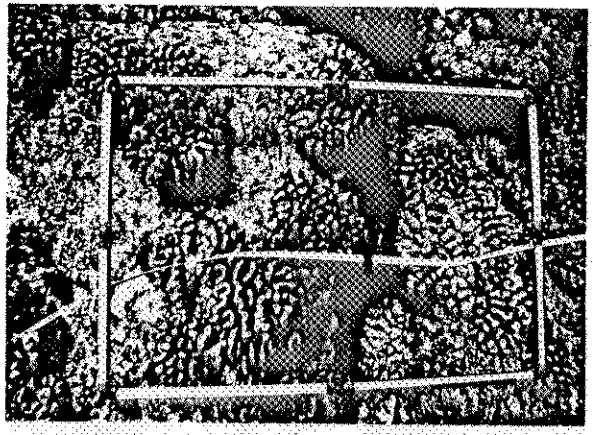

PLATE 8. Typical photo-quadrat in P. meandrina boulder zone on transect 1-15.

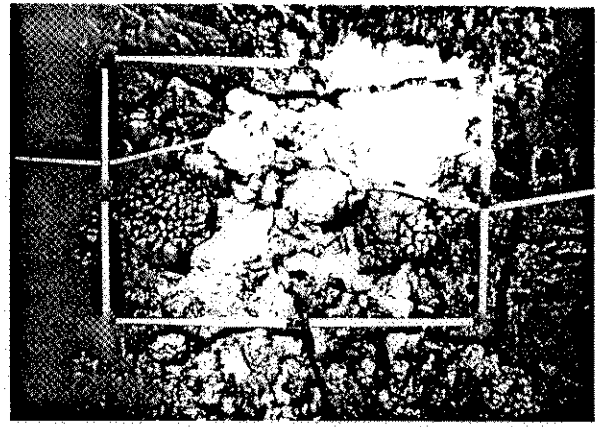

PLATE 9. Typical photo-quadrat in P. lobata reef building zone on transect 2-30.

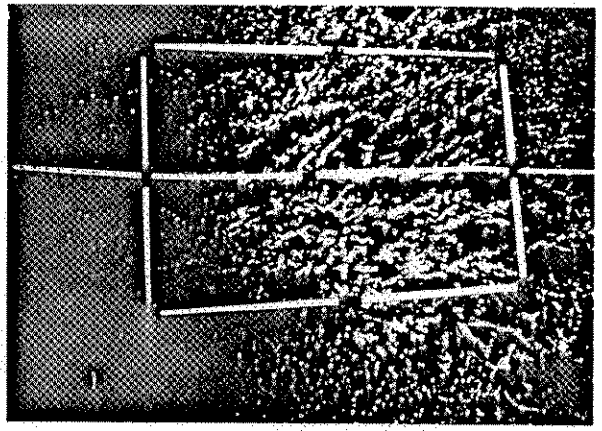

PLATE 10. Typical photo-quadrat in P. compressa reef slope zone on transect 1-60. In this quadrat 100% of the reef surface is covered with coral.

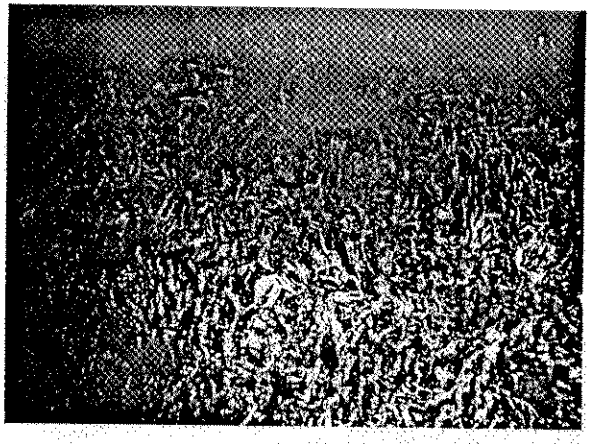

PLATE 11. View of P. compressa thicket. In center of photograph an area can be seen where many of the branches are broken from their base of attachment and are lying loose on the reef. Such damage is normally caused by wave action or dragging anchors. Compared to other areas of west Hawaii, wave stress is mild on the reefs fronting the proposed Hawaiian Riviera.

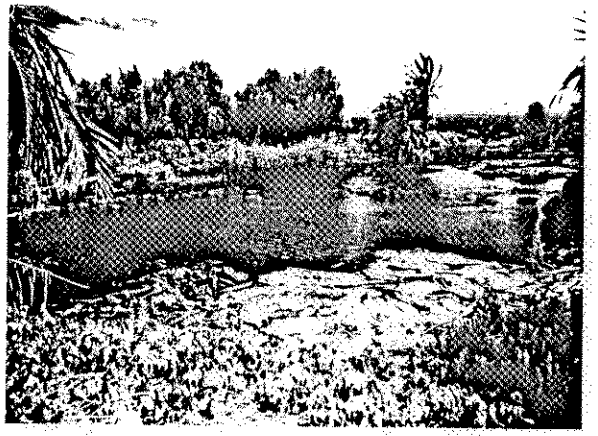

PLATE 12. Anchialine pond #1. This large pond is the main feature of the area known as the "waterhole". Rock structure in center of pond appears to be man-made, and may be part of a wall to separate fish holding pens. Green surface algal film in foreground is probably an alternate form of Shizothrix. Bottom of pond is covered with thick sediment deposit of organic origin

PLATE 13. Anchialine pond #2. Small orange-crust pond located north of pond #1 within "waterhole" complex. Orange crusts on rocks exposed at low tide are formed from mineralized deposits of alga Shizothrix sp. Green color of pond is due to dense growth of pond plants, Ruppia martima and Egeria densa.

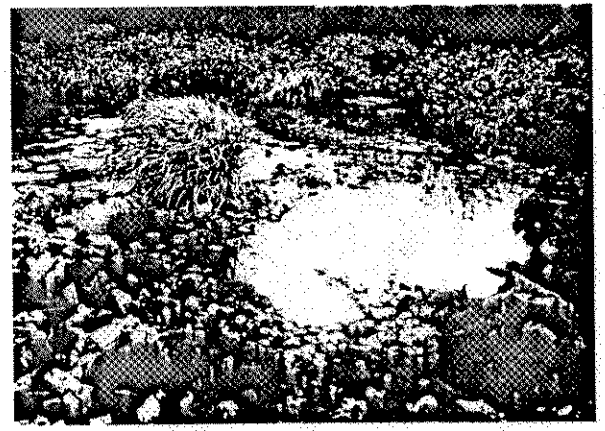

PLATE 14. Anchialine pond #3. Located at the northern end of waterhole complex. This pond contains some orange crust and pond plants, but is predominantly free of sediments. Lava berm in background marks the boundary of the low-lying "waterhole" where the largest aggregation of Hawaiian Riviera ponds was located.

PLATE 15. Anchialine pond #5. Small a'a pond contains no pond plants on bottom sediments. Located at northeastern side of waterhole complex.

PLATE 16. Anchialine pond #7. The surface of this large pond was completely covered with a thick layer of green algal slime. At the time of the photograph, the tide was low and slime can be seen coating protruding rocks throughout the pond. Such algal mats, as well as dense growth of bushes, trees and grasses around pond borders, indicate pond is in later stages of succession, and may soon be completely filled with organic material. Pond #7 is located in center of "waterhole" complex.

PLATE 17. Anchialine pond #8. Composed of 3 small a'a ponds that may be connected at high tide. Palm trees appeared to be planted at pond edge. Located at southern corner of "waterhole".

PLATE 18. Anchialine pond #10. Located along jeep trail near southern end of property. This pond represents the classic a'a type with no substantial plant or crust growth, and no sediment cover.

PLATE 19. Anchialine pond #11. Large orange crust pond located near the southern end of the Hawaiian Riviera property. It can be seen that the pond is located just behind the beach berm within 100 feet of the wash of waves.

PLATE 20. Anchialine pond #12. Located in a small valley probably formed by a slump in a lava flow, this long, narrow pond contains dense growth of Ruppia.

PLATE 21. Anchialine pond #13. This a'a pond is located farther from the shoreline (approximately 500 feet) than any other on the Hawaiian Rivera site, and appears to have been formed from the collapse of a lava "bubble".

PLATE 22. Anchialine ponds 15 and 16. These large ponds are part of a pond complex located in a low-lying a'a field at the extreme southern end of the development property.

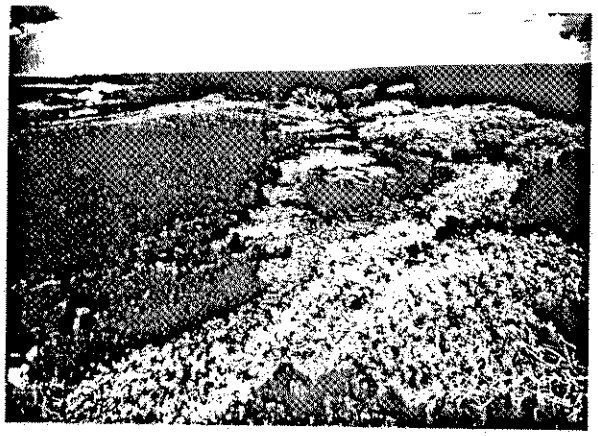

PLATE 23. Anchialine pond #18. Large pond located in central area of development property just behind beach berm. For comparison of pond size, note car at upper left.

PLATE 24. Anchialine pond #19. Located adjacent to pond #18, this pond probably has the most extensive deposits of mineralized orange Schizothrix crusts, and Ruppia and Egeria growth.

PLATE 25. Underwater view showing close-up of mineralized orange crust (Schzothrix) deposits. Green plant in center is Egeria densa, and dark green plant at upper left is Ruppia maritima. Numerous small red objects throughout photo are opae'ula shrimp (Halocaridina rubra).

APPENDIX D

Coastal Engineering Planning and Design Considerations

COASTAL ENGINEERING

PLANNING AND DESIGN CONSIDERATIONS

FOR THE

HAWAIIAN RIVIERA RESORT

KAHUKU, KA'U, HAWAII

Sea Engineering, Inc.

COASTAL ENGINEERING

PLANNING AND DESIGN CONSIDERATIONS

FOR THE

HAWAIIAN RIVIERA RESORT

KAHUKU, KA'U, HAWAII

Prepared for

Palace Development Corporation/

Hawaii Ka'u Aina Partnership

Prepared by

Sea Engineering, Inc.

Makai Research Pier

Waimanalo, Hawaii

July 1987

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I. INTRODUCTION

PROJECT AREA LOCATION AND GENERAL DESCRIPTION

The project area is located on the southwest coast of the island of Hawaiil (Ka'u District T.M.K. 9-2-01:Portion 72), between Humuhumu Point and Kahakahakea Point. The resort project will involve about 550 acres with a shoreline frontage of approximately 4.5 miles.

The coast is composed of rough and barren lave flows, inaccessible by land except for a few jeep trails. The shoreline is rocky and irregular, with sea cliffs, rock and rubble predominating. A few small black sand pocket beaches exist adjacent to eroding cinder cones along the shore. The offshore bottom slopes steeply to deep water at a 20 to 30 percent grade. The coast is sheltered from the direct approach of tradewind waves and north swell, however the tradewinds and tradewind waves wrap around the southern tip of the island often making the coastal waters windy and choppy. South swell during the summer months and westerly Kona wind waves in the winter approach the coast directly. The coastal currents reverse with the tide, setting west-southwesterly with the ebb tide and southeasterly with the flood tide, at speeds of about 1/4 knot.

STUDY PURPOSE

This study provides coastal engineering parameters for feasibility analysis, conceptual planning and environmental assessment for the proposed Hawaiian Riviera Resort. Included is (1) an evaluation of coastal engineering design parameters, (2) assessment of tsunami and hurricane storm wave inundation limits, (3) preliminary layout and design of a small boat marina, (4) layout and design considerations for recreational sand beach and swimming lagoons, and (5) a discussion of large cruise ship docking and mooring considerations.

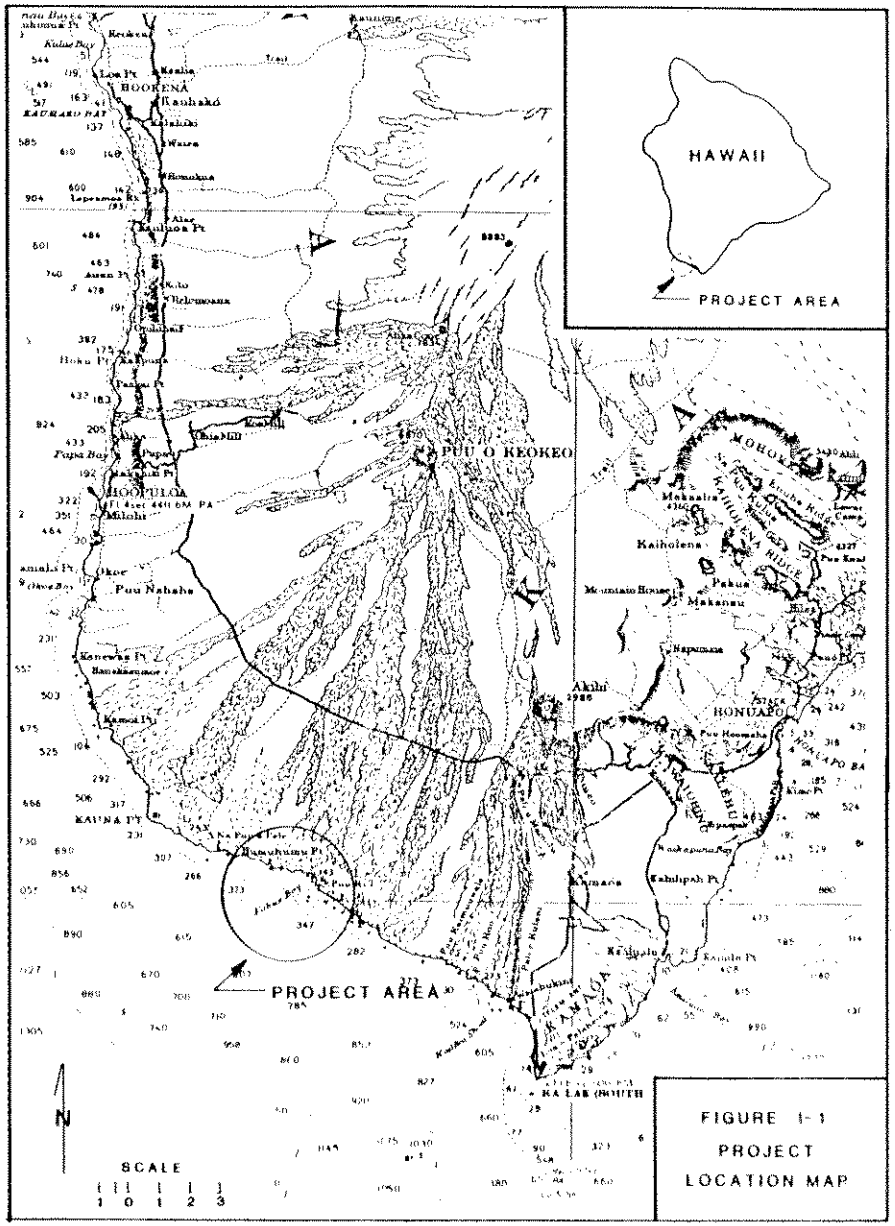


FIGURE 1-1
PROJECT
LOCATION MAP

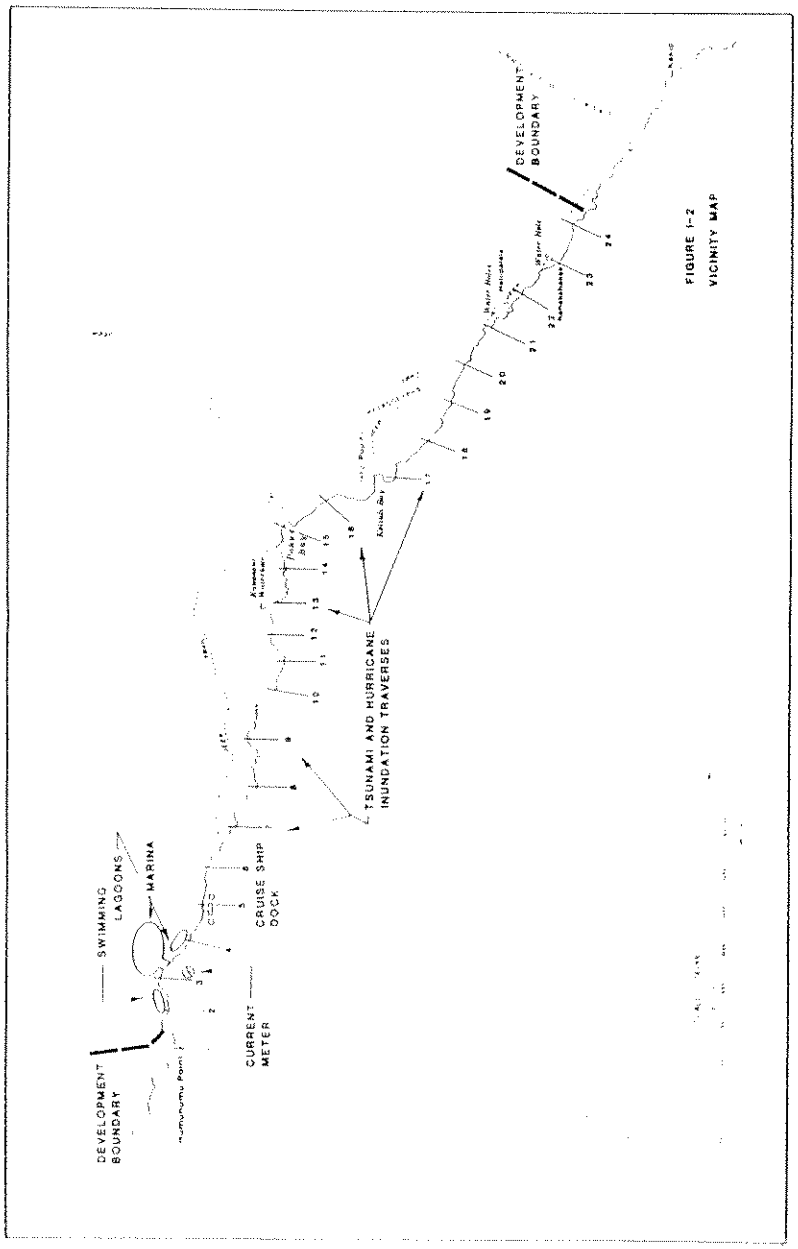


FIGURE I-2
VICINITY MAP

II. OCEANOGRAPHIC CHARACTERISTICS IN THE PROJECT AREA

WIND

Prevailing Wind

The climate in Hawaii is characterized by two distinct seasons, primarily defined by the annual variation in persistence of the northeast tradewinds. During the summer months of about May through September, the tradewinds predominate, blowing out of the northeast 80 to 90 percent of the time with speeds generally from 10 to 25 mph. The winter season, from about November through March, is characterized by a weakening of the tradewind persistence and the occurrence of southerly or westerly winds as a result of localized low pressure and frontal systems. The months of October and April are generally considered transitional periods between seasons. The mean monthly frequency of tradewind occurrence in Hawaiian waters is shown on Table II-1.

Open ocean wind statistics for leeward Hawaii are shown in Table II-2 and the wind rose on Figure II-1, which have been compiled by the U.S. Naval Weather Service Command in the Summary of Synoptic Meterological Observations (SSMO). The SSMO data was obtained through direct synoptic observations by ships in passage and represents average conditions recorded during the 8-year period from 1963 to 1970. According to the data, 75% of wind speeds range from 7 to 27 knots and the wind directions are easterly 80% of the time.

During conditions of no tradewinds or nearby storms the winds may become light and variable, with land/sea breezes predominating due to the diurnal heating and cooling of the island. The large mountains of Mauna Kea and Mauna Loa shelter much of the west coast of the island of Hawaii from the tradewinds, and Hariguchi (1979) reports light and variable winds prevail to about 40 miles offshore of southwest Hawaii.

There is no existing available wind data for the project area (wind data is being obtained as part of the initial planning and

design process), however site visits by study personnel and discussions with local boaters indicate that the site is south of the coastal areas sheltered by Mauna Loa, and in fact may be subject to somewhat accelerated tradewinds diffracting and wrapping around the southern slope of Mauna Kea and South Point. This is illustrated on Figure II-2. It is hypothesized that during tradewind conditions the wind direction is easterly in the project area, resulting in winds along and offshore, with speeds generally equal to or greater than the open ocean wind speed. Local boaters stated that this area was generally windy, without the sheltering effects you would expect on a lee shore during tradewind conditions.

The project area is directly exposed to Kona winds flowing from the south-southwest to west, generated by low pressure systems or cold fronts moving toward Hawaii at speeds of about 10 to 15 knots. Periods of Kona winds are generally of short duration (1 to 3 days), and damaging Kona winds are not common. A severe Kona storm in January 1980, however, had sustained wind speeds of about 30 knots or greater for a period of several days, and caused considerable damage. According to the SSMO data, winds from the south through west with speeds greater than 17 knots were reported about 1% of the time.

TABLE II-1

MEAN FREQUENCY OF TRADEWIND OCCURRENCE

(From Haraguchi, 1979)

MONTH	PERCENT (%)
January	42
February	55
March	61
April	74
May	86
June	91
July	95
August	94
September	83
October	71
November	64
December	57
ANNUAL	65

TABLE II-2

WIND STATISTICS FOR LEEWARD HAWAII

PERCENT FREQUENCY OF WIND DIRECTION VS. WIND SPEED

WIND SPEED	WIND DIRECTION								
KNOTS	N	NE	E	SE	S	SW	W	NW	TOTAL (%)
CALM									1.5
0-6	2.1	5.8	5.8	2.6	1.7	1.1	1.0	1.1	21.2
7-16	2.8	16.0	21.1	5.2	2.6	1.5	1.1	1.2	51.6
17-27	0.8	9.6	11.1	1.3	0.6	0.3	0.2	0.3	24.2
28-40	0.1	0.7	0.6	0.1	*	*	*	*	1.6
4K	0.0	*	*	*	0.0	0.0	0.0	0.0	*
Total (%)	5.8	32.1	38.6	9.3	4.9	2.9	2.4	2.6	100.00

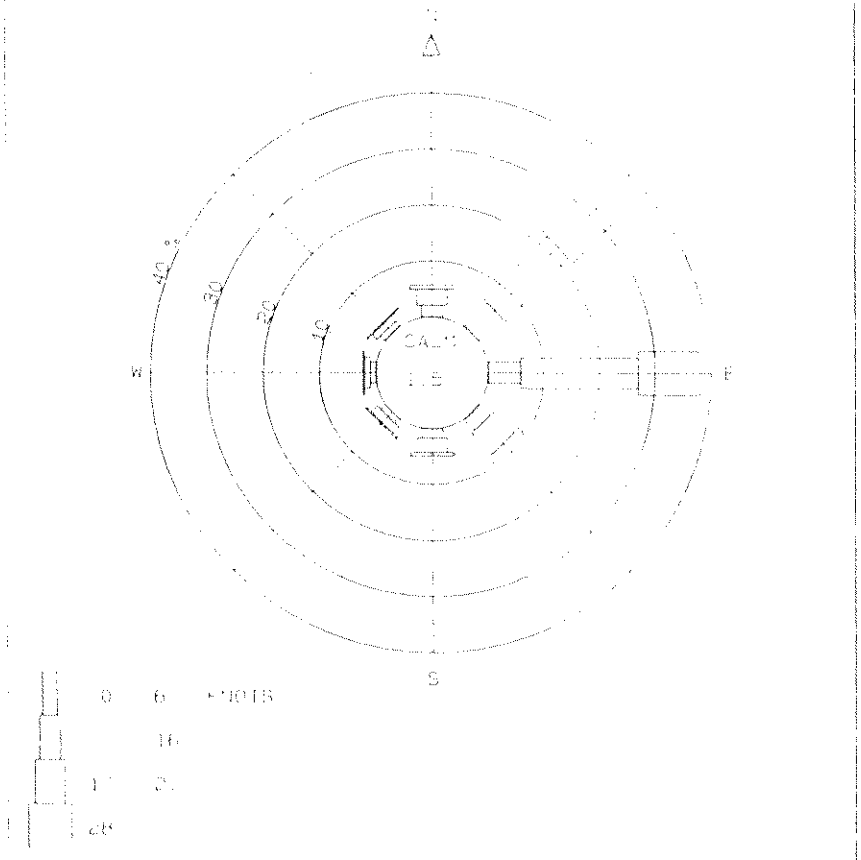


FIGURE II-1

WIND ROSE BASED ON SSMO DATA

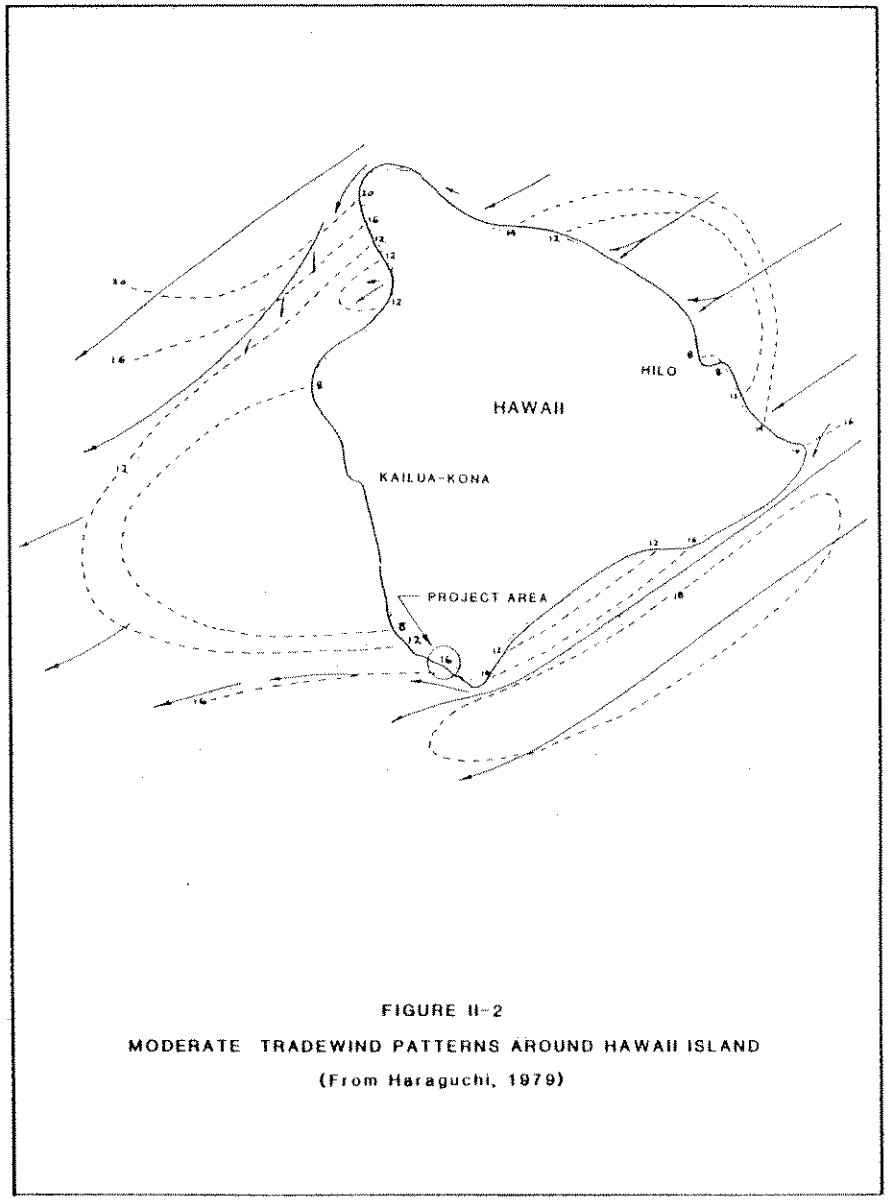


FIGURE II-2

MODERATE TRADEWIND PATTERNS AROUND HAWAII ISLAND

(From Haraguchi, 1979)

Hurricanes

Hurricanes form near the equator, and in the central North Pacific usually move toward the west or northwest. During the primary hurricane season of July, August and September, hurricanes generally form off the west coast of Mexico and move westward across the Central Pacific. These tropical storms or hurricanes usually pass south of the Hawaiian Islands, with a northward curvature near the Hawaiian Islands. However, they generally stay far enough offshore to only cause high surf or heavy rainfall as they pass. Late season tropical storms and hurricanes follow a somewhat different track, forming south of Hawaii and moving north toward the islands. Hurricane Nina formed near Palmyra Island (6° N, 162° W) in November 1957 and moved north toward Hawaii, approaching within 150 miles of Kauai before being turned sharply westward by the tradewinds. Hurricane Iwa, in November 1982, formed in the same location and followed a similar path north, however this time the tradewinds were absent and it reached Hawaii.

There are many recorded tropical storms or hurricanes which have approached the Hawaiian Islands during the past 37 years. Most of these storms passed well south or west of the islands, or weakened in intensity as they reached Hawaii, but there have been notable exceptions. Hurricanes Hiki, Della, Nina and Fico passed within about 200 miles of the islands, Dot passed over Kauai, and Iwa passed within 30 miles (25 NM) of Kauai. Hurricane Susan, with sustained wind speeds estimated at 120 knots was pointed directly at the Big Island approaching from the southwest but died before coming within 200 miles of the islands. The tracks of these storms and ther general characteristics as reported by Haraguich (1984) are shown on Figure II-3 and Table II-3.

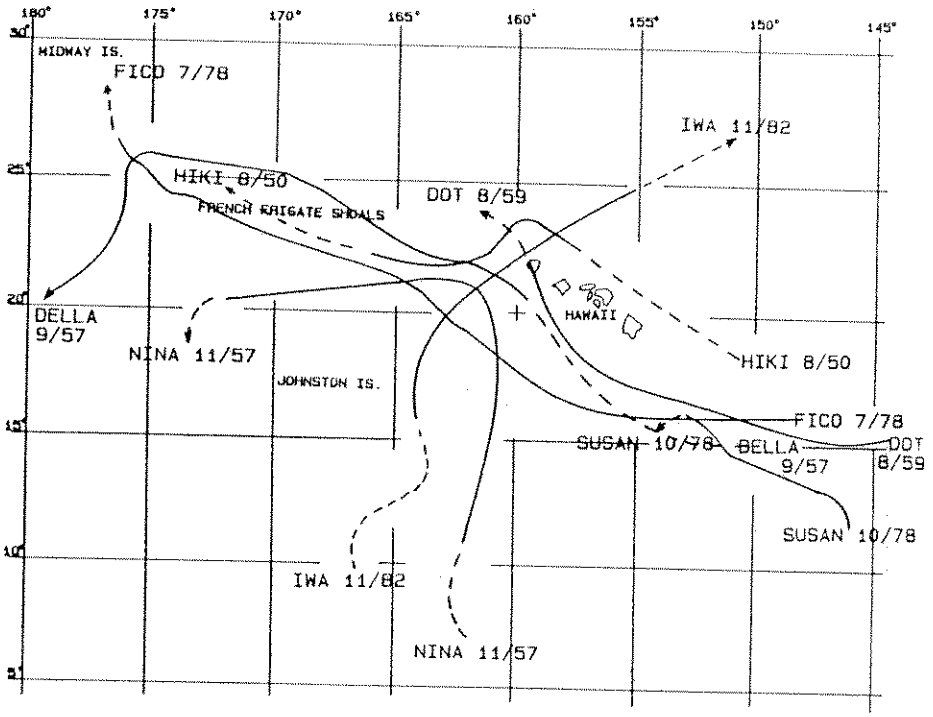


FIGURE II-3

HISTORICAL HURRICANE STORM TRACKS

TABLE II-3

HISTORICAL HURRICANE CHARACTERISTICS

Name	Date	Max. Sustained Wind Speed (kts)	Lowest Sea Level Pressure (mbs)	Direction	Forward Speed (kts)	Eye Diameter (NM)
HIKI	Aug. 50	65	983	WNW	5	10-20
DELLA	Sep. 57	-	-	NW	6	-
NINA	Nov. 57	80	-	NNW	8	-
DOT	Aug. 59	65	984	NNW	9	20-30
FICO	Jul. 78	100	955	WNW	10	30
SUSAN	Oct. 78	120	954	NW	6	10-20
IWA	Nov. 82	65	972	NE	32	20-30

WAVE CLIMATE

Prevailing Deepwater Waves

The general Hawaiian wave climate can be described by four primary wave types; the northeast tradewind waves, south swell, Kona storm waves and North Pacific swell. These wave types and their general approach directions are shown on Figure II-4. Waves are considered to be in deepwater, and thus unaffected by the bottom, when the water depth is equal or greater than one-half the wave length.

Tradewind waves may be present in Hawaiian water throughout most of the year, but are most frequent between April and September, the summer season, when they usually dominate the Hawaiian wave climate. They result from the strong and steady tradewinds blowing from the northeast quadrant over long fetches of open ocean. Typically, the deepwater tradewind waves have periods of 6 to 8 seconds and heights of 4 to 10 feet.

South swell is generated by southern hemisphere storms and is most prevalent during the months of April through October. These long, low waves approach from the southeast through southwest, with periods of 12 to 20 seconds and deepwater heights of 1 to 6 feet.

Kona waves are generated by intense winds associated with local fronts or low pressure systems and typically have periods ranging from 6 to 10 seconds and heights up to 10+ feet. These waves approach from the south to west, with the larges waves usually from the southwest. Deepwater wave heights during a severe Kona storm in January 1980 were about 17 feet with a period of 9 seconds.

North Pacific swell is produced by severe winter storms in the Aleutian area of the North Pacific Ocean and by mid-latitude low pressure areas. North swell may arrive in the Hawaiian Islands throughout the year but is largest and most frequent during the winter months of October through March. North or northeast swell

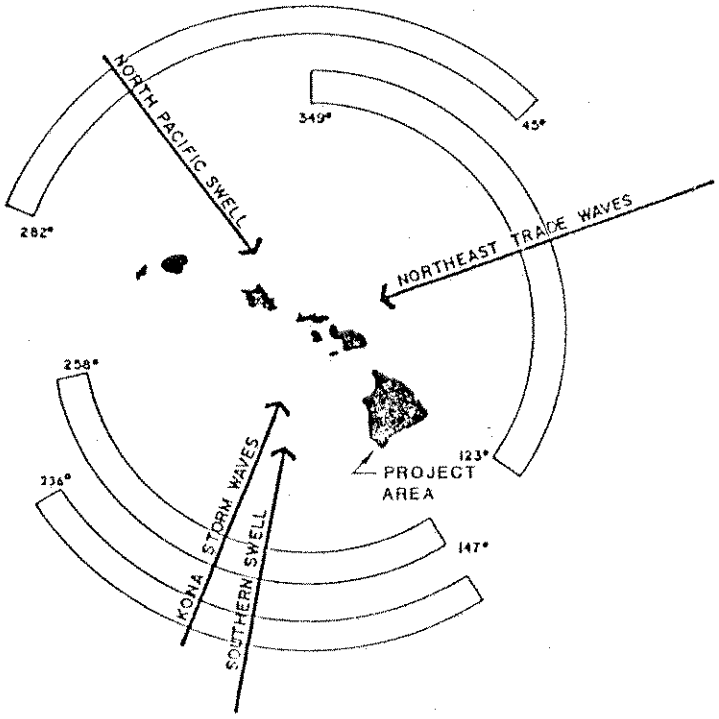


FIGURE II-4
GENERALIZED WAVE TYPES
(Adapted From The Atlas of Hawaii)

is sometimes generated by winter storms northeast of the islands. North Pacific swell typically has periods of 12 to 20 seconds and heights of 5 to 15 feet.

These general deepwater wave types follow different paths to reach the study area. North Pacific swell diffracts and refracts around the islands with only a portion of their deepwater energy generally reaching the projected area. Tradewind waves diffract around South Point on the island of Hawaii, and again only a portion of their energy reaches the project area. Kona storm waves and south swell, on the other hand, approach the coast in the project area directly.

Open ocean (deepwater) wave statistics have been compiled by the U.S. Naval Weather Service Command in the Summary of Synoptic Meteorological Observations (SSMO) - Hawaiian and Selected North Pacific Island Coastal Marine Areas. The SSMO datra was obtained through direct synoptic observations by ships in passage and represents average conditions recorded during the 8-year period from 1963 to 1970. The wave data is summarized both monthly and annually and is presented two ways. Sea waves generated by local winds in the vicinity of the observer are presented as percent frequency of sea height versus surface wind speed and direction (8 compass points), and the percent frequency of wave height versus wave period. For the latter presentation when both sea and swell waves are present, the higher of the two is used. Sea is defined as waves generated by winds in the vicinity of the observer, and swell as waves generated by winds distant from local area of observation. It should be noted that ships tend to avoid bad weather when possible, thus biasing the SSMO data toward good weather samples (and thus lower wave heights). In addition, longer period swell may be masked from visual observation by shorter period local wind waves superimposed on top of the swell.

Deepwater wave data in the Hawaiian Islands is also collected by the Coastal Data Information Program (CDIP) a coastal wave data collection and analysis program conducted by Scripps Institution

of Oceanography under the sponsorship of the U.S. Army Corps of Engineers. Wave height and period data is measured by a network of Waverider buoys conected to a central data acquisition and analysis station at Scripps Institution. Unfortunately, no wave direction data is obtained. Hawaii has two buoys which are monitored by the program, one located about 5 miles east of Makapuu Point, Oahu, and one located west of Barking Sands, Kauai. Both buoys are moored in about 600 feet of water. The Makapuu buoy is partially sheltered from westerly waves by the island of Oahu, and the Barking Sands buoy is sheletered from easterly waves by the island of Kauai.

A summary of the SSMO data from leeward Hawaii is provided on Table II-4, and a summary of the percent frequency of wave height versus period over a one-year period (1983 and/or 1984) for both the Makapuu Point and Barking Sands Waverider buoys is provided on Table II-5. According to the SSMO data, waves will approach the project area from the southeast clockwise to northwest approximately 22% of the time.

Deepwater Storm Waves

The project area is also exposed to severe wave attack from passing tropical storms and hurricanes. The U.S. Army Corps of Engineers (1967) hindcasted wave heights generated by 17 severe storms during the period 1947 to 1965, and seven of these affected the south and/or west shores of the islands. Marine Advisors (1963) also hindcasted deepwater wave conditions off the west coasts of Lanai and Molokai produced by the ten worst storms of the 15-year period from 1947 to 1961. Sea Engineering, Inc., hindcasted the deepwater wave characteristics for the Kona storm of January 1980, and the hurricane Iwa deepwater wave heights near the project area. Storm wave data from these sources is summarized in Table II-6.

TABLE II-4
SSMO DEEPWATER WAVE STATISTICS FOR LEEWARD HAWAII

a) PERCENT FREQUENCY OF WIND DIRECTION VERSUS WAVE HEIGHT

HEIGHT(FT) \ WIND DIR.	N	NE	E	SE	S	SW	W	NW	TOTAL
<1 (FT)	0.9	1.4	1.8	0.7	0.7	0.4	0.5	0.4	6.8
1-2	2.7	6.4	10.9	2.9	1.9	1.1	1.2	1.2	28.3
3-4	2.8	9.2	15.9	2.8	1.5	0.6	0.8	0.6	34.2
5-6	1.6	4.5	8.8	1.2	0.5	0.1	0.3	0.3	17.3
7	0.8	2.5	4.0	0.4	0.3	0.1	0.1	0.1	8.3
8-9	0.3	1.1	1.6	0.1	*	*	0.1	0.1	3.3
10-11	0.1	0.4	0.5	0.1	*	*	*	*	1.1
12	0.1	0.1	0.1	*	0.0	0.0	*	0.0	0.3
13-16	*	0.1	0.1	*	*	0.0	0.0	0.0	0.2
17-19	0.0	0.0	*	0.0	0.0	0.0	0.0	0.0	*
>20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	9.2	25.5	43.8	8.4	4.9	2.5	3.0	2.7	100.0

(b) PERCENT FREQUENCY OF WAVE PERIOD VERSUS WAVE HEIGHT

HEIGHT(FT) \ PERIOD(SEC)	<6	6-7	8-9	10-11	12-13	<13	INDET	TOTAL
<1	1.5	0.1	*	0.0	0.0	0.0	3.6	5.3
1-2	12.5	2.1	0.4	0.1	*	0.0	1.1	16.2
3-4	21.2	8.1	2.2	0.5	*	0.0	1.0	33.1
5-6	8.3	8.6	2.8	0.7	0.2	0.1	0.6	21.2
7	3.2	6.2	2.8	0.7	0.3	0.1	0.2	13.6
8-9	1.0	2.2	1.6	0.6	0.2	0.1	0.1	5.9
10-11	0.3	0.9	1.0	0.4	0.1	*	0.1	2.8
12	0.1	0.3	0.4	0.2	*	*	*	0.9
13-16	0.1	0.2	0.2	0.2	0.1	*	*	0.7
17-19	0.0	*	*	*	0.0	*	0.0	0.1
20-22	0.0	*	*	*	0.0	*	0.0	0.1
23-25	0.0	*	*	*	*	0.0	0.0	0.1
26-32	0.0	0.0	0.0	0.0	*	0.0	0.0	*
>33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	48.5	28.6	11.5	3.3	1.0	0.4	6.7	100.0

TABLE II-5
CDIP PROGRAM DEEPWATER WAVE STATISTICS FOR HAWAII

ANNUAL PERCENT FREQUENCY OF WAVE PERIOD (T) VERSUS
HEIGHT (H) FROM THE MAKAPUU POINT BUOY
(JAN. - DEC. 1984)

HEIGHT(FT)/ TIME(SEC)	4-6	6-8	8-10	10-12	12-14	14-16	16-18	>18	TOTAL
<2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.5-4.4	2.90	1.98	4.18	0.78	0.92	0.07	0.0	0.0	10.83
4.5-6.4	20.59	10.90	8.35	2.97	2.90	1.34	0.35	0.0	47.42
6.5-8.4	4.74	12.88	5.45	1.63	2.05	0.78	0.21	0.0	27.74
8.5-10.4	0.07	5.80	2.26	0.71	0.99	0.71	0.07	0.0	10.62
10.5-12.4	0.0	0.78	0.50	0.0	0.42	0.21	0.07	0.0	1.98
12.5-14.4	0.0	0.0	0.50	0.28	0.14	0.14	0.07	0.0	1.13
>14.5	0.0	0.0	0.0	0.28	0.0	0.0	0.0	0.0	0.28
TOTAL	28.31	32.34	21.23	6.65	7.43	3.26	0.78	0.0	100.0

ANNUAL PERCENT FREQUENCY OF WAVE PERIOD (T) VERSUS
HEIGHT (H) FROM THE BARKING SANDS BUOY
(JAN.- AUG. 1983 & SEP.- DEC. 1984)

HEIGHT(FT)/ TIME (SEC)	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	TOTAL
<2.5	0.43	0.34	0.26	0.00	0.00	0.00	0.00	0.00	0.00	1.03
2.5-4.4	12.96	12.02	6.61	4.03	1.03	0.77	0.00	0.00	0.00	37.42
4.5-6.4	5.58	6.70	5.24	7.47	4.81	1.55	0.17	0.09	0.00	31.59
6.5-8.4	0.34	1.63	1.55	3.78	4.38	1.63	0.34	0.09	0.00	13.73
8.5-10.4	0.00	0.00	0.43	1.29	3.18	2.15	0.94	0.09	0.09	8.15
10.5-12.4	0.00	0.00	0.17	0.60	1.55	1.63	0.69	0.00	0.00	4.72
12.5-14.4	0.00	0.00	0.09	0.17	0.52	0.43	0.17	0.09	0.00	1.46
14.5-16.4	0.00	0.00	0.00	0.17	0.26	0.34	0.26	0.00	0.00	1.03
16.5-18.4	0.00	0.00	0.00	0.00	0.00	0.17	0.26	0.00	0.00	0.43
>18.4	0.00	0.00	0.00	0.00	0.09	0.09	0.26	0.00	0.00	0.43
TOTAL	19.31	20.77	14.33	17.51	15.79	8.76	3.09	0.34	0.09	100.00

TABLE II-6. HISTORIC STORM WAVE CHARACTERISTICS

Date	Deepwater Wave Height (feet)	Deepwater Wave Period (seconds)	Approach Direction
20 Dec 1955	14.8	11	West
5 Sep 1957 (Della)	18.9	21	West
2 Dec 1957 (Nina)	20.0	13	South & West
18 Jan 1959	14.0	10	South & West
6 Aug 1959 (Dot)	22.5	12	South & West
7 Jan 1962	13.6	11	South & West
17 Jan 1963	12.0	10	Southwest
11 Jan 1980	17.0	9	Southwest
23 Nov 1982 (Iwa)	14.0	14	Southwest

Extreme storm wave conditions can be predicted by analyzing the large waves reported in SSMO data. Bretschneider, et al (1977) describe a method for predicting extreme wave conditions using Gumbel's distribution function. Taking the smallest annual maxima of interest as 16.5 feet, 34 waves in the SSMO data were used to determine wave height versus return period as follows:

Return Period In Years	Wave Height In Feet
10	28.7
25	31.0
50	32.8
100	34.5

The above return period is the average expected duration between occurences of a given wave height, i.e. a 63% chance of a given wave height within its return period. This analysis estimates the possible occurrence of extreme waves in the waters off Leeward Hawaii, however it does not mean that these waves would necessarily reach the project area.

Nearshore Wave Climate

Deepwater waves propagating toward the coast are primarily altered by refraction as they pass over changing bottom contours, shoaling as the waves move from deep to shallow water and ultimately by breaking. The speed at which a wave travels depends on wave period and is proportional to the water depth in which it is propagating. As waves move at an angle to underwater contours, the part of the wave in deeper water moves faster than the part in shallower water and the wave crest bends or refracts toward alignment with the bottom contours. This change in directin of different parts of the wave may result in convergence or divergence of wave energy and has a major influence on the distribution of wave height and energy along a coastline. The waves travel toward shore until the water depth become shallow enough to initiate breaking. The maximum breaker height in shallow water is a function of (1) the water depth; (2) the bottom slope; and (3) the incident wave height and period (steepness). The large storm waves will break some distance offshore, then reform and continue shoreward as smaller waves until they also break.

Wave refraction diagrams were numerically calculated for 12 and 16 second waves from the south (180°), and 8 and 12 second waves from the southwest (225°) and west (270°), to illustrate the effect of wave refaction and shoaling on deepwater waves directly approaching the project area. These refraction diagrams are shown in Appendix A. The diagrams, which show wave energy divergence or convergence by the change in distance between the wave orthogonals (lines perpendicular to the wave crests) as they approach the shore. Increasing distance between adjacent orthogonals indicates energy divergence and vice-versa. As can be seen on the diagrams there is some localized wave convergence and divergence, however overall the approaching waves are not very much altered as they approach shore. With the exception of waves from the west, which tend to decrease in height by about 30% as they approach the shore, the deepwater wave heights change very little as a result of refraction and shoaling. This is primarily because

deep water extends so close to the shore that the approaching waves "feel" the bottom for only a short distance and thus have little time or distance in which to react to the bottom. Deep-water waves from the south or southwest with heights of 2 to 5 feet would result in nearshore breaker heights of about 3 to 6 feet, and lower breaker heights for waves from the west. These waves would break within about 30 to 70 feet of the shoreline. The SSMO data indicates that wind waves from these directions occur less than 10% of the time. The rest of the time the near-shore wave climate is predominantly comprised of short period tradewind waves which refract and diffract around South Point and propogate up the southwest coast parallel to the shore, and very short, steep seas generated by the prevailing easterly winds. These waves are less than 4 feet-high with periods less than 6 seconds. In the summer months, when low height and long period south swell is present, these short, steep seas almost perpendicularly cross the south swell with virtually no interaction between the two wave systems.

ASTRONOMICAL TIDE

The tides in Hawaiian Waters are semi-diurnal, with pronounced diurnal inequalities (i.e. two tidal cycles per day with the range of water levels being unequal). Tidal data, shown below, was obtained from the U.S. Department of Commerce, National Oceanic and Atmospheric Agency, National Ocean Survey. The closest tidal station is located at Honuapo Bay approximately 20 miles northeast of the project area.

	Feet
Mean Higher High Water	2.5
Mean High Water	2.0
Half Tide Level (approx. MSL)	1.1
Mean Low Water	0.3
Mean Lower Low Water	0.0

TSUNAMIS

The Hawaiian Islands are directly exposed to the major tsunami wave generating areas in the Pacific Ocean, the Kuril-Kamchatka-Aleutian region of the north and northwestern Pacific, the west coast of South America, and the seismically active southwest Pacific. Tsunamis, or seismic sea waves, are primarily generated by submarine earthquakes and earth movement with magnitudes greater than about 6.5 on the Richter scale. Coastal and submarine landslides and volcanic eruptions can also generate tsunamis. Loomis (1976) lists 22 significant tsunamis in Hawaii since 1819, with the most damaging occurring in 1946 when an earthquake in the East Aleutian Islands generated a tsunami which killed 173 people in Hawaii and caused $26 million in property damage in Hilo alone.

Very little historical tsunami runup and inundation information is available for the project area, presumably due to its relatively remote, inaccessible and uninhabited location. Loomis (1976) reports a tsunami wave height of 13 feet for the 1960

tsunami, generated off the coast of Chile, at Pohakeo, on the west side of South Point approximately 8 miles south of the project area. He also reports tsunami wave heights of 2, 5 and 3 feet at Milolii, 12 miles north of the project site, for the 1946, 1957 and 1960 tsunamis, respectively.

Tsunamis generated by local earthquakes in Hawaii also pose a threat to coastal areas. In November 1975 an earthquake of magnitude 7.2 on the Richter scale, with an epicenter near Kalapana on the southeast coast of the island of Hawaii, generated a tsunami which did considerable damage to shoreline areas on the southern two-thirds of the island (Loomis, 1975). The largest wave was 20 feet high and overran the shoreline near the epicenter within seconds of the earthquake. Loomis (1975) reports wave runup heights of about 14 to 18 feet in the vicinity of South Point, and heights of 6 to 12 feet on the west coast as far north as Kailua-Kona. The largest reported tsunami runup height in Hawaii, 45 to 60 feet on the southeast coast of the island of Hawaii, occurred as a result of a locally generated tsunami in 1868. Locally generated tsunamis pose a particular problem for Hawaii shorelines because of the lack of warning time for coastal residents, campers or beach goers.

CURRENTS AND CIRCULATION

General

Coastal currents in Hawaii are the resultant of several components: (1) the oceanic "permanent flow" sweeping past the islands; (2) tidal currents generated by the passage of astronomical tide waves past the islands; (3) wind-induced surface currents; and (4) mass transport associated with the movement of wind waves. Along the shoreline the nearshore currents are also the result of wave action against the shore. Each of the components is variable in direction and strength with time, and the components are greatly influenced by the nearshore topography, thus there can be a great deal of variability in the coastal current speeds and directions on a daily basis as well as seasonally and annually.

The oceanic flow around the Hawaiian Islands sets toward the west, with an average velocity of less than about 0.5 knots and a range of less than 0.1 knots to more than 1 knot. The tide waves move through the islands from north-northeast to south-southwest. In the open ocean the tidal currents set approximately southwest at high tide (i.e. the flood tide current sets in the direction of propagation of the tide wave), and reverse direction during the ebb tide. Nearshore tidal currents are greatly affected by the shape of the islands and the nearshore topography. The local wind-driven surface currents generally follow the prevailing wind direction, and are often in different directions than the currents below the surface.

Waves are a major factor influencing the nearshore, shallow water currents. The mass transport of water by breaking waves and the action of waves breaking at an angle to the shore generates longshore currents which are largely responsible for sediment transport and rip currents which facilitate the exchange of nearshore water and coastal waters.

There is no existing available information specific to the coastal currents offshore of the project area. Wyrthi et al

(1969) reported the net transport off South Point, 10 miles southeast of the project area, to set west-southwest at a speed of 19 cm/sec (0.4 knots) at the 15 m depth in a water depth of 80 m. This was based on 38 days of measurement during August and September 1968.

Current Measurement

Methodology. Nearshore current speed and direction and general circulation patterns in the vicinity of the project area were measured using an in situ recording current meter and drift drogues. The current meter provided a continuous record of subsurface current speed and direction at a fixed location, which the drift drogues provided information of horizontal and vertical current gradients and the general flow pattern.

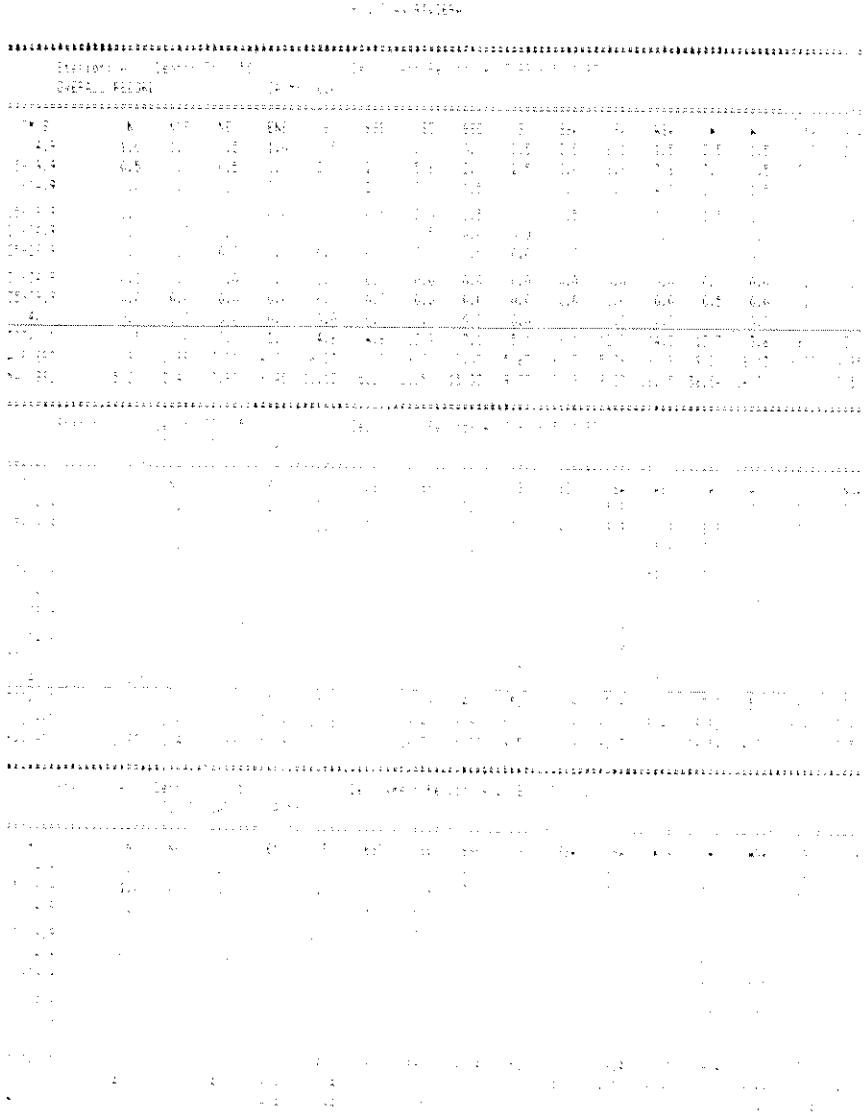
A General Oceanics Model 2010 current meter was deployed at the west end of the project area, near the proposed marina entrance (see Figure I-2), from April 23 to May 1, 1987. The meter was located at the 35-foot depth in a total water depth of 55 feet. The meter recorded the date, time, current speed and current direction at 7.5 minute intervals during the deployment period.

Drift drogues were followed during a flood-slack-ebb tide on April 23, 1987. The drogues used were window shade type drogues with cross-sectional areas of 50 square feet, suspended from small surface floats. The large surface areas of the drogue relative to the small surface float minimizes undesireable influences of the wind on drogue movement. The drogues were suspended at two depths, at the surface from 0 to -10 feet and subsurface from -25 to -35 feet, and were tracked by measuring horizontal sextant angles to known points on land.

Data Analysis and Conclusions. The current meter data was sorted into frequency histograms by the overall record and for ebb and flood tide stages, and the histograms are presented in Table II-7. Current roses which graphically depict the speed and

TABLE II-7

CURRENT SPEED AND DIRECTION HISTOGRAMS



direction histograms are shown on Figure II-5. A plot of the drift drogue tracks is shown on Figure II-6.

General characteristics of the currents offshore of the project area revealed by the current measurements include:

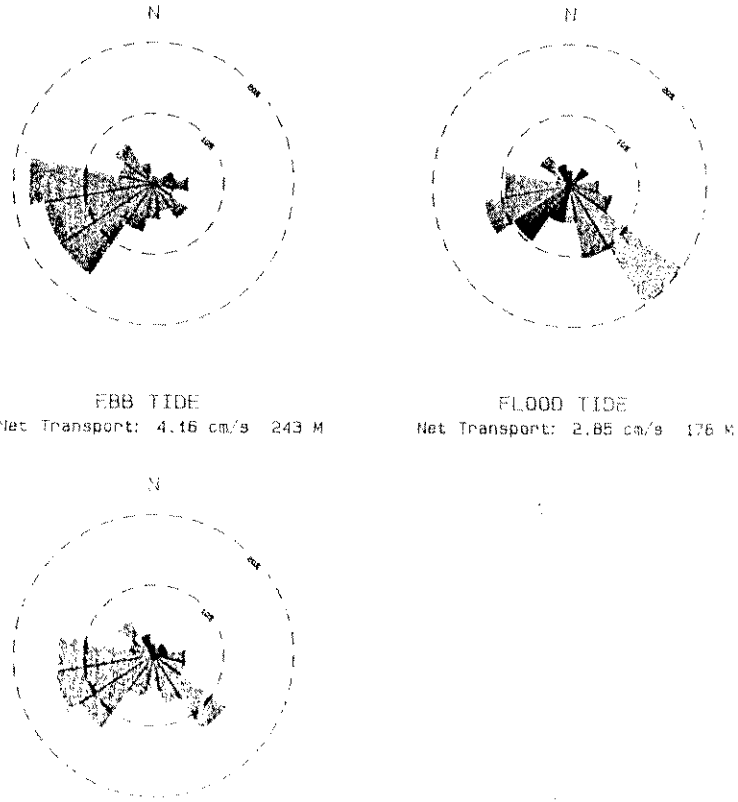
1. The prevailing currents are semi-diurnal tidal currents, with a 1 to 2 hour lag between slack tide and the current reversal.

2. The predominant ebb tide current is west-southwesterly at an average speed of .9 cm/sec, and directionally consistent. The predominant flood tide current is southeasterly with an average speed of 9 to 10 cm/sec, and is less directionally consistent.

3. The net transport during the ebbing tide is about 4 cm/sec to the west-southwest, and during the flooding tide is about 3 cm/sec to the south-southeast. The overall net transport away from the project area is about 3 cm/sec offshore to the south-southwest.

HAWAIIAN RIVIERA 4/23/87 - 5/1/87

Station: A Meter/Water Depth: 35'/ 55'



EBB TIDE
Net Transport: 4.16 cm/s 243 M

FLOOD TIDE
Net Transport: 2.85 cm/s 176 M

OVERALL RECORD
Net Transport: 2.9 cm/s 217 M

Average Current Speeds (cm/s)

0 5 10 20

FIGURE II-5
CURRENT SPEED AND DIRECTION ROSES

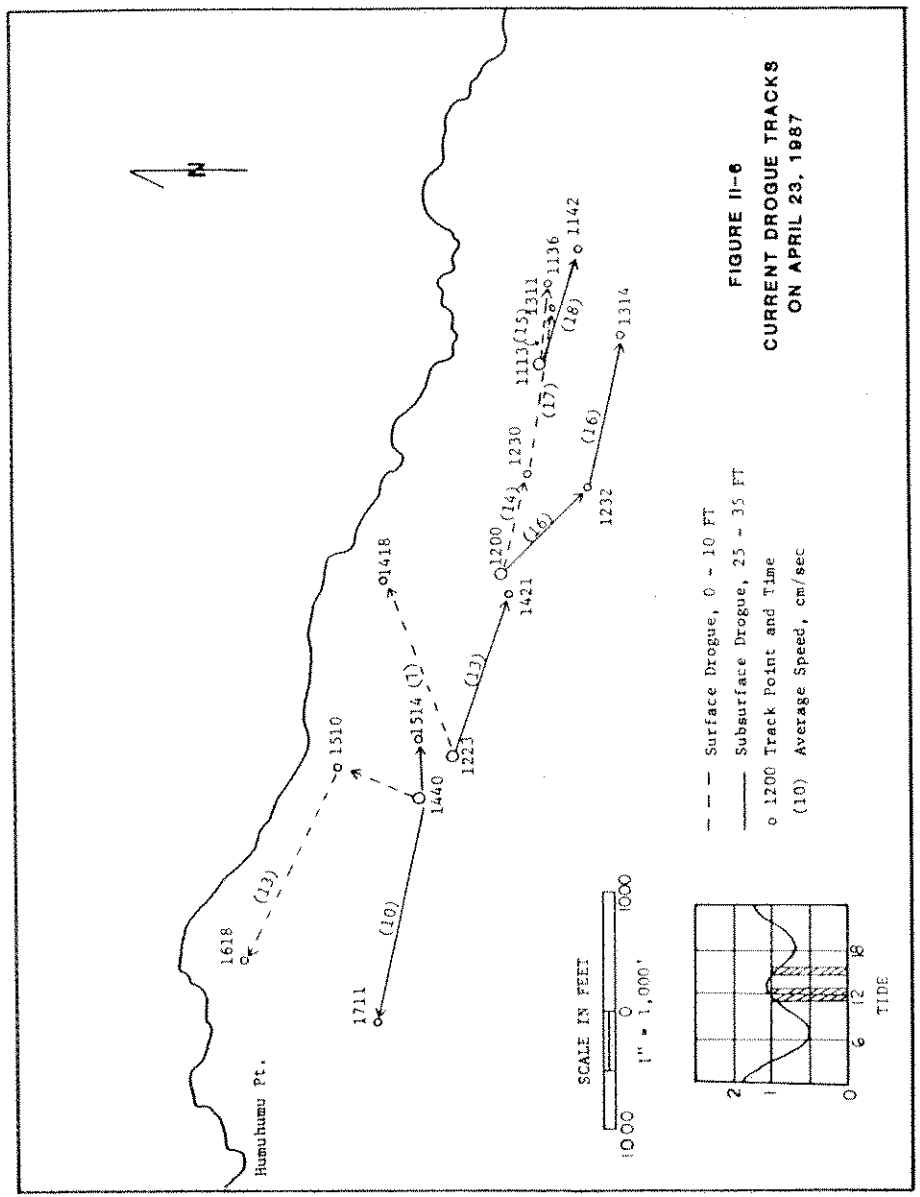


FIGURE II-6
CURRENT DROGUE TRACKS
ON APRIL 23, 1987

NEARSHORE BATHYMETRY

Field investigations at the project site included detailed bathymetric surveying of the nearshore waters along the approximately 24,000 feet of shoreline planned for development. Bottom profiles were determined from the shoreline to the 200 foot depth at 31 locations along the coast, with approximate 1,000 foot intervals between range lines and additional profiles at 250 foot intervals in the vicinity of the proposed marina at the Hawaiian Palace site. The survey data was used to plot a bathymetric map of the project area (provided under separate cover).

Deep water extends very close to shore all along the coast, with the 200-foot contour being within 800 to 1,000 feet of the shore and the 50-foot contour generally being within 50 feet of the shore.

III. TSUNAMI AND STORM WAVE VULNERABILITY

TSUNAMI INUNDATION

The predicted 100-year recurrence interval tsunami water surface elevations in the project area have been determined by methodology described in the publication "Manual for Determining Tsunami Runup Profiles on Coastal Areas of Hawaii", issued by the U.S. Army Corps of Engineers in 1978. The procedures in the manual are consistent with those followed in the preparation of flood boundary and flood rate maps for the National Flood Insurance Program. The methods are derived from a tsunami wave study conducted by the U.S. Army Engineer Waterways Experiment Station (WES) and work by Dr. Charles Bretschneider and Pieter G. Wybro (1976) on tsunami runup determination. The manual is widely used in Hawaii for determining coastal tsunami hazards and is the accepted standard reference.

WES used the ten largest tsunamis from 1837 through 1976 to determine a tsunami elevation versus frequency of occurrence relationship. A numerical model was used to supplement historical data for locations with no historical data.

The relationship is represented by the equation below:

$$H = -B - A\log_{10} F$$

- H = elevation of maximum tsunami wave crest above mean sea level (MSL) 200 feet inland of the coastline.
- F = frequency per year of occurrence (valid for F equal to or less than 0.05)
- A,B = coefficients determined for specific locations along the shoreline and obtained from the manual.

The frequency per year of occurrence (F) denotes the probability of an event to occur in each year. An extreme event, such as a 100-year tsunami, will have a long term average of occurring once per 100 years, but could occur at shorter time intervals.

The 100-year tsunami water surface elevation was determined at 24 locations along the shoreline in the project area, at approximately 1,000 foot intervals beginning at Humuhumu Point at the northwest end (Figure I-2). Most of the tsunami elevations at the selected sites do not exceed the existing land elevation 200 feet inland of the coastline, and thus are considered the final tsunami runup elevations. The tsunami elevations exceeding the land elevation 200 feet inland require further evaluation to determine the total extent of inundation. The method used to determine the profile of inland flooding due to a tsunami wave is based on work by Bretschneider and Wybro (1976). They solved the classical long wave momentum equation for runup, assuming that Froude number remains constant and that the local acceleration is negligible for the inundation flow.

The governing differential equation for the tsunami runup is given by:

$$dh/dx = -[\tan\theta + n^2 g F^2 h^{-1/3}/(1.486)^2]\ [F^2/2 + 1]^{-1}$$

where
- h = tsunami wave depth in feet
- x = horizontal distance in feet
- $\tan\theta$ = vertical rise in ground elevation by horizontal distance
- n = Manning's friction factor
- g = gravitational constant = 32.2 ft/sec^2
- F = Froude number (F = 1 for nonbore, F = 2 for bore formation)

For the project area a Manning's "n" of 0.032 was uniformly applied assuming smoothed coastal conditions after the project development. This is suggested by the Corps of Engineers (1978) for "developed areas (lawn grass up to 5cm high, gravel, presence of some buildings, houses and other obstructions)". The Froude number, F, was considered unity for nonbore-type tsunami waves in the project area. The Corps of Engineers (1978) report that Hilo is the only known location along the coast of the Island of Hawaii where bore-type tsunamis have occurred in the past. Using

the constant values of 0.032 and 1 for Manning's "n" and the Froude number, respectively, the above equation was numerically integrated, with h and tanθ being a function of x.

The predicted 100-year frequency of occurrence tsunami elevations and inundation distance inland is shown on Table III-1 for the 24 locations along the shoreline. The tsunami runup elevations range from 9.5 to 12 feet above MSL. The steep coastline generally limits the inundation distance to less than 100 feet, however in the low-lying areas around Kanonone waterhole (adjacent to Pohue Bay) and at the extreme southeast end of the project area the predicted tsunami inundation would extend approximately 425 to 445 feet inland, respectively. The calculated tsunami inundation limits are drawn on 1 inch = 200 foot scale maps submitted under separate cover.

TABLE III-1

PREDICTED 100-YEAR TSUNAMI INUNDATION LIMITS

Location (Approx. 1,000 ft. Intervals)	Inundation Limits Elevation (Ft. MSL)	Inundation Limits Distance Inland (Feet)
1- Humuhumu Pt.	10	110
2	10	85
3	10	40
4	10	150
5	10	25
6	10	15
7	9.5	15
8	9.5	10
9	9.5	20
10	10	100
11	10	100
12	10	100
13	11	425
14	10	65
15	10.5	65
16	10.5	45
17	11	75
18	10.5	25
19	11	15
20	11	20
21	11.5	30
22	11.5	95
23	12	445
24 - Southeast End	11.5	35

HURRICANE STORM WAVE INUNDATION

Scenario Hurricanes

The report Hurricanes in Hawaii (Haraguchi, 1984) for the U.S. Army Corps of Engineers presents hypothetical model and worst case hurricane scenarios for the Hawaiian Islands, a model and worst case from the est or southeast and from the south or southwest.

The model Hawaiian hurricane is defined as the probable hurricane that will strike the Hawaiian Islands in the future. The worst case Hawaiian hurricane is defined as the strongest hurricane that can strike the Hawaiian Islands in the future. The characteristics of the model Hawaiian hurricane are based on the characteristics of the hurricanes that previously struck the Islands, Dot and Iwa. The worst case Hawaiian hurricane has not yet struck the Islands and its characteristics will be based on subjective reasoning of the data from 20 critical hurricanes in the Central Pacific and understanding of the basic atmospheric and oceanic conditions surrounding the Hawaiian Islands.

For the hurricane approaching from the southeast through east, the model Hawaiian hurricane winds will decrease in intensity from 100 knots about 300 miles away to 65 knots at the island with the storm traveling at 11 knots. The worst case Hawaiian hurricane from the southeast through east will decrease in intensity from 1230 knot winds about 300 miles away to 100 knot winds at the island, traveling at 11 knots.

For the hurricane approaching from the southwest through south, the model Hawaiian hurricane will decrease in intensity from 80 knot winds about 300 miles away to 65 knot winds at the island increasing its forward speed from 10 knots to 20 knots. The worst case Hawaiian hurricane from the southwest through south will decrease in intensity from 100 knot winds about 300 miles away to 90 knot winds at the island, increasing its forward speed from 10 knots to 25 knots.

For the hurricane approaching from the southwest through south, the model Hawaiian hurricane will decrease in intensity from 80 knot winds about 300 miles away to 65 knot winds at the island increasing its forward speed from 10 knots to 20 knots. The worst case Hawaiian hurricane from the southwest through south will decrease in intensity from 100 knot winds about 300 miles away to 90 knot winds at the island, increasing its forward speed from 10 knots to 25 knots.

The characteristics of the scenario hurricanes are summarized in Tables III-2 and III-3.

Hurricane Wave Model

The two-direction hurricane wave model developed by Dr. C. L. Bretschneider is the basis used for hurricane wave forcasting in this study. This model has been previously applied to hurricane vulnerability studies for Oahu (Bretschneider, et al, 1985) and Kauai (Sea Engineering, 1986). The hurricane wave fields previously determined for Oahu are considered applicable to the project area, considering that the large size of the hurricane field makes the difference in the wave fields for Oahu and Hawaii very slight. The wave fields are determined using the scenario hurricane characteristics from Haragushi (1984), and for a hurricane located 50 miles offshore of the project site. Selected deepwater hurricane wave conditions which potentially produce the largest wave heights immediately offshore of the project area are given in Table III-4.

Wave Transformation From Deepwater To Breaking

Deepwater hurricane waves propagating toward the coast are primarily altered by refraction, shoaling and ultimately by breaking. The hurricane waves travel toward shore until the water depth becomes shallow enough to initiate wave breaking. The large storm waves will break some distance offshore, then reform and continue shoreward as smaller waves until they also break.

TABLE III-2a MODEL HURRICANE FROM THE EAST TO SOUTHEAST

Characteristics	300 miles/ 1 day away	150 miles/ 1/2 day away	at island
max. sustained wind speed (kt)	100	85	65
maximum gust (kt)	120	115	90
min. sea level pressure (mbs)	952	964	979
radius 34-kt	160	160	160
radius 50-kt	70	60	50
radius 64-kt	40	30	20
radius 100-kt	--	--	--
direction/rate (degrees/kt)	300/11	300/11	300/11
eye diameter (n. miles)	20	20	20

TABLE III-2b WORST CASE HURRICANE FROM THE EAST TO SOUTHEAST

Characteristics	300 miles/ 1 day away	150 miles/ 1/2 day away	at island
max. sustained wind speed (kt)	120	110	100
maximum gust (kt)	145	130	120
min. sea level pressure (mbs)	934	943	952
radius 34-kt	180	175	170
radius 50-kt	100	90	80
radius 64-kt	70	60	50
radius 100-kt	40	30	25
direction/rate (degrees/kt)	300/11	300/11	300/11
eye diameter (n. miles)	20	20	20

TABLE III-3a MODEL HURRICANE FROM THE SOUTH TO SOUTHWEST

Characteristics	300 miles/ 1 day away	150 miles/ 1/2 day away	at island
max. sustained wind speed (kt)	80	70	65
maximum gust (kt)	100	95	90
min. sea level pressure (mbs)	968	975	979
radius 34-kt	160	160	160
radius 50-kt	60	50	45
radius 64-kt	30	25	20
radius 100-kt	--	--	--
direction/rate (degrees/kt)	45/10	45/15	45/20
eye diameter (n. miles)	20	20	20

TABLE III-3b WORST CASE HURRICANE FROM THE SOUTH TO SOUTHWEST

Characteristics	300 miles/ 1 day away	150 miles/ 1/2 day away	at island
max. sustained wind speed (kt)	100	95	90
maximum gust (kt)	120	115	110
min. sea level pressure (mbs)	952	956	960
radius 34-kt	170	170	170
radius 50-kt	80	80	70
radius 64-kt	50	45	40
radius 100-kt	25	--	--
direction/rate (degrees/kt)	45/10	45/18	45/25
eye diameter (n. miles)	20	20	20

TABLE III-4

SELECTED DEEPWATER HURRICANE WAVE CHARACTERISTICS

FOR THE PROJECT AREA

	Model (Probable) Hurricane		Worst Case Hurricane	
	E-SE	S-SW	E-SE	S-SW
Deepwater Wave Height (ft.)	30.8	36.2	40.5	51.8
Wave Period (Sec.)	12.2	13.3	14.0	15.8
Wave Approach Direction (^{o} N)	165	210	165	215
Hurricane Approach Direction (^{o} TN)	135	180	135	180

The wave refraction and shoaling was determined using a numerical computer model based on linear wave theory and assuming that wave energy is only transmitted perpendicular to the wave fronts (i.e. energy between orthogonals remains constant). When this assumption results in unrealistically high refraction coefficients (indicating energy transfer laterally along the wave crest) the predicted wave heights are interpolated from several adjacent orthogonals. The initial wave breaking point was determined using an empirical formula by Weggel (1972), which relates maximum breaker height to water depth and bottom slope.

The wave refraction, shoaling and breaking was based on the nearshore bathymetry map accomplished as part of this study, with depths greater than 200 feet interpolated from the existing navigation charts for the area.

Nearshore Water Level Rise

The rise in stillwater level along the shoreline during a hurricane is a function of the astronomical tide, storm surge due to reduced atmospheric pressure and wind stress, and wave setup. The components of the water level rise to add linearly.

For the hurricane storm wave inundation analysis an astronomical tide of 2.5 feet (mean higher high waters) is considered appropriate because of the frequency of occurrence of this tide level. This is equal to an elevation of 1.4 feet mean sea level (MSL) if the half-tide level is considered as approximating MSL.

The water level rise due to a drop in atmosphere pressure as the hurricane passes is approximately 1.3 feet for the model (probable) hurricanes and 2 feet for the worst case hurricanes.

The water level rise due to wind stress effects is generally very small, less than 0.5 feet, for the Hawaiian Islands because deep water extends for all practical purposes right up to the shoreline. Considering the bathymetry at the project site the wind stress waters level rise was considered negligible and assumed to be zero for this analysis.

The water level along a coast is partly a function of the incident wave field. Laboratory studies and field observations show a lowering of the water level, "set down", as the waves approach the break point and a steady rise in water level, "set up", shoreward of the breakers. Wave setup in this report refers to the rise in mean water level along the shore caused by wave action alone. The wave setup model used in this study is primarily based on the theoretical model developed by Longuet-Higgins and Stewart (1964) which balances mean water level changes against the changes in the momentum flux in a train of waves of changing amplitude.

Wave Runup and Inundation

The vertical height to which water from a breaking wave will ruup on a foreshore slope is termed wave runup. The wave runup determines the wave inundation on a given shoreline where the foreshore slope continuously rises, including flat bed segments. Where the wave runup exceeds the crest of the foreshore land, wave overtopping occurs. In the case of wave overtopping, the estimation of wave inundation distance requires other information

in additon to the wave runup. For this study, evaluation of overland, flooding primarily utilized topographic information to estimate the overland flooding limits.

The analysis of wave setup, runup and inundation was made along 24 selected shoreline traverses, which were located along the coast in the study area with an approximately spacing of 1000 feet between traverses (see Figure I-2). The orientation of each tranverse was approximately perpendicular to the shoreline at that point. Traverse number one was located at Humuhumu Point.

An empirical formula developed by Hunt (1959) was used to predict wave runup in this study. Saville's (1958) method of composite slopes was used to approximate the single equivalent slope needed for the computations from the existing irregular shoreline profile. The method assumes that a composite slope can be replaced with a hypothetical, uniform slope running from the bottom at the point where the incident wave breaks to the point of maximum runup. Successive calculations are made to find the point of maximum runup.

Runup is decreased by roughness on the slope, which increases turbulence and thus disspates energy, as well as by slope permiability. The choice of roughness correction factors to be applied to wave runup on natural shorelines is made difficult because of the complex and variable rougness found in natural terrain. For this study, a roughness factor of 0.8 was assumed over the entire area of interest, corresponding to a rock and rubble surface.

The resultant wave runup elevations and inundation distances along the selected traverses for the four scenario hurricanes are given on Table III-5. The estimated maximum inunudation limits for both the probable hurricanes and the worst case hurricanes are shown on 1 inch = 200 foot scale maps of the project area, submitted under separate cover.

The analysis of hurricane storm wave flooding was accomplished using numerical computer models based on existing coastal engineering techniques and the existing physical characteristics of the project area. A detailed discussion of the methodology used is presented in two previous hurricane vulnerability reports for the island of Kauai prepared for the U.S. Army Corps of Engineers by Sea Engineering, Inc. (1976).

TABLE III-5

HURRICANE WAVE INUNDATION LIMITS

	Model (Probable) Hurricane				Worst Case Hurricane			
	E-SE		S-SW		E-SE		S-SW	
Traverse	Dist. (Feet)	Elev. (Feet)	Dist. (Feet)	Elev. (Feet)	Dist. (Feet)	Elev. (Feet)	Dist. (Feet)	Elev. (Feet)
1	145	13.0	155	14.0	185	17.0	210	20.5
2	125	10.0	75	9.0	215	11.0	145	10.0
3	55	12.5	60	13.0	75	15.0	80	15.5
4	155	11.0	175	16.0	190	18.0	250	21.5
5*	85	40.5	115	42.5	120	43.0	130	43.5
6*	55	52.0	70	60.0	65	57.5	105	60.0
7	45	20.5	65	21.5	70	21.5	135	23.5
8	60	25.5	80	26.5	95	27.0	165	31.0
9	70	16.0	85	17.5	105	19.5	115	21.0
10	165	15.0	225	16.0	235	17.0	360	20.5
11	185	19.0	215	20.5	270	23.0	315	25.0
12	85	9.0	95	9.5	130	17.5	110	12.5
13	335	6.7	345	7.0	385	9.0	415	10.5
14	95	18.0	105	21.0	120	24.0	140	27.0
15	50	7.5	70	11.0	60	10.0	95	14.0
16	60	15.0	90	19.0	80	17.5	130	25.5
17	135	19.0	185	32.0	150	24.5	175	30.5
18	80	24.0	125	31.5	105	29.5	175	36.0
19	155	34.0	170	36.5	185	39.5	185	39.5
20	50	27.0	85	35.0	65	30.5	165	43.5
21	40	12.0	120	15.5	60	13.5	315	18.5
22	40	8.5	105	12.0	80	11.0	200	15.0
23	255	7.5	385	11.0	360	10.5	565	13.5
24	60	20.0	105	27.5	95	26.5	165	34.5

* The high runup elevation at these two locations results from the very steep offshore and shoreline slope along the traverse.

IV. MARINA DESIGN

PURPOSE AND FUNCTION

The proposed marina will provide safe berthing for recreational and commercial power boats and sailboats, a ramp for launching trailered craft, and ancillary facilities such as a fuel and ice dock, marine supplies and parking. The marina is designed to accommodate vessels such as fishing and charter boats in the 25 to 50 foot size as well as larger sailboats and motor vessels up to 120 to 150 feet in length and capable of international travel. The marina will berth appraoximately 400 vessels, with primary emphasis on boats 25 to 50 feet in length. Berths 50 feet long or less comprise 85 percent of the total capacity.

In addition to providing protection for boats permanently berthed there, the marina will provide a safe haven for any vessel operating along the southern shores of the island of Hawaii in the event of a sudden storm or bad weather. At present the nearest safe haven is located at Honokohau Boat Harbor, approximately 50 miles north of the project site, or Hilo Harbor even further away on the east coast.

DESIGN VESSEL CHARACTERISTICS AND GENERAL NAVIGATION CRITERIA

The entrance channel, turning basin and access channels are designed to provide safe navigation for a range of vessels as shown on Table IV-1. All vessels are assumed to have at least average maneuverability, and sailboats are assumed to have auxiliary power. Consideration is given to the marina entrance channel location on an exposed coast directly exposed to sea and swell and alongshore winds. The entrance channel is designed to be navigable under prevailing wind and wave conditions, however the entrance may be dangerous during extreme high wave or storm conditions.

TABLE IV-1

TYPICAL VESSEL CHARACTERISTICS

	Power		Sail	
Lengt (ft)	Beam (ft)	Draft (ft)	Beam (ft)	Draft (ft)
25	10	3	8	6
26 - 40	13	4	11	7
41 - 40	16	5	14	11
80	18	5	15	13
120	22	6	18	15

Entrance Channel

Criteria:

1. Two-way traffic by vessels up to 60 feet, one-way traffic for larger vessels
2. Design vessel-beam = 16 feet (60' power boat)
   -draft = 15 feet (120' sailboat)
3. Nearshore wave height 6 feet, approach direction 200° - 240° TN
4. Wind/wave factor 2

Minimum Width: 5 Beam Widths (16 feet) x 2 = 160 feet
Use 200 feet seaward of the shoreline

Minimum Dept:

Draft	15 feet
Squat and Trim	1 foot
Wave Trough Allowance	3 feet
Bottom Clearance	3 feet
Total	22 feet

Turning Basin:

Criteria: Adequate water area for maneuvering of the largest vessel anticipated to use the harbor (assume 120 feet), and for access to the fuel dock and entering and leaving the main access channels.

Minimum Length and Width: 2 x 120 feet = 240 feet

Minimum Depth:

Draft	15 feet
Wave Trough Allowance	1 foot
Bottom Clearance	2 feet
Total	18 feet

Access Channel

Minimum Width: Equal to widest fairway served

Minimum Depth: Vessel draft + 1 foot wave allowance + 2 foot bottom clearance

Berths and Fairways

Typical dimensions for berths and fairways:

Berth Length (ft)	Berth Widths (ft)*	Fairway Width (ft)
30	28	55
40	32	70
50	36	100
60	42	120
80	56	160

*Assumes 3 foot wide finger piers

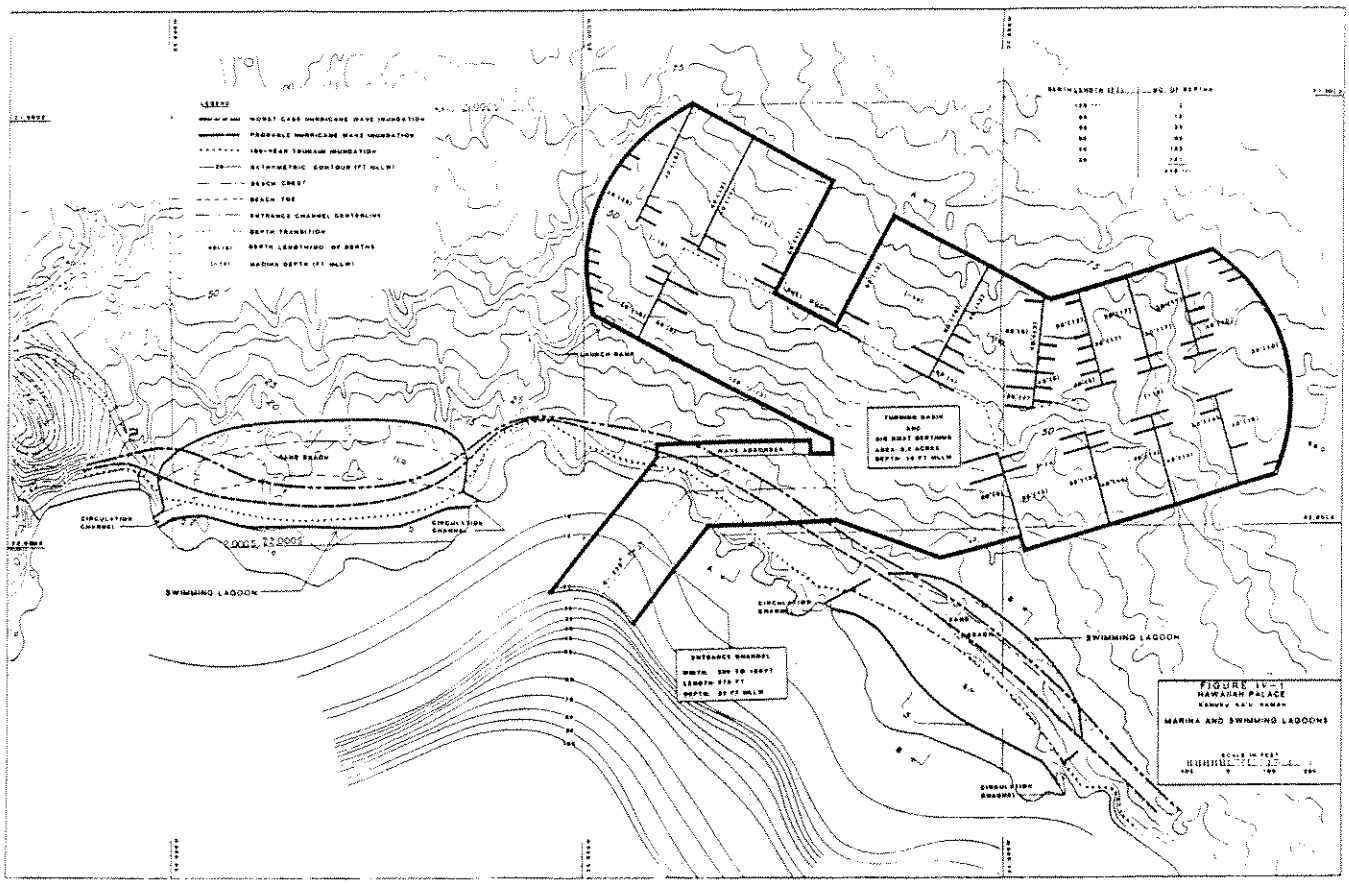
MARINA LAYOUT AND FACILITIES

The nearshore bathymetry, with deep water extending very close to shore, makes it impractical and prohibitively expensive to construct protective structure for a marina seaward of the shoreline. Thus, the proposed marina would be constructed entirely inland, with only a minimal amount of dredging required seaward of the shoreline for the entrance channel. This has the advantage of minimizing construction impacts to the ocean environment while still providing a fully functional and safe harbor facility. The marina would be constructed similarly to the existing Honokahau Boat Harbor near Kailua-Kona, 50 miles north of the projectd area, and the recently constructed Barbers Point Deep-Draft Harbor on Oahu, both of which were excavated inland rather than built offshore. The marina would be entirely excavated prior to opening the entrance channel to the sea, thus eliminating the possibility of turbidity and sedimentation impacts to the nearshore coastal waters except during the final stage of construction when the entrance is opened and the offshore channel dredging accomplished.

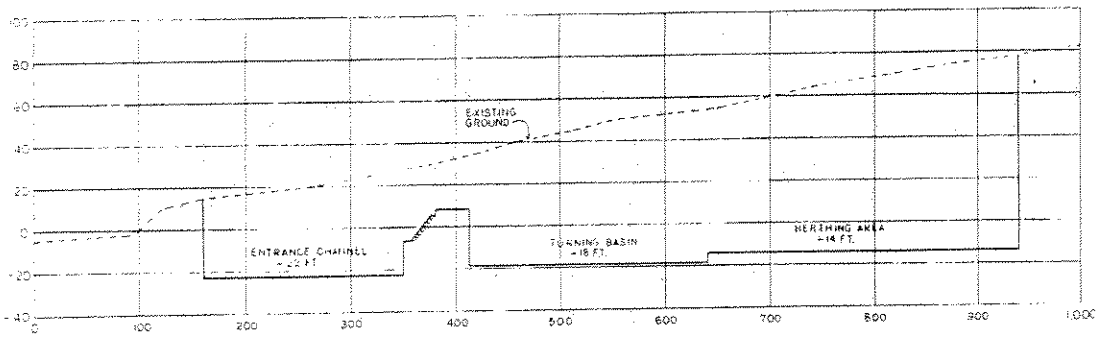
The marina is located at the northwest end of the project area, approximately 0.5 miles east of Humuhumu Point (see Figure I-2). The proposed configuration and layout is shown on Figure IV-1. A

typical section through the marina is shown on Figure IV-2. Larger scale drawings (1 inch = 100 feet) of both the marina layout and the section are provided in the envelope at the back of this report. Access to the marina is via a 670 foot-long, 200 to 160-foot-wide, 22-foot-deep entrance channel. The entrance channel dog-legs to the right at the shoreline, with a rock wave absorber on the landward side, and then enters a 6.2 acre, 18-foot-deep turning basin and large boat (80 foot plus) berthing area. A 13.2 acre berthing area would accommodate approximately 390 boats from 25 to 60 feet in length. Depths in the berthing areas vary from 10 to 14 feet. All depths in the marina are referred to a mean lower low water datum (MLLW).

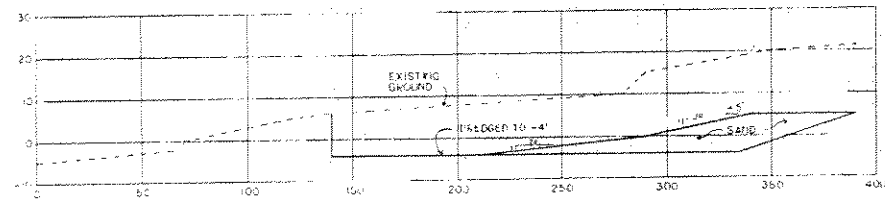
Access to the berthed vessels would be by a series of main piers generally extending perpendicular to the marina sides with finger piers extending at right angles from the main pier on either side. In some instances, such as at the ends of the marina and along the sides of the fuel dock, the finger piers would extend directly from the marina sides. Fixed piers comprised of pile supported stringers and decking are generally recommended where tidal fluctutations are low, such as is the case in Hawaii. Advantages of a fixed-pier system include possible construction cost savings, less frequent and expensive maintenance, and the fact that they are stronger and more stable. However, considering that the marina will be excavated in solid rock which may increase the cost of setting piles by requiring drilling prior to driving piles, a combination of fixed and floating piers may be the most resonable and economical system. The minimum deck elevation for piers, docks, the marina walls, and other fixed structures should be + 6 feet MLLW (+5 feet MSL).



IV-6



SECTION A - A
SCALE: HORIZ. 1" = 40'
VERT. 1" = 20'
EL. DATUM: 0 MLLW (1' MSL)



SECTION B - B
SCALE: HORIZ. 1" = 20'
VERT. 1" = 10'
EL. DATUM: 0 MLLW (1' MSL)

FIGURE IV-2
HAWAIIAN PALACE
MARINA AND SWIMMING LAGOONS
TYPICAL SECTIONS

IV-7

V. SWIMMING LAGOON DESIGN

PURPOSE AND FUNCTION

The rocky, irregular coast with deep water extending very close to shore, and its direct exposure to deepwater waves and storms, makes it infeasible to develop safe and stable recreational sand beaches seaward of the shoreline. The only existing sand beaches are small, steep pocket beaches formed by eroding cinder cones. These can be found near Humuhumu Point and inside Keliuli Bay. The only existing reasonably safe swimming beach is a 250-foot-long pocket beach in Pohue Bay.

In order to provide safe and protected recreational sand beaches and swimming areas for the Hawaiian Palace Resort it is proposed to construct swimming lagoons inland of the shoreline. Two lagoons would be constructed, one on either side of the marina. These lagoons would have man-made sand beaches on their landward side and would be dredged sufficiently deep to provide a swimming area even during low tide. Circulation and flushing of the lagoons would be accomplished by circulation channels at each end of the lagoons.

LAYOUT AND DESIGN

Lagoon Configuration

The location and general layout of the two lagoons is shown on Figure IV-1. The lagoon to the east of the harbor is approximately 650-feet-long and the lagoon to the west is about 750-feet-long. Each lagoon is approximately 250-feet-wide, with about 150 to 180 feet of total sand width. The lagoons would be excavated inland of the existing shoreline, with a maximum depth of -4 feet, MLLW (-5 feet MSL) in the swimming area. The minimum shoreline elevation seaward of the lagoons should be +6 feet MSL to avoid overtopping by the prevailing wave conditions and Kona storm waves. Where the natural shoreline is below this elevation or not stable, a rubblemound rock berm would be constructed to the required elevation.

Beach Design

Typical beach slopes for calcareous sand beaches in Hawaii range from 1V:8H to 1V:12H, with sand of medium grain-size (median size 0.4 - 0.6 mm). Below the low tide elevation the beach slope is generally flatter than the upper slope, and typically has a slope in the range of 1V:20H to 1V:30H. The sand is generally coarser and the beach slopes steeper on high wave energy beaches. Sand for the lagoon beaches would come from available commercial sources and would be typical of that found on natural beaches.

Assuming well-sorted, medium grain-size sand and given that the beaches are protected from wave attack, a design foreshore slope of 1V:10H above MLLW and 1V:20H below MLLW is considered reasonable.

The minimum beach crest elevation should be +4 feet MSL (+5 feet MLLW). The width of a recreational beach is generally governed by the area required for recreational use. Although there is no formally established standard, 75 square feet of dry beach per user is often considered adequate. With a crest elevation of +4 feet MSL and a slope of 1:10, the foreshore slope above mean sea level provides a width of 40 feet. If the crest width is 50 feet (total dry beach width of 40 + 50 = 90 feet) and assuming a beach length of 600 feet, the beach would provide a suitable area for about 700 bathers. A minimum beach crest width of 50 feet is necessary to accommodate the process of reaching equilibrium after construction.

A typical lagoon and beach cross-section is shown on Figure IV-2. The east and west beaches would require approximately 18,000 and 20,000 cubic yards of sand, respectively.

Circulation Channels

The lagoon waters will be regularly exchanged with the nearshore coastal waters through circulation channels at either end of the lagoons. In addition to the daily tidal exchange, which would

exchange approximately 50 percent of the lagoon water each 24-hour period, the circulation channels would take advantage of mixing and circulation due to wave action along the shore.

The circulation channels are sized to eliminate the risk of tidal currents dangerous to swimmers as well as to preclude sand transport out of the lagoons. Assuming a median sand grain-size of 0.5 mm, a flow velocity of about 0.6 feet per second (fps) is required to initiate sand movement. The maximum tide range at the project site is 2.5 feet. Two channels, per lagoon, each with a minimum cross-section area 20 feet wide by 3 feet deep (below MSL), would reduce the tidal current speed to less than 0.4 fps (0.25 knots). This would be the maximum tidal current speed to be expected, and the currents would generally be less.

In addition to providing circulation for the lagoons, the channels would provide access to the nearshore coastal water for snorklers and divers during calm seas and fair weather conditions.

VI. CRUISE SHIP DOCK

INTRODUCTION

The location and proposed facilities at the Hawaiian Riviera Resort makes it an attractive site for stops by the burgeoning cruise ship business in Hawaii. Discussion with American Hawaii Cruises, who currently operate two 680-foot-long vessels on weekly interisland tours, has indicated their interest in possibly making the resort one of their scheduled stops. Passengers would be able to take advantage of the recreation facilities and shopping offered by the resort, as well as tours to the volcano area.

The deepwater and steep bottom slope offshore of the project area makes anchoring a large vessel infeasible, and even makes the installation of a permanent single-point mooring system impractical.

Thus, passengers must either be ferried to shore from the cruise ship by small boat while it station keeps offshore, or a fixed mooring nearshore provided for temporary docking of the vessel. American Hawaii Cruises have stated their preference for the ease and convenience of a fixed mooring. Sufficient water depth for the 30-foot-draft vessel exists within about 250 feet of the shore at the northwest end of the project area, offshore of the proposed Hawaiian Palace. Representatives of American Hawaii Cruises have indicated that their ships, which are equipped with bow thrusters and thus very maneuverable, would be able to dock at a fixed-mooring at this location. This report section discusses the required mooring elements and presents a conceptual mooring plan, however detailed design of the mooring has not been accomplished at this stage of project planning.

DESCRIPTON OF THE DOCK FACILITIES

The proposed fixed-mooring would consist of two breasting platforms or dolphins (including fendering), mooring dolphins for the attachment of mooring lines to secure the vessel, and a light-duty access pier for pedestrians and small vehicles. The general layout of the fixed-mooring at the proposed location is shown on Figures VI-1 and VI-2.

The breasting structure is designed to withstand both berthing and mooring loads. A typical design consists of a concrete deck supported by vertical, as well as battered, concrete piles. The battered piles resist large lateral berthing and mooring loads, while the vertical piles support the deck. Concrete platforms are rigid structures, an alternative would be a flexible, steel-pipe supported dolphin. The mooring structures would be smaller, concrete or steel pile supported platforms or dolphins situated to obtain a balanced distribution of the mooring line loads. Two mooring structures should be sufficient, opposite the bow and stern of the vessel, coupled with spring lines to the breasting structure, for mooring in fair weather conditions. It is assumed that a small boat would be available to assist with the handling of mooring lines so that catwalks would not be required between the mooring structures. The mooring lines could also go to points on the shore, as shown on Figure VI-1, in lieu of constructing mooring structures in the water. The pile supported access pier would provide a direct link between the ship and shore for passengers. The minimum elevation of the underside of the pier deck would be +14 feet MSL to keep it above the wave action during large south swell or severe Kona storm wave attack.

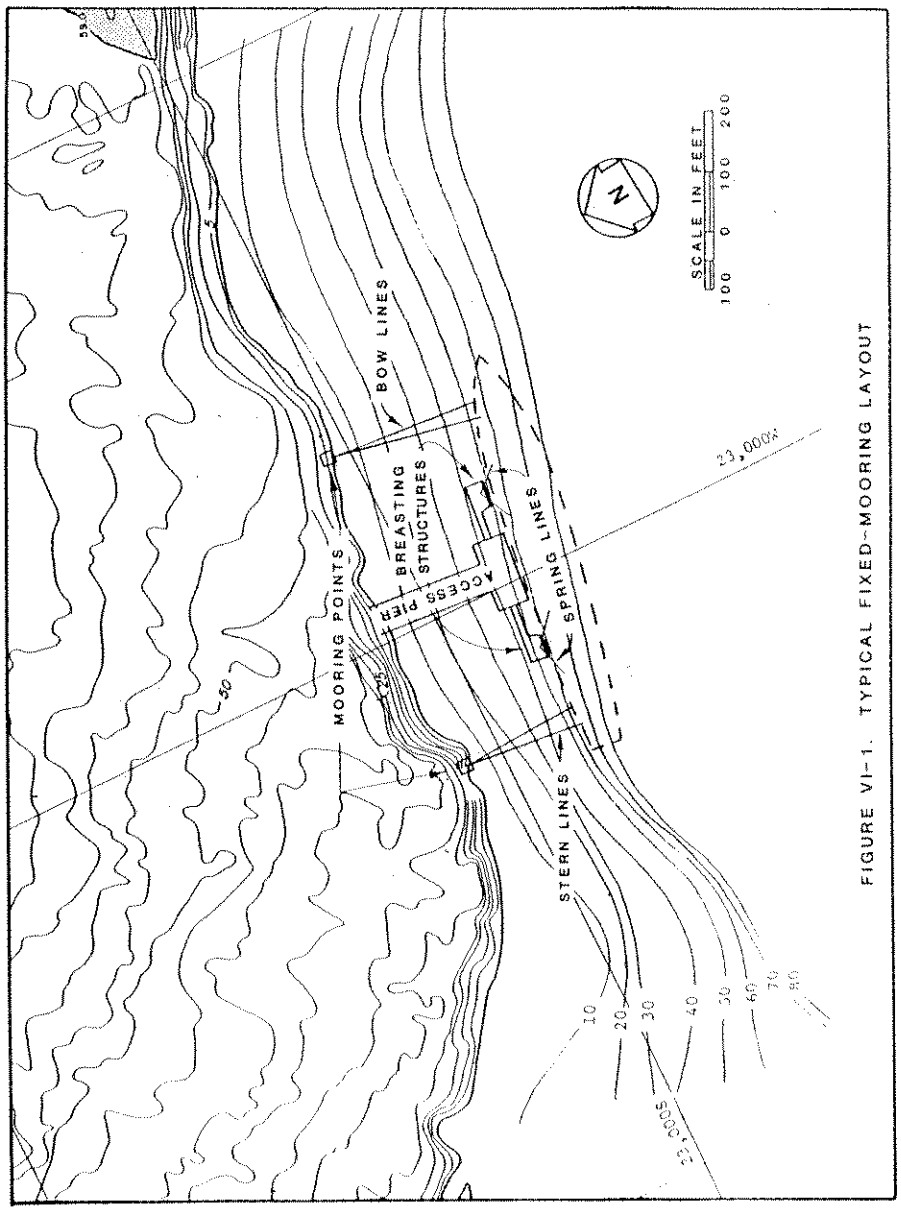


FIGURE VI-1. TYPICAL FIXED-MOORING LAYOUT

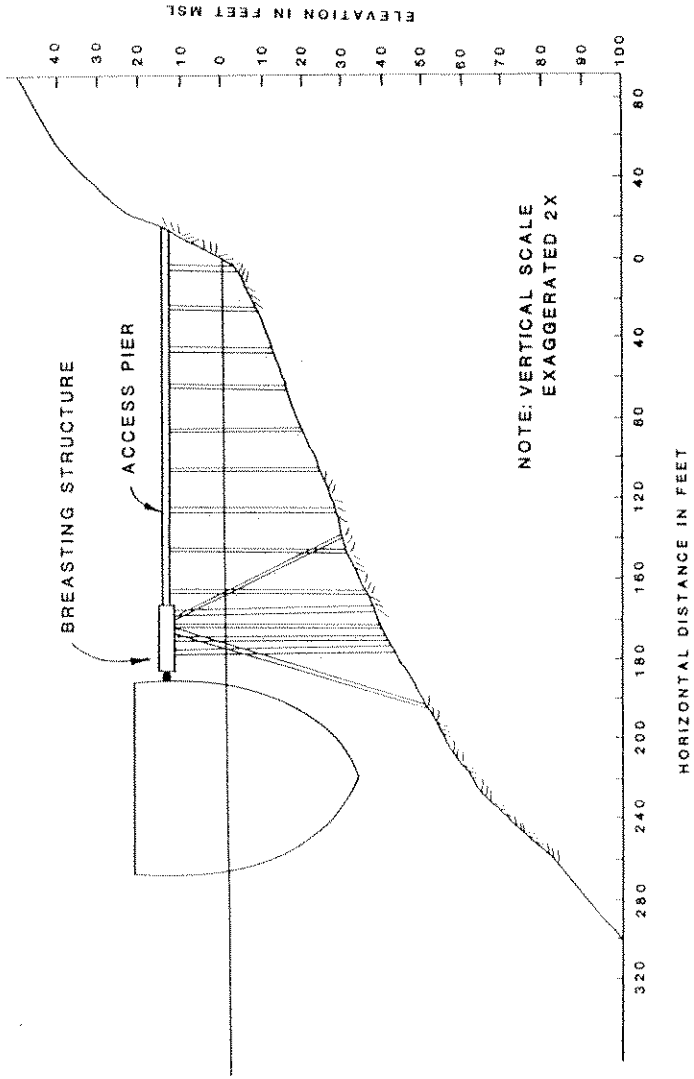


FIGURE VI-2. TYPICAL FIXED-MOORING SECTION

PROBLEMS AND LIMITATIONS

Fixed-moorings are generally located at well protected sites or within harbors to minimize wind, wave and current loads. Although they can be constructed on open, exposed coasts, their useability may be severely curtailed by wave action, and the structures must be designed not only to resist vessel loading but also to resist storm wave forces on the structure itself. The mooring should be oriented so that the longitudinal axis of the vesel is parallel to the prevailing wind, waves and currents. The proposed mooring location is approximately parallel to the prevailing easterly wind, and the coastal currents should not pose a major problem. The vessel would face the short, steep local wind generated seas, however it would be perpendicular to the approach direction of south swell and westerly waves. Special dynamic analysis of the mooring system is recommended for wave heights exceeding about four feet. More detailed, site specific wave versus frequency of occurrence data at the proposed mooring site is required in order to estimate the extent to which wave action will limit the moorings usefulness.

The offshore substrate is presumably solid coralline limestone and lava rock. If so, it will be necessary to first drill before driving support piles for the mooring structures. This would greatly increase their construction cost. Offshore borings will be required to determine the actual foundation conditions. The mooring would also be subject to possible hurricane storm wave forces, and should be designed to withstand hurricane wave forces to avoid severe damage or complete failure during hurricane conditions. The possible high cost due to the substrate conditions and the need to design for hurricane wave forces in 50 feet of water will make the mooring very expensive to construct.

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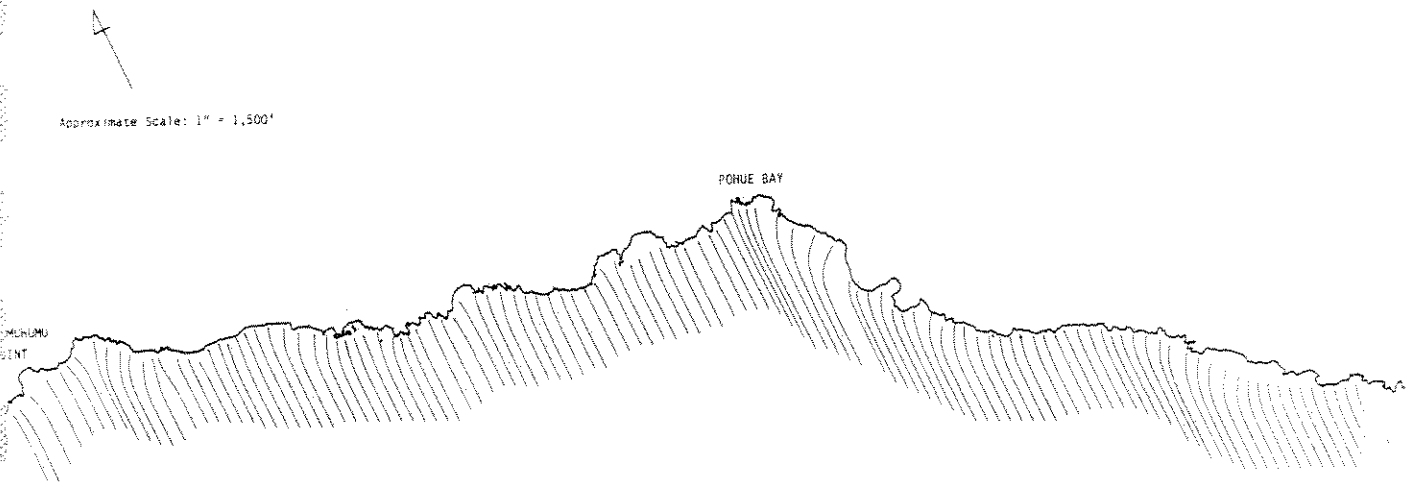
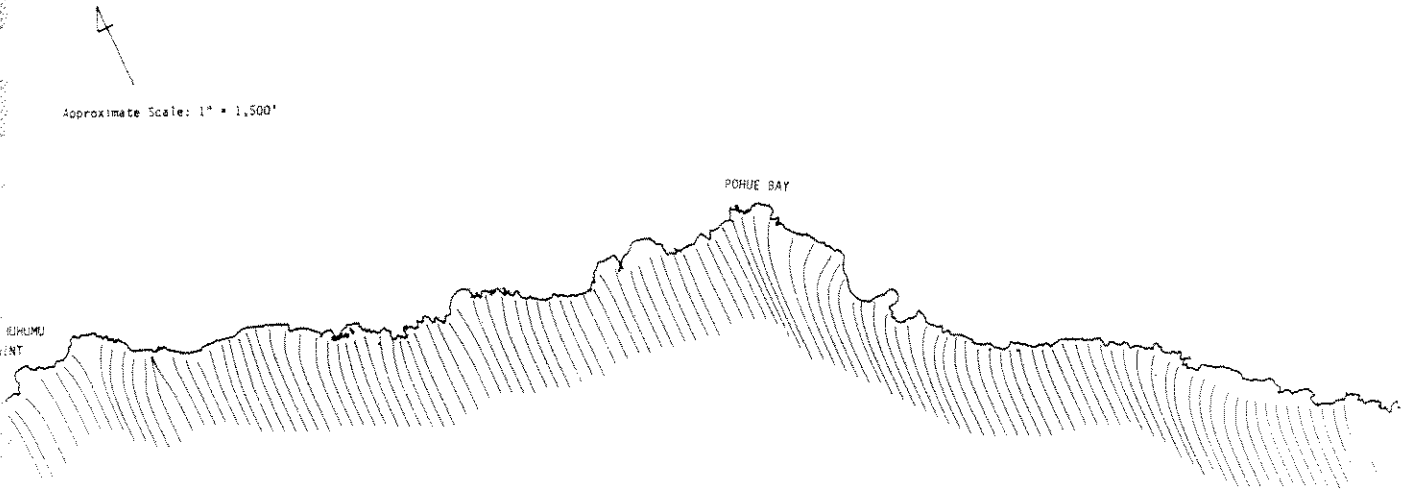
APPENDIX A

WAVE REFRACTION DIAGRAMS

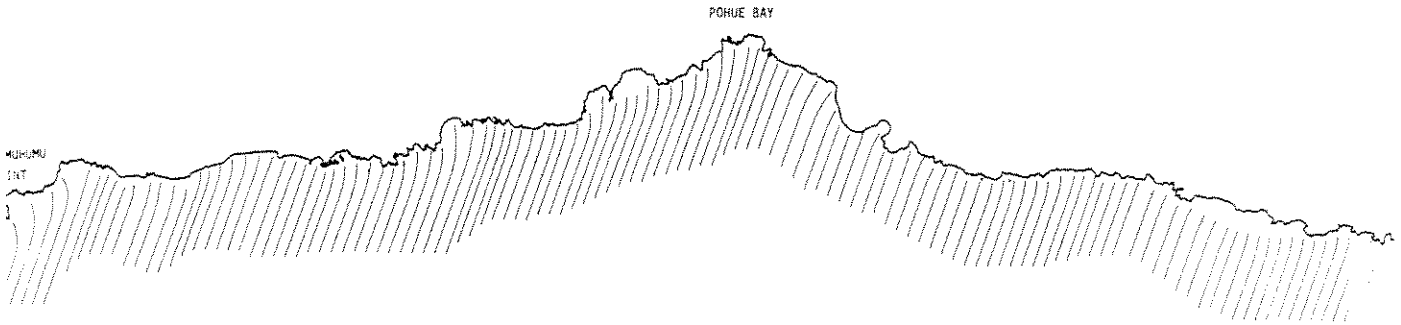


REFRACTION PATTERN
WAVE DIRECTION: 180°TN
WAVE PERIOD: 8 Sec.



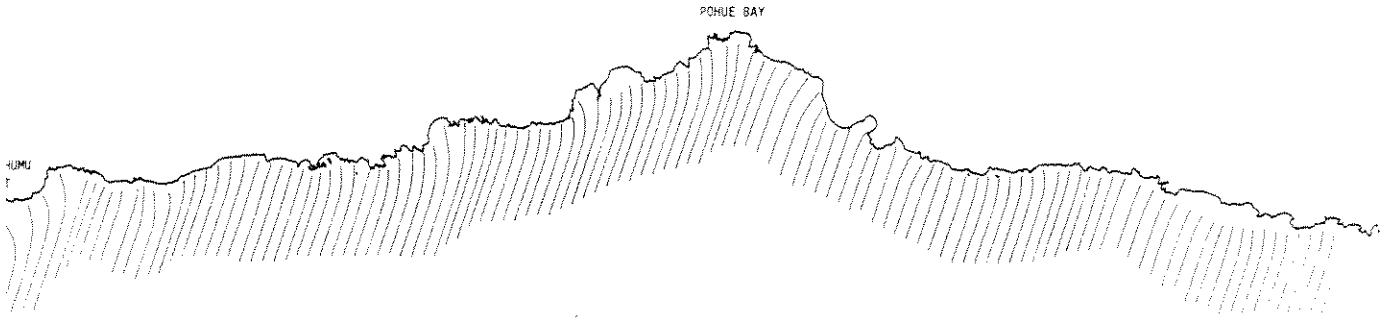
REFRACTION PATTERN
WAVE DIRECTION: 180°TN
WAVE PERIOD: 16 Sec.

Approximate Scale: 1" = 1,500'



REFRACTION PATTERN
WAVE DIRECTION: 225°TN
WAVE PERIOD: 8 sec

Approximate Scale: 1" = 1,500'



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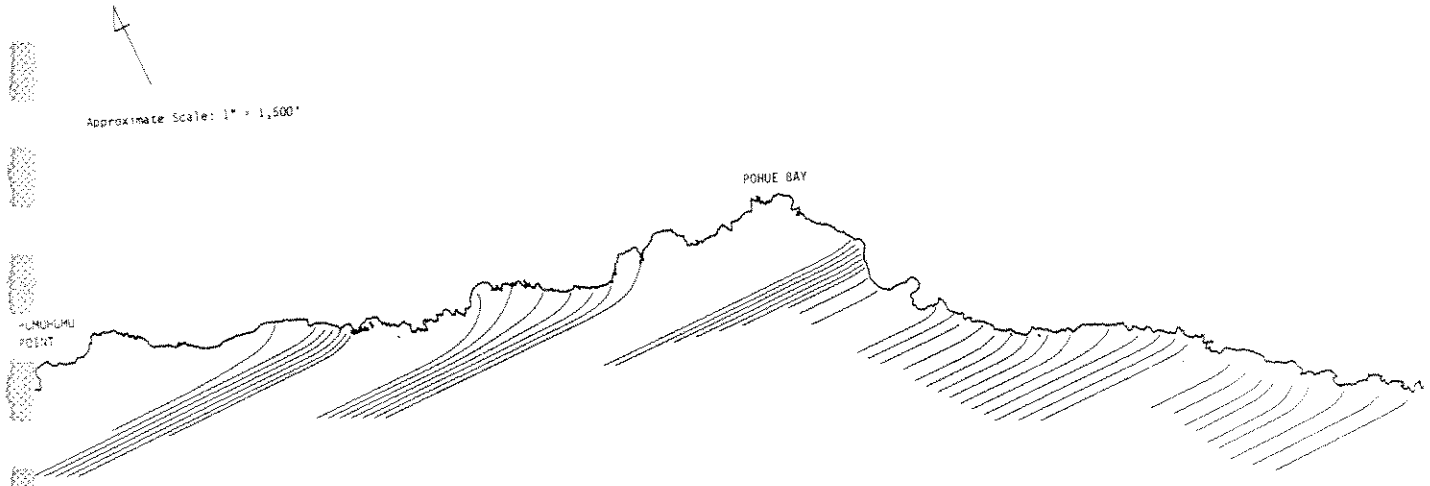
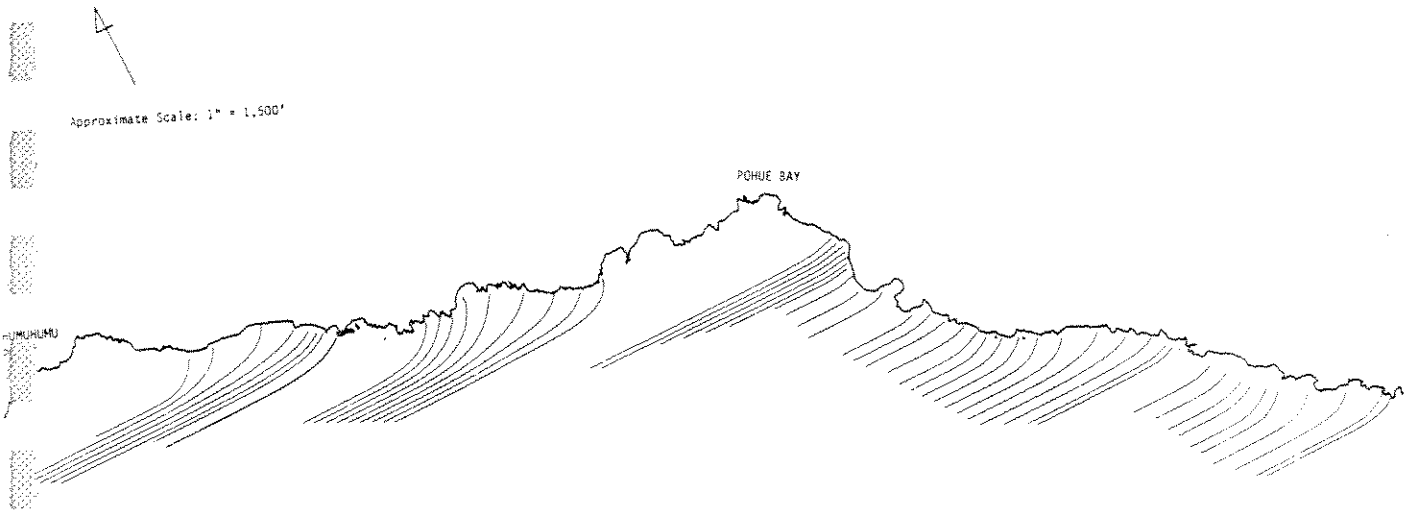


REFRACTION PATTERN
WAVE DIRECTION: 270°N
WAVE PERIOD: 8 sec.



REFRACTION PATTERN
WAVE DIRECTION: 270°N
WAVE PERIOD: 12 sec.

APPENDIX E

Archaeological Investigations

PAUL H. ROSENDAHL, Ph.D., Inc.
Consulting Archaeologist

Report 308-060487

FINAL REPORT:

ARCHAEOLOGICAL RECONNAISSANCE SURVEY HAWAIIAN RIVIERA RESORT PROJECT AREA

Land of Kahuku

Kau District, Island of Hawaii

August 1987

PAUL H. ROSENDAHL, Ph.D., Inc.
Consulting Archaeologist

Report 308-060487

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ARCHAEOLOGICAL RECONNAISSANCE SURVEY
HAWAIIAN RIVIERA RESORT PROJECT AREA

Land of Kahuku
Kau District, Island of Hawaii
(TMK:3-9-2-01:Por.72)

by

Alan E. Haun, Ph.D.
Senior Archaeologist

and

Alan T. Walker, B.A.
Supervisory Archaeologist

Prepared for

Palace Development Corporation
and
Hawaii Ka'u Aina Partnership
c/o Mr. Richard H. Van Horn, Planner
Belt, Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

August 1987

305 Mohouli Street • Hilo, Hawaii 96720 • (808) 969-1763 or 966-8018

SUMMARY

An archaeological reconnaissance survey of the Hawaiian Riviera Resort project area was conducted by Paul H. Rosendahl, Ph.D., Inc. (PHRI), during the period May 27-June 6, 1987, at the request of Mr. Richard Van Horn, planner, currently with Belt, Collins & Associates and formerly with Helber, Hastert, Van Horn, and Kimura, Planners, on behalf of their clients, Palace Development Corporation and Hawaii Ka'u Aina Partnership. The area surveyed consists of c. 3,360 acres located within the Land of Kahuku, North Kona District, Island of Hawaii.

The project area consists of three interrelated development sites--the Immediate/Remainder Coastal Zone, the Support Community, and the Airfield. The project area was surveyed by aerial and pedestrian reconnaissance. A total of 298 sites with 1,144 component features was identified within the project area; this number includes 32 of 33 previously identified sites. Sites within the project area were in fair to good condition. Generally, sites were distributed in fairly dense concentrations along the coast, and they were usually centered in the vicinities of anchialine ponds, trail systems, or old lava flows.

Archaeological sites identified in the project area include multiple-feature and single-component sites. Formal feature types present within the sites include C-, U-, and L-shape walls; enclosures; platforms; terraces; cairns; linear and curved walls; petroglyphs; mound alignments; pahoehoe excavations; anchialine ponds; overhangs; lava tubes and blisters; and miscellaneous modified areas. Probable functional interpretations were determined for most sites; functional types encountered include: habitation, temporary habitation, quarry, transportation, water source, storage, tool preparation, religious, and rock art.

Two hundred twenty-eight sites are assessed as being solely significant for information content. Five sites are significant for their information content and as good examples of specific site types. Nineteen sites are significant for information content and cultural value. Eight sites (possible burials) are significant for information content and potential cultural value. Thirty-eight sites are significant for information content, cultural value, and as examples of specific site types.

Additional archaeological work in the form of further data collection is recommended for 122 sites. No further work is recommended for the remaining 176 sites. Forty-three sites are recommended for some level of interpretive development following further data collection. Eighteen sites are trail segments or trail markers which require no further data collection and are recommended for preservation as is.

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INTRODUCTION

BACKGROUND

At the request of Mr. Richard H. Van Horn, planner, currently with Belt, Collins & Associates and formerly with Helber, Hastert, Van Horn & Kimura, Planners, on behalf of their clients, Palace Development Corporation and Hawaii Ka'u Aina Partnership, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological reconnaissance survey of the c. 3,360-ac proposed Hawaiian Riviera Resort project area in the Land of Kahuku, Kau District, Island of Hawaii. The overall objective of the survey was to provide information appropriate to and sufficient for the preparation of an Environmental Impact Statement (EIS) which is being prepared in conjunction with a General Plan Amendment (GPA) application filed with the County of Hawaii, as required by Chapter 343 of the Hawaii Revised Statutes. The information provided by the survey is also intended to be appropriate to and sufficient for the subsequent preparation of a Land Use Boundary Amendment petition to be submitted at a later date to the State Land Use Commission.

Field investigations were conducted between May 27 and June 6, 1987 under the direction of PHRI Senior Archaeologist Dr. Alan E. Haun and Supervisory Archaeologist Alan T. Walker. A total of 117 man-hours was expended conducting the field work.

Previous archaeological studies within the project area identified 33 archaeological sites. PHRI field investigations relocated 32 of these sites and identified 287 new sites. Of the 32 relocated sites, 21 are subsumed under five PHRI temporary site numbers as component features or areas. PHRI findings within the project area result in a cumulative total of 298 sites containing 1,144 component features.

The present document is the final report on the reconnaissance survey project. Included in this document is (a) background information pertaining to the environmental and cultural-historical setting of the project area, (b) a summary of previous archaeological investigations, and (c) a description of field procedures. The Findings section discusses the field work and data analysis results. This report's Conclusions presents site significance evaluations and specific/recommended general treatments for each site. Appended to this report are findings of the historical documentary research (Silva, Appendix D).

SCOPE OF WORK

The goal of a reconnaissance survey is to identify--to discover and locate on available maps--sites and features of potential archaeological significance. A reconnaissance survey comprises the initial level of archaeological investigation. It is extensive rather than intensive in scope and is conducted, basically, to determine the presence or absence of archaeological resources within a specified project area. A reconnaissance survey indicates the general nature of, and variety of, archaeological remains present, and the general distribution and density of such remains. Furthermore, reconnaissance surveys permit a general significance assessment of archaeological resources and facilitate formulation of realistic recommendations and estimates for such further work as might be necessary or appropriate. Such work could include intensive survey--data collection involving detailed recording of sites and features, and selected test excavations; and subsequent mitigation--data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

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

For the reconnaissance survey, the project area's c. 3,360 acres were divided into the following Survey Areas:

1. Immediate Coastal Zone--seaward part of main resort portion of project area, extending from the shoreline to c. 1,200 ft inland (c. 715 ac)

2. Remainder Coastal Zone--inland part of main resort portion of project area, extending variably from c. 1,200 ft inland to a maximum c. 5,500 ft inland (c. 1,585 ac)

3. Support Community--parcel located c. 5.5 miles inland, adjacent to and seaward of the Mamalahoa Highway (c. 800 ac)

4. Airfield--parcel located c. 1.5 miles inland and adjacent to the main resort portion of the project area (c. 100 ac)

5. Access Road--150-ft-wide corridor extending from Mamalahoa Highway to the main resort area along the coast (c. 160 ac)

Based on a review of readily available background literature and on discussions with Virginia Goldstein, staff planner and historic sites

specialist in the Hawaii County Planning Department, and Dr. Ross Cordy, chief archaeologist in the Hawaii State Department of Land and Natural Resources-Historic Sites Section (DLNR-HSS), the following specific tasks were determined to constitute an adequate scope of work for the Hawaiian Riviera Resort project area reconnaissance survey:

1. Review available archaeological and historical literature relevant to the immediate project area

2. Conduct 100% coverage low-level (c. 30-50 ft altitude) aerial reconnaissance (helicopter) of the entire c. 3,360-ac project area emphasizing (a) following out foot trails and plotting them on aerial photographs and/or maps, (b) identifying all sites observed, and (c) identifying areas devoid of sites (e.g., recent lava lands)

3. Conduct 100% coverage high intensity (30-ft field crew intervals) ground reconnaissance of the Immediate Coastal Zone

4. Conduct variable coverage (partial to 100%), variable intensity (30- to 90-ft intervals) ground reconnaissance of the remaining parts of the project area (Remainder Coastal Zone, Support Community, Airfield, Access Road), with relatively higher intensity coverage being given to the older pahoehoe lava lands and relatively lower intensity coverage to the more recent aa lava lands

5. Conduct limited historical documentary research (emphasis on readily available literature and documentary sources) and interview appropriate and available local informant sources

6. Analyze field and historical research data and prepare appropriate reports

At the request of Dr. Cordy of DLNR-HSS, volcanic glass samples were surface collected during the reconnaissance survey field work for hydration-rind dating analyses. Dr. Cordy pointed out during a pre-field work discussion of the project's Scope of Work that, with the exception of two radiocarbon dates from a single site excavated by Soehren in 1965, there were no dating results available for any of the numerous known sites located within the project area.

The reconnaissance survey was carried out in accordance with the minimum requirements for reconnaissance level survey recommended as standard by the Society for Hawaiian Archaeology (SHA). These standards are currently used by the Hawaii County Planning Department and DLNR-HSS as guidelines for the review and evaluation of archaeological reconnaissance survey reports submitted in conjunction with various development permit applications.

Because of certain field conditions, two modifications to the Scope of Work were made. The first modification involved limiting aerial coverage of the Immediate Coastal Zone to non-systematic inspection coverage. Individual sites were not flagged during the Immediate Coastal Zone aerial survey because sites were so numerous and because the area was going to be subjected to high-intensity ground coverage. The second modification was to the high-intensity ground survey field crew interval spacing. The interval was expanded from 30 ft to an average of 30 m because site visibility was excellent; however, when irregular areas or vegetation-covered terrain were encountered the interval was reduced in order to ensure that no sites were missed.

PROJECT AREA DESCRIPTION

The Hawaiian Riviera Resort project area (Figures 1 and 2) consists of three interrelated development sites--the Immediate/Remainder Coastal Zone, the Support Community, and the Airfield--all situated within the Land of Kahuku, Kau District, on the leeward coast of the Island of Hawaii (TMK: 3-9-2-01:Por.72). The Immediate/Remainder Coastal Zones, situated on c. 2,300 ac along the coast and bounded to the southwest by the Pacific Ocean, extends southeast from Humuhumu Point to an area just east of Kahakahakea Point, and inland (northeast) from the coast to approximately the 200-ft elevation contour. Within this area, average annual rainfall is estimated at 20 inches (Armstrong 1983:63).

Major geologic mapping units present within or immediately adjacent to the proposed Immediate/Remainder Coastal Zones include Unit 2 lava flows, Unit 3 lava flows (Hapaimanu Flows, Kipuka Kanohina Flow, Pohue Bay Flow, and Halepohaha Flow), and historic-period lava flows (AD 1868, 1887, and 1907) (Lipman and Swenson 1984) (Figure 3). The Unit 2 flows are situated inland of Pohue Bay at the upper edge of the Immediate/Remainder Coastal Zones, and although no ages are available for flows west of the southwest rift zone (SWRZ), Unit 2 flows east of the zone range in age from 1,400-2,950 radiocarbon years BP (Before Present) (1000 BC-AD 550) (Lipman and Swenson 1984).

The age range of Unit 3 flows is 750-1,500 radiocarbon years BP (AD 450-1200) (Lipman and Swenson 1984). The Hapaimanu Flows, which on its north side includes Kipuka Kamiloaina, is situated on the northwest end of the Immediate/Remainder Coastal Zones. It consists primarily of aa lava and is dated c. 800-1,000 radiocarbon years BP (AD 950-1150) by Lipman and Swenson (1984). Halepohaha Flow is situated on the southeast end of the Immediate/Remainder Coastal Zones, inland of Kahakahakea. It consists of aa lava overlain by 1887 and 1907 flows, and like Hapaimanu Flows, it dates AD 950-1150. Little or no volcanic activity occurred within the project area vicinity between AD 1200-1843 (Lockwood and Lipman 1987:509).

Kipuka Kanohina Flow, excluding a small area surrounding Kanonone Pond, extends from the edge of Hapaimanu Flow southeast to Pohue Bay. The

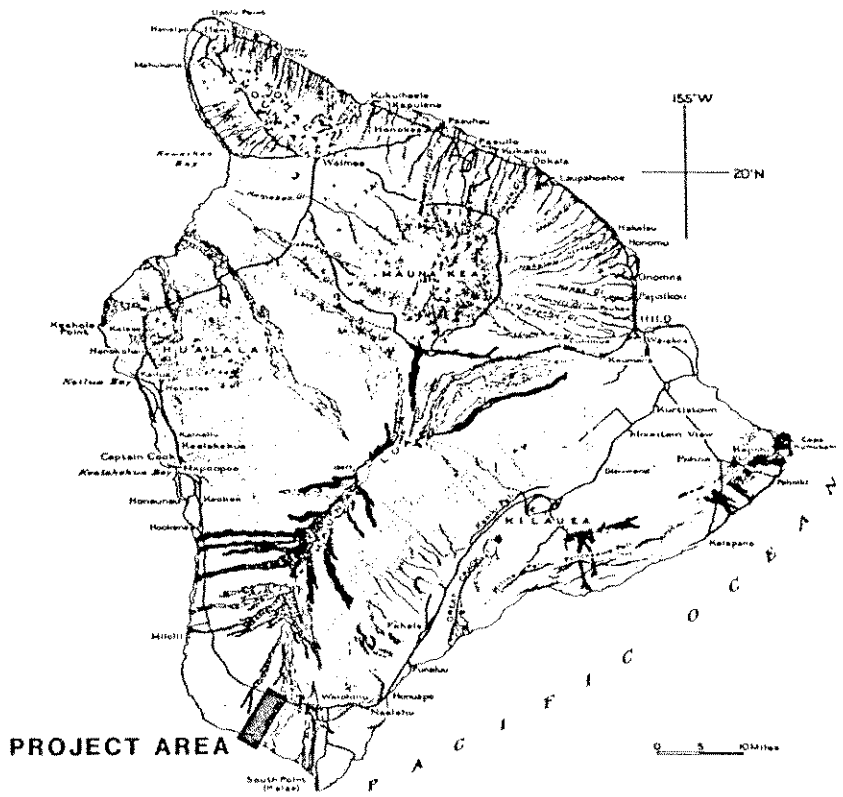


Figure 1. PROJECT LOCATION MAP

ARCHAEOLOGICAL RECONNAISSANCE SURVEY
HAWAIIAN RIVIERA RESORT PROJECT AREA

Land of Kahuku, Kau District
Island of Hawaii (TMK:3-9-2-01:Por.72)

PHRI 87-308 June 1987

(Map from Macdonald and Abbott 1970:288.)

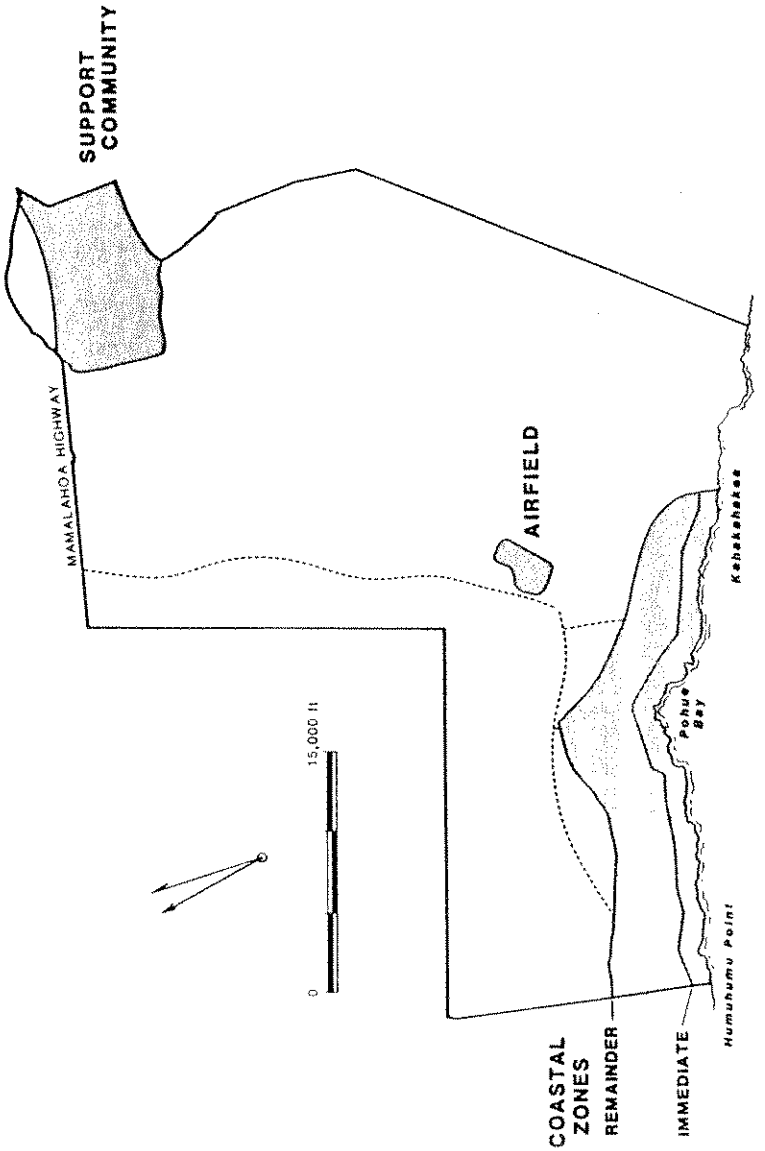


Figure 2. PROJECT AREA MAP

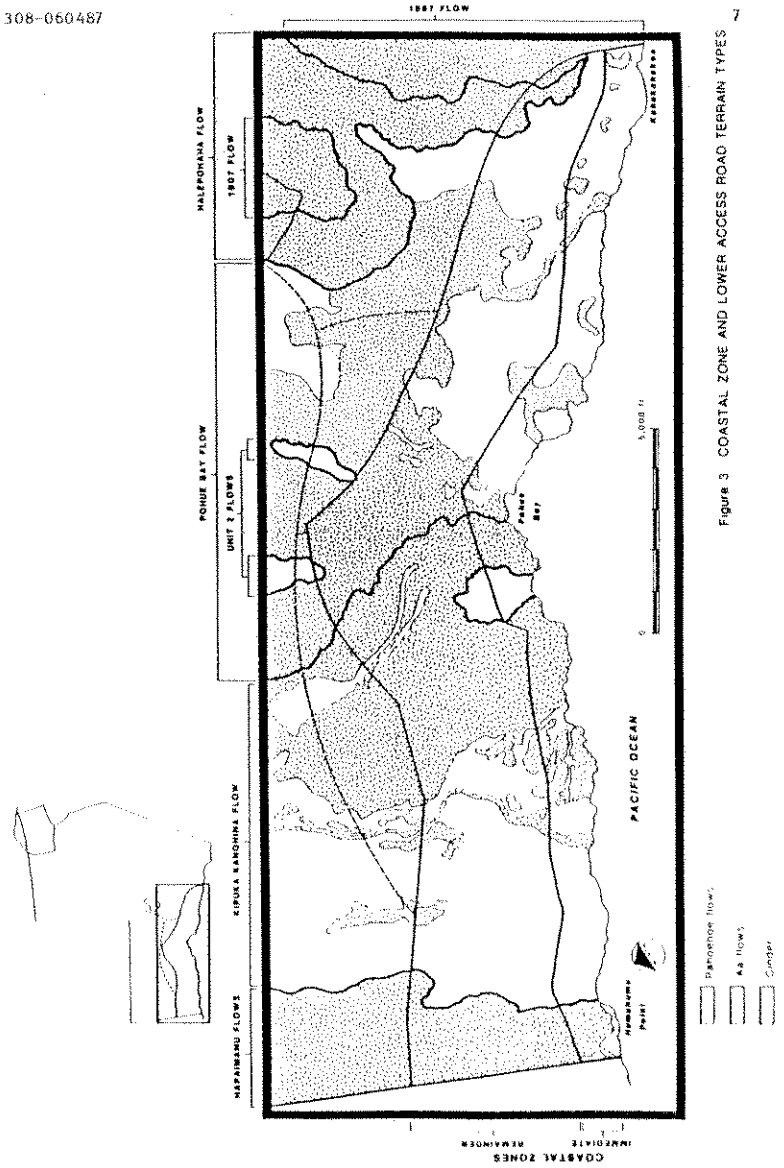


Figure 3 COASTAL ZONE AND LOWER ACCESS ROAD TERRAIN TYPES

flow is characterized by aa and pahoehoe lavas. Pohue Bay Flow, which includes the area surrounding Kanonone Pond, extends southwest from Kipuka Kanohina Flow to Halepohaha Flow and other 1887 flows near Kahakahakea. Pohue Bay Flow consists of aa and pahoehoe lavas. Kipuka Kanohina Flow, according to Lipman and Swenson (1984), predates Halepohaha and Hapaimanu Flows, and postdates Pohue Bay Flow. This suggests that Pohue Bay and Kipuka Kanohina Flow fall into the age range AD 450-950.

Other topographic features in the Immediate/Remainder Coastal Zones include sand deposits, a series of littoral cinder cones, a number of anchialine ponds (including ponds at Kipuka Kanohina, Kanonone, Haliipalala, and Kahakahakea), and a cinder plain in Kipuka Kanohina near the coast. The most prominent cinder cones are Puu Ki and Puu Kahakahakea. Sand deposits are present along the coast at Pohue Bay, Kipuka Kanohina, and Kahakahakea. Deposits from the latter two areas are interspersed with accumulations of waterworn boulders and cobbles. Generally, the remainder of the coastline is characterized by low rocky cliffs.

Immediate/Remainder Coastal Zones vegetation consists of sparse grass and occassional shrubs. Denser vegetation is present in the vicinity of the anchialine ponds. Taxa noted during the survey include the introduced species Indian Pluchea (Pluchea indica [L.]), 'uhaloa (Waltheria americana L.); also ferns (Nephrolepis sp.) growing in damp cracks and various grasses. Native trees and shrubs noted within the coastal area include pohuehue (Ipomoea pes-caprae [L.] Sweet), pua-kala (Argemone glauca [Nutt. ex Prain] Pope), hala (Pandanus odoratissimus L.f.), milo (Thespesia populnea [L.] Sol.), niu (Cocos nucifera [L.]), and 'ilima (Sida fallax Walp.).

The Support Community is situated on c. 800 ac of land located approximately five miles inland (northeast) of the Immediate/Remainder Coastal Zones (Figures 2 and 4). The Support Community is bounded at approximately the 1,900-ft elevation by Mamalahoa Highway on the inland (northeast) side and extends seaward (southwest) to approximately the 1,600-ft elevation. A portion of the Support Community's southwest boundary is delineated by a Kahuku Ranch stone wall. Its southeast boundary is situated in the vicinity of a ranch jeep road, while its northwest boundary is in the vicinity of an AD 1887 lava flow finger.

The terrain throughout the Support Community is exclusively aa and pahoehoe lavas (Sato et al. 1973) with slight soil development on older aa and pahoehoe flows. Historic lava flows (1868 and 1887) in the northwest and southeast portions of the Support Community are separated by a much older mixed aa and pahoehoe flow which spans the community's central portion. This older aa/pahoehoe area is part of the Unit 2 flows (Lipman and Swenson 1984) discussed above. Average annual rainfall within the general area of the Support Community is estimated to range from 40 to 50 inches (Armstrong 1983:63).

Vegetation on the 1887 and 1868 lava flows is characterized by sparse 'ohia (Metrosideros collina [Forst.] Gray subsp. polymorpha [Gaud.] Rock) and 'ohelo (Vaccinium reticulatum Smith) on barren lava with no visible

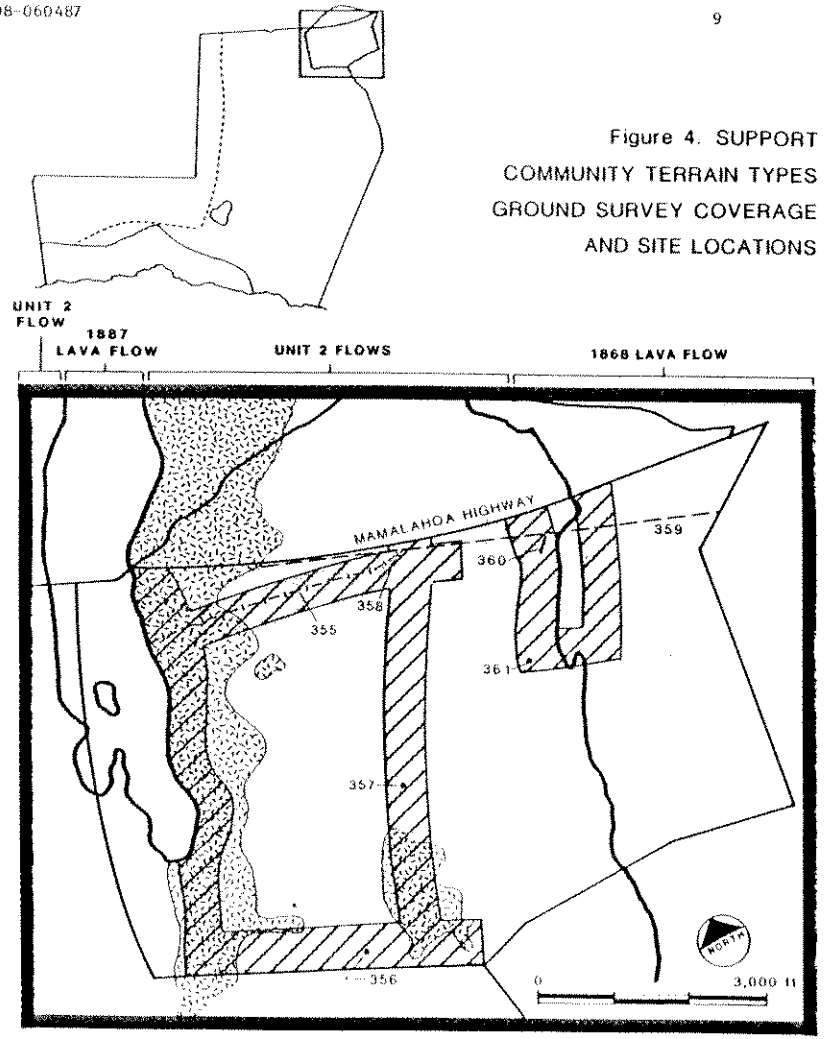


Figure 4. SUPPORT COMMUNITY TERRAIN TYPES GROUND SURVEY COVERAGE AND SITE LOCATIONS

soil development. A band of older prehistoric aa, situated in the northwest side of the Support Community and in a centrally located pocket near the 1,600-ft elevation contour, supports a scattered to moderately dense overstory of 'ohia and an understory of lama (Diospyros ferrea var. sandwicensee [A.DC.] Fosb.), Christmas-berry (Schinus terebinthifolius Raddi), 'a'ali'i (Dodonaea eriocarpa), pa-nini (Opuntia megacantha Salm-Dyck), kauna'oa (Cuscuta sandwichiana Choisy), pukiawe (Styphelia tameiameiae [Cham] F. Muell.), and various ferns.

Vegetation on the older pahoehoe flow in the central portion of the proposed Support Community is characterized by a moderate to dense cover of various grasses that stand up to one meter high, and Christmas-berry, 'ohia, 'a'ali'i, and pukiawe.

The Airfield is situated on c. 100 acres located at approximately the 300-ft elevation, one mile inland (northeast) of the Immediate/Remainder Coastal Zones, and four miles seaward (southwest) of Mamalahoa Highway (Figures 2 and 5). A major portion of the Airfield is situated on the 1907 flow; the Airfield's east and west ends are situated on older pahoehoe flows. The 1907 flow is barren, but the older pahoehoe flow is characterized by a moderate ground cover of various grasses.

The Airfield and the Immediate/Remainder Coastal Zones are linked by a proposed Access Road which extends almost perpendicularly from Mamalahoa Highway and enters the Remainder Coastal Zone at three separate places. The Access Road is generally situated on the AD 1907 flow, but it does cross several older kipuka areas including Kipuka Kanohina. Vegetation present in these older areas, on both aa and pahoehoe terrain, include scattered 'ohia trees and grasses.

PREVIOUS ARCHAEOLOGICAL WORK

The earliest archaeological work within the project area appears to be an excavation conducted in July 1958 by W.J. Bonk and Y.H. Sinoto (Hansen field notes: on file in Bernice P. Bishop Museum [BPBM]). Bonk and Sinoto excavated Site H59# (HRHP Site 3654*) at Pohue Bay as part of the Bishop Museum-Department of Anthropology Hawaiian Archaeological Program; however, the results of the excavation were never published.

*Hawaii Register of Historic Places (HRHP) site designation system: all four-digit site numbers prefixed by 50-10-72,75- (50=State of Hawaii, 10=Island of Hawaii, 72, 75=USGS 7.5' series quad map [Puu Hou, Fohui, Hawaii]).

#B.P. Bishop Museum (BPBM) site designation system: all site numbers prefixed by 50-Ha-B23- (50=State of Hawaii, Ha=Island of Hawaii, B=District of Kau, 23=Lands of Kahuku).

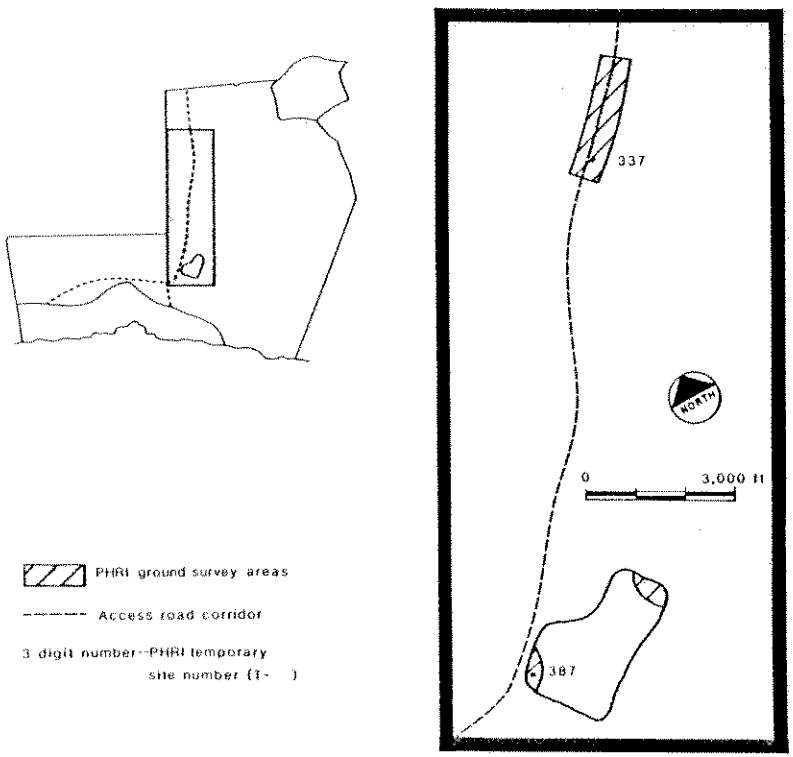


Figure 5. UPPER ACCESS ROAD CORRIDOR AND AIRFIELD PROJECT AREA GROUND SURVEY COVERAGE, AND SITE LOCATIONS

Sometime between 1954 and 1960, during one of his field trips to Hawaii Island, J.H Cox recorded several hundred petroglyph units located in the vicinity of Pohue Bay (Cox 1970:80,82). Recorded are figures, dots, circles, abstractions, fans, crabs, ships, rubbing holes, dates, and names.

V. Hansen, in November 1962 and September 1966, and R. Green, in April 1965, both of the Department of Anthropology, BPBM, conducted preliminary surveys of the coastal portions of the Land of Kahuku in the District of Kau (field notes: on file in BPBM). Hansen and Green recorded 33 sites--walled house sites, cave shelters, burial platforms, trails, anchialine ponds, and petroglyphs--in the vicinity of Pohue Bay and Kahakahakea.

During the summer of 1965, L. Soehren of the Dept. of Anthropology, BPBM, with National Science Foundation support, conducted archaeological excavations of two cave shelters at Kahakahakea--Sites H65 (3635) and H66 (HRHP Site 3636) (Soehren 1965). Site H65 yielded radiocarbon dates from the fourteenth and fifth century, but Soehren rejected the latter date as too early. However, according to Kirch, based on early dates recorded for nearby South Point sites (H1), Soehren's fifth century date should not be rejected (Kirch 1985:87). Soehren's excavation crew also explored, besides the numbered sites, a large tube (no site designation) in the vicinity of Site H65. In a nearly inaccessible chamber of the tube, they discovered an upright wooden pole with a gourd on the upper end, a two-piece fishhook, and strands of human hair (Kirch 1985:160-161).

With the exception of the last unnumbered site described above, all recorded sites were later included in an inventory of Hawaii Island sites prepared by B.P. Bishop Museum in 1970 for the Hawaii County Planning Department (Emory 1970). That inventory was based entirely on existing records in the B.P. Bishop Museum-Department of Anthropology, and did not involve any field work.

FIELD METHODS AND PROCEDURES

On April 27-28, and May 22, 1987, two to three PHRI archaeologists conducted aerial surveys of the project area using a helicopter piloted by Mr. Kalani Ching of Kona Helicopters. For orientation, the archaeologists first flew over the boundaries of the entire project area. Next the Support Community was examined by initiating a series of overlapping aerial sweeps oriented north-south. Sweeps averaged 3 to 15 m above ground, depending on terrain and vegetation. As sites were identified, whenever possible, the helicopter landed so achaeologists could further examine the sites and flag them with pink engineer's flagging tape for relocation. Sites were assigned a sequential number designation beginning with "1" and prefixed by "AS-" (Aerial Survey), and the designation was marked on the site flag and recorded in a field notebook (e.g., AS-1). Identified sites were plotted on 1"=400' scale aerial photographs (R.M. Towill Corp., 1970: Photo Nos. 5289-2, 5289-4). Four sites were identified in the Support Community.

Next, the Access Road Corridor between Mamalohoa Highway and the Airfield Site was examined from an altitude of 3 to 10 m. No sites were identified. Subsequently, the Airfield Site was surveyed by flying 3 to 10 m above ground over the area in a series of overlapping transects oriented northeast-southwest. Particular attention was given to older areas of pahoehoe lava. No sites were identified. Following the Airfield survey, the lower portion of the Access Road Corridor, the portion between the Airfield and the Resort Area, was examined, and one site was identified.

The final portion of the aerial survey focused on the Remainder Coastal Zone. The survey was conducted by flying over the area at an average altitude of 3 to 10 m in a series of overlapping sweeps oriented northeast-southwest. Site flagging was done from the air, by attaching a site flag to a stone and dropping it on the site. Site locations were plotted on 1"=400' scale aerial photographs (Photo nos. 5287-4, -6, -8, -10). A total of 62 sites was identified.

During the aerial surveys, visible trails were followed and plotted and numerous aerial photographs were taken. Visibility along the Access Road, at the Airfield, and in the coastal zone was excellent because the terrain was open and treeless. Visibility in the Support Community, due to the presence of moderate grass cover and forested areas, was fair to good.

Ground survey began with examination of the Immediate Coastal Zone, which extends from the shore to c. 366 m (1,200 ft) inland. This area was surveyed beginning from the southeast end of the project area, near Kahakahakea. A crew of five conducted sweeps oriented inland-seaward, usually perpendicular to the shoreline, with an average spacing of 30 m between crew members. As sites were identified, they were flagged with pink and blue flagging tape and assigned a sequential number beginning with 102, prefixed with "T-" (T-101 was assigned to a site recorded during the aerial survey). All sites were plotted on 1"=200' scale aerial photos (R.M. Towill Corp., 1970: Photo Nos. 5287-4, -6, -8, -10) and were listed in field notebooks. Sweep edges were flagged when necessary with red or blue polka dot flagging tape to ensure complete coverage. Survey sites were only identified and flagged. Site recording was done later. Survey of the Immediate Coastal Zone identified 151 sites.

Ground survey of the Remainder Coastal Zone, Access Road corridor, Airfield and Support Community employed a sampling strategy guided by two main goals: (a) to maximize site location (i.e., to identify the majority of sites present) and (b) to sample all types of terrain--aa and pahoehoe lava flows and the various vegetation types. Selection of survey areas was based on the earlier aerial survey results and the results of the Immediate Coastal Zone ground survey. The Remainder Coastal Zone was first examined by ground sweeps (average 30 m between surveyors) focused on trail systems along which the majority of sites identified by the aerial survey were located. Subsequent survey sweeps were conducted in areas where few or no aerially identified sites were present. These sweeps were generally oriented to sample aa and pahoehoe lava flows and

were positioned, to the extent possible, at regular intervals. These latter surveys confirmed expectations gained from the aerial Immediate Coastal Zone surveys regarding site density. Figure 6 shows the areas of ground survey coverage in the Immediate/Remainder Coastal Zones. During the Remainder Coastal Zone survey, which covered c. 35% of the area in the Remainder Coastal Zone, a total of 139 sites, including aerially relocated sites, was identified.

Because most of the Airfield and the Access Road between the Airfield and Mamalahoa Highway is on a recent (1907) lava flow, ground survey of the Access Road and Airfield focused on older lava lands. Only two sites, both isolated cairns, were located in these older areas surveyed.

Ground survey of the Support Community focused on the older central areas of aa and pahoehoe lava (Figure 4). Forested areas in the Support Community, areas which correspond with the older flows, were surveyed completely. In addition, a portion of the 1868 lava flow located at the southeast end of the Support Community was surveyed. Ground survey was also conducted along the T-355 trail located in the north corner of the Support Community. The ground surveys covered c. 28% of the Support Community and located only two sites, isolated cairns which were not identified from the air.

Sites were recorded on standard PHRI site record forms. Sites were either sketch mapped or scale mapped. Sites were scale mapped using tape and compass if mapping could be completed quickly (c. 10 to 20 min.). One or more black-and-white 35mm photographs were taken of most sites. Sites were tagged with an aluminum strip bearing the site number, PHRI project number (87-308), and the date. The same information on the aluminum strip was also written on pieces of pink flagging tape which were wrapped around large pebble- to cobble-sized rocks, which were placed in protected places on the site. If present, volcanic glass flakes were surface collected for possible age determination.

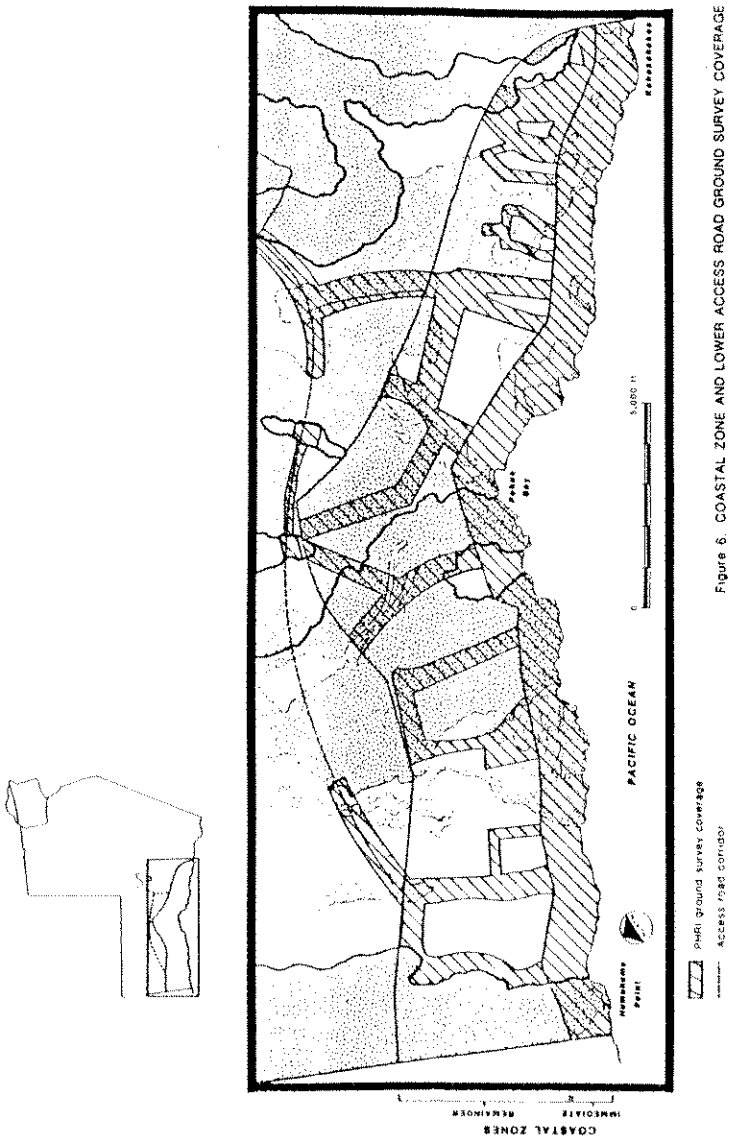


Figure 6. COASTAL ZONE AND LOWER ACCESS ROAD GROUND SURVEY COVERAGE

FINDINGS

ARCHAEOLOGICAL SURVEY

Two hundred ninety-eight archaeological sites containing 1,144 component features were identified within the Hawaiian Riviera Resort project area. The sites and their component features are summarized in Appendices A and B, and their locations are plotted on Figures 4, 5, and 6. Previous studies within the project area identified 33 archaeological sites. PHRI field investigations relocated 32 of these sites and identified a 287 new sites. Of the 32 relocated sites, 21 are subsumed under five PHRI temporary site numbers as component features or areas. Table 1 correlates previously recorded site numbers with those assigned during the present study.

The previously recorded site not relocated, even though its vicinity was surveyed, HRHP Site 3638 consisting of an upright waterworn stone associated with a concentration of coral and interpreted as a small shrine (Emory 1970:14), was possibly not located because of its small size or because it has since been destroyed. Its supposed location is marked on Figure 7 by a small triangle situated inland and west of Kahakahakea.

Archaeological sites identified in the project area include 166 site complexes (multiple-feature sites such as T-126 and T-127, Figures 8 and 9), and 132 single-feature sites. A variety of formal types are present within the sites, including C-, U-, and L-shape walls; enclosures; platforms; terraces; cairns; trails; linear and curved walls; petroglyphs; mounds; alignments; pahoehoe excavations; modified and unmodified anchialine ponds; unmodified overhangs; lava tubes and lava blisters; and miscellaneous leveled, walled, and/or otherwise modified areas (Table 2). Also present, occasionally, are structures interconnected with each other, such as compound enclosures, double or triple C/U-shapes, and double or triple curved walls. Two hundred seventy-seven (24%) of the identified features are C-shapes (Photos 7, 11, 14; Appendix C). Cairns comprise 21% (N=237); lava tubes, blisters and overhangs c. 10% (N=109); linear walls 8% (N=91); curved walls c. 7% (N=85); walled overhangs c. 3% (N=37) (Photo 3: Appendix C); walled or otherwise modified depressions (Photo 4; Appendix 6) and outcrops c. 7% (N=87); enclosures (N=47); and trails (N=42) c. 4% each.

Fifty-two of the C-shape walls, curved walls, and cairns occur in aligned pairs, such as the aligned pair in Site T-278 (Figure 10; for other examples see Photos 10, 15, 16-Appendix C). Such pairs are usually situated along trails or near quarried areas a moderate distance from the coast. C-shape or curved walls usually are open to the southwest with the cairn positioned c. 4 to 5 m to the southwest. The cairns generally have a central hole presumably designed to support a post, which in turn supported some sort of superstructure.

Table 1.

CORRELATION OF SITE AND FEATURE DESIGNATIONS

State	BPBM	PHRI	Comments
3612	B23-1	T-163; Fea. A	-
3613	B23-2	T-163; Fea. E	-
3614	B23-3	T-163; Fea. F	-
3615	B23-4	T-163; Fea. G	-
3616	B23-5	T-163; Fea. H	-
3617	B23-6	T-172; Fea. A	-
3618	B23-7	T-172; Fea. B	-
3619	B23-8	T-172; Fea. D	-
3620	B23-9	T-163; Fea. S	-
3621	B23-10	T-163; Fea. Y	-
3622	B23-11	T-163; Fea. T	-
3623	B23-12	T-163; Fea. U	-
3624	B23-13	T-163; Fea. Z	-
3625	B23-14	T-163; Fea. AA	-
3626	B23-15	T-163; Fea. BB	-
3627	B23-16	T-163; Fea. GG	-
3635	B23-24	-	Formerly H65
3636	B23-25	-	Formerly H66
3637	B23-26	T-131; Fea. A	-
3638	B23-28	-	Not relocated
3639	B23-27	-	-
3647	B23-40	T-140	Includes undefined portion of T-140
3649	B23-42	-	-
3650	B23-43	-	-
3651	B23-44	-	-
3652	B23-45	-	-
3653	B23-46	-	-
3654	B23-47	T-163; Fea. I	Formerly H59

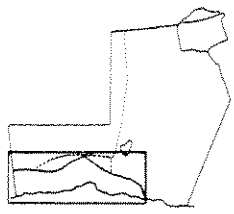
Table 1. (Cont.)

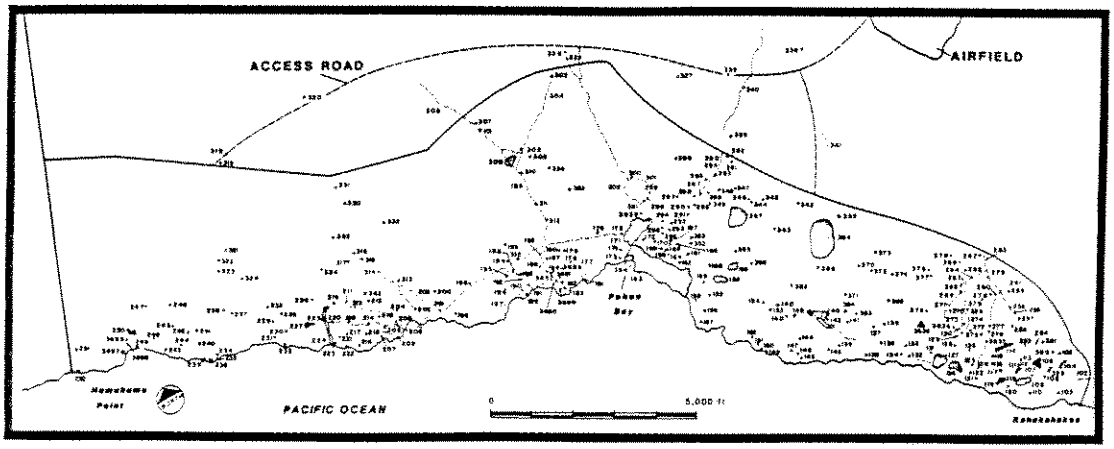
State	BPBM	PHRI	Comments
3655	B23-48	T-170	Includes undefined portion of T-170
3656	B23-49	T-170	Includes undefined portion of T-170
3697	B23-57	-	-
3698	B23-58	-	-
3699	B23-59	-	-

Probable functional interpretations were determined for most sites, with many sites being ascribed two or more probable functions. Functional types encountered in the project area include habitation, temporary habitation, quarry, transportation, water source, storage, tool preparation, recreation, religious, burial, and rock art. Habitation sites are presumed to have been occupied on a more frequent or semipermanent basis compared to temporary habitation sites. The distinction between the two site types is based on an assessment of quantitative differences in such things as structural complexity and scale, and variety and density of food remains.

Sites which were assigned a temporary habitation function usually consist of one or a few shelters (caves, C-shapes, etc.). These sites either lack midden or contain sparse amounts of midden. A temporary habitation function was assigned to 66% of the sites. Sites assigned a habitation function are characterized by (a) moderate to dense amounts of midden present at the site, (b) a relatively thick cultural deposit present at the site, and (c) surface artifacts generally present. Most habitation sites consist of large complexes of features; however, several are single feature sites such as caves with moderate amounts of portable remains. A habitation function was assigned to 7% of the sites.

The functional interpretation "quarry" is based on the presence in the project area of excavated areas of pahoehoe. These areas usually occur along surface faults or other natural breaks in older pahoehoe flows. The breaks and faults have been greatly enlarged through removal of stone. Frequently, large waterworn cobbles or small boulders with heavily battered surfaces, which presumably served as picks or hammers to break up the pahoehoe lava, are present within the excavations. Quarrying activity within the area evidently sought scoriaceous pahoehoe lava used to make abrading implements. Tabular pieces of scoria were occasionally found clustered in small piles among the fault's/break's excavated areas. Some quarry sites are associated with abraded depressions used to shape stone into finished form. Approximately 13% of the sites in the project area were assigned a quarry function.





3 digit number—PHRI temporary site number (T-)
6 digit number—Hawaii Register of Historic Places (HRHP) site number (50-10-72-)

Figure 7. COASTAL ZONE AND LOWER ACCESS ROAD SITE LOCATION MAP

308-060487

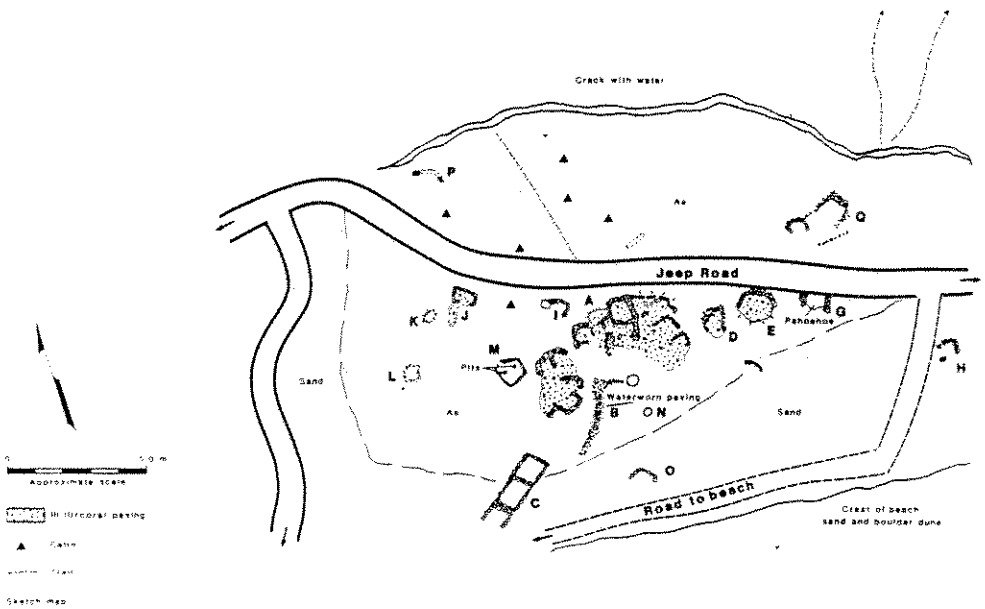


Figure 8. SITE T-126 SKETCH MAP

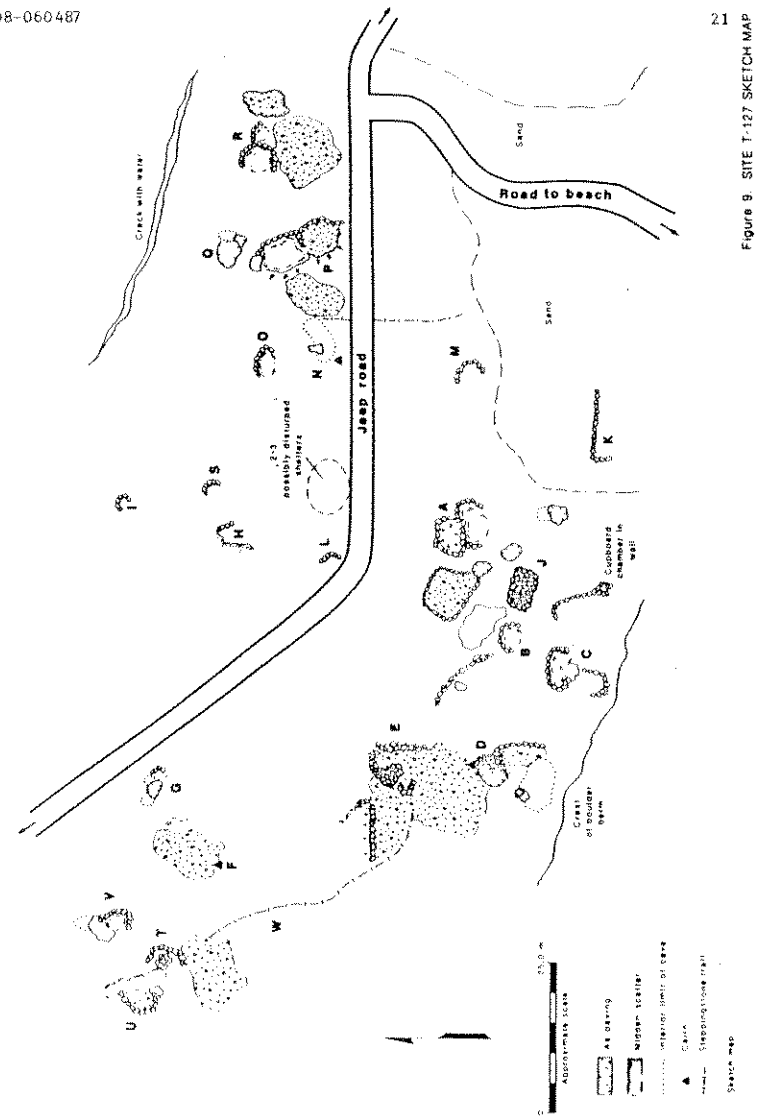


Figure 9. SITE T-127 SKETCH MAP

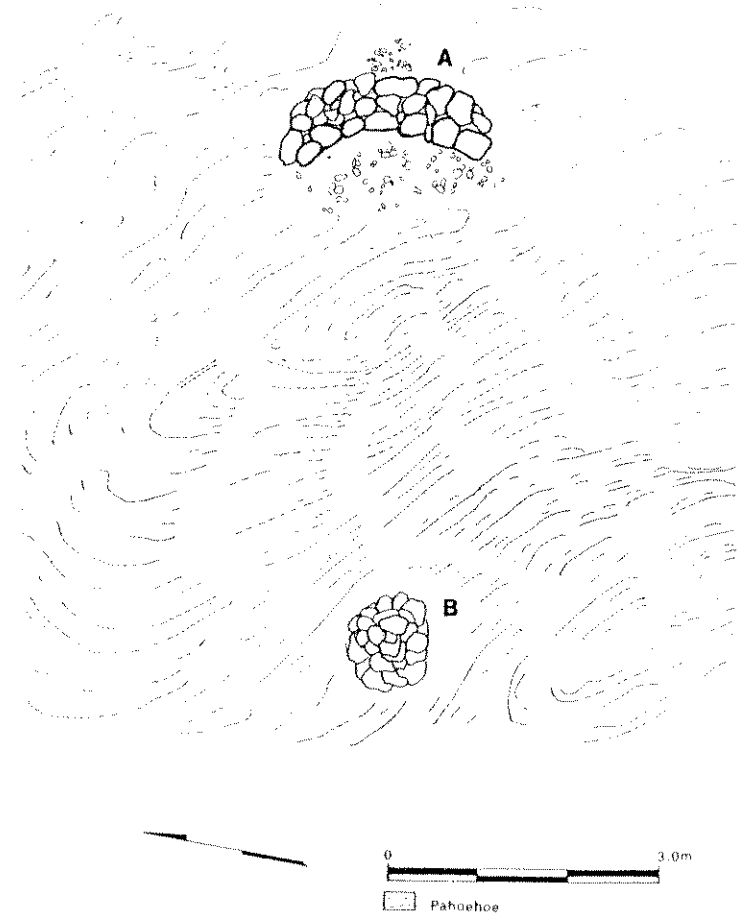


Figure 10. SITE T-278, FEATURES A AND B

Table 2.

FREQUENCIES OF FORMAL FEATURE TYPES

Formal Type	Number	%
C-shape Wall	277	24.2
Cairn	237	20.7
Wall	91	8.0
Curved Wall	85	7.4
Cave/Tube	79	6.9
Enclosure	47	4.1
Trail	42	3.7
Walled Overhang	37	3.2
Other Walled Areas	37	3.2
Overhang	30	2.6
Platform	22	1.9
U-shape Wall	15	1.3
Terrace	14	1.2
Double C-shape Wall	13	1.2
Petroglyph(s)	13	1.2
Mound	12	1.0
Leveled Areas	11	1.0
L-shape Wall	11	1.0
Alignment	8	0.7
Anchialine Ponds	5	0.4
Miscellaneous	58	5.1
TOTAL	1,144	100.00

Sites interpreted as having a transportation function (c. 14%) include trails (Photo 1; Appendix C), trail markers (cairns), ramps, and roads. Individual site numbers were assigned to numerous trails and trail segments which form several major trail networks. Two main lateral trails were recorded. One is a well-constructed interior curbed trail, with faced causeways over low areas, which extends in a roughly east-west direction through the Support Community (T-355). Associated with this trail is Site T-359, a historic road segment which intersects T-355 trail and roughly parallels it. The second lateral trail follows the coastline; it consists of a linear series of discontinuous segments and/or branches. Over aa lava this coastal trail is well-defined, and usually has stepping stones and occasional causeways. In areas of pahoehoe lava, the trail is less distinct--occasionally visible as a worn path--and is marked by cairns and pieces of shell or coral.

Four definite and two probable coastal-inland trail networks were identified. The definite trail networks extend inland from the coasts at Kahakahakea (N=1), Pohue Bay (N=2), and Kanonone Pond (N=1). The two probable trail systems extend from the coast across areas of Kipuka

Kanchina Flow pahoehoe lava; they are evidenced by several isolated trail segments and a linear distribution of shelters. All coastal-inland trail networks are composed near the coast of numerous secondary branches which coalesce into one or two primary trails further inland. The branches generally lead to individual residential sites or to the main lateral, coastal trail network.

A water source function is assigned to excavated, or otherwise modified, anchialine ponds. Pond modifications include subdividing walls such as those noted at Kanonone Pond, small well-built enclosures surrounding small pools, such as Features E and F at Site T-109, and rough retaining walls.

As mentioned above, tool preparation sites are characterized by abraded depressions. These depressions, along with papamu (Photo 2; Appendix C) which are assigned a recreation function, are in this study distinguished from other petroglyphs. (Usually depressions and papamu are considered petroglyphs.) All petroglyphs (e.g., Photo 5; Appendix C) aside from depressions and papamu were assigned a rock art function, indicating they are interpreted as symbolic representations.

A religious function is assigned to possible shrines and to several possible shrines which are also possible burials. For the latter sites, test excavations are necessary to determine the specific religious function. Shrines range from pieces of coral and/or upright stones placed within probable residential structures, such as Feature A at Site T-106 to concentrations of coral and/or waterworn stones associated with small platforms (Photo 8; Appendix C), cairns, or other nonresidential structures. A burial function is assigned to confirmed (T-361 cave), and possible (T-158, -161, -167, -169, -194) burials. Photo 6 (Appendix C) shows a possible burial platform at Site T-169.

Several sites/features, including a large U-shaped alignment at Site T-227 and a walled ramp feature at Site T-239, were assigned an indeterminate or unknown function. The U-shape consists of a c. 24 by 65 m alignment of pahoehoe slabs located on a cinder plain near the coast (Photo 13; Appendix C). The U-shape is open to the northeast, and the northern leg consists of two parallel pahoehoe slab alignments. Eight cairns are associated with the U-shape; two at the open end, and six arranged in a linear pattern extending from the outside center of the south leg to the southeast. The walled ramp at Site T-239 consists of two parallel walls extending up a gentle slope to meet a small rectangular platform. The walled ramp is 3.0 m wide, 15.0 m long, and the walls average 55 cm in height. Two parallel, discontinuous alignments of pahoehoe slabs are situated on the floor of the ramp, parallel to the walls. At least ten parallel alignments of small upright pahoehoe slabs (avr. 0.15 to 0.20 m high) extend between the walls, perpendicular to them. Seven habitation shelters (C- and L-shape walls) are associated with the walled ramp; the whole Site 239 complex is located near the coast.

In general, sites were found in fairly dense concentrations along the coast, usually near anchialine ponds. Extending along the coast between concentrations, and inland of them, were other linear concentrations of sites associated with trail systems. Concentrations of sites were also most common on older Pohue Bay and Kipuka Kanonone Flows. Quarry sites were primarily located on Pohue Bay pahoehoe lava flows.

CHRONOLOGY

Based on the site/feature types and artifacts encountered, most sites in the project area are prehistoric. Soehren's (1966) work at Site 3635 recovered two carbon samples which, through radiocarbon assay, yielded fifth and fourteenth century dates--dates which suggest the site had a long period of use. The majority of prehistoric sites in the project area are in fair to good condition, which suggests most were used late in prehistory. In order to begin developing a more detailed local chronology, 321 volcanic glass flakes were collected from 48 features at 25 sites for potential age determination analysis (Table 3). Also, based on optical characteristics, 31 flakes from 22 sites were selected for hydration-rind age determinations.

Table 4 presents the results of the volcanic glass hydration-rind age determinations. On the basis of five source-affinity tests, and on the basis of petrographic thin-section comparisons of 26 samples by MOHLAB, two probable glass sources were identified: Kau and Puueo (Michels 1986a, 1986b). These two sources were previously identified, and induced hydration rates were experimentally determined for them, in conjunction with a data recovery project conducted near South Point (Spear 1987). Five samples, two from Site 3635 and one each from Sites 3636, T-127, and T-296, are identified as coming from the Puueo source. The rest of the samples are from the Kau source.

The calendric age ranges of samples at two sigma span 723 years (AD 1118-1841). The age ranges form two distinct clusters of overlapping age ranges. One cluster, which spans a 64-year period (AD 1777-1841), consists of three age ranges produced by samples from Sites 3635 and 3636. The remaining 28 age determination results form an overlapping cluster of ranges spanning 571 years (AD 1118-1689). Of the six most recent age ranges yielded, five come from the Puueo source. These five ranges include all three samples from the late cluster and two of three from the early cluster.

The samples for dating purposes came from several formal feature types including C- and U-shape walls (N=5), caves and tubes (N=16), overhangs (N=4), and a walled depression. Some samples came from surface contexts not associated with feature types. The age determination results do not indicate a specific temporal period for any of the feature types.

Sites from which samples were dated are clustered near Pohue Bay and Kahakahakea. Two dated sites are situated between Pohue Bay and Kahakahakea, and two are coastal sites northwest of Pohue Bay. As with

Table 3.

INVENTORY OF VOLCANIC GLASS

Site Number	Feature	Number of Pieces Collected	Number of Pieces Submitted for Age Determination
3635	Backdirt I	3	2
3635	Backdirt II	4	2
3636	Backdirt	11	1
3639	A	1	1
T-104	B	1	1
T-107	A	20	1
-	B	10	1
T-124	B	7	1
T-125	-	1	1
T-126	E	1	-
T-127	B	40	1
-	C	23	-
-	E	27	-
-	F	8	-
-	G	14	1
-	J	5	-
-	N	4	-
-	R	2	-
-	V	5	-
T-131	-	4	-
-	B	3	1
T-142	-	1	1
T-152	-	7	1
T-160	-	10	1
T-162	A	10	1
T-163	I, S. Chamber	7	1
-	J	15	1
-	V	1	-

Table 3. (Cont.)

Site Number	Feature	Number of Pieces Collected	Number of Pieces Submitted for Age Determination
"	X	3	"
"	CC	5	"
"	HH	3	"
T-166	C	1	1
T-170	"	17	1
T-171	N	1	"
"	L	1	"
"	Q	4	1
"	W	1	"
"	DD	1	"
"	LL	2	1
T-174	"	6	1
"	C	4	1
T-184	"	1	"
T-192	A	2	1
T-204	A	2	1
"	G	1	1
T-295	"	3	1
T-296	"	9	1
"	A	6	"
25 Sites	48 Features	318	31

feature types, age determination results do not indicate within the project area specific occupation periods for particular areas. However, all dated sites are situated on either the Kipuka Kanonone or Pohue Bay Flows, which both date to before AD 950.

Given the small number of recovered volcanic glass samples, usually only one per site, patterns indicated by dating results should be viewed cautiously. Taken as a whole, the age ranges do provide a good starting point for building a local chronology, and certainly they can be taken as ample evidence that occupation of the particular coastal Kahuku area the samples were taken from spanned late prehistoric to early historic times. The possibility of obtaining samples old enough to verify Soehren's fifth century date for Site 3635 should not be ruled out because all the present

Table 4.

SUMMARY OF VOLCANIC GLASS HYDRATION-RIND AGE DETERMINATIONS

PHRI Lab. No. VG-	MOHLAB Lab. No.	Source	Provenience	Hydration Rind (microns)	*Calendric Date Yrs. AD	Calendric Range Yrs. AD (2 sigma)
SITE 3635						
633	423-1A	P	BD-I	4.66±0.09	1829±06	1817-1841
634	423-1B	K	BD-I	0.93±0.03	1643±23	1597-1689
635	423-2A	K	BD-II	1.07±0.06	1534±49	1436-1632
636	423-2B	P	BD-II	5.10±0.14	1797±10	1777-1817
SITE 3636						
637	423-3A	P	Surface	5.08±0.13	1799±10	1779-1819
SITE 3639						
641	423-49a	K	Feature A Surface	0.92±0.05	1648±35	1578-1718
SITE T-104						
642	423-4	K	Feature B Surface	1.07±0.04	1528±34	1460-1596
SITE T-107						
643	423-5	K	Feature A Surface	1.22±0.10	1397±98	1201-1593
644	423-6	K	Feature B Surface	1.35±0.06	1256±69	1118-1394
SITE T-124						
645	423-31A	K	Feature B Surface	1.27±0.04	1348±40	1268-1428

*Hydration rate based upon experimentally derived hydration constants for Kau and Puueo volcanic glass (MOHLAB Technical Reports 71 and 70, respectively) and an effective hydration temperature computed from air temperature data for the Kau District, Island of Hawaii. Hydration rate for Kau is 1.76 microns^2 per 1,000 years and for Puueo is 107.38 microns^2 per 1,000 years.

Table 4. (Cont.)

PHRI Lab. No. VG-	MOHLAB Lab. No.	Source	Provenience	Hydration Rind (microns)	Calendric Date Yrs. AD	Calendric Range Yrs. AD (2 sigma)
SITE T-125						
647	423-8	K	Surface	0.97±0.03	1615±24	1567-1663
SITE T-127						
648	423-10	P	Feature B Surface	7.05±0.19	1626±19	1588-1664
649	423-14	K	Feature G Surface	1.10±0.04	1501±35	1431-1571
SITE T-131						
650	423-20	K	Feature B Surface	1.27±0.05	1348±47	1254-1442
SITE T-142						
651	423-51	K	Surface	1.11±0.02	1496±18	1460-1532
SITE T-152						
652	423-52A	K	Surface	1.29±0.06	1322±65	1192-1452
SITE T-160						
654	423-32A	K	Surface	1.29±0.05	1322±54	1214-1430
SITE T-162						
656	423-33A	K	Feature A Surface	1.02±0.04	1575±34	1507-1643
SITE T-163						
658	423-34	K	Feature I South Chamber Surface	1.20±0.04	1570±31	1508-1632
659	423-35	K	Feature J Surface	1.14±0.04	1468±36	1396-1540
SITE T-166						
660	423-40	K	Feature C Surface	1.07±0.05	1534±45	1444-1624

Table 4. (Cont.)

PHRI Lab. No. VG-	MOHLAB Lab. No.	Source	Provenience	Hydration Rind (microns)	Calendric Date Yrs. AD	Calendric Range Yrs. AD (2 sigma)
SITE T-170						
661	423-41	K	Surface	1.20±0.06	1415±59	1297-1533
SITE T-171						
663	423-23	K	Feature Q Surface	1.20±0.08	1415±76	1263-1567
664	423-45	K	Feature LL Surface	1.02±0.03	1570±23	1524-1616
SITE T-174						
665	423-24	K	Surface	1.17±0.04	1445±39	1367-1523
666	423-25	K	Feature C Surface	1.20±0.02	1409±23	1363-1455
SITE T-192						
667	423-27	K	Feature A Surface	1.13±0.04	1473±40	1393-1553
SITE T-204						
668	423-29	K	Feature A Surface	1.03±0.06	1565±48	1469-1661
669	423-30	K	Feature G Surface	0.98±0.03	1600±23	1544-1646
SITE T-295						
670	423-46A	K	Surface	1.00±0.05	1585±42	1501-1669
SITE T-296						
672	423-47B	P	Surface	7.09±0.13	1621±13	1595-1647

samples except those from Sites 3635 and 3636 came from surface contexts. Samples from Sites 3635 and 3636 came from Soehren's backdirt piles and thus, have an unknown provenience.

HISTORICAL DOCUMENTARY RESEARCH

Historical documentary research, conducted by historical researcher Carol Silva, for the Hawaiian Riviera project area is presented in Appendix D. Her research focuses on readily available information relating to the traditional significance of the area, various historical accounts, Land Commission Award testimonies, and other sources. A brief summary of Appendix D follows.

Legendary and other traditional sources refer to the use of upland trails used by the Chiefs Umi and Ehu for gaining and maintaining control over Kau. These sources also indicate the upland forests were a source of wood for weapons. In historic times, the chief Keoua resided in the uplands of Kahuku, and Kamehameha during his later years occasionally fished at Pohue Bay.

Land Commission testimonies suggest that agricultural and residential sites were located far inland because the land there was suitable for growing bananas and taro. The testimonies refer to upland trails and a variety of exploited upland resources including birds caught for food (uwao and nene) and feathers (mamo and oo), pulu, wood (sandalwood and koa), and feral goats.

Early historical accounts depict the coastal areas as uninhabited expect for occasional fishermen who periodically stayed at the coast. According to these accounts, the main area of settlement was inland, probably above c. 1,500 ft elevation where rainfall was sufficient for agriculture. Supposedly, some of the more fertile occupied portions of inland Kahuku were covered by the 1868 and 1887 lava flows.

Later historic-period coastal use appears to have been restricted to fishing until a road to the coast was constructed in the 1940s. After construction of the road, the area became more accessible for fishing and other recreational activities.

INFORMANT INTERVIEWS

The search for informants was guided by a desire to contact individuals who had lived in the area for a long period of time in the hope that they could provide information on recent land use. Two such individuals, Mr. Bud Doty and Mr. Molcilio, were contacted and were also asked about their knowledge of archaeological sites in the area.

On June 2, 1987 PHRI Supervisory Archaeologist Margaret L.K. Rosendahl accompanied Mr. Bud Doty to the project area. Mr. Doty has lived in Kau

for almost 23 years and is very familiar with archaeological sites within the district. Doty's primary interest is the study of petroglyphs. He has spent much time investigating the petroglyphs at Pohue and petroglyphs in the surrounding coastal area, and has always had access to the area.

Doty identified clusters of petroglyphs and site areas that he felt were most significant in terms of their uniqueness, variety, condition, and density. These areas include Site T-171, major groupings within Site T-163 (generally within the southern portion of the site), Site T-160 (a cave with petroglyphs), Site T-155, Site T-154, and Site T-140 (especially sections B and D). He indicated that in Site T-140 the petroglyphs are generally adjacent to the trail. Doty pointed out a large petroglyph boulder on the seaward side of Kanonone Pond. He was concerned that additional petroglyph boulders may be present within the vicinity. Doty's knowledge of the area comes from many years of study and exploration. He is not aware of legends about the area, or of any specific early historic accounts of the area.

Ms. Rosendahl also interviewed Mr. Molcilio, presently foreman at Kahuku Ranch. Over the past 35 years, Mr. Molcilio has spent time fishing at Pohue Bay. In the 1940s James W. Glover, who Mr. Molcilio originally worked for, put in the road that leads to the coast. Prior to that, people used trails to get to the coast, or they arrived by boat. According to Mr. Molcilio, fishing along the coast was excellent. However, in the late 1950s some other fishermen used "powder" or dynamite and Clorox to "fish" with, which greatly reduced the fish population. During fishing trips, Mr. Molcilio and others would camp in caves just inland of Pohue Bay.

Mr. Molcilio was aware of petroglyphs in the vicinity and recalled "museum people" being asked to inspect finds that other fishermen had located. He did not personally find anything nor was he involved with any located archaeological materials. During the last 35 years, there apparently have been no residents at Pohue Bay. Pohue Bay has only been occasionally visited by fishermen and campers.

Contacts were also made with knowledgeable kupuna from Kau; in general, they knew of the petroglyphs and the Hawaiian trail but were not familiar with historic use of, or mythologies associated with, the area.

CONCLUSIONS

DISCUSSION

Evaluation of Survey Methodology

The archaeological reconnaissance survey consisted of a 100% systematic low elevation aerial coverage of the Support Community, the Access Road, the Airfield, and the Remainder Coastal Zone. The Immediate Coastal Zone was aerially inspected prior to ground coverage; however, because it contained numerous sites and was soon to be subjected to high-intensity ground coverage, individual sites were not plotted or flagged from the air. High-intensity (average 30-m interval spacing) ground coverage included 100% of the Immediate Coastal Zone, c. 35% of the Remainder Coastal Zone, c. 26% of the Support Community, and approximately 10% of the Airfield and Access Road.

As mentioned previously, surface visibility was excellent in all survey areas except the Support Community, where visibility was good in grass-covered portions and fair in forested areas. Throughout the project area sites such as tubes and trails were frequently more obvious from the air than from the ground. Excepting petroglyphs, all other site/feature types, including small types such as isolated cairns, were easily recognized from the air. Recognizing petroglyphs was not a problem because they are usually associated with site/feature types readily identifiable from the air.

Ground survey sample selection was guided by two main goals: to identify all sites and to sample all types of terrain. Sample selection sought to verify the results of the aerial identification effort. For inland survey areas (Remainder Coastal Zone, Access Road, Airfield, and Support Community), ground coverage sampling included all trails and sites identified aerially. Ground coverage frequently identified additional features of aerially identified sites, and additional sites in the immediate vicinity of aerially identified sites. For example, ground coverage of a trail system would result in identifying cairns and shelters situated along the trail.

Additional samples were selected from areas where no sites had been aerially identified in order to sample all the project area's main terrain types. The terrain types encountered within the project area include aa and pahoehoe flows assigned to two prehistoric members (Unit 3 Flows--Hapaimanu, Kipuka Kanohina, Pohue Bay, Halepohaha Flows--and unnamed flows belonging to Unit 2) and three historic members (1887 and 1907 flows).

Based on a consideration of the survey methodology and results, it is likely that all sites on the Hapaimanu and Halepohaha Flows within the project area have been identified. The Hapaimanu and Halepohaha Flows represent a relatively minor portion of the Immediate/Remainder Coastal

Zone. The Halepohaha Flow also comprises a portion of the Airfield and one small kipuka along the upper Access Road. Both flows are relatively recent, and they both, within the Immediate/Remainder Coastal Zones, consist exclusively of aa lava. Ground coverage of both flows focused on flow edges and trails in the Remainder Coastal Zone because complete ground coverage of Immediate Coastal Zone flows and aerial coverage of the Remainder Coastal Zone, Access Road, and Airfield revealed that sites were restricted to trails and flow edges.

The Kipuka Kanohina Flow comprises c. 40% of the Immediate/Remainder Coastal Zones and consists of roughly equal amounts of aa and pahoehoe lavas. Sites identified in the project area are primarily restricted (a) to the Immediate Coastal Zone, and (b) along one definite (across aa lava) and two probable (based on linear site distributions across pahoehoe lava) trail routes in the Remainder Coastal Zone and lower Access Road survey areas. This site distribution pattern is based on the aerial survey and confirmation of the aerial survey by ground coverage sampling. Overall, survey results demonstrate that, with the exception of trail routes, Kipuka Kanohina Flow lavas inland of the Immediate Coastal Zone are devoid of sites. Considering the survey methodology and results, it is likely that all significant sites on the Kipuka Kanohina Flow part of the project area have been identified.

The Pohue Bay Flow comprises c. 40% of the Immediate/Remainder Coastal Zone and a portion of the lower Access Road. The flow is characterized along the coast primarily by pahoehoe lavas. Aa lava dominates inland portions. In addition to aerial coverage, nearly half of the Pohue Bay Flow situated within the Remainder Coastal Zone, comprised of c. 75% pahoehoe lava and 25% aa lava, was covered by high-intensity ground survey. Substantial areas of Pohue Bay aa and pahoehoe lavas, located inland of the Remainder Coastal Zone along the Access Road, were also ground surveyed. The distribution of sites in the Pohue Bay Flow, relative to lava texture and distance from the coast, parallels that described above for Kipuka Kanohina Flow (i.e., sites are concentrated on the coast and along inland oriented trails). However, Pohue Bay Flow sites are also present on certain inland aa and pahoehoe lavas, which contain areas of interfaces and broken pahoehoe; areas where quarrying is evident. Based on a consideration of aerial and ground survey methodology and results, it is likely that all significant sites on the Pohue Bay Flow have been identified. A few isolated abraded depressions and/or small pahoehoe excavations within the unsurveyed portions of pahoehoe lava are probably the only sites not identified.

Unit 2 Flows comprise several small kipuka along the Access Road and c. 70% of the Support Community. The kipuka were surveyed from the air and ground. In the Support Community, Unit 2 aa and Unit 2 pahoehoe flows can be differentiated by their vegetation. Aa areas are characterized by sparse 'ohia forest, and pahoehoe areas are characterized by grass. Ground survey coverage of the Support Community included c. 75% of forested Unit 2 aa flows--areas the least visible from the air--and c.15% of the grass-covered pahoehoe flows. As with all other survey areas, ground survey sampling within the Support Community included the

vicinities of all aerially identified sites (i.e., tube systems and a trail). All identified sites, excepting a historic road that crosses the 1868 lava flow, were located on Unit 2 flows. No sites were identified on Unit 2 aa lava. One site, an isolated cairn (T-356) not seen from the air, was identified during the ground survey. Considering survey methodology and results, with the possible exception of a few isolated cairns, it is likely that all significant sites on Unit 2 flows have been identified.

The 1887 lava flows comprise strips of rough aa along the southwestern end of the Immediate/Remainder Coastal Zone and along the western edge of the Support Community. The 1868 lava flow covers the eastern third of the Support Community, where the flow is characterized by both aa and pahoehoe lava. Aerial survey covered 100% of these flows and was followed by sample ground coverage. No additional sites were located by the sample ground coverage; it is therefore assumed that all significant sites located on the 1868 and 1887 lava flows within the project area have been located.

The 1907 flow comprises most of the Airfield and upper Access Road. Aerial coverage of this rough aa flow did not identify any sites. Because of the negative aerial results, and because it is extremely unlikely that significant sites would be located on such a recent flow, ground sample coverage was not attempted.

Summary of Kahuku Prehistory and History

Prior to the present project, little archaeological and historical research had been done in Kahuku. Archaeological work in the 1950s and 1960s indicated that a variety of archaeological sites including trails, residential features, shrines, and petroglyphs were present along the coast. The results of Soehren's excavations at Sites 3635 and 3636 were interpreted by him as evidence of periodic occupation by fishermen since the fourteenth century (1966:50-51).

The present research has significantly added to the number and types of archaeological sites known in the area. The variety of formal types present in the project area includes C-, U-, and L-shape walls; enclosures; platforms; terraces; cairns; trails; linear and curved walls; petroglyphs; mounds; alignments; pahoehoe excavations; modified and unmodified anchialine ponds; unmodified overhangs; lava tubes and lava blisters; and miscellaneous leveled, walled, and/or otherwise modified areas. Most of these types are commonly encountered elsewhere on Hawaii Island, such as in coastal areas dominated by barren lava, like in North Kona and South Kohala. Notable exceptions are the walled ramp at Site T-239 and the U-shape alignment at Site T-227, which appear to be unique types.

Functional types encountered include habitation, temporary habitation, quarry, transportation, water source, storage, tool preparation, recreation, religious, burial, and rock art. Historic references and the

nature of the sites themselves suggest that none were permanently occupied. Permanent habitation sites were evidently situated far inland. It is probable that fishing and exploitation of scoriaceous pahoehoe lava for abraders, were the main prehistoric uses of the coastal area. Most other activities represented were probably incidental to fishing and stone tool procurement.

As mentioned earlier, sites were found in fairly dense concentrations along the coast, usually near anchialine ponds. Extending along the coast between concentrations, and inland of them, were other linear concentrations of sites associated with trail systems. Concentrations of sites can in part be correlated with the age of the various flows characterizing the area (i.e., greatest concentrations of sites on the oldest flows).

Most sites appear to be prehistoric, with several dating to the historic period. Age determinations of volcanic glass samples indicate occupation of coastal sites between the early 1100s and mid-1800s. Given Soehren's early date from Site 3635, initial occupation as early as the fifth century, perhaps occupation of a few sites scattered along trails, cannot be ruled out.

Aside from the discovery of apparently unique feature types in the project area, the identification of numerous aligned pairs of cairns and walls, and of large abrader quarries and abrader manufacturing sites represent important additions to knowledge of the area. The aligned pairs are usually situated a moderate distance from the coast along trails or near quarried areas. Their associated C-shape or curved walls consistently are open to the southwest, with the cairn positioned c. 4 to 5 m to the southwest. The cairns generally have a central hole, a hole presumably designed to support a post, which in turn supported some sort of superstructure. Portable remains associated with aligned pairs in the project area were very rare.

Stone tool raw material quarries and tool preparation sites are concentrated on the Pohue Bay Flow pahoehoe lava. The quarry areas usually occur along surface faults or along other natural breaks in the pahoehoe lava. The breaks and faults have been greatly enlarged through removal of stone. Quarrying of stone was evidently carried out partly by implementing large waterworn cobbles or small boulders as picks or hammers. Quarrying activity apparently sought scoriaceous pahoehoe lava for making abrading implements. Some quarry sites are associated with abraded depressions used to shape stone into finished form. These abraded depressions are also found at some distance located in quarried areas near residential sites and along trails. Similar sites have been described from inland areas at Anaehoomalu by Donham (1987) and Rosendahl (1972).

Traditional sources of information refer to the use of upland trails by various chiefs for gaining and maintaining control over Kau. Site T-355 may be one such upland trail. Land Commission testimonies indicate that agricultural and residential sites were located far inland. These sources also refer to upland trails and a variety of exploited upland resources including birds for food and feathers, pulu, wood, and feral

goats. Early historical accounts indicate that coastal areas were uninhabited expect for occasional fishermen, and that the main area of settlement was inland, probably above the c. 1,500 ft elevation, where rainfall was sufficient for agriculture. These accounts also suggest that some of the more fertile occupied portions of inland Kahuku were covered by historic lava flows.

Suggested Future Research Questions

Future research in the area should be directed toward a variety of relevant research questions. These questions include, but are not necessarily limited to, the following:

1. When was the area first inhabited, and were these initial inhabitants local residents, or were they simply transiting through the area to places such South Point?

2. What is the nature of and intensity of site occupation, particularly in the larger coastal sites?

3. What is the period of use for the quarries and tool preparation areas, and what was the nature of this technology in terms of production and socio-political organization?; and

4. What is the range of variability, spatial patterning, and meaning of the numerous petroglyphs?

Future excavations should attempt to to verify Soehren's early date for Site 3635. Verification might come from further work at Site 3635 or from other sites with substantial cultural deposits. Determination of the nature of and intensity of occupation of any early sites should be emphasized in future excavations in an effort to determine if the earliest occupants were local residents.

Investigations designed to define the nature of and intensity of coastal habitation site occupation need to verify that coastal habitation sites were not permanently occupied, as is suggested here. If this can be verified, then further studies should seek to determine whether these sites were occupied on a recurrent, semipermanent or seasonal basis, or a short-term temporary basis.

Investigation of quarry and tool preparation sites needs to establish the temporal range of these sites. In addition, these investigations need to define the nature of the quarrying and preparation activity in terms of source selection and quarrying techniques, production sequence, and the associated socio-political organization and control of these activities. The potential for identifying trade patterns through petrographic "finger printing" of source material should also be assessed.

The large number of petroglyphs scattered throughout portions of the project area offer a valuable opportunity to study the range of types and their spatial distribution. Many petroglyphs are associated with either residential sites or trail routes. Definition of specific petroglyph forms and their distribution relative to particular site types may offer an opportunity to understand their symbolic meaning.

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

To facilitate outside review, general significance assessments and recommended general treatments for all identified sites are summarized in Table 5. Significance categories used in the site evaluation process are based on the National Register criteria for evaluation, outlined in the Code of Federal Regulations (36 CFR Part 60). The Hawaii State Historic Preservation Office uses these criteria for evaluating cultural resources. Sites determined to be potentially significant for information content (Category A, Table 5) fall under Criterion D, which defines significant resources as ones which "have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR Sec. 60.4). Sites potentially significant as representative examples of site types (Category B) are evaluated under Criterion C, which defines significant resources as those which "embody the distinctive characteristics of a type, period, or method of construction...or that represent a significant and distinguishable entity whose components may lack individual distinction" (36 CFR Sec. 60.4).

Sites with potential cultural significance (Category C) are evaluated under guidelines prepared by the Advisory Council on Historic Preservation (ACHP) entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (Draft Report, August 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth" (1985:1). The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value" (1985:7).

Seventy sites within the project area are assessed as being significant solely for their information content and needing further data collection. For most of these sites, intensive survey-level data collection (i.e., detailed recording, surface collection, and possibly test excavation) is probably sufficient. After further data collection is completed, the sites' physical preservation is not considered essential, although some sites might be considered for inclusion into landscaping.

Five sites are assessed as being significant for information content and as good examples of specific site types. Further intensive-level data collection is necessary at these sites, after which some level of interpretive development of selected features would be appropriate.

Because they contain or possibly contain human burials, Site T-361 and eight other sites (see Table 5) are assessed as being significant for their information content, and potentially for their cultural value. Further data collection is necessary to confirm the presence of skeletal remains at sites; or, in the case of T-361, further data collection is necessary to determine the number and distribution of remains. Human remains recovered could be preserved and protected in place, or, following archaeological disinterment and physical anthropological study, they could be relocated and reinterred elsewhere.

Thirty-eight sites are assessed as being significant for information content, as a site type example, and for their cultural value. Additional data collection is necessary at these sites; for most sites, because most of the more substantial cultural deposits unfortunately have been looted by artifact hunters, leaving little or no remaining excavates deposit, data recovery could be adequately accomplished by an intensive survey-level data collection effort. Following data recovery, some level of interpretive development of selected features or portions of sites would be appropriate.

Eighteen sites, mostly trail segments, are considered to be significant for their information content, and because they are considered to have cultural value. The reconnaissance survey data collection effort at these sites is considered sufficient, and no further work is necessary. It is recommended that these sites be preserved as is.

Sketch maps with measured or approximate dimensions, completed site forms, and photographs of the 148 sites discussed above, are in archives at the Hilo offices of PHRI. These records are available for review by qualified researchers.

One hundred and fifty-eight sites, sites generally consisting of single features or small clusters of features and usually lacking cultural deposits and portable remains, are assessed as being significant solely for their information content and needing no further data collection. These sites have been measured, mapped, described, photographed, and plotted; data collected from them during the reconnaissance survey is considered to be sufficient, and no further work is necessary. Their preservation is not essential; however, some sites could perhaps be incorporated into landscaping.

At the request of the Historic Sites Section of the Department of Land and Natural Resources, all PHRI temporary site numbers have been assigned permanent Hawaii Register of Historic Places (HRHP) site numbers. Appendix E lists the newly assigned HRHP numbers with their respective PHRI temporary numbers.

CULTURAL RESOURCE MANAGEMENT: PRELIMINARY CONSIDERATIONS

In order to facilitate future client management decisions regarding site treatments, sites are further evaluated terms of three value modes which are derived form the above State and Federal evaluation criteria. Research value refers to the potential of archaeological resources for producing information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization. Interpretive value refers to the potential of archaeological resources for public education and recreation. Cultural value refers to the potential of archaeological resources to preserve and promote cultural and ethnic identity and values. Significance assessments for each site, in terms of nature and degree of these three value modes, and specific data collection field work tasks are included in Appendix A.

Table 5.

SUMMARY OF GENERAL SIGNIFICANCE ASSESSMENTS
AND RECOMMENDED GENERAL TREATMENTS
HAWAIIAN RIVIERA RESORT DEVELOPMENT PROJECT AREA

Site or Feature No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
3639	+	–	–	–	+	–	–	–
3651	+	–	–	–	+	–	–	–
3652	+	–	–	–	+	–	–	–
3697	+	–	–	–	+	–	–	–
T-104	+	–	–	–	+	–	–	–
T-107	+	–	–	–	+	–	–	–
T-108	+	–	–	–	+	–	–	–
T-110	+	–	–	–	+	–	–	–
T-112	+	–	–	–	+	–	–	–
T-116	+	–	–	–	+	–	–	–
T-118	+	–	–	–	+	–	–	–
T-122	+	–	–	–	+	–	–	–
T-123	+	–	–	–	+	–	–	–
T-124	+	–	–	–	+	–	–	–
T-125	+	–	–	–	+	–	–	–
T-128	+	–	–	–	+	–	–	–
T-129	+	–	–	–	+	–	–	–
T-134	+	–	–	–	+	–	–	–
T-142	+	–	–	–	+	–	–	–

General Significance Categories:

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

Recommended General Treatments:

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

Table 5. (Cont.)

Site or Feature No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
T-149	+	–	–	–	+	–	–	–
T-150	+	–	–	–	+	–	–	–
T-152	+	–	–	–	+	–	–	–
T-156	+	–	–	–	+	–	–	–
T-157	+	–	–	–	+	–	–	–
T-159	+	–	–	–	+	–	–	–
T-160	+	–	–	–	+	–	–	–
T-162	+	–	–	–	+	–	–	–
T-174	+	–	–	–	+	–	–	–
T-184	+	–	–	–	+	–	–	–
T-187	+	–	–	–	+	–	–	–
T-189	+	–	–	–	+	–	–	–
T-190	+	–	–	–	+	–	–	–
T-192	+	–	–	–	+	–	–	–
T-201	+	–	–	–	+	–	–	–
T-202	+	–	–	–	+	–	–	–
T-226	+	–	–	–	+	–	–	–
T-231	+	–	–	–	+	–	–	–
T-235	+	–	–	–	+	–	–	–
T-238	+	–	–	–	+	–	–	–
T-240	+	–	–	–	+	–	–	–
T-241	+	–	–	–	+	–	–	–
T-245	+	–	–	–	+	–	–	–
T-248	+	–	–	–	+	–	–	–
T-250	+	–	–	–	+	–	–	–
T-254	+	–	–	–	+	–	–	–
T-276	+	–	–	–	+	–	–	–
T-265	+	–	–	–	+	–	–	–
T-277	+	–	–	–	+	–	–	–
T-279	+	–	–	–	+	–	–	–
T-284	+	–	–	–	+	–	–	–
T-288	+	–	–	–	+	–	–	–
T-291	+	–	–	–	+	–	–	–
T-293	+	–	–	–	+	–	–	–
T-294	+	–	–	–	+	–	–	–
T-295	+	–	–	–	+	–	–	–
T-296	+	–	–	–	+	–	–	–
T-299	+	–	–	–	+	–	–	–
T-300	+	–	–	–	+	–	–	–
T-315	+	–	–	–	+	–	–	–
T-321	+	–	–	–	+	–	–	–
T-322	+	–	–	–	+	–	–	–
T-347	+	–	–	–	+	–	–	–
T-349	+	–	–	–	+	–	–	–
T-352	+	–	–	–	+	–	–	–
T-354	+	–	–	–	+	–	–	–

Table 5. (Cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-357	+	–	–	–	+	–	–	–
T-359	+	–	–	–	+	–	–	–
T-363	+	–	–	–	+	–	–	–
T-364	+	–	–	–	+	–	–	–
T-379	+	–	–	–	+	–	–	–
Subtotal: 70	70	0	0	0	70	0	0	0
T-158	+	–	–	*	+	–	–	*
T-161	+	–	–	*	+	–	–	*
T-167	+	–	–	*	+	–	–	*
T-169	+	–	–	*	+	–	–	*
T-172	+	–	–	*	+	–	–	*
T-183	+	–	–	*	+	–	–	*
T-194	+	–	–	*	+	–	–	*
T-225	+	–	–	*	+	–	–	*
T-361	+	–	–	+	+	–	–	+
Subtotal: 9	9	0	0	9	9	0	0	9
3635	+	–	+	+	+	–	+	–
3636	+	–	+	+	+	–	+	–
3650	+	–	+	+	+	–	+	–
3698	+	–	+	+	+	–	+	–
3699	+	–	+	+	+	–	+	–
T-102	+	–	+	+	+	–	+	–
T-106	+	–	+	+	+	–	+	–
T-109	+	–	+	+	+	–	+	–
T-117	+	–	+	+	+	–	+	–
T-121	+	–	+	+	+	–	+	–
T-126	+	–	+	+	+	–	+	–
T-127	+	–	+	+	+	–	+	–
T-130	+	–	+	+	+	–	+	–
T-131	+	–	+	+	+	–	+	–
T-140	+	–	+	+	+	–	+	–
T-155	+	–	+	+	+	–	+	–
T-163	+	–	+	+	+	–	+	–
T-166	+	–	+	+	+	–	+	–
T-170	+	–	+	+	+	–	+	–
T-171	+	–	+	+	+	–	+	–

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

Table 5. (Cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-173	+	–	+	+	+	–	+	–
T-175	+	–	+	+	+	–	+	–
T-185	+	–	+	+	+	–	+	–
T-188	+	–	+	+	+	–	+	–
T-199	+	–	+	+	+	–	+	–
T-203	+	–	+	+	+	–	+	–
T-204	+	–	+	+	+	–	+	–
T-206	+	–	+	+	+	–	+	–
T-208	+	–	+	+	+	–	+	–
T-211	+	–	+	+	+	–	+	–
T-215	+	–	+	+	+	–	+	–
T-224	+	–	+	+	+	–	+	–
T-227	+	–	+	+	+	–	+	–
T-228	+	–	+	+	+	–	+	–
T-230	+	–	+	+	+	–	+	–
T-239	+	–	+	+	+	–	+	–
T-355	+	–	+	+	+	–	+	–
T-386	+	–	+	+	+	–	+	–
Subtotal: 38	38	0	38	38	38	0	38	0
3649	+	–	+	–	+	–	+	–
T-103	+	–	+	–	+	–	+	–
T-213	+	–	+	–	+	–	+	–
T-287	+	–	+	–	+	–	+	–
T-367	+	–	+	–	+	–	+	–
Subtotal: 05	05	0	05	0	05	0	05	0
3653	–	+	–	+	–	+	–	+
T-255	–	+	–	+	–	+	–	+
T-260	–	+	–	+	–	+	–	+
T-261	–	+	–	+	–	+	–	+
T-263	–	+	–	+	–	+	–	+
T-264	–	+	–	+	–	+	–	+
T-271	–	+	–	+	–	+	–	+
T-274	–	+	–	+	–	+	–	+
T-280	–	+	–	+	–	+	–	+
T-301	–	+	–	+	–	+	–	+
T-302	–	+	–	+	–	+	–	+
T-304	–	+	–	+	–	+	–	+
T-308	–	+	–	+	–	+	–	+
T-310	–	+	–	+	–	+	–	+
T-311	–	+	–	+	–	+	–	+

Table 5. (Cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-312	-	+	-	+	-	+	-	+
T-316	-	+	-	+	-	+	-	+
T-341	-	+	-	+	-	+	-	+
Subtotal: 18	-	18	-	18	-	18	-	18
T-101	-	+	-	-	-	+	-	-
T-105	-	+	-	-	-	+	-	-
T-111	-	+	-	-	-	+	-	-
T-113	-	+	-	-	-	+	-	-
T-114	-	+	-	-	-	+	-	-
T-115	-	+	-	-	-	+	-	-
T-119	-	+	-	-	-	+	-	-
T-120	-	+	-	-	-	+	-	-
T-132	-	+	-	-	-	+	-	-
T-133	-	+	-	-	-	+	-	-
T-135	-	+	-	-	-	+	-	-
T-136	-	+	-	-	-	+	-	-
T-137	-	+	-	-	-	+	-	-
T-138	-	+	-	-	-	+	-	-
T-139	-	+	-	-	-	+	-	-
T-141	-	+	-	-	-	+	-	-
T-143	-	+	-	-	-	+	-	-
T-144	-	+	-	-	-	+	-	-
T-145	-	+	-	-	-	+	-	-
T-146	-	+	-	-	-	+	-	-
T-147	-	+	-	-	-	+	-	-
T-148	-	+	-	-	-	+	-	-
T-151	-	+	-	-	-	+	-	-
T-153	-	+	-	-	-	+	-	-
T-154	-	+	-	-	-	+	-	-
T-164	-	+	-	-	-	+	-	-
T-165	-	+	-	-	-	+	-	-
T-168	-	+	-	-	-	+	-	-
T-176	-	+	-	-	-	+	-	-
T-177	-	+	-	-	-	+	-	-
T-178	-	+	-	-	-	+	-	-
T-179	-	+	-	-	-	+	-	-
T-180	-	+	-	-	-	+	-	-
T-181	-	+	-	-	-	+	-	-
T-182	-	+	-	-	-	+	-	-
T-186	-	+	-	-	-	+	-	-
T-191	-	+	-	-	-	+	-	-
T-193	-	+	-	-	-	+	-	-
T-195	-	+	-	-	-	+	-	-

Table 5. (Cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-196	-	+	-	-	-	+	-	-
T-197	-	+	-	-	-	+	-	-
T-198	-	+	-	-	-	+	-	-
T-200	-	+	-	-	-	+	-	-
T-205	-	+	-	-	-	+	-	-
T-207	-	+	-	-	-	+	-	-
T-209	-	+	-	-	-	+	-	-
T-210	-	+	-	-	-	+	-	-
T-212	-	+	-	-	-	+	-	-
T-214	-	+	-	-	-	+	-	-
T-216	-	+	-	-	-	+	-	-
T-217	-	+	-	-	-	+	-	-
T-218	-	+	-	-	-	+	-	-
T-219	-	+	-	-	-	+	-	-
T-220	-	+	-	-	-	+	-	-
T-221	-	+	-	-	-	+	-	-
T-222	-	+	-	-	-	+	-	-
T-223	-	+	-	-	-	+	-	-
T-229	-	+	-	-	-	+	-	-
T-232	-	+	-	-	-	+	-	-
T-233	-	+	-	-	-	+	-	-
T-234	-	+	-	-	-	+	-	-
T-236	-	+	-	-	-	+	-	-
T-237	-	+	-	-	-	+	-	-
T-242	-	+	-	-	-	+	-	-
T-243	-	+	-	-	-	+	-	-
T-244	-	+	-	-	-	+	-	-
T-246	-	+	-	-	-	+	-	-
T-247	-	+	-	-	-	+	-	-
T-249	-	+	-	-	-	+	-	-
T-251	-	+	-	-	-	+	-	-
T-252	-	+	-	-	-	+	-	-
T-253	-	+	-	-	-	+	-	-
T-256	-	+	-	-	-	+	-	-
T-257	-	+	-	-	-	+	-	-
T-258	-	+	-	-	-	+	-	-
T-259	-	+	-	-	-	+	-	-
T-262	-	+	-	-	-	+	-	-
T-266	-	+	-	-	-	+	-	-
T-267	-	+	-	-	-	+	-	-
T-268	-	+	-	-	-	+	-	-
T-269	-	+	-	-	-	+	-	-
T-270	-	+	-	-	-	+	-	-
T-272	-	+	-	-	-	+	-	-
T-273	-	+	-	-	-	+	-	-
T-275	-	+	-	-	-	+	-	-

Table 5. (Cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-278	–	+	–	–	–	+	–	–
T-281	–	+	–	–	–	+	–	–
T-282	–	+	–	–	–	+	–	–
T-283	–	+	–	–	–	+	–	–
T-285	–	+	–	–	–	+	–	–
T-286	–	+	–	–	–	+	–	–
T-289	–	+	–	–	–	+	–	–
T-290	–	+	–	–	–	+	–	–
T-292	–	+	–	–	–	+	–	–
T-297	–	+	–	–	–	+	–	–
T-298	–	+	–	–	–	+	–	–
T-303	–	+	–	–	–	+	–	–
T-305	–	+	–	–	–	+	–	–
T-306	–	+	–	–	–	+	–	–
T-307	–	+	–	–	–	+	–	–
T-309	–	+	–	–	–	+	–	–
T-313	–	+	–	–	–	+	–	–
T-314	–	+	–	–	–	+	–	–
T-317	–	+	–	–	–	+	–	–
T-318	–	+	–	–	–	+	–	–
T-319	–	+	–	–	–	+	–	–
T-320	–	+	–	–	–	+	–	–
T-323	–	+	–	–	–	+	–	–
T-324	–	+	–	–	–	+	–	–
T-325	–	+	–	–	–	+	–	–
T-326	–	+	–	–	–	+	–	–
T-327	–	+	–	–	–	+	–	–
T-328	–	+	–	–	–	+	–	–
T-329	–	+	–	–	–	+	–	–
T-330	–	+	–	–	–	+	–	–
T-331	–	+	–	–	–	+	–	–
T-332	–	+	–	–	–	+	–	–
T-333	–	+	–	–	–	+	–	–
T-334	–	+	–	–	–	+	–	–
T-335	–	+	–	–	–	+	–	–
T-336	–	+	–	–	–	+	–	–
T-337	–	+	–	–	–	+	–	–
T-338	–	+	–	–	–	+	–	–
T-339	–	+	–	–	–	+	–	–
T-340	–	+	–	–	–	+	–	–
T-342	–	+	–	–	–	+	–	–
T-343	–	+	–	–	–	+	–	–
T-344	–	+	–	–	–	+	–	–
T-345	–	+	–	–	–	+	–	–
T-346	–	+	–	–	–	+	–	–
T-348	–	+	–	–	–	+	–	–

Table 5. (Cont.)

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
T-350	–	+	–	–	–	+	–	–
T-351	–	+	–	–	–	+	–	–
T-353	–	+	–	–	–	+	–	–
T-356	–	+	–	–	–	+	–	–
T-358	–	+	–	–	–	+	–	–
T-360	–	+	–	–	–	+	–	–
T-362	–	+	–	–	–	+	–	–
T-365	–	+	–	–	–	+	–	–
T-366	–	+	–	–	–	+	–	–
T-368	–	+	–	–	–	+	–	–
T-369	–	+	–	–	–	+	–	–
T-370	–	+	–	–	–	+	–	–
T-371	–	+	–	–	–	+	–	–
T-372	–	+	–	–	–	+	–	–
T-373	–	+	–	–	–	+	–	–
T-374	–	+	–	–	–	+	–	–
T-375	–	+	–	–	–	+	–	–
T-376	–	+	–	–	–	+	–	–
T-377	–	+	–	–	–	+	–	–
T-378	–	+	–	–	–	+	–	–
T-380	–	+	–	–	–	+	–	–
T-381	–	+	–	–	–	+	–	–
T-382	–	+	–	–	–	+	–	–
T-383	–	+	–	–	–	+	–	–
T-384	–	+	–	–	–	+	–	–
T-385	–	+	–	–	–	+	–	–
T-387	–	+	–	–	–	+	–	–
Subtotal: 158	0	158	0	0	0	158	0	0
Total: 298	122	176	43	65	122	176	43	27

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APPENDIX A:

SUMMARY OF IDENTIFIED SITES AND FEATURES

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance* Evaluation R	I	C	Field Work# Tasks DR	SC	EX	Comments
3612-3616	-	See Site T-163; Features A, E, F, G, H								--
3617-3619	-	See Site T-172; Features A, B, D								--
3620-3627	-	See Site T-163; Features S, T, U, Y, Z, AA, BB, GG								--
3635	-	Complex (17+)**	Habitation	H	M/H	M/H	+	+	+	Approx. eight cairns; identified as Site H65 and excavated by Soehren (1966); identified by Hansen as BPBM No. B23-24
A		Tube w/mod.								
B-D		Tube								
E		Wall								
F		Sink w/tube								
G		Wall								
H-I		Curved wall								
3636	-	Tube	Habitation	M	M	M	+	+	+	Identified as Site H66 and excavated by Soehren (1966); identified by Hansen as BPBM No. B23-25

*Significance Evaluation--Nature: R = scientific research, I = interpretive, C = cultural
Degree: H = high, M = moderate, L = low

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

**Number of component features within complex

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
3637	-	See Site T-131								--
3638	-	Upright water-worn stone	Shrine	M	M/H	H	+	-	-	Not relocated; identified by Hansen as BPBM No. B23-28
3639	-	Complex (5)	Habitation	M	L	L/H	+	+	+	Identified by Green as BPBM No. B23-27
A		Cave								
B		Steppingstone trail								
C-E		C-shape wall								
3647	-	See Site T-140								--
3649	-	L-shape wall	Temp. hab.	M	M	L	+	+	+	First identified by Hansen; BPBM No. B23-42
3650	-	Trail	Transport.	M	H	H	+	-	-	Major coastal trail; identified by Hansen as BPBM No. B23-43
3651	-	Terrace	Indeterminate	M	L/M	L/M	+	-	+	BPBM No. B23-44
3652	-	Enclosure	Temp. hab.	M	L	L	+	+	+	BPBM No. B23-45
3653	-	Anchialine pond	Recreation	L	M	H	+	-	-	BPBM No. B23-46; Kanonone Pond
3654	-	See Site T-163; Feature I								BPBM No. B23-47/H59
3655	-	See Site T-170								BPBM No. B23-48
3656	-	See Site T-170								BPBM No. B23-49

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
3697	-	Complex (19)	Indeterminate/ temp. hab.	M	L	L	+	+	+	BPBM No. B23-57
A-J		Cairn								
K		Circular boulder alignment								
L-R		Cairn								
S		Midden deposit								
3698	-	Complex (3)	Habitation/ transport.	M	L/M	L/M	+	+	+	BPBM No. B23-58
A-B		Linear wall								
C		Trail								
3699	-	Complex (15)	Habitation/ transport.	M	L/H	L/H	+	-	+	BPBM No. B23-59
A-K		Cairn								
L		Trail								
M		Platform								
N-O		Wall								

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-101	Complex (2)	Temp. hab.	L	L	L	-	-	-	Posthole in cairn
	A	C-shape wall								
	B	Cairn								
-	T-102	Complex (3)	Transport./ Temp. hab.	M	M	M/H	+	-	-	Pieces of coral mark trail
	A	Trail								
	B	Curved wall								
	C	Oval enclosure								
-	T-103	Complex (8+)	Habitation	M	M	L	+	+	+	Other minor features present
	A	Double U-shape wall								
	B	U-shape wall								
	C	Curved wall								
	D	Rectangular and irreg. enclosures								
	E	U-shape wall								
	F	Walled outcrop								
	G	Curved wall and cairn								
	H	Curved wall								
-	T-104	Complex (4)	Temp. hab./ quarry	M/H	L	L/M	+	+	+	--
	A	Double C-shape wall								
	B	Tube								
	C-D	Cairn								
-	T-105	Complex (3)	Temp. hab./ quarry	L	L	L	-	-	-	--
	A	Curved wall								
	B	Cairn								
	C	Oval enclosure								

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-106	Complex (12+)	Habitation/ religious/ quarry	H	M/H	M/H	+	+	+	Two cairns and other minor features including excavated areas also present; poss. small shrine within Fea. A
	A	Enclosure								
	B	Walled overhang								
	C	Tube								
	D	Curved wall								
	E	Cairn								
	F	Sink w/tube								
	G	Curved wall								
	H	Sink w/tube								
	I-J	Curved wall								
	K	Walled tube								
	L	Curved wall								
-	T-107	Complex (2)	Temp. hab./ recreation	M/H	L/M	L/M	+	-	+	Papamu near Fea. A
	A	C-shape wall								
	B	Overhang								
-	T-108	Complex (2)	Temp. hab./ water source	L	L	L	-	+	-	--
	A	Three excavated anchialine ponds								
	B	Walled overhang								
-	T-109	Complex (6)	Habitation	H	M/H	M/H	+	+	+	Extensive disturbance of Feas. A and B deposits
	A	Walled overhang								
	B	Small cave								
	C	Paved ramp								
	D	Walled overhang								
	E-F	Anchialine pond enclosure								
-	T-110	Complex (4)	Temp. hab.	L/M	L	L	+	-	-	--
	A-B	L-shape wall								
	C	Cairn								
	D	Enclosure								

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-111	Complex (4)	Temp. hab.	L	L	L	-	-	-	Located in deep pahoehoe flow channel
	A-D	Walled overhang								
-	T-112	Tube	Temp. hab.	L/M	L	L	-	-	-	Gourd fragments and very sparse shell midden present
-	T-113	U-shape wall	Temp. hab./ quarry	L	L	L	-	-	-	--
-	T-114	Complex (3)	Temp. hab.	L	L	L	-	-	-	--
	A	Curved wall								
	B	Wall								
	C	Curved wall								
-	T-115	Complex (3)	Temp. hab./ quarry	L	L	L	-	-	-	Fea. B cairn is upwind (ENE) from wall
	A	Curved wall								
	B	Curved wall w/cairn								
	C	Cairn								
-	T-116	Complex (2)	Quarry/storage	M	L	L	+	-	-	Fea. B contains wooden poles
	A	Pahoehoe excavations								
	B	Tube (small)								
-	T-117	Complex (15+)	Religious/ temp. hab.	H	M	M/H	+	+	-	Thirteen cairns and other minor features; Fea. A is poss. shrine
	A	Terrace in rock-shelter w/coral								
	B	Enclosure								
-	T-118	Complex (16+)	Temp. hab./ quarry	M	M	M	+	+	-	Four cairns and excavated areas also present
	A	Double C-shape wall								

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-118 (cont.)									
	B	C-shape wall w/wing wall								
	C-D	Curved wall								
	E	Linear wall								
	F-H	C-shape wall								
	I-K	Curved wall								
	L	Excavated pond								
-	T-119	Excavated ponds (2)	Water source	L	L	L	-	-	-	--
-	T-120	Excavated pond	Water source	L	L	L	-	-	-	--
-	T-121	Complex (6)	Temp. hab.	M/H	M	M	+	+	+	Substantial construction using waterworn cobbles and boulders
	A	Platform								
	B	Steppingstone trail								
	C	L-shape wall								
	D	Leveled area								
	E	Walled depression								
	F	Enclosure								
-	T-122	U-shape wall	Temp. hab.	M	L	L	+	-	+	Recent modification
-	T-123	Complex (15)	Temp. hab.	M	L/M	L/M	+	+	-	--
	A-B	C-shape wall								
	C	Curved wall								
	D	C-shape wall								
	E-F	Curved wall								
	G	Overhang								
	H-I	Curved wall								
	J-O	Cairn								

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-124	Complex (5)	Temp. hab./ religious (?)	M/H	L	L/H	+	+	+	Fea. A poss. shrine
	A	Platform								
	B	Overhang								
	C	Wall								
	D	Cave								
-	T-125	Complex (15)	Temp. hab./ recreation	M	M	M	+	+	+	Papamu present
	A	Cave/wall								
	B	Cairn								
	C	Cave								
	D	Wall								
	E	Cave								
	F	Cairn								
	G-I	Wall and excavated depression								
	J	Wall and tube								
	K	Wall and excavated depression								
	L-M	Wall								
	N-O	Cairn								
-	T-126	Complex (25+)	Habitation/ religious/ quarry	H	M/H	M/H	+	+	+	Six cairns and other minor feas. including three collapsed walled shelters
	A	Enclosure on platform with walls and terrace/platform								
	B	Cairn								
	C	Compound enclosure								
	D	U-shape wall								
	E	Curved wall w/terrace								
	F	U-shape wall								
	G	Curved wall								
	H	U-shape wall								

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-126 (cont.)									
	I	Oval enclosure								
	J	Rectangular enclosure								
	K-L	Oval platform								
	M	Irregular platform								
	N	Mound								
	O	L-shape alignment								
	P	Curved wall								
	Q	Double C-shape wall								
-	T-127	Complex (28+)	Habitation	H	M/H	M/H	+	+	+	Three cairns, two walled shelters, and minor features also present
	A	Compound enclosure								
	B	U-shape wall								
	C	Double enclosure								
	D	Terrace/cupboard/ walled enclosure								
	E	Double enclosure								
	F	Cairn/walled overhang								
	G	Walled sink w/tubes								
	H	Wall								
	I	Walled outcrop								
	J	Platform								
	K	L-shape alignment								
	L	Curved wall								
	M	C-shape wall								
	N	Tube								
	O	C-shape wall								
	P	Double U-shape wall								
	Q	Pit and walled bliater								
	R	U-shape wall								
	S-T	Curved wall								

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-127 (cont.)									
	U	U-shape wall								
	V	Walled outcrop w/cave								
	W	Steppingstone trail								
-	T-128	Complex (5)	Temp. hab./ transport.	M	L	L	+	+	+	--
	A	Cave								
	B	Curved wall								
	C	Cairn								
	D	Trail								
	E	Cairn								
-	T-129	Complex (8+)	Temp. hab./ quarry/ recreation	M	L	L	+	+	-	Excavated depressions and papamu also present
	A-G	Curved wall								
	H	Walled depression								
-	T-130	Complex (16+)	Temp. hab.	M	M	M	+	+	+	Four cairns and minor features also present
	A-B	Curved wall								
	C	Double curved wall								
	D	Curved wall								
	E-F	Walled depression								
	G-H	Linear wall								
	I	Walled depression								
	J-K	Curved wall								
3637	T-131	Complex (7)	Temp. hab./ transport.	M/H	L/M	M/H	+	+	+	Fea. A identified by Green as BPBM No. B23-26
	A-B	Tube								
	C	Walled overhang								
	D	Overhang								
	E-F	Trail								
	G	Cairn								

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-132 A B C D-E F	Complex (6) Cairn Walled terrace C-shape wall Wall Trash pile (recent)	Temp. hab.	L	L	L	-	-	-	Poss. recent historic
-	T-133	Cairn	Marker	L	L	L	-	-	-	--
-	T-134 A B C D E-F	Complex (6) Cairn Double C-shape wall Curved wall Wall C-shape wall	Temp. hab.	M	L	L	+	+	-	--
-	T-135	Cairns (2)	Markers/ quarry	L	L	L	-	-	-	Excavated pahoehoe areas present
-	T-136 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-137	Cairn	Marker	L	L	L	-	-	-	--
-	T-138 A-B C	Complex (3) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-139 A B	Complex (2) Curved wall Cairn	Temp. hab.	L	L	L	-	-	-	--

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
3647	T-140 A B C-D E F	Complex (6) Trail, cairns, petroglyphs, abraded depressions Cairn, petroglyphs, abraded depressions Abraded depressions Trail, cairns, petroglyphs, abraded depressions Petroglyphs, abraded depressions	Transport./ rock art/stone tool manufacture	M	M/H	M/H	+	-	-	Includes State Site 3647 (BPBM No. B23-40); feature designations assigned to areas of site
-	T-141	Cairn	Marker	L	L	L	-	-	-	--
-	T-142	Cave	Temp. hab.	M	L	L	+	+	+	--
-	T-143 A-C	Complex (3) Cairn	Marker	L	L	L	-	-	-	--
-	T-144 A B C	Complex (3) Curved wall C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-145 A B C	Complex (3) C-shape wall Cairn Wall	Temp. hab.	L	L	L	-	-	-	--

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HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-146	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-147	Complex (2) A C-shape wall B Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-148	Cairn	Marker	L	L	L	-	-	-	--
-	T-149	Cave	Temp. hab./ quarry	M	L	L	+	+	+	--
-	T-150	Cave	Temp. hab	M	L	L	+	+	-	--
-	T-151	Complex (2) A C-shape wall B Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-152	Cave	Temp. hab.	M	L	L	+	+	-	--
-	T-153	Cairn	Transport./ marker	L	L	L	-	-	-	--
-	T-154	Cairn	Transport./ marker	L	L	L	-	-	-	--
-	T-155	Complex (3) A Petroglyphs, abraded depressions, excavations B Petroglyphs, abraded depressions C C-shape wall	Rock art/ stone tool preparation/ quarry/temp. hab.	M	M/H	M/H	+	-	-	--

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-156	Complex (2) A Modified overhang B Petroglyphs	Temp. hab./ rock art	L	L	M	+	-	-	--
-	T-157	Complex (2) A-B Cave	Temp. hab.	M	L	L	+	-	+	--
-	T-158	Cairn/cyst	Burial (?)	H	M/H	M/H	+	+	-	--
-	T-159	Complex (10) A-B Cairn C Walled depression D-H Cairn	Markers/ rock art	L/M	L/M	L/M	+	-	-	Approx. 200 m sq area of petroglyphs included within site area; two other cairns also present
-	T-160	Cave	Temp. hab.	M/H	L	L	+	+	+	--
-	T-161	Complex (6) A Cave and wall B Bedrock depression C Wall D-E Cairn F Platform	Temp. hab./ burial(?)	M/H	L	L/H	+	+	+	Fea. F is poss. burial
-	T-162	Complex (4) A-B C-shape wall C Platform D Cairn	Temp. hab.	M	L	L	+	-	+	--
3612-3616 and 3620-3627 and 3654	T-163	Complex (47) A Walled terrace area B Cave C C-shape wall D Wall	Habitation/ rock art	H	H	H	+	+	+	Pohue Bay Settlement Complex; BPBM Nos. B23-1, -2, -3, -4, -5, -9, -10, -11, -12, -13, -14, -15 -16, -17

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-163 (cont.)									
	E	Terrace								
	F	Walled terrace								
	G	Enclosure								
	H	Terrace								
	I	Tube								
	J	Cave								
	K	Mound								
	L	Terrace								
	M	C-shape and terrace								
	O	C-shape wall								
	P-Q	Terrace								
	R	C-shape wall								
	S	Enclosure								
	T	U-shape								
	U	U-shape wall								
	V-X	C-shape wall								
	Y	Enclosure								
	Z	Triple C-shape wall								
	AA	Triple U-shape and wall								
	BB	Enclosure								
	CC	Cave								
	DD-EE	C-shape wall								
	FF	Overhang								
	GG	Enclosure								
	HH	C-shape wall								
	II	Walled blister								
	JJ-KK	Tube								
	LL	Wall								
	MM	C-shape wall								
	NN	U-shape wall								
	OO-PP	C-shape wall								
	QQ	Walled blister								
	RR	Collapsed wall								
	SS-TT	Rubble mound								
	UU	Walled blister								

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-164	Complex (2)	Temp. hab.	L	L	L	-	-	-	--
	A	Cairn								
	B	Curved wall								
-	T-165	Circular wall	Temp. hab.	L	L	L	-	-	-	--
-	T-166	Complex (4)	Temp. hab./ marker/rock art/tool prep.	M/H	M	M	+	+	+	Petroglyphs and abraded depressions also present
	A	Cave								
	B	Wall								
	C	Walled depression								
	D	Cairn								
-	T-167	Complex (2)	Poss. burial	M	L	M/H	+	-	+	--
	A	Platform								
	B	Enclosure								
-	T-168	Complex (6)	Temp. hab./ quarry/ transport.	L	L	L	-	-	-	Pahoehoe excavations present in and around site
	A	Wall								
	B	Enclosure								
	C	Walled pahoehoe excavation								
	D	Steppingstone trail								
	E	Curved wall								
	F	C-shape wall								
-	T-169	Platform	Burial (?)	H	L/M	H	+	-	+	--
3655 - 3656	T-170	Complex (47)	Habitation/ rock art/ burial (?)/ transport.	H	M	M/H	+	+	+	Pohue Bay Settlement Complex; BPBM Nos. B23-48, -49; trail runs through site
	A-E	Wall								
	F	C-shape wall								
	G	Overhang								
	H	Enclosure								
	I-J	Wall								
	K-Q	Enclosure								

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-170 (cont.)									
	R	Enclosure and overhang								
	S-T	C-shape wall								
	U	Wall								
	V-W	C-shape wall								
	X	Wall								
	Y	Cave and wall								
	Z	C-shape wall								
	AA	Wall								
	BB-EE	C-shape wall								
	FF	Wall								
	GG	Platform								
	HH	Wall								
	II	C-shape wall								
	JJ	Walled depression and petroglyphs								
	KK	C-shape wall								
	LL	Depression								
	MM	Enclosure								
	NN	Large enclosure and overhang								
	OO-PP	Wall								
	QQ-SS	C-shape wall								
	TT	Enclosure								
	UU	Deleted								
	VV	Platform								
-	T-171	Complex (78)	Habitation/ rock art	M/H	M	M	+	+	+	Pohue Bay Settlement Complex; numerous petroglyphs
	A	Walled paved outcrop								
	B	C-shape wall								
	C	Linear wall								
	D-G	C-shape wall								
	H	Walled outcrop								

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-171 (cont.)									
	I	Cave								
	J	C-shape wall								
	K	Linear wall								
	L	Blister cave								
	M-R	C-shape wall								
	S	Linear wall								
	T	Cairn								
	U	C-shape wall								
	V-W	Cairn								
	X	Linear wall								
	Y	Cairn								
	Z	C-shape wall								
	AA-CC	C-shape wall								
	DD	Overhang								
	EE	C-shape wall								
	FF	Linear wall								
	GG-HH	C-shape wall								
	II	U-shape wall								
	JJ-LL	C-shape wall								
	MM-RR	Rock mound								
	SS	C-shape wall								
	TT	Double C-shape wall								
	UU-VV	C-shape wall								
	WW	Modified outcrop								
	XX-ZZ	C-shape wall								
	AAA	Enclosure								
	BBB	C-shape wall								
	CCC	8 Cairns								
	DDD-JJJ	C-shape wall								
	KKK	Boulder rubble mound								
	LLL-MMM	C-shape wall								
	OOO	Triple C-shape wall								
	PPP-QQQ	C-shape wall								

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HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-171 (cont.)									
	RRR	Linear wall								
	SSS	Walled blister								
	TTT-UUU	C-shape wall								
	VVV	Overhang								
	WWW-XXX	Cairn								
3617-3619	T-172	Complex (5)	Religious (shrine and/or burials ?)	M	M	H	+	+	+	Situated on top of aa knoll; high amounts of coral present
	A-D	Platform								
	E	Enclosure								
-	T-173	Complex (11)	Transport. temp. hab/ quarry	M	M/H	M/H	+	+	+	Site complex overlooks ocean; contains marine shell midden; associated with coastal trail
	A-B	Wall								
	C-D	Enclosure								
	E-G	Wall								
	H-K	Cairn								
		+2 trails								
-	T-174	Complex (5)	Temp. hab./ transport.	M	L	L	+	+	+	Overhang shelter contains marine shell midden, waterworn stones, and volcanic glass artifacts (six collected for dating)
	A	Walled overhang								
	B	Wall and level area								
	C	Overhang and paved area								
	D	Overhang and level area								
	E	Trail								
-	T-175	Complex (6)	Transport.	L	M/H	H	+	-	-	Poss. Interp. Dev.; Fea. A major coastal trail; Feas. B,C,D, and F adjacent to and associated with trail
	A	Trail								
	B	Wall								
	C-E	Cairn								
	F	Rectangular level area								

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HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-176	Complex (2)	Marker	L	L	L	-	-	-	Cairns situated c. 15.0 m inland of trail (T-175)
	A-B	Cairn								
-	T-177	Wall	Animal control	L	L	L	-	-	-	Prob. historic; wood fence posts and wire present
-	T-178	Complex (2)	Temp. hab.	L	L	L	-	-	-	Feas. A and B typical of C-shape/cairn alignment
	A	C-shape wall								
	B	Cairn								
-	T-179	Modified overhang	Temp. hab.	L	L	L	-	-	-	Flat slabs present under overhang
-	T-180	Modified overhang	Temp. hab.	L	L	L	-	-	-	Entrance partially blocked by flat slabs creating shelter
-	T-181	Complex (4)	Temp. hab.	L	L	L	-	-	-	--
	A	Curved wall								
	B-C	Cairn								
	D	C-shape wall								
-	T-182	C-shape wall	Temp. hab.	L	L	L	-	-	-	Assoc. with paved trail
-	T-183	Platform	Religious	M	L/M	M/H	+	-	+	Poss. shrine or burial
-	T-184	Walled overhang	Temp. hab.	M	L	L	+	+	+	Contains marine shell midden; volcanic glass artifact collected for dating

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-185 A B C	Complex (3) Trail Cairn Terrace/ramp section	Transport.	L	L	H	+	-	-	Poss. Interp. Dev. Comprises major coastal-inland trail at Kanonone Pond
-	T-186 A B-J	Complex (10) Walled overhang Cairn	Temp. hab./ markers	L	L	L	-	-	-	No portable remains visible; cairns situated in semi-circle pattern west of Fea. A
-	T-187 A B C D E	Complex (5) Cairn Collapsed cairn Cave C-shape wall Cairn	Temp. hab.	M	L	L	+	+	+	Feas. D and E typical of C-shape/cairn alignment; site complex situated along trail (T-185)
-	T-188 A B C D	Complex (4) Trail Ramp Wall Cairn	Transport.	L	L	M/H	-	-	-	Coastal inland trail connects Kanonone Pond with coastal trail (T-175)
-	T-189 A B-D	Complex (4) Walled overhang C-shape wall	Temp. hab./ quarry	M	L	L	+	+	+	Marine shell midden, coral, and waterworn basalt present; excavation potential
-	T-190 A-C D	Complex (4) Walled overhang Modified outcrop	Temp. hab.	M	L	L	+	+	-	All feas. contain marine shell midden; Fea. D overlooks coastal area and Kanonone Pond

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-191	Curved wall	Temp. hab.	L	L	L	-	-	-	Contains sparse marine shell midden
-	T-192 A-C D	Complex (4) Overhang Excavated overhang	Temp. hab.	M	L	L	+	+	+	Two volcanic glass artifacts collected from Fea. A for dating; dense marine shell midden present in Fea. A
-	T-193 A B C	Complex (3) Walled area C-shape wall Cairn	Temp. hab./ quarry	L	L	L	-	-	-	Feas. B and C typical of C-shape/cairn alignment; no portable remains visible; pahoehoe excavations nearby
-	T-194	Platform w/cairn	Poss. burial and marker	L/H	L/M	L/H	+	-	+	Poss. burial
-	T-195 A-B	Complex (2) Cairn	Markers	L	L	L	-	-	-	High amounts of coral cobbles situated downslope; possibly once functioned as a shrine
-	T-196 A B C D E F	Complex (6) Cairn L-shape wall Cairn Pahoehoe excavation C-shape wall Cairn	Temp. hab./ quarry	L	L	L	-	-	-	Fea. D contains waterworn basalt bouider; Feas. E and F typical of C-shape/ cairn alignment

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-197	C-shape wall	Temp. hab.	L	L	L	-	-	-	Coral cobbles poss. mark nearby coastal trail
-	T-198	Complex (4)	Temp. hab./ marker	L	L	L	-	-	-	Sparse amounts of marine shell midden present; overhang areas under large lava boulders; situated along trail
	A-C	Boulder overhang								
	D	Cairn								
-	T-199	Complex (15)	Habitation/ religious	M	M	H	+	+	+	Fea. C contains moderate amounts of marine shell midden and cultural deposit; Fea. D prob. a shrine; Feas. A-H overlook anchialine ponds; Feas. I-O near Site T-175 trail
	A	Walled overhang								
	B	Modified outcrop								
	C	Walled overhang								
	D	Waterworn cobble concentration								
	E	C-shape wall								
	F	Modified outcrop								
	G	Walled overhang								
	H-I	Modified boulder								
	J	Walled overhang								
	K-L	Overhang								
	M	Walled overhang								
	N	L-shape wall								
	O	Cairn								
-	T-200	C-shape wall	Temp. hab.	L	L	L	-	-	-	No portable remains visible
-	T-201	Complex (10)	Temp. hab.	M	L	L	+	+	-	Site complex overlooks anchialine ponds; sparse marine shell midden present
	A	C-shape wall								
	B-C	Walled boulder								
	D	L-shape wall								

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HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-201 (cont.)									
	E	Enclosure								
	F	Walled boulder								
	G	Cave								
	H	Trail								
	I-J	Cairn								
-	T-202	Complex (4)	Temp. hab./ transport.	M	L	L	+	+	-	Fea. C trail leads to Fea. D overhang shelter; Fea. D contains marine shell midden
	A-B	C-shape wall								
	C	Trail								
	D	Overhang								
-	T-203	Trail	Transport.	L	L	H	+	-	-	Inland-coastal oriented trail with segment branching toward Site T-202
-	T-204	Complex (17)	Habitation/ religious (?)/ quarry	M	M	M/H	+	+	+	Volcanic glass artifact collected from Fea. A for dating; site contains excavation potential; rock-lined firepit present in Fea. A; marine shell midden present; Echinoid spine abrader present in Fea. A (not collected); Fea. Q poss. shrine
	A	Blister cave								
	B	C-shape wall								
	C	Cairn								
	D	C-shape wall								
	E	Cave								
	F-G	Blister overhang								
	H	Double C-shape wall								
	I	Cave								
	J-K	C-shape wall								
	L-N	Cairn								
	O	Walled blister								
	P	Pahoehoe excavation								
	Q	Walled cairn (or walled platform)								
-	T-205	C-shape wall	Temp. hab. quarry	L	L	L	-	-	-	One Cellana sp. shell present

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HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-206 A B-C	Complex (3) Trail Wall	Transport.	L	H	H	+	-	-	Poss. Interp. Dev.
-	T-207 A B C	Complex (3) C-shape wall Cairn C-shape wall	Temp. hab.	L	L	L	-	-	-	Feas. A and B typical of C-shape/cairn alignment; Fea. B contains posthole
-	T-208	Trail	Transport.	L	L	H	+	-	-	Contains crude ramp feature
-	T-209	C-shape wall	Temp. hab./ quarry	L	L	L	-	-	-	Sparse amounts of Cellana spp. and Echinoidea present
-	T-210 A-B	Complex (2) C-shape wall	Temp. hab.	L	L	L	-	-	-	Fea. B contains two pieces Cellana spp. shell
-	T-211	Trail	Transport.	L	M	H	+	-	-	Poss. Interp. Dev.
-	T-212	C-shape wall	Temp. hab.	L	L	L	-	-	-	No portable remains
-	T-213 A B C D E	Complex (6) Oval wall Linear wall C-shape wall Linear wall C-shape wall	Temp. hab.	M	M	L	+	+	+	Fea. A contains perforated Cypraea sp. shell octopus lure and moderate amounts of marine shell midden; additional

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HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-213 (cont.) F	Cairn								small cairns and cupboard features present in area; Feas. E and F typical of C-shape/cairn alignment
-	T-214 A B C	Complex (3) C-shape wall Wall Curved wall	Temp. hab.	L	L	L	-	-	-	--
-	T-215 A B-C D-E F-H I J-K L	Complex (12) Small platform Wall Overhang Cavehang Double C-shape wall C-shape wall Trail	Habitation	M/H	L/M	L/H	+	+	+	Dense marine shell midden present near Feas. F, G, and H; exvacation potential; Fea. L probably extension of Site T-208 trail
-	T-216	Cairn	Marker	L	L	L	-	-	-	Cairn possibly marks coastal trail
-	T-217	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-218	Walled overhang	Temp. hab.	L	L	L	-	-	-	--
-	T-219 A B C-F	Complex (6) C-shape wall Cairn Walled overhang	Temp. hab./ quarry	L	L	L	+	+	-	--

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HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-220	Complex (3)	Temp. hab.	L	L	L	-	-	-	Scattered midden
	A	Modified outcrop								
	B	Wall								
	C	C-shape wall								
-	T-221	Complex (2)	Temp. hab.	L	L	L	-	-	-	--
	A	Enclosure								
	B	C-shape wall								
-	T-222	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-223	L-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-224	Complex (27)	Religious/ temp. hab.	H	L/M	L/H	+	+	+	Large linear settlement complex
	A	Walled terrace								
	B	Overhang								
	C	C-shape wall								
	D	Blister cave								
	E	C-shape wall								
	F	Cave								
	G	Walled overhang								
	H-L	Wall								
	M-O	C-shape wall								
	P	Double C-shape wall								
	Q-R	C-shape wall								
	S	L-shape wall								
	T-U	Curved wall								
	V-W	C-shape wall								
	X-Y	Enclosure								
	Z	Circular enclosure								
	AA	Parallel walls								

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-225	Complex (2)	Religious	M	L	L/H	+	-	+	Poss. burial or shrine
	A	Platform								
	B	Cairn w/upright								
-	T-226	Complex (7)	Temp. hab.	L	L	L	+	-	-	--
	A	Wall								
	B	Linear wall								
	C	Human figure rock alignment								
	D-E	Cairn								
	F	Walled overhang								
	G	C-shape wall								
-	T-227	Complex (9)	Indeterminate	L/H	L/H	L/H	+	-	+	Alignment is c. 24 x 65 m; very unusual site; poss. defines court
	A	U-shape alignment								
	B-I	Cairn								
-	T-228	Petroglyphs	Rock art	M	L	M	+	-	-	10-15 total; most are very faint
-	T-229	Cairn	Marker (?)	L	L	L	-	-	-	--
-	T-230	Complex (3)	Transport.	L	M	M/H	-	-	-	--
	A	Trail								
	B-C	Cairn								
-	T-231	Complex (3)	Temp. hab./ quarry	L	L	L	+	-	-	--
	A	C-shape wall								
	B-C	Cairn								
-	T-232	Wall	Temp. hab.	L	L	L	-	-	-	--

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-233	Complex (4)	Temp. hab./ quarry	L	L	L	-	-	-	Waterworn boulder hammerstone
	A	C-shape wall								
	B	Walled overhang								
	C	Cairn								
	D	Pahoehoe excavation								
-	T-234	Linear wall	Temp. hab.	L	L	L	-	-	-	--
-	T-235	Complex (2)	Temp. hab.	M	L	L	+	+	+	--
	A	Midden concentration								
	B	Overhang								
-	T-236	Cairn	Indeterminate	L	L	L	-	-	-	Contains an upright waterworn boulder; possibly recent
-	T-237	Wall	Poss. temp. habitation	L	L	L	-	-	-	--
-	T-238	Complex (8)	Temp. hab.	M	L	L	+	+	+	--
	A	Cairn								
	B	C-shape wall								
	C	Wall								
	D	Cave								
	E	Wall								
	F	Blister cave								
	G	Cairn								
	H	C-shape wall								
-	T-239	Complex (8)	Habitation	M/H	M/H	M/H	+	+	+	Fea. E is a unique type
	A	C-shape wall								
	B	L-shape boulder alignment								

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
	T-239 (cont.)									
	C	Wall								
	D	C-shape wall								
	E	Walled ramp								
	F	Double C-shape wall								
	G	C-shape wall								
	H	L-shape wall								
-	T-240	Complex (6)	Temp. hab./ quarry	M	L	L	+	-	-	Pahoehoe excavations present
	A	Wall								
	B	Cairn								
	C-D	C-shape wall								
	E	Cairn								
	F	Double C-shape wall								
-	T-241	Complex (8)	Temp. hab./ quarry	M	L	L	+	-	-	Pahoehoe excavations present
	A	Walled blister								
	B-C	C-shape wall								
	D-E	Cairn								
	F-H	C-shape wall								
-	T-242	Complex (4)	Temp. hab./ quarry	L	L	L	-	-	-	Pahoehoe excavations present
	A-B	C-shape wall								
	C-D	Wall								
-	T-243	Walled fault	Temp. hab.	L	L	L	-	-	-	--
-	T-244	Complex (2)	Temp. hab.	L	L	L	-	-	-	--
	A	Walled blister								
	B	Walled blister								
-	T-245	U-shape wall	Habitation	M	L	L	+	-	+	One overhang also present
-	T-246	Walled overhang	Temp. hab.	L	L	L	-	-	-	--

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-247	Wall	Temp. hab./ quarry	L	L	L	+	-	-	Pahoehoe excavation present
-	T-248	Walled blister	Temp. hab.	M	L	L	-	-	-	Sparse shell midden
-	T-249	C-shape wall	Temp. hab.	L	L	L	-	-	-	
-	T-250	Complex (12)	Habitation	M	L	L	+	+	+	Largest site at northwestern end of project area
	A	C-shape wall								
	B	Tube								
	C	C-shape wall								
	D	Walled cave								
	E	Walled blister								
	F	Cairn								
	G	C-shape wall								
	H	C-shape wall and cairn								
	I	C-shape wall								
	J	Wall								
	K	C-shape wall								
-	T-251	Complex (2)	Temp. hab.	L	L	L	-	-	-	--
	A	C-shape wall								
	B	Cairn								
-	T-252	Walled outcrop	Temp. hab.	L	L	L	-	-	-	--
-	T-253	Curved wall	Temp. hab.	L	L	L	-	-	-	--
-	T-254	Complex (5)	Temp. hab.	M/H	L	L	+	+	+	Pahoehoe excavations present
	A	Tube with modifications								
	B-D	Curved wall								
	E	Paved terrace								

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-255	Trail	Transport.	L	L	L/H	-	-	-	--
-	T-256	Curved wall	Temp. hab.	L	L	L	-	-	-	--
-	T-257	Curved wall	Temp. hab.	L	L	L	-	-	-	--
-	T-258	Curved wall	Temp. hab.	L	L	L	-	-	-	--
-	T-259	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-260	Trail with cairn	Transport./ marker	L	L	L/H	-	-	-	Coastal-inland trail
-	T-261	Trail	Transport.	L	L	L/H	-	-	-	--
-	T-262	Complex (2)	Temp. hab.	L	L	L	-	-	-	--
	A	Cave								
	B	Wall and level area								
-	T-263	Trail	Transport.	L	L	L/H	-	-	-	--
-	T-264	Trail	Transport.	L	L	L/H	-	-	-	--
-	T-265	Complex (4)	Temp. hab./ quarry/ rock art	M	L	L	+	-	-	Pahoehoe excavations present
	A	Sink with walled tubes								
	B-C	Cairn								
	D	Petroglyphs								
-	T-266	Complex (2)	Temp. hab.	L	L	L	-	-	-	--
	A	Curved wall								
	B	Cairn								
-	T-267	Circular wall	Indeterminate/ quarry	L	L	L	-	-	-	--

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-268 A B	Complex (2) Curved wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-269	Wall	Temp. hab.	L	L	L	-	-	-	--
-	T-270 A B	Complex (2) Walled overhang Cave	Temp. hab.	L	L	L	-	-	-	--
-	T-271	Trail	Transport.	L	L	L/H	-	-	-	Coral markers
-	T-272	Rubble mound	Indeterminate	L	L	L	-	-	-	--
-	T-273	Wall	Temp. hab.	L	L	L	-	-	-	--
-	T-274	Trail	Transport.	L	L	L/H	-	-	-	Marker cairns
-	T-275 A B	Complex (2) Curved wall Linear wall	Temp. hab.	L	L	L	-	-	-	--
-	T-276	Cave	Temp. hab.	M	L	L	+	-	+	--
-	T-277 A B C-D E	Complex (5) Cave Curved wall Cairn Petroglyph	Temp. hab./ rock art	M	L/M	L/M	+	+	+	Five shell midden taxa
-	T-278 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-279	Tube	Temp. hab./ storage/ religious (?)	M	L	L/M	+	+	-	Poss. shrine; described in Kirch (1985:161)
-	T-280	Trail	Transport.	L	L	L/H	-	-	-	Cairn marks trail
-	T-281 A B C	Complex (3) C-shape wall Cairn Curved wall	Temp. hab./ quarry	L	L	L	-	-	-	Central hole in cairn
-	T-282	Pahoehoe excavation	Quarry	L	L	L	-	-	-	Large waterworn hammerstone present
-	T-283	Curved wall	Temp. hab.	L	L	L	-	-	-	No portable remains
-	T-284 A B C	Complex (3) Curved wall Cairn Petroglyphs	Temp. hab./ rock art	M	L/M	L/M	+	-	-	Cairn on windward side of wall
-	T-285 A B C	Complex (3) C-shape wall Modified overhang Walled overhang	Temp. hab.	L	L	L	-	-	-	Two pieces shell in Fea. A
-	T-286 A B	Complex (2) Curved wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-287 A B	Complex (2) Linear wall Petroglyphs	Temp. hab./ rock art	M	L/M	L	+	-	-	--

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-288	Complex (14)	Temp. hab.	M	L	L	-	-	-	--
	A-F	C-shape wall								
	G	Terrace								
	H-N	C-shape wall								
-	T-289	Complex (2)	Temp. hab.	L	L	L	-	-	-	--
	A-B	C-shape wall								
-	T-290	Complex (2)	Temp. hab.	L	L	L	-	-	-	--
	A	Enclosure								
	B	C-shape wall								
-	T-291	Complex (20)	Temp. hab.	M	L	L	+	-	-	Near T-280 trail
	A	Curved wall								
	B	C-shape wall								
	C	Overhang								
	D-T	C-shape wall								
-	T-292	Complex (4)	Temp. hab.	L	L	L	-	-	-	--
	A	C-shape wall								
	B	Overhang								
	C	Linear wall								
	D	Cairn								
-	T-293	Complex (13)	Temp. hab.	M	L	L	+	-	-	Near T-280 trail
	A-C	Level area								
	D	Terrace								
	E-F	Level area								
	G	C-shape wall								
	H	Overhang								
	I	Level area								
	J	Overhang								
	K-L	Wall								
	M	C-shape wall								

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-294	Complex (16)	Temp. hab./ quarry	M	L	L	+	+	-	Pahoehoe excavations present
	A-B	C-shape wall								
	C	Pahoehoe excavation								
	D-F	C-shape wall								
	G	Overhang								
	H	Linear wall and level area								
	I-J	C-shape wall								
	K	Depression								
	L-M	C-shape wall								
	N	Overhang								
	O	Walled depression								
	P	Overhang								
-	T-295	Cave	Temp. hab.	M	L	L	+	+	+	--
-	T-296	Cave	Temp. hab.	M	L	L	+	+	+	--
-	T-297	Complex (3)	Temp. hab.	L	L	L	-	-	-	--
	A	C-shape wall								
	B-C	Cairn								
-	T-298	Complex (3)	Temp. hab.	L	L	L	-	-	-	--
	A	C-shape wall								
	B	Cairn								
	C	C-shape wall								
-	T-299	Complex (3)	Temp. hab/ rock art	M	L	L/H	+	-	-	--
	A	C-shape wall								
	B	Cairn								
	C	Petroglyphs								

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-300 A-B C D-E F	Complex (3) C-shape wall Double C-shape walled depression Cave Cairn	Temp.hab.	M	L	L	+	-	-	--
-	T-301	Trail	Transport.	L	L	H	-	-	-	Coastal-inland
-	T-302	Trail	Transport.	L	L	L/H	-	-	-	Coastal-inland
-	T-303 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-304	Trail	Transport.	L	M	H	-	-	-	--
-	T-305	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-306 A B	Complex (2) C-shape wall Cairn	Temp. hab./ quarry	L	L	L	-	-	-	Pahoehoe excavations present
-	T-307	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-308	Trail	Transport.	L	L	L/H	-	-	-	Coastal-inland
-	T-309	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-310	Cairn	Marker	L	L	L/H	-	-	-	Probably marks T-185 trail
-	T-311	Cairn	Trail marker	L	L	L/H	-	-	-	Cairn marks T-185 trail

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-312 A B-C	Complex (3) Walled overhang Cairn	Temp. hab.	L	L	L/H	-	-	-	Feas. B and C mark trail (T-185); Fea. A contains four water-worn boulders
-	T-313	C-shape wall	Temp. hab.	L	L	L	-	-	-	One piece coral present
-	T-314 A B C	Complex (3) C-shape wall Cairn C-shape wall	Temp. hab.	L	L	L	-	-	-	Feas. A and B typical of C-shape/cairn alignment; Fea. B contains hole
-	T-315 A B C	Complex (3) Cave shelter Curved wall C-shape wall	Temp. hab./ quarry	M	L	L				Fea. A contains marine shell midden and waterworn stone; pahoehoe excavations present
-	T-316	Trail	Transport.	L	L	L	-	-	-	Cairns (T-317) also present
-	T-317 A-E F	Complex (6) Cairn Curved wall	Markers/ Temp. hab./ quarry	L	L	L	-	-	-	No portable remains visible; pahoehoe excavations also present
-	T-318 A B-C D	Complex (4) C-shape wall Cairn C-shape wall	Temp. hab.	L	L	L	-	-	-	No portable remains
-	T-319 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	No portable remains

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-320 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	Central hole in cairn
-	T-321 A B C	Complex (3) Cave/tube Terrace Level areas	Habitation	M	L	L	+	+	+	Connects to T-322
-	T-322 A-C	Complex (3) Cave	Temp. hab.	M/H	M	M	+	+	+	Connects to T-321
-	T-323	Cairn	Marker	L	L	L	-	-	-	--
-	T-324	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-325	Cave/Tube	Indeterminate	L	L	L	-	-	-	--
-	T-326	Cave/Tube	Temp. hab.	L	L	L	-	-	-	Cave contains short wall section
-	T-327	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-328 A B	Complex (2) Curved wall Walled overhang	Temp. hab./ quarry	L	L	L	-	-	-	--
-	T-329 A B	Complex (2) Curved wall Cairn	Temp. hab./ quarry	L	L	L	-	-	-	--
-	T-330	C-shape wall	Temp. hab.	L	L	L	-	-	-	C-shape open on west

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-331 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	Feas. A and B typical of C-shape/cairn alignment; Fea. B contains hole
-	T-332 A B	Complex (2) C-shape wall Cairn	Temp.hab.	L	L	L	-	-	-	Feas. A and B typical of C-shape/cairn alignment; Fea. B contains hole
-	T-333	C-shape wall	Temp. hab.	L	L	L	-	-	-	C-shape open on west
-	T-334	Linear wall	Temp. hab.	L	L	L	-	-	-	No portable remains present
-	T-335 A B-D	Complex (4) Curved wall Cairn	Temp. hab.	L	L	L	-	-	-	Feas. A and B typical of C-shape/cairn alignment; situated near trail (T-175)
-	T-336 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	Feas. A and B typical of C-shape/cairn alignment
-	T-337	Cairn	Marker	L	L	L	-	-	-	Poss. trail marker
-	T-338	Cave	Temp. hab./ quarry	L	L	L	-	-	-	Rock pile "step" for entry; sparse midden and one waterworn
-	T-339 A B	Complex (2) C-shape wall Cairn	Temp. hab./ quarry	L	L	L	-	-	-	Central hole in cairn

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-340 A B C D	Complex (4) Double curved wall Cairn Wall overhang Cairn	Temp. hab.	L	L	L	-	-	-	One piece waterworn coral present; lies along trail
-	T-341	Trail	Transport./ quarry	L	L	L/H	-	-	-	Pahoehoe excavations along trail
-	T-342 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	Central hole in cairn
-	T-343 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	Central hole in cairn
-	T-344 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-345	Cairn	Marker	L	L	L	-	-	-	--
-	T-346	Wall	Temp. hab.	L	L	L	-	-	-	--
-	T-347	Cave	Indeterminate	L/H	L/H	L/H	+	-	-	--
-	T-348	Curved wall	Temp. hab.	L	L	L	-	-	-	--
-	T-349	Cave	Temp. hab./ rock art	M	L	L	+	+	+	2-3 petroglyphs
-	T-350 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--

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Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-351 A B C D-E F G	Complex (7) C-shape wall Cave Cairn C-shape wall Cairn Linear wall	Temp. hab.	L	L	L	-	-	-	--
-	T-352 A-B C-D E F G	Complex (7) Enclosure C-shape wall Enclosure Curved wall Walled pahoehoe excavation	Temp. hab.	L/M	L	L	+	-	-	No deposit
-	T-353 A B	Complex (2) Enclosure C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-354 A-B C D E F G H I	Complex (9) C-shape wall Platform Walled outcrop Level area Boulder facing Walled overhang Walled terrace Level area	Temp. hab.	L	L	L	+	+	+	--
-	T-355	Trail	Transport.	L	M	H	+	-	-	Main trail
-	T-356	Cairn	Marker	L	L	L	-	-	-	--
-	T-357	Blister tube	Indeterminate	L/H	L/H	L/H	+	-	-	Pending further investigations

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-358 A-B	Complex (2) Cairn	Marker (surveyor station)	L	L	L	-	-	-	--
-	T-359	Road	Transport.	L/M	L	M	+	-	-	--
-	T-360	Wall	Indeterminate	L	L	L	-	-	-	--
-	T-361	Cave	Burial/hab.	H	L/M	H	+	-	-	--
-	T-362	Double C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-363 A-B	Complex (2) Cave	Temp. hab.	M	L	L	+	-	-	Poss. excavation
-	T-364	Abraded depressions	Tool prep.	M/H	L	L	+	-	-	--
-	T-365 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-366 A B	Complex (2) Curved wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-367 A B	Complex (2) Large rubble depression Abraded basin	Quarry	M	L/M	L	+	-	-	--
-	T-368 A B	Complex (2) L-shaped wall Cave	Temp. hab.	L	L	L	-	-	-	--

Appendix A. (Cont.)

HRHP Site/Fea. Number	PHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R	I	C	Field Work Tasks DR	SC	EX	Comments
-	T-369	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-370 A B	Complex (2) Curved wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-371	Cairn	Marker	L	L	L	-	-	-	--
-	T-372 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-373 A B C	Complex (3) C-shape wall Cairn Trail	Temp. hab.	L	L	L	-	-	-	--
-	T-374 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-375	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-376	Curved wall	Temp. hab.	L	L	L	-	-	-	--
-	T-377	C-shape wall	Temp. hab.	L	L	L	-	-	-	--
-	T-378 A B	Complex (2) C-shape wall Cairn	Temp. hab.	L	L	L	-	-	-	--
-	T-379	Cave	Habitation	M	L	L	+	-	-	--

Appendix A. (Cont.)

NRHP Site/Fea. Number	FHRI Temp. Site/Fea. Number	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R I C	Field Work Tasks DR SC EX	Comments
-	T-380	Wall	Temp. hab.	L L L	- - -	--
-	T-381	Cave	Temp. hab.	L L L	- - -	--
-	T-382	Complex (2) A C-shape wall B Cairn	Temp. hab.	L L L	- - -	--
-	T-383	Cairn	Marker	L L L	- - -	--
-	T-384	Cairn	Marker	L L L	- - -	--
-	T-385	Complex (2) A Curved wall B Cairn	Temp. hab.	L L L	- - -	--
-	T-386	Complex (5+) A Trail B U-shape wall C U-shape alignment D Alignment E Petroglyphs	Transport.	M L/M M/H	+ - -	Two cairns and numerous depressions also present
-	T-387	Cairn	Marker (?)	L L L/H	- - -	Poss. trail marker

APPENDIX B:

SITE DESCRIPTIONS

SITE NO: State: 3635 BFBM: B23-24 FHRI: --- (17+ Features)
SITE TYPE: Complex
TOPOGRAPHY: Large depressed area in a pahoehoe lava flow channel
VEGETATION: Sparse grass
CONDITION: Fair to good
INTEGRITY: Altered--previous controlled excavations
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Site was initially identified by V. Hansen as BFBM Site H65. Site was subsequently evaluated by Green and in 1965 was excavated by Soehren. Soehren recovered two charcoal samples which produced age ranges in the fourth and fourteenth centuries. Component features include five tubes, two walls, two curved walls, at least eight cairns, and numerous pahoehoe excavations. The largest tube, Feature A, has a paved terrace adjacent to a partially-walled entrance. Features A, B, and C have intact deposits.

SITE NO: State: 3636 BFBM: B23-25 FHRI: --- (1 Feature)
SITE TYPE: Lava tube
TOPOGRAPHY: Aa and pahoehoe on the east of a littoral cone at edge of an escarpment overlooking the coast
VEGETATION: Sparse grass, bushes growing in several shelters.
CONDITION: Fair to good
INTEGRITY: Altered--previous controlled excavation
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Site was initially identified by V. Hansen and was designated Site H-66. Green evaluated the site, which was later excavated in 1965 by Soehren. Site is a small lava tube situated at the northwest end of Site T-130.

SITE NO: State: 3637 BFBM: B23-26 FHRI: T-131 (7 Features)
SITE TYPE: Complex
TOPOGRAPHY: Aa lava flow
VEGETATION: Indian Pluchea
CONDITION: Good
INTEGRITY: Altered--uncontrolled excavations
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/transport
DESCRIPTION: Feature A first identified and recorded by Green as BFBM Site B23-26. Feature A also previously designated State No. 3637. Site Complex consists of two tubes, a walled overhang, an overhang, two trail sections, and a cairn. Dense marine shell midden present. Volcanic glass

collected from Features A and B. Features A and B appear partially disturbed by vandals.

SITE NO: State: 3639 BPBM: B23-27 PHRI: --
SITE TYPE: Complex (5 Features)
TOPOGRAPHY: Aa and pahoehoe lava flows
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Altered--unauthorized excavation
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Recorded by Green as BPBM Site B23-27. Site complex consists of a cave, steppingstone trail, and three C-shapes. Feature A cave contains marine shell midden, kukui, artifacts, and a 5-10 cm cultural deposit. Deposit partially disturbed by vandals. Volcanic glass collected for dating. Scattered waterworn pebbles present within Features C and D. Feature E contains oval cupboard. Branch of trail (Site T-302) leads to site from the northwest.

SITE NO: State: 3649 BPBM: B23-42 PHRI: --
SITE TYPE: L-shape wall (1 Feature)
TOPOGRAPHY: On Aa lava flow overlooking small bay at Kanonone Pond
VEGETATION: Indian Pluchea
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Wall construction of stacked angular and subangular aa and waterworn boulders and cobbles. Wall faced on interior side, but sloping on exterior. Marine shell midden (five taxa), volcanic glass, cultural deposit, and historic glass present.

SITE NO: State: 3650 BPBM: B23-43 PHRI: --
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Generally unaltered, portions disturbed
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site is one of two main coastal trails. Trail construction is of waterworn steppingstone boulders. Trail is situated between Pohue Bay and Kanonone Pond. Isolated coral cobbles mark trail. Crude wall noted along trail near northwest end.

SITE NO: State: 3651 BPBM: B23-44 PHRI: --
SITE TYPE: Terrace (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric (?)/historic
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: First identified and recorded by V. Hansen as BPBM Site B23-44. She interpreted the site as a "goathide drying rack." Terrace slopes to west. Interior surface consists of waterworn boulder and cobble fill. High amounts of coral present.

SITE NO: State: 3652 BPBM: B23-45 PHRI: --
SITE TYPE: Enclosure (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: Indian Pluchea
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: First identified and recorded by V. Hansen as BPBM Site B23-45. Hansen interpreted the site to be an animal pen. Three taxa marine shell midden present. Enclosure open to southwest.

SITE NO: State: 3653 BPBM: B23-46 PHRI: --
SITE TYPE: Anchialine pond (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: Wide variety
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Wall in pond possibly historic
FUNCTIONAL INTERPRETATION: Pond
DESCRIPTION: Site identified as Kanonone Pond. Small wall recently constructed in pond. On aerial photo (1970) several walls noted in pond. Pond is approximately 30.0 m in diameter.

SITE NO: State: 3697 BPBM: B23-57 PHRI: --
SITE TYPE: Complex (19 Features)
TOPOGRAPHY: On southeast edge of aa lava flow overlooking Kipuka Kanohina
VEGETATION: None
CONDITION: Fair
INTEGRITY: Altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate/temporary habitation

DESCRIPTION: First identified by V. Hansen. Site complex consists of 17 cairns, a circular rock alignment, and an eroding midden deposit. All cairns generally constructed of angular aa boulders and cobbles. Broken fragment of octopus lure present on Feature I. Waterworn boulder on top of Features J and Q. Interior surface of circular boulder alignment consists of aa pebble/cobble fill. Eroding midden includes cultural deposit and is truncated by jeep road. Midden deposit includes five taxa marine shell.

SITE NO: State: 3698 BPBM: B23-58 PHRI: --
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Aa lava flow overlooking pahoehoe to the east and the ocean to the south
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY:
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/transportation
DESCRIPTION: First identified and recorded by V. Hansen. Site complex consists of two walls and a trail section. Walls comprise a house site. Marine shell midden includes four taxa. Artifacts, coral, and shallow soil deposit present. Interior floor consists of waterworn pebbles and cobbles. Trail constructed with waterworn steppingstones.

SITE NO: State: 3699 BPBM: B23-59 PHRI: --
SITE TYPE: Complex (5 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation/habitation
DESCRIPTION: First identified by V. Hansen. Site complex consists of eleven cairns, five enclosure walls, two linear walls, a platform, and a steppingstone trail section. Scattered marine shell midden present. No artifacts visible on surface.

SITE NO: State: -- BPBM: -- PHRI: T-101
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe surrounded by aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation

DESCRIPTION: Site complex consists of typical C-shape/cairn alignment. The cairn is situated downwind (WSW) 4.00 m from the center of Feature A. Cairn contains hole (c. 0.20 m dia.). Several pieces coral present.

FEATURE A: C-shape wall
DIMENSIONS: 2.40 m by 0.50 m by 0.50 m

Wall made of medium-sized slabs of aa. Wall is roughly stacked and is not faced. The wall is open to the SW. Associated with the wall are a few pieces of coral. Feature B, a cairn, is located 4.00 m to the WSW.

FEATURE B: Cairn
DIMENSIONS: 1.50 m by 1.50 m by 0.75 m

A well-stacked cairn built from large aa cobbles. A 0.20 by 0.20 m central hole is present in the cairn.

SITE NO: State: -- BPBM: -- PHRI: T-102
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation/temporary habitation
DESCRIPTION: Site consists of trail, curved wall, and oval enclosure. Trail is a portion of the main coastal trail and is marked with coral and shell. Wall and enclosure is situated along trail. Very sparse midden present within curved wall. Oval enclosure contains no portable remains.

SITE NO: State: -- BPBM: -- PHRI: T-103
SITE TYPE: Complex (8 Features)
TOPOGRAPHY: Broken pahoehoe lava flow bordered by aa flow to south and small littoral cone remnant to east.
VEGETATION: Grass and scattered bush
CONDITION: Fair
INTEGRITY: Partially altered--two bulldozed roads
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Site complex consists of a double U-shape wall, two U-shape walls, two curved walls, rectangular and irregular enclosures, a walled outcrop, and a curved wall and cairn. Seven marine shell taxa present.

SITE NO: State: -- BPBM: -- PHRI: T-104
SITE TYPE: Complex (4 Features)

TOPOGRAPHY: Pahoehoe lava flow at edge of littoral cone remnant. Feature D is situated on an aa lava flow c. 70 m eastward.
VEGETATION: Grass and Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a double C-shape wall, a tube, and two cairns. Five marine shell midden taxa present in sparse to dense amounts. One volcanic glass flake collected for dating. Tube contains ashy cultural deposit. Pahoehoe excavations in vicinity.

SITE NO: State: -- BPBM: -- PHRI: T-105
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow bordered by aa flow to the north and east.
VEGETATION: Scattered grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of cairn, oval enclosure, and curved wall. Cairn is situated downwind (WSW) 5.40 m from center of Feature A. Numerous pahoehoe excavations in vicinity. No portable remains or deposit.

FEATURE A: Curved wall
DIMENSIONS: 2.90 m by 2.10 m by 1.00 m

Contains basal interior course of small angular pahoehoe boulders. Wall measures c. 1.30 m thick at base and tapers to c. 0.30 m at top. Wall consists of roughly stacked slabs and cobbles; several upright slabs are located in the "wings." Feature overlooks ocean and is situated c. 75-100 m from seaward edge of beach.

FEATURE B: Cairn
DIMENSIONS: 1.80 m by 1.30 m by 0.80 m

Cairn comprised of stacked small to large cobbles and includes several waterworn rocks. Cairn contains a centrally located hole. Hole is probably a posthole for a superstructure associated with Feature A wall. The sides of the cairn are not formally faced, but they appear rounded or sloping in profile.

FEATURE C: Oval enclosure
DIMENSIONS: 5.50 m by 3.50 m by 1.00 m

Interior area measures 3.00 by 1.20 m. Comprised of 1.00-1.25 m thick pahoehoe slab walls stacked around a small excavated lava blister. The sides are not faced, but appear rounded or sloping in profile.

Interior floor of feature is covered with collapse. Enclosure is located c. 120 degrees Az and c. 44.00 m from Features A and B.

SITE NO: State: -- BPBM: -- PHRI: T-106
SITE TYPE: Complex (12 Features)
TOPOGRAPHY: Aa and pahoehoe lava flows
VEGETATION: Sparse grass and scattered Indian Pluchea
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/religious/quarry
DESCRIPTION: A small probable shrine is present in Feature A. At least two cairns and numerous pahoehoe excavations are present at site. Also present: enclosure, walled overhang, tube, five curved walls, a cairn, two sinks with tubes, and a walled tube. Ash and marine shell midden present within several features.

SITE NO: State: -- BPBM: -- PHRI: T-107
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow at top of escarpment overlooking coast
VEGETATION: Grass and Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/recreation
DESCRIPTION: Twenty volcanic glass flakes collected for potential age determination. Site consists of a C-shaped wall and overhang. Ashy brown soil and dense marine shell midden (five taxa) present. C-shape wall contains hole (0.40 m dia.). Papamu noted west of C-shape wall.

SITE NO: State: -- BPBM: -- PHRI: T-108
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: Sparse grass and Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/water source
DESCRIPTION: Site consists of several excavated anchialine ponds and a walled overhang. Sparse marine shell midden (two taxa) present. Brackish water present within walled overhang.

SITE NO: State: -- BPBM: -- PHRI: T-109
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe lava cliff and bench above deep pahoehoe flow channel which leads to small beach.

VEGETATION: None
CONDITION: Fair
INTEGRITY: Altered--historic use and uncontrolled excavation
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Site complex consists of two walled overhangs, overhang, ramp, and two anchialine pond enclosures. Moderate amounts of marine shell midden present. Also present: cultural deposit and a bone fishhook point (collected). Site probably partially altered by historic use, but has excavation potential.

SITE NO: State: -- BPBM: -- PHRI: T-110
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Boulder and cobble beach
VEGETATION: None
CONDITION: Good
INTEGRITY: Altered--recent historic debris and firepit
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site complex consists of an L-shaped wall, cairn, and an enclosure. Coral and very sparse marine shell (one taxon) present.

SITE NO: State: -- BPBM: -- PHRI: T-111
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Features are situated along base of cliffs on both sides of a deep and narrow pahoehoe lava flow channel.
VEGETATION: Sparse grass and scattered Indian Pluchea
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site complex consists of four walled overhangs. No cultural deposit present. Feature D contains sparse marine shell (one taxa) and waterworn rock.

FEATURE A: Walled overhang
DIMENSIONS: See below

Wall measures c. 2.80-3.50 m long by 0.80-1.00 m wide and 0.70 m high. Comprised of roughly stacked cobble- to boulder-sized pahoehoe slabs and blocks. Wall creates windbreak for overhang area. Overhang measures c. 3.80 m long by 1.40 m high with a ceiling 1.30 m high. Situated on west side of lava flow channel c. 9.00 m from Feature B.

FEATURE B: Walled overhang
DIMENSIONS: See below

Wall measures c. 1.70-2.50 m long by 0.70-0.80 m wide and 0.70 m high. It is comprised of roughly stacked cobble- to boulder-sized

pahoehoe slabs and blocks, and it is faced on a portion of the interior with pahoehoe slabs placed on edge. Wall creates windbreak for overhang area. The overhang measures c. 3.50 m long by 0.70-0.80 m wide with a ceiling 2.00+ m high. Feature B is situated on east side of the lava flow channel.

FEATURE C: Walled overhang
DIMENSIONS: See below

Wall measures c. 2.00-2.50 m long by 1.00-1.20 m wide and is 0.50 m high. It is comprised of roughly stacked cobble- to boulder-sized pahoehoe slabs and blocks. The wall contains no faced sides; it creates a windbreak for an overhang area. The overhang measures c. 5.50-6.0 m long by 0.80-1.00 m wide with a ceiling 1.40 m high. Feature C is built on a natural lava bench/shelf c. 2.50 m above the lava channel floor and is c. 14.00 m north of Feature B.

FEATURE D: Walled overhang
DIMENSIONS: See below

Wall measures c. 5.00-5.20 m long by 0.50-0.80 m wide and 0.70 m high. It is comprised of roughly stacked small boulder- to cobble-sized pahoehoe slabs. The wall is mostly collapsed and does not contain faced sides. The wall creates a windbreak for the overhang area. The overhang measures c. 5.80-6.00 m long by 0.50-1.30 m wide with a ceiling 1.20 m high. A large waterworn "basher" is situated c. 5.00 m south. Feature D is located c. 35.00 m north of Feature C.

SITE NO: State: -- BPBM: -- PHRI: T-112
SITE TYPE: Lava tube (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Sparse marine shell midden (four taxa), gourd fragments, and waterworn cobbles present. No internal or external structural modifications.

SITE NO: State: -- BPBM: -- PHRI: T-113
SITE TYPE: U-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow on side of deep flow channel
VEGETATION: Very sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Extensive pahoehoe excavations in vicinity on both sides of deep channel. Several waterworn boulder hammerstones noted. No portable remains or cultural deposit present.

FEATURE: U-shape wall
DIMENSIONS: 3.20 m by 2.60 m (approx.)

The wall measures c. 0.30-0.40 m wide by 0.40-0.60 m high and is comprised of stacked pahoehoe slabs and small pahoehoe blocks. Portions of interior faced with upright slabs, several of which have collapsed inward. U-shape open to southwest. Wall functions as temporary windbreak shelter.

SITE NO: State: -- BPBM: -- PHRI: T-114
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site complex consists of two curved walls and a wall. One waterworn cobble present in Feature B. No cultural deposit or shell midden present.

FEATURE A: Curved wall
DIMENSIONS: 2.20 m by 0.40 m by 0.50 m

This wall is constructed of pahoehoe slabs the size of medium to large cobbles. The wall is well-stacked, not faced, and has some slumping evident in its center portion. This feature is open to the west.

FEATURE B: Wall
DIMENSIONS: 2.80 m by 1.40 m by 0.60 m

The wall, c. 0.80 m wide at its base, is comprised of crudely stacked cobble-sized pahoehoe blocks and slabs and is oriented roughly north-south. This feature probably functioned as a temporary windbreak shelter.

FEATURE C: Curved wall
DIMENSIONS: 1.80 m by 0.55 m by 0.60 m

The east end of the wall abuts pahoehoe bedrock, and the west end curves slightly to the south. The wall is comprised of medium to large cobbles and small boulders. The stones are roughly stacked, with some slumping in the interior.

SITE NO: State: -- BPBM: -- PHRI: T-115
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow; Feature B is situated in a flow channel to west
VEGETATION: None
CONDITION: Fair

INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of two curved walls and a cairn. Cairn situated 1.40 m northeast (upwind) of Feature B. No cultural deposit or marine shell midden present. Pahoehoe excavations present throughout area.

FEATURE A: Curved wall
DIMENSIONS: 3.20 m by 1.80 m by 1.00 m

Wall is comprised of rough-stacked pahoehoe chunks and slabs, cobble- to small boulder-sized.

FEATURE B: Curved wall
DIMENSIONS: 2.70 m by 0.50 m by 0.50 m

Wall is comprised of roughly stacked medium to large cobbles and is quite collapsed. The wall runs NW-SE. NE 1.40 m from the wall is a cairn comprised of roughly stacked cobbles. This cairn is also quite collapsed.

SITE NO: State: -- BPBM: -- PHRI: T-116
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Quarry/storage
DESCRIPTION: Site consists of pahoehoe excavations and a small tube. Waterworn boulder present in excavations. No cultural deposit present. Three sticks (one bamboo) and one shell present in Feature B. Excavations represent probable quarrying activity; possible abrader blanks noted.

FEATURE A: Pahoehoe excavations
DIMENSIONS: 100.00 m (approx.)

Numerous cracks and depressions excavated within 100.0+ m diameter area.

FEATURE B: Tube (small)
DIMENSIONS: See below

This short tube opens onto a quarried area. The tube opening is 0.90 m wide and 0.50 m high. The associated wall is comprised of roughly stacked cobbles. Three sticks (one bamboo) and one piece of shell were found at this feature.

SITE NO: State: -- BPBM: -- PHRI: T-117
SITE TYPE: Complex (15 Features)
TOPOGRAPHY: Base of littoral cone remnant
VEGETATION: Grass and Indian Pluchea
CONDITION: Fair to good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious (?)/temporary habitation
DESCRIPTION: Site consists of a terrace with coral and enclosure under overhang. Thirteen cairns (no feature designations) also present. Feature A terrace contains an at least 0.25-0.30 m cultural deposit. Organic fiber (possible bedding material) visible in deposit. Marine shell midden (four taxa) and Crustacea and coral present. Site is possibly a shrine.

SITE NO: State: -- BPBM: -- PHRI: T-118
SITE TYPE: Complex (16 Features)
TOPOGRAPHY: Pahoehoe lava flow overlooking coast
VEGETATION: Sparse grass and Indian Pluchea
CONDITION: Fair
INTEGRITY: Several features probably historically modified
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Small fisherman's shack, privy, and recent historic debris present. Site consists of double C-shape wall, four C-shape walls, five curved walls, a linear wall, four cairns, and an excavated pond. Sparse midden and no cultural deposit present.

SITE NO: State: -- BPBM: -- PHRI: T-119
SITE TYPE: Excavated ponds (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Water source
DESCRIPTION: Site complex consists of two excavated anchialine ponds. No shell midden and cultural deposit present. Ledge of waterworn stones present adjacent to ponds.

FEATURE: Excavated ponds (2)
DIMENSIONS: 5.00 m by 3.00 m

Both ponds are excavated into pahoehoe. The larger of the two ponds has a number of waterworn stones around its edges. Near the south edge of the larger pond is a short, low terrace made of flat waterworn stones. The smaller pond measures 2.00 by 1.50 m. Coral is scattered about both ponds.

SITE NO: State: -- BPBM: -- PHRI: T-120
SITE TYPE: Excavated pond (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered (?); recent historic debris present
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Water source
DESCRIPTION: No shell midden or cultural deposit present. Few coral fragments present. Pond appears artificially excavated.

FEATURE: Excavated pond
DIMENSIONS: 2.50 m by 1.50 m

Pond was excavated through pahoehoe. There is no structure present associated with the pond. A few pieces of coral are present. Considerable recent historic debris litters the area.

SITE NO: State: -- BPBM: -- PHRI: T-121
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Boulder and cobble beach
VEGETATION: Indian Pluchea growing in enclosure
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of platform with paved area, steppingstone trail section, L-shape wall, leveled area, walled depression, and enclosure. Sparse shell midden present.

SITE NO: State: -- BPBM: -- PHRI: T-122
SITE TYPE: U-shape wall (1 Feature)
TOPOGRAPHY: Boulder and cobble beach
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Altered--historic modification; roof and firepit
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Dense coral and sparse marine shell midden (two taxa) present. Recently modified with iron roof and wooden beams. Structure open to southwest.

SITE NO: State: -- BPBM: -- PHRI: T-123
SITE TYPE: Complex (15 Features)
TOPOGRAPHY: Aa and pahoehoe lava flows
VEGETATION: Scattered grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation

DESCRIPTION: Site consists of three C-shape walls, five curved walls, an overhang, and six cairns. Marine shell midden concentration, coral, and waterworn stones present.

SITE NO: State: -- BPBM: -- PHRI: T-124
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava flow, flow channel bisects site
VEGETATION: Scattered Indian Pluchea and grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/religious
DESCRIPTION: Site complex consists of platform, overhang, wall, and cave. Marine shell midden concentrations and volcanic glass (seven pieces collected) present. Feature A is possible shrine.

SITE NO: State: -- BPBM: -- PHRI: T-125
SITE TYPE: Complex (15 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass and scattered Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/recreation
DESCRIPTION: Site complex consists of cave with wall, four cairns, two caves, three walls, four walls with excavated depressions, and a wall and tube. Marine shell midden present. One volcanic glass flake collected from Feature A. Papamu noted between Features H and K.

SITE NO: State: -- BPBM: -- PHRI: T-126
SITE TYPE: Complex (25 Features)
TOPOGRAPHY: Edge of aa and pahoehoe lava flows; sand beach borders site
VEGETATION: Grass and Indian Pluchea
CONDITION: Fair to good
INTEGRITY: Altered--structural modifications and uncontrolled excavation
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/religious/quarry
DESCRIPTION: Site complex consists of an enclosure on platform with walls, seven cairns, a compound enclosure, three U-shape walls, three curved walls, an oval enclosure, a rectangular enclosure, two oval platforms, an irregular platform, a mound, an L-shape alignment, a double C-shape wall, and various leveled, walled, and excavated areas. One volcanic glass flake collected from Feature E. Feature A contains upright waterworn boulder (probably a shrine), slab-lined firepit, and portions are paved. Marine shell midden present

SITE NO: State: -- BPBM: -- PHRI: T-127
SITE TYPE: Complex (28 Features)
TOPOGRAPHY: Aa lava flow with small areas of pahoehoe lava; site is bordered by sand beach to southeast
VEGETATION: Sparse grass and Indian Pluchea
CONDITION: Fair to good
INTEGRITY: Unaltered to altered--uncontrolled excavations
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Site consists of compound enclosure, three U-shape walls, two double enclosures, a terrace/cupboard/walled enclosure, cairn/walled overhang, sink with tube, wall, two walled outcrops, platform, L-shaped alignment, three curved walls, two C-shape walls, tube, double U-shape wall, walled blister, and a steppingstone trail segment. In addition to main features: three cairns, two walled shelters, and other minor ones (leveled areas, etc.) present. Volcanic glass collected. Midden present in several features.

SITE NO: State: -- BPBM: -- PHRI: T-128
SITE TYPE: Complex (5 Features)
TOPOGRAPHY: Aa and pahoehoe lava flows
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Possibly altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/transportation
DESCRIPTION: Site complex consists of cave, curved wall, two cairns, one trail. Marine shell midden concentration and 0.03-0.04 m of cultural deposit present in Feature A. Trail segment leads to Site T-129.

SITE NO: State: -- BPBM: -- PHRI: T-129
SITE TYPE: Complex (8+ Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass, Indian Pluchea
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry/recreation
DESCRIPTION: Site complex consists of seven curved walls and a walled depression. Sparse marine shell midden and large waterworn cobbles present. No cultural deposit present. Excavated areas and papamu are also present.

SITE NO: State: -- BPBM: -- PHRI: T-130
SITE TYPE: Complex (16+ Features)
TOPOGRAPHY: Pahoehoe and aa lava flow interface at top of escarpment overlooking ocean. Large littoral cone borders site to the west.

VEGETATION: Sparse grass, Indian Pluchea
CONDITION: Fair-good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site is adjacent to Site 3636. Site complex consists of five curved walls, a double curved wall, three walled depressions, and two linear walls. Four cairns, other minor features, and pahoehoe excavations present. Site also includes small platform or cairn on top of cone to west. Thin ashy deposit and marine shell midden present.

SITE NO: State: -- BPBM: -- PHRI: T-132
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Cobble and boulder beach
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Altered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site complex consists of cairn, walled terrace, C-shape wall, two walls, and a recent trash pile. Concrete block utilized as part of Feature B. No cultural deposit present. Bulldozer track present through site.

FEATURE A: Cairn
DIMENSIONS: 1.20 m by 1.00 m (approx.)

Comprised of roughly stacked medium to large cobbles and small boulders. Sides are not formally faced, but appear rounded or sloping in profile.

FEATURE B: Walled terrace
DIMENSIONS: 2.60 m by 1.00 m (approx.)

Comprised of roughly stacked medium to large cobbles and small boulders. On the interior side of wall is a low small coral-filled terrace. Also incorporated into the wall is a concrete block. Recent historic debris is present. Feature B is c. 3.00 m southwest of Feature A.

FEATURE C: C-shape wall
DIMENSIONS: 1.60 m by 1.20 m (approx.)

Comprised of roughly stacked medium to large cobbles and small boulders. Recent historic debris (glass, metal) is present. Feature C, open to the south, is c. 2.00-3.00 m northwest of Feature A.

FEATURE D: Wall
DIMENSIONS: 3.00 m by 0.50 m (approx.)

Comprised of roughly stacked medium to large cobbles and small boulders. Wall is quite collapsed. Recent historic debris (tin, glass) present. Feature D is situated along a bulldozer track c. 6.00 m southeast of Feature A.

FEATURE E: Wall
DIMENSIONS: 1.00 m by 0.50 m by (approx.)

Comprised of roughly stacked medium to large cobbles and small boulders. Wall is quite collapsed. Feature E is situated c. 1.00 m east of Feature D.

FEATURE F: Trash pile (recent)
DIMENSIONS: 2.50 m by 1.50 m (approx.)

Recent historic debris, including tin, glass, and plastic. Feature F is situated c. 7.00 m west of Feature A.

SITE NO: State: -- BPBM: -- PHRI: T-133
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Cairn probably marks trail. No other portable remains present.

FEATURE: Cairn
DIMENSIONS: 0.65 m by 0.60 m by 0.65 m

Cairn of stacked medium to large cobbles with a large piece of coral on the top; cairn built atop a large boulder.

SITE NO: State: -- BPBM: -- PHRI: T-134
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe lava flow at coast
VEGETATION: Sparse brush and grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site complex consists of a cairn, a double C-shape wall, a curved wall, a wall, and two C-shape walls. Marine shell midden deposit concentrated around Feature B.

SITE NO: State: -- BPBM: -- PHRI: T-135
SITE TYPE: Cairn (2 Features)
TOPOGRAPHY: Pahoehoe lava flow overlooking ocean
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric (?)
FUNCTIONAL INTERPRETATION: Marker/quarry
DESCRIPTION: Site consists of two cairns. Pahoehoe excavations present in vicinity. One small branch coral located nearby. No cultural deposit present.

FEATURE: Cairns (2)
DIMENSIONS: 0.40 m by 0.40 m by 0.60 m (approx.)

Both cairns are of similar size and are constructed of approximately six to eight cobble-sized pahoehoe blocks stacked on bedrock. The cairns do not appear formally faced. Second cairn is situated c. 30.0 m and 105 degrees Az from first.

SITE NO: State: -- BPBM: -- PHRI: T-136
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow channel
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of C-shape and cairn. Site typical of C-shape/cairn alignment. Cairn located 4.00 m from C-shape. Cairn contains hole in center (0.20 m dia. by 0.60 m deep). No portable remains or cultural deposit present.

FEATURE A: C-shape wall
DIMENSIONS: 1.30 m by 0.70 m by 0.60 m

The wall is c. 0.90 m wide and is comprised of piled pahoehoe slabs and boulders. The wall is not faced; it appears generally collapsed, and it is rounded or sloping in profile. Feature A is open west.

FEATURE B: Cairn
DIMENSIONS: 1.30 m by 1.10 m by 0.60 m

Cairn is roughly oval and is comprised of crudely stacked pahoehoe slabs and boulders. Cairn is centrally raised, but the sides are not formally faced. Feature B is situated c. 250 degrees Az from Feature A. Possible trail along lava channel, but trail is not visible on pahoehoe bedrock.

SITE NO: State: -- BPBM: -- PHRI: T-137
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow with smooth and rough/broken areas
VEGETATION: Sparse grass; scrub 'ilima
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Cairn possibly marks trail on pahoehoe. No portable remains or cultural deposit present.

FEATURE: Cairn
DIMENSIONS: 0.80 m by 0.60 m by 0.75 m

Comprised of stacked pahoehoe slabs and rough broken boulders. The cairn is centrally raised, but its sides are not formally faced.

SITE NO: State: -- BPBM: -- PHRI: T-138
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Historic (?)
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two C-shape walls and a cairn. Very sparse marine shell midden and historic rubbish present. Beer bottle located under Feature B wall. Jeep road leads to site.

FEATURE A: C-shape wall
DIMENSIONS: 4.00 m by 1.20 m

Wall measures c. 0.50-0.60 m wide by 0.70-1.20 m high and is comprised of stacked blocky pahoehoe boulders and cobbles. The wall is crudely faced on the interior and exterior. C-shape is built around the edge of a low collapsed blister which measures c. 2.90 by 2.00 m. Feature A is open west.

FEATURE B: C-shape wall
DIMENSIONS: 2.60 m by 0.50 m

Wall measures c. 0.60-1.20 m wide by 0.40-0.80 m high and is comprised of crudely stacked/piled blocky basalt boulders. It is very crudely faced on the interior and appears sloping or rounded (collapsed) on the exterior. C-shape is open east. Feature B is c. 32.00 m and 5 degrees Az from Feature A.

FEATURE C: Cairn
DIMENSIONS: 0.90 m by 0.70 m by 0.70 m

Comprised of piled blocky basalt boulders and contains a branch coral cobble on top. The cairn is centrally raised but does not have formally faced sides. Feature C is c. 13.00 m and 95 degrees Az from Feature A.

SITE NO: State: -- BPBM: -- PHRI: T-139
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow next to ocean cliffs
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of curved wall and cairn. Site typical of C-shape/cairn alignment. Cairn contains central hole (0.20 by 0.15 m). No portable remains or cultural deposit present.

FEATURE A: Curved wall
DIMENSIONS: 2.90 m by 0.55 m by 0.60 m

Wall runs roughly N-S, curves slightly to west, and is open to west It is comprised of roughly stacked small to large cobbles.

Feature B lies 4.00 m west of Feature A.

FEATURE B: Cairn
DIMENSIONS: 1.30 m by 1.00 m by 0.65 m

Cairn is comprised of stacked large cobbles. A central hole is present and measures 0.20 by 0.15 m

SITE NO: State: 3647 BPBM: B23-40 PHRI: T-140
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric-historic
FUNCTIONAL INTERPRETATION: Transportation/rock art/tool preparation
DESCRIPTION: Portions of this site include State Site 3647. Site consists of a linear series of petroglyph and abraded depression concentrations situated along the main coastal trail route. Human figures and western letters/writing included among various petroglyph forms.

SITE NO: State: -- BPBM: -- PHRI: T-141
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Cairn possibly marks trail on pahoehoe. No portable remains or cultural deposit present.

FEATURE: Cairn
DIMENSIONS: 0.50 m by 0.37 m by 0.60 m

Cairn comprised of stacked medium-sized cobbles. No slumping or collapse is present.

SITE NO: State: -- BPBM: -- PHRI: T-142
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow; large littoral cone is situated c. 12.00 m west.
VEGETATION: Grass, Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Moderate marine shell and 0.02-0.03 m cultural deposit present. One volcanic glass flake collected. Cave entrance open to west.

SITE NO: State: -- BPBM: -- PHRI: T-143
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Site consists of three cairns. Cairns possibly mark trail on pahoehoe. No portable remains or cultural deposit present.

FEATURE A: Cairn
DIMENSIONS: 0.56 m by 0.56 m by 0.56 m

Comprised of roughly stacked medium-sized cobbles. No sign of slumping or collapse.

FEATURE B: Cairn
DIMENSIONS: 0.64 m by 0.54 m by 0.65 m

Comprised of roughly stacked medium-sized cobbles. No sign of slumping or collapse.

FEATURE C: Cairn
DIMENSIONS: 0.48 m by 0.40 m by 0.47 m

Constructed of roughly stacked medium-sized cobbles. No sign of slumping or collapse.

SITE NO: State: -- BPBM: -- PHRI: T-144
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow at north edge of large littoral cone
VEGETATION: Grass, Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a curved wall, a C-shape wall, and a cairn. Sparse marine shell midden (two taxa) present in Feature B. No cultural deposit present. Features B and C typical of C-shape/cairn alignment.

FEATURE A: Curved wall
DIMENSIONS: 2.10 m by 0.50 m by 0.70 m

Wall runs approximately N-S, with a slight curve to the west. Constructed of small to large cobbles and small boulders. Wall is roughly stacked with some collapse at the north end.

FEATURE B: C-shape wall
DIMENSIONS: 2.25 m by 2.00 m by 0.80 m

Wall built of large cobbles and small boulders. Wall is roughly stacked with some collapse at its SE end. Wall is open to SW. Feature C, a cairn, is 5.00 m SW of the wall.

Associated with Feature B is a small amount of scattered shell midden.

FEATURE C: Cairn
DIMENSIONS: 1.20 m by 1.10 m by 0.60 m

Cairn is comprised of stacked large cobbles and small boulders. Some collapse has occurred on the west side and no central hole is evident.

SITE NO: State: -- BPBM: -- PHRI: T-145
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe and aa lava flow interface

VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a C-shape wall, a cairn, and a wall. Features A and B typical of C-shape/cairn alignment. Feature B situated c. 3.00 m southwest of Feature A. Cairn contains central hole (0.20 by 0.20 m). No portable remains or cultural deposit present.

FEATURE A: C-shape wall
DIMENSIONS: 1.70 m by 1.60 m by 0.95 m

Structure built partially into bedrock and constructed with large cobbles and small boulders. Some collapsed portions along the wall. Wall is open to the west.

FEATURE B: Cairn
DIMENSIONS: 1.20 m by 1.10 m by 0.40 m

Cairn is constructed of medium to large cobbles. It is collapsed on its north side. A central hole measures 20 by 20 cm.

FEATURE C: Wall
DIMENSIONS: 1.65 m by 0.65 m by 0.65 m

Wall runs approximately N-S. It is comprised of roughly stacked medium to large cobbles. The wall is collapsed along its southern half.

SITE NO: State: -- BPBM: -- PHRI: T-146
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: End of a pahoehoe lava channel between an aa lava flow and a littoral cone
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposit present. C-shape open to southwest.

FEATURE: C-shape wall
DIMENSIONS: 2.05 m by 1.50 m by 0.60 m

Wall is comprised of medium to large cobbles and small boulders. The structure is generally slumped and collapsed. The wall is open to the SW.

SITE NO: State: BPBM: PHRI: T-147
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow near ocean cliffs
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape/cairn alignment. Cairn situated c. 4.00 m southwest of C-shape. Cairn contains central hole (0.20 m dia.). Sparse marine shell midden (two taxa) present. No cultural deposit.

FEATURE A: C-shape wall
DIMENSIONS: 2.60 m by 1.60 m by 0.45 m

Wall runs NW to SE, opening to SW. The wall is constructed of large cobbles and small boulders. It is generally collapsed and slumped. A slight scatter of midden is located inside the curve of the wall. Feature B lies 4.00 m to the SW of Feature A.

FEATURE B: Cairn
DIMENSIONS: 1.20 m by 1.00 m by 0.75 m

Cairn is constructed of large cobbles and small boulders. Cairn is well-stacked and shows no sign of collapse. A central hole is present and measures 0.20 by 0.20 m.

SITE NO: State: -- BPBM: -- PHRI: T-148
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Cairn possibly marks trail on pahoehoe. No portable remains or cultural deposit present.

FEATURE: Cairn
DIMENSIONS: 0.45 m by 0.35 m by 0.45 m

Cairn is constructed of large cobble-sized stone slabs. No slumping or collapse is evident.

SITE NO: State: -- BPBM: -- PHRI: T-149
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Small collapsed tube in pahoehoe lava flow near a cliff
VEGETATION: Grass, Indian Pluchea in cave opening
CONDITION: Good

INTEGRITY: Altered--probable uncontrolled excavations
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site is situated within a large area of pahoehoe excavations. Horizontal cave entrance opens to southwest. Moderate amounts of marine shell midden and 0.02-0.03 m cultural deposit present. Coral abrader noted.

SITE NO: State: -- BPBM: -- PHRI: T-150
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Narrow pahoehoe lava flow channel which ends near a cliff
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Vertical entrance measures 1.30 by 1.85 m in area and 1.05 m deep. Moderate amounts of marine shell midden present.

SITE NO: State: -- BPBM: -- PHRI: T-151
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow c. 10.00 m north of ocean cliffs
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn situated c. 4.00 m west of C-shape. Sparse amounts of marine shell midden (two taxa) present. No cultural deposit.

FEATURE A: C-shape wall
DIMENSIONS: 3.90 m by 2.20 m by 0.80 m

Feature runs approximately N-S and is open to the west. Wall is constructed of large cobbles and small boulders; it is very collapsed. Associated with the wall is a small amount of shell midden and coral. A cairn lies 4.00 m to the west.

FEATURE B: Cairn
DIMENSIONS: 1.40 m by 1.40 m by 0.65 m

Cairn is constructed of large cobbles and small boulders. Some collapse has occurred on the north side. No central hole is present. A small amount of shell midden and coral is associated with this cairn.

SITE NO: State: -- BPBM: -- PHRI: T-152
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow 10.00 m east of large littoral cone
VEGETATION: Grass; Indian Pluchea in tube
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Horizontal entrance open to east. Moderate amounts of marine shell midden present. Seven volcanic glass flakes collected.

SITE NO: State: -- BPBM: -- PHRI: T-153
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation/marker
DESCRIPTION: Cairn situated along segment of main coastal trail. Screw-top, clear glass, half-gallon bottle "Santa Fe Vintage Co." present by cairn. Cairn probably marks trail segment on pahoehoe.

FEATURE: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.30 m

Comprised of crudely stacked small- to medium-sized cobbles.

SITE NO: State: -- BPBM: -- PHRI: T-154
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation/marker
DESCRIPTION: Cairn situated along segment of main coastal trail. Cairn probably marks trail segment on pahoehoe. No portable remains or cultural deposit present.

FEATURE: Cairn
DIMENSIONS: 0.65 m by 0.40 m by 0.55 m

Cairn is comprised of roughly stacked medium-sized cobbles. Cairn marks a trail that runs in the general vicinity N-S.

SITE NO: State: -- BPBM: -- PHRI: T-155
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Rock art/quarry/tool prep./temp. hab.
DESCRIPTION: Site consists of one panel of four petroglyphs and an extensive area of petroglyphs, abraded depressions, and pahoehoe excavations.

SITE NO: State: -- BPBM: -- PHRI: T-156
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/rock art
DESCRIPTION: Site complex consists of modified overhang and petroglyph. Overhang open to southwest. Petroglyph represents human figure. Sparse marine shell midden (three taxa) present. Coral and waterworn stones also present. No cultural deposit.

SITE NO: State: -- BPBM: -- PHRI: T-157
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Depressed areas of an undulating pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two caves. Feature A opens to south and contains moderate marine shell midden and a 0.02-0.03 m cultural deposit. Feature B opens north and contains sparse marine shell midden, but no cultural deposit.

SITE NO: State: -- BPBM: -- PHRI: T-158
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Top of littoral cone overlooking ocean
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric (?)
FUNCTIONAL INTERPRETATION: Possible burial
DESCRIPTION: Contains small opening on west end. Several pieces of coral scattered about.

SITE NO: State: -- BPBM: -- PHRI: T-159
SITE TYPE: Complex (10 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Markers/rock art
DESCRIPTION: In addition to features listed here, site area includes a c. 200 sq m area of petroglyphs. Site consists of nine cairns and a walled depression. One taxa marine shell present. No cultural deposit.

SITE NO: State: -- BPBM: -- PHRI: T-160
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Altered--probable uncontrolled excavations
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/rock art
DESCRIPTION: Entrance open to northwest. Marine shell midden, bone, and 0.03-0.04 m cultural deposit present. Ten volcanic glass flakes collected. Several human figure petroglyphs noted at cave entrance. Cave appears partially disturbed by vandals.

SITE NO: State: -- BPBM: -- PHRI: T-161
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass, bush in Feature A.
CONDITION: Good
INTEGRITY: Altered--uncontrolled excavations
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/markers/burial (?)
DESCRIPTION: Site consists of: cave, bedrock depression, wall, two cairns, and a platform (possible burial) Features A and B contain marine shell midden and cultural deposit. Deposit partially disturbed by vandals.

SITE NO: State: -- BPBM: -- PHRI: T-162
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/rock art

DESCRIPTION: Site complex consists of two C-shape walls, platform and cairn. Feature A contains sparse marine shell midden. Ten volcanic glass flakes collected. Several petroglyphs situated c. 7.0-9.0 m east of Feature A.

SITE NO: State: Various BPBM: Various PHRI: T-163
SITE TYPE: Complex (47 Features)
TOPOGRAPHY: Pahoehoe with aa pockets
VEGETATION: Grasses, Indian Pluchea, niu, pohuehue, 'ilima
CONDITION: Fair
INTEGRITY: Unaltered to altered--uncontrolled excavations
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/rock art
DESCRIPTION: Site area includes State Sites 3612-3616 and 3620- 3627, BPBM Sites B23-1 thru -5, -9 thru -16. Site consists of several well-construction walled structures, terraces, cave/tubes, C-shape walls, enclosures, a triple C-shape wall, a triple U-shape wall, overhangs, walled blisters, and mounds. Petroglyph concentrations scattered throughout site complex. Cave/tubes contain moderate to high marine shell and cultural deposits, but partially disturbed by vandals. Site complex also includes Site H59/B23-47 (3654) identified by Hansen.

SITE NO: State: -- BPBM: -- PHRI: T-164
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a cairn and a curved wall. Cairn situated east of wall. No portable remains or cultural deposit present.

FEATURE A: Cairn
DIMENSIONS: 2.00 m by 1.70 m by 0.70 m

Comprised of small to large cobbles stacked on pahoehoe. The sides appear slightly slumped or collapsed.

FEATURE B: Curved wall
DIMENSIONS: 2.15 m by 0.80 m by 0.70 m

Wall oriented roughly north-south. Comprised of well-stacked boulders, but it is slightly collapsed on the north end. Wall is built on south edge of, and abuts, bedrock slope. Feature B is situated c. 10.00 m and 290 degrees Az from Feature A.

SITE NO: State: -- BPBM: -- PHRI: T-165
SITE TYPE: Circular wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Several pahoehoe excavations present in area. No portable remains or cultural deposit.

FEATURE: Circular wall
DIMENSIONS: 1.20 m by 1.10 m by 0.50 m

Wall is c. 0.40 m thick and is comprised of small to large cobbles on pahoehoe. The wall is raised but is not formally faced, and the interior is slightly collapsed. East side is built up, in contrast to west side, which appears slightly open.

SITE NO: State: -- BPBM: -- PHRI: T-166
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass, bush growing in Feature A.
CONDITION: Good
INTEGRITY: Feature A altered--uncontrolled excavations
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temp. hab./marker/rock art/tool prep.
DESCRIPTION: Site area includes numerous petroglyphs and abraded depressions. Site consists of: cave, wall, walled depression, and cairn. Cave (Feature A) has two entrances, one vertical and one horizontal. Cave and walled depression (Feature C) contains dense marine shell midden. Feature A has 0.08-0.10 m cultural deposit. One volcanic glass flake collected from walled Feature C. Site partially disturbed by vandals. Abraded depressions and petroglyphs present in general area.

SITE NO: State: -- BPBM: -- PHRI: T-167
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Possible burial
DESCRIPTION: Site complex consists of a platform and an enclosure. One battered waterworn cobble present. Hole/pit (possible vandal disturbance) present on platform (Feature A) surface. Feature A possible burial platform. Enclosure (Feature B) situated on large boulder.

SITE NO: State: -- BPBM: -- PHRI: T-168
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Situated at the edge of an aa lava flow overlooking a pahoehoe flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/transportation/quarry
DESCRIPTION: Numerous pahoehoe excavations in and around site. Site complex consists of wall, enclosure, walled pahoehoe excavation, steppingstone trail section, curved wall, and C-shape wall. Sparse marine shell (two taxa) present. No cultural deposit. Possible posthole (0.40 by 0.30 m and 0.50 m deep) situated c. 0.50 m east of wall (Feature A).

FEATURE A: Wall
DIMENSIONS: 2.80 m. by 0.80 m. by 0.70 m

Wall oriented east to west. Comprised of stacked medium to large aa cobbles. Ends of the wall slightly curved southward. Interior of wall slightly collapsed.

FEATURE B: Enclosure
DIMENSIONS: 2.90 m by 2.20 m by 0.50 m

Enclosure is roughly rectangular. Comprised of roughly stacked medium to large aa cobbles and small boulders. Interior area is level and filled with small aa pebbles. Two waterworn cobbles present. Wall contains opening or entrance on west. Feature B is situated c. 3.00 m east of Feature A.

FEATURE C: Walled pahoehoe excavation
DIMENSIONS: 2.60 m by 0.70 m by 0.50 m

Wall comprised of well-stacked medium to large aa cobbles and small boulders. Wall built on east edge of pahoehoe excavation. The wall is raised, but is not faced and is slightly collapsed.

FEATURE D: Steppingstone trail
DIMENSIONS: 6.00 m by 0.50 m

Consists of four flat slabs. Trail oriented east-west and leads to Feature A.

FEATURE E: Curved wall
DIMENSIONS: 2.50 m by 0.70 m by 0.70 m

Comprised of large pahoehoe cobbles and small boulders stacked along the south and east edges of a pahoehoe excavation. Southern portion of wall is slightly collapsed. Feature E, slightly open to the northwest, is c. 12.00 m and 290 degrees Az from Feature C.

FEATURE F: C-shape wall
DIMENSIONS: 2.50 m by 1.10 m by 0.70 m

Wall is c. 0.60 m wide and is comprised of medium to large pahoehoe cobbles. The south end of the wall is slightly collapsed. C-shape is open to the west. Feature is c. 6.00 m southwest of Feature E. Probably functioned as a windbreak.

SITE NO: State: -- BPBM: -- PHRI: T-169
SITE TYPE: Platform (1 Feature)
TOPOGRAPHY: Aa lava flow in swale between two aa flow ridges
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Probable burial
DESCRIPTION: No portable remains or cultural deposit. Hole/pit (possible vandal disturbance) present on platform. Probably a burial platform.

SITE NO: STATE: -- BPBM: -- PHRI: T-171
SITE TYPE: Complex (82 Features)
TOPOGRAPHY: Pahoehoe lava flow with smooth and rough/broken surfaces
VEGETATION: Sparse grasses
CONDITION: Fair
INTEGRITY: Altered--uncontrolled excavations
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/rock art
DESCRIPTION: Site consists of a walled and paved outcrop, 43 C-shape walls, six linear walls, a walled outcrop, two caves, 14 cairns, two overhangs, a U-shape wall, seven rock mounds, a double C-shape wall, a modified outcrop, an enclosure, a triple C-shape wall, and a walled blister. Petroglyphs scattered throughout site area. Caves (Features W and L) contain high amounts of marine shell midden and moderate cultural deposit, but partially disturbed by vandals. Volcanic glass collected from Features Q, LL, DD, W, and L.

SITE NO: STATE: 3617-19 BPBM: B23-6, -7, -8 PHRI: T-172
SITE TYPE: Complex (5 Features)
TOPOGRAPHY: Aa lava hill
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious (poss. shrine and/or burials)
DESCRIPTION: Site consists of four platforms and an enclosure. High amounts of coral present. Site identified by Hansen (BPBM Sites B23-6 through -8).

SITE NO: STATE: -- BPBM: -- PHRI: T-173
SITE TYPE: Complex (11 Features)
TOPOGRAPHY: Aa lava flow and pahoehoe lava flow
VEGETATION: Sparse grass and Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/transport/quarry
DESCRIPTION: Site situated along portion of main coastal trail. Site consists of five walls, two enclosures, and four cairns. Pahoehoe excavations associated with Features B and E (walls). Additional pahoehoe excavations present. Marine shell midden present.

SITE NO: STATE: -- BPBM: -- PHRI: T-174
SITE TYPE: Complex (5 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/transportation
DESCRIPTION: Site consists of a walled overhang, a wall and level area, two overhangs, and a trail section. Marine shell midden and 2-3 cm deposit present in Feature A. Six volcanic glass flakes collected from Feature A and four from Feature D.

SITE NO: STATE: -- BPBM: -- PHRI: T-175
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Aa lava flow overlooking pahoehoe flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site includes one of two main coastal trails. Site consists of a trail, a wall, three cairns, and a rectangular level area. Several marine shells mark trail. Trail oriented northwest from Site T-171 toward Site T-201.

SITE NO: STATE: -- BPBM: -- PHRI: T-176
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric

FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Site consists of two cairns. No portable remains or cultural deposits. Cairns probably associated with trail (Site T-175).

FEATURE A: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.50 m

Comprised of stacked aa boulders and cobbles. Cairn is centrally raised, but the sides are not formally faced; they appear rounded or sloping in profile.

FEATURE B: Cairn
DIMENSIONS: 0.50 m by 0.40 m by 0.60 m

Comprised of stacked aa boulders and cobbles. The cairn is centrally raised but the sides, not formally faced, appear rounded or sloping in profile. Feature B is c. 1.00 m south of Feature A. Both cairns are situated c. 15.00 m north of T-175 trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-177
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal control or boundary
DESCRIPTION: Wooden fence posts and wire associated with wall. No other portable remains or cultural deposits present.

FEATURE: Wall
DIMENSIONS: 120.00 m by 0.45 m by 0.40 m (approx.)

Comprised of roughly stacked small to large aa cobbles. Wall appears generally collapsed and has no faced sides.

SITE NO: STATE: -- BPBM: -- PHRI: T-178
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Situated on pahoehoe lava surrounded by aa lava flow.
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape/cairn alignment. No portable remains or cultural deposits present. Cairn contains hole/pit (0.20 m dia. by 0.30 m deep).

FEATURE A: C-shape wall
DIMENSIONS: 2.70 m by 1.30 m

Wall measures c. 0.40 m wide by 0.90 m high and is comprised of stacked aa boulders. The wall is crudely faced on the interior and exterior. Feature A is open west.

FEATURE B: Cairn
DIMENSIONS: 1.30 m by 1.20 m by 0.80 m

Comprised of stacked aa boulders and blocky pahoehoe boulders. The cairn is centrally raised but is not formally faced, and it is rounded or sloping in profile. Feature B is situated c. 6.00 m and 240 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-179
SITE TYPE: Modified overhang (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Fern
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Overhang modified with several flat slabs on interior floor surface. Very sparse marine shell fragments (one taxon) present.

FEATURE: Modified overhang
DIMENSIONS: 3.10 m by 1.00 m by 1.00 m

No cultural deposits. Horizontal entrance open to the southwest.

SITE NO: STATE: -- BPBM: -- PHRI: T-180
SITE TYPE: Modified overhang (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow on southwest side of ridge
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Overhang modified with boulders and slabs partially blocking entrance. Very sparse marine shell (two taxa) present. No cultural deposits. Horizontal entrance open southwest.

FEATURE: Modified overhang
DIMENSIONS: 4.40 m by 2.00 m by 1.00 m

Overhang modified by basalt boulders and slabs piled around the entrance creating a smaller opening and a larger interior protected area. Modified horizontal entrance measures c. 1.50 m wide by 0.90 m high. Interior floor modified with slabs and cobbles creating a roughly level surface. Several fragments of Cypraea spp. and Cellana spp. shell present.

SITE NO: STATE: -- BPBM: -- PHRI: T-181
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Aa lava flow ocean cliff
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a curved wall, two cairns, and a C-shape wall. Sparse marine shell midden (four taxa) present. No cultural deposits. Site associated with faint coastal trail.

FEATURE A: Curved wall
DIMENSIONS: 4.30 m by 0.90 m by 1.10 m

Comprised of well-stacked small to large aa cobbles. The wall is crudely faced and slightly open to the southwest. Several coral fragments, in addition to Cellana spp., Thaididae, Cypraea spp., and Neritidae present.

Feature A and Feature C typical of C-shape/cairn alignment.

FEATURE B: Cairn
DIMENSIONS: 1.90 m by 1.30 m by 1.10 m

Cairn is hollow in center. Comprised of well-stacked aa rocks. The east wall is several rocks wide; the west wall is only one rock wide. Feature B is c. 6.00 m southwest of Feature A.

FEATURE C: Cairn
DIMENSIONS: 1.00 m by 1.00 m by 0.60 m

Comprised of stacked aa rocks. The cairn is centrally raised and does not appear collapsed. No hole or pit is visible in cairn. Feature C is situated c. 4.00 m southwest of Feature A.

FEATURE D: C-shape wall
DIMENSIONS: 2.30 m by 1.20 m

Wall is c. 0.80 m wide by 0.40-0.75 m high and is comprised of well-stacked basalt boulders. The wall is only a little collapsed.

The interior area has been excavated to lower the surface. The C-shape is open southwest. Very sparse amounts of Cellana spp. and coral present. Feature D is situated c. 8.00 m southwest of Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-182
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Aa lava flow overlooking bay
VEGETATION: Indian Pluchea
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Steppingstone trail (Site 3650) present north of site. Sparse marine shell midden (three taxa) present. No cultural deposits.

FEATURE: C-shape wall
DIMENSIONS: 3.00 m by 2.50 m

Wall is c. 1.10 m wide by 0.55 m high and is comprised of piled small to large aa boulders and cobbles. Several waterworn rocks also present in the wall. The poorly defined walls are not faced and appear generally collapsed. Shell midden includes sparse amounts of Cellana spp., Neritidae, and Cypraea spp. Coral and historic glass also present.

SITE NO: STATE: -- BPBM: -- PHRI: T-183
SITE TYPE: Platform (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious
DESCRIPTION: Site is probable shrine or burial. Waterworn and coral cobbles present. No other portable remains or cultural deposits present. Possible posthole present 0.60 m west of platform.

SITE NO: STATE: -- BPBM: -- PHRI: T-184
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Situated on aa flow inland of anchialine pond
VEGETATION: Indian Pluchea
CONDITION: Fair
INTEGRITY: Altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Sparse to moderate marine shell midden, waterworn boulders, and 0.05-0.10 m cultural deposit present. One

volcanic glass flake collected. Site situated adjacent to trail (Site T-185, Feature A).

SITE NO: STATE: -- BPBM: -- PHRI: T-185
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site consists of a trail, a cairn, and a ramp. Trail (Feature A) comprises main coastal-inland oriented trail. Cairn marks trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-186
SITE TYPE: Complex (10 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: Grass, bush
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of nine cairns and a walled overhang. Walled overhang open to south. Cairns arranged in semicircle. No portable remains or cultural deposits present.

FEATURE A: Walled overhang
DIMENSIONS: 1.75 m by 1.40 m by 1.20 m

The wall measures c. 1.00 m long by 0.50 m wide and is 0.50 m high. Comprised of stacked medium to large cobbles. Second wall or crude boulder alignment built above overhang.

FEATURE B: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.50 m (approx.)

Comprised of roughly stacked medium-size aa cobbles. Feature B is situated c. 7.00 m south of Feature A.

FEATURE C: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.50 m (approx.)

Comprised of roughly stacked medium-size aa cobbles.

FEATURE D: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.50 m (approx.)

Comprised of roughly stacked medium-size aa cobbles.

FEATURE E: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.50 m (approx.)

Comprised of roughly stacked medium-size aa cobbles

FEATURE F: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.50 m (approx.)

Comprised of roughly stacked medium-size aa cobbles.

FEATURE G: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.50 m (approx.)

Comprised of roughly stacked medium-size aa cobbles.

FEATURE H: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.50 m (approx.)

Comprised of roughly stacked medium-size aa cobbles.

FEATURE I: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.50 m (approx.)

Comprised of roughly stacked medium-size aa cobbles.

FEATURE J: Cairn
DIMENSIONS: 0.50 m by 0.50 m (approx.)

Cairn is collapsed. Constructed of medium-sized aa cobbles.

SITE NO: STATE: -- BPBM: -- PHRI: T-187
SITE TYPE: Complex (5 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grasses
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site situated along main coastal-inland trail (Site T-185). Site consists of three cairns, a cave, and a C-shape wall. Sparse marine shell midden and waterworn boulders present. Cave (Feature C) contains c. 5-10 cm greyish-colored cultural deposit.

SITE NO: STATE: -- BPBM: -- PHRI: T-188
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe and aa lava flows
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered

PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site includes trail section which connects with Site T-175 trail. Site consists of a trail section, ramp, a wall, and a cairn.

SITE NO: STATE: -- BPBM: -- PHRI: T-189
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a walled overhang and three C-shape walls. Pahoehoe excavations scattered throughout site. Marine shell midden present.

SITE NO: STATE: -- BPBM: -- PHRI: T-190
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Aa lava flow overlooking Kanonone Ponds and coast
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of three walled overhangs and a modified outcrop. Sparse amounts of marine shell midden present. Thin cultural deposits (1-3 cm) present in Features B and D.

SITE NO: STATE: -- BPBM: -- PHRI: T-191
SITE TYPE: Curved wall (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Sparse amounts of marine shell midden (two taxa) present. No cultural deposits.

FEATURE: Curved wall
DIMENSIONS: 3.50 m by 0.80 m by 1.20 m

Comprised of well-stacked large cobbles and small boulders with sides crudely faced. Portions of exterior side slightly slumping. Wall is open to the south. Several waterworn cobbles present. Sparse midden includes Cypraea spp. and Cellana spp.

SITE NO: STATE: -- BPBM: -- PHRI: T-192
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava flow next to anchialine ponds
VEGETATION: Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of three overhangs and an excavated overhang. Marine shell midden present. Two volcanic glass flakes collected from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-193
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Crest of aa lava flow ridge (Feature A); Features B and C on adjacent pahoehoe lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of walled area, a C-shape wall, and a cairn. Features B and C typical of C-shape/cairn alignment. Hole (0.20-0.50 m dia.) present in cairn (Feature C). No portable remains or deposits present. Numerous pahoehoe excavations situated to the south and east of site.

FEATURE A: Walled area
DIMENSIONS: 2.60 m by 1.60 m

The walled area is level and is situated between several large boulders modified with a wall. Wall measures c. 1.50 m long by 0.50 m wide and is 0.65 m high. It is oriented roughly east-west and is comprised of medium to large aa cobbles.

FEATURE B: C-shape wall
DIMENSIONS: 1.40 m by 1.15 m

Wall measures c. 0.45 m wide by 1.00 m high and is comprised of stacked aa slabs and large cobbles. The wall is raised and crudely faced, but portions appear slumped and collapsed. C-shape is open west.

FEATURE C: Cairn
DIMENSIONS: 1.20 m by 1.00 m by 0.80 m

Comprised of well-stacked large cobbles and small boulders. Cairn is centrally raised, but does not have formally faced sides. Feature C is situated southwest of Feature B.

SITE NO: STATE: -- BPBM: -- PHRI: T-194
SITE TYPE: Platform (1 Feature)
TOPOGRAPHY: Pahoehoe lave flow between two aa flows
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Possible burial and marker
DESCRIPTION: Cairn present on platform. One marine shell present. No cultural deposits. Trail (T-175) situated downslope (south) of site. Several small cairns noted in area.

SITE NO: STATE: -- BPBM: -- PHRI: T-195
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Site consists of two cairns. No portable remains or cultural deposits present. High amounts of coral cobbles present downslope to east and west of cairns.

FEATURE A: Cairn
DIMENSIONS: 0.60 m by 0.60 m by 0.45 m

Comprised of stacked medium aa cobbles and coral. The cairn is raised, but appears generally collapsed. Medium-size waterworn rock adjacent to cairn.

FEATURE B: Cairn
DIMENSIONS: 0.85 m by 0.45 m by 0.45 m

Comprised of small- to medium-size aa rock and coral. West and east portions of cairn appear collapsed. Feature B is situated c. 6.00 m south of Feature A. Both cairns built on high aa ridge.

SITE NO: STATE: -- BPBM: -- PHRI: T-196
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Situated on seaward edge of aa lava flow overlooking small bay
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Possible prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of three cairns, an L-shape wall, a pahoehoe excavation, and a C-shape wall. Waterworn boulder hammerstone present in pahoehoe excavation. No cultural deposits. Features E and F typical of C-shape/cairn alignment. Feature F contains hole. Features E and F situated on level cobble area (5.00 by 6.00 m).

FEATURE A: Cairn
DIMENSIONS: 1.60 m by 1.10 m by 0.55 m

Roughly oval and comprised of piled aa boulders. Cairn is centrally raised; it contains no faced sides and is rounded or sloping in profile.

FEATURE B: L-shape wall
DIMENSIONS: 2.30 m by 1.40 m

Wall measures c. 0.30-0.50 m wide by 0.45-1.00 m high and is comprised of stacked aa boulders. The wall is crudely faced on its interior and exterior and opens to the west. The interior surface consists of level basalt pebbles and cobbles. A waterworn basalt boulder is present. Feature B is situated c. 75.0 m and 310 degrees Az from Feature A.

FEATURE C: Cairn
DIMENSIONS: 1.00 m by 1.00 m by 0.60 m

Comprised of piled aa and blocky pahoehoe boulders. Roughly rounded and centrally raised. No formally faced sides. Sloping or collapsed in profile. Feature C is c. 7.00 m and 243 degrees Az from Feature B.

FEATURE D: Pahoehoe excavation
DIMENSIONS: 1.50 m by 1.50 m by 0.80 m

Contains bashed waterworn basalt boulders. Blocky basalt boulders scattered about excavation. Feature D is c. 4.00 m and 190 degrees Az from Feature C.

FEATURE E: C-shape wall
DIMENSIONS: 2.50 m by 1.00 m

Wall measures c. 0.50-0.60 m by 0.55-0.95 m high and is comprised of stacked aa boulders and cobbles. Wall faced on interior, but is collapsing in places. C-shape opens to the west. Feature E is c. 70.0 m and 321 degrees Az from Feature B. Waterworn basalt boulders present c. 2.50 m south of Feature E.

FEATURE F: Cairn
DIMENSIONS: 1.00 m by 0.90 m by 0.60 m

Cairn roughly oval, comprised of piled aa boulders and cobbles. Centrally raised but sides not formally faced; appears rounded or sloping in profile. Posthole measures c. 0.10-0.15 m in diameter. Feature F is situated c. 6.50 m and 268 degrees Az from Feature E.

SITE NO: STATE: -- BPBM: -- PHRI: T-197
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: On aa lava flow west of small bay
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: C-shape open south. No portable remains or cultural deposits present. Possible trail (faint) marked by coral adjacent to site.

FEATURE: C-shape wall
DIMENSIONS: 2.60 m by 2.60 m

The wall measures c. 0.50-0.90 m wide by 0.60-0.90 m high and is comprised of crudely stacked aa boulders and cobbles. The walls are crudely faced on the interior and exterior and are collapsed in areas. The interior consists of a rough and uneven aa boulder and cobble surface. This site probably functioned as a temporary windbreak.

SITE NO: STATE: -- BPBM: -- PHRI: T-198
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of three boulder overhangs and a cairn. Sparse amounts of marine shell midden (one taxon) present. Site is situated along a trail (T-175).

FEATURE A: Boulder overhang
DIMENSIONS: 1.90 m by 0.90 m

Overhang area created by removing or clearing rubble from the base of a boulder leaving a flat level area of pebble and small cobble-size rock. Feature A is open west. Very sparse amounts of Cellana spp. shell midden present.

FEATURE B: Boulder overhang
DIMENSIONS: 2.50 m by 1.10 m by 1.20 m

Overhang area created by removing or clearing rubble from base of boulder leaving a flat level area of pebble and small cobble-size rock. The overhang is open east. Sparse amounts of Cellana spp. shell midden present. Feature B is situated c. 15.0 m east of Feature A.

FEATURE C: Boulder overhang
DIMENSIONS: 1.50 m by 1.30 m by 1.00 m

Overhang area created by removing or clearing rubble from the base of boulder leaving a flat level area of pebble and small boulder-size rock. Overhang is open west. Very sparse amounts of Cellana spp. shell midden present. Feature C is situated east of Feature B.

FEATURE D: Cairn
DIMENSIONS: 1.60 m by 1.00 m

Cairn comprised of roughly stacked basalt boulders. Feature D is situated near Feature B.

SITE NO: STATE: -- BPBM: -- PHRI: T-199
SITE TYPE: Complex (15 Features)
TOPOGRAPHY: Aa lava flow overlooking anchialine ponds
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/religious
DESCRIPTION: Site consists of five walled overhangs, two modified outcrops, a waterworn cobble concentration, a C-shape wall, two modified boulders, two overhangs, an L-shaped wall, and a cairn. Sparse to moderate marine shell midden and cultural deposit present. Waterworn cobble concentration possibly a shrine. Situated near trail (T-175).

SITE NO: STATE: -- BPBM: -- PHRI: T-200
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: C-shape wall
DIMENSIONS: 1.60 m by 1.70 m

Wall measures c. 0.70 m wide by 0.85 m high and is comprised of well-stacked medium to large aa cobbles and small boulders. The wall is raised but is not formally faced, and it is collapsed in places. Interior is of level aa pebbles and small cobbles. C-shape is open west. Wall probably functioned as a temporary windbreak shelter.

SITE NO: STATE: -- BPBM: -- PHRI: T-201
SITE TYPE: Complex (10 Features)
TOPOGRAPHY: Irregular aa lava flow surface overlooking coast and anchialine ponds
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a C-shape wall, three walled boulders, an L-shape wall, an enclosure, a cave, a trail section, and two cairns. Marine shell midden and coral present.

SITE NO: STATE: -- BPBM: -- PHRI: T-202
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava flow at edge of Aa lava flow
VEGETATION: Grass, Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two C-shape walls, a trail section, and an overhang. Marine shell midden present in overhang (Feature D). Steppingstone trail section leads to Feature D. Rough wall and raised terrace associated with Feature D. Trail (Feature C) continues to southwest.

SITE NO: STATE: -- BPBM: -- PHRI: T-203
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Pahoehoe surrounded by aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Comprises section of coastal-inland oriented trail. No portable remains present.

SITE NO: STATE: -- BPBM: -- PHRI: T-204
SITE TYPE: Complex (17 Features)
TOPOGRAPHY: Pahoehoe
VEGETATION: Indian Pluchea
CONDITION: fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/religious/quarry
DESCRIPTION: Site consists of three caves, four C-shape walls, five cairns, two overhangs, a double C-shape wall, a walled blister, and a pahoehoe excavation. Moderate to sparse amounts of marine shell midden and cultural deposits present. Rock-lined firepit present in cave (Feature A). One volcanic glass flake collected from Feature A. Echinoid spine abrader present in Feature E. Hammerstone present in pahoehoe excavation (Feature P). Features B and C typical of C-shape/cairn alignment. Feature Q (cairn) possibly a shrine.

SITE NO: STATE: -- BPBM: -- PHRI: T-205
SITE TYPE: C-shape (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: One marine shell present. No deposit. Pahoehoe excavations in area.

FEATURE: C-shape wall
DIMENSIONS: 3.00 m by 2.20 m

Wall measures c. 0.30-0.80 m wide by 0.30-0.60 m high and is comprised of crudely stacked blocky pahoehoe boulders. The wall is raised but is collapsed in places, and it is crudely faced on the interior and exterior. One fragment Cellana spp. shell midden present.

SITE NO: STATE: -- BPBM: -- PHRI: T-206
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric/historic
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site consists of a trail and two walls. Trail is continuation of major coastal trail. Trail marked by marine shell and coral. Walls (Features B and C) situated near Site T-220 (Feature B), at west end of trail. Several wooden posts noted near walls which are probably historic.

SITE NO: STATE: -- BPBM: -- PHRI: T-207
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe flow near ocean cliffs
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric

FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of two C-shape walls and a cairn. Features A and B typical of C-shape/cairn alignment. Cairn contains central hole. Cairn situated 4.50 m west of Feature A. Sparse marine shell midden present. No cultural deposits.

FEATURE A: C-shape wall
DIMENSIONS: 2.40 m by 1.00 m

Wall measures c. 0.65 m wide by 0.80 m high and is constructed of basalt boulders. The wall is raised but is not formally faced, and it is collapsed in places. Shell midden includes Cellana spp. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.30 m by 1.30 m by 0.90 m

Comprised of crudely stacked medium- to large-sized cobbles and small boulders. Cairn is centrally raised but does not have formally faced sides.

FEATURE C: C-shape wall
DIMENSIONS: 1.70 m by 1.15 m

Wall measures c. 0.50 m wide by 0.70 m high and is comprised of crudely stacked medium- to large-sized cobbles and small boulders. The wall is not formally faced and is collapsed in places. The C-shape opens to the southwest.

Feature C is situated c. 20.0-25.0 m west of Feature B.

SITE NO: STATE: -- BPBM: -- PHRI: T-208
SITE TYPE: Trail (3 Features)
TOPOGRAPHY: Aa and pahoehoe lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site consists of trail section, cairn, and ramp feature. Trail comprises branch section of major coastal trail. Scattered coral cobbles and cairn mark trail. Ramp feature is c. 10.0 m east of Site T-207.

SITE NO: STATE: -- BPBM: -- PHRI: T-209
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow with areas of cinder
VEGETATION: Sparse grass
CONDITION: Good

INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Sparse marine shell midden (one taxon) and echinoid remains present. No cultural deposits. C-shape open west. Pahoehoe excavations present between Site T-209 and T-210, especially between trails T-206 and T-210.

FEATURE: C-shape wall
DIMENSIONS: 2.40 m by 1.10 m

Wall measures c. 0.45 m wide by 0.60 m high and is constructed of well-stacked small to large cobbles and small boulders. The walls, raised slightly, are collapsed inward in places.

SITE NO: STATE: -- BPBM: -- PHRI: T-210
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow near edge of aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two C-shape walls. Two marine shells (one taxon) present in Feature B. No cultural deposits. Both C-shapes open to west. Feature B situated c. 20.0 m south of Feature A.

FEATURE A: C-shape wall
DIMENSIONS: 2.25 m by 0.75 m

Wall measures c. 0.50 m wide by 0.90 m high and is comprised of well-stacked large aa cobbles and small boulders. The wall is raised but not formally faced.

FEATURE B: C-shape wall
DIMENSIONS: 1.25 m by 1.80 m

Wall measures c. 0.70 m wide by 0.60 m high and is comprised of crudely stacked small to large aa cobbles and small boulders. The wall is raised slightly but is not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-211
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Trail section oriented east-west. One section present between Sites T-213 and T-219.

SITE NO: STATE: -- BPBM: -- PHRI: T-212
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow with cinder covered areas
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits. C-shape opens to west.

FEATURE: C-shape wall
DIMENSIONS: 1.60 m by 0.30 m

Wall measures c. 0.30-0.50 m wide by 0.50-0.70 m high and is comprised of stacked angular aa boulders and slabs. The wall is very crudely faced on the interior (west) side, and it is sloping or rounded on the exterior.

SITE NO: STATE: -- BPBM: -- PHRI: T-213
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of an oval wall, two linear walls, two C-shape walls, and a cairn. Pahoehoe excavations also present. Marine shell midden and octopus lure present within oval wall (Feature A). Waterworn boulder noted in pahoehoe excavation. Site associated with trail (T-211).

SITE NO: STATE: -- BPBM: -- PHRI: T-214
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow surrounded by aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site is associated with Site T-206 trail. Site consists of a C-shape wall, a wall, and a curved wall. No portable remains or cultural deposit.

FEATURE A: C-shape wall
DIMENSIONS: 1.80 m by 0.85 m

Wall measures c. 0.30 m wide by 0.47 m high and is constructed one to two courses high of large aa cobbles and small boulders. The south end of the wall is collapsed. The C-shape opens to the east.

FEATURE B: Wall
DIMENSIONS: 1.50 m by 0.25 m by 0.28 m

The wall is comprised of crudely stacked large aa cobbles and opens to the northwest. The wall is two courses high and is collapsed in places. Feature B is c. 6.20 m and 265 degrees Az from Feature A.

FEATURE C: Curved wall
DIMENSIONS: 1.70 m by 0.35 m by 0.47 m

Comprised of roughly stacked medium- to large-sized pahoehoe cobbles. The wall is oriented roughly southwest-northeast. Southwest end is collapsed.

SITE NO: STATE: -- BPBM: -- PHRI: T-215
SITE TYPE: Complex (12 Features)
TOPOGRAPHY: Aa lava flow and pahoehoe lava flow
VEGETATION: Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/quarry
DESCRIPTION: Site consists of a small platform, two walls, five overhangs, a double C-shape wall, two C-shape walls, four cairns, and a trail section. Feature L is probably a portion of the Site T-208 trail. Dense marine shell midden present at several features. Pahoehoe excavations also present.

SITE NO: STATE: -- BPBM: -- PHRI: T-216
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Cairn probably marks faint coastal trail.

FEATURE: Cairn
DIMENSIONS: 1.00 m by 0.40 m by 0.70 m

Comprised of crudely stacked angular aa boulders. The cairn is centrally raised but has no formally faced sides and appears rounded or sloping in profile.

SITE NO: STATE: -- BPBM: -- PHRI: T-217
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Surrounded by aa lava flow
VEGETATION: None

CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits.

FEATURE: C-shape wall
DIMENSIONS: 2.50 m by 1.30 m

Wall measures c. 0.20-0.30 m wide by 0.50-0.75 m high and is comprised of crudely stacked angular to subangular aa boulders and cobbles. The wall is raised and crudely faced. The C-shape opens to the southwest. The interior surface consists of cinder/soil and measures c. 1.90 by 1.00 m.

SITE NO: STATE: -- BPBM: -- PHRI: T-218
SITE TYPE: Walled overhang (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Very sparse marine shell midden (two taxa) present. No cultural deposits. Site probably associated with Site T-206, Feature A trail.

FEATURE: Walled overhang
DIMENSIONS: 2.30 m by 1.20 m by 0.60 m

Overhang modified with a c. 0.30-0.60 m high wall. Wall is constructed of large cobbles and small boulders. No opening or entrance visible in wall. Cellana spp. and Thaididae present. Site is situated c. 45.0 m and 106 degrees Az from Site 206-C.

SITE NO: STATE: -- BPBM: -- PHRI: T-219
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a C-shape wall, a cairn, and four walled overhangs. Sparse marine shell midden present. Cinder/soil deposit present. Features A and B typical of C-shape/cairn alignment. Site associated with T-211 trail. Pahoehoe excavations located in vicinity.

FEATURE A: C-shape wall
DIMENSIONS: 2.20 m by 0.40 m by 0.55 m

Comprised of blocky pahoehoe boulders. The wall is raised and crudely faced. C-shape opens to the west. One Thaididae fragment present.

FEATURE B: Cairn
DIMENSIONS: 1.00 m by 1.00 m by 0.40 m

Comprised of piled blocky pahoehoe boulders. The cairn is centrally raised, but its sides are collapsed or sloping in profile.

FEATURE C: Walled overhang
DIMENSIONS: 2.10 m by 3.00 m by 1.20 m

Overhang entrance measures 1.10 m wide by 1.20 m high and is modified with a wall. The wall measures 0.90 m long by 0.60 m wide and 0.90 m high. It is comprised of stacked blocky pahoehoe boulders and slabs. The wall is raised and crudely faced. The overhang utilizes a large boulder as a windbreak. Several Cellana spp. shells present. Feature C is situated c. 8.00 m and 70 degrees Az from Feature A.

FEATURE D: Walled overhang
DIMENSIONS: 2.00 m by 3.00 m by 0.65 m

Wall measures 2.00 m long by 0.40-0.50 m wide and 0.85 m high. It is comprised of crudely stacked large, blocky pahoehoe boulders, several of which are upright. The shelter is open west. Sparse N. picea and Cellana spp. shell midden present. Feature D is situated c. 15.00 m and 355 degrees Az from Feature C.

FEATURE E: Walled overhang
DIMENSIONS: 3.00 m by 2.50 m by 1.50 m

Overhang entrance measures 1.90 m wide by 1.50 m high and is modified with a wall which measures 1.60 m long by 0.35-0.40 m wide and 0.50-0.80 m high. The wall is comprised of crudely stacked blocky and angular pahoehoe boulders. The wall is raised and crudely faced on the interior and exterior. Cellana spp., Cypraea spp., N. picea, and Thaididae shell midden present. Feature E is situated c. 3.00 m and is 340 degrees Az from Feature D.

FEATURE F: Walled overhang
DIMENSIONS: 1.20 m by 1.50 m by 1.10 m

Overhang entrance measures 1.30 m wide by 0.40-1.10 m high and is modified with a wall which measures 1.50 m long by 0.40 m wide and 1.00-1.20 m high. Wall is comprised of crudely stacked aa and blocky pahoehoe boulders. The wall is raised and crudely faced on the interior and exterior. The overhang opens to the south. Sparse Cellana spp., N. picea, Echinoidea, and Thaididae midden present. Feature F is situated c. 12.00 m and is 190 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-220
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Indian Pluchea
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a modified outcrop, a wall, and a C-shape wall. Very sparse marine shell midden present in wall (Feature B). No cultural deposits. Cinder/soil deposits present.

FEATURE A: Modified outcrop
DIMENSIONS: 3.00 m by 1.30 m

Outcrop modified with a wall on its north side. Wall measures 1.30 m long by 0.40-0.50 m wide and 0.50-0.70 m high. The bedrock outcrop measures 2.30 m long by 1.30 m high on the west side and 0.80 m high on the east side. Wall and bedrock outcrop form L-shape shelter. V-shape opening in bedrock filled with boulders forming a windbreak.

FEATURE B: Wall
DIMENSIONS: 2.30 m by 0.30 m by 0.47 m

Wall comprised of crudely stacked pahoehoe cobbles and boulders; it is collapsed on the northwest end. Wall oriented northwest-southeast.

FEATURE C: C-shape wall
DIMENSIONS: 2.00 m by 0.30 m by 0.50 m

Wall is comprised of crudely stacked pahoehoe slabs several of which are upright. It is raised and crudely faced on the interior and exterior. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-221
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of an enclosure and a C-shape wall. No portable remains or cultural deposits present.

FEATURE A: Enclosure
DIMENSIONS: 3.90 m by 2.90 m

Wall measures 0.80 m wide by 1.33 m high and is comprised of well-stacked aa boulders and cobbles. Entrance or opening in

northwest wall. Northeast section is partially collapsed on interior. Feature associated with trail.

FEATURE B: C-shape wall
DIMENSIONS: 2.20 m by 0.65 m by 0.75 m

Wall comprised of crudely stacked aa cobbles and boulders. Wall sits on small cinder flat. The wall is raised but is not formally faced. Feature B is situated c. 47.0 m and 350 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-222
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow point overlooking ocean
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No marine shell midden or cultural deposits present. One metal fragment noted.

FEATURE: C-shape wall
DIMENSIONS: 2.10 m by 0.70 m by 0.00 m

Wall measures 0.30-0.40 m wide by 0.40-1.10 m high and is comprised of stacked blocky pahoehoe boulders. Cobbles and pebbles fill cracks between boulders. Wall is faced on the interior and exterior. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-223
SITE TYPE: L-shape wall (2 Features)
TOPOGRAPHY: Aa lava flow--cinder flat near cliff
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Spare marine shell midden (three taxa) present. No cultural deposits. Trail section present immediately north of site.

FEATURE: L-shape wall
DIMENSIONS: 4.00 m by 2.60 m

Wall measures 0.55-0.60 m wide by 0.60-0.75 m high and is comprised of crudely stacked aa cobbles and boulders. The wall is raised, but not formally faced and is collapsed in places. Sparse N. picea, Cypraea spp., and Ceilana spp. shell midden present.

SITE NO: STATE: -- BPBM: -- PHRI: T-224
SITE TYPE: Complex (27 Features)
TOPOGRAPHY: Pahoehoe lava flow and cinder land flat
VEGETATION: Indian Pluchea
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/religious
DESCRIPTION: Site consists of a walled terrace, an overhang, nine C-shape walls, two caves, a walled overhang, five walls, a double C-shape wall, an L-shape wall, two curved walls, two enclosures, a circular enclosure, and parallel walls. Marine shell midden present. Walled terrace (Feature A) probably a small shrine. Cinder/soil deposit present. Site associated with Sites T-225 and T-227.

SITE NO: STATE: -- BPBM: -- PHRI: T-225
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious
DESCRIPTION: Site consists of platform and adjacent cairn with upright waterworn boulder. Sparse marine shell midden present. Platform contains rectangular-shaped pit (0.60 by 0.70 m and 0.75 cm deep); possible burial or shrine.

SITE NO: STATE: -- BPBM: -- PHRI: T-226
SITE TYPE: Complex (7 Features)
TOPOGRAPHY: Pahoehoe lava flow abutting aa lava flow finger
VEGETATION: Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a wall, a linear wall, a human figure rock alignment, two cairns, a walled overhang, and a C-shape wall. Sparse marine shell midden present. Cinder/soil deposits present.

SITE NO: STATE: -- BPBM: -- PHRI: T-227
SITE TYPE: Complex (9 Features)
TOPOGRAPHY: Cinder plain
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Fair
PROBABLE AGE: Prehistoric/historic (?)--alignment

FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: Site consists of an U-shape alignment and eight cairns. Sparse marine shell midden present. Six cairns (Features B through G) form northwest-southeast alignment perpendicular to large U-shape alignment (Feature A).

SITE NO: STATE: -- BPBM: -- PHRI: T-228
SITE TYPE: Petroglyphs (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Altered---road crosses alignment
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Rock art
DESCRIPTION: Approximately 10-15 glyphs. Human figures, a bird, and footprint symbols present.

SITE NO: STATE: -- BPBM: -- PHRI: T-229
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: No portable remains or cultural deposit present. Site possibly marks route to T-228 petroglyphs.

FEATURE: Cairn
DIMENSIONS: 1.00 m by 0.75 m by 0.50 m

Comprised of blocky pahoehoe boulders piled on bedrock. Cairn is centrally raised but is not formally faced.

VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Fair
PROBABLE AGE: Prehistoric/historic (?)--alignment
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: Site consists of an U-shape alignment and eight cairns. Sparse marine shell midden present. Six cairns (Features B through G) form northwest-southeast alignment perpendicular to large U-shape alignment (Feature A).

SITE NO: STATE: -- BPBM: -- PHRI: T-228
SITE TYPE: Petroglyphs (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass

CONDITION: Poor
INTEGRITY: Altered---road crosses alignment
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Rock art
DESCRIPTION: Approximately 10-15 glyphs. Human figures, a bird, and footprint symbols present.

SITE NO: STATE: -- BPBM: -- PHRI: T-229
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: No portable remains or cultural deposit present. Site possibly marks route to T-228 petroglyphs.

FEATURE: Cairn
DIMENSIONS: 1.00 m by 0.75 m by 0.50 m

Comprised of blocky pahoehoe boulders piled on bedrock. Cairn is centrally raised but is not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-230
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Aa channel surrounded by cinder covered flat
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site consists of a trail section and two cairns. Trail section visible over aa channel. Cairns mark trail. Several pieces marine shell present near trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-231
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Indian Pluchea
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of C-shape wall and two cairns. Marine shell midden (three taxa) and hammerstone present nearby. Pahoehoe excavation also present. No cultural deposits.

SITE NO: STATE: -- BPBM: -- PHRI: T-232
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Aa lava flow on coast
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No indigenous cultural deposits. Recent historic rubbish present.

FEATURE: Wall
DIMENSIONS: 4.90 m by 0.60 m by 1.00 m

Constructed of well-stacked aa cobbles and boulders; incorporates a small depression in the aa as part of wall. Four flat slabs (possibly used for seats) also present.

SITE NO: STATE: -- BPBM: -- PHRI: T-233
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Aa lava flow and pahoehoe lava ridge
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a C-shape wall, a walled overhang, a cairn, and a pahoehoe excavation. Several additional pahoehoe excavations also present. Very sparse marine shell midden, two waterworn boulders, hammerstones present in pahoehoe excavation (Feature D). No cultural deposits.

FEATURE A: C-shape wall
DIMENSIONS: 2.00 m by 0.80 m

Wall measures 0.40-0.70 m wide by 0.40-0.60 m high and is comprised of aa boulders piled two to three courses high. Wall is raised, but not formally faced and is collapsed in places. C-shape opens to the west. Wall abuts bedrock ridge to northwest.

FEATURE B: Walled overhang
DIMENSIONS: 2.50 m by 1.50 m

Measurements reflect overall area. Overhang measures 0.70 m deep by 1.40 m wide with a maximum ceiling height of 0.95 m. The wall measures 2.00 m long by 0.50-0.60 m wide and 0.50-0.80 m high. It is comprised of piled basalt boulders and is east of the overhang. Feature B is situated c. 5.00 m and 40 degrees Az from Feature A.

FEATURE C: Cairn
DIMENSIONS: 1.70 m by 1.10 m by 0.40 m

Constructed of aa boulders and pahoehoe slabs piled on bedrock. The aa boulders are placed east of the flat slabs creating the appearance of a collapsed wall shelter. Feature C is situated c. 10.0 m and 240 degrees Az from Feature A.

FEATURE D: Pahoehoe excavation
DIMENSIONS: 3.00 m by 1.50 m by 0.60 m

Consists of excavated area with quarried boulders piled on east side of excavation.

SITE NO: STATE: -- BPBM: -- PHRI: T-234
SITE TYPE: Linear wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Poor
INTEGRITY: Altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Several marine shell fragments (one taxon) present. No cultural deposits. Additional boulders present nearby possibly from original structure.

FEATURE: Linear wall
DIMENSIONS: 1.00 m by 0.50 m by 0.65 m

Comprised of piled blocky pahoehoe boulders. One centrally located (west side) boulder is upright, creating a faced appearance. The walls exterior appears collapsed or sloping in profile. Shelter area appears to be on west side of wall. Several fragments Cellana spp. shell midden present.

SITE NO: STATE: -- BPBM: -- PHRI: T-235
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Feature A situated on Pahoehoe lava flow at cliff edge overlooking ocean. Feature B situated on bedrock ledge below Feature A.
VEGETATION: None
CONDITION: Fair
INTEGRITY: Altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a surface midden concentration and an overhang. Moderate amounts of marine shell midden (four taxa) present. Echinoid remains also present. Overhang (Feature B) contains greyish cultural deposits; also partially disturbed by recent fishermen.

SITE NO: STATE: -- BPBM: -- PHRI: T-236
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: Cairn contains upright waterworn boulder; appears recently constructed. Additional crude cairns, constructed of rocks piled one upon another, present near cliff edge overlooking ocean.

FEATURE: Cairn
DIMENSIONS: 0.60 m by 0.50 m by 0.70 m

Comprised of crudely stacked blocky basalt boulders precariously supporting an upright waterworn boulder. The cairn is raised but not formally faced. Does not appear to be a shrine feature.

SITE NO: STATE: -- BPBM: -- PHRI: T-237
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow, large depressed area
VEGETATION: Grass, small fern
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Possible temporary habitation
DESCRIPTION: Sparse marine shell midden (one taxon) present. No cultural deposits.

FEATURE: Wall
DIMENSIONS: 1.55 m by 0.45 m by 0.60 m

Comprised of well-stacked medium- to large-sized cobbles; wall constructed on the edge of a depression. The wall is raised, but not formally faced. Creates 1.50 m high shelter area on depression (west) side of wall.

SITE NO: STATE: -- BPBM: -- PHRI: T-238
SITE TYPE: Complex (8 Features)
TOPOGRAPHY: Pahoehoe lava flow. Feature B is situated immediately above and west of Feature D cave entrance
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two cairns, two C-shape walls, two walls, and two caves. Sparse to moderate amounts of marine shell midden (five taxa) present. Thin, greyish cultural deposits present in caves (Features D and F).

SITE NO: STATE: -- BPBM: -- PHRI: T-239
SITE TYPE: Complex (8 Features)
TOPOGRAPHY: Pahoehoe lava flow overlooking the ocean
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of three C-shape walls, an L-shape boulder alignment, a wall, a walled ramp, a double C-shape wall, and an L-shape wall. Sparse amounts of marine shell midden (three taxa) present. Cinder/soil present. Walled ramp (Feature E) is an unusual structure. Ramp terminates at small platform; numerous small upright slabs in ramp floor

SITE NO: STATE: -- BPBM: -- PHRI: T-240
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass and Indian Pluchea
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a wall, two cairns, two C-shape walls, and a terrace. Sparse amounts of marine shell midden (four taxa), in addition to a utilized basalt flake, present. Pahoehoe excavations also present.

SITE NO: STATE: -- BPBM: -- PHRI: T-241
SITE TYPE: Complex (8 Features)
TOPOGRAPHY: Aa lava flow and pahoehoe lava flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a walled blister, five C-shape walls, and two cairns. Very sparse amounts of marine shell midden (four taxa) present. Cinder soil/sand present but does not appear cultural. Pahoehoe excavation also present.

SITE NO: STATE: -- BPBM: -- PHRI: T-242
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered

PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of two C-shape walls and two walls. Very sparse amounts of marine shell (one taxon) present. Cinder/soil present, but does not appear cultural. Pahoehoe excavations also present.

FEATURE A: C-shape wall
DIMENSIONS: 2.40 m by 0.40 m by 0.47 m

Comprised of stacked pahoehoe cobbles and boulders. The wall is raised but not formally faced. C-shape opens to the northwest and wall is built on the edge of a natural pit. Several Conus spp. shell midden present.

FEATURE B: C-shape wall
DIMENSIONS: 2.30 m by 0.55 m by 0.90 m

Comprised of stacked pahoehoe cobbles and boulders. The wall is raised but not formally faced. C-shape opens to the northwest. Several Conus spp. shell midden present. Feature B is situated c. 1.60 m northwest of Feature A.

FEATURE C: Wall
DIMENSIONS: 1.30 m by 0.50 m by 0.60 m

Constructed of medium- to large-sized pahoehoe and aa cobbles. The wall is curved slightly and appears open to the southwest. Feature C is situated c. 35.00 m and 65 degrees Az from Feature A.

FEATURE D: Wall
DIMENSIONS: 5.60 m by 0.50 m by 0.68 m

Comprised of crudely stacked pahoehoe boulders and cobbles. The wall is raised but not formally faced, and portions are collapsed. Feature D is situated c. 35.0 m and 237 degrees Az from Features A and B.

SITE NO: STATE: -- BPBM: -- PHRI: T-243
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY:
VEGETATION: Indian Pluchea
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Probably historic
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Sparse amounts of marine shell midden (two taxa) present. Beach sand deposits present.

FEATURE: Walled fault
DIMENSIONS: See below

Wall measures 0.40-1.00 m wide by 0.50-1.30 m high and is constructed almost exclusively of large waterworn beach boulders. The wall is constructed across (perpendicular) the fault and is faced on the interior (west). The exterior (east) is sloping in profile. The fault measures 0.60-2.50 m wide by 0.80-1.00 m deep. The fault is situated c. 15.00 m from the ocean and appears impacted by seasonal high surf.

SITE NO: STATE: -- BPBM: -- PHRI: T-244
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Probably prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two walled blisters. Very sparse amounts of marine shell midden (one taxon) present.

FEATURE A: Walled blister
DIMENSIONS: 1.50 m by 0.70 m by 0.70 m

Blister is modified with wall which measures 2.20 m long by 0.25-0.40 m wide and 0.30-0.50 m high. The wall is comprised of crudely stacked blocky basalt boulders, and is located on the east side of the blister. The wall is raised, but not formally faced.

FEATURE B: Walled blister
DIMENSIONS: 1.00 m by 0.80 m by 0.85 m

Blister is modified with wall which measures 2.50 m long by 0.50-0.65 m wide and 0.40-0.50 m high. The wall is comprised of crudely stacked blocky pahoehoe boulders, and is located on the east side of the blister. The wall is raised but not formally faced. The blister leads to a small cave measuring 1.50 m long by 2.20 m wide with a ceiling 0.65 m high. Feature B is situated c. 11.00 m and 320 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-245
SITE TYPE: U-shape wall (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Some grass and Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Overhang present immediately south of U-shape wall. Dense amounts of marine shell midden (six taxa), in addition to

echinoid remains, present. Historic shoe soles and metal also present. Soil deposits in both features may contain cultural material.

SITE NO: STATE: -- BPBM: -- PHRI: T-246
SITE TYPE: Walled overhang (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains present. Cinder/sand deposits present, but no cultural material visible.

FEATURE: Walled overhang
DIMENSIONS: 2.00 m by 0.80 m by 0.85 m

Overhang opens to the south and is modified with a wall on the east side. The wall measures 1.80 m long by 0.35 m wide and 0.35-0.45 m high. It is constructed of pahoehoe blocks piled one to two courses high. The wall is slightly raised, but not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-247
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass, Indian Pluchea
CONDITION: Good
INTEGRITY: Good
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: No portable remains or cultural deposits present. Numerous pahoehoe excavations present in area. Wall constructed around pahoehoe excavation hole.

FEATURE: Wall
DIMENSIONS: 2.15 m

Wall measures 0.40-0.75 m wide by 0.60-1.00 m high and is comprised of crudely stacked cobbles and boulders. The wall is raised but not formally faced. The wall is several courses high on the east half, in contrast to one to two courses high on the west half. The wall is slightly curved and open northwest. It is built on the east edge of a pahoehoe excavation which measures 2.40 by 1.20 m in area.

SITE NO: STATE: -- BPBM: -- PHRI: T-248
SITE TYPE: Walled blister (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow adjacent to fault
VEGETATION: Indian Pluchea

CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Sparse amounts of marine shell midden (five taxa) present in crawlspace area. Greyish cinder/sand deposits may contain cultural deposits. Mammal bone, coral, and waterworn boulder also present.

SITE NO: STATE: -- BPBM: -- PHRI: T-249
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No indigenous cultural deposits visible. Recent historic trash and firepit present.

FEATURE: C-shape wall
DIMENSIONS: 3.80 m by 2.00 m

The wall measures 0.45-0.50 m wide by 0.65-0.75 m high and is comprised of crudely stacked blocky basalt and waterworn boulders. The wall is raised on the interior and exterior but is not formally faced. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-250
SITE TYPE: Complex (12 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/quarry
DESCRIPTION: Site consists of five C-shape walls, a C-shape wall and cairn, a tube, a walled cave, a walled blister, cairn, and a wall. Pahoehoe excavations also present in area. Sparse to moderate amounts of marine shell midden (five taxa), possible hammerstone, and greyish cultural deposit present. C-shape wall and cairn (Feature H) typical of C-shape/cairn alignment. Feature H cairn also contains interior hole (0.20 m dia.).

SITE NO: STATE: -- BPBM: -- PHRI: T-251
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None

CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape/cairn alignment. No portable remains or cultural deposits present. Cairn contains interior hole (0.10-0.15 m dia.).

FEATURE A: C-shape wall
DIMENSIONS: See below

Wall measures 0.15-0.50 m wide by 0.65-0.80 m high and is comprised of stacked aa cobbles and boulders. Wall is raised and crudely faced on the interior and exterior. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.80 m by 1.08 m by 0.80 m (approx.)

Comprised of stacked aa boulders and cobbles. Cairn is raised but not formally faced. Feature B is situated 4.85 m and 215 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-252
SITE TYPE: Walled outcrop (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Poor
INTEGRITY: Altered
PROBABLE AGE: Possibly historic
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Very sparse marine shell (one taxon), in addition to historic rubbish. No indigenous cultural deposits. Site partially disturbed by bulldozed jeep road.

FEATURE: Walled outcrop
DIMENSIONS: 3.10 m by 2.00 m

Walled in area consists of roughly level aa cobbles. Wall on north side of level area constructed between bedrock outcrops measures 2.50 m long by 0.50 m wide and 0.80 m high and is comprised of crudely stacked aa boulders, several of which are large. Site utilizes bedrock outcrop as additional windbreak walls.

SITE NO: STATE: -- BPBM: -- PHRI: T-253
SITE TYPE: Curved wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flat and aa lava flow 10.0 m to the SW
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric

FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or deposits present.

FEATURE: Curved wall
DIMENSIONS: 1.20 m by 0.45 m by 0.50 m

Comprised of crudely stacked pahoehoe cobbles. The wall is raised slightly but is not formally faced, and it is collapsed in places. C-shape opens to the southwest.

SITE NO: STATE: -- BPBM: -- PHRI: T-254
SITE TYPE: Complex (5 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a tube with modifications, three curved walls, and a terrace. Marine shell midden, two wooden boards, a possible abrader, and thin (1-2 cm) ash deposits present. Pahoehoe excavations also present in area.

SITE NO: STATE: -- BPBM: -- PHRI: T-255
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow, closely bordered by two aa lava flows
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site consists of visible segment of a coastal-inland oriented trail. One piece coral present. Trail averages 0.80 m wide. Surface is cleared of larger stones leaving pebble- to small cobble-sized crushed aa. Trail is part of a network of trails inland from Kahakahakea.

SITE NO: STATE: -- BPBM: -- PHRI: T-256
SITE TYPE: Curved wall (1 Feature)
TOPOGRAPHY: Pahoehoe and aa lava flows
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: Curved wall
DIMENSIONS: 2.90 m by 1.50 m

Wall measures 0.40-0.50 m wide by 0.80 m high and is comprised of stacked pahoehoe slabs and aa cobbles. The wall is raised and partially faced on both the interior and exterior but is collapsed in places. The C-shape opens to the west. This site probably functioned as a windbreak.

SITE NO: STATE: -- BPBM: -- PHRI: T-257
SITE TYPE: Curved wall (1 Feature)
TOPOGRAPHY: Large pahoehoe lava channel; aa lava flow to the east, situated at crest of fault in pahoehoe lava
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Several pieces of waterworn coral pebbles present. No cultural deposits. Possible pecked area on pahoehoe visible southwest of wall.

FEATURE: Curved wall
DIMENSIONS: 3.00 m by 1.40 m

Wall measures 0.50-0.80 m wide by 0.50 m high and is comprised of crudely stacked angular to subangular pahoehoe boulders and cobbles. The wall is slightly curved and opens to the southwest.

SITE NO: STATE: -- BPBM: -- PHRI: T-258
SITE TYPE: Curved wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: Curved wall
DIMENSIONS: 1.70 m by 0.35 m by 0.55 m

Constructed of small boulder-sized slabs set on edge. The wall is crudely built, and it is partially collapsed on the exterior. The wall is slightly curved and opens to the southwest.

SITE NO: STATE: -- BPBM: -- PHRI: T-259
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow 20.00 m south of edge aa lava flow

VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: C-shape wall
DIMENSIONS: 1.40 m by 0.75 m

Wall measures 0.50 m wide by 0.60 m high and is crudely constructed of large slabs. The wall, slightly collapsed in places and open to the west, is raised but not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-260
SITE TYPE: Trail/Cairn (2 Features)
TOPOGRAPHY: Aa flow, trail joins to area of pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Nearby cairn marks trail. No portable remains visible. Trail is a segment of a coastal-inland oriented trail system. Trail is 1.20 m wide and paved with aa pebbles and small cobbles. Cairn is 0.60 m by 0.40 m by 0.50 m high. Cairn is comprised of roughly stacked aa cobbles.

SITE NO: STATE: -- BPBM: -- PHRI: T-261
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Trail comprises branch of a coastal-inland oriented trail system. No portable remains visible. Trail averages 0.75 m in width. Surface is cleared of larger stones leaving pebble- to small cobble-sized aa.

SITE NO: STATE: -- BPBM: -- PHRI: T-262
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava area surrounded by aa lava flow
VEGETATION: Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation

DESCRIPTION: Site consists of a cave and a wall and paved area. Sparse amounts of marine shell midden (three taxa), in addition to echinoid remains present. Human-figure petroglyphs present above cave entrance. No cultural deposits visible.

FEATURE A: Cave
DIMENSIONS: 3.40 m by 3.20 m by 1.00 m

Horizontal cave entrance opens to the north and measures 2.70 m wide and 0.80 m high. Cellana spp. and Thaididae shell midden, in addition to waterworn stone and coral, are present.

FEATURE B: Wall and level area
DIMENSIONS: 5.00 m by 0.70 m by 0.65 m

Wall is comprised of well-stacked cobbles and boulders. It is raised but is not formally faced, and it appears collapsed in places. The level area measures 3.50 by 2.90 m. It consists of small cobble- to pebble-sized rock. Sparse Cypraea spp., Cellana spp., Thaididae, and Echinoidea midden are present.

SITE NO: STATE: -- BPBM: -- PHRI: T-263
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Trail segment comprises branch of a coastal-inland oriented trail system. Trail segment visible on aa flow. Trail averages 1.0 m in width. Surface is paved with small- to medium-sized cobbles. Occasional pieces of coral or Cellana sp. shell mark the trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-264
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Shattered pahoehoe/aa
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Trail segment comprises branch of a coastal-inland oriented trail system. Occasional waterworn rocks and coral present along trail. Trail averages 1.00-1.50 m in width. Path is cleared of larger stones. Pahoehoe slabs used as steppingstones along trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-265
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grasses
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry/rock art
DESCRIPTION: Site consists of a sink with walled tubes, two cairns, and petroglyphs. Marine shell midden, wooden poles, waterworn basalt (pebbles, cobbles, and bashers), coconut, gourd, and thin pockets of ashy deposit present. Pahoehoe excavations also present.

SITE NO: STATE: -- BPBM: -- PHRI: T-266
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of curved wall (C-shape)/cairn alignment. Cairn contains interior hole.

FEATURE A: Curved wall
DIMENSIONS: 2.30 m by 1.20 m

Wall measures 0.60 m wide by 0.80 m high and is comprised of stacked pahoehoe slabs, cobbles, and boulders. Wall opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.20 m by 1.20 m by 0.60 m

Comprised of stacked pahoehoe slabs, cobbles, and boulders. The cairn is centrally raised, but is not formally faced. Feature B is situated c. 8.00 m and 52 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-267
SITE TYPE: Circular wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate/quarry
DESCRIPTION: No portable remains or cultural deposits present. Pahoehoe excavations present.

FEATURE: Circular wall
DIMENSIONS: 1.50 m by 1.50 m by 0.40 m

Constructed of single-stacked cobble-sized pahoehoe slabs. One slab is placed upright.

SITE NO: STATE: -- BPBM: -- PHRI: T-268
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe surrounded by aa flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a curved wall and a cairn. No portable remains or cultural deposits present.

FEATURE A: Curved wall
DIMENSIONS: 2.15 m by 0.60 m by 0.90 m

Comprised of stacked cobbles and boulders. The wall is raised but not formally faced, and it is collapsed on interior portions. The wall is slightly curved and opens to the west.

FEATURE B: Cairn
DIMENSIONS: 0.80 m by 0.80 m by 0.60 m

Comprised of crudely stacked cobbles and boulders. The cairn is raised but not formally faced, and it is partially collapsed. Feature B is c. 2.00 m and 215 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-269
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present. Site situated along trail (T-271) route.

FEATURE: Wall
DIMENSIONS: 1.40 m by 0.60 m by 0.40 m

Wall is oriented roughly northeast-southwest. It is comprised of stacked pahoehoe slabs. The wall is faced on the interior and slopes sloping on the exterior.

SITE NO: STATE: -- BPBM: -- PHRI: T-270
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a walled overhang and a cave. One piece coral and four to five pieces of wood (some burnt) with flat head nails present. Wood appears recent. No cultural deposits.

FEATURE A: Walled overhang
DIMENSIONS: 1.70 m by 1.50 m by 1.00 m

The overhang modified with a wall on the north side, contains a level interior area. The overhang opens to the west. The wall measures 1.30 m long by 0.60 m wide and 0.30 m high; it is constructed of medium- to large-sized cobbles.

FEATURE B: Cave
DIMENSIONS: 20.00 m deep (approx.)

The cave is c. 3.00-5.00 m wide and has a ceiling c. 0.50-0.80 m high; it contains no visible modifications.

SITE NO: STATE: -- BPBM: -- PHRI: T-271
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Trail comprises branch of a coastal-inland oriented trail system. Very sparse amounts of coral and marine shell midden (Cellana, Cypraeidae) present along trail. Trail averages 0.70 m in width. Surface composed of pebbles and small cobbles.

SITE NO: STATE: -- BPBM: -- PHRI: T-272
SITE TYPE: Rubble mound (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: Rubble mound
DIMENSIONS: 1.30 m by 1.00 m by 0.30 m

Comprised of stacked cobble-sized slabs and chunks. The feature resembles a collapsed cairn or wall.

SITE NO: STATE: -- BPBM: -- PHRI: T-273
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: Wall
DIMENSIONS: 2.40 m by 0.70 m by 0.80 m

Comprised of stacked cobble-sized pahoehoe slabs and chunks. The wall is oriented roughly north-south; it is raised but not formally faced, and the north end appears slightly collapsed.

SITE NO: STATE: -- BPBM: -- PHRI: T-274
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Pahoehoe and aa flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Trail comprises branch of a coastal-inland oriented trail system. Occasional pieces of coral and cairns mark trail. Trail is 0.80-1.20 m wide. Trail is only visible on aa where surface is composed of pebble- to small cobble-sized aa.

SITE NO: STATE: -- BPBM: -- PHRI: T-275
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a curved wall and a linear wall. No portable remains or cultural deposits present.

FEATURE A: Curved wall
DIMENSIONS: 1.80 m by 0.50 m by 0.40 m

Comprised of crudely stacked small- to large-sized cobbles. It is raised slightly but not formally faced, and it is collapsed in places. The wall is oriented roughly northwest-southeast.

FEATURE B: Linear wall
DIMENSIONS: 1.30 m by 0.30 m by 0.30 m

Comprised of crudely stacked small- to large-sized cobbles. The wall is raised very slightly but is not formally faced, and it is collapsed in places. The wall is oriented roughly northwest-southeast. Feature B is situated c. 2.00 m southwest of Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-276
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Marine shell midden (four taxa) and 2-3 cm cultural deposit present. Goat bones also present.

SITE NO: STATE: -- BPBM: -- PHRI: T-277
SITE TYPE: Complex (5 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass and Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a cave, a curved wall, two cairns, and a petroglyph. Marine shell midden (five taxa) and 2-3 cm cultural deposits, in addition to echinoid remains, present.

SITE NO: STATE: -- BPBM: -- PHRI: T-278
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a wall and a cairn. No portable remains or cultural deposits present. Trail route/intersection present near site.

FEATURE A: C-shape wall
DIMENSIONS: 2.10 m by 1.10 m

Wall measures 0.60 m wide by 0.60 m high and is comprised of crudely stacked cobble-sized pahoehoe chunks and slabs. The wall is raised but not formally faced and appears collapsed in places.

FEATURE B: Cairn
DIMENSIONS: 1.10 m by 1.10 m by 0.70 m

Comprised of crudely stacked cobble-sized pahoehoe chunks and slabs. Cairn is raised but not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-279
SITE TYPE: Tube (1 Feature)
TOPOGRAPHY: Pahoehoe at edge of aa flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/storage/religious (?)
DESCRIPTION: Tube mentioned in Kirch (1985: 160-161). Contains bamboo poles, possible hau log, waterworn cobble, two pieces marine shell, gourd, and organic material. Inland end of tube (accessible by crawling) contains chamber with upright pole, fallen pole with gourd, and twined organic material.

SITE NO: STATE: -- BPBM: -- PHRI: T-280
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site comprises major coastal-inland oriented trail. Trail begins at Pohue Bay and continues inland to line of large sinks and tubes inland of present project area. Trail is marked by cairn. Cairn is 1.10 m by 1.40 m by 0.60 m high and is comprised of stacked aa cobbles. Surface of trail averages 1.20 m wide and is paved with aa pebbles and small cobbles.

SITE NO: STATE: -- BPBM: -- PHRI: T-281
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe at edge of aa flow
VEGETATION: Grass
CONDITION: Good

INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a C-shape wall, a cairn, and a curved wall. Features A and B typical of C-shape/cairn alignment. Cairn contains interior hole. Pahoehoe excavations also present. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.00 m by 0.90 m

Wall measures 0.50 m wide by 0.80 m high and is comprised of well-stacked cobbles and boulders. The wall is raised, but appears collapsed in places, and it opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.20 m by 0.90 m by 0.80 m

Comprised of stacked cobbles and boulders. The cairn is raised but not formally faced and it is collapsed in places. The interior hole or pit measures 0.25 by 0.20 m in area. Feature B is situated c. 5.00 m southwest of Feature A.

FEATURE C: Curved wall
DIMENSIONS: 2.40 m by 0.60 m by 0.50 m

Comprised of piled cobbles and boulders. The wall oriented roughly north-south and extremely collapsed, is curved very slightly and appears to open to the west. Feature C is situated c. 20.0 m east of Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-282
SITE TYPE: Pahoehoe excavation (1 Feature)
TOPOGRAPHY: Small pahoehoe island surrounded by aa flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Quarry
DESCRIPTION: Large waterworn boulder with definite signs of battering present.

FEATURE: Pahoehoe excavation
DIMENSIONS: 2.00 m by 1.25 m by 0.90 m

Consists of an oblong excavated pit. Blocky basalt boulders scattered on interior and exterior surfaces of excavation. Waterworn boulder situated on north side of excavation.

SITE NO: STATE: -- BPBM: -- PHRI: T-283
SITE TYPE: Curved wall (1 Feature)
TOPOGRAPHY: Pahoehoe at edge of aa flow
VEGETATION: Dense grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposit present.

FEATURE: Curved wall
DIMENSIONS: 4.00 m by 0.55 m by 0.35 m

Comprised of roughly piled medium- to large-sized cobbles. The wall is slightly curved, appears open to the west, is oriented north-south, and is collapsed.

SITE NO: STATE: -- BPBM: -- PHRI: T-284
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Dense grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/rock art
DESCRIPTION: Site consists of a curved wall, a cairn, and petroglyphs. Cairn situated east of curved wall. No portable remains or cultural deposits present. Petroglyphs include western lettering, human figures, and other miscellaneous symbols.

SITE NO: STATE: -- BPBM: -- PHRI: T-285
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe at edge of lava flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a C-shape wall, a modified overhang, and a walled overhang. Two fragments marine shell present. No cultural deposits.

FEATURE A: C-shape wall
DIMENSIONS: 3.50 m by 2.60 m

Wall measures 0.60 m wide by 0.55 m high and is comprised of roughly stacked aa cobbles and boulders. The wall is raised but not formally faced, and portions of it are considerably collapsed. C-shape opens to the south. Thaididae and Cypraea sp. (one each) shell present.

FEATURE B: Modified overhang
DIMENSIONS: 2.00 m by 2.35 m by 1.00 m

Overhang modified with level area south of entrance measuring 2.35 by 1.80 m. Boulders piled on bedrock surface above overhang. Overhang entrance opens south. Feature B is situated c. 12.0 m and 330 degrees Az from Feature A.

FEATURE C: Walled overhang
DIMENSIONS: 2.20 m by 2.00 m by 1.20 m

Overhang opens to the east and is modified with a L-shape wall on the north and east sides of the entrance. The wall is comprised of roughly stacked medium- to large-sized aa cobbles; it appears slumped and collapsed. The area between the wall and overhang is level. Feature C is situated c. 15.0-20.0 m and 355 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-286
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Poor-fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a curved wall and cairn. Cairn situated off south end of wall (not typical of wall/cairn alignment). Sparse marine shell midden (one taxon) present. No cultural deposits.

FEATURE A: Curved wall
DIMENSIONS: 3.80 m by 0.80 m by 0.50 m

Comprised of crudely stacked cobbles and boulders. The wall is raised but not formally faced and it appears extremely collapsed in places. The wall is oriented roughly east-west, is curved slightly, and opens south.

FEATURE B: Cairn
DIMENSIONS: 1.00 m by 1.00 m by 0.70 m

Comprised of crudely stacked cobbles and boulders. The wall is raised but not formally faced, and it is collapsed on the southeast side.

SITE NO: STATE: -- BPBM: -- PHRI: T-287
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered

PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/rock art
DESCRIPTION: Site consists of linear wall and petroglyphs. No portable remains or cultural deposits present. Petroglyphs consist of western lettering, feet, and human figures.

SITE NO: STATE: -- BPBM: -- PHRI: T-288
SITE TYPE: Complex (14 Features)
TOPOGRAPHY: Pahoehoe lava flow and aa "island"
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of 13 C-shape walls and a terrace. Petroglyphs also present in area. No portable remains or cultural deposits present.

SITE NO: STATE: -- BPBM: -- PHRI: T-289
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass, dense in places
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two C-shape walls. Two pieces coral present, but no other portable remains or cultural deposits.

FEATURE A: C-shape wall
DIMENSIONS: 2.30 m by 1.40 m

Wall measures 0.45 m wide by 0.45 m high and is constructed of medium to large aa slabs and cobbles. The wall is not faced and is collapsed in the middle. C-shape opens to the west.

FEATURE B: C-shape wall
DIMENSIONS: 2.10 m by 1.70 m

Wall measures 0.30 m wide by 0.40 m high and is comprised of aa cobbles and boulders stacked one or two courses high. The C-shape opens to the southwest and is centrally collapsed. Feature B is situated c. 15.00 m and 123 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-290
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa island surrounded by pahoehoe
VEGETATION: Grass

CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of an enclosure and a C-shape wall. No portable remains or cultural deposits present.

FEATURE A: Enclosure
DIMENSIONS: 4.50 m by 2.60 m

The enclosure is roughly oval. The enclosure wall, 0.40 m wide by 0.45 m high, is comprised of crudely stacked aa cobbles, is not faced, and portions of it are collapsed. A opening or entrance on the south end of the enclosure measures 1.00 m wide.

FEATURE B: C-shape wall
DIMENSIONS: 1.60 m by 1.00 m

Wall measures 0.60 m wide by 0.60 m high and is comprised of crudely stacked aa cobbles and a large bedrock boulder. The wall is raised but not formally faced, and portions of it are collapsed. C-shape opens to the southwest. Feature B is situated c. 2.50 m south of Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-291
SITE TYPE: Complex (20 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass shrub
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a curved wall, 18 C-shape walls, and an overhang. Sparse marine shell midden present. No cultural deposits. Site associated with T-280 trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-292
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe at edge of aa flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a C-shape wall, an overhang, a linear wall, and a cairn. Features C and D typical of wall/cairn alignment. Very sparse amounts of marine shell midden and one scoria abrader present. No cultural deposits. Site associated with T-280 trail.

FEATURE A: C-shape wall
DIMENSIONS: 2.80 m by 1.20 m

Wall measures 0.40 m wide by 0.54 m high and is comprised of stacked aa cobbles and boulders. The wall is raised but not formally faced, and it is collapsed on each end. C-shape opens to the southwest.

FEATURE B: Overhang
DIMENSIONS: 1.40 m by 1.85 m by 0.76 m

Overhang opens to the south. Interior area is level and cleared of rubble. Feature B is situated c. 12.0 m and 340 degrees Az from Feature A.

FEATURE C: Linear wall
DIMENSIONS: 1.40 m by 0.45 m by 0.50 m

Comprised of crudely stacked large aa cobbles and roughly oriented north-south. Wall is raised but not formally faced, and it is partially collapsed on the south end. Feature C is situated c. 1.50 m northwest of Feature B.

FEATURE D: Cairn
DIMENSIONS: 0.75 m by 0.50 m by 0.90 m

Comprised of well-stacked aa cobbles and boulders. Cairn is raised, but the sides are collapsed slightly. Feature D is situated c. 3.00 m and 240 degrees Az from Feature C.

SITE NO: STATE: -- BPBM: -- PHRI: T-293
SITE TYPE: Complex (13 Features)
TOPOGRAPHY: Mixed pahoehoe and aa lava flow
VEGETATION: Grass in lower area
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of six level areas, a terrace, two C-shape walls, two overhangs, and two walls. Very sparse marine shell midden present. No cultural deposits. Site associated with T-280 trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-294
SITE TYPE: Complex (16 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry

DESCRIPTION: Site consists of nine C-shape walls, a pahoehoe excavation, three overhangs, a linear wall, a depression, and a walled depression. Very sparse marine shell midden and generally no cultural deposits present.

SITE NO: STATE: -- BPBM: -- PHRI: T-295
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe, depressed area
VEGETATION: Grass brush growing in pahoehoe and in cave entrance
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Marine shell midden, waterworn stones, and coral present. Three volcanic glass flakes collected. Cultural deposit present; depth undetermined.

SITE NO: STATE: -- BPBM: -- PHRI: T-296
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe at edge of aa flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Marine shell midden, waterworn stones, and a scoria abrader fragment present. Fifteen volcanic glass flakes collected. Cultural deposit estimated at 2-3 cm. Site partially disturbed by vandals.

SITE NO: STATE: -- BPBM: -- PHRI: T-297
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a C-shape wall and two cairns. No portable remains or cultural deposits present. Cairns situated east of C-shape.

FEATURE A: C-shape wall
DIMENSIONS: 1.50 m by 0.70 m

Wall measures 0.70 m wide by 0.70 m high and is comprised of stacked pahoehoe slabs. Wall is crudely faced on the interior and is sloping or rounded on the exterior. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.00 m by 0.70 m by 0.50 m

The cairn is roughly square and is comprised of stacked pahoehoe slabs. Sides are crudely faced; cairn is centrally raised. Situated c. 6.00 m and 137 degrees Az from Feature A.

FEATURE C: Cairn
DIMENSIONS: 0.40 m by 0.40 m by 0.30 m

Comprised of piled pahoehoe slabs. The cairn is centrally raised, but contains no faced sides. Feature C is situated c. 12.50 m and 168 degrees Az from Feature B.

SITE NO: STATE: -- BPBM: -- PHRI: T-298
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe surrounded by pahoehoe and broken aa
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two C-shape walls and a cairn. Features A and B typical of C-shape/cairn alignment. No portable remains or cultural deposits present. Trail segment (branch of T-302) links T-298 and T-299.

FEATURE A: C-shape wall
DIMENSIONS: 2.60 m by 0.70 m

Wall measures 0.60 m wide by 0.80 m high (maximum) and is comprised of crudely stacked pahoehoe slabs (several upright) and boulders. The wall is raised but not faced, and it is partially collapsed in places.

FEATURE B: Cairn
DIMENSIONS: 1.20 m by 1.10 m by 0.75 m

Comprised of stacked pahoehoe boulders. The cairn is centrally raised is sloping or rounded in profile and has no formally faced sides. Feature B is situated c. 4.00 m and 230 degrees Az from Feature A.

FEATURE C: C-shape wall
DIMENSIONS: 2.50 m by 0.80 m

Wall measures 0.50 m wide by 0.55 m high and is comprised of piled pahoehoe boulders and slabs. The wall is raised but not faced and it is collapsed in places. Feature C is situated c. 40.00 m and 280 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-299
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe pocket surrounded by aa
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/rock art
DESCRIPTION: Site consists of a C-shape, a cairn, and petroglyphs. Cairn situated east of C-shape. Petroglyphs include western lettering, possible animal figures, and amorphous shapes.

SITE NO: STATE: -- BPBM: -- PHRI: T-300
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe surrounded by aa
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of three C-shape walls, a double C-shape walled depression, a cave, and a cairn. Sparse marine shell midden present. No cultural deposits. Site situated along T-301 trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-301
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site comprises segment of major coastal-inland oriented trail. Portion of trail in vicinity of Site T-300 paved with slabs. Trail connects with T-302 trail. Several cairns mark trail. Trail is 0.50-0.80 m wide. Surface consists of crushed aa cobbles.

SITE NO: STATE: -- BPBM: -- PHRI: T-302
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site comprises segment of major coastal-inland oriented

trail. Site connects with T-301 trail. Several cairns mark trail. Trail is 0.50-0.80 m wide. Surface consists of crushed aa cobbles.

SITE NO: STATE: -- BPBM: -- PHRI: T-303
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe kipuka surrounded by aa flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.60 m by 0.80 m by 0.65 m

Comprised of crudely stacked cobbles and boulders. The wall is raised but not faced, and it is slumped or collapsed in places. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.50 m by 1.40 m by 0.60 m

Comprised of crudely stacked cobbles and boulders. Cairn is centrally raised but very collapsed, and no central hole is visible in it. Feature B is situated c. 3.00 m southwest of Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-304
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Trail
DESCRIPTION: Site comprises branch of major coastal-inland oriented trail. Site connects with T-185 and T-308 trails. Trail is 1.00 m wide surface of trail is cleared of larger stones leaving pebble- to small cobble-sized aa.

SITE NO: STATE: -- BPBM: -- PHRI: T-305
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric

FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: C-shape wall
DIMENSIONS: 2.00 m by 1.00 m by 0.70 m (approx.)

Wall comprised of crudely stacked aa cobbles and boulders. The north wing wall is collapsed and the central interior area is slumped. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-306
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn contains interior hole. Cairn situated 4.50 m southwest of C-shape. Pahoehoe excavations also present. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.60 m by 1.20 m

Wall measures 0.65 m wide by 0.80 m high and is comprised of stacked cobbles and boulders. Wall is raised but not faced, and it is collapsed in places. C-shape opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.40 m by 1.30 m by 1.00 m

Comprised of stacked cobbles and boulders. Wall is centrally raised but not formally faced, and it is slightly collapsed in places. Interior hole or pit measures 0.15 m in diameter.

SITE NO: STATE: -- BPBM: -- PHRI: T-307
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe and aa lava
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site associated with T-308 trail. No portable remains or cultural deposits present.

FEATURE: C-shape wall
DIMENSIONS: 1.20 m by 0.40 m by 0.40 m

Constructed of medium-sized slabs and small- to medium-sized cobbles. Wall is slightly raised but is collapsed on both ends. C-shape opens to the southwest.

SITE NO: STATE: -- BPBM: -- PHRI: T-308
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Pahoehoe mixed
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE:
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site comprises branch of major coastal-inland oriented trail. Trail connects with T-185 and T-304 trails. Occasional coral fragments mark trail. Trail is 0.75 m wide. Trail is visible across aa patches where surface consists of aa pebbles and small cobbles.

SITE NO: STATE: -- BPBM: -- PHRI: T-309
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Small area pahoehoe surrounded by aa
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present. Site associated with T-308 trail.

FEATURE: C-shape wall
DIMENSIONS: 1.90 m by 0.40 m by 0.60 m

Wall comprised of crudely stacked aa slabs. Wall is raised but not formally faced, and it is collapsed on both ends. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-310
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Cairn marks T-185 trail. Cairn situated near intersection of T-304, T-308, and T-185 trails. Cairn is 0.60 m by

0.70 m by 1.30 m high. It is comprised of stacked medium to large cobble-sized aa. Cairn is well constructed. It is situated 1.50 m east of T-185.

SITE NO: STATE: -- BPBM: -- PHRI: T-311
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Cairn marks T-185 trail. Cairn is 0.70 m in diameter and 1.10 m high. It is comprised of stacked aa boulders and cobbles.

SITE NO: STATE: -- BPBM: -- PHRI: T-312
SITE TYPE: Complex (3 Features)
TOPOGRAPHY:
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a walled overhang and two cairns. Sparse marine shell midden (two taxa) and four waterworn boulders present. No cultural deposits visible. Cairns situated on opposite sides of and mark T-185 trail.

FEATURE A: Walled overhang
DIMENSIONS: 3.10 m by 2.50 m by 0.60 m high

Feature consists of a shallow overhang, 1.80 by 1.30 m by 0.90 m high. Overhang is enclosed by a semicircular wall, 4.60 m long, 0.60 m high, and 0.40-0.50 m thick. The wall is comprised of stacked aa boulders and cobbles. Interior of wall is faced with several upright slabs. Enclosed interior area of shelter measures 3.10 m by 2.10 m in area. Waterworn boulders (4) are present in interior as are several pieces of Cellana spp. and Cypraea sp.

FEATURE B: Cairn
DIMENSIONS: 0.60 m by 0.70 m by 1.00 m high

Cairn is comprised of stacked aa boulders. Feature has a rounded profile. It is located 4.00 m east of T-185 trail.

FEATURE C: Cairn
DIMENSIONS: 0.90 m in diameter by 0.60 m high

Comprised of stacked aa boulders and cobbles. Cairn has a rounded profile and is adjacent to west side of T-185 trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-313
SITE TYPE: C-shape wall (1 Features)
TOPOGRAPHY: Pahoehoe surrounded by aa flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: One piece coral present. No other portable remains or cultural deposits present. Site T-203 c. 10.0 m to south.

FEATURE: C-shape wall
DIMENSIONS: 1.90 m by 0.65 m

Wall measures 0.40 m wide by 0.50 m high and is comprised of crudely stacked small to large cobbles. Wall is raised but is not formally faced, and it is collapsed in places.

SITE NO: STATE: -- BPBM: -- PHRI: T-314
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two C-shape walls and a cairn. Features A and B typical of C-shape/cairn alignment. Feature C situated c. 20.00 m southeast of Features A and B. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.80 m by 1.30 m

Wall measures 0.50 m wide by 0.75 m high and is comprised of crudely stacked cobbles and boulders. Wall is raised but is collapsed in places. C-shape opens to the southwest. Interior consists of a cinder surface.

FEATURE B: Cairn
DIMENSIONS: 1.40 m by 1.00 m by 0.65 m

Comprised of crudely stacked cobbles and boulders. Cairn is centrally raised and contains an interior hole or pit. Feature B is situated c. 2.00 m southwest of Feature A.

FEATURE C: C-shape wall
DIMENSIONS: 2.00 m by 0.90 m

Wall measures 0.60 m wide by 0.70 m high and is comprised of well-stacked small- to medium-sized cobbles. Wall is raised but is

slightly collapsed on the east wing. C-shape is open southwest. Feature C is situated c. 15.0-20.0 m southeast of Features A and B.

SITE NO: STATE: -- BPBM: -- PHRI: T-315
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass and Indian Pluchea in depression
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a cave, a curved wall, and a C-shape wall. Marine shell midden and waterworn stone present in cave (Feature A). Superficial deposit present. Pahoehoe excavations also present. No portable remains or cultural deposits present in Features B and C.

SITE NO: STATE: -- BPBM: -- PHRI: T-316
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site consists of isolated trail segment visible on aa. Trail connects two pahoehoe areas. No trail markers visible. Surface of trail is composed of crushed pebble- to small cobble-sized aa. Trail averages 0.50 m in width. Trail may be part of an inland-coastal trail system which includes Trail T-203.

SITE NO: STATE: -- BPBM: -- PHRI: T-317
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe and aa lava flows
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry/marker
DESCRIPTION: Site consists of five cairns and a curved wall. Pahoehoe excavations also present. No portable remains or cultural deposits present.

FEATURE A: Cairn
DIMENSIONS: 0.70 m by 0.50 m by 1.00 m (approx.)

Constructed of medium- to large-sized cobbles.

FEATURE B: Cairn
DIMENSIONS: 0.70 m by 0.50 m by 0.80 m (approx.)

Constructed of medium- to large-sized cobbles.

FEATURE C: Cairn
DIMENSIONS: 0.70 m by 0.50 m by 0.30-0.40 m (approx.)

Constructed of medium- to large-sized cobbles. Cairn is partially collapsed.

FEATURE D: Cairn
DIMENSIONS: 0.70 m by 0.50 m by 0.10 m (approx.)

Constructed of medium- to large-sized cobbles. Cairn is completely collapsed.

FEATURE E: Cairn
DIMENSIONS: 0.70 m by 0.50 m by 0.75 m (approx.)

Constructed of medium- to large-sized cobbles.

FEATURE F: Curved wall
DIMENSIONS: 1.50 m by 0.25 m by 0.45 m

Comprised of crudely stacked medium- to large-sized aa cobbles. The wall, oriented roughly north-south, curves slightly and opens to the west; it is not faced and appears collapsed. Feature F is situated c. 15.0-20.0 m east of Features A through E.

SITE NO: STATE: -- BPBM: -- PHRI: T-318
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava surrounded by aa lava flow
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two C-shape walls and two cairns. Features A and B typical of C-shape/cairn alignment. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 1.90 m by 1.00 m

Wall measures 0.55 m wide by 0.55 m high and is constructed of aa cobbles and boulders. Wall is not faced and is generally collapsed in appearance. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.30 m by 1.20 m by 0.35 m

Constructed of aa cobbles and boulders. Cairn is raised slightly and is rounded or sloping in profile. Feature B is situated c. 7.00 m southwest of Feature A.

FEATURE C: Cairn
DIMENSIONS: 1.10 m by 1.00 m by 0.25 m

Constructed of aa cobbles and boulders. Cairn is raised slightly and is rounded or sloping in profile. Feature C is situated c. 6.00 m south of Feature A.

FEATURE D: C-shape wall
DIMENSIONS: 1.10 m by 0.90 m

Wall measures 0.40 m wide by 0.30 m high and is constructed of aa cobbles and boulders. Wall is not faced and is generally collapsed in appearance. C-shape opens to the west. Feature D is situated c. 5.50 m southeast of Feature C.

SITE NO: STATE: -- BPBM: -- PHRI: T-319
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa and pahoehoe lava flows
VEGETATION: Grass and Indian Pluchea
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.30 m by 1.10 m

Wall measures 0.70 m wide by 0.60 m high and is comprised of well-stacked aa slabs, cobbles, and boulders. Wall is raised but appears collapsed. C-shape opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.60 m by 1.50 m by 0.55 m

Constructed of aa cobbles and boulders. Cairn is slightly raised but is not faced and appears generally collapsed. No interior hole or pit is visible. Feature B is situated c. 4.50 m southwest of Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-320
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa and pahoehoe mixed

VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn contains interior hole (0.20 m dia.). Cairn situated 4.50 m southwest of C-shape. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.15 m by 1.00 m

Wall measures 0.80 m wide by 0.80 m high and is constructed of cobble-sized aa slabs. Wall is raised, but not formally faced, and it is collapsed in places. C-shape opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.40 m by 1.30 m by 0.55 m

Comprised of stacked medium- to large-sized aa cobbles. Cairn is centrally raised but is not formally faced, and portions of it are collapsed.

SITE NO: STATE: -- BPBM: -- PHRI: T-321
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Site consists of a cave/tube, a terrace, and a level area. Marine shell midden (four taxa), echinoid remains, waterworn rock, and greyish cultural deposits present in cave/tube (Feature A). All tubes were explored and no human burial remains visible. Site connects underground with T-322.

SITE NO: STATE: -- BPBM: -- PHRI: T-322
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Roof fall
INTEGRITY: No historic evident
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of three caves. Marine shell midden, fish bone, greyish cultural deposits, and coral present. Caves all connect underground and continue to Site T-321. All tubes explored and no human burial remains visible.

SITE NO: STATE: -- BPBM: -- PHRI: T-323
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe
VEGETATION: Grass and scrub brush
CONDITION: Good
INTEGRITY: Good
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Cairn situated southwest of T-322. Cairn may possibly mark trail on pahoehoe. No portable remains or cultural deposits present.

FEATURE: Cairn
DIMENSIONS: 1.20 m by 0.90 m by 0.75 m

Comprised of stacked blocky pahoehoe boulders. Cairn is centrally raised but not formally faced. Situated c. 75.0 m and 162 degrees Az from Site T-322.

SITE NO: STATE: -- BPBM: -- PHRI: T-324
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary Shelter
DESCRIPTION: No portable remains or cultural deposits present. C-shape open west.

FEATURE: C-shape wall
DIMENSIONS: 2.10 m by 0.50 m

Wall measures 0.60-0.68 m high and is comprised of crudely stacked small- to medium-sized cobbles. Wall is raised but not formally faced, and portions of it are slumped or collapsed. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-325
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Good
PROBABLE AGE: Prehistoric (?)
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: Bamboo poles present. No cultural deposits visible. All tubes explored and no human burial remains visible. Tubes entered through vertical openings and oriented generally north-south. Several side tubes are present. Main tube measures c. 0.40-0.50 m long by 3.00-4.00 m wide and 2.00-3.00 m high.

SITE NO: STATE: -- BPBM: -- PHRI: T-326
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe kipuka
VEGETATION: Dense grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Cave entrance modified with short wall. Three wooden sticks (one burnt) present in cave. No human burial remains or cultural deposits present.

FEATURE: Cave/tube
DIMENSIONS: 7.00 m by 2.00 m by 1.00 m (approx.)

Cave entrance measures 1.50 m wide by 0.80 m high and opens to the northeast. Short wall on north side of entrance measures 1.50 m long by 0.60 m wide and 0.70 m high. Wall is comprised of crudely stacked slabs, cobbles, and boulders; it is raised but not formally faced, and it does not appear collapsed.

SITE NO: STATE: -- BPBM: -- PHRI: T-327
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe and aa flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Good
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: C-shape wall
DIMENSIONS: 2.65 m by 1.50 m

Wall measures 0.30-0.80 m wide by 0.75 m high and is comprised of blocky basalt boulders crudely stacked four courses high. Wall is built around the edge of a small low sink/depression. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-328
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe abutting against slope of elevated pahoehoe flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site consists of a curved wall and a walled overhang. Pahoehoe excavations also present. Sparse marine shell midden (four taxa) present.

FEATURE A: Curved wall
DIMENSIONS: 2.00 m by 0.55 m by 0.60 m

This wall, curved slightly and open to the west, is comprised of crudely stacked medium- to large-sized cobbles. Wall is raised but not formally faced, and it is collapsed on the southeast end. The wall is curved slightly and open west.

FEATURE B: Walled overhang
DIMENSIONS: 2.45 m by 3.50 m by 1.35 m

Overhang opens to the south. Overhang is modified with a wall running east-west across the opening. The wall measures 2.80 m long by 0.80 m wide by 1.10 m high and creates on its west end a 0.90 m high entrance to the overhang. The wall is constructed of basalt cobbles and boulders. Scattered Thaididae, Cypraea spp., Cellana spp., and N. picea shell midden present.

SITE NO: STATE: -- BPBM: -- PHRI: T-329
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site typical of curved wall/cairn alignment. No portable remains or cultural deposits present. Cairn possibly contains interior hole. Site associated with T-274 trail. Pahoehoe excavations also present.

FEATURE A: Curved wall
DIMENSIONS: 2.60 m by 1.00 m

Wall measures 0.30-0.60 m wide by 1.00 m high and is comprised of stacked cobble- and boulder-sized pahoehoe slabs and blocks. Several slabs on the north end of the wall are upright. The wall, raised and crudely faced in places, is curved slightly and opens to the west. This feature probably functioned as a temporary windbreak.

FEATURE B: Cairn
DIMENSIONS: 1.40 m by 1.40 m by 0.80 m

Comprised of stacked cobble- to boulder-sized pahoehoe slabs and blocks. The cairn is centrally raised and crudely faced. It is situated c. 5.00 m and 255 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-330
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe, channel of aa 10.00 m to west

VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: C-shape wall
DIMENSIONS: 1.70 m by 0.50 m by 0.60 m

Comprised of crudely stacked cobbles and boulders. Wall is raised but appears collapsed, and it is not formally faced. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-331
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn contains interior hole. Cairn situated c. 4.00 m southwest of C-shape. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.70 m by 1.10 m

Wall measures 0.50 m wide by 0.80 m high and is comprised of well-stacked cobbles and boulders. Wall is raised but collapsed in places, and it is not formally faced. C-shape opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.50 m by 1.25 m by 0.80 m

Constructed of basalt cobbles and boulders. The cairn is centrally raised but is collapsed in places.

SITE NO: STATE: -- BPBM: -- PHRI: T-332
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn contains interior hole (0.20 m dia.). Cairn situated c. 6.00 m west of C-shape. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 3.00 m by 1.60 m

Wall measures 0.30-0.80 m wide by 0.30-0.70 m high and is comprised of crudely stacked blocky pahoehoe boulders. Wall is raised and crudely faced in places but is generally collapsed. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.30 m by 1.20 m by 0.80 m

Comprised of piled blocky pahoehoe boulders. The cairn is centrally raised but is sloping or collapsed in profile; it is not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-333
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present. C-shape open west.

FEATURE: C-shape wall
DIMENSIONS: 2.40 m by 1.20 m

Wall measures 0.40-1.10 m wide by 0.30-0.90 m high and is comprised of stacked pahoehoe slabs, cobbles, and boulders. Wall is faced on the interior and is sloped or rounded on the exterior. The slabs are placed upright and create an overhang effect.

SITE NO: STATE: -- BPBM: -- PHRI: T-334
SITE TYPE: Linear wall (1 Feature)
TOPOGRAPHY: Aa wall on pahoehoe flow
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: No portable remains or cultural deposits present.

FEATURE: Linear wall
DIMENSIONS: 3.00 m long

Wall measures 0.40-0.70 m wide by 0.40-0.90 m high and is comprised of crudely stacked aa cobbles and boulders. It is raised and crudely faced, but collapsed in places.

SITE NO: STATE: -- BPBM: -- PHRI: T-335
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Aa and pahoehoe
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a curved wall and three cairns. Features A and B typical of curved wall/cairn alignment. No portable remains or cultural deposits present.

FEATURE A: Curved wall
DIMENSIONS: 1.85 m by 0.55 m by 0.65 m

This wall, comprised of crudely stacked aa boulders, is slightly curved and open to the west. The wall is raised but is collapsed in places, and it is not formally faced. It is curved slightly and open west.

FEATURE B: Cairn
DIMENSIONS: 0.90 m by 0.90 m by 0.40 m

Constructed of large aa cobbles and completely collapsed in appearance. No interior hole or pit is visible. Feature B is situated several meters southeast of Feature A.

FEATURES C AND D: Cairns
DIMENSIONS: 0.80-0.90 m diameter by 0.50-0.60 m high

Comprised of stacked aa cobbles and boulders.

SITE NO: STATE: -- BPBM: -- PHRI: T-336
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn contains interior hole. Cairn situated 4.00 m southwest of C-shape. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.60 m by 0.60 m

Wall measures 0.90 m wide by 1.10 m high and is comprised of stacked blocky pahoehoe boulders and slabs. Wall is faced on the interior (west side), but is sloping or rounded in profile on the exterior.

The slabs are predominately on the exterior and are, for maximum windbreak efficiency, set upright or leaned against boulders. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.50 m by 1.40 m by 0.90 m

Constructed of blocky pahoehoe boulders. The cairn is centrally raised but does not contain formally faced sides.

SITE NO: STATE: -- BPBM: -- PHRI: T-337
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Isolated feature. No visible trail on pahoehoe. No portable remains or cultural deposits present.

FEATURE: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.80 m

Comprised of angular aa slabs and boulders stacked three to four courses high. Cairn's sides are raised but are not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-338
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Sparse amounts of marine shell midden (three taxa), burnt wood, ash, and a battered waterworn cobble present. No cultural deposits present. Pahoehoe excavations also present.

FEATURE: Cave
DIMENSIONS: 6.10 m by 5.30 m by 1.27 m

Vertical opening of cave measures 2.20 by 1.10 m. A boulder pile is present below the opening and functions as a step. Shell midden present consists of Cellana spp., Thaididae, and N. picea.

SITE NO: STATE: -- BPBM: -- PHRI: T-339
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe surrounded by aa flow

VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/quarry
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn contains interior hole. Cairn is situated west of C-shape. Pahoehoe excavations and scattered waterworn cobbles also present. No marine shell midden or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.40 m by 1.10 m

Wall measures 0.80 m wide by 0.90 m high and is comprised of crudely stacked blocky pahoehoe boulders. Wall is raised and crudely faced on the interior and exterior. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.60 m by 1.30 m by 0.90 m

Comprised of crudely stacked blocky pahoehoe boulders. The cairn is centrally raised but is rounded or sloping in profile and is not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-340
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava flow, narrow flow channel crosses site.
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site is situated along a probable trail route. Site consists of a double curved wall, two cairns, and a walled overhang. One piece coral present. Features A and B typical of curved wall/cairn alignment. No cultural deposits present. Site associated with T-280 trail.

FEATURE A: Double curved wall
DIMENSIONS: 9.70 m by 2.60 m (approx.)

Wall measures 1.00-1.60 m wide by 0.45 m high and is constructed of aa and pahoehoe cobbles and boulders. Wall is collapsed and not formally faced. A short wall section, perpendicular (southwest) to the main wall approximately two-thirds from the northwest end, create the appearance of a double C-shape wall. Feature A is curved slightly and open to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.90 m by 1.80 m by 0.70 m (approx.)

Comprised of well-stacked aa and pahoehoe cobbles and boulders. The cairn is centrally raised, but its sides are slightly collapsed and are not formally faced. No interior hole or pit is visible. Feature B is situated c. 7.00 m southwest of Feature A.

FEATURE C: Walled overhang
DIMENSIONS: 6.00 m by 0.50 m by 1.40 m (approx.)

Overhang opens to the east; it is modified with a wall measuring c. 6.00 m long by 0.80 m wide located c. 1.50 m east of the entrance. The wall is parallel to the overhang opening. The overhang area is partially cleared of aa cobbles. Feature C is situated c. 15.0-20.0 m from Feature B.

FEATURE D: Cairn
DIMENSIONS: 1.20 m by 1.20 m by 0.60 m (approx.)

Comprised of well-stacked aa cobbles and boulders. The cairn is raised, but is partially collapsed on the north side, and it is not formally faced. Feature D is situated c. 30.0 m north of Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-341
SITE TYPE: Trail (1 Feature)
TOPOGRAPHY: Aa/broken pahoehoe
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation/quarry
DESCRIPTION: Isolated trail segment oriented coastal-inland. No cairns visible. Pahoehoe excavations also present in area. Segment is 0.80 m wide and c. 20.0 m long. Pahoehoe slabs use as steppingstones.

SITE NO: STATE: -- BPBM: -- PHRI: T-342
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn contains interior hole (0.20 m dia.). Cairn situated 4.00 m southwest of C-shape. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 1.50 m by 0.60 m

Wall measures 0.70 m wide by 0.60 m high and is comprised of crudely stacked angular aa and blocky pahoehoe boulders. Wall is raised, but the sides are collapsed and are not faced. C-shape opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.10 m by 1.00 m by 0.80 m

Comprised of crudely stacked angular aa and blocky pahoehoe boulders. Cairn is centrally raised, but the sides are sloping or rounded in profile.

SITE NO: STATE: -- BPBM: -- PHRI: T-343
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe broken, west of aa flow
VEGETATION: Sparse grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn contains interior hole (0.15-0.20 m dia.). Cairn is situated 3.50 m southwest of C-shape. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.30 m by 1.00 m

Wall measures 0.50 m wide by 0.45 m high and is comprised of crudely stacked aa and blocky pahoehoe cobbles and boulders. Wall is raised, but the sides are rounded or sloping in profile and are not formally faced. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.50 m by 1.20 m by 0.70 m

Comprised of crudely stacked aa and blocky pahoehoe cobbles and boulders. The cairn is centrally raised but is rounded or sloping in profile and is not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-344
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa and pahoehoe mixed
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric

FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site typical of C-shape/cairn alignment. Cairn situated 4.50 m northwest of C-shape. No portable remains or cultural deposits present.

FEATURE A: C-shape wall
DIMENSIONS: 2.35 m by 1.50 m

Wall measures 0.50 m wide by 1.10 m high and is comprised of well-stacked aa cobbles and boulders. Wall is raised but is collapsed on the north end and is not formally faced. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.40 m by 1.00 m by 0.60 m

Comprised of crudely stacked aa cobbles and boulders. Cairn is centrally raised but not formally faced. No interior hole or pit is visible.

SITE NO: STATE: -- BPBM: -- PHRI: T-345
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe surrounded by aa flow
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker (?)
DESCRIPTION: Site consists of isolated cairn.

FEATURE: Cairn
DIMENSIONS: 1.40 m by 1.30 m by 0.45 m

Comprised of crudely stacked aa slabs and medium- to large-sized cobbles. The cairn is generally sloping or rounded in profile and collapsed in appearance.

SITE NO: STATE: -- BPBM: -- PHRI: T-346
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a short linear wall segment. No artifacts or midden are present.

FEATURE: Wall
DIMENSIONS: 2.00 m by 0.60 m by 0.60 m

Constructed of medium- to large-sized aa cobbles; several slabs also used. The wall, oriented roughly north-south, is generally raised but is collapsed on the north end.

SITE NO: STATE: -- BPBM: -- PHRI: T-347
SITE TYPE: Tube (1 Feature)
TOPOGRAPHY: Rough pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: ?
FUNCTIONAL INTERPRETATION: Unknown
DESCRIPTION: Site consists of a lava tube. No visible midden or artifacts present. Entry to tube requires rope or ladder. Further investigation is necessary to establish function and verify cultural use.

SITE NO: STATE: -- BPBM: -- PHRI: T-348
SITE TYPE: Curved wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of short curved wall segment. No portable remains or deposit are present.

FEATURE: Curved wall
DIMENSIONS: 1.25 m by 0.50 m by 0.45 m

Comprised of crudely stacked small to large aa cobbles. The wall, slightly curved and open to the southwest, is oriented roughly northwest-southeast and appears collapsed.

SITE NO: STATE: -- BPBM: -- PHRI: T-349
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow at edge of aa flow
VEGETATION: Grass, large bush growing in entrance
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/rock art
DESCRIPTION: Site consists of small lava tube containing moderate amount of marine shell midden and one scoria abrader. There are two openings to the tube. Several petroglyphs are present on the surface between the entrances.

SITE NO: **STATE:** -- **BPBM:** -- **PHRI:** T-350
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Typical C-shape/cairn alignment. Cairn has a central hole 0.20 m in diameter and 0.30 m deep. Cairn is situated c. 4.0 m SW of C-shape wall.

FEATURE A: C-shape wall
DIMENSIONS: 2.10 m by 0.50 m

Wall measures 0.60 m wide by 0.80 m high and is constructed of crudely stacked aa and blocky pahoehoe boulders and cobbles. Wall sides, raised and crudely faced are collapsed in places. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.60 m by 1.50 m by 0.60 m

Constructed of piled basalt boulders. The cairn, raised slightly, appears collapsed.

SITE NO: **STATE:** -- **BPBM:** -- **PHRI:** T-351
SITE TYPE: Complex (7 Features)
TOPOGRAPHY: Small island of pahoehoe lava
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of three C-shapes, two cairns, a cave, and a linear wall. Two C-shapes and two cairns are paired in typical C-shape wall/cairn alignment; however, there are no obvious holes in cairns. Sparse amounts of marine shell midden (3 taxa) and coral are present in a 0.01 to 0.02 m thick deposit over bedrock. Several recent historic bottles noted.

FEATURE A: C-shape wall
DIMENSIONS: 2.70 m by 0.70 m

This wall, 0.90 m wide by 1.10 m high, comprised of stacked pahoehoe boulders, is raised, and the wall's interior and exterior are crudely faced. Three half-gallon clear glass bottles are present within the C-shape; two have a twist-top bottle finish.

FEATURE B: Cave
DIMENSIONS: 4.80 m by 3.10 m by 0.80 m

Cave is entered through a horizontal opening modified by several pahoehoe boulders stacked on the cave's south end. The boulders create additional overhang ceiling area. The entrance opens to the west. Sparse shell midden (Thaididae, N. picea, and Cellana spp.) and a thin deposit present.

FEATURE C: Cairn
DIMENSIONS: 1.30 m by 1.00 m by 0.60 m

Comprised of piled pahoehoe boulders. The cairn is centrally raised but is sloping or rounded in profile and is not formally faced.

FEATURE D: C-shape wall
DIMENSIONS: 2.70 m by 2.50 m

Wall measures 0.50 m wide by 0.70 m high and is comprised of crudely stacked aa cobbles and boulders. Wall is raised and crudely faced. C-shape opens to the southwest.

FEATURE E: C-shape wall
DIMENSIONS: 2.60 m by 1.80 m

Wall measures 0.50 m wide by 0.60 m high and is comprised of crudely stacked aa cobbles and boulders. Wall is raised and crudely faced. C-shape opens to the southwest.

FEATURE F: Cairn
DIMENSIONS: 1.60 m by 1.30 m by 0.70 m

Comprised of piled aa boulders. The cairn is centrally raised, but is sloping or rounded in profile and is not formally faced.

FEATURE G: Linear wall
DIMENSIONS: 2.50 m by 1.00 m by 0.65 m

Comprised of piled basalt boulders. It is collapsed in appearance and sloping or rounded in profile with no faced sides. The wall is oriented roughly north-south and is situated several meters west of the Feature B cave entrance.

SITE NO: **STATE:** -- **BPBM:** -- **PHRI:** T-352
SITE TYPE: Complex (7 Features
TOPOGRAPHY: On pahoehoe lava flow at edge of aa flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation

DESCRIPTION: Site consists of two attached rectangular enclosures, a circular enclosure, two C-shape walls, a curved wall, and a walled pahoehoe excavation. No deposit or portable remains are present.

SITE NO: STATE: -- BPBM: -- PHRI: T-353
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Aa lava flow ridge with pahoehoe flow to west and aa flow to east
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a circular enclosure with no associated portable remains or deposit.

FEATURE A: Enclosure
DIMENSIONS: 4.10 m by 4.10 m

Wall measures 0.80 m wide by 0.60 m high and is comprised of well-stacked aa cobbles and boulders. The enclosure is raised, but is not formally faced and is slightly collapsed on the interior side. The level interior area of the enclosure consists of aa pebbles and cobbles. An opening or entrance is present on the enclosure's west side.

FEATURE B: C-shape wall
DIMENSIONS: 1.60 m by 1.90 m

This well-built wall measures 0.50 m wide by 0.60 m high and is constructed of medium- to large-sized aa cobbles and slabs. The wall is raised but is slightly slumped, and its central portion is collapsed. The wall's level interior consists of aa pebbles and cobbles. C-shape opens to the west. Feature B is situated c. 25.0-30.0 m and 20 degrees Az from Feature A.

SITE NO: STATE: -- BPBM: -- PHRI: T-354
SITE TYPE: Complex (9 Features)
TOPOGRAPHY: Aa lava flow fronting a sand beach
VEGETATION: None
CONDITION: Fair
INTEGRITY: Slightly altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two C-shape walls, a platform, two leveled areas, a walled outcrop, an overhang, and a terrace. Sparse marine shell midden and pieces of coral present. Possible deposit in Feature H walled terrace.

SITE NO: STATE: -- BPBM: -- PHRI: T-355
SITE TYPE: Transportation (1 Feature)
TOPOGRAPHY: Uneven terrain
VEGETATION: Grass, various shrubs, and trees
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site consists of a 3.80 m wide curbstone trail following the contour of the slope. Causeways are constructed across low areas. Probable major trail.

SITE NO: STATE: -- BPBM: -- PHRI: T-356
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass, fern
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Site consists of an isolated cairn.

FEATURE: Cairn
DIMENSIONS: 1.10 m by 0.90 m by 0.50 m

Comprised of crudely stacked pahoehoe cobbles and boulders. It is centrally raised, but slightly collapsed on the southwest side. The cairn is not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-357
SITE TYPE: Blister Tube (1 Feature)
TOPOGRAPHY: Smooth pahoehoe lava flow
VEGETATION: Grass
CONDITION: ?
INTEGRITY: ?
PROBABLE AGE: ?
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: Site consists of a large lava tube. Opening to tube is a c. 10.00 m diameter and 8.00 to 9.00 m deep sink. Tube should be explored, but this will require ropes, ladder, etc.

SITE NO: STATE: -- BPBM: -- PHRI: T-358
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass, shrubs
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Historic

FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Site consists of two isolated cairns which appear to be recent surveyors markers.

FEATURE A: Cairn
DIMENSIONS: 1.30 m by 1.20 m by 0.50 m

Comprised of stacked medium- to large-sized cobbles. Cairn is centrally open and is doughnut-shaped. The opening measures 0.58 by 0.30 m. The cairn is raised on the interior and exterior but is not formally faced.

FEATURE B: Cairn
DIMENSIONS: 0.95 m by 0.80 m by 0.25 m

Comprised of stacked medium- to large-sized cobbles. Cairn is centrally open and shaped like a doughnut. The opening measures 0.46 by 0.37 m in area. The cairn is raised on the interior and exterior but is not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-359
SITE TYPE: Road (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass, brush
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Site consists of a historic road bed which follows contour of slope.

SITE NO: STATE: -- BPBM: -- PHRI: T-360
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Thick grass
CONDITION: Poor
INTEGRITY: Altered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Probable boundary wall
DESCRIPTION: Site consists of a poorly preserved wall segment c. 116 m long.

FEATURE: Wall
DIMENSIONS: 116.00 m by 1.40 m by 0.60 m (approx.)

Wall is extremely collapsed and is comprised of piled basalt boulders. Sides are rounded or sloping in profile. Portions are raised slightly, but no formally faced sections are visible. This wall may have functioned as an early ranch wall.

SITE NO: STATE: -- BPBM: -- PHRI: T-361
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Dense grass and brush
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Burial/habitation
DESCRIPTION: Site consists of a large lava tube containing at least six burials. Tube is part of extensive system requiring further exploration. Probable prehistoric deposit present containing marine shell midden, kukui nut, and gourd fragments.

SITE NO: STATE: -- BPBM: -- PHRI: T-362
SITE TYPE: Double C-shape wall (1 Feature)
TOPOGRAPHY: Aa lava flow structure on small cinder flat
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of two attached C-shape walls. No portable remains or deposit are present.

FEATURE: Double C-shape wall
DIMENSIONS: 3.20 m by 0.70 m

Wall measures 0.45-0.50 m wide by 0.60-0.65 m high and is comprised of well-stacked medium- to large-sized aa cobbles. The walls are raised but are not formally faced. The north compartment measures 1.55 m long by 0.70 m wide, and it opens to the west. The south compartment measures 1.65 m long by 0.65 m wide, and it opens to the southwest.

SITE NO: STATE: -- BPBM: -- PHRI: T-363
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation/tool preparation
DESCRIPTION: Site consists of two caves formed at the edge of a pahoehoe depression. Marine shell midden, bone, and sea urchin remains are scattered over the bedrock floor of the caves. One waterworn stone and two abraded depressions are present in Feature B.

SITE NO: STATE: -- BPBM: -- PHRI: T-364
SITE TYPE: Abraded depressions (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Tool preparation/quarry
DESCRIPTION: Site consists of numerous abraded depressions and areas of probable quarrying activity.

SITE NO: STATE: -- BPBM: -- PHRI: T-365
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical curved wall/cairn alignment. Cairn has a central hole. Cairn is located 4.00 m southwest of curved wall. No portable remains or deposit are present.

FEATURE A: C-shape wall
DIMENSIONS: 2.55 m by 1.00 m

Wall measures 0.60 m wide by 0.70 m high and is comprised of crudely stacked medium- to large-sized cobbles. Wall is raised but is not formally faced and is collapsing on the interior. C-shape opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.70 m by 1.40 m by 0.70 m

Comprised of crudely stacked medium- to large-sized cobbles. Cairn is raised but not formally faced and is slightly collapsed on the north and east sides. Central hole measures 0.15 by 0.15 m. Several abraded basins are also present between Features A and B.

SITE NO: STATE: -- BPBM: -- PHRI: T-366
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow and cinder area
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical curved wall and cairn alignment. Cairn has a central hole. Cairn is located 4.80 m southwest of curved wall. No portable remains or deposit are present.

FEATURE A: Curved wall
DIMENSIONS: 2.50 m by 0.90 m by 0.55 m

This wall, curved slightly and open to the west, is comprised of crudely stacked medium to large cobbles and small boulders. The wall is raised slightly but is not formally faced, and it appears collapsed or slumped. One Thaididae shell and waterworn cobble present.

FEATURE B: Cairn
DIMENSIONS: 1.10 m by 0.80 m by 0.55 m

Comprised of crudely stacked medium- to large-sized cobbles. Cairn is centrally raised but is not formally faced, and it is collapsed on the north side. Central hole measures 0.15 by 0.10 m in area.

SITE NO: STATE: -- BPBM: -- PHRI: T-367
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Quarry/tool preparation
DESCRIPTION: Site consists of a large depression with extensive areas of excavation/quarrying activity. Numerous abraded depressions are located on the surfaces near the depression. No portable remains or deposit noted.

SITE NO: STATE: -- BPBM: -- PHRI: T-368
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass, Indian Pluchea growing inside wall
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a wall segment and shallow cave. No portable remains or deposit present.

FEATURE A: L-shape wall
DIMENSIONS: 0.95 m by 0.80 m long

The wall's major axis is oriented roughly northeast-southwest and measures 3.70 long. It is raised, but not formally faced and slightly collapsed at the intersection of the two walls. The wall abuts adjacent bedrock at each end. Sparse Cellana spp. and Thaididae shell are present.

FEATURE B: Cave
DIMENSIONS: 15.00 m by 4.00 m by 1.10 m (approx.)

Contains sparse Cellana spp. and Thaididae marine shell midden.

SITE NO: STATE: -- BPBM: -- PHRI: T-369
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of an isolated C-shape wall. No portable remains or deposit present.

FEATURE: C-shape wall
DIMENSIONS: 1.15 m by 1.00 m by 0.00 m

Wall measures 0.40 m wide by 0.50 m high and is constructed of medium- to large-sized cobbles and small boulders. Wall is raised but is not formally faced and is collapsed on the northwest side. C-shape opens to the southwest.

SITE NO: STATE: -- BPBM: -- PHRI: T-370
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Smooth pahoehoe lava flow
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape wall and cairn alignment. Cairn has a central hole. Cairn is located 6.0 m west of C-shape wall. No portable remains or deposit present.

FEATURE A: Curved wall
DIMENSIONS: 1.80 m by 0.80 m by 0.80 m

Comprised of crudely stacked rough/broken pahoehoe boulders. The wall is raised but is not formally faced, and it is collapsed in appearance. Wall is oriented roughly north-south, curves slightly, and is open to the west.

FEATURE B: Cairn
DIMENSIONS: 1.00 m by 1.00 m by 0.80 m

This cairn roughly round and comprised of piled blocky pahoehoe boulders, is centrally raised but is not formally faced, and it is

sloping or rounded in profile. Central hole measures 0.10 m in diameter by 0.40 m deep.

SITE NO: STATE: -- BPBM: -- PHRI: T-371
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Smooth pahoehoe surrounded by broken pahoehoe
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Trail Marker
DESCRIPTION: Site consists of an isolated cairn.

FEATURE: Cairn
DIMENSIONS: 0.90 m by 0.70 m by 0.40 m

Comprised of piled blocky pahoehoe boulders and cobbles. Cairn is centrally raised but is not formally faced, and it is collapsed on the east side. Cairn may mark a trail, but no trail was visible on the pahoehoe bedrock.

SITE NO: STATE: -- BPBM: -- PHRI: T-372
SITE TYPE: Complex (2 Features
TOPOGRAPHY: Smooth pahoehoe lava flow
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape wall and cairn alignment. Cairn has a central hole, and is located 5.0 m west of C-shape wall. No portable remains or deposit present.

FEATURE A: C-shape wall
DIMENSIONS: 2.70 m by 1.50 m by 0.80 m

Comprised of piled blocky and broken pahoehoe boulders and cobbles. Wall is raised but appears generally collapsed. Wall is sloping or rounded in profile and has no formally faced sides.

FEATURE B: Cairn
DIMENSIONS: 1.50 m by 1.50 m by 0.80 m

Comprised of piled blocky pahoehoe boulders. Cairn is centrally raised but is not formally faced, and it is generally rounded or sloping in appearance. Central hole measures 0.15-0.20 m in diameter by 0.60 m deep.

SITE NO: STATE: -- BPBM: -- PHRI: T-373
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape wall and cairn alignment. Trail leads to site. Cairn has a central hole and is located c. 5.00 m west of C-shape wall. No portable remains or deposit present.

FEATURE A: C-shape wall
DIMENSIONS: 2.50 m by 0.60 m

Wall measures 0.70 m wide by 0.50 m high and is comprised of stacked upright slabs that create a faced interior (west side). On the exterior are slabs leaning against each other creating a wall profile that is rounded or sloping. C-shape opens to the west.

FEATURE B: Cairn
DIMENSIONS: 1.50 m by 1.50 m by 0.70 m

Comprised of piled blocky pahoehoe boulders and slabs. Cairn is centrally raised; sides are rounded or sloping in profile and are not formally faced.

FEATURE C: Trail
DIMENSIONS: 50.00 m long

Trail measures 0.50-0.70 m wide and consists of crushed aa cobbles. It connects two pahoehoe bedrock areas and is visible only on the aa lava flow.

SITE NO: STATE: -- BPBM: -- PHRI: T-374
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Smooth pahoehoe lava pocket surrounded by aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape wall and cairn alignment. Cairn has central hole and is located 4.00 m west of C-shape wall. No portable remains or deposit present.

FEATURE A: C-shape wall
DIMENSIONS: 2.50 m by 0.80 m

Wall measures 0.50 m wide by 0.45 m high and is comprised of blocky pahoehoe boulders piled (in order to utilize the 0.80 m high bedrock as a windbreak) on the edge of a pahoehoe flow. The wall is raised slightly but appears sloping or collapsed. It is not formally faced. C-shape opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.00 m by 1.00 m by 0.55 m

Roughly oval and comprised of piled blocky pahoehoe boulders. The cairn is centrally raised, but its sides appear sloping or collapsed. Interior hole measures 0.15 m in diameter by 0.50 m deep.

SITE NO: STATE: -- BPBM: -- PHRI: T-375
SITE TYPE: C-shape (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of isolated C-shape wall. No portable remains or deposit present.

FEATURE: C-shape wall
DIMENSIONS: 2.10 m by 0.70 m

Wall measures 0.55 m wide by 0.60 m high and is comprised of stacked medium to large cobbles. Wall is raised but is collapsed on the north side; the wall is not formally faced. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-376
SITE TYPE: Curved wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of curved wall segment. Open [illegible] southwest. No portable remains or deposit present.

FEATURE: Curved wall
DIMENSIONS: 2.10 m by 0.80 m by 0.50 m

Constructed of medium to large-sized cobbles. Wall is raised slightly but is for the most part extremely collapsed in appearance.

The wall, curved slightly and open to the southwest, is oriented roughly northwest-southeast. One Cellana sp. shell present.

SITE NO: STATE: -- BPBM: -- PHRI: T-377
SITE TYPE: C-shape wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of isolated C-shape wall. No portable remains or midden present

FEATURE: C-shape wall
DIMENSIONS: 2.40 m by 1.00 m

Wall measures 0.70 m wide by 0.45 m high and is constructed of large slabs. Wall is generally collapsed in appearance, especially on the north end. C-shape opens to the west.

SITE NO: STATE: -- BPBM: -- PHRI: T-378
SITE TYPE: C-shape (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape wall and cairn alignment. No central hole in cairn is visible. Cairn is situated 4.00 m southwest of C-shape. No portable remains or deposit present.

FEATURE A: C-shape wall
DIMENSIONS: 2.40 m by 1.10 m

Wall measures 0.75 m wide by 1.05 m high and is comprised of well-stacked cobbles and boulders. Wall is raised but is collapsed in places and is not formally faced. C-shape opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.80 m by 1.80 m by 0.70 m (approx.)

Comprised of stacked medium- to large-sized cobbles. The cairn is centrally raised but slightly collapsed in places.

SITE NO: STATE: - BPBM: PHRI: T-379
SITE TYPE: Cave (1 Feature)

TOPOGRAPHY: Small depression in broken pahoehoe lava flow
VEGETATION: None
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Site consists of a small cave containing moderate amounts of marine shell midden scattered over bedrock. No artifacts observed.

SITE NO: STATE: -- BPBM: -- PHRI: T-380
SITE TYPE: Wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Grass
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a short wall segment. No portable remains or deposit present.

FEATURE: Wall
DIMENSIONS: 1.40 m by 0.35 m by 0.20-0.30 m (approx.)

Constructed of small- to medium-sized cobbles. The wall is extremely collapsed in appearance and is oriented roughly north-south.

SITE NO: STATE: -- BPBM: -- PHRI: T-381
SITE TYPE: Cave (1 Feature)
TOPOGRAPHY: Aa and pahoehoe lava flow interface
VEGETATION: None
CONDITION; Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a small cave containing a very sparse scatter of marine shell midden (1 taxon).

FEATURE: Cave
DIMENSIONS: 5.00 m by 3.00 m by 0.80 m (approx.)

Horizontal entrance measures 0.80 m wide by 0.80 m high and opens to the south. Sparse Cellana spp. shell present.

SITE NO: STATE: - BPBM: - PHRI: T-382
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Older aa lava flow surrounded by more recent aa lava
VEGETATION: Grass
CONDITION: Good
INTEGRITY: Unaltered

PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape wall and cairn alignment. Cairn has a central hole and is located 5.0 m southwest of C-shape wall. No portable remains or deposit present.

FEATURE A: C-shape wall
DIMENSIONS: 2.10 m by 0.80 m

Wall measures 0.60 m wide by 0.95 m high and is comprised of well-stacked medium- to large-sized cobbles. Wall is raised but is collapsed on both ends, and it is not formally faced. C-shape opens to the southwest.

FEATURE B: Cairn
DIMENSIONS: 1.30 m by 1.10 m by 0.60 m

Constructed of small to large size cobbles. The cairn is centrally raised but is slightly collapsed in places, and it is not formally faced. Central hole measures 0.15 by 0.15 m in area.

SITE NO: STATE: -- BPBM: -- PHRI: T-383
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow channel
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Site consists of cairn situated along a lava flow channel.

FEATURE: Cairn
DIMENSIONS: 0.50 m by 0.50 m by 0.65 m

Comprised of rough/broken pahoehoe boulders stacked on bedrock. The cairn is centrally raised but is not formally faced. Cairn possibly marks trail within lava flow channel, but no trial was visible on the smooth pahoehoe bedrock. Sites T-383 and T-384 are both situated along a lava flow channel.

SITE NO: STATE: -- BPBM: -- PHRI: T-384
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow channel
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Site consists of isolated cairn along lava flow channel. No portable remains or deposit.

FEATURE: Cairn
DIMENSIONS: 0.50 m by 0.40 m by 0.40 m

Comprised of rough/broken pahoehoe boulders and slabs stacked on bedrock. The cairn is centrally raised but is not formally faced. Cairn possibly marks trail within lava flow channel, but no trail visible on smooth pahoehoe bedrock.

SITE NO: STATE: -- BPBM: -- PHRI: T-385
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: None
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of typical C-shape wall and cairn alignment. Possible central hole in cairn which is situated 4.00 m southwest of C-shape wall.

FEATURE A: Curved wall
DIMENSIONS: 3.00 m long by 0.70 m high

Wall measures 0.60-0.80 m wide and is comprised of crudely stacked blocky pahoehoe boulders. Wall is raised but collapsed on the southeast end and not formally faced. The wall is curved slightly and open southwest. A waterworn boulder is present nearby.

FEATURE B: Cairn
DIMENSIONS: 1.40 m by 1.40 m by 0.65 m

Roughly oval and comprised of piled blocky pahoehoe boulders, several of which measure 0.30 by 0.60 m in size. The cairn is centrally raised; the sides appear generally collapsed and are not formally faced.

SITE NO: STATE: -- BPBM: -- PHRI: T-386
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Aa lava flow
VEGETATION: None
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transport/recreation/temporary habitation
DESCRIPTION: Trail segment through site is a portion of the [illegible] to Pohue Bay. Upright waterworn cobble (possibly a shrine), a marker, and two cairns present, but they were not assigned feature designations.

SITE NO: STATE: -- BPBM: -- PHRI: T-387
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe kipuka, surrounded by aa flow
VEGETATION: Grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Cairn probably marks a trail route.

FEATURE: Cairn
DIMENSIONS: 2.00 m by 1.70 m by 0.55 m

Constructed of aa cobbles and boulders. The cairn is centrally raised but is slightly collapsed in places and is not formally faced. No interior hole present.

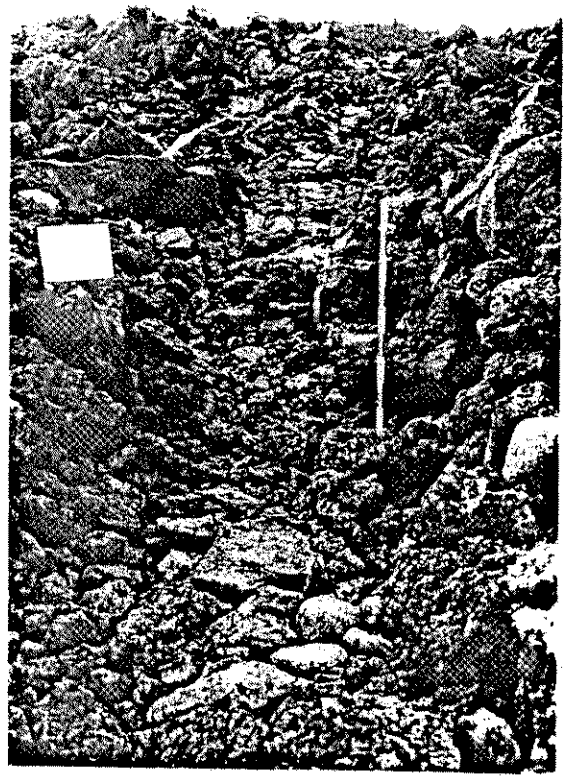

Photo 1. SITE T-102, FEATURE A. COASTAL FOOT TRAIL. View to east. (PHRI Neg. 572-33)

Photo 2. SITE T-107. PAPAMI BOARD. View to north. (PHRI Neg. 572-13)

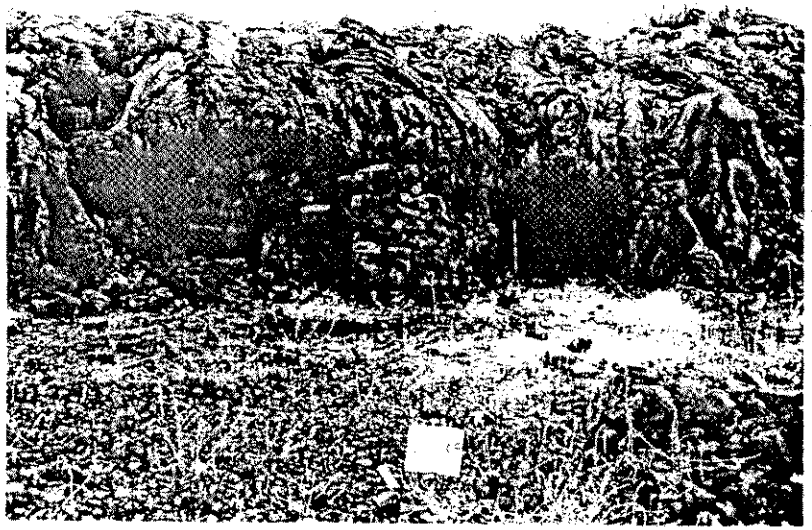

Photo 3. SITE T-109, FEATURE A. WALLED OVERHANG. View to north. (PHRI Neg. 578-11a)

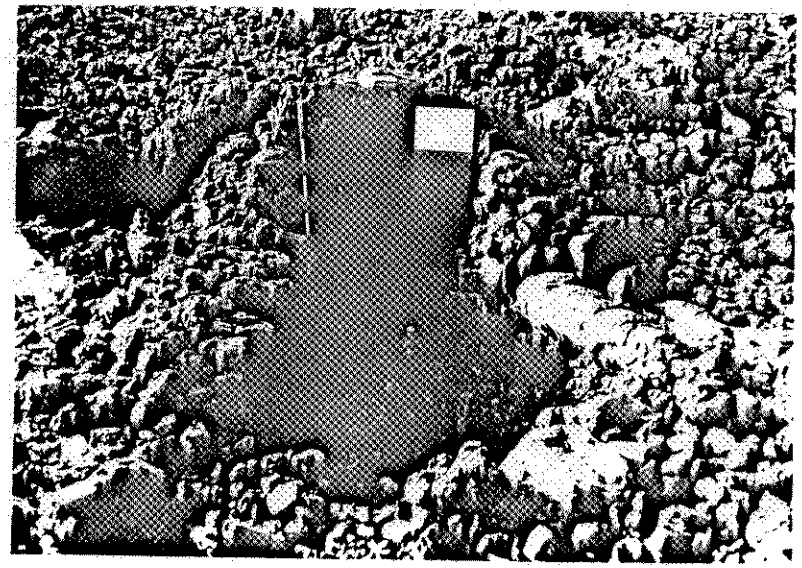

Photo 4. SITE T-121, FEATURE E. WALLED DEPRESSION. View to east. (PHRI Neg. 579-11)

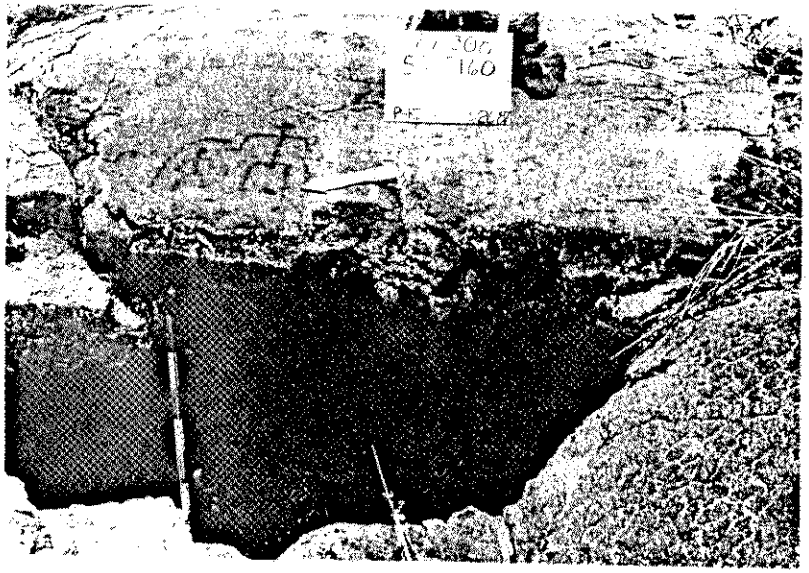

Photo 5. SITE T-160. CAVE ENTRANCE AND PETROGLYPHS. View to east. (PHRI Neg. 585-27)

Photo 6. SITE T-169. PLATFORM. View to northwest. (PHRI Neg. 585-8)

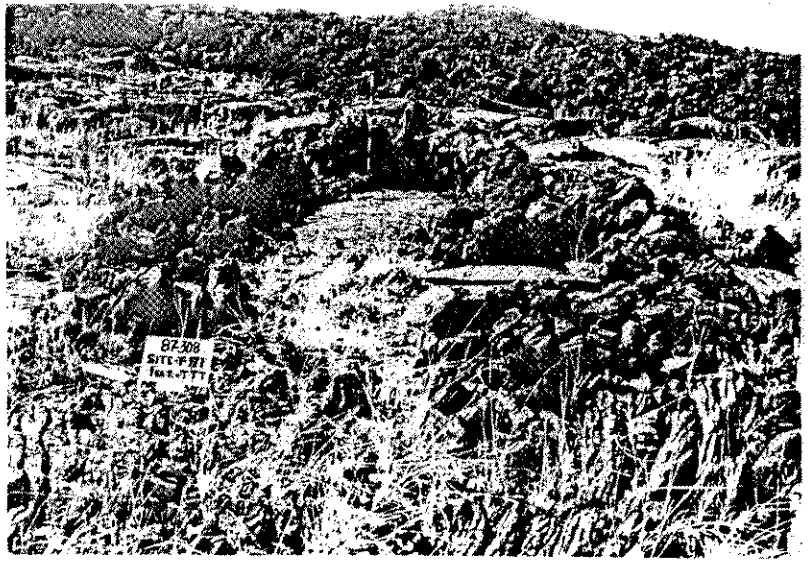

Photo 7. SITE T-171, FEATURE TTT. C-SHAPE WALL. View to east. (PHRI Neg. 587-0a)

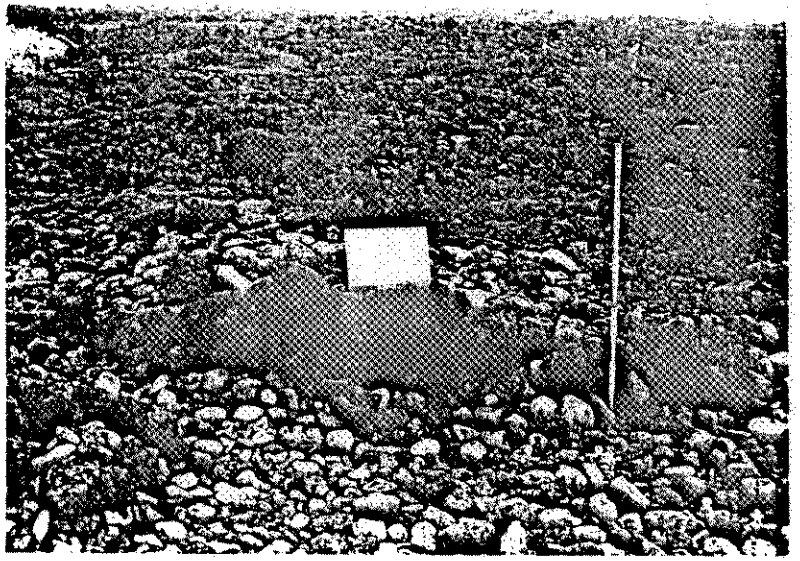

Photo 8. SITE T-183. PLATFORM. View to northeast. (PHRI Neg. 583-28a)

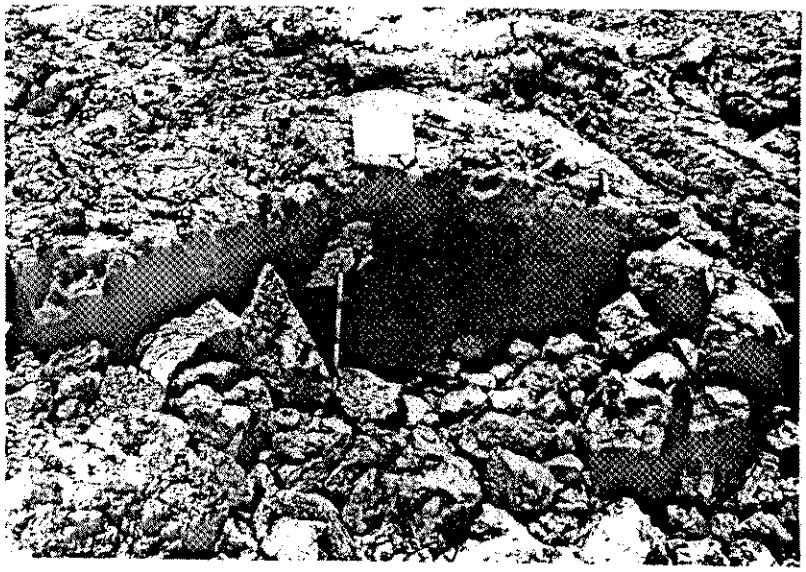

Photo 9. SITE T-190. WALLED OVERHANG. View to north. (PHR) Neg. 582 13a)

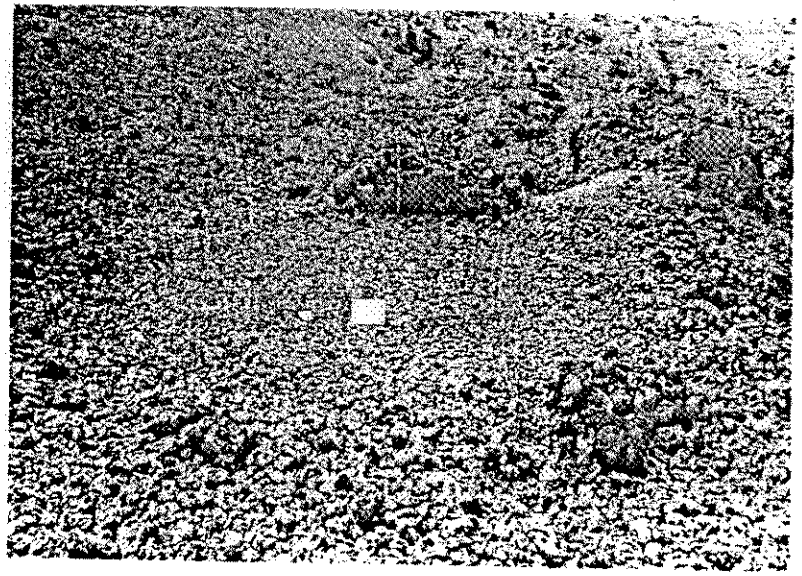

Photo 10. SITE T-196, FEATURE E AND F. C-SHAPE WALL AND CAIRN. View to southeast. (PHR) Neg. 582-10a)

Photo 11. SITE T-224, FEATURE C. C-SHAPE WALL. View to east. (PBRI Neg. 574-26a)

Photo 12. SITE T-224, FEATURE Z. CIRCULAR ENCLOSURE. View to west. (PBRI Neg. 576 15)

Photo 13. SITE T-227, FEATURE A. U-SHAPE ALIGNMENT. View to northeast. (PHRI Neg. 572-5)

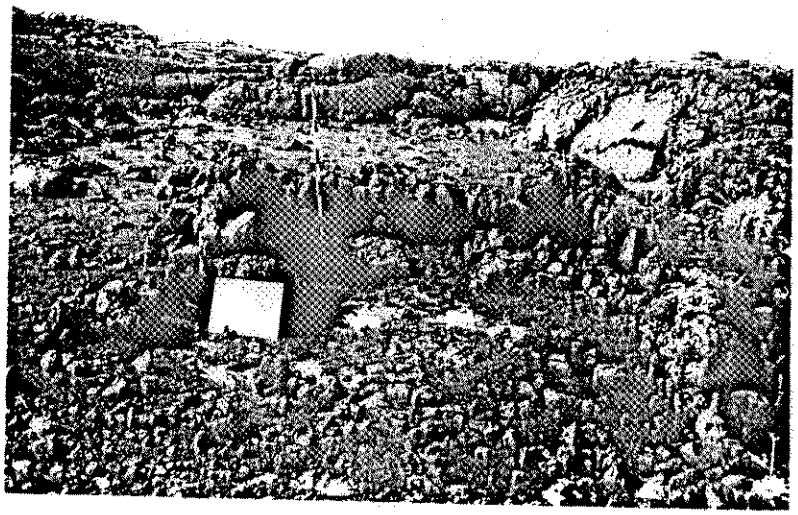

Photo 14. SITE T-239, FEATURE D. C-SHAPE WALL. View to south. (PHRI Neg. 575-11)

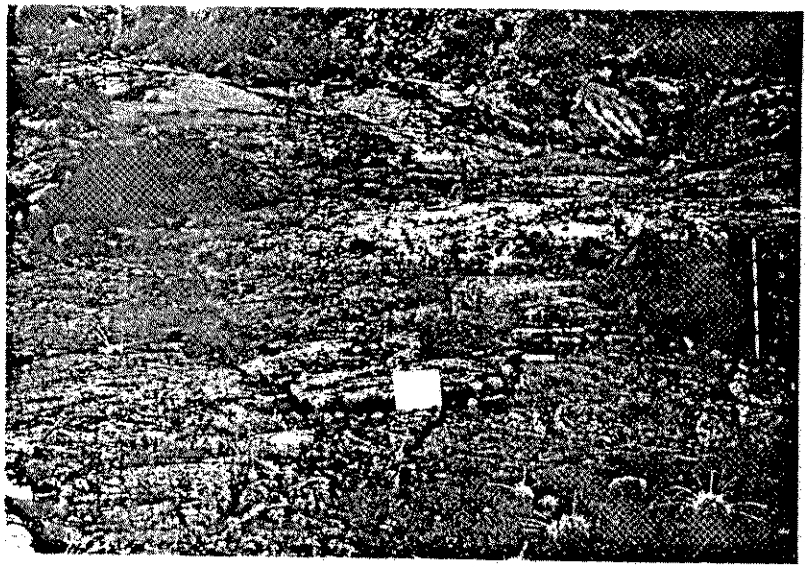

Photo 15. SITE T-251, FEATURES A AND B. C-SHAPE WALL AND CAIRN. View to east. (PHRI Neg. 572-9)

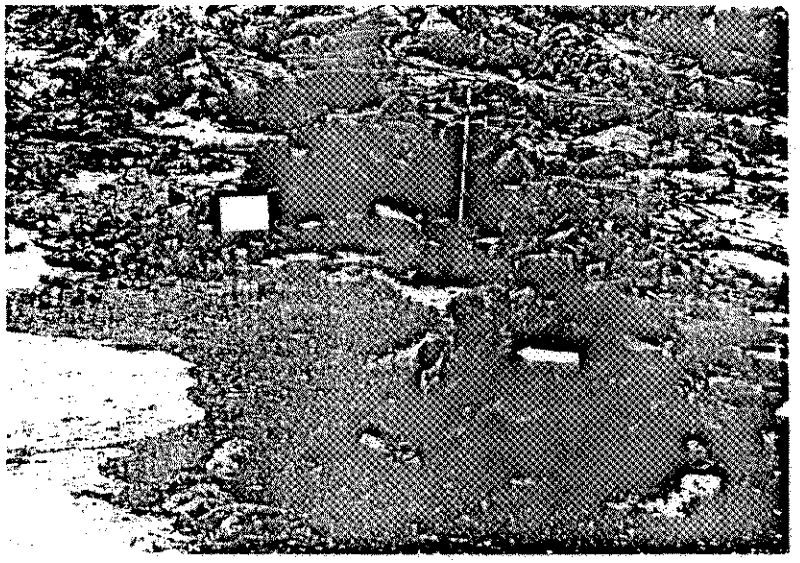

Photo 16. SITE T-314, FEATURES A AND B. C-SHAPE WALL AND CAIRN. View to east. (PHRI Neg. 581-18)

APPENDIX D:
HISTORICAL DOCUMENTARY RESEARCH

by

Carol L. Silva, B.A.

It is the intent of this research effort to identify and examine immediately available sources for information relative to the project area. Toward this end, a sampling of traditional, cultural, and historical data has been assembled from the writing of native historians, descriptive accounts, land records, and cartographic sources.

In an effort to foster a proper, clearer perspective of the specific project site in terms of the whole Kahuku land area, general historical information relative to Kahuku precedes data detailing TMK:3-9-2-01:72. It is thus hoped that this historical background will serve as a suitable context from which the project site can be better perceived.

TRADITIONAL REFERENCES TO THE KAHUKU AREA

As Kahuku is situated a little south of the boundary separating South Kona from Kau, many of its traditions are intertwined with those of Kona.

Many, many generations before Kamehameha (when civil strife among the chiefs of each district was rampant), there lived a chief of Kona named Ehu. A notable contribution of Ehu's rule was a road which he constructed "from the uplands of Kona into Kau which is called the way of Ehu" (Kamakau 1961:429).

Ehu and the blind Kau chief Imaikalani were both overpowered by Umialiloa, who used these upland paths to his advantage strategically. Umialiloa apparently preferred the protection the uplands afforded to an obvious approach by sea. Kamakau noted:

> ...In former days Imaikalani was not blind, and Umi was never able to take Kau. The war lasted a long time. Umi went by way of the mountains to stir up a fight with Imaikalani and the chiefs of Kona. He became famous as a chief who travelled through the mountains of Hawaii, and [its trails] became the routes by which he went to war (Kamakau 1961:18).

Some time after Umialiloa had conquered the districts of Hawaii, he was visited by Kihaapiilani. This Maui chief sought Umi's support in

recovering control of a portion of Maui from his own brother Lonoapiilani. The native historian S.M. Kamakau wrote:

> Lonoapiilani heard that Kihaapiilani was on Hawaii, and that war canoes were being built there in great numbers. The kauila wood of Napuu and Kahuku, the oā and koaie were being made into clubs to be used against Maui. When the news of impending war reached him and his warrior chiefs, they trembled with fear.
>
> A whole year of the making of canoes and war implements went by, and all of the warriors were well supplied. There was no war prior to that time to compare with this one, in which there were so many canoes. The first ones reached Hana, Maui while the last ones were still on Hawaii (Kamakau 1961:28-29).

Needless to say Umi and Kihapiilani were victorious.

Upon Umialiloa's death, his kingdom was divided in two and descended to his sons Keawenuiaumi and Keliiokaloaaumi. Keawenui chose Hilo as the seat of the Hilo half of the kingdom while Keliiokaloa settled in Kailua and ruled his half from that location. Regarding these brothers, Kamakau related the following:

> When Keawenuiaumi learned of the unjust rule of Keliiokaloa and the burdening of the common people, he was filled with compassion for the chiefs and commoners of Kona. Therefore he made himself ready with his chiefs, war lords, war leaders, and warriors from Hilo, Puna, and Kau to make war on Kona. The war parties [met?] at the volcano (pit of Pele) before going on to battle along the southern side of Mauna Kea and the northern side of Mauna Loa. The mountain road lay stretched on the level. At the north flank of Hualalai, before the highway, was a very wide, rough bed of lava barren, waterless, and a desert of rocks. It was a mountain place familiar to Umialiloa when he battled against the chiefs of Hilo, Kau, and Kona. There on that extensive stretch of lava stood the mound (ahu), the road, the house, and heiau of Umi. It was through there that Keawenuiaumi's army went to do battle against his older brother, Keliiokaloa.
>
> When the chiefs of Kona heard that those of Hilo were coming by way of the mountain to do battle, Keliiokaloa sent his armies, but they were defeated by the armies from Hilo. The armies of Kona were put top flight. When the armies of Hilo reached the shore of Kona the war canoes arrived from Kau and from Hilo. The battle was [both] from the upland and from the sea. Keliiokaloa fled and was killed on a lava bed... (Kamakau 1961:35-6).

These sites--the mound, road, house and heiau fall within the ancient upland boundaries of Kahuku and were frequently referred to by native informants testifying before the Boundary Commission.

In summary, it can be said that Kahuku was characterized in tradition as having upland routes which served chiefs such as Ehu and Umi in gaining and maintaining control over Kau and Kona. Its wooded areas were also an excellent primary resource; particular kinds of wood from this district were fashioned into war weapons. Finally, Kahuku sites connected with Umi were also familiar to his son during his own conquests and were visible until the last century perhaps when lava flows covered much of the terrain.

HISTORICAL REFERENCES TO THE KAHUKU AREA

Preliminary examination of historic documents revealed few references to Kahuku Ahupuaa. The earliest reference is by Archibald Menzies, botanist on the Vancouver Expedition (1790-1795). As he travelled from South Kona to Kau in 1794 enroute to Mauna Loa, Menzies stopped at Manuka, the first coastal village he encountered in Kau, and then continued his trip by canoe to Pakini. He described the coastline between Manuka and Pakini as:

> a dreary rugged tract composed of black porous rock of lava forming here and there grotesque arches, vaults and deep caverns into which the sea pushes in by the violence and agitation of the waves with great force, and frequently gushes up again several yards inland through chinks and crevices with a hissing noise in the form of fountains...(Menzies 1920:180).

According to Menzies, local travel from the west to Pakini was generally by canoe. From Pakini, travellers continued their journey on foot (Sinoto and Kelly 1975:84).

By the time of Cook's arrival, Chief Kalaniopuu had assumed the rule of the island of Hawaii. Upon his death, his nephew Kamehameha is entrusted with the war god Kukailimoku. In honor of his god, Kamehameha constructed numerous heiau--one of his greatest being Puukohola at Kawaihae:

> As soon as the heiau was completed, just before it was declared free, Kamehameha's two counselors, Keaweaheulu and Kamanawa, were sent to fetch Keoua, ruling chief of the eastern end of the island of Hawaii. These two men were skilled in preparing a dose of the slippery hau sap and the uhi root; they knew well how to use cunning and deceitful speech. Keoua was living in Kau mauka in Kahuku with his chiefs and the warriors of his guard. Keaweaheulu and his companion landed at Kailikii and began the ascent of Kahehawahawa along the plains of Keekeekai. Close to the extreme edge of the tabu enclosure of Keoua's place the two got down and rolled in the dirt and began to weave their nets of speech. Keoua's people nodded at each other, and Kaieiea said to Keohua, "It will be a good thing to kill these counselors of Kamehameha." Keoua

> answered, "They must not be killed for they are younger brothers of my father." Kaieiea went on, "If these are killed he will have but two counselors left, and the government will become yours." "I cannot kill my uncles." The two messengers rolled along in the dirt until they came to the place where Keoua was sitting, when they grasped his feet and wept. When the weeping was over Keoua asked, "What is your errand?" Keaweheaheulu answered, "We have come to fetch you, the son of our lord's older brother, and to take you with us to Kona to meet your younger cousin, and you two to be our chiefs and we to be your uncles. So then let war cease between you." "I consent to go with you to Kona," answered Keoua (Kamakau 1961:155).

Keoua became Kamehameha's sacrifice at Puukohola, despite all entreaties by his counselors to kill the messengers and to "return by the mountain" to his sacred residence in Kahuku, Kau.

After Kamehameha's conquest of the Island chain, he eventually retired to Kailua, Kona where he engaged in farming and fishing. Kamakau listed Pohue in Kahuku among his favorite spots for ahi fishing:

> Fishing was the occupation of Kamehameha's old age at Kailua. He would often go out with his fishermen to Kekaha off Kaelehuluhulu and when there had been a great catch of aku or ahi fish he would give it away to the chiefs and people, the cultivators and canoe makers. If word was brought that ahi were plentiful at Kalae off went the chief to the ahi fishing, and he fished also at Kaulana, Kailikii, Pohue, Napuuopele, Kapalilua, and at other places along the coast. During the season for flying fish he would sail to Kohala where the big schools ran and dispose of his catch to the cultivators of Kohala, Waimanu, and Waipio. Kamehameha made a crafty bargain with the cultivators to give a single fish for a single bundle of pounded taro (pai ai) or a calabash of poi, and so on. The cultivators lost on this, so they sought a way to get even with him, and wrapped up a single taro in bundle and gave it to him for a single fish. Kamehameha said, "If the fisherman drives a crafty bargain, why should not the planter retort upon him? One cannot long play a one-sided game." (Kamakau 1961:203-4) The above anecdote is commemorated in the saying:
>
> Kahuku kau 'ao'ao.
> One-sided Kahuku.
>
> One-sided Kahuku refers to Kahuku, Kau. At one time, Kamehameha I made a bargain with some farmers to exchange poi for fish. A konchiki of Kahuku named Kaholowaho took huge calabashes of poi to the chief, who gave him one small fish in return. Kaholowaho tied the fish to one end of a carrying stick to show his neighbors what the chief had done. After several such exchanges, Kaholowaho brought Kamehameha a small taro in a big container. When the chief saw the taro he laughed, and from then on he played fair. The fish tied to one side of the carrying stick produced the saying, "One sided Kahuku" (Fukui 1983:144).

Not only was Kahuku mentioned historically as Keoua's residence and a spot for fishing and the exchange of taro; it becomes known for other things as well.

Natives of Kahuku and the immediate vicinity who were born at the turn of the 1800s presented valuable testimony in determining the ancient boundaries of Kahuku district. These informants were seriously aware of these boundaries as they discovered that whatever they had obtained outside of these boundaries was quickly confiscated and handed over to the konohiki of the respective district. Testimonies reflected much activity--bird catching in the uplands for the uwao and nene, collecting of sandalwood, felling of timber for carpentry from the koa woods, goat-catching, gathering of fern pulu, etc.,. One aged canoe-maker commented:

> ...In ancient days the people of Kahuku did not go fishing, but were after birds of all kinds to eat and this is the reason all the land on the mountain belonged to Kahuku. My Makuaponoi and others always took their weapons with them as they used to have fights, when they found people from other lands catching birds. The sandalwood belonged to Kahuku; there was none in Kona except on Kapua, and when the other Kona people came on Kahuku after it the Kahuku people would take it away...

Waterholes, shelter caves, heiau connected with Umi and Ehu and scattered clusters of house sites are mentioned as landmarks along the boundaries. One informant stated that at one time uhu was the taboo fish for the district and koa was the taboo wood. Mamo and oo birds apparently flourished in the upland woods. Several informants mention that Kamehameha III travelled to Kahuku and in 1835 a tax or tribute of mamo feathers was given to him at the boundary between Manuka and Kahuku.

Roads and trails associated with Ehu and Umi were spoken of; one trail lead from the uplands and was used to haul tree trunks which were earmarked for canoes.

The detail contained within these testimonies was nearly beyond belief; natives to protect their rights had painstakingly memorized each landmark pointed out by a grandparent or an uncle. It is somewhat regretful that many of these landmarks may have disappeared under the flow of lava, however the resources available and the land uses which were described from ancient times hold much significance.

In 1823, Rev. William Ellis jotted down the following impressions of the Kau district. He described the upland area especially, which I believe was probably characteristic of what existed throughout the higher elevations in Kahuku. (The verdancy and cultivation he observed is confirmed, as will later be shown, by the land documents of the 1840s and 50s.)

> The division of Kau commences at Kaulanamauna, runs down to the south point of the island, and stretches about forty miles along the southeast shore. On entering it, the same

> gloomy and cheerless desert of rugged lava spread itself in every direction from the shore to the mountains. Here and there at distant intervals they passed a lonely house, or a few wandering fishermen's huts, with a solitary shrub, or species of thistle, struggling for existence among the crevices in the blocks of scoriae and lava. All besides was "one vast desert, dreary, bleak, and wild."
>
> In many places all traces of a path entirely disappeared; for miles together they clambered over huge pieces of vitreous scoriae, or rugged piles of lava, which, like several of the tracts they had passed in Kona, had been tossed in its present confusion by some violent convulsion of the earth.
>
> From the state of the lava covering that part of the country through which we have passed, we should be induced to think that eruptions and earthquakes had been, almost without exception, concomitants of each other; and the shocks must have been exceedingly violent, to cause what we every where beheld.
>
> Slabs of lava, from nine to twelve inches thick, and from four to twenty or thirty feet in diameter, were frequently piled up edgewise or stood leaning against several others piled up in a similar manner. Some of them were six, ten, or twelve feet above the general surface fixed in the lava below, which appeared to have flowed round their base, and filled up the interstices occasioned by the separation of the different pieces.
>
> One side of these rugged slabs generally presented a compact, smooth, glazed, and gently undulated surface, while the other appeared rugged and broken, as if torn with violence form the viscid mass to which it had tenaciously adhered. Probably these slabs were raised by the expansive force of the heated air beneath the sheet of lava...
>
> Hitherto we had travelled along the seashore, in order to visit the most populous villages in the districts which we had passed. But here receiving information that we should find more inhabitants a few miles inland, than nearer the sea, we thought it best to direct our course towards the mountains.
>
> Makoa, our guide, procured men to carry our baggage, and at nine a.m. we left Tairitii. Our way lay over a bed of ancient lava, smooth, considerably decomposed, and generally covered with a thin layer of soil. We passed along the edge of a more recent stream of lava, rugged, black, and appalling in its aspect, compared with the tract we were walking over, which here and there showed a green tuft of grass, a straggling shrub, or a creeping convolvulus.
>
> Tramping along the Kahuku Bluff.

After travelling about a mile, we reached the foot of a steep precipice. A winding path led to its top, up which we pursued our way, occasionally resting beneath the shade of huge overhanging rocks. This precipice is about three hundred feet high, and the rocks on fracture proved a dark grey kind of lava, more compact than that on the adjacent plain.

The whole pile appears to have been formed by successive eruptions from some volcano in the interior, as there appeared to be a thin layer of soil between some of the strata, or different inundations, which we supposed was produced by the decomposition of the lava on the surface of the lower stratum, before overflowed by the superintendence mass.

The rocks appeared to have been rent in a line from the seashore towards the mountains, and probably the same convulsion which burst the rocks asunder, sunk the plain to its present level...

In half an hour we reached its summit. A beautiful country now appeared before us, and we seemed all at once transported to some happier island, where the devastations attributed to Nahoaarii, and Pele, deities of the volcanoes, had never been known.

The rough and desolate tract of lava, with all its distorted forms, was exchanged for the verdant plain, diversified with gently rising hills, and sloping dales, ornamented with shrubs, and gay with blooming flowers. We saw, however, no stream of water during the whole of the day; but, from the luxuriance of the herbage in every direction, the rains must be frequent or the dews heavy.

About noon we reached Kalehu, a small village, upwards of four miles from Tairitii. The kind cottagers brought us some fine watermelons, which afforded us a grateful repast while we rested during the heat of the noonday sun.

Between sixty and seventy persons collected around the house in which we were sitting, and as I was so far recovered as to be able to preach, I addressed them from Matt. i. 21...We remained about an hour, conversing on some of the first principles of the religion of Jesus Christ, and then resumed our journey over the same beautiful country, which was partially cultivated, and contained a numerous, though scattered, population.

The prospect was delightful. On one hand the Pacific dashed its mighty waves against the rocky shore, and on the other, the kuahivi (mountain ridges) of Kau, and snow-cap'd Mauna Loa, rose in the interior, with lofty grandeur...

The path led us through several fields of mountain taro (a variety of the arum), a root which appears to be extensively cultivated in many parts of Hawaii. It was growing in a dry sandy soil, into which our feet sank two or three inches every step we took. The roots were of an oblong shape, generally from ten inches to a foot in length, and four or six inches in diameter. Seldom more than two or three leaves were attached to a root, and those of a light green colour, frequently blotched and sickly in their appearance. The inside of the root is of a brown or reddish colour, and much inferior to that of the arum esculentum, or lowland taro. It is, however, very palatable, and forms a prime article of food in those parts of the island, where there is a light soil, and but little water...

Between three and four o'clock in the afternoon we reached Kauru, a small village environed with plantations, and pleasantly situated on the side of a wide valley, extending from the mountains to the south point of the island. As the men with our baggage had not come up, we waited about two hours, when Tuite, the head man of the village, arrived, and pressed us to spend the night at his house. We accepted his invitation, and proposed to him to collect the people of the village together, to hear about the true God. He consented, and a little before sunset about a hundred and fifty assembled in front of his house.

Mr. Thurston, after the usual devotional exercises, preached to them for about half an hour, and they paid great attention. During the evening, a baked pig, with some potatoes, and taro, was brought for our supper, of which we made a hearty repast...

At the request of Makoa, Tuite furnished men to carry our baggage to the next district, and soon after daylight on the 29th we left Kauru, and, taking an inland direction, travelled over a fertile plain, covered with a thin yet luxuriant soil. Sometimes the surface was strewed with small stones, or fragments of lava, but in general it was covered with brushwood.

The population in this part did not appear concentrated in towns and villages, as it had been along the seashore, but scattered over the whole face of the country, which appeared divided into farms of varied extent, and upon these the houses generally stood singly, or in small clusters, seldom exceeding four or five in number.

After walking six or seven miles, we entered the district of Papapelaku. When we had nearly passed through it, we sat down to rest, on a pile of stones by the way side. Between sixty and seventy natives soon collected around us; presenting

a motley group. Most of the children were naked, or at best had only a narrow slip of tapa fastened round their loins...

Several of the men, on seeing us pass along the road, had left their work in the fields and gardens, and, although covered with dust and perspiration, had seated themselves in the midst, with their o-os in their hand. (This o-o is the principal implement of husbandry which a Hawaiian farmer uses. Formerly it was sharp-pointed stick of hard wood; it is now usually pointed with iron. The best are made with broad socket chisels, into which they fix a handle four or six feet long.) Their only clothing was the maro, a narrow girdle worn round the loins, one end of which passes between the legs, and fastens in front.

The old men were most of them dressed in a kihei, as were also some of the women, but many of the latter wore only a pau of native cloth wound round their loins. Their black hair was in several instances turned up, and painted white all round the forehead, with a kind of chalk or clay, which is found in several parts of the island.

Many also wore a small looking-glass, set in a solid piece of wood and suspended on the bosom by a handkerchief, or a strip of native cloth, fastened round the neck, to which was sometimes added another article, considered equally useful, and not less ornamental; viz. a small wooden brass-tipped tobacco pipe; the looking-glass and tobacco pipe were sometimes combined in one ornament...

Our path running in a northerly direction, seemed leading us towards a ridge of high mountains, but it suddenly turned to the east, and presented to our view a most enchanting valley, clothed with verdure, and ornamented with clumps of kukui and kou trees. On the southeast it was open towards the sea, and on both sides adorned with gardens, and interspersed with cottages, even to the summits of the hills.

A fine stream of fresh water, the first we had seen on the island, ran along the centre of the valley, while several smaller ones issued from the rocks on the opposite side, and watered the plantations below. We drank a most grateful draught from the principal stream, and then continued our way along its margin, through Kiolaakaa, travelling towards the sea, till we reached Waiohinu...(Ellis 1963:126-133).

Thus it is seen that Kahuku was populated more in its interior, leaving its shoreline relatively devoid of permanent residents, excepting fishermen who dwelt for period of time near the sea.

It is suspected that his area described by Ellis as populated and cultivated lay below these elevations where the woods were found. Ellis

mentioned nothing of woods yet surely they existed at the time as they were constantly referred to in testimony to the Boundary Commission. Relative to these upland forest, native informants consistently stated that those who entered the woods for birds or fowl, timber or goats would descend and seek shelter and sustenance in lower regions where numerous named caves and waterholes were utilized.

The cultivated interior experienced by Ellis was further documented and sketched-out in the claims for lands submitted during the land reform of the Great Mahele of the 1840s and early 1850s.

Kahuku district was first claimed then given up by William Pitt Leleiohoku to the King in the reapportionment of lands under the Great Mahele. He surrendered Kahuku and other lands in lieu of commutation fees due on the lands he was awarded. The government subsequently set apart and designated Kahuku as School Lands--lands to be used for educational purposes as dictated by the Department of Public Instruction.

Within Kahuku, 25 separate claims for various parcels of land were traced. Of this total, 14 were awarded to claimants and an almost equal number (11) were denied. Reasons for the unacceptability of these claims were not specified or even hinted at. All 25 seemed well-integrated, valid and reasonable.

Claimants were allowed to register only those parcels of land on which they actively dwelt or held in cultivation. Numerous taro patches, upland banana fields and plots reserved for the growth of mamaki (whose bark was used in the production of tapa) were delineated. A complete roster of both awarded and unawarded claims is appended to this report.

Prior to 1916, a single grant to Kahuku lands was given; C.C. Harris purchased in 1861, 184,298 acres under Patent 2791.

The following description provides an abstract of land use before the devastation caused by successive lava flows in 1868, 1887, 1907, and 1950:

> Continuing our journey into Kau, going southeastward, the next ahupuaa after Manuka is Kahuku. Until the land was covered by lava throughout much of the verdant lower forest area in the last century, this must have been a far more favorable area for human occupation than was Manuka. The evidences of such occupation have, however, been obliterated. Where lava has not covered the land, the pastures of Kahuku Ranch have done so. The seacoast of Kahuku is as barren as any on this side of Hawaii.
>
> Standing on top of a hillock named Puu Lohena on the coast of Pakini and looking north across the 1868 flow, one can see beyond lava-covered land to where there was an open sandy area of Kaiiki between two sections of the 1868 flows. Kaiiki was in 1823 described by Ellis as "a populous shore village." The open ground led directly north toward Kahuku from the beach

at Kailikii, where travelers from Kona often landed. We could see how their path would have crossed an older flow that was there before the 1868 flow, as they headed for a break in the pali. This is a low dip in the ridge called Lua Puali.

In its lower reaches Kahuku is said formerly to have had flourishing gardens of sweet potato and sugar cane on the land now covered with lava. If so, and we have no reason to doubt the veracity of informants, there must have been underground water here. Surface verdure, also, may have drawn more cloud and dew. There probably was more rain coming across from Pakini when the plains east of the Pali-o-Mamalu and Pali Kulani (the great cliff that borders Kahuku on the east) were more verdant and covered with brush. The bare lava of the recent flows, and the now dry plains of Pakini, Kamaoa, and Kaalualu must desiccate the winds which, sweeping along the coast line, normally throw up a cloud of cooled air that is moisture laden when the trade winds blow.

There is no similar drift of moisture over the naked shores of Kahuku and Manuka. Yet these coasts, barren as they are today, must have sufficed as good fishing grounds for the population settled in the two western ahupuaa of Kau. Wai-o-Ahu-kini close by, with its spring, pond, and canoe haven, and the best fishing ground in all Hawaii, was awarded in an ancient land allotment to Pakini, then one of the most verdant of the plains areas of cultivation. Doubtless it was Pakini's numerous population, which gave its alii power, that was responsible for this award (Handy 1972:571-2).

As a result of the numerous lava flows which swept the area, it was rather difficult to locate good descriptive references after 1868.

The following serves to bring us up to date; in his account, John Clark moves from past into the present as he comments on the coastal area near the Manuka boundary:

On the shoreline of Kau, between South Point and Kauna point, lava flows from the southwest rift zone of Mauna Loa entering the ocean have formed a series of littoral cones. The largest concentrated group of these cones is situated at the end of Road to the Sea, a cinder road that leads from the Hawaii Belt Road to the shoreline. The highest of the cones are the two known as Na Puu a Pele (The Hills of Pele) at Keawaiki. According to Hawaiian legend, these hills were once two young men, chiefs of Kahuku, who excelled in all sports, especially holua (sled)-riding. Pele also loved this sport. One day she appeared as a beautiful young chiefess to join in the competition. The chiefs, however, suspected her identity and refused to race with her. Angered, Pele came after them with a lava flow that devastated the once fertile lands of Kahuku as she chased them toward the beach. She overtook the chiefs just inland of Keawaiki and turned them into the hills that bear her name, Na Puu a Pele.

On January 9, 1908, another flow from Mauna Loa reached the sea in the same area, surrounding Na Puu a Pele and creating several smaller littoral cones on either side of the older hills. The ocean has eroded the cone to the south of Humuhumu Point and the one to the south of Awili Point, creating two green sand beaches.

[NOTE: Humuhumu Point or Lae Humuhumu is the boundary between Manuka and Kahuku. cs]

The small pocket of black sand at Humuhumu is liberally sprinkled with olivines, giving it a definite green tint in the sunlight. Swimming is safe under normal weather conditions, but the rocky offshore bottom drops abruptly to overhead depths. Snorkeling and nearshore scuba diving are good around the rocky points. High surf, particularly during kona storms, sweeps across the entire beach onto the face of the littoral cone and creates a strong shorebreak, undertows, and rip currents.

The larger and longer pocket of black sand at Awili also is tinted green from the high concentration of olivines.

The beach at Humuhumu Point and the beach at Awili Point are collectively known to most area residents as Road to the Sea. Road to the Sea, a 7-mile-long cinder road, begins at the western edge of Hawaiian Ocean View Estates and ends on the shoreline at Humuhumu Point. It is one of the few mauka-makai access routes in Kau to the ocean. Ordinary passenger cars traveling slowly can negotiate the road except for the last rugged downhill slope to sea level; so most drivers park above this last section, which requires a vehicle with four-wheel drive, and walk to the shore. Visitors to the area include swimmers and sunbathers during periods of calm seas, and shoreline fishermen who camp and fish throughout the year (Clark 1985:80-1).

REFERENCES TO TMK:3-9-2-01:72

Very little in the way of specific information could be uncovered in traditional or historical literature relative to the project site.

Fringing the upland boundary is a cluster of land awards described on the tax map as "unlocated." These awards were deeded to the following individuals: Ku, Kaaua, Kepola or Debora, Naohe and Kila. In reviewing land documents registering these claims and testimony verifying each, it appears this particular land area was known as Keopuka. Here, taro was cultivated as well as bananas. Several claimants mentioned that their parcels adjoined that of Samuela, the school teacher of Kahuku district. Samuela's taro patch in Keopuka was situated adjacent to his school house; a road also ran along another boundary of his patch.

The proximity of the project site to Pohue merits inclusion of the following historical summary by Clark. (The earlier reference made to Pohue as a favorite fishing spot of Kamehameha's should also be called to mind here in its proper geographical context.)

POHUE

> Yesterday the lava reached the sea. It appears that in its course that stream of fire has done much damage to the Kahuku Ranch, that vast tract owned by Col. Samuel Norris. The flow is described as having split into three rivers of fire and to have gone over the flows of 1887 and 1868.
>
> Hawaii Tribune Herald, Jan. 15, 1907

Pohue, "gourd," is a beautiful little pocket of white sand bordering a small sand-bottomed inlet in Pohue Bay. During periods of calm seas this picturesque beach is one of the safest swimming areas in the district of Kau and offers excellent snorkeling opportunities along the otherwise rocky shoreline. Pohue Bay's recessed position in the shoreline protects it from dangerous currents under normal weather conditions and for boaters it is known as the best refuge from the wind between South Point and Kauna Point. However, hazardous conditions occur occasionally when high surf, particularly during kona storms, sweeps across the entire bay and funnels unchecked directly into the beach. The moderately steep slope of the sand is a good indication that dangerous water conditions are sometimes encountered. High surf and storm waves create a powerful shorebreak, backwash, undertows, and rip currents.

Along the eastern margin of the bay, a large, rounded littoral cone, Puu Ki, dominates the shoreline and slopes gently down to Pohue Beach. A number of habitation sites of a former Hawaiian fishing community are located on this rocky slope, which offers a magnificent view of the bay and all points along the coast and inland. Here too is the beginning of a vast petroglyph field that stretches beyond Puu Ki toward Kahakahakea.

Tucked into the inside corner of the eastern point of Pohue Bay is a small beach of black sand with a sprinkling of olivines and white sand. Rocks border the sand at the water's edge and boulders cover the bottom offshore, making it a poor swimming beach. Farther east of the bay, fronting the summit of Puu Ki, low, flat-topped sea cliffs overlook one of the most productive ulua fishing grounds in the district. Local fishermen throughout the Hawaiian Islands know this area as Hosaka Point or simply as Eddie Hosaka. Edward Y. Hosaka was born and raised in Hawaii and attended the University of Hawaii at Manoa in the early 1930s. After earning a master's degree

in 1934 he became an agronomist with the University's Extension Services, specializing in pasture management. In time he became recognized throughout the Pacific as an authority on pasture grasses for cattle. His work took him often to the Big Island and into the remotest areas of many of the island's large ranches. In these areas, when his work was completed, he often went shoreline fishing, one of his greatest pleasures. Hosaka, regarded as one of the finest ulua fishermen of his day, often fished at Puu Ki, located on the shoreline of Kahuku Ranch, and it was there at the age of 55 while doing what he loved best, that he suffered a stroke. Taken immediately by his companions to Hilo Hospital, he died on July 23, 1961. Since that date the point has been known as Eddie Hosaka.

In addition to his work for the University, Hosaka was for many years an honorary associate in Botany at the Bishop Museum--and also an author. Probably his best known and most widely circulated work is Sport Fishing in Hawaii, first published in 1944 and still considered one of the standard works on fish and fishing in the Hawaiian Islands.

To the west of Pohue Beach, a storm beach of white sand, lava fragments, coral rubble, and water-rounded pebbles borders a larger inlet of Pohue Bay. The bottom immediately offshore is a very wide, shallow, and rocky shelf that precludes swimming. Just inland of the beach is a large rectangular brackish-water pond, Kanonone Waterhole, that is encircled by coconut and hala trees. This little oasis in the surrounding desert of barren aa stands out very clearly and constitutes Pohue's most visible landmark.

The Pohue shoreline is known to some local residents as Glover's Beach, for James W. Glover, a former owner of Kahuku Ranch, who founded the general construction firm James W. Glover, Ltd. The company continues to operate from offices in Honolulu and Hilo and has been acknowledged for many years as one of the major local contracting firms in the Hawaiian Islands. After Glover's death, the ranch was sold under court order by the Hawaiian Trust Company, the executor of his estate, to pay estate debts including inheritance taxes amounting to almost a million dollars. The trustees of the Samuel M. Damon estate with an offer of $1,363,630, were the successful bidders in 1958 for the 158,000-acre ranch. Because Kahuku Ranch has controlled access to Pohue for so many years, some Kau residents also know the area as Kahuku Beach. There is no convenient public access to this shoreline (Clark 1985:79-80).

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LAND CLAIMS IN THE KAHUKU AREA DURING THE GREAT MAHELE

LCA Awardee	Term of Residence	Land Uses	Comments/Description
8769 Kepola	land rec'd in 1819 from Ma-iliilii	an ili in Puukoae; probably banana patch	surrounded by land of konohiki; upland 15.2 A.
8770 Kanoe	-	-	NOT AWARDED
8771 Kila	land rec'd in 1819 from Ma-iliilii	ili in Keopuka	surrounded by land of konohiki; bound on a side by Samuela; 9.25 A.
8772 Kaaloa	Ap. 2 from Haumea in 1839	banana patch	surrounded by Paele, Namanele, Namale, Hanuhanu (not descr'd. in deed)
8773B Haumea	land from Kapulikoliko in 1830; may have been a konohiki	claims opelu fishing rights and mamaki trees	NOT AWARDED
8775 Kaopuana	land from Haumea in 1833	ili	surrounded by land of konohiki; NOT AWARDED
9058 Kuoha	Ap. 4 from Debora in 1840	banana patch	surrounded by land of konohiki
9156 Kualaula	Ap. 3 & 4 from Haumea in 1840	taro garden and banana patch	surrounded by claimants on 3 sides; (not descr'd. in deed)
9175 Kauwila	Ap. 3 from Haumea in 1840	taro garden and bananas	surrounded by claimants on 3 sides
9209 Kemu	Ap. 2 from Haumea in 1840	taro, bananas and mamaki for tapa-making	surrounded by land of konohiki; claimant deceased (not descr'd. in deed)
9229 Kaaua	ili from Wahine in 1840; taro land from Kumauna in 1840	ili in Kekoekai and 5 taro plots in Puukoae	both surrounded by the land of the konohiki; in 1867 sold to A.E. Spencer of Waiohinu for $12. 7.4 A.
9247 Kaleo	from Haumea in 1833	lands for taro, bananas, mamaki for tapa	surrounded by land of konohiki; NOT AWARDED

LCA Awardee	Term of Residence	Land Uses	Comments/Description
9248 Ku	from Kumauna in 1840	ili of taro and 3 banana patches in Keopuka and 2 taro plots in Puukoae	nearly surrounded by konohiki lands; 9.[illegible] A.
9995 Laamaikahiki	ili from Haumea in 1833	ili	surrounded by land of konohiki; NOT AWARDED
9997 Luamano	from Haumea in 1833	ili	surrounded by land of konohiki; NOT AWARDED
10508 Namanele	from Haumea in 1843	6 taro lands and 1 banana land	surrounded by land of konohiki; NOT AWARDED
10509 Nuhi	from Haumea in 1846	taro lands and mamaki for tapa	surrounded by land of konohiki; NOT AWARDED
10511 Namale	from Haumea in 1833	4 taro lands and 1 banana land	surrounded by land of konohiki; NOT AWARDED
10113 Manae	-	ili	surrounded by land of konohiki; NOT AWARDED
10514 Naohe	from Haumea in 1839	ili in Aikahua, taro land in Keopuka and banana land in the uplands	3 sections, one with a road through it; 13.6 A.
10842 Pau	from Haumea in 1839 & 1840	ili in Kukuinui, taro land and banana land upland; also a houselot	cultivated land surrounded on 3 sides by konohiki land; houselot surrounded by konohiki land
10843 Paele	from Haumea in 1833	ili	surrounded by land of konohiki; NOT AWARDED
11007 Wahine	from Kumauna in 1840	taro land	surrounded by land of konohiki; (not descr'd. in deed)
11028 Samuela	from Debra in 1847	a taro land and a banana land	Samuela was listed as the school teacher of Kaladi
11078B Samuela Kuula	Ap. 1 from parents in 1819; Ap. 4 from Kepola (Debora) in 1847	3 taro lands in Kiao and a houselot there; taro land in Keopuka and a banana land probably upland	Keopuka [illegible] bound on [illegible] the [illegible] on [illegible] by road

APPENDIX E:

CONVERSION OF PHRI TEMPORARY SITE NUMBERS TO HRHP PERMANENT SITE NUMBERS

PHRI Temporary Site No. T-	HRHP Permanent Site No. 50-10-	PHRI Temporary Site No. T-	HRHP Permanent Site No. 50-10-
101	72-10353	143	72-10395
102	75-10354	144	72-10396
103	75-10355	145	72-10397
104	75-10356	146	72-10398
105	75-10357	147	72-10399
106	75-10358	148	72-10400
107	75-10359	149	72-10401
108	75-10360	150	72-10402
109	75-10361	151	72-10403
110	75-10362	152	72-10404
111	75-10363	153	72-10405
112	75-10364	154	72-10406
113	75-10365	155	72-10407
114	75-10366	156	72-10408
115	75-10367	157	72-10409
116	75-10368	158	72-10410
117	75-10369	159	72-10411
118	75-10370	160	72-10412
119	75-10371	161	72-10413
120	75-10372	162	72-10414
121	75-10373	163	72-10415
122	75-10374	164	72-10416
123	75-10375	165	72-10417
124	75-10376	166	72-10418
125	75-10377	167	72-10419
126	75-10378	168	72-10420
127	75-10379	169	72-10421
128	75-10380	170	72-10422
129	75-10381	171	72-10423
130	72-10382	172	72-10424
131	75-10383	173	72-10425
132	75-10384	174	72-10426
133	72-10385	175	72-10427
134	72-10386	176	72-10428
135	72-10387	177	72-10429
136	72-10388	178	72-10430
137	72-10389	179	72-10431
138	72-10390	180	72-10432
139	72-10391	181	72-10433
140	72-10392	182	72-10434
141	72-10393	183	72-10435
142	72-10394	184	72-10436

Appendix E. (Cont.)

PHRI Temporary Site No. T-	HRHP Permanent Site No. 50-10-	PHRI Temporary Site No. T-	HRHP Permanent Site No. 50-10-
185	72-10437	232	72-10484
186	72-10438	233	72-10485
187	72-10439	234	72-10486
188	72-10440	235	72-10487
189	72-10441	236	72-10488
190	72-10442	237	72-10489
191	72-10443	238	72-10490
192	72-10444	239	72-10491
193	72-10445	240	72-10492
194	72-10446	241	72-10493
195	72-10447	242	72-10494
196	72-10448	243	72-10495
197	72-10449	244	72-10496
198	72-10450	245	72-10497
199	72-10451	246	72-10498
200	72-10452	247	72-10499
201	72-10453	248	72-10500
202	72-10454	249	72-10501
203	72-10455	250	72-10502
204	72-10456	251	72-10503
205	72-10457	252	72-10504
206	72-10458	253	75-10505
207	72-10459	254	75-10506
208	72-10460	255	72-10507
209	72-10461	256	75-10508
210	72-10462	257	75-10509
211	72-10463	258	72-10510
212	72-10464	259	72-10511
213	72-10465	260	72-10512
214	72-10466	261	72-10513
215	72-10467	262	72-10514
216	72-10468	263	72-10515
217	72-10469	264	72-10516
218	72-10470	265	72-10517
219	72-10471	266	72-10518
220	72-10472	267	72-10519
221	72-10473	268	72-10520
222	72-10474	269	72-10521
223	72-10475	270	72-10522
224	72-10476	271	72-10523
225	72-10477	272	75-10524
226	72-10478	273	72-10525
227	72-10479	274	72-10526
228	72-10480	275	75-10527
229	72-10481	276	75-10528
230	72-10482	277	75-10529
231	72-10483	278	72-10530

Appendix E. (Cont.)

PHRI Temporary Site No. T-	HRHP Permanent Site No. 50-10-	PHRI Temporary Site No. T-	HRHP Permanent Site No. 50-10-
279	72-10531	326	72-10578
280	72-10532	327	72-10579
281	72-10533	328	75-10580
282	72-10534	329	72-10581
283	72-10535	330	72-10582
284	72-10536	331	72-10583
285	72-10537	332	72-10584
286	72-10538	333	72-10585
287	72-10539	334	72-10586
288	72-10540	335	72-10587
289	72-10541	336	72-10588
290	72-10542	337	72-10589
291	72-10543	338	72-10590
292	72-10544	339	72-10591
293	72-10545	340	72-10592
294	72-10546	341	72-10593
295	72-10547	342	72-10594
296	72-10548	343	72-10595
297	72-10549	344	72-10596
298	72-10550	345	72-10597
299	72-10551	346	72-10598
300	72-10552	347	72-10599
301	72-10553	348	72-10600
302	72-10554	349	72-10601
303	72-10555	350	72-10602
304	72-10556	351	72-10603
305	72-10557	352	72-10604
306	72-10558	353	72-10605
307	72-10559	354	72-10606
308	72-10560	355	72-10607
309	72-10561	356	72-10608
310	72-10562	357	72-10609
311	72-10563	358	72-10610
312	72-10564	359	72-10611
313	72-10565	360	72-10612
314	72-10566	361	72-10613
315	72-10567	362	72-10614
316	72-10568	363	72-10615
317	72-10569	364	72-10616
318	72-10570	365	72-10617
319	72-10571	366	72-10618
320	72-10572	367	72-10619
321	72-10573	368	72-10620
322	72-10574	369	72-10621
323	72-10575	370	72-10622
324	72-10576	371	72-10623
325	72-10577	372	72-10624

Appendix E. (Cont.)

PHRI Temporary Site No. T-	HRHP Permanent Site No. 50-10	PHRI Temporary Site No. T-	HRHP Permanent Site No. 50-10-
373	72-10625	381	75-10633
374	72-10626	382	72-10634
375	72-10627	383	72-10635
376	72-10628	384	72-10636
377	72-10629	385	72-10637
378	72-10630	386	72-10639
379	72-10631	387	72-10639
380	75-10632		

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Report 402-121587

ARCHAEOLOGICAL RECONNAISSANCE SURVEY
HAWAIIAN RIVIERA RESORT REVISED AIRFIELD SITE, AIRFIELD ACCESS ROAD, AND PALACE RESORT INLAND ADDITION

Land of Kahuku

Kau, Island of Hawaii

December 1987

305 Mohouli Street • Hilo, Hawaii 96720 • (803) 969-1763 or 966-8038

Report 402-121587

ARCHAEOLOGICAL RECONNAISSANCE SURVEY
HAWAIIAN RIVIERA RESORT REVISED AIRFIELD SITE, AIRFIELD ACCESS ROAD, AND PALACE RESORT INLAND ADDITION

Land of Kahuku

District of Kau, Island of Hawaii

(TMK:3-9-2-01:72)

by

Alan E. Haun, Ph.D.
Senior Archaeologist

Prepared for

Palace Development Corporation
and
Hawaii Ka'u Aina Partnership
c/o Mr. Richard H. Van Horn, Planner
Belt, Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

December 1987

INTRODUCTION

At the request of Mr. Richard H. Van Horn, planner, currently with Belt, Collins & Associates (formerly with Helber, Hastert, Van Horn & Kimura, Planners), on behalf of their clients, Palace Development Corporation and Hawaii Ka'u Aina Partnership, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological reconnaissance survey of several areas added to the previously surveyed (Haun and Walker 1987) c. 3,360-ac proposed Hawaiian Riviera Resort development area, located in the Land of Kahuku, Kau District, Island of Hawaii (Figure 1). The added areas include (a) the Revised Airfield Site (c. 100 ac), (b) the access road corridor associated with the Revised Airfield Site (c. 12 ac), and (c) an inland extension of the Palace Resort parcel (c. 93 ac), which is situated at the western end of the overall Hawaiian Riviera Resort development area (Figure 2).

The overall objective of the reconnaissance survey was to provide information appropriate to and sufficient for the preparation of an Environmental Impact Statement (EIS) which is being prepared in conjunction with a General Plan Amendment (GPA) application filed with the County of Hawaii, as required by Chapter 343 of the Hawaii Revised Statutes. The present document is the final report on the survey; it includes (a) background information, (b) a brief description of the project area, (c) a description of field procedures, (d) a discussion of results, and (e) significance evaluations and specific/recommended general treatments for each site. Detailed information pertaining to the environmental and cultural-historical setting of the project area and to previous archaeological investigations relevant to the project area, is contained in the report prepared for the previously mentioned Haun and Walker survey (1987).

SCOPE OF WORK

The goal of the reconnaissance survey was to identify--to discover and locate on available maps--sites and features of potential archaeological significance. A reconnaissance survey comprises the initial level of archaeological investigation. It is extensive rather than intensive in scope and is conducted, basically, to determine the presence or absence of archaeological resources within a specified project area. A reconnaissance survey indicates the general nature of, and variety of, archaeological remains present, and the general distribution and density of such remains. Furthermore, reconnaissance surveys permit a general significance assessment of archaeological resources and facilitate formulation of realistic recommendations and estimates for such further work as might be necessary or appropriate. Such work could include intensive survey--data collection involving detailed recording of sites and features, and selected test excavations; and subsequent

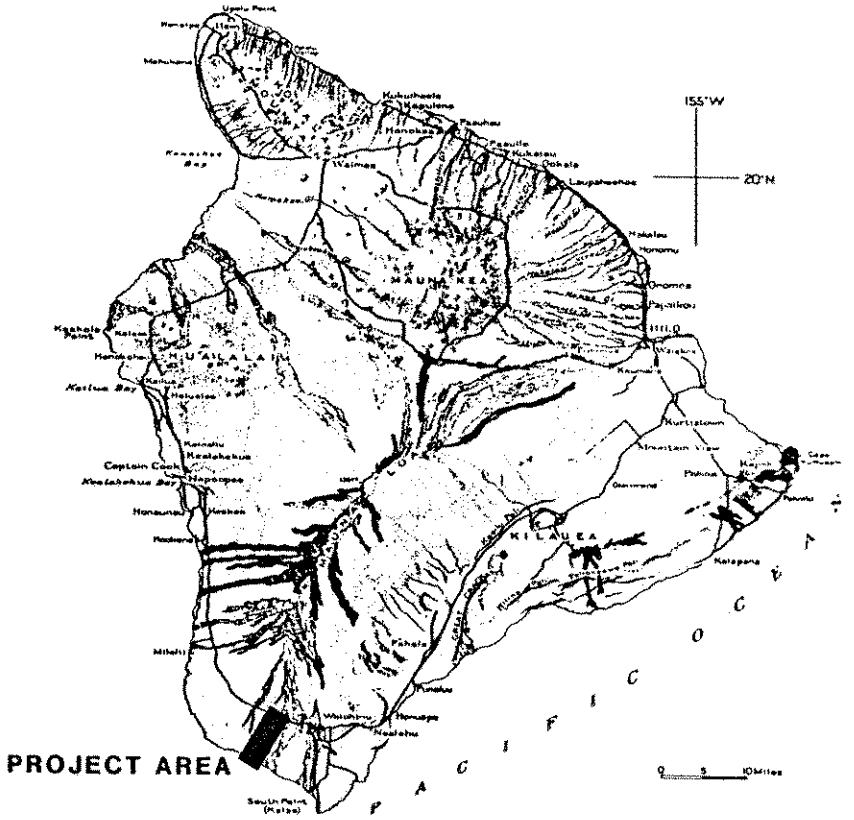

Figure 1. PROJECT LOCATION MAP

ARCHAEOLOGICAL RECONNAISSANCE SURVEY
HAWAIIAN RIVIERA RESORT REVISED AIRFIELD SITE,
AIRFIELD ACCESS ROAD, AND PALACE RESORT INLAND ADDITION

Land of Kahuku, District of Kau,
Island of Hawaii (TMK:3-9-2-01:72)

PHRI 87-402 December 1987

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

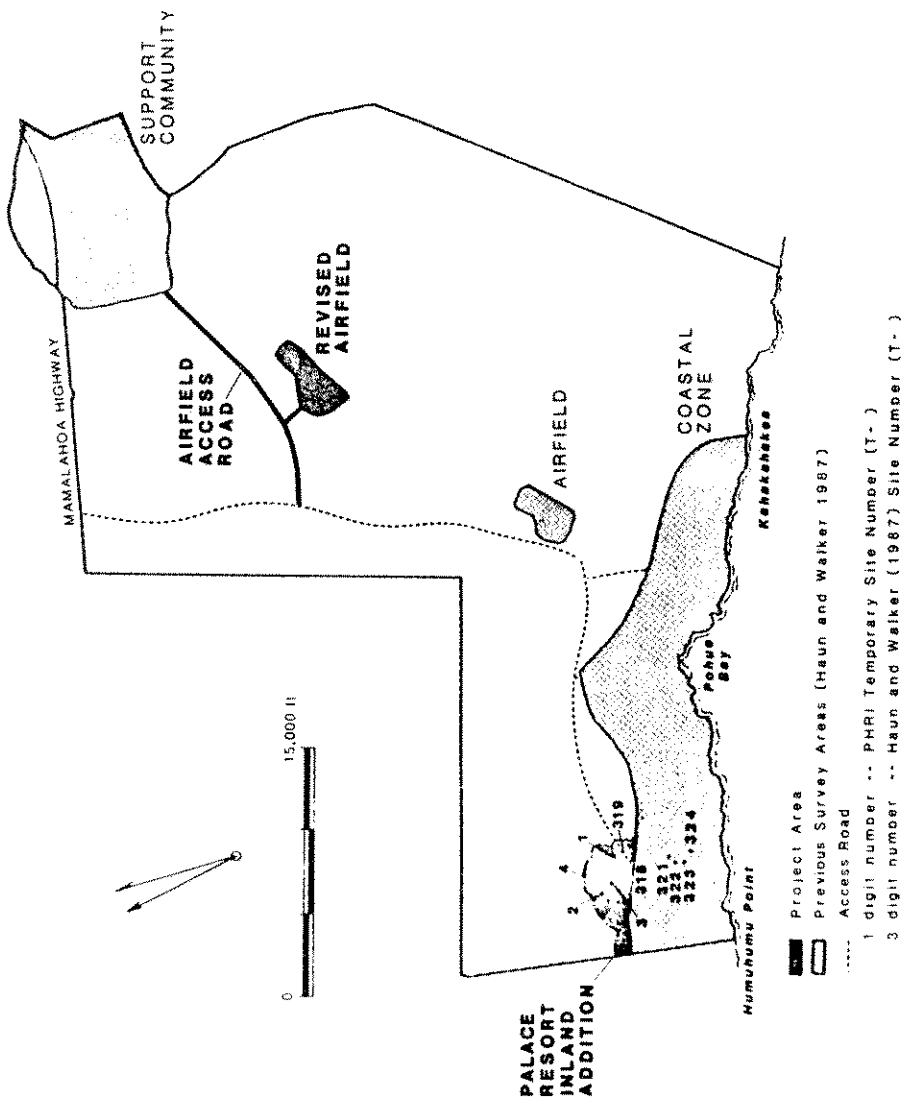

Figure 2. PROJECT AREA AND SITE LOCATION MAP

mitigation--data recovery research excavations, construction monitoring, interpretive planning and develop- ment, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

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

The reconnaissance survey was carried out in accordance with the minimum requirements for reconnaissance-level survey recommended as standard by the Society for Hawaiian Archaeology (SHA). These standards are currently used by the Hawaii County Planning Department and the Department of Land and Natural Resources (DLNR-HSS) as guidelines for reviewing and evaluating archaeological reconnaissance survey reports submitted in conjunction with various development permit applications.

PROJECT AREA DESCRIPTION

As mentioned previously, the project area consists of the Revised Airfield Site, the access road associated with the airfield site, and an inland addition to the Palace Resort portion of the Hawaiian Riviera Resort development area (Haun and Walker 1987:2-4),. The project area and the entire Hawaiian Riviera Resort development area are situated in the Land of Kahuku, Kau District, on the leeward coast of the Island of Hawaii (TMK:3-9-2-01:Por.72). The Revised Airfield Site is a c. 100-ac tract situated on the 1887 lava flow between the c. 1240 and 1020 ft elevation contours. Within this tract the 1887 lava flow is comprised almost exclusively of barren aa lava. The only vegetated area of the tract is on its eastern end where a small kipuka of older pahoehoe lava is present. Vegetation in the kipuka includes scattered 'ohia (Metrosideros collina [Forst.] Gray subsp., polymorpha [Gaud.] Rock), 'ohelo (Vaccinium reticulatum Smith), and various grasses.

The Airfield Access Road extends c. 8,600 ft between the Support Community (c. 1,640 ft elevation) and the main resort Access Road (c. 1,180 ft elevation), and includes a short section of road which branches to the Revised Airfield Site. The Airfield Access Road at its western end crosses the 1907 and Halepohaha aa lava flows, and at its eastern end it crosses an older Unit 2 pahoehoe lava flow (Lipman and Swenson 1984). The remaining middle portion of the Access Road crosses the 1887 lava flow and a small pahoehoe kipuka. The 1907 lava flow is devoid of vegetation. The Halepohaha Flow is characterized by very sparse 'ohia and grasses. The Unit 2 flow supports a scattered overstory of 'ohia and an understory of lama (Diospyros ferrea var. sandwicenses

[A.DC.] Fosb.), Christmas-berry (Schinus terebinthifolius Raddi), 'a'ali'i (Dodonaea eriocarpa), pa-nini (Opuntia megacantha Salm-Dyck), kauna'oa (Cuscuta sandwichiana Choisy), pukiawe (Styphelia tameiameiae [Cham] F. Muell.), and various ferns and grasses. The kipuka the middle portion of the road crosses contains vegetation similar to vegetation noted in the previously mentioned kipuka.

The Palace Resort Inland Addition extends between the 230 ft and 320 ft elevation contours and spans Hapaimanu aa lava flows and predominately pahoehoe lavas of the Kipuka Kanohina Flow (Lipman and Swenson 1984). The Hapaimanu aa flows support widely scattered 'ohia and tufts of grass. The Kipuka Kanohina pahoehoe lavas support scattered 'ohia, grasses, the introduced Indian Pluchea (Pluchea indica [L.]), 'ubalos (Waltheria americana L.), and ferns (Nephrolepis sp.).

FIELD WORK PROCEDURES

Field investigations were conducted on December 11, 1987 under the direction of PHRI Senior Archaeologist Dr. Alan E. Haun. Twenty-four (24) man-hours of labor were expended conducting the field work. Although no previous archaeological investigations had been conducted in the project area, previous studies in adjacent properties (proposed Hawaiian Riviera Resort development area) had identified 298 sites containing 1,144 component features (Haun and Walker 1987); therefore, it was expected that the present project would identify a number of new sites.

The project area was surveyed aerially by three PHRI archaeologists, who used a helicopter piloted by Mr. Gene Soles of Kona Helicopters. For orientation, the archaeologists first flew over the boundaries of the entire project area. Next, the project area was examined by flying over it in a series of overlapping sweeps oriented roughly north-south. The sweeps were flown at an altitude of 3-5 m, depending on terrain and vegetation. When sites were identified, the helicopter landed so the achaeologists could further examine the sites and flag them for relocation with pink engineer's flagging tape. Identified sites were assigned a sequential number designation beginning with "1" and prefixed by "T-" (e.g., T-1, T-2, etc.) and the number was marked on the site flag; sites were also plotted on 1"=400' scale aerial photographs (R.M. Towill Corp., 1970: Photo Nos. 5289-2, 5289-4, 5387-8, 5287-10) and were fully recorded on standard PHRI site record forms. Recordation included (a) mapping all sites to scale using tape and compass, (b) two or more black-and-white 35 mm photographs of each site, and (c) tagging of each site with an aluminum strip bearing the site number, PHRI project number (87-402), and the date. Finally, pieces of pink engineer's flagging tape bearing the same information as on the aluminum strip were wrapped around large pebbles/cobbles, which were placed in protected places on the site.

FINDINGS

Four sites comprised of seven component features were present within the project area (sites/features are summarized in Table 1 and Appendix A). All four sites were located in the Palace Resort Inland Addition (Figure 2). Formal features present at the sites include a mound (1), a wall (1), an alignment (2), a curved wall (1), and a cairn (2). Functional types present at the sites include temporary habitation (2) and trail marker (2).

Table 1.

SUMMARY OF IDENTIFIED SITES AND FEATURES
HAWAIIAN RIVIERA RESORT REVISED AIRFIELD SITE,
AIRFIELD ACCESS ROAD, PALACE RESORT INLAND ADDITION

Site & Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	*CRM Value Mode R	I	C	Comments
T-1	Cave/Cmplx.(4)+	Temp. Hab.	L	L	L	Complex lies along probable coastal-inland trail route; 4 pieces shell midden present
A	Alignment					
B	Alignment					
C	Mound					
D	Wall					
T-2	Curved wall	Temp. Hab.	L	L	L	Site situated along probable coastal-inland trail route
T-3	Cairn	Trail Marker	L	L	L	Cairn appears to mark coastal-inland trail route across pahoehoe
T-4	Cairn	Trail Marker	L	L	L	Cairn appears to mark coastal-inland trail route across pahoehoe

*Cultural Resource Mgmt. Value Modes--Nature: R = scientific research, I = interpretive, C = cultural; Degree: H = high, M = moderate, L = low.

+Number of component features within complex.

In addition to the above sites and features, encountered along the eastern edge of the Palace Resort Inland Addition and in the general vicinity of Site T-2 was very scattered evidence of probable scoriaceous pahoehoe lava prospecting. The evidence consists of a few crevices/faults in pahoehoe which have been enlarged by removal of a few loose stones. Concentrations of probable abrader blanks or large boulder-sized hammerstones, which characterize quarry locations such as those reported in the vicinity of Pohue Bay and Kahakahakea to the east (Haun and Walker 1987), were not encountered within or around the crevices/faults.

Concerning the lava tube features, a complex system of discontinuous lava tubes traverses the eastern end of the Palace Resort Inland Addition. All of these tubes were searched for evidence of human occupation or use; only one tube segment (Site T-1) was found to contain such evidence.

CONCLUSION

DISCUSSION

The reconnaissance survey identified four sites within the project area; all four sites were located within the Palace Resort Inland Addition. Identified sites consist of probable trail markers (cairns) and temporary habitations (curved wall; structurally altered lava tubes not assigned letter designations). There is in the vicinity of the sites no worn footpath in the pahoehoe; however, the distribution of the sites in a pattern that suggests they were once linked, plus the fact that six other sites identified during the earlier survey of the Hawaiian Riviera Resort development area form another linked pattern which seems to connect with the first pattern, and are also comprised of temporary habitations (Sites T-318, -319, -321, -322, -324 and a probable trail-marking cairn (Site T-323) (see Figure 2), strongly suggests the sites are situated along one or more former trail routes. Sites T-1 and -4 may have been located along a primary route connecting with Sites T-318, -319, -321, -322, -323, and -324. Sites T-2 and T-3 may have been located along a branch of the main trail.

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

Site significance assessments are based on the National Register criteria for evaluation, outlined in the Code of Federal Regulations (36 CFR Part 60). The Hawaii State Department of Land and Natural Resources-Historic Sites Section (DLNR-HSS) uses these criteria for evaluating site significance. Sites determined to be potentially significant for information content fall under Criterion D, which defines

significant resources as ones which "have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR Sec. 60.4). Sites potentially significant as representative examples of site types are evaluated under Criterion C, which defines significant resources as those which "embody the distinctive characteristics of a type, period, or method of construction...or that represent a significant and distinguishable entity whose components may lack individual distinction" (36 CFR Sec. 60.4).

Sites with potential cultural significance are evaluated under guidelines prepared by the Advisory Council on Historic Preservation (ACHP) entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (ACHP 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth" (1985:1). The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value" (1985:7).

Based on the above federal and state criteria, all four sites in the present project area are assessed as being significant solely for information content. These sites have been measured, mapped, described, photographed, and plotted; data collected from them is considered sufficient to warrant a recommendation of no further work.

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

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

REFERENCES CITED

ACHP (Advisory Council on Historic Preservation)

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

CFR (Code of Federal Regulations)

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

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1987 Final Report: Archaeological Reconnaissance Survey, Hawaiian Riviera Resort Project Area....

Lipman, P.W., and A. Swenson

1984 Generalized Geologic Map of the Southwest Rift Zone of Mauna Loa Volcano, Hawaii. U.S. Geological Survey Miscellaneous Investigations Map I-1323, scale 1:100,000.

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

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

APPENDIX A: SITE DESCRIPTIONS

SITE NO: STATE: -- BPBM: -- PHRI: T-1 (see Figure 3)
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of one cairn, one wall, and two alignments. Features are located near large opening in lava tube system.

FEATURE A: Alignment
DIMENSIONS: 2.00 m by 0.85 m by 0.20 m

Comprised of pahoehoe slabs placed on bedrock. Alignment located in the central interior area of the northern tube extension. Fragments of Cellana spp., Cypraea spp., and Thaididae spp. are present in the vicinity of the alignment.

FEATURE B: Alignment
DIMENSIONS: 2.00 m by 0.20 m by 0.25 m

Alignment of pahoehoe slabs; several slabs are upright. Feature is located at entrance to southern tube extension and is oriented perpendicular to the long axis of the tube. One Thaididae spp. fragment present.

FEATURE C: Mound
DIMENSIONS: 1.10 m by 0.50 m by 0.30 m

A loosely stacked mound of blocky pahoehoe cobbles and small boulders. Feature situated at entrance to southern tube extension.

FEATURE D: Wall
DIMENSIONS: 2.00 m by 0.80 m by 0.35 m

This feature crosses the interior of the southern lava tube extension. It is constructed of several large pahoehoe slabs and small blocky pahoehoe boulders.

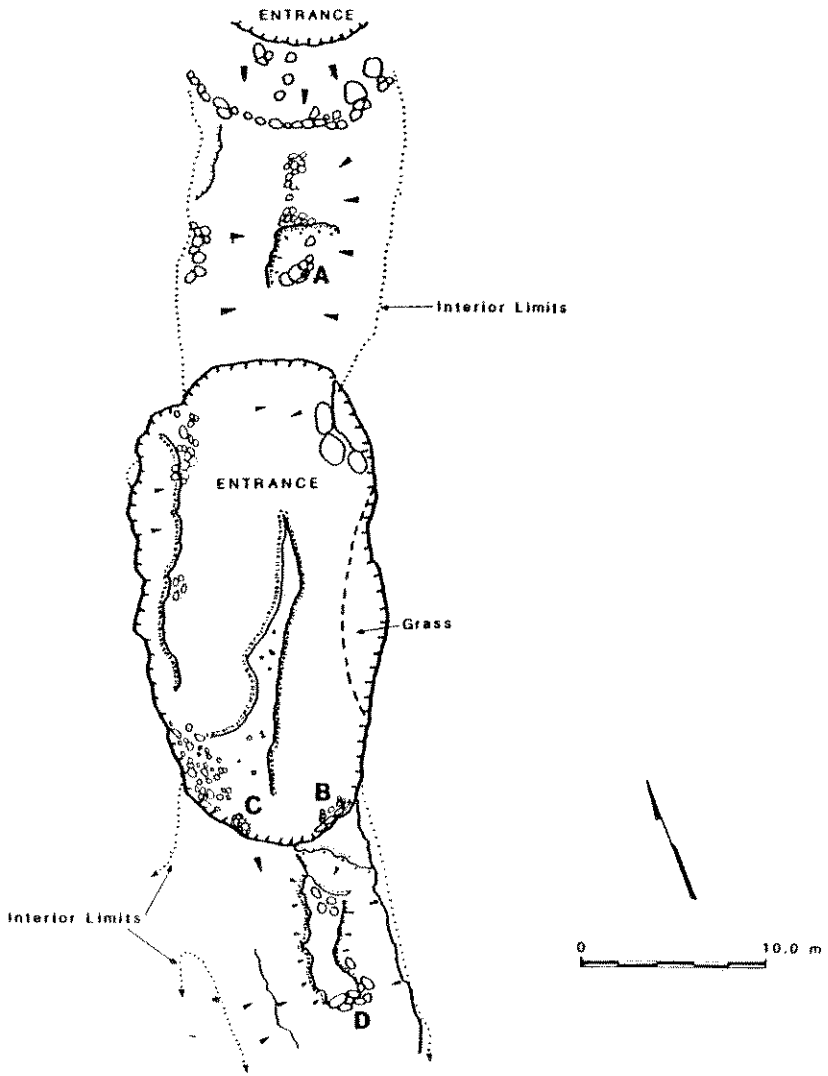

Figure 3. PLAN VIEW OF SITE T-1

SITE NO: **STATE:** -- **BPBM:** -- **PHRI:** T-2 (see Figure 4)
SITE TYPE: Curved wall (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass with scattered ohia
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: Site consists of a curved wall. A scatter of blocky pahoehoe cobbles was noted c. 3.0 m northwest of the wall. The scatter measured 1.5 m in diameter by 0.15 m high. No portable remains/cultural deposit present.

FEATURE: Curved wall
DIMENSIONS: 2.40 m by 0.85 m by 0.60 m

This wall, which opens to the west, is comprised of stacked pahoehoe slabs, small boulders, and cobbles. Several upright slabs are present along the interior face of the wall. The mid-section of the wall is faced; the ends are collaped. Possible cupboard is present inland of the wall; piled cobbles connect the cupboard to the wall.

SITE NO: **STATE:** -- **BPBM:** -- **PHRI:** T-3
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Consists of a single cairn. No portable remains or cultural deposit present. Located on striated pahoehoe flow, seaward and westward of a low escarpment.

FEATURE: Cairn
DIMENSIONS: 1.50 m by 0.75 m by 0.45 m

Comprised primarily of pahoehoe slabs and blocky pahoehoe cobbles and boulders piled on bedrock. Feature incorporates raised outcrop on east side. Cairn is oval and is centrally raised.

SITE NO: **STATE:** -- **BPBM:** -- **PHRI:** T-4
SITE TYPE: Cairn (1 Feature)
TOPOGRAPHY: Pahoehoe lava flow
VEGETATION: Sparse grass
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric

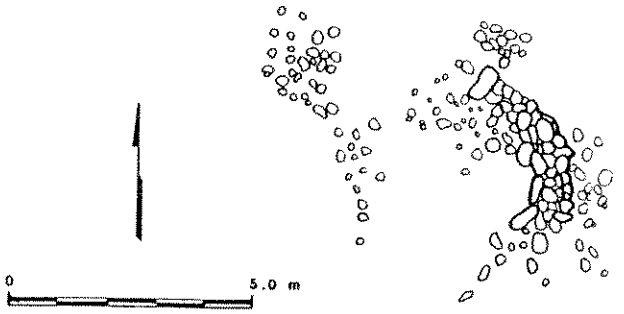

Figure 4. PLAN VIEW OF SITE T-2

FUNCTIONAL INTERPRETATION: Marker
DESCRIPTION: Consists of a single cairn. No portable remains or cultural deposit present. Located on striated pahoehoe flow.

FEATURE: Cairn
DIMENSIONS: 1.60 m by 1.40 m by 0.50 m

Comprised of blocky pahoehoe cobbles and boulders piled on bedrock. Cairn is centrally raised but is not formally faced.

APPENDIX F

Flora Survey

FLORA SURVEY

PROPOSED HAWAIIAN RIVIERA RESORT

KAHUKU, DISTRICT OF KA'U, ISLAND OF HAWAI'I

by

Winona P. Char

CHAR & ASSOCIATES

Botanical/Environmental Consultants

Honolulu, Hawaii

Prepared for:

BELT COLLINS & ASSOCIATES

May 1987

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FLORA SURVEY

PROPOSED HAWAIIAN RIVIERA RESORT

KAHUKU, DISTRICT OF KA'U, ISLAND OF HAWAI'I

INTRODUCTION

The subject property lies within the Kahuku Ahupua'a, District of Ka'u, island of Hawai'i. Three separate areas, which constitute a total of 3,200 acres, form the subject property. These three areas proposed for development are located within a larger 20,616 acre parcel. The components of the development are (1) a major resort area (2,300 acres) situated on the coast; (2) a small regional airport (100 acres) in the interior of the property; and (3) a support community (800 acres) adjacent to the Mamalahoa Highway.

Lava flows of different ages, some of them relatively recent, dominate the landscape in all three areas. On the makai parcel (proposed resort area) the vegetation is sparse and consists primarily of scrub. Along the shoreline, rocky cliffs which plunge percipitously to the sea below are the predominant feature although a few sandy or coral-rubble strewn beaches may be found. A number of anchialine ponds are also found along the coastline. The proposed airport site is largely located on the barren 'a'a lava flow of 1907. The mauka parcel (proposed support community) ranges in elevation from 1,600 to 1,960 ft. and receives about 50 in. of rainfall per year. Vegetation types are thus quite different from the drier, lower elevation makai parcels. Native plant species are more frequently encountered on this parcel. A grassland-scrub community covers most of the mauka parcel, 'ohi'a forests occur on an ancient 'a'a lava flow, and a pioneer 'ohi'a community can be found on the 1868 lava flow.

A botanical survey to inventory the flora, describe the major vegetation types, search for rare, threatened and endangered plant species, and to identify potential environmental problems or concerns was conducted from April 10 through April 16, 1987. A team of three botanists was used to gather the technical data required for this report. This report will be incorporated into the Environmental Impact Statement (EIS).

SURVEY METHODS

Prior to the field survey, a search was made of the pertinent literature to familiarize the principal investigator with previous botanical studies conducted in the general area. Topographic maps and recent aerial photographs of the project site were studied to determine access, terrain characteristics, and potential logistical and technical problems which might be encountered in the field.

Access onto most of the parcels was by means of a 4-wheel drive vehicle, primarily along a number of jeep roads which criss-cross the larger 20,616 acre parcel and follow the coastline.

A walk-through survey method was used. Criteria such as structure, composition, and associated plant species were used in identifying and describing each vegetation type. Notes were made of the species found in each of these vegetation types; species which could not be positively identified in the field were collected for later determination in the herbarium and laboratory. The species recorded are indicative of the season and environmental conditions at the time of the survey. A survey taken at a different season and under varying environmental conditions would no doubt yield slight variations in the abundance and kinds of species present, especially the less annual taxa.

Whenever possible, areas immediately adjacent to the parcels proposed for development were also surveyed as these buffer areas may be indirectly affected by the proposed development.

DESCRIPTION OF VEGETATION

The distribution of vegetation types on the proposed Hawaiian Riviera Resort area is influenced by a number of environmental factors including rainfall, elevation, substrate type and age, topography, and exposure.

For this study, the two lower elevation parcels are referred to as the makai portion, collectively the proposed resort area and airport facility; the upper elevation parcel, the proposed support community, is referred to as the mauka portion. The makai portion receives roughly 30 in. of rainfall per year (State of Hawaii, DLNR 1973). Elevation ranges from sea-level to about 280 ft. on the proposed resort area; and from 240 to roughly 360 ft. on the proposed airport facility. Vegetation is generally sparse. Pahoehoe and 'a'a lava flows occur in about equal proportions (Sato et al 1973). Pahoehoe flows support a mixed scrub vegetation; 'a'a flows are usually barren or support only a few scattered plants. The littoral cones, composed of cinder and ash, and the coastal cliffs and beach areas support different vegetation types.

The wetter mauka portion receives 50 in. of rainfall per year (State of Hawaii, DLNR 1973). Elevation ranges from 1,600 to approximately 1,960 ft. A rather dense cover of mixed grass and shrub species is found on the prehistoric pahoehoe flow which occupies most of the mauka section. Several kipukas with 'ohi'a forests are found on prehistoric 'a'a flows. On the 1868 Lava Flow, which is largely pahoehoe, small 'ohi'a trees, from 3 to 18 ft. tall are numerous.

The major vegetation types recognized on the makai and mauka

portions are presented in Figure 1 and are discussed in detail below.

A. Vegetation on Proposed Resort and Airport Areas (Makai Portion)

1. Coastal vegetation

The coastal vegetation forms a narrow to somewhat wide band along the shoreline; it may vary in width from 50 to as much as 500 ft. as in the Hali'ipalala - Kahakahakea area. Rocky coastal cliffs are the primary feature of the shoreline. Sandy beaches or areas with waterworn coral rubble and boulders occupy a smaller portion of the shoreline. A number of anchialine ponds are associated with the coastal area.

Vegetation on the rocky coastal areas is sparse. The most frequently observed species is the native sedge, Fimbristylis pycnocephala. This perennial, tufted sedge forms low, rounded clumps 4 to 6 in. high. It is often the only plant cover along these rocky coasts which are constantly exposed to salt-spray. Other species which may be found on the rocky coastal areas include a number of elements from the adjacent scrub vegetation. These include hi'aloa (Waltheria indica var. americana), ironweed (Vernonia cinerea), lovegrass (Eragrostis tenella), Natal redtop (Rhynchelytrum repens), ballon plant (Gomphocarpus physocarpus), pua-kala (Argemone glauca), and 'ihi (Portulaca cyanosperma).

On sandy beaches (usually a mixture of coralline sand and olivine), coral rubble and boulder strewn areas, and around the anchialine ponds, the vegetation is more abundant. Plants of pohuehue vine (Ipomoea brasiliensis) and pa'u-o-Hi'iaka (Jacquemontia sandwicensis) may form rather large, creeping mats in these areas. The white-flowered koali (Ipomoea macrantha) sends its course, twining stems scrambling over the waterworn boulders and up into the low coastal shrubs and trees.

Pluchea shrubs (Pluchea odorata) often form a dense thicket in

the areas back of the beaches and are especially numerous on the landward sides of the ponds. An almost impenetrable tangle of pluchea shrubs is found along the landward side of the large unnamed pond west of the Kanonone pond.

Coconut trees (Cocos nucifera) are found in the sandy areas such as Pohue Bay and also around the anchialine ponds. A few small trees (less than 15 ft. tall) of kou (Cordia subcordata), false kamani (Terminalia catappa), and milo (Thespesia populnea) can be found planted around the ponds. The Kanonone pond area supports a large colony of hala (Pandanus odoratissimus)trees which provide shade and a windbreak for the local fishermen. The beach fronting this area is known locally as "Lauhala Beach".

Around the margins of the larger anchialine ponds several members of the sedge family may be found, these include 'uki (Cladium leptostachyum), makaloa (Cyperus laevigatus), Fimbristylis pycnocephala, and Pycreus polystachyos. Forming a green carpet on the bottoms of the larger ponds is the widegeon grass (Ruppia maritima var. pacifica), an aquatic flowering plant. The smaller ponds, located on 'a'a flows further in from the beach, generally support only sparse vegetation, if at all, around their margins.

2. Cinderland vegetation

Scattered along the shore, particularly in the area from Keliuli Bay to the 1887 Lava Flow, are a number of littoral cones and areas covered with ash and a fine cinder material. These cinder and ash cones extend all along the south shore of the island for about 14 miles west of South Point (Ka Lae).

The cones were formed when 'a'a lava flows (rarely pahoehoe flows) entered the sea and the hot central part of the flows came into contact with the sea water. The outrushing steam carried clouds of liquid lava which cooled on contact with the

water and air. The littoral ash, along with varying amounts of lapilli and bombs, piled up along the surface of the lava flow at the side of the main channel to form a hill, known as a littoral cone (Macdonald and Abbott 1970). Double cones, one on each side of the lava flow where it entered the sea, are often formed. On the project site, a layer of fine cinder material, only a few inches deep, covers the yellowish-brown ash.

On the littoral cones in the area from Keliuli Bay to the 1887 Lava Flow, plant cover varies from 40 to 50%. Thatchinggrass (Hyparrhenia rufa) is the most abundant species, although, in places, Natal redtop (Rhynchelytrum repens) may be just as numerous. Patches of Fimbristylis pycnocephala, 5 to 10 ft. in diameter, are found scattered on the seaward slopes of the cones. Clumps of barbwiregrass (Cymbopogon refractus) can be found on Pu'u Ki and some of the other nearby littoral cones. Fountaingrass (Pennisetum setaceum), considered a noxious weed (Hosaka and Thistle 1954; State of Hawaii, DOA 1978, 1981), is restricted to the seaward margin of Pu'u Ki on cinder-ash and pahoehoe substrates. Shrubby species are few and usually consist of pluchea (Pluchea odorata) and hi'aloa (Waltheria indica var. americana).

Plant cover on the cinder field on the eastern, coastal portion of the proposed resort area is sparse, roughly 3% cover. Fimbristylis is the most frequently encountered species; occurring in smaller numbers are hi'aloa, Natal redtop, swordfern (Nephrolepis multiflora), and broomsedge (Andropogon virginicus).

3. Scrub community

This vegetation type occurs on pahoehoe and the older, weathered 'a'a lava flows. Within the scrub community, Natal redtop (Rhynchelytrum repens) and hi'aloa (Waltheria indica var.

americana) are the most abundant species. Scattered patches of ballon plant (Gomphocarpus physocarpus), lovegrass (Eragrostis tenella), pluchea (Pluchea odorata), ironweed (Vernonia cinerea), and 'ilima (Sida fallax) are occasionally observed.

Kipuka Kanohina is a weathered, prehistoric pahoehoe flow with pockets of ash and cinder, as well as litter, found in depressions, cracks, crevices and other low-lying areas. The scrub community which occurs on Kipuka Kanohina supports scattered 'ohi'a trees (Metrosideros collina ssp. polymorpha) and a number of other species not found in the other scrub communities of the makai portion. Again hi'aloa and Natal redtop are abundant, although, in places broomsedge (Andropogon virginicus) becomes just as abundant as the other two species. The 'ohi'a trees range in height from 12 to 18 ft. tall with trunks of 8 in. to 1 ft. in diameter. A few may be as large as 1.5 ft. in diameter. Many of the trees have died back at the top. The number of trees increases as one moves upslope. No trees were found roughly below the 120 ft. contour line. Plant species found only in the Kipuka Kanohina scrub during this survey include a'ali'i (Dodonaea sandwicensis), 'ena'ena (Gnaphalium sandwicensium), golden beardgrass (Chrysopogon aciculatus), pili (Heteropogon contortus), West Indian dropseed (Sporobolus indicus), and 'ahuhu (Tephrosia purpurea).

4. Lava

Large areas which are covered by 'a'a lava flows are nearly devoid of vegetation. Only a few of the more hardy species such as Natal redtop (Rhynchelytrum repens), garden spurge (Euphorbia hirta), pluchea (Pluchea odorata), hi'aloa (Waltheria indica var. americana), and 'ihi (Portulaca cyanosperma) are found as scattered individuals, usually in areas which have accumulated some soil. In areas where the flow is thin or where pockets of the older flows were left more or less intact, a scrub community can be found.

Along the margins of the flows, especially where it abuts older, more weathered flows, plants are more numerous and may form small clusters. Plant species often found in this interface zone include swordfern (Nephrolepis multiflora), Natal redtop, broomsedge (Andropogon virginicus), and pluchea. The 'a'a flow which forms Humuhumu Point and lies adjacent to Kipuka Kanohina supports a few, very scattered trees of 'ohi'a (Metrosideros collina ssp. polymorpha).

B. Vegetation on Proposed Support Community (Mauka Portion)

1. Grassland-scrub community

The grassland-scrub community, which covers the most area on the mauka portion, occurs on a prehistoric lava flow. Small knolls and swales are found on the gently rolling pahoehoe.

The grassland-scrub community was used for grazing at one time, as several old fencelines and a rock wall can be found here.

The most abundant species are broomsedge (Andropogon virginicus) and barbwiregrass (Cymbopogon refractus). Barbwiregrass is especially dense on the sides of small knolls which are partially shaded during parts of the day. It is a bunchy perennial grass, 1 to 3 ft. tall, with tough stems and a dense mass of narrow, harsh, wiry leaves. The flowers twist at an angle from the stem, resembling the prongs of barbwire. It was first reported in the islands in 1936 from the Kahuku area, Ka'u District (Hosaka and Thistle 1954). In Ka'u, the wild goats dessiminate it from one grazing area to another (Hosaka and Thistle 1954).

In swales, depressions and other low-lying areas where it is damper, molassesgrass (Melinis minutiflora), perennial foxtail (Setaria geniculata), and Guinea grass (Panicum maximum) are locally abundant. Patches of golden beardgrass (Chrysopogon aciculatus) and kikuyugrass (Pennisetum clandestinum) may be found occasionally, especially in the upper sections of the

mauka portion near the highway.

Four species of Desmodium (D. uncinatum, D. triflorum, D. canum, and D. tortuosum) are occasionally encountered in this plant community and may have originally been introduced into this area to improve pasturage.

A mixture of native and introduced shrub species can be found throughout the area. Shrubs may make up 30 to 40% of the plant cover. Native shrubs found in this community include 'ulei (Osteomeles anthyllidifolia), pukiawe (Styphelia tameiameiae), and a'ali'i (Dodonaea sandwicensis). Native shrubs are especially numerous in the area adjacent to the 'ohi'a forest and the upper sections of the mauka portion. Introduced shrub species include indigo (Indigofera suffruticosa), lantana (Lantana camara), and Christmas berry (Schinus terebinthifolius). Christmas berry is especially numerous along the 1868 Lava Flow where it may form dense, rounded, windswept thickets.

Scattered trees, or sometimes small clumps, of 'ohi'a (Metrosideros collina ssp. polymorpha) can be found on the tops of rocky knolls.

2. 'Ohi'a forest

Prehistoric 'a'a lava flows on the mauka portion support a sclerophyllous forest of native trees. The large, angular, jumbled blocks of 'a'a make botanizing difficult.

'Ohi'a (Metrosideros collina ssp. polymorpha) is the dominant species. The canopy cover of this forest type is open, varying from 25 to 50% cover, although, in places, it may be somewhat dense, almost closed (canopy cover greater than 60%). The trees range in height from 20 to 40 ft.; some of the larger trees may have trunks with diameters of 2 to 3 ft. dbh.

A number of smaller tree species, 9 to 20 ft. tall, is associated with this 'ohi'a forest. Mamane (Sophora chrysophylla) with its drooping clusters of bright yellow flowers may form small thickets. Other species frequently encountered include naio or false sandalwood (Myoporum sandwicense), 'iliahi or sandalwood (Santalum paniculatum), lama (Diospyros ferrea), and alahe'e (Canthium odoratum). Less frequently seen are trees of kolea (Myrsine lanaiensis). Only one tree of maua (Xylosma hawaiiensis var. hillebrandii) was found during this survey.

In some places, a'ali'i (Dodonaea sandwicensis) and pukiawe (Styphelia tameiameiae) shrubs may form localized thickets but generally are widespread throughout the 'ohi'a forest. Other shrub species which are found occasionally include 'ulei (Osteomeles anthyllidifolia) and the introduced Christmas berry (Schinus terebinthifolius) and lantana (Lantana camara). A few plants of kului (Nototrichium sandwicense) can be found in the upper sections of the 'ohi'a forest bordering the 1887 Lava Flow.

In places where the 'ohi'a trees are scattered, ground cover is denser and consists principally of broomsedge (Andropogon virginicus) and barbwiregrass (Cymbopogon refractus). Where the trees are closer together and the canopy cover is denser, or in areas with partially shaded gullies or depressions, ground cover consists of a mixture of the grass species mentioned above in less abundance, ferns, and a few sedges. Fern species include the sword fern (Nephrolepis multiflora), kumu-niu (Doryopteris decipiens), kalamoho (Pellaea ternifolia), and 'iwa'iwa (Asplenium adiantum-nigrum). Carex wahuensis var. rubiginosa is occasionally observed especially in the more heavily shaded areas.

Climbing up into the trees and shrubs or scrambling over the blocks of 'a'a are huehue (Cocculus ferrandianus) and ka noa'oa

(Cassytha filiformis) vines.

A candidate endangered species, Pleomele hawaiiensis or halapepe, is found in this vegetation type between the 1,880 and 1,920 ft. elevation (see Rare, Threatened and Endangered Species section of this report for more details).

3. Pioneer 'ohi'a community

On the mauka portion, the 1868 Lava Flow is composed of smooth to ropey pahoehoe, although, in places, there may be pockets of rough, scoriaceous 'a'a.

Among the first plant colonizers to appear on this flow are 'ohi'a (Metrosideros collina ssp. polymorpha), pukiawe (Styphelia tameiameiae), and 'ohelo (Vaccinium reticulatum). 'Ohi'a trees range in height from 3 to 20 ft. with most trees 9 to 15 ft. tall. 'Ohi'a cover is generally about 5% with a mixture of various shrubs, grasses, herbs, and ferns making up another 3 to 5% of the vegetation cover, however, on certain portions of the flow, cover may be as much as 30 to 40%. Below 1,760 ft. elevation plant cover becomes much more sparse. Among the shrubs, pukiawe and kupaoa (Dubautia scabra) are the most numerous. The introduced Christmasberry (Schinus terebinthifolius) and pluchea (Pluchea odorata) shrubs are found primarily along the periphery of the flow where it adjoins the grassland-scrub community. Fairly common, especially at the base of trees or in cracks and crevices, are small patches of ferns such as swordfern (Nephrolepis multiflora), 'ae (Polypodium pellucidum), moa (Psilotum nudum), and pakahakaha (Pleopeltis thunbergiana). The most frequently observed grasses are broomsedge (Andropogon virginicus) and molassessgrass (Rhynchelytrum repens).

Surprisingly, three species which are usually regarded as ornamental or landscape specimens have established themselves on this flow. Several color variants of epidendrum (Epidendrum sp.) are abundant in one area of the flow. A large cluster of long-

leaf ironwood (Casuarina glauca) with trees 20 to 40 ft. tall is found near a heaviliy vegetated knoll; smaller plants are found scattered about nearby. A few plants of the swamp mahogany (Eucalyptus robusta) are found on the project's boundary adjacent to Kahuku Ranch.

On pockets of clinkery 'a'a lava, the whitish-gray lichen, Stereocaulon volcani, becomes more abundant.

4. Lava

The 1887 Lava Flow is mostly devoid of vegetation except for an area near the highway. At one time the county excavated material from this site for its highway project.

Patches of weedy grass and shrub species such as broomsedge (Andropogon virginicus), barbwiregrass (Cymbopogon refractus , Natal redtop (Rhynchelytrum repens), indigo (Indigofera suffruticosa), and pluchea (Pluchea odorata) occur on the former cinder/gravel pit.

Because plant species on the lava flow of the mauka portion vary little from those found on the lava flows of the makai portion, they have been grouped in the species list presented in Appendix 1.

RARE, THREATENED AND ENDANGERED SPECIES

None of the species inventoried during this survey are officially listed endangered or threatened species which are protected by federal and state laws. There are also no species currently being proposed as endangered or threatened species. However, one species found on the mauka portion is a candidate endangered species. Pleomele hawaiiensis (syn. Dracaena hawaiiensis), the halapepe, is a Category 1 candidate endangered species (U.S. Fish and Wildlife Service 1980).

A Category 1 species is a taxon for which the U.S. Fish and Wildlife Service presently has sufficient information on hand to support the biological appropriateness of it being listed as an Endangered or Threatened species. Plants listed in Category 1 may be considered candidates for listing and, as such, consideration should be given them in environmental planning.

The halapepe is a freely-branching tree, up to 50 ft. tall, with many, coarse, erect, main branches. Strap-like leaves, about 1 ft. long and 1 in. wide, are crowded at the ends of branches. Tubular yellowish-green to cream-colored flowers are borne in short panicles. Fruits are round, about 0.3 in. wide, and orange-brown to red when mature.

The type specimen for Pleomele hawaiiensis described by Degener and Degener in 1980 in their Flora Hawaiiensis was collected at 1,900 ft. elevation near the "Belt Road", mauka of Pohue Bay, Ka'u, Hawai'i. Nagata (1983) reported three trees from the nearby, proposed Kapu'a Farms project area.

Halapepe is found in the dry forests of North and South Kona and Ka'u, generally between 1,000 and 2,000 ft. elevation. It reaches its best development in the dry forests of Pu'u Wa'awa'a, North Kona.

About 8 halapepe trees are found on the mauka portion, where they occur primarily in the open 'ohi'a forest (Figure 1), although one plant is found in the grassland-scrub community. The plants range in size from 15 to 20 ft. tall. No seedlings or juvenile plants were observed during this survey. About a dozen feral goats, as well as goat-damaged vegetation, were noted during the field study. Most of the trees had just finished flowering and bore immature fruits.

Two species found during this survey are listed in Fosberg and

and Herbst (1975). These two species also occur in the 'ohi'a forest vegetation type on the mauka portion. The maua (Xylosma hawaiiensis var. hillebrandii), a small tree, is considered "Depleted", much less common over all or most of its range than formerly, the depletion directly or indirectly the result of human activities. Only one plant was found at about 1,640 ft. elevation. Korthasella remyi, a member of the mistletoe family, is listed as "Uncertain", insufficient information available to determine status. It is found growing on the branches of 'ohi'a trees. Neither of these two species is considered threatened or endangered by federal and/or state agencies.

DISCUSSION AND RECOMMENDATIONS

A total of 140 vascular plant species were inventoried during this survey. Of these, 85 (61%) are introduced or exotic species; 5 (3%) are of Polynesian origin; 22 (16%) are indigenous; and 28 (20%) are endemic.

Native taxa (indigenous and endemic) make up 36% of the species inventoried and the greatest numbers and kinds of native species are found in the 'ohi'a forest vegetation type on the mauka portion of the proposed development. One candidate endangered species, Pleomele hawaiiensis, the halapepe, is found in this vegetation type.

The coastal, lowland areas of the makai portion do not support any rare, threatened or endangered plant species. The vegetation is composed largely of a scrub community consisting primarily of Natal redtop (Rhynchelytrum repens) and hi'aloa (Waltheria indica var. americana). The makai portion has a rather depauperate flora. Notably missing are beach naupaka (Scaevola taccada), hinahina (Heliotropium anomalum), pua-pilo (Capparis sandwicensis), and noni (Morinda citrifolia). At one time, large

herds of goats roamed the area. The plants mentioned above probably occurred on the site but were extirpated due to grazing by the great numbers of goats.

The proposed project will require clearing, grading, and construction of buildings and homes and other related resort amenities, as well as landscaping. These activities will cause major changes in the vegetation communities which now exist on the project site.

The following mitigation measures are offered:

Makai portion

° Anchialine ponds - As many of the anchialine pond areas should be preserved and incorporated into the landscape plans. Although there are no rare, threatened or endangered plant species around the pond areas, the ponds have been rated as "Class A" ponds by Maciolek and Brock (1974). The ponds have been determined by Maciolek and Brock to have exceptional natural value based on physical structure, diversity, representative aquatic communities, and new or unusual endemic species.

° Impact on vegetation and landscaping - The project will remove much of the existing vegetation on the proposed resort site; large portions of the resort area will be landscaped. On the airport facilities area, the impact will be minimal as it is located on the 1907 Lava Flow which is largely devoid of vegetation.

It is recommended that, wherever possible, native species already found on the project area or nearby areas be propagated and used for landscaping. These include 'ohi'a (Metrosideros collina ssp. polymorpha), hinahina, pohuehue (Ipomoea brasiliensis), beach naupaka, pa'u-o-Hi'i-aka (Jacquemontia sandwicensis), noni, pua-pilo, naio (Myoporum sandwicense), hala

(Pandanus odoratissimus), 'ilima (Sida fallax), alahe'e (Canthium odoratum), 'ulei (Osteomeles anthyllidifolia), and pua-kala (Argemone glauca). Plants introduced by the Hawaiians such as milo (Thespesia populnea), kou (Cordia subcordata), coconut (Cocos nucifera), and ti (Cordyline terminalis) are also excellent choices for landscaping.

These native and Polynesian species are adapted to the low rainfall, salt-spray, higher solar radiation, and other environmental conditions characteristic of the coastal lowland. They will require very little soil and less water than the more commonly used landscape plants. In addition, as they are already found in the general region, they will not pose an "invasive threat" to the native ecosystems found on the adjoining Manuka Natural Area Reserve.

If introduced, ornamental species are used, then only sterile, hybrid cultivars such as bougainvilleas, plumerias, hibiscus, hybrid turf grasses, etc., should be planted.

Mauka portion

° 'Ohi'a forest and candidate endangered species - The kipuka of 'ohi'a forest which lies adjacent to the 1887 Lava Flow should be preserved as it contains a number of native plant species as well as the candidate endangered Pleomele hawaiiensis.

A passive, nature park with an interpretive nature trail and picnic shelters would be an excellent use of this natural resource. A brochure prepared for the trail could highlight the candidate endangered Pleomele, identify and describe how the Hawaiians used the native species found in the area, and point out common plants and birds found in this area.

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APPENDIX 1. PLANT SPECIES LIST, HAWAIIAN RIVIERA RESORT, KA'U, ISLAND OF HAWAI'I

In the plant species list, families are arranged alphabetically within each of three groups: Pteridophytes, Monocotyledons, and Dicotyledons. Taxonomy and nomenclature of the Pteridophytes (fern and fern allies) follow C. H. Lamoureux's unpublished checklist (1984); taxonomy and nomenclature of the flowering plants (Monocotyledons, Dicotyledons) follow St. John (1973) except where more recently accepted names are used. Hawaiian names used are in accordance with Porter (1972) or St. John (1973). The following information is provided:

1. Scientific name with author citation.

2. Common English or Hawaiian name, when known.

3. Biogeographic status of a species. The following symbols are used:

   E = endemic = native only to the Hawaiian Islands

   I = indigenous = native to the Hawaiian Islands and also to one or more other geographic areas

   P = Polynesian = plants of Polynesian introduction; all those plants brought by the Polynesian immigrants prior to contact with the Western world

   X = introduced or alien = not native to the Hawaiian Islands; brought here intentionally or accidentally after Western contact

4. Vegetation types. Seven major vegetation types or plant communities are recognized on the project site and are discussed in detail in the text. The letter heading each of the columns refers to the following vegetation types:

   c = Coastal vegetation

   cl = Cinderland vegetation

   s = Scrub community

   l = Lava

   g = Grassland-scrub community

   o = 'Ohi'a forest

   p = Pioneer 'ohi'a community

5. Relative abundance. Within each of the vegetation types, the relative abundance of a species or its absence is given. These ratings reflect the abundance of a particular species within the project site and are not applicable to areas outside the project. The following symbols are used:

   A = abundant = the major or dominant species in a given vegetation type

   C = common = distributed throughout a given vegetation type in large numbers

   L = locally common = found in localized patches where it may occur in large numbers, otherwise uncommon to rare in a given vegetation type

   O = occasional = distributed throughout a given vegetation type in moderate numbers

   U = uncommon = observed infrequently but more than 10 times in a given vegetation type

   R = rare = observed 1 to 10 times in a certain vegetation type

   - = absent = not observed in a certain vegetation type during this survey.

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	p
PTERIDOPHYTA (FERNS AND FERN ALLIES)									
ASPLENIACEAE (Bird's-nest Fern Family)									
Asplenium adiantum-nigrum L.	'iwa 'iwa	I	-	-	-	-	R	U	-
BLECHNACEAE (Blechnum Family)									
Sadleria cyatheoides Kaulf.	'ama'u	E	-	-	-	-	U	-	R
GLEICHENIACEAE (Vine Fern Family)									
Dicranopteris linearis (Burm.) Underw.	uluhe,eluhe	I	-	-	-	-	-	-	R
HEMIONITIDACEAE (Gold Fern Family)									
Pityrogramma calomelanos (L.) Link	gold fern, silver fern	X	-	-	-	-	R	R	-
HYPOLEPIDACEAE (Bracken Fern Family)									
Pteridium aquilinum var. decompositum (Gaud.) Tryon	kilau, kilau-pueo	E	-	-	-	-	O	-	-
LINDSAEACEAE (Lace Fern Family)									
Sphenomeris chinensis (L.) Maxon	pala'a	I	-	-	-	-	R	_	U
NEPHROLEPIDACEAE (Sword Fern Family)									
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	sword fern	X	U	O	U	U	O	O	O
POLYPODIACEAE (Common Fern Family)									
Phymatosorus scolopendria (Burm.) Pic.-Ser.	laua'e, lauwa'e	X	-	-	-	-	R	-	R
Pleopeltis thunbergiana Kaulf.	pakahakaha, 'ekaha-'akolea	I	-	-	-	-	R	O	O
Polypodium pellucidum Kaulf.	'ae, 'ae-lau-nui	E	-	-	-	-	U	U	O

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	p
PSILOTACEAE (Psilotum Family)									
Psilotum nudum (L.) Beauv.	moa,pipi	I	-	-	R	-	R	O	L
SINOPTERIDACEAE (Cliffbrake Fern Family)									
Doryopteris decipiens (Hook.) J. Sm.	kumu-niu, manawahua, 'iwa 'iwa	E	-	U	U	-	U	O	-
Pellaea ternifolia (Cav.) Link	kalamoho, lau-kahi	I	-	-	-	-	U	O	U
Pellaea viridis (Forsk.) Prantl.		X	-	-	-	-	-	R	-
MONOCOTYLEDONS (FLOWERING PLANTS)									
AGAVACEAE (Sisal Family)									
Cordyline terminalis (L.) Kunth	ti, ki	P	-	-	-	-	R	-	R
Pleomele hawaiiensis Deg. & Deg.	halapepe	E	-	-	-	-	-	R	-
CYPERACEAE (Sedge Family)									
Bulbostylis capillaris (L.) C.B. Clarke		X	-	-	-	-	-	-	U
Carex wahuensis var. rubiginosa R.W. Krauss		E	-	-	-	-	R	O	-
Cladium leptostachyum Nees & Meyen	'uki	E	L	-	-	-	-	-	-
Cyperus laevigatus L.	makaloa,'ehu'awa	I	L	-	-	-	-	-	-
Cyperus aff. meyenianus Kunth		X	-	-	-	-	R	U	R
Fimbristylis dichotoma (L.) Vahl	tall fringe rush	X	-	-	-	-	U	-	-
Fimbristylis aff. hawaiiensis Hbd.		E	-	-	U	-	-	-	-
Fimbristylis pycnocephala Hbd.		I	L/O	L/O	U/R	-	-	-	-
Kyllinga polystachyos (Rottb.) Beauv.		I	R	-	-	-	-	-	R

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	p
GRAMINEAE (Grass Family)									
Andropogon pertusus (L.) Willd.	pitted beardgrass	X	-	R	-	-	-	-	-
Andropogon virginicus L.	broomsedge	X	-	U	O	U	A	C	O
Cenchrus ciliaris L.	buffel grass	X	U	-	-	-	-	-	-
Cenchrus echinatus L.	common sandbur, 'ume'alu	X	R	-	-	-	-	-	-
Chloris inflata Link	swollen fingergrass, mau'ulei	X	-	R	-	-	-	-	-
Chrysopogon aciculatus (Retz.) Trin.	golden beardgrass, pilipili-'ula	X	-	-	L	-	O	-	-
Cymbopogon refractus (R. Br.) A. Camus	barbwiregrass	X	-	L	L	-	A	C	U
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X	O	O	-	-	O	-	-
Eleusine indica (L.) Gaertn.	goosegrass, manienie-ali'i	X	-	R	-	-	-	-	-
Eragrostis tenella (L.) Beauv. ex R. & S.	lovegrass	X	U	-	O	U	-	-	-
Eragrostis sp.		X	-	-	-	-	U	-	R
Heteropogon contortus (L.) Beauv. ex R. & S.	pili, piligrass	I	-	-	O	-	-	-	-
Hyparrhenia rufa (Nees) Stapf	thatchinggrass, jaragua	X	-	L	R	-	-	-	-
Melinis minutiflora Beauv.	molassesgrass	X	-	-	-	-	L/O	O	O
Oplismenus hirtellus (L.) Beauv.	basketgrass, honohono-kukui	X	-	-	-	-	-	O	-
Panicum maximum Jacq.	Guinea grass	X	-	-	-	-	L/O	O	-
Pennisetum clandestinum Hochst. ex Chiov.	kikuyugrass	X	-	-	-	-	L/U	U	-
Pennisetum setaceum (Forsk.) Chiov.	fountaingrass	X	-	U	R	-	-	-	-

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	p
Rhynchelytrum repens (Willd.) C.E. Hubb.	Natal redtop	X	O	C	A	U	O	O	U
Setaria geniculata (Poir.) Beauv.	perennial foxtail	X	-	-	-	-	L/O	O	-
Sporobolus indicus (L.) R. Br.	West Indian dropseed	X	-	-	R	-	-	-	-
ORCHIDACEAE (Orchid Family)									
Arundina bambusaefolia (Roxb.) Lindl.	bamboo orchid	X	-	-	-	-	U	-	R
Epidendrum sp.	epidendrum	X	-	-	-	-	-	-	L
Phaius tankervilliae (Banks ex L'Her.) Bl.		X	-	-	-	-	-	U	-
Spathoglottis plicata Bl.	Chinese ground orchid	X	-	-	-	-	U	U	R
PALMAE (Palm Family)									
Cocos nucifera L.	coconut, niu	P	L	-	-	-	-	-	-
PANDANACEAE (Screw Pine Family)									
Pandanus odoratissimus L. f.	pandanus, hala	I	L	-	-	-	-	-	-
RUPPIACEAE (Ruppia Family)									
Ruppia maritima var. pacifica St. John & Fosberg	widgeon grass, ruppia	I	L	-	-	-	-	-	-
DICOTYLEDONS (FLOWERING PLANTS)									
AMARANTHACEAE (Amaranth Family)									
Nototrichium sandwicense (Gray in Mann) Hbd.	kulu'i	E	-	-	-	-	-	U	-
ANACARDIACEAE (Mango Family)									
Schinus terebinthifolius Raddi	Christmas berry, wilelaiki	X	R	-	R	-	L/O	O	U

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	p
ASCLEPIADACEAE (Milkweed Family)									
Asclepias curassavica L.	butterfly weed, lau-lele	X	-	-	-	-	R	-	-
Gomphocarpus physocarpus E. Mey.	ballon plant, gomphocarpus	X	O/U	-	O	U	O	-	-
BORAGINACEAE (Heliotrope Family)									
Cordia subcordata Lam.	kou	P	R	-	-	-	-	-	-
Messerschmidia argentea (L. f.) Johnston	tree heliotrope	X	R	-	-	-	-	-	-
CACTACEAE (Cactus Family)									
Opuntia ficus-indica (L.) P. Mill.	prickly pear, panini	X	-	-	-	-	U	R	-
CASUARINACEAE (Casuarina Family)									
Casuarina glauca Sieb.	longleaf ironwood	X	-	-	-	-	-	-	L
COMBRETACEAE (Terminalia Family)									
Terminalia catappa L.	false kamani	X	R	-	-	-	-	-	-
COMPOSITAE (Daisy Family)									
Ageratum conyzoides L.	ageratum, maile-hohono	X	-	-	-	-	U	O	-
Bidens alba (L.) DC.		X	-	-	-	-	-	U	-
Bidens pilosa L.	Spanish needle, ko'oko'olau	X	-	-	-	-	R	U	-
Dubautia scabra (DC.)Keck	kupaoa	E	-	-	-	-	-	-	O
Emilia fosbergii Nicolson	red pua-lele	X	-	-	-	-	U	U	-
Emilia sonchifolia (L.) DC.	lilac pua-lele	X	-	-	-	-	R	-	-
Erechtites valerianaefolia (Wolf) DC.	erechtites	X	-	-	-	-	-	R	-
Erigeron bonariensis L.	hairy horseweed, ilioha	X	-	-	R	-	U	-	-

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	p
Eupatorium riparium Regel	pamakani	X	-	-	-	-	U	-	R
Gnaphalium sandwicensium Gaud. var. sandwicensium	'ena'ena	E	-	-	R	-	U	R	R
Hypochoeris radicata L.	hairy cats-ear	X	-	-	-	-	U	-	R
Picris hieracioides L.	hawkesweed	X	-	-	-	-	U	-	-
Pluchea odorata (L.) Cass.	pluchea, shrubby fleabane	X	L	O	O/U	U	U	U	O
Sonchus asper (L.) Hill	spiny sow thistle	X	U	-	-	-	R	-	-
Sonchus oleraceus L.	sow thistle, pua-lele	X	R	-	R	-	U	-	R
Vernonia cinerea (L.) Less.	ironweed	X	R	O	O	U	-	U	-
CONVOLVULACEAE (Morning-glory Family)									
Ipomoea brasiliensis (L.) Sweet	pohuehue, beach morning glory	I	L	-	-	-	-	-	-
Ipomoea indica (Burm.) Merr.	koali-'awania,koali-awa	I	-	-	-	-	U	U	U
Ipomoea macrantha Roemer & Schultes	koali	I	L	-	-	-	-	-	-
Ipomoea triloba L.	little bell	X	-	-	-	-	R	-	-
Jacquemontia sandwicensis Gray	pa'u-o- Hi'i-'aka	E	L	-	-	-	-	-	-
CRUCIFERAE (Mustard Family)									
Lepidium virginicum L.	wild peppergrass	X	-	R	-	-	-	-	-
CUCURBITACEAE (Squash Family)									
Cucumis dipsaceus Ehrenb. ex Spach	wild cucumber	X	R	-	-	-	-	-	-
Momordica charantia var. pavel Crantz	wild bittermelon	X	-	-	-	-	-	R	-

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	u
EBENACEAE (Ebony Family)									
Diospyros ferrea (Willd.) Bakh.	lama	E	-	-	-	-	R	O	-
EPACRIDACEAE (Epacris Family)									
Styphelia tameiameiae (Cham.) F. Muell.	pukiawe, maiele, kawa'u	I	-	-	-	-	L/O	L/O	O
ERICACEAE (Heath Family)									
Vaccinium reticulatum Sm.	'ohelo	E	-	-	-	-	R	-	U
EUPHORBIACEAE (Spurge Family)									
Euphorbia hirta L.	garden spurge, koko-kahiki	X	-	U	U	U	-	-	-
Euphorbia prostrata Ait.	prostrate spurge	X	-	R	-	-	-	-	-
FLACOURTIACEAE (Flacourtia Family)									
Xylosma hawaiiensis var. hillebrandii (Wawra) Sleumer	maua	E	-	-	-	-	-	R	-
GENTIANACEAE (Gentian Family)									
Centaurium erythraea Rafn.	bitter herb, European centaury	X	-	-	-	-	U	-	-
LABIATAE (Mint Family)									
Ocimum gratissimum L.	wild basil	X	-	-	R	-	-	-	-
Plectranthus parviflorus Willd.	spurflower, 'ala'ala-wai-nui	I	-	-	-	-	R	O	-
Salvia occidentalis Sw.	West Indian sage	X	-	-	-	-	R	-	-

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	u
LAURACEAE (Laurel Family)									
Cassytha filiformis L.	kaunoa'oa, kaua'oa-pehu	I	-	-	-	-	-	L	-
LEGUMINOSAE (Pea Family)									
Cassia lechenaultiana DC.	partridge pea, lauki	X	-	U	-	-	O	U	R
Crotalaria incana L.	fuzzy rattlepod, kukae-hoki	X	-	-	-	-	R	-	-
Crotalaria pallida Aiton		X	-	-	R	-	U	R	-
Desmodium canum (Gmel.) Schinz & Thell.	Spanish clover, ka'imi	X	-	-	-	-	O	U	-
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	X	-	-	-	-	U	-	R
Desmodium triflorum (L.) DC.	three-flowered beggarweed	X	R	-	-	-	O	-	-
Desmodium uncinatum (Jacq.) DC.	Spanish clover, Hawaiian tick-trefoil	X	-	-	-	-	O	-	U
Indigofera suffruticosa Mill.	indigo, 'iniko	X	-	-	-	-	O	R	R
Leucaena leucocephala (Lam.) de Wit	koa-haole, ekoa	X	-	-	-	-	U	U	R
Phaseolus lathyroides L.	cow pea, wild bush bean	X	-	R	-	-	U	-	R
Sophora chrysophylla (Salisb.) Seem.	mamane	E	-	-	-	-	-	L/O	-
Tephrosia purpurea (L.) Pers.	'ahuhu, 'auhuhu	I	-	-	R	-	-	-	-
LORANTHACEAE (Mistletoe Family)									
Korthalsella remyana v. Tiegh.	hulumoa, kaumahana	E	-	-	-	-	-	U	-

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	p
MALVACEAE (Mallow Family)									
Malvastrum coromandelianum (L.) Garcke	false mallow, hauuoi	X	-	-	-	-	R	-	-
Sida fallax Walp.	'ilima	I	-	-	C/O	U	O	U	-
Sida rhombifolia L.	Cuba jute	X	-	-	-	-	R	R	-
Thespesia populnea (L.) Soland. ex Correa	milo	P	R	-	-	-	-	-	-
MENISPERMACEAE (Moonseed Family)									
Cocculus ferrandianus Gaud.	huehue, hue'ie	E	-	-	-	-	U	O	U
MYOPORACEAE (Naio Family)									
Myoporum sandwicense Gray	naio, bastard sandalwood	E	-	-	-	-	R	O	-
MYRSINACEAE (Myrsine Family)									
Myrsine lanaiensis Hbd.	kolea	E	-	-	-	-	-	O	-
MYRTACEAE (Myrtle Family)									
Eucalyptus robusta Sm.	swamp mahogany	X	-	-	-	-	-	-	R
Metrosideros collina ssp. polymorpha (Gaud.) Rock	'ohi'a, 'ohi'a-lehua	E	-	-	U	R	O/U	A	A
Psidium guajava L.	guava, kuawa	X	-	-	-	-	U	R	R
NYCTAGINACEAE (Four o'clock Family)									
Boerhavia coccinea Mill.		X	-	-	R	-	-	-	-
Boerhavia diffusa L.	alena	I	U	-	-	-	-	-	-
PAPAVERACEAE (Poppy Family)									
Argemone glauca Pope	pua-kala	E	U/R	-	U	R	R	-	-
PASSIFLORACEAE (Passion Flower Family)									
Passiflora foetida L.	scarlet-fruited passion flower, pohapoha	X	U	U	U	-	-	-	-

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	p
PIPERACEAE (Pepper Family)									
Peperomia latifolia Miq.	'ala'ala-wai-nui, kupali'i	E	-	-	-	-	-	R	-
Peperomia sp.		E	-	-	-	-	R	R	-
PLANTAGINACEAE (Plantain Family)									
Plantago major L.	broad-leaved plantain, lau-kahi	X	R	-	-	-	-	-	-
PORTULACACEAE (Purslane Family)									
Portulaca cyanosperma Egler	'ihi	E	O	-	U	U	-	U	-
Portulaca oleracea L.	common purslane, 'ihi	X	-	-	-	-	-	R	R
Portulaca quadrifida L.		X	-	-	-	-	-	-	R
PROTEACEAE (Silky Oak Family)									
Grevillea robusta A. Cunn.	silk oak, 'oka-kilika	X	-	-	-	-	U	-	-
ROSACEAE (Rose Family)									
Osteomeles anthyllidifolia Lindl.	uulei, 'ulei	E	-	-	-	-	L/O	O	R
RUBIACEAE (Coffee Family)									
Canthium odoratum (Forst. f.) Seem.	alahe'e, walahe'e	I	-	-	-	-	R	O	-
SANTALACEAE (Sandalwood Family)									
Santalum paniculatum H. & A.	'ili-ahi	E	-	-	-	-	R	O	-
SAPINDACEAE (Soapberry Family)									
Dodonaea sandwicensis Sherff	a'ali'i	E	-	-	R	-	L	L/O	R
SOLANACEAE (Tomato Family)									
Nicotiana tabaccum L.	tobacco, paka	X	-	-	-	R	-	-	-

Scientific name	Common name	Status	Vegetation types c	cl	s	l	g	o	p
STERCULIACEAE (Cocoa Family)									
Waltheria indica var. americana (L.) R. Br. ex Hosaka	hi'aloa, 'uhaloa	I	C/O	O	A	U	O	U	U
VERBENACEAE (Verbena Family)									
Lantana camara L.	lantana, lakana	X	R	-	R	-	O	O	R
Stachytarpheta australis Mold.	Cayenne vervain	X	-	-	-	-	U	U	-
Verbena litoralis HBK.	weed verbena, ha'uowi, ha'uoi	X	-	-	-	-	R	-	R

CHAR & ASSOCIATES

Botanical [illegible]

MEMORANDUM

TO Richard H. Van Horn
Belt Collins & Associates

FROM Winona P. Char

DATE 20 May 1987

SUBJECT Summary of Findings of Flora Survey

A field survey of the proposed resort area, airfield, and support community was conducted from 10 April to 16 April 1987. A total of 139 vascular plant species were inventoried. The majority of the plants were introduced species (i.e., brought here intentionally or accidentally after Western contact). One candidate endangered species, pleomele hawaiiensis (formerly Dracaena hawaiiensis) or halapepe, was found in the forested area of the proposed support community.

Vegetation on the makai portion of the project area (resort area and airfield) consists largely of a scrub community composed primarily of Natal redtop (Rhynchelytrum repens) and hi'aloa (Waltheria indica var. americana). A band of coastal vegetation of varying width is found along the shore.

On the mauka portion of the project area (support community), a grassland-scrub association dominated by broomsedge (Andropogon virginicus), barbwiregrass (Cymbopogon refractus), and scattered shrubs covers most of the area. Several stands of 'ohi'a forest (Metrosideros collina ssp. polymorpha) are found on the mauka portion. These forests support a large number of native tree and shrub species including the halapepe, a candidate endangered species. The 1868 lava flow supports a community of scattered 'ohi'a trees and other native species which are able to colonize barren lava flows.

APPENDIX G

Geological Investigations

GEOLOGICAL INVESTIGATION
PROPOSED HAWAIIAN RIVIERA RESORT
KA'U, HAWAII, HAWAII
TMK: 9-2-01: Portion 72
FOR PALACE DEVELOPMENT CORPORATION AND
KA'U AINA PARTNERSHIP

DAMES & MOORE JOB NO. 15742-001-11

Dames & Moore

DAMES & MOORE

July 29, 1987
15742-001-11

Belt Collins Associates, Inc.
606 Coral Street
Honolulu, Hawaii 96814

Attention: Mr. Richard Van Horn

Subject: Geological Investigation
Proposed Hawaiian Riviera Resort
Ka'u, Hawaii, Hawaii
TMK: 9-2-01: Portion 72
For Palace Development Corporation and
Ka'u Aina Partnership

Gentlemen:

Six copies of our report, "Geological Investigation, Proposed Hawaiian Riviera Resort, Ka'u, Hawaii, Hawaii, TMK: 9-2-01: Portion 72, for Palace Development Corporation and Ka'u Aina Partnership," are submitted herewith.

The scope of our work was defined in our proposal dated March 11, 1987, and this geological investigation has generally conformed to the scope described in the proposal.

It has been a pleasure performing this assignment for you. If you have any questions regarding this report, please feel free to contact us for clarification.

Respectfully submitted,

DAMES & MOORE
A Professional Limited Partnership

S. K. Djou, P.E.
Partner (Ltd.)

SKD:ob/mjo(4080A/323A:15742-001-11)
(Six copies submitted)

cc: Helber, Hastert & Kimura, Planners
Attention: Mr. Lawrence Helber

Palace Development Corporation
Attention: Mr. Charles Chidiac

Ka'u Aina Partnership
Mr. Thomas Bodden

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1.0 INTRODUCTION

This report presents the results of our geological investigation for the proposed Hawaiian Riviera Resort to be located west of South Point in Ka'u, Hawaii, Hawaii. The site is shown on the Location Map, Island of Hawaii, Plate 1.

It is our understanding that the resort site encompasses approximately 2,300 acres of oceanfront property and is a portion of a larger parcel. The property is located southwest of the Mamalahoa Highway. It extends from Humuhumu Point to the area east of Kahakahakea. The proposed site location and area of our study is shown as the shaded area on the Plot Plan, Plate 2.

The property is subdivided into two parcels. Palace Development Corporation will develop the portion on the west end. The development will be called the Hawaiian Palace Resort. The eastern portion will be developed by Hawaii Ka'u Aina Partnership.

Helber, Hastert & Kimura, Planners, and Belt Collins & Associates, Inc., are preparing the Environmental Impact Statement for this project. We understand that the entire 3,200-acre project will consist of resort hotels, residential homes, a marina complex, golf courses, equestrian areas, an airfield, and a support community. Our study was focused on 2,300 acres of ocean front property as this is perceived as the area most susceptable to geological effects and hazards, and will therefore require the most planning. The proposed access roadway, airfield, and support community areas were not included in this geological investigation because their locations were not fully defined at the time of our study.

2.0 PURPOSE AND SCOPE OF WORK

The purpose of our investigation was to prepare a geological study of the area which would be included in the environmental impact statement. The geological investigation would consist of studying the history of the site, mapping the geological features at the resort site, drilling two probes at the proposed marina site, assessing the risk with regards to new lava flows and of ground movement due to earthquakes.

Our geological investigation consisted of the following scope of work:

1. Conduct a literature study of the geological history of the site. Emphasis would be given for the proposed resort destination area.
2. Conduct an air and land reconnaissance of the area to photograph and to map the lava features.
3. Conduct a subsurface exploration at the proposed marina area by drilling two air track probe borings to explore the lava formation and stratification.
4. Conduct a risk assessment of the possibility of new lava flows entering into the area.
5. Conduct a risk assessment of future widening or movement of the existing cracks at the site.
6. Conduct an evaluation of known method of crushing the lava for landscaping and agricultural development.

This report presents the findings of our geological study and our recommended resort planning guidelines to mitigate on-site geological hazards. The Geological Study section is organized to present a brief overview of the geology of the Island of Hawaii, the regional geological features surrounding the resort site, followed by specific geological features and hazards identified by our study team.

The Discussion and Recommendations section is organized to present our ideas on how to utilize on-site materials as resources for construction and how to mitigate the unique as well as commonly-known geological hazards with a minimum of environmental impacts.

3.0 GEOLOGICAL STUDY

3.1 ISLAND GEOLOGY

The Island of Hawaii is the largest land mass in the Hawaiian chain and is also the youngest. It is formed by five volcanoes: Kohala, Hualalai, Mauna Kea, Mauna Loa, and Kilauea. At present, Mauna Loa and Kilauea are active. The other three are considered to be dormant.

A sixth volcano, Loihi Seamount, has recently been located off the southeast coast of Kilauea. The volcano locations are shown on Plate 1.

The shield of Mauna Loa has been built by eruptions along a southwest and a northeast rift zone which radiate out from the summit cauldera. The rift zones are shown on Plate 3. The southwest (SW) rift of Mauna Loa is about 60 miles (100 kilometers) long, including a submarine portion which extends to the base of the volcano.

Island volcanoes are constructed of lava flows characterized by very fluid lavas capable of spreading great distances from their vents. In Hawaii, two types of lava, pahoehoe and a'a, are identified based on contrasting surface features and flow behavior (Ref. 1). A'a flows are thicker and more viscous than pahoehoe lava. Hawaiian lava flows range from a few yards to more than 35 miles (56 kilometers) in length. The width of the flows varies from about

6 feet (2 meters) to 2.5 miles (4 kilometers). More descriptive definitions of a'a and pahoehoe lavas and other geologic terms used in this report are contained in Appendix A of this report.

3.2 REGIONAL GEOLOGY

The resort site is located along the seacoast of the southwest flank of Mauna Loa below the SW rift zone. Mauna Loa's summit is located 35 miles north of the site. The southwest flank of Mauna Loa is constructed of numerous pahoehoe and a'a lava flows. The geological region is bounded by the ocean, and the Kealakekua and Kahuku faults. The location of the faults is shown on the Regional Geological Structures Map, Plate 3.

The north-south trending Kahuku fault, which is located 6 miles (10 kilometers) southeast of the site, is located on the SW rift zone at South Point. The western side of the fault is down-dropped 600 feet (180 meters) relative to the eastern side, and forms a cliff at the sea coast. The fault can be traced inland for 11 miles (16 kilometers). The fault scarp gradually decreases in height until it disappears a short distance above Mamalahoa Highway (Highway 11 or the Belt Highway). This is due in part to infilling by younger lava flows. The fault extends beyond South Point at least 17.4 miles (29 kilometers) under the ocean.

The Kealakekua fault at Kealakekua Bay is located more than 31 miles (50 kilometers) from the site. This fault is observed to extend inland for approximately 5 miles (8 kilometers).

The slope of Hawaiian shield volcanoes is commonly at an angle of repose of 3 to 5 degrees or 10 percent. However, the ground slope in this geological region between the two faults is about 10 degrees or 18 percent.

Because the seaward flank of Mauna Loa is unbuttressed and sloped at a relatively steep angle, the repeated intrusion of magma into the SW rift zone often causes ground shifts on a regional scale. The inflation and deflation of the magma chamber in the rift zone causes gravitational tensional movement along the flank and causes the area between the two main faults to break into large regional slump blocks. These regional blocks are movable and have slumped downwards relative to each other. Recent geological investigation reports indicate that the slumping extends to the submarine region offshore (Refs. 2, 3). The location of the off-shore slump blocks are shown on Plate 3.

It should be noted that virtually all of the major slump blocks above sea level located between the two faults have been covered by lava flows (Ref. 2). This suggests that regional block-faulting has not been active for decades or maybe centuries. Also, the resort site is located in subsidence zone 4, the lowest risk zone (Ref. 1).

3.3 SITE GEOLOGY

The proposed resort site extends along the shoreline for approximately 5 miles from Point Humuhumu to the area east of Kahakahakea. It extends from the shoreline to an elevation of approximately +240 feet Mean Sea Level (MSL). Topographically, the site has an average slope of 3 degrees or approximately 5 to 6 percent. The slope of the area above the proposed resort site is at approximately 10 degrees or 18 percent.

The site is covered by a'a and pahoehoe lava. Surface features of this site were determined by the characteristics of the prehistoric (pre-1789) and historic lavas of the Ka'u volcanic series of Mauna Loa.

3.3.1 Lava Flows

The majority of the lava flows on the site are prehistoric (pre-1789). The western boundary of the proposed Hawaiian Palace site is located on a prehistoric a'a lava flow with an estimated age in the range of 800 to 1,000 years (Ref. 4). The pahoehoe lava that makes up the east portion of the Hawaiian Palace site and all of the land of the Ka'u Aina site (except the 1887 flow at the east boundary) range in age from 750 to greater than 1,500 years (Ref. 5).

There have been seven historic eruptions recorded along the southwest rift zone of Moana Loa. Two of these historic lava flows, 1887 and 1907, are located on or near the Ka'u Aina site. The lava flow of 1887 marks the eastern boundary of the resort site. In 1887, it was recorded that a vent opened approximately 12.5 miles from the site, at the +5,400 feet (1,700 meters) elevation on the southwest rift zone (Ref. 5). The vent was originally 4.5 miles (7.5 km) long but activity quickly localized to 2 vents, each about 1/2 mile (0.8 km) long. Due to the steepness of the terrain, the great volume of lava which erupted from the vents, and the relatively short distance to the sea, the flow reached the sea within one day. The eruption continued for 10 days.

The 1907 flow came from a vent at Elevation +5,800 feet (1,800 meters) that was active for 15 days. The a'a lava flow split into two lobes. The first lobe crossed the Mamalahoa Highway after one day, and the other crossed it after three days. Neither of the lobes of lava reached the sea. The location of the major flows and their estimated ages are shown on the Map of Relative Ages of Lava Flows, Plate 4.

A'a lava covers anywhere from 1/3 to 1/2 of the western portion of each of

the projects, and pahoehoe covers most of the eastern portions. A scaly pahoehoe lava was identified throughout much of the eastern portion of the site. The location of the lava flow types is shown in the Geologic Map, Plate 5.

The a'a flows at the site are typical in that they have a surface of crumbly clinker underlain by a massive core of hard, dense lava. Lava balls were observed along many flow margins, and two flow channels were located, one at each end of the site.

The pahoehoe flows have a smoother surface than the a'a flow. Numerous features characteristic of pahoehoe lava flows such as feeder channels, tumuli, and collapse features such as ponds, lava tubes, blisters and voids, were located on the site. No large lava tubes greater than 6 feet in diameter were located during the geological reconnaissance. Evidence of a large lava tube was observed, however, during the aerial reconnaissance in the kipuka above the proposed Hawaiian Palace Resort property. Many smaller lava tubes were located and were identified as caves.

Scaly pahoehoe appears to be transitional between pahoehoe and a'a. Its surface texture is more like that of a'a clinker. Many of the large collapse features, such as ponds, lava tubes, and blisters were associated with the scaly pahoehoe lava.

3.3.2 Shoreline Features

Other features observed at the site and shown on the Geologic Map are beaches, ground cracks, and brackish water ponds.

Several different types of beaches were identified. A white coralline sand beach is located at Pohue Bay. Black volcanic cinder sand beaches are located at the base of the littoral cones.

During the field reconnaissance, we observed that some of the shoreline areas (up to 200 feet inland) were covered with coarse to cobble-sized basaltic and coralline materials. We believe the presence of these loose surface materials is most likely the result of storm wave activity.

Several littoral cones are located east of Pohue Bay. They are aligned in two distinct rows. The row of younger cones is located along the shoreline. A second row of older littoral cones sits inland and marks the location of a former shoreline. The littoral cones are covered or surrounded by subsequent lava flows.

Large ground cracks were observed along portions of the shoreline at the resort site. These cracks were particularly obvious in the pahoehoe lava flows. The cracks tend to run in pairs, are about 2 feet wide and some have a vertical displacement on the oceanside portion of the crack of up to 2 feet. These cracks are estimated to be greater in depth than 25 feet as our geologist was able to push a 25-foot long measurement tape through the cracks. At the westernmost end of the proposed Hawaiian Palace site, it appears that the cracks may extend under a more recent a'a lava flow.

Brackish water or anchialine ponds were observed along the coastline of the property. Kanonone Water Hole and another large pond were located west of Pohue Bay. Several smaller ponds and two large ground cracks containing brackish water were located at the east end of the property. Seepage of fresh and brackish water was observed along the entire length of the coast. Beach rock, which forms at intertidal areas where fresh water is seeping, was observed on the eastern end of the Ka'u Aina site. In other portions of the shoreline, fresh water was observed floating at the surface of the salt water, particularly during low tide. This occurrence is commonly referred to as "gasoline water."

Sea cliffs are located along approximately 30 percent of the coastline. The sea cliffs have an average height of 30 feet above sea level. Two large sea caves were observed shoreward of Puu Kahakahakea.

3.4 ON-SITE GEOLOGICAL HAZARDS

3.4.1 Ground Cracks

As stated in the Geology section, ground cracks are visible along portions of the coastal length of the property. They are generally located along the coastline but can also be found about 2,000 feet (610 meters) inland in the western portion.

The ground cracks are slightly arcuate in shape and exhibit a pairing tendency. They averaged about 1.5 feet (0.4 meters) in width but several on both sides of the resort site were as much as 3 feet (0.8 meters) wide. A slight vertical off-set was noticed along most of the ground cracks. There were three major cracks which were offset vertically by about 2 feet (0.6 meters). The cracks are very deep, probably much deeper than 25 feet. Two ground cracks on the eastern part contained brackish water. Their length varied from 30 feet (9 meters) to 1,800 feet (550 meters) with an average length of about 1,300 feet (490 meters).

The exact causes of ground cracking at the site are still under investigation. However, the consensus of the geologists is that these cracks are related to the offshore regional slump blocks (discussed in Section 3.2), and the inflation and deflation of the volcano flanks.

Our current level of investigative effort has not yielded sufficient data to assess the age, rate of movement, and depth of these ground cracks. Based on our knowledge of the probable ages of the pre-historic a'a and pahoehoe

lava flows on the site, our best guess of the age of these ground cracks may be between 300 to 1,000 years old.

In 1976, U. S. Geologic Survey personnel began monitoring a geodetic control line from Na Puu a Pele located west of the site, to Puu Ki on the eastern end of the site (Plate 6). Within the last 11 years, the survey indicates that there has been little or no ground movement across this control line (Ref. 4).

The recordable movements were very small and well within the surveying accuracy tolerance limits. Ground cracks are rather unique geological features that should be considered in the resort planning. Engineering techniques are available and implementable to further quantify the physical characteristics of these cracks. Appropriate planning guidelines have been established in this report to mitigate the potential hazards posed by ground cracks.

3.4.2 Lava Tubes and Voids

Lava tubes and voids are commonly known geological hazards on all Hawaiian islands. Collapsed lava tubes are often identified by aligned circular depressions at the surface of pahoehoe flows. However, many times, there are no visible clues to the presence of lava tubes. Lava tubes and voids have been noticed in the central part of the kipuka on the proposed Hawaiian Palace Resort portion of the site and in the scaly pahoehoe and pahoehoe on the proposed Ka'u Aina property.

A Higher Hazard Lava Tube Area (Plate 5) was identified for the proposed Hawaiian Riviera Resort area because several large depressions with visible lava tube feeders and a collapsed lava tube were located. Very large aligned circular depressions were observed above the property line during the air

reconnaissance. Their size and alignment (suggesting a large lava tube) and the location of the depressions on the property determined the boundaries of this higher hazard area.

Two very large depressions with large visible feeder tubes, were located on the proposed Ka'u Aina site behind Puu Ki. These features were located within the proposed park area. If this area is to be developed, it should also be considered a Higher Hazard Lava Tube area.

Lava tubes and voids are commonly known in Hawaii, and the local construction industry has gained considerable knowledge on how to eliminate or mitigate these incidental hazards.

3.4.3 Tumuli

Tumuli are usually dome-shaped protrusions on the surface of pahoehoe flows. Some tumuli have a thin crust with a large void inside. Their geological hazards are similar to lava tubes and voids, and can be treated similarly. Sometimes, however, tumuli are infilled with solidified lava.

Tumuli can be found in the central part of the kipuka on the proposed Hawaiian Palace Resort part of the site, and in both the pahoehoe and scaly pahoehoe lavas of the proposed Ka'u Aina Resort part of the site.

3.5 EXTERNAL GEOLOGICAL HAZARDS

3.5.1 Lava Flow Hazards

Lava flow hazard in the Hawaiian Islands has recently been quantified on a proposed classification map based on lava-flow coverage of different areas during specific time periods (Ref. 1). The Island of Hawaii is divided into nine hazard zones, with Zone 1 having the highest lava flow risk and Zone 9 having the lowest risk. The proposed site is located in Zone 2. By

comparison, the primary population centers, Hilo and Kailua-Kona, are located in risk Zones 3 and 4, respectively.

Zone 2 is defined as, "several areas that are adjacent to and downslope from an active rift zone ... and therefore, subject to burial by lava flows of even small volume erupted in those rift zones" (Ref. 1). Long and voluminous lava flows have repeatedly entered Mauna Loa's Zone 2, covering about 5 percent of those areas since 1950 and about 20 percent within historical time. The classification of hazard zones is somewhat subjective and may change when new lava flows occur.

Given that two historic (1887 and 1907) a'a lava flows had reached the site and that there have been seven (7) historic eruptions recorded along the southwest rift zone of Mauna Loa, it is likely that there will be more eruptions along this rift in the future. The possibility of a lava flow entering this 5 mile-wide site exists. Accurate predictions of short-term probabilities of lava-flow coverage for this area are not yet feasible (Ref. 1).

Research and monitoring of lava flow occurance is continuing. Recent trends indicate that the SW rift zone eruptive vent locations have a tendency to move upslope (Ref. 2). If this trend continues, it would imply that future eruptive vents will be further away from the site. Therefore, the risk of on-site lava flows may decrease.

3.5.2 Seismic Hazards

The Island of Hawaii has been classified as seismic Zone 3 according to the Uniform Building Code (Ref. 6).

In Hawaii, the majority of earthquakes are the result of magma moving at shallow depth and seldom cause any damage. However, there are occasional

larger scale earthquakes that are associated with structural readjustment within the volcano that can cause property damage. A very large seismic event could cause the regional submarine slump block to move, which in turn may cause tsunami and may also cause the existing ground cracks at the site to move.

The most recent large earthquake to affect this area occurred along the Kealakekua fault in 1951, and had a magnitude of 6.2. A tabulation and a plot of all known large earthquakes between 1918 and 1985 near the Hawaiian Islands are presented in Appendix B.

Currently, there are strong motion detection devices installed in Hawaii to monitor volcanic and seismic activities. Scientists, however, are still not able to accurately forecast earthquake events.

Currently, state-of-the-art earthquake engineering is capable of quantifying seismic risk and providing structural design parameters for a specific site. Concrete and steel buildings can now be designed to provide adequate protection against collapse in case of large earthquakes.

3.5.3 Tsunami Hazards

Tsunamis are generated when a large mass of water is abruptly displaced. A tsunami that affects Hawaii may have been generatd anywhere within the Pacific Basin including the immediate vicinity of Hawaii itself. Locally-generated tsunamis are usually associated with a locally-occurring earthquake or a volcanic eruption.

The effects of locally-generated tsunami are similar to the effects of those generated within the Pacific Basin. Locally-generated tsunamis, however, are more dangerous because they give very little warning time for evacuation.

The most recent local tsunami occurred in 1975 and was generated in the Kalapana area by an earthquake of magnitude 7.2. This 1975 tsunami probably traveled past the shoreline of this site but there is no record of damage or of wave run-up heights.

The best safe guard against tsunami hazards is afforded by the National Weather Service Pacific Warning Center located in Ewa Beach, Oahu. It can identify an earthquake large enough to trigger a possible tsunami within a few minutes and with its strategically located tsunami sensing stations in the Pacific, can verify the occurrence of a tsunami in about half an hour.

3.5.4 Storm Wave Hazards

Storm waves are not a geologic hazard but are mentioned here because storm waves can dislodge large amounts of sea-bottom debris and throw it onto shore areas.

Large coral gravel deposited approximately 200 feet inland was observed along the shore at both ends of the site. This indicates that large storm waves can occur along the shoreline.

Appropriate shoreline protection and setback guidelines for either tsunami or storm wave runups are being developed separately by Sea Engineering Inc.

3.5.5 Miscellaneous Hazards

The site is located far enough away from the Mauna Loa vents so that other geological hazards such as ash fall, volcanic-gas emissions, and pyroclastic surges should not pose a great hazard to the site.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 ENGINEERING PROPERTIES OF GEOLOGIC FEATURES

4.1.1 Pahoehoe

Large portions of the site are covered with pahoehoe lava. Pahoehoe consists of massive, highly vesicular basalt. The nearsurface pahoehoe may be ripped with large bulldozers with great effort. This rock is probably more economically excavated by conventional drilling, blasting, and excavating techniques.

The excavated pahoehoe will come out as relatively large boulders which would have to be crushed in order to be used as fill. The crushing of boulders less than 12 inches can be done using large self-propelled sheepsfoot compactors such as a Caterpillar 825 or 835. Crushing using lighter equipment will be very difficult. The crushing of the material using sheepsfoot compactors will yield fairly coarse aggregate with little fines.

The boulders greater than 12 inches would have to be processed through a 7echanical crusher. The crushed rock will yield fairly well-graded material which can be used for structural fill and road way base course.

4.1.2 A'a

The a'a flow creates a basalt consisting of layers of clinker which are large, highly vesicular gravel particles sandwiched between cores of massive, very low vesicular basalt. The clinker material can be easily crushed using a self-propelled sheepsfoot compactor, and this material yields well graded gravel. With great effort, the clinker can be crushed into sand-sized particles. However, the a'a core, which is very hard and massive, will have to be excavated using blasting techniques and will have to be crushed by mechanical crushers in order to create aggregate.

4.1.3 Lava Tubes and Voids

Within lava flows, generally pahoehoe, there are gas bubbles or lava tubes which may not be able to provide adequate support for buildings. A common technique to detect these voids has been to drill at each of the heavily loaded foundations. Once a lava tube or other void has been detected, several standard solutions for dealing with these features are available. The void may be grouted if small enough, or the foundation structure may be relocated to the bottom of the void. Voids which are very close to the surface can be collapsed using a very heavy weight dropped from a crane. This technique is called dynamic compaction and has been used for compaction of granular soils in other parts of the world. Dynamic compaction should be considered for this project as an economical ground improvement method.

Construction of buildings in lava tube and void areas is feasible. Numerous successful examples can be readily identified in Kawaihae, Waikoloa, Keahole, and Kailua-Kona.

4.1.4 Tumuli and Blisters

Tumuli often contain large volumes of solid basaltic rock but they may also contain a thin hard crust and a large void underneath. Solid tumuli may require extra blasting effort for removal, But they may also be considered as a resource for architectural masonry materials. Hollow tumuli and lava blisters can be treated in similar manner as lava tubes and voids.

4.1.5 Littoral Cones

Littoral cones or lithified ash deposits are generally loose and easily removable. They are a good source of fine-grained construction material, and good soil conditioner for golf course construction.

Because of the loose and compressible nature of the ash materials,

building foundations constructed on the ash could undergo excessive settlement. Accordingly, we recommend that no footings be placed on in-situ ash materials. The footings should be extended to sound rock or be placed on piles. Additional foundation investigation would be required for planning buildings in the littoral cone areas.

4.2 MARINA CONSTRUCTION

The proposed marina is located in pahoehoe lava. The location of the marina is shown on the Geologic Map, Plate 5. To study the subsurface conditions, two probes 35 feet deep were drilled with an air track drill rig from Isemoto Construction Co. The locations of the probes are shown on Plate 7. The probes indicated that the surface layer of pahoehoe lava was 25 to 35 feet deep. Probe 1, located near the ocean, encountered two voids 4 feet in height within a hard rock layer. In Probe 2, drilled inland, the encountered voids were no more than 1 foot in height. A clinker layer was encountered at 25 feet in Probe 2. The clinkers indicated that an a'a lava flow exists below the pahoehoe. The Log of Probes are shown on Plates 8.1 and 8.2.

The rock in the proposed marina can be excavated by drilling and blasting. The edges of the marina basin may be cut to near vertical. The side slopes surrounding the marina should be designed at a maximum slope of 1/2 Horizontal to 1 Vertical (1/2H:1V) or in accordance to architectural and civil engineering design requirements. Flatter-design slopes may be necessary if loose clinker is uncovered. Presplitting is recommended for creating relatively smooth-cut slopes.

Side slope planning should consider the existance of ground cracks. Flatter slopes, set back, and benches may be required near the known ground cracks to maintain slope stability.

Additional borings and a more detailed investigation of the rock condition should be done after the marina location and surrounding grades are established. Material excavated during construction of the proposed marina can be used as fill for foundation pads or stockpiled at the proposed airport site for later use.

4.3 RECOMMENDED RESORT PLANNING GUIDELINES TO MITIGATE GEOLOGICAL HAZARDS

Ground Cracks - Ground cracks are the primary constraints on the site resort planning. These cracks do not pose any planning problem for the siting of the proposed marina.

For the siting of permanent habitable buildings, we recommend that:

1. No building should straddle any crack,
2. No building should be sited within 500 feet from the longitudinal extension of a crack.

Once the building size and column loads are known, then the horizontal setback distance from the ground cracks can best be determined. As a general rule, heavier buildings should have greater setback distance from crack edges.

These planning recommendations may be amended if the age and depth of cracks can be better defined by subsequent investigation studies.

Mat foundations are recommended for buildings that are near any known ground crack. Thick, coarse aggregate cushion fill is recommended under the mat foundations. Utility lines and roadways crossing the cracks will require special design details to tolerate any potential differential ground movement.

Lava Tubes - All building sites should have appropriate foundation investigation and probing to locate lava tubes and voids. Conventional foundation treatment can be implemented if any lava tube or void is found.

Earthquakes - Since this area is a high risk area for earthquakes, the buildings should be designed according to the Uniform Building Code, Seismic Zone 3 requirements. It may also be appropriate to conduct a seismicity evaluation at the design phase of the project to select a most appropriate seismic criteria for building design.

Lava Flows - There is no proven engineering technology which can be used to divert lava flows from entering a site. Recent experience in Iceland and in Hawaii has demonstrated that water sprayed on the advancing lava flow can sometimes alter the flow direction. Technologies for predicting earthquakes, volcanic eruptions, lava flows, and other known geological hazards are still at an early stage of development. Therefore, mitigation against these natural hazards are primarily dependent on early detection, early warning, and evacuation procedures offered by governmental agencies such as the Pacific Tsunami Warning Center and the Department of Civil Defense.

5.0 SUGGESTED FUTURE STUDIES

As part of the design and development of the proposed resort, we recommend that further geotechnical and geophysical studies be conducted to quantify the physical characteristics of the ground cracks. They would consist of cross hole geophysical investigations to determine the depth of the cracks, and the shear wave velocity of the rock. Core samples from the borings can be thin-sliced for mineral analysis. A refraction survey should be performed on the a'a lava flow adjacent to the cracks to determine if the cracks are continuous underneath the a'a flow.

We would also recommend an earthquake engineering study of the site. The purpose of this study would be to derive earthquake design response spectra for the structural design.

These additional studies should preferably be scheduled after the Master Plan for development is finalized, but before the design phase of the development.

6.0 LIMITATIONS

This report has been prepared for the use of Belt Collins & Associates for inclusion in an Environmental Impact Statement. This report has been done in accordance with generally accepted geological engineering procedures and no other warranty, expressed or implied, is made as to the professional advice included in this report. This report has been prepared for use by the Hawaiian Palace Development Corporation; Ka'u Aina Partnership; Belt Collins & Associates, Inc.; and Helber, Hastert & Kimura, Planners. It may not contain sufficient information for purposes of other parties or for other uses.

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The following Plates and Appendices are attached:

Plate 1	- Location Map, Island of Hawaii
Plate 2	- Plot Plan, Proposed Hawaiian Riviera
Plate 3	- Regional Geological Structures Map
Plate 4	- Relative Ages of Lava Flows
Plate 5	- Geologic Map
Plate 6	- Map of USGS Geodetic Control Line
Plate 7	- Marina Map
Plates 8.1 and 8.2	- Logs of Probes, Probes 1 and 2
Appendix A	- Geologic Definitions
Appendix B	- Seismic Events

Respectfully submitted,

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SKD/MAY/PDL:ob/mjo(4080A/323A:15742-001-11)
(Six copies submitted)

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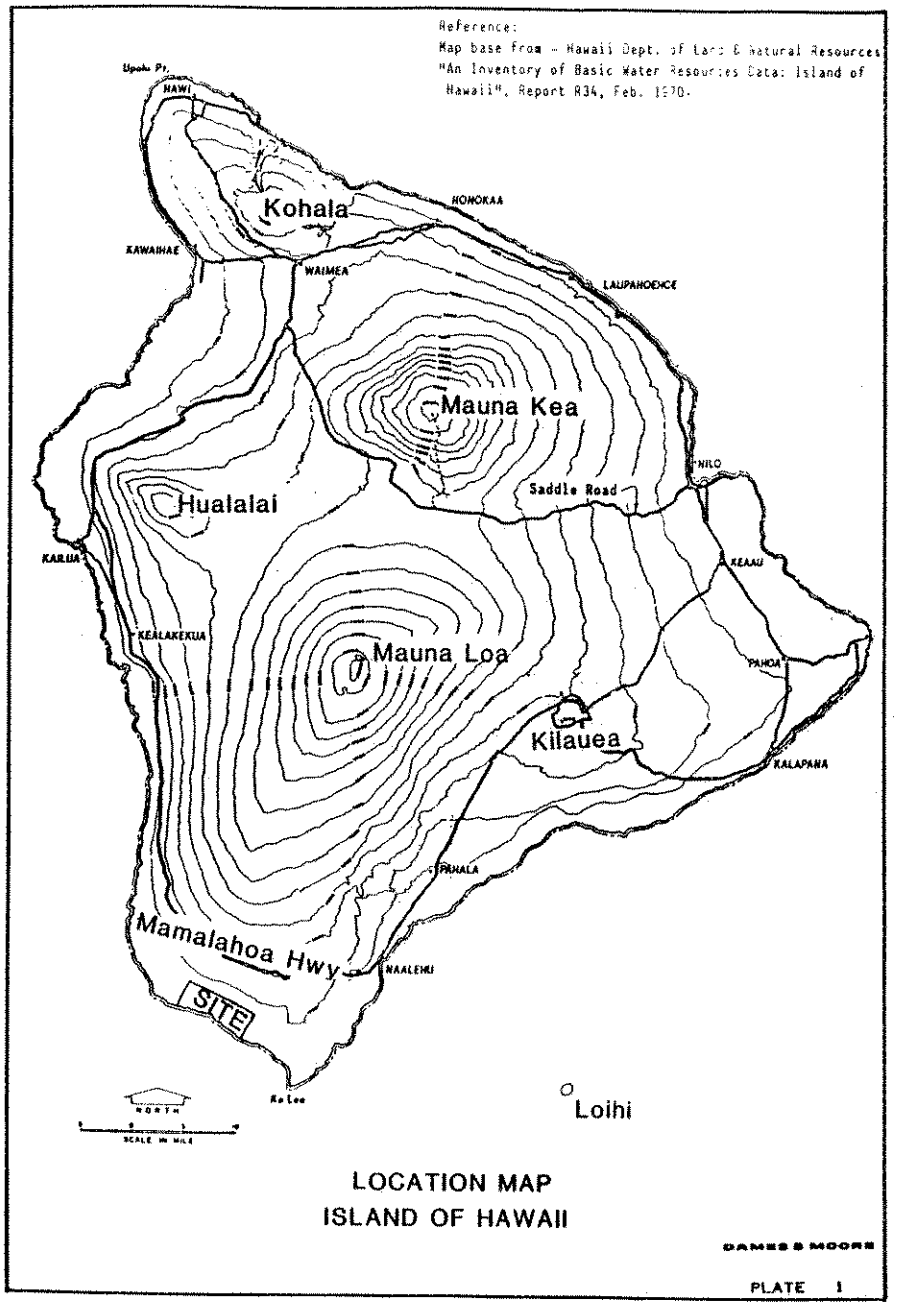

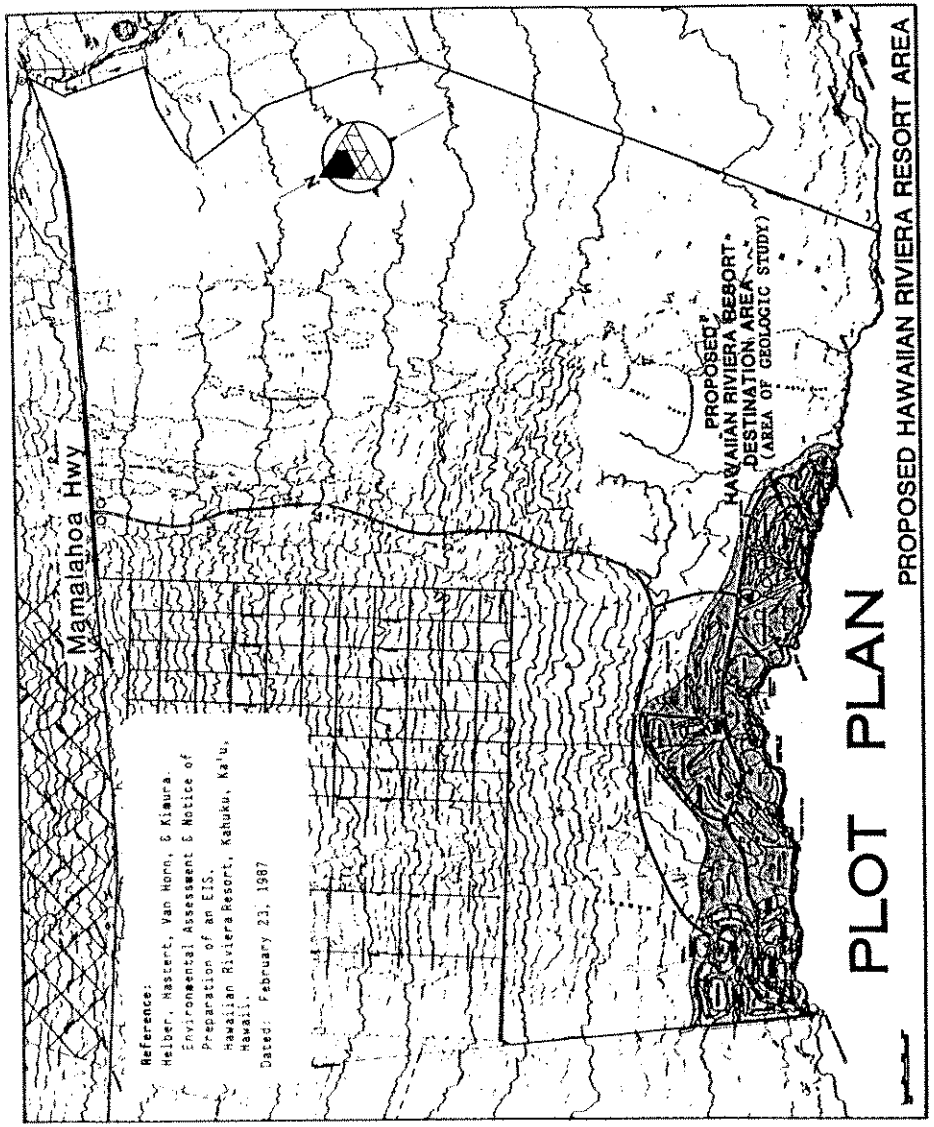

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PLATE 2

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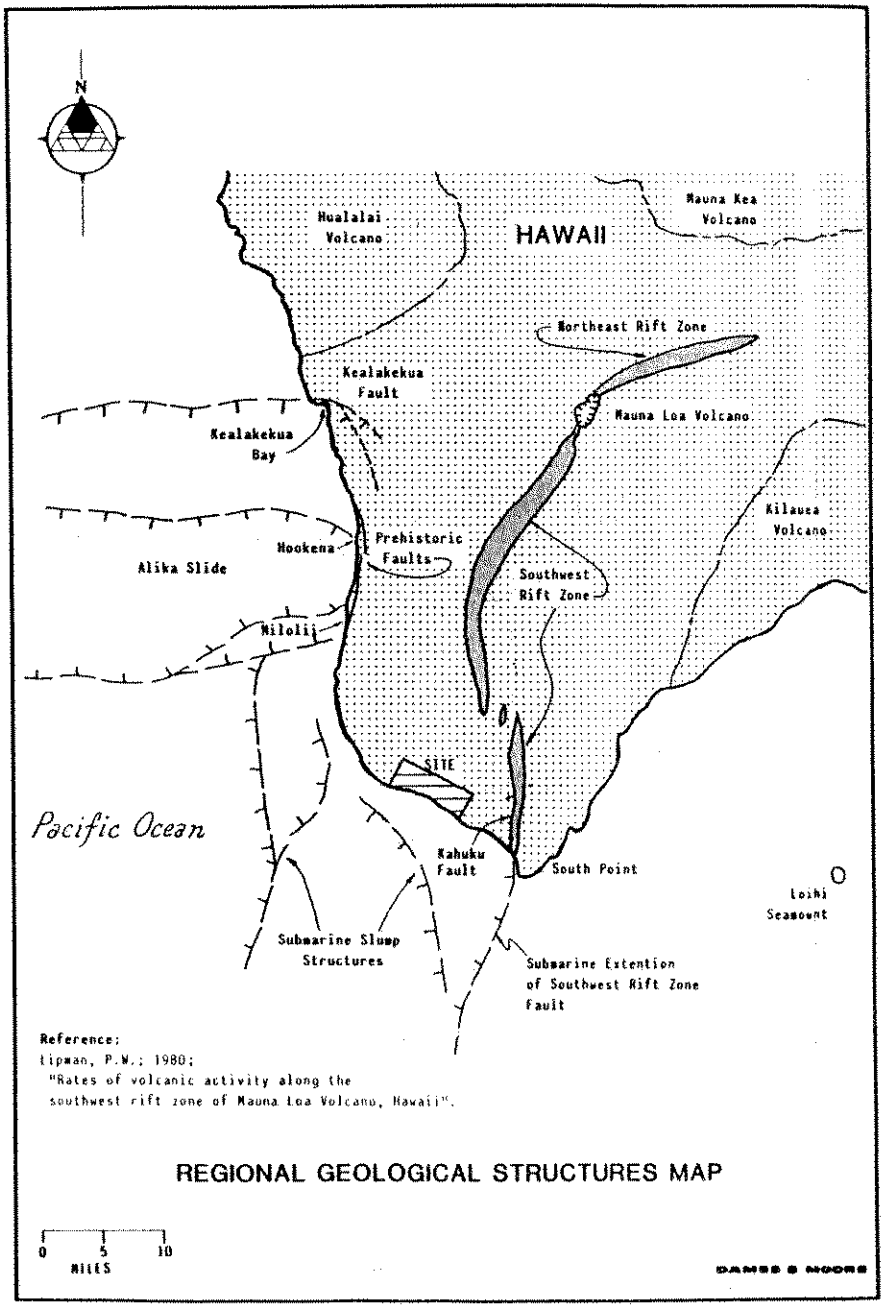

REGIONAL GEOLOGICAL STRUCTURES MAP

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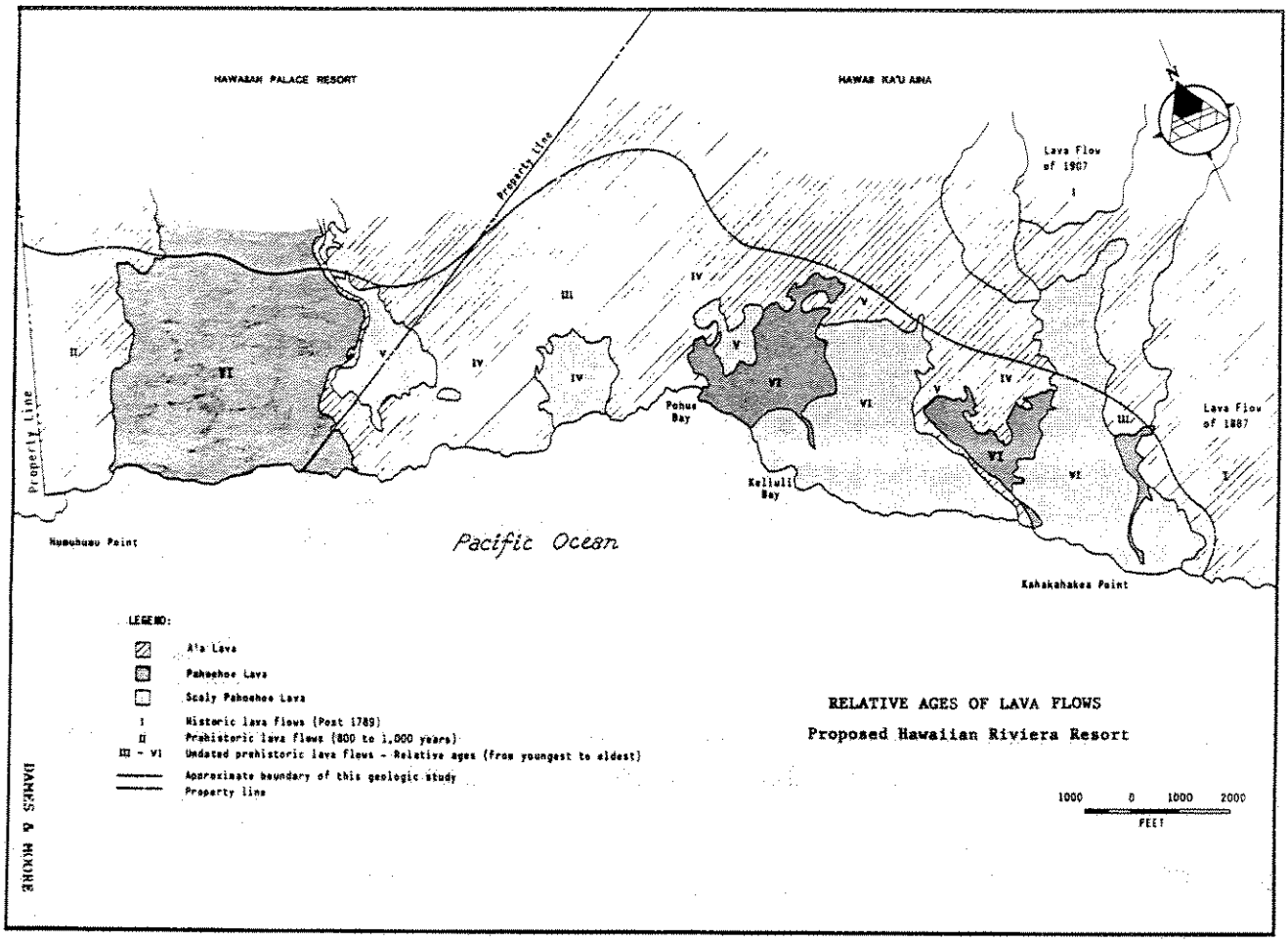
PLATE 1


HAWAIIAN PALACE RESORT
HAWAII KA'U AINA
Property Line
Lava Flow of 1907
Lava Flow of 1887
Pohue Bay
Keliuli Bay
Humuhumu Point
Kahakahakea Point
Pacific Ocean
LEGEND:
A'a Lava
Pahoehoe Lava
Scaly Pahoehoe Lava
I Historic lava flows (Post 1789)
II Prehistoric lava flows (800 to 1,000 years)
III - VI Undated prehistoric lava flows - Relative ages (from youngest to eldest)
Approximate boundary of this geologic study
Property line
RELATIVE AGES OF LAVA FLOWS
Proposed Hawaiian Riviera Resort
1000 0 1000 2000
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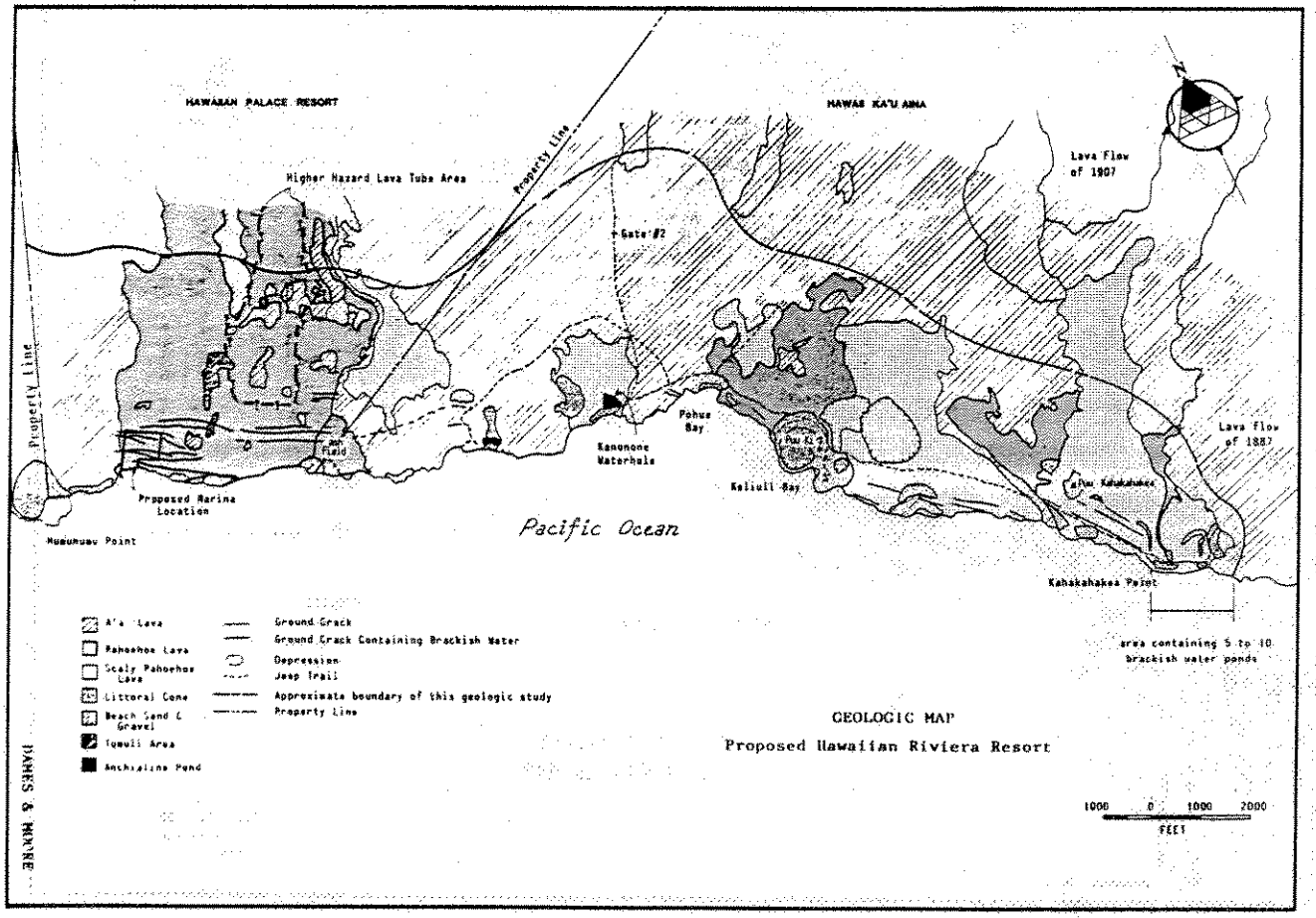
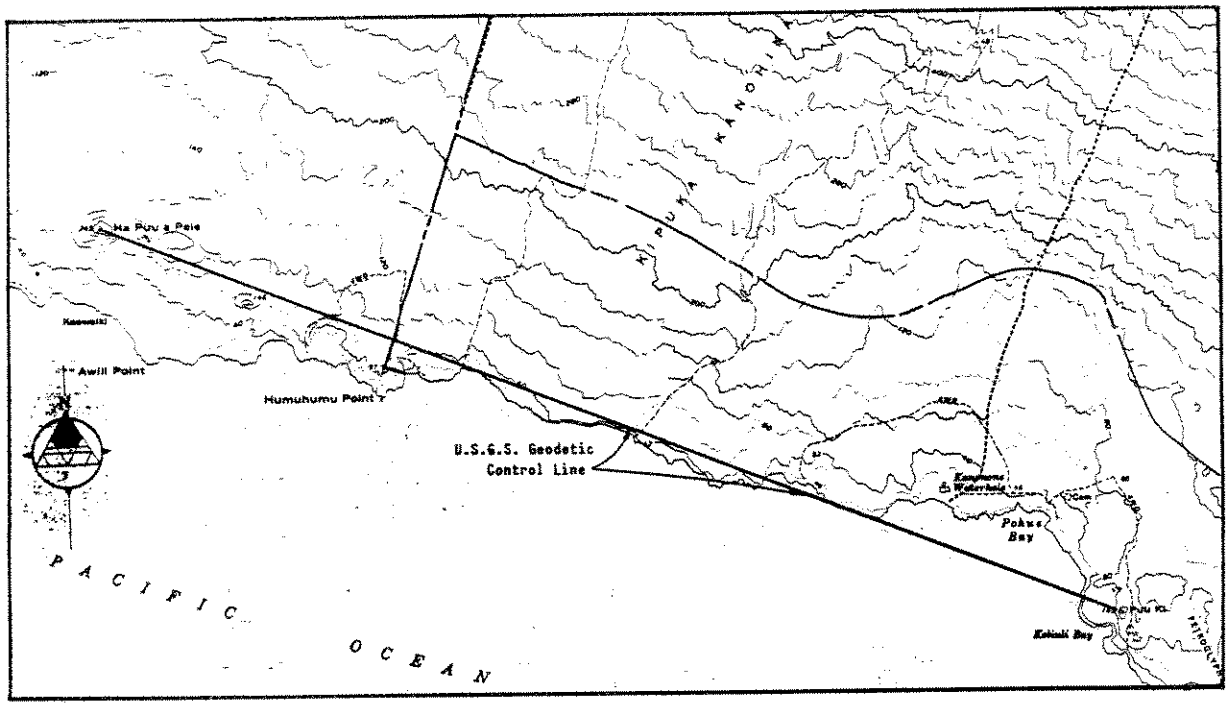

HAWAIIAN PALACE RESORT
HAWAII KA'U AINA
Property Line
Higher Hazard Lava Tube Area
Gate #2
Lava Flow of 1907
Lava Flow of 1887
Pohue Bay
Kanonone Waterhole
Keliuli Bay
Proposed Marina Location
Humuhumu Point
Kahakahakea Point
Pacific Ocean
area containing 5 to 10 brackish water ponds
A'a Lava
Pahoehoe Lava
Scaly Pahoehoe Lava
Littoral Cone
Beach Sand & Gravel
Tumuli Area
Anchialine Pond
Ground Crack
Ground Crack Containing Brackish Water
Depression
Jeep Trail
Approximate boundary of this geologic study
Property Line
GEOLOGIC MAP
Proposed Hawaiian Riviera Resort
1000 0 1000 2000
FEET
DAMES & MOORE



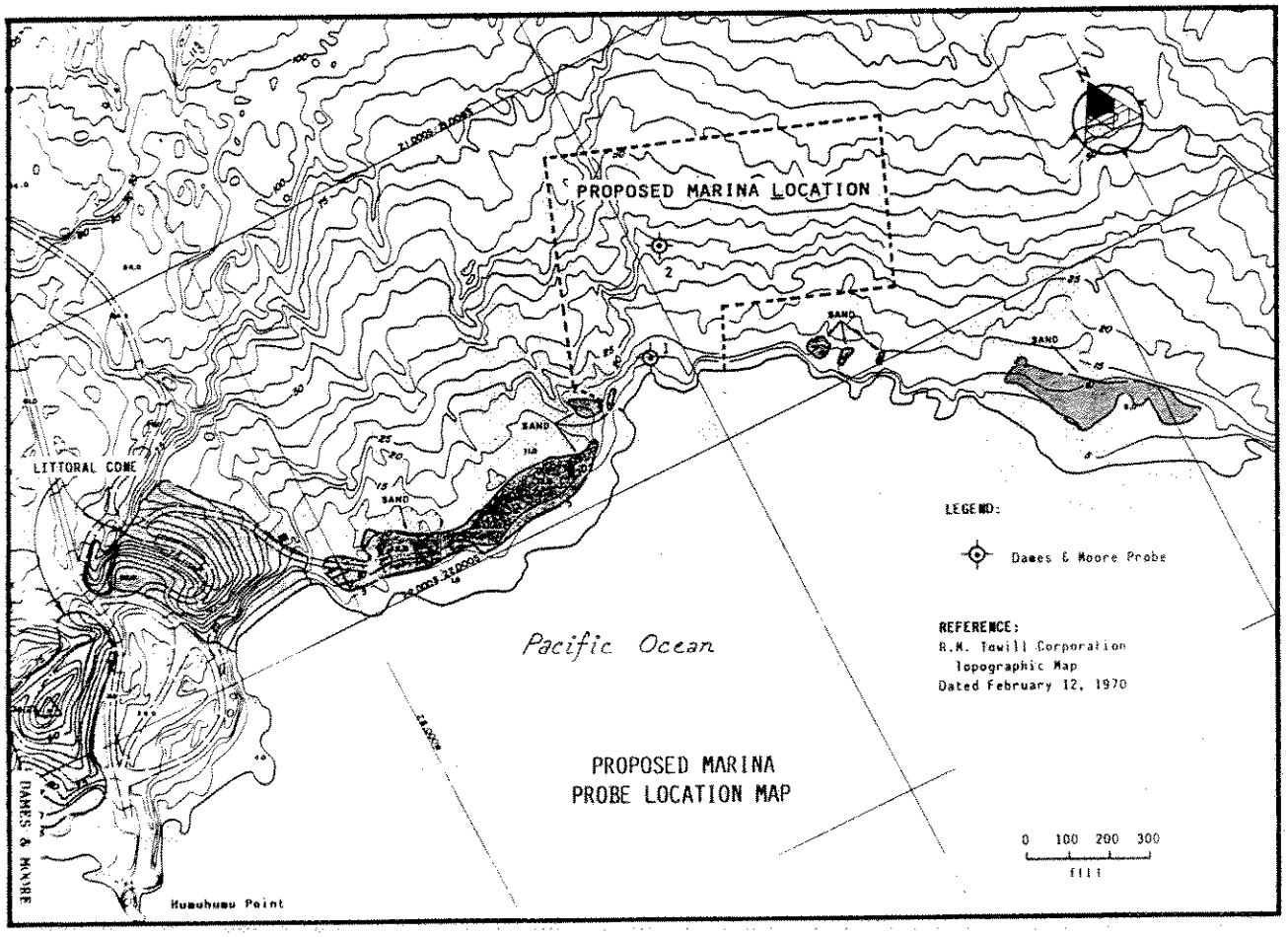
MAP OF U.S.G.S. GEODETIC CONTROL LINE

1000 0 1000 2000 3000
FEET

Reference:
U.S.G.S. Topographic Map
Ponue Bay, Hawaii, Hawaii
Dated 1981

DAMES & MOORE

15742-001-11 jmf 7/14/87



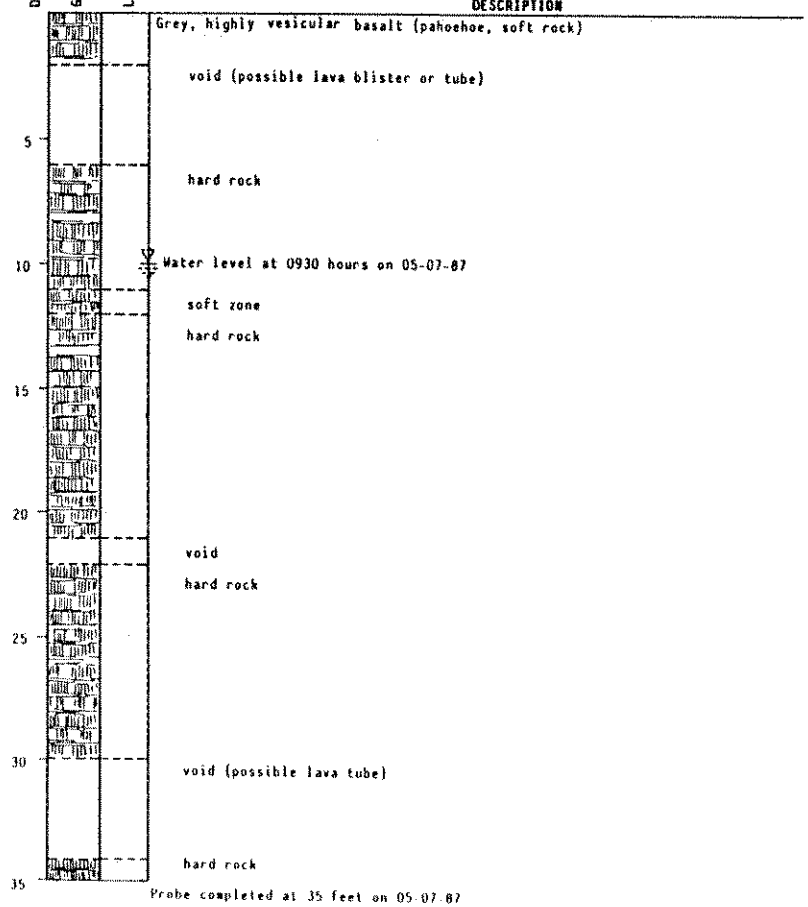
PROPOSED MARINA
PROBE LOCATION MAP

DAMES & MOORE

PLATE 2

PROBE 1

SURFACE ELEVATION 10 ± Feet
MSL Datum



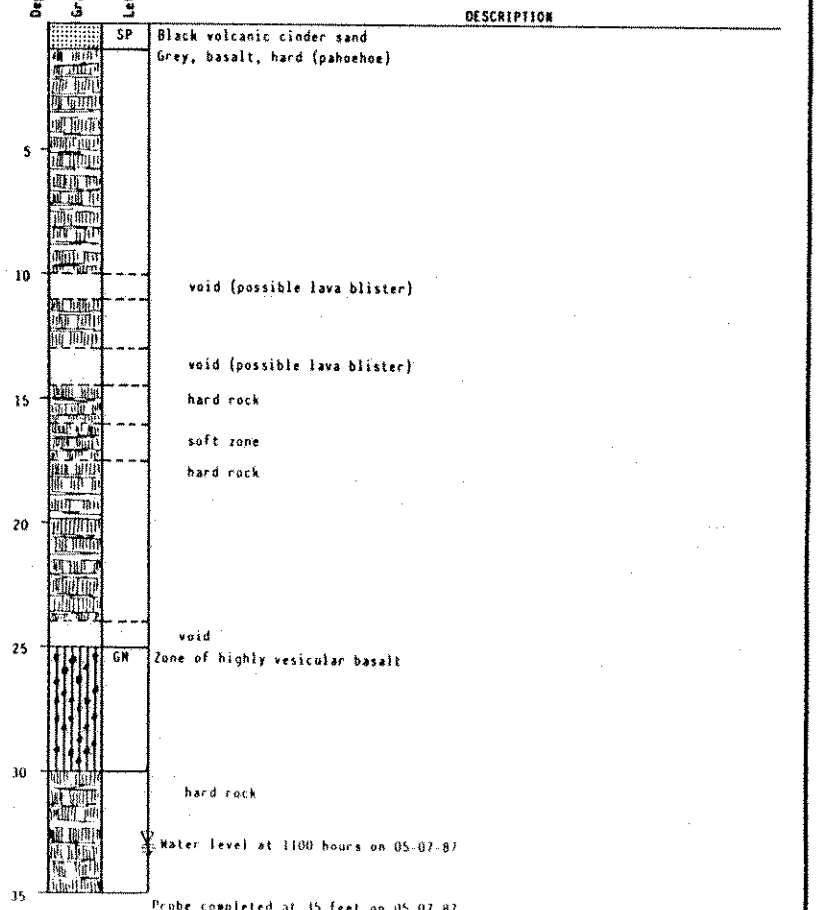
LOG OF PROBES

DAMES & MOORE

PLATE

PROBE 2

SURFACE ELEVATION 35 ± Feet
MSL Datum



LOG OF PROBES

DAMES & MOORE

PLATE

APPENDIX A

GEOLOGIC DEFINITIONS

Definitions and explanation of the certain geologic terms used in this report are presented below. They have generally been taken from Volcanoes in the Sea (Ref. 3).

A'a - A'a lava has a higher viscosity than pahoehoe lava. Because of its high viscosity and the brittle nature of the cooled lava, the pasty a'a lava flows in a coarse clinker shell of its own making. This gives the flow a jagged morphology.

The massive pasty core is the active portion of the flow. Clinker is carried atop the flow, falls down the front of the flow front, and is buried by the overriding mass. The result is a dense interior layer between a clinkery top and bottom. Individual a'a flows are generally 6 to 24 feet thick, but locally they can be as thick as 60 feet.

Accretionary lava balls, ranging in size from a few inches to 3 yards or more, are common on a'a flows, and are generally located towards the flow margins. They are formed when a fragment of solidified lava is rolled along and coated with the viscous liquid. They grow in size much like a snowball rolling down a hill in sticky snow.

Pahoehoe - Pahoehoe lava can be described as lava with a low viscosity. It is characterized by a relatively smooth, hummocky surface with tubes and cavities under the surface. Because of high gas content, the pahoehoe lavas are generally filled with numerous gas bubbles or vesicles. Smooth swells or blisters in the lava surface reflect larger gas pockets immediately beneath the surface.

Individual pahoehoe flows range in thickness from a few inches to as much as 9 feet. During the course of a single eruption, successive pahoehoe flows moving along the same path may build up thicknesses of many tens of feet.

Scaly Pahoehoe - Scaly pahoehoe lava appears to be a transitional lava between pahoehoe and a'a. It is usually found near the coastline in areas where the terrain has flattened out and flows have entered the sea. The crumpled, fractured texture is most likely a reflection of a cooler portion of the flow that is trapped between advancing material from the vent and material stalled by terrain change and rapid cooling. Many of the larger collapse or depression features, ponds, and lava tubes were associated with this lava type.

Tumuli - Tumuli (singular: tumulus) are nearly round to oval dome-shaped hills, which are occasionally found on the surface of pahoehoe flows. Commonly 9 to 18 feet high, they are often crowned with a gaping crevasse across the top of the dome in which the internal structure of the upper part of the flow is revealed. Tumuli are generally formed on a part of the flow that has been confined,

cooled slightly, then heaved up when the crust is pushed against stationary crust farther downstream. Sometimes the tumulus is hollow, but usually lava has run within and filled it.

Lava Blisters - Hollow toes of pahoehoe flows that were inflated by expansion of volcanic gas.

Lava Tubes - Pahoehoe lavas flow as lava rivers which quickly crust over and develop more or less continuous roofs. The lava stream then flows within a tunnel of its own making called a lava tube. Many smaller tubes branch off the main tubes, feeding the front and margins of the flow. At the end of the eruption, most of the lava may drain out of the main tubes leaving open tunnels which may be anywhere from a few feet to 40 feet in diameter.

Flow Channel - At the end of an eruption, the fluid lava may partly drain out of the central river of an a'a flow. A distinct channel or canyon is left which often acts as a channel for subsequent flows.

Littoral Cones - Where a'a flows enter the ocean, littoral cones, composed of lithified ash deposits, are constructed by violent explosions as the dense core of the flow encounters water. The cones, 30 to 70 feet high, may occur in pairs, one on each side of the a'a flow. Most cones have a steep seaward facing wall due to wave erosion. The internal structure of these cones is visible from the steep ocean side. Due to chemical weathering, the lithified ash deposits are often banded in colors that range from reds to browns and blacks. Grain size varies from fine sand to cobbles, takes the form of tuff, spatter and bombs, and can also be banded in appearance.

Tsunamis - Tsunamis, or seismic sea waves, are often associated with earthquakes and are generated when a large mass of water is abruptly displaced. Run-up distances are a function of local topography and volume of water. In Hawaii, the heights and distances reached by different tsunamis, or by the same tsunami on different islands, vary greatly. Heights varying between 3 and 45 feet have been recorded on the same island due to a single event.

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APPENDIX B

SEISMIC EVENTS

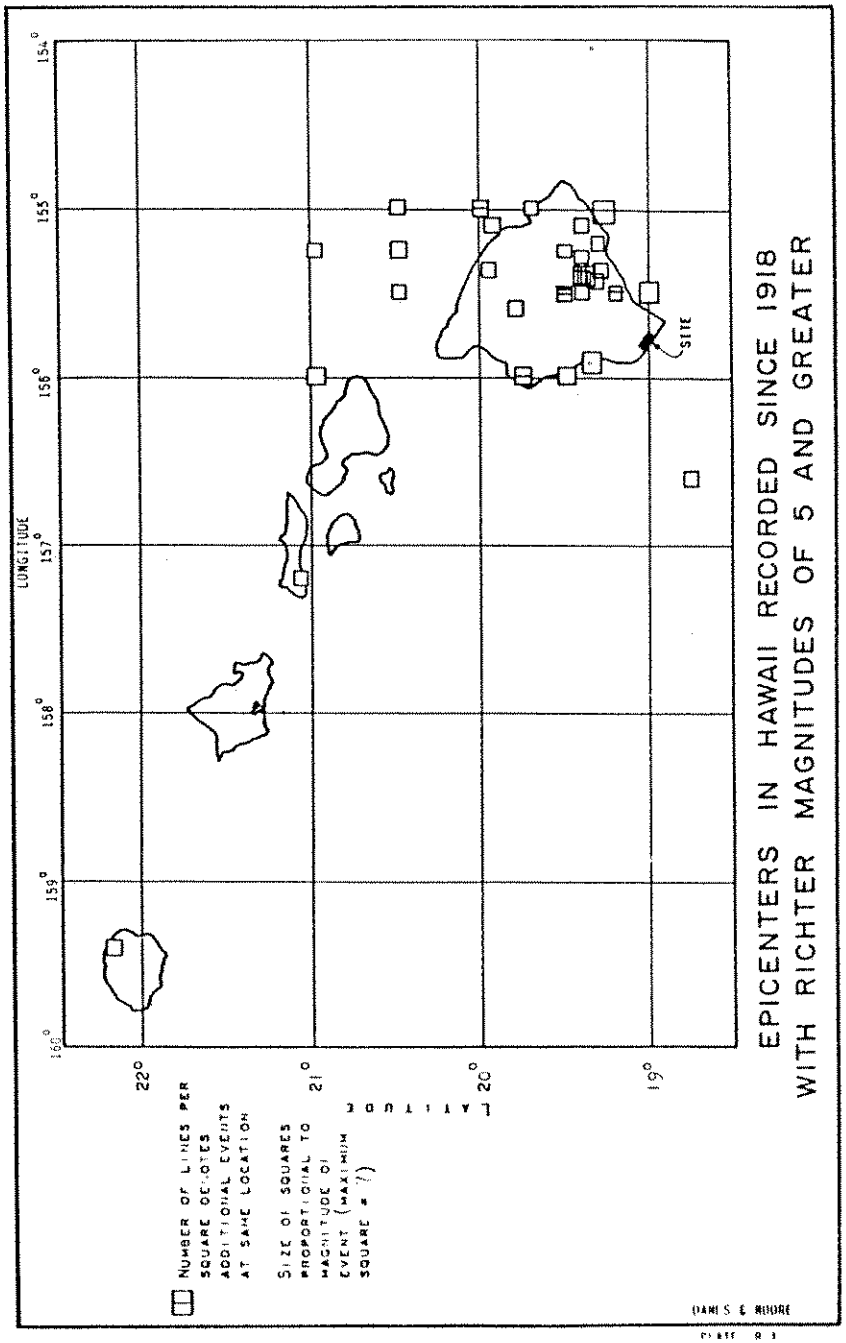
There were 35 seismic events with magnitudes of 5 or greater occurring in the Hawaiian Islands between 1918 and 1985. The locations of the epicenters are shown on Plate B1. Most of the earthquakes were located on or very near to the Island of Hawaii. The date, location, and magnitude of the epicenter are listed on the following pages, B2.1 through B2.8.

- o0o -

Attachments:

Plate B-1 - Epicenters in Hawaii
Plate B-2.1 through 2.8 - List of Earthquakes

JDS 6/29/87 15742-001



LIST OF EARTHQUAKES

DATE	LATITUDE	LONGITUDE	INTENSITY	MAGNITUDE
NOV 02, 1918	21.100	157.200	VII	
SEP 14, 1919	22.200	159.400	VII	
APR 22, 1926	19.420	155.270	IV	
SEP 26, 1929	19.750	156.000	VII	5.6
OCT 06, 1929	19.750	156.000	VII	6.5
FEB 6, 1932	17.800	156.700	II	
JUN 14, 1932	19.280	155.220		4.0
JUL 8, 1932	19.420	155.270	IV	
JAN 11, 1933	19.000	158.000	III	4.0
DEC 02, 1933	19.700	155.000	VI	
MAY 10, 1934	19.633	155.383	V	
JAN 02, 1935	19.418	155.283	V	
JUN 28, 1935	19.500	155.250	V	5.6
OCT 01, 1935	19.366	155.651	V	
OCT 1, 1935	19.635	155.434	V	
NOV 21, 1935	19.516	155.518	V	
APR 15, 1936	19.400	155.250	V	
JAN 23, 1938	21.000	156.000	VIII	6.7
FEB 17, 1938	19.550	155.450	V	
MAY 15, 1939	19.366	155.133	V	
MAY 24, 1939	19.468	155.366	V	
MAY 24, 1939	19.416	155.233	V	
MAY 30, 1939	19.500	156.833	V	
JUN 01, 1939	19.566	155.168	V	
JUL 14, 1939	19.318	155.116	V	
JUN 17, 1940	20.500	155.250	VI	6.0
JUL 16, 1940	20.500	155.000		5.6
SEP 2, 1940	21.000	155.250	V	5.6
SEP 25, 1941	19.500	155.500	VII	6.0
DEC 27, 1944	19.500	155.500	VI	5.6
APR 10, 1949	26.000	175.000	II	4.0
MAY 30, 1950	19.500	156.000	VI	6.3
JUN 14, 1950	20.000	155.500		4.0
DEC 10, 1950	19.500	155.500		4.0
DEC 11, 1950	19.500	155.500		4.0
APR 23, 1951	19.000	155.500	VII	6.5
AUG 21, 1951	19.750	156.000	IX	6.9
SEP 16, 1951	19.200	155.500	V	
NOV 08, 1951	19.200	155.500	VI	
MAR 18, 1952	19.125	155.033	V	

LIST OF EARTHQUAKES

DATE	LATITUDE	LONGITUDE	INTENSITY	MAGNITUDE
APR 7, 1952	21.000	157.000	V	
MAY 23, 1952	19.483	155.483	VI	6.0
JUL 12, 1952	19.500	155.500	V	
JAN 10, 1953	19.400	155.550	V	
JAN 15, 1953	19.316	155.433	V	5.2
FEB 12, 1953	19.283	155.450	IV	
MAR 30, 1954	20.000	155.000		6.0
MAR 30, 1954	20.000	155.000	VII	6.5
JUL 3, 1954	20.500	155.500	VI	
APR 1, 1955	19.500	155.000	V	
AUG 7, 1955	20.500	155.500	V	
AUG 14, 1955	19.500	155.500	V	
OCT 27, 1955	20.000	155.500	V	
MAY 14, 1956	20.283	155.283	V	
OCT 16, 1956	20.000	157.000	V	
JUL 4, 1957	20.200	157.900	V	4.5
JUL 26, 1957	20.250	156.250		4.6
AUG 10, 1957	21.000	155.470		4.2
AUG 11, 1957	21.000	155.470		4.3
AUG 18, 1957	21.000	156.000	V	
FEB 19, 1958	19.350	155.150		4.5
OCT 22, 1958	19.201	155.316		4.3
OCT 23, 1958	19.201	155.316		4.3
FEB 19, 1959	19.350	155.150		4.0
MAR 07, 1959	19.733	155.200		4.0
MAR 09, 1959	19.833	155.633		3.5
MAR 12, 1959	20.016	155.416		4.0
JUN 03, 1959	20.916	156.166		3.3
JUN 26, 1959	19.220	156.370		4.2
JAN 15, 1961	19.897	155.628		4.2
JAN 21, 1961	19.208	155.633		4.7
MAY 19, 1961	19.052	155.233		4.3
JUL 23, 1961	19.400	155.283	V	5.1
JUL 23, 1961	19.400	155.283	V	4.7
AUG 25, 1961	19.865	155.070		4.5
SEP 23, 1961	19.400	155.100	V	4.1
SEP 25, 1961	19.400	155.100	V	5.9
SEP 25, 1961	19.400	155.100	V	4.1
JAN 07, 1962	19.408	155.052	IV	4.0
MAR 10, 1962	19.797	155.838		4.0

LIST OF EARTHQUAKES

DATE	LATITUDE	LONGITUDE	INTENSITY	MAGNITUDE
MAR 24, 1962	19.402	155.285		4.4
MAR 31, 1962	19.402	155.918		4.5
APR 24, 1962	19.400	155.617		4.0
MAY 10, 1962	19.402	155.285		4.3
JUN 14, 1962	19.417	155.285		4.3
JUN 27, 1962	19.400	155.417		6.1
JUN 28, 1962	19.800	155.600		5.7
JUL 14, 1962	19.740	155.637		4.0
JUL 23, 1962	19.482	155.987		4.5
JUL 24, 1962	19.570	156.030		4.9
AUG 18, 1962	19.180	155.533		4.0
AUG 18, 1962	19.300	155.195		4.6
SEP 8, 1962	19.038	155.142		4.1
NOV 22, 1962	19.333	155.083		4.1
DEC 28, 1962	19.308	155.083		4.1
DEC 31, 1962	19.233	155.596		4.0
JAN 08, 1963	19.401	155.285		4.3
JAN 09, 1963	19.401	155.285		4.2
FEB 17, 1963	19.720	156.870		4.1
MAR 24, 1963	19.750	155.563		4.5
JUN 6, 1963	19.198	155.551		4.2
AUG 26, 1963	19.800	155.600		4.9
SEP 21, 1963	19.200	155.500		4.8
OCT 23, 1963	19.400	155.500		5.3
FEB 20, 1964	20.700	155.830		4.3
JUN 04, 1964	19.447	155.280		4.0
JUN 8, 1964	19.630	155.418		4.1
JUL 1, 1964	19.313	155.115		4.5
JUL 17, 1964	19.892	155.987		4.5
AUG 13, 1964	19.500	155.400		4.1
AUG 26, 1964	20.230	156.150		4.4
SEP 18, 1964	19.315	155.115		4.9
OCT 11, 1964	18.750	156.617		5.5
DEC 03, 1964	19.401	155.285		4.7
DEC 03, 1964	19.402	155.285		4.0
DEC 10, 1964	19.308	155.203		5.0
FEB 13, 1965	18.750	155.267		4.5
MAR 06, 1965	19.250	155.222		4.0
MAR 22, 1965	19.222	155.538		4.6
JUL 22, 1965	19.335	155.510		4.3

Plate B-2.3

LIST OF EARTHQUAKES

DATE	LATITUDE	LONGITUDE	INTENSITY	MAGNITUDE
DEC 26, 1965	19.400	155.200		4.3
JAN 19, 1966	19.405	155.328		4.0
JAN 19, 1966	19.397	155.558		4.1
MAR 01, 1966	19.412	155.453		4.0
MAR 14, 1966	19.317	155.442		4.1
JUL 30, 1966	19.417	155.420		4.3
SEP 05, 1966	19.353	155.437		4.7
OCT 31, 1966	19.320	155.467		4.0
NOV 05, 1966	19.500	155.903	V	
JAN 23, 1967	19.450	155.430		4.6
FEB 02, 1967	19.362	155.092		4.6
MAR 24, 1967	19.780	155.680		4.3
MAY 4, 1967	19.394	155.453		4.4
JUL 01, 1967	19.500	155.300		4.2
JUL 5, 1967	19.383	155.435		4.1
AUG 15, 1967	19.967	155.384		4.0
SEP 8, 1967	19.417	155.284		4.0
OCT 13, 1967	19.566	155.867		2.9
OCT 29, 1967	19.984	155.552		3.8
NOV 3, 1967	19.990	156.700		4.0
FEB 22, 1968	19.250	156.320		4.5
MAR 31, 1968	21.500	156.900		4.0
APR 28, 1968	19.368	155.285		4.5
JUL 02, 1968	20.000	155.817		3.4
AUG 01, 1968	19.333	155.102		4.0
AUG 03, 1968	19.852	155.916		3.8
AUG 05, 1968	19.900	155.883		3.1
AUG 7, 1968	19.316	155.800		4.4
AUG 09, 1968	19.384	155.283		4.1
AUG 16, 1968	19.883	155.369		4.1
SEP 24, 1968	20.167	155.801		4.1
NOV 18, 1968	19.217	154.966		4.3
DEC 16, 1968	19.319	155.200		4.7
JAN 1, 1969	20.100	157.870		4.2
FEB 10, 1969	19.330	155.133		4.5
FEB 22, 1969	19.434	156.525		3.9
MAR 05, 1969	18.984	155.484		3.6
APR 9, 1969	20.983	155.716		4.0
MAY 7, 1969	20.830	155.350		4.1
MAY 10, 1969	19.366	155.069		4.9

Plate B-2.4

LIST OF EARTHQUAKES PAGE 5

DATE	LATITUDE	LONGITUDE	INTENSITY	MAGNITUDE
JUN 6, 1969	19.418	155.450		4.4
JUN 6, 1969	19.380	155.288		4.0
JUN 7, 1969	19.267	155.183		4.0
JUL 13, 1969	19.200	155.568		4.2
JUL 20, 1969	19.385	155.902		3.6
AUG 07, 1969	19.685	156.035		3.5
SEP 3, 1969	19.330	155.420		4.3
OCT 11, 1969	20.333	155.050		3.0
OCT 14, 1969	19.369	155.067		4.0
NOV 10, 1969	19.168	155.501	V	4.5
NOV 24, 1969	19.685	156.051		4.5
DEC 27, 1969	19.316	155.235		4.1
MAR 03, 1970	20.069	155.651		4.0
MAR 18, 1970	19.368	155.050	II	4.1
MAR 30, 1970	19.518	155.251		4.3
APR 12, 1970	19.369	155.417		4.3
APR 17, 1970	19.518	155.918		4.1
MAY 01, 1970	20.052	155.883		3.7
MAY 10, 1970	19.368	155.052		4.1
AUG 16, 1970	19.418	154.785		4.4
SEP 21, 1970	19.333	155.200		4.5
OCT 25, 1970	19.300	155.234		4.2
OCT 25, 1970	21.001	156.816		4.9
OCT 29, 1970	19.517	156.433		4.0
NOV 13, 1970	20.084	155.834		4.3
NOV 18, 1970	19.867	155.768		3.4
DEC 06, 1970	19.383	155.616		4.0
DEC 13, 1970	19.684	156.083		3.6
DEC 21, 1970	20.200	155.235		3.0
MAR 31, 1971	20.370	156.217		3.8
APR 26, 1971	19.392	155.283	V	4.4
MAY 14, 1971	19.900	156.267		3.7
AUG 1, 1971	18.200	154.200		4.8
AUG 04, 1971	20.100	155.800		4.0
AUG 16, 1971	19.367	155.283		4.5
FEB 29, 1972	19.283	156.533		4.9
MAR 27, 1972	21.150	156.250		3.8
SEP 5, 1972	19.330	155.200		4.4
SEP 6, 1972	19.350	155.117		3.7
DEC 23, 1972	19.587	155.983		4.9

Plate B-2.5

LIST OF EARTHQUAKES

DATE	LATITUDE	LONGITUDE	INTENSITY	MAGNITUDE
DEC 23, 1972	19.567	156.000		4.5
APR 23, 1973	19.967	154.667		4.2
APR 24, 1973	19.917	155.733		4.2
APR 26, 1973	19.933	155.100	VIII	6.0
SEP 16, 1973	19.383	155.283		3.7
OCT 09, 1973	19.333	155.283		4.8
OCT 09, 1973	19.333	155.283		4.8
OCT 13, 1973	20.625	155.915		4.3
DEC 13, 1973	19.357	155.292		4.4
JAN 02, 1974	19.230	155.460	III	
JAN 08, 1974	19.310	155.220	III	
JAN 12, 1974	19.343	155.034	III	4.8
JAN 16, 1974	19.780	155.600	III	4.4
JAN 20, 1974	19.150	155.690	III	
FEB 05, 1974	19.540	155.900	V	4.1
FEB 05, 1974	19.150	155.670	III	
FEB 06, 1974	19.667	156.000	III	
FEB 08, 1974	19.490	155.260	III	
MAR 24, 1974	19.290	155.190	III	
MAR 28, 1974	18.910	155.540	III	4.0
APR 04, 1974	19.350	155.270	III	4.0
APR 25, 1974	19.320	155.220	III	4.0
APR 30, 1974	19.360	155.080	III	
APR 30, 1974	19.360	155.080	III	
MAY 05, 1974	19.340	155.260	III	4.4
JUN 03, 1974	19.420	155.430	III	4.1
JUN 19, 1974	19.360	155.400	V	5.1
JUN 19, 1974	19.350	155.420	III	
JUN 19, 1974	19.350	155.410	III	
JUN 21, 1974	19.330	155.214	III	4.3
JUN 28, 1974	19.410	155.280	III	
JUL 12, 1974	19.470	155.440	III	
JUL 13, 1974	19.450	155.730	III	
JUL 13, 1974	19.350	155.250	III	
JUL 19, 1974	18.540	155.290	III	
JUL 19, 1974	19.380	155.250	III	
JUL 19, 1974	19.380	155.250	III	
JUL 20, 1974	19.800	155.560	III	4.0
JUL 22, 1974	19.320	155.210	III	
JUL 24, 1974	19.390	155.280	III	

Plate B-2.6

LIST OF EARTHQUAKES

DATE	LATITUDE	LONGITUDE	INTENSITY	MAGNITUDE
AUG 08, 1974	19.470	155.670	III	
AUG 08, 1974	19.350	155.300	III	4.2
AUG 12, 1974	19.370	155.430	III	
AUG 18, 1974	19.790	156.170	III	
AUG 21, 1974	19.550	155.950	III	
AUG 24, 1974	19.310	155.220	III	
AUG 28, 1974	19.333	155.210	III	4.8
SEP 18, 1974	19.390	155.870	III	
SEP 20, 1974	19.780	155.530	III	
SEP 26, 1974	20.160	155.550	III	
OCT 15, 1974	19.420	155.490	III	4.0
OCT 26, 1974	19.330	155.190	III	
OCT 30, 1974	19.390	155.410	III	
OCT 31, 1974	19.370	155.080	III	4.0
OCT 31, 1974	19.360	155.070	III	
NOV 09, 1974	19.370	155.140	III	
NOV 10, 1974	19.400	155.410	III	4.1
NOV 13, 1974	19.420	155.280	III	
NOV 16, 1974	19.190	156.220	III	
NOV 22, 1974	19.340	155.317	III	3.9
NOV 30, 1974	19.417	155.400	III	5.1
NOV 30, 1974	19.490	155.360	III	
NOV 30, 1974	19.440	155.380	III	
DEC 08, 1974	19.400	155.440	III	4.3
DEC 09, 1974	19.420	155.380	III	
DEC 11, 1974	19.450	155.520	III	
DEC 11, 1974	19.430	155.560	III	
DEC 12, 1974	19.360	155.110	III	
DEC 15, 1974	19.450	155.590	III	4.3
DEC 16, 1974	19.390	155.420	V	5.0
DEC 16, 1974	19.390	155.420	III	
DEC 16, 1974	19.400	155.420	III	
DEC 21, 1974	19.380	155.440	III	4.2
DEC 25, 1974	19.320	155.283	III	4.5
DEC 26, 1974	19.220	155.290	III	4.3
DEC 26, 1974	19.230	155.290	III	4.1
DEC 26, 1974	19.220	155.300	III	4.4
DEC 29, 1974	19.740	156.050	III	
DEC 29, 1974	19.350	155.090	III	4.2
DEC 30, 1974	19.320	155.280	III	4.1

LIST OF EARTHQUAKES

DATE	LATITUDE	LONGITUDE	INTENSITY	MAGNITUDE
DEC 30, 1974	19.400	155.410	III	
DEC 31, 1974	19.390	155.280	III	
DEC 31, 1974	19.360	155.430	III	
DEC 31, 1974	19.310	155.330	III	
DEC 31, 1974	19.290	155.360	III	
DEC 31, 1974	19.300	155.370	III	
DEC 31, 1974	19.290	155.360	V	5.5
DEC 31, 1974	19.270	155.360	III	
DEC 31, 1974	19.340	155.330	III	
NOV 29, 1975	19.354	155.065		5.7
NOV 29, 1975	19.335	155.029		7.2
MAR 5, 1981	21.259	156.478		5.3
JAN 21, 1982	19.139	155.355		5.6
JAN 21, 1982	19.131	155.331		5.4
SEP 9, 1983	19.198	155.732		5.2
NOV 16, 1983	19.258	155.271	VIII-IX	6.7

APPENDIX H

Market Assessment for Resort Development

KPMG Peat Marwick

Market Assessment for Resort Development at the

Hawaiian Riviera Resort
Ka'u, Hawaii

Prepared for

PALACE DEVELOPMENT CORPORATION
HAWAII KA'U AINA

September 1987

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September 11, 1987

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Dear Ms. Abbott and Mr. Bodden:

At your request, we have completed our market study for the proposed Hawaiian Riviera Resort in Ka'u, Hawaii. The accompanying report presents the detailed findings and conclusions regarding our assessments of the markets for hotel, condominium, resort residential lot, commercial and support community development at the proposed resort.

BACKGROUND

The Palace Development Corporation and Hawaii Ka'u Aina Partnership (Owners) propose to develop a resort complex to be known as the Hawaiian Riviera Resort in the Ka'u district on the island of Hawaii. The Resort complex will consist of two distinct resort areas, the Hawaiian Palace Resort and the Hawaii Ka'u Aina Resort.

The Owners are preparing a general plan amendment and land use and zoning applications for the Resort. Thus you have asked Peat Marwick Main & Co. to prepare a market assessment for the proposed land uses at the Resort.

STUDY OBJECTIVES

The primary objective of our assistance was to assess the market support for the proposed land uses for the two resorts separately and for the Hawaiian Riviera Resort as a whole. These land uses include hotels, condominiums, single-family lots, retail shopping areas, support community and resort amenities. This market study may be incorporated in applications for amendments to the County of Hawaii General Plan and other governmental applications.

KPMG Peat Marwick

Mr. Charles C. Chidiac
Mr. Thomas Bodden
September 11, 1987
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REPORT ORGANIZATION

The report is organized into seven chapters as follows:

I. Project Description and Market Support Summary - reviews the background, objectives and study approach of the market assessment and summarizes the major findings and conclusions of the study.

II. State and Island of Hawaii Visitor Market Review - presents an overview of the visitor market in Hawaii in terms of visitor arrivals and characteristics and projected visitor trends.

III. Hotel Market Assessment - assesses the current and anticipated room demand in the state and county of Hawaii and projects the market support for the proposed Resort hotels.

IV. Condominium Market Assessment - reviews trends in condominium development in the state, identifies comparable projects on the islands of Hawaii and Maui and assesses the market for condominium units at the Resort.

V. Resort Residential Lot Market Assessment - assesses trends in resort residential lot development, identifies comparable projects on the islands of Hawaii, Maui and Kauai and assesses the market support for Resort residential lots.

VI. Commercial Market Assessment - reviews characteristics of resort shopping centers, identifies potential target markets and tenant mixes and provides estimates for supportable commercial space.

VII. Support Community Market Assessment - assesses existing housing supply and trends, reviews estimated future housing demand, provides estimates for supportable residential units and assesses commercial space requirements at the planned support community.

* * * * * * *

We appreciate the opportunity to assist you in the planning of this unique master-planned resort.

Very truly yours,

Peat Marwick Mitchell & Co.

HAWAIIAN RIVIERA RESORT

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I - PROJECT DESCRIPTION AND MARKET SUPPORT SUMMARY

This chapter reviews the study background and objectives of our engagement and describes the proposed Hawaiian Riviera Resort in terms of its project concept and the proposed land uses. The chapter also summarizes the major findings and conclusions of the study.

BACKGROUND

The Palace Development Corporation and Hawaii Ka'u Aina Partnership (owners) propose to develop a resort complex to be known as the Hawaiian Riviera Resort in the Ka'u district on the island of Hawaii. The resort complex will consist of two separate but complementary resort areas, the Hawaiian Palace Resort and the Hawaii Ka'u Aina Resort.

The Hawaiian Palace Resort, to be developed by the Palace Development Corporation, is conceived to be a highly innovative master-planned Resort and village complex situated on about 780 acres of land. The Resort will be designed with a Mediterranean theme and provide the ambience of a Riviera seaside resort community. The facilities will include one grand luxe and one deluxe hotel, an enclave of expansive, luxurious villa suites, condominium townhouses and single-family lots. These accommodations will surround a plaza and marina area of shops, restaurants and entertainment facilities. Recreational amenities will include an 18-hole championship golf course, a multicourt tennis center and polo field with stables and riding trails. The marina will accommodate cruise ships and commercial sightseeing and fishing boats, as well as private sail and motor vessels.

The Ka'u Aina Resort, also a high-end, master-planned development, will be located on 1,560 acres of land. Adjoining the Palace Resort, the low-density concept of the Ka'u Aina will provide an alternate vacation or residential option to its higher density neighbor. Whereas the Palace Resort will provide a Euro-Mediterranean experience, the Ka'u Aina Resort will create a Hawaiian ambience, melding lava fields, palm oases and high country and ocean views with a variety of hotels, condominiums, residential lots, shopping areas and land and aquatic recreational facilities featuring two championship golf courses.

Belt, Collins & Associates (Belt Collins) and Helber, Hastert & Kimura Planners (Helber Hastert) have been retained to prepare the master plan and land use, zoning and other required governmental applications for the proposed developments. In this regard, Peat Marwick Main & Co. (Peat Marwick) was asked to assess the market support for the proposed Resort development.

STUDY OBJECTIVES

The primary objective of Peat Marwick's assistance was to assess the market support for the proposed land uses for the two resorts separately and for the Hawaiian Riviera Resort as a whole. These land uses include hotels, luxury villa suites, condominiums, single-family lots, retail shopping areas, major support community and other Resort amenities. This market study may be incorporated in applications for amendments to the County of Hawaii General Plan and other governmental applications.

APPROACH

To accomplish the study objectives, we have completed the following study approach:

1. Met with representatives of the owners, Belt Collins and Helber Hastert to review the proposed development concepts and facility mix for the Hawaiian Riviera Resort.

2. Reviewed the experience of comparable resorts and resort land uses on Hawaii, Maui, Kauai and other resort destinations.

3. Assessed the market orientation of the proposed resorts and the market support for the proposed land uses for the individual resorts and for the Hawaiian Riviera Resort as a whole.

4. Summarized our findings in this report.

HAWAIIAN RIVIERA RESORT AREA DESCRIPTION

This section describes the site and regional characteristics pertinent to the Hawaiian Riviera Resort and provides an overview of the applicable competitive elements.

Site and Regional Characteristics

The Hawaiian Riviera Resort site is on the southwestern coast of the island of Hawaii in the Kahuku area of the Ka'u district. The site location and resort master plan is shown in Exhibit I-A. The land area is characterized by lava flows and therefore is not suitable for agriculture or ranching. Other physical features of the area are described as follows:

- Unlike the generally flatter terrain of the Mauna Kea, Mauna Lani and Waikoloa Beach resorts, the Hawaiian Riviera Resort site slopes downward to the sea, providing attractive vistas. The property's terrain can be compared to the Wailea Resort in that ocean views are available from most areas at the Resort. There are also several cinder cones and other elevations that provide an interesting topography.

- There are about five miles of scenic coastline with some sandy beach areas.

- Offshore waters are well suited to boating, fishing and marine sports.

The Ka'u region of Hawaii is presently rural in nature with a limited population and only a few small settlements. Population growth, despite the attractiveness of the area, has been somewhat restricted to date by the lack of municipal water sources and the lack of employment opportunities in the area. Some ranching, macadamia nut and sugar cane growing is being conducted, along with limited commercial fishing.

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Site Location and Master Plan

SEE FIGURE II-3 OF THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Two other unrelated proposals for development of the area are now under consideration. These are a satellite launch port at South Point and extensive expansion of the Punalu'u area. The development of one or both of these projects could significantly enhance the viability of the Hawaiian Riviera Resort by contributing to the creation of a visitor destination and residential area.

Competitive Market Elements

The natural and created visitor attractions on the island of Hawaii offer experiences and sightseeing activities that extend throughout the island. The location of the Hawaiian Riviera Resort midway between Kona and Hilo could serve as a unique diversion and visitor destination, while also encouraging further development of circle island tours.

The Kohala, Kailua and Keauhou resort areas on the island of Hawaii would provide direct competition for the Hawaiian Riviera Resort. In order to compete with these more established resorts, the owners are coordinating their efforts to provide for economies of infrastructure development and marketing, along with establishing a critical mass of activities to attract the visitor market.

The individual resorts have also embarked on marketing strategies to serve market niches in the visitor industry, namely the international traveler and those seeking a traditionally Hawaiian experience. The wide range of recreational amenities that have been planned would offer guests a greater variety of activities than at any of the present resorts in the state.

The current absence of accommodations and attractions on the southern end of the island, coupled with an excellent climate and limited rainfall, offer opportunities for attracting a wide range of visitor and resident market segments. The area's relative proximity to Volcano National Park offers an additional factor conducive to visitor development at the Resort.

MARKET CHARACTERISTICS OF THE HAWAIIAN RIVIERA RESORT

This section describes characteristics of the individual resorts, focusing on the design and marketing considerations. These characteristics are summarized in Exhibit I-8.

Hawaiian Palace Resort

Situated on about 784 acres of land, the Hawaiian Palace Resort has been planned as a high-activity marina, dining, shopping and sports complex emphasizing a Mediterranean ambience. Development plans call for two hotels totaling 900 units; seven condominium projects totaling 975 units, including 375 luxury villa suites; and five residential subdivisions totaling 352 single-family lots. Also included are 120,000 square feet of commercial space and an 18-hole championship golf course. A 400-slip marina, cruise ship terminal, 26-acre polo field, 15-acre stable complex and 11-acre tennis center are other planned attractions.

The major core of activities will be centered around the marina, serving to integrate the two resort hotels. The Resort guests and visitors would be directed toward a central promenade lined with retail shops, restaurants and cafes, providing a festive atmosphere for shopping and outdoor dining.

HAWAIIAN RIVIERA RESORT

Characteristics of the Hawaiian Riviera Resort

	Hawaiian Palace Resort	Hawaii Ka'u Aina Resort
Land area	784 acres	1,560 acres
Average unit densities (units per acre)(1):		
Hotel	20	10
Villa-suites and condominiums	8	1
Single-family	2	1
Scope of development:		
Hotel	900 (2 hotels)	1,200 (3 hotels)
Condominiums	975 (7 projects)	200 (4 projects)
Single-family lots	352 (5 subdivisions)	300 (10 subdivisions)
	2,227	1,700
Commercial area (square feet)	120,000	40,000
Championship golf courses	18 holes	36 holes
Other attractions	400-slip boat marina Cruise ship terminal 26-acre polo field 15-acre stable complex 11-acre tennis center	142-acre petroglyph park 16-acre Kahonohe oasis park
Major design concepts	• Major core of activities centered around the marina and connecting the two Resort hotels. • Resort guests and visitors channelled into central pedestrian core and promenade. • Highly amenitized luxury hotels as major resort "showpieces."	• Major focus of the resort centered around the high-activity hotel and cultural center. • Low-rise, low density resort. • Waterfalls, orchid gardens, bungalows and lush green park settings.
Major market appeal	• Mediterranean village suggestive of the European Riviera. • High activity and high traffic resort with numerous day visitors. • Full complement of recreational amenities. • Strong pride of association with luxury resort development.	• Hawaiian vacation experience with emphasis on the image and romance of Hawaii. • Low density resort atmosphere without the crowded feeling of other resort areas.

Exhibit I-8, Cont.

HAWAIIAN RIVIERA RESORT

Characteristics of the Hawaiian Riviera Resort, Continued

	Hawaiian Palace Resort	Hawaii Ka'u Aina Resort
Target market:	• International elite travelers. • Mainland U. S. executives, incentive groups and FIT travelers seeking a prestigious and active recreational resort. • Higher average unit/lot prices than the Ka'u Aina Resort. • Second home owners and vacationers with great freedom from commitments.	• Most coast U. S. couples, families and repeat visitors on packages or FIT travelers. • Incentive, association and group markets. • Foreign travelers attracted by natural and cultural aspects. • Repeat visitors seeking new and/or "retreat" environment. • Local travelers. • Greater number of full-time and part-time residents than the Palace Resort.

(1) Unit densities for master-planned sites designated for the respective land uses.

The major target markets of the property will include mainland U. S. executives, incentive groups and FIT travelers seeking a prestigious and active recreational resort. Also envisioned is a clientele of international elite travelers attracted by the unique offerings suggestive of Mediterranean Riviera luxury. Potential residents are expected to be attracted by the quality and diversity of the surrounding areas, along with the range of residential accommodations from marina condominiums to single-family lots.

Hawaii Ka'u Aina Resort

Situated on about 1,560 acres of land, the Hawaii Ka'u Aina Resort has been planned as an expansive, low-density development emphasizing elements of the property's natural terrain and its Hawaiian archeological heritage. Development plans call for three hotels totaling 1,200 units, four condominium projects totaling 200 units and ten residential subdivisions totaling 300 single-family lots. Also included are 40,000 square feet of commercial space and two 18-hole championship golf courses. A 142-acre petroglyph park and 16-acre Kanonone oasis park are other planned attractions.

The major activity nodes of the project will be its high-activity hotels. Gardens and lush landscaping will provide an interesting contrast to the barren lava flows of the area. Also at Ka'u Aina, visitors would have the opportunity to enjoy a tranquil, relaxing and romantic vacation experience.

The major target markets of the property include couples, families and repeat visitors on vacation packages or FIT travelers from the west coast of the United States. The incentive, association and group markets are also expected to form an important market segment, along with local travelers on vacations. Also, a greater number of full-time and part-time residents are expected to reside within the Hawaii Ka'u Aina Resort.

MARKETING EMPHASIS

The viability of introducing and establishing Ka'u as a destination resort area is dramatically improved through the development of two contrasting, but complementary, resort properties that together can offer a critical mass of activities and accommodations for visitors. Visitors to each of the resorts are expected to patronize the recreational, commercial and entertainment facilities of the neighboring resorts.

The market assessment has been based on the extensive infrastructure and facilities that have been planned and the timetable for development. In addition to water sources, sewage systems and integrated roadways, the improvements include the creation of high-quality alternative beach and swimming areas, park areas, marina, cruise ship terminal, shopping and dining complex and promenade, championship golf courses, airstrip, resort roadways, polo field, equestrian stables, tennis complex and other recreational facilities. A support community to accommodate the population growths and other needs is planned on a 800-acre site about five miles above the Resort.

The Hawaiian Riviera Resort is a highly imaginative and innovative project that could be appreciated by both visitors and residents. The development concept is intended to provide a balance between the diversity of planned attractions and activities while also enhancing the natural beauty of the land and sea.

The proposed development has been strategically planned to cater to unique market demands not being fully served by existing resort properties:

- The Hawaiian Palace Resort will offer luxurious facilities, settings and activities at a level of service to which elite international travelers are accustomed.

- The Hawaii Ka'u Aina Resort will offer expansive open areas and recreational amenities and enable visitors to enjoy the heritage of Hawaii through the land of Ka'u.

The two Resort properties will provide guests with a new range of alternatives in choosing the type of experiences that can be enjoyed. The addition of the Hawaiian Riviera Resort could further serve to distinguish the island of Hawaii as a visitor destination that is a unique and distinctly different offering from the already established resort destinations of the state of Hawaii.

The degree of resort amenities and support facilities planned for the Hawaiian Riviera Resort significantly enhances its viability as a new visitor destination.

HAWAIIAN RIVIERA RESORT
AMENITIES AND FACILITIES

This section further describes the planned attractions and the contribution they provide to the success of the Resort.

Hawaiian Palace Resort

The European influence on Hawaii began with Captain James Cook's "discovery" of the Sandwich Isles and flourished during the period of King Kalakaua and his world tour. The Mediterranean theme and distinctiveness of the Hawaiian Palace Resort would be reemphasized through the detailed attention paid to its amenities:

- Boat marina - Mediterranean ports have traditionally been the focal points of entertainment and activities. With a 400-slip capacity and docking facilities for cruise ships, the marina area will host an array of water sports and become a point of interest for browsers, shoppers and other Resort residents and visitors. The marina is expected to be a major facility for both private and commercial boaters and would provide access to the resorts by cruise ships and sightseeing boats.

- Shopping promenade and complex - The shopping complex will be fronted by a wide promenade for taking in the marina sights and social excitement. The commercial area on the promenade is planned to include an assortment of cafes and restaurants, designer boutiques and other specialty retail outlets targeted toward the upper income segment as well as stores providing basic supplies for condominium and resident occupants. Outdoor entertainment will also be offered.

- Golf and tennis complex - An 11-acre tennis facility and 18-hole championship golf course would be provided for guests of the Resort, local residents and other visitors. The tennis complex is seen as being capable of hosting major tournaments or events and could include viewing stands and private boxes modeled after Wimbledon in England.

- Equestrian facilities - A 26-acre polo field and 15-acre stable facility are a unique resort amenity and could become an equestrian center for the entire Ka'u area. The polo field is also seen as being a possible site for large-scale tournaments or events.

Hawaii Ka'u Aina Resort

Hawaiian culture has been enjoying a renaissance in Hawaii, with greater awareness of the history, legends and characteristics of the Hawaiians among both residents and visitors. From its recognition as home to Pele, the goddess of fire, to Hilo's role as host to the annual Merrie Monarch Hula Festival, the island of Hawaii has maintained a strong role in the process of rediscovery.

The amenities of the Ka'u Aina Resort are expected to emphasize some of the more traditional aspects and attractions of Hawaii and provide an alternative to the more urban and Mediterranean amenities of the Palace Resort.

- Archeological attractions - The archeological landmarks, the petroglyph park and other areas will have outstanding visitor appeal and contribute greatly to the Hawaiian image to be emphasized throughout the Ka'u Aina development.

- Kanonone oasis park - A 16-acre oasis park which consists of a natural spring on the property surrounded by natural tropical vegetation. The site will be preserved and enhanced for the enjoyment of Resort visitors and residents.

- Golf course facilities - Two 18-hole championship golf courses are planned for the property and could benefit both resorts as a whole and give avid golfers the opportunity to go "course hopping" in the Ka'u region.

Support Community

Also planned for the combined benefit of both resorts is a nearby 800-acre support community and airstrip. The airstrip will accommodate private and commercial aircraft and expand the potential forms of transport to the Resort.

Special Features

The Hawaiian Riviera Resort is planned to be a high-activity resort containing a unique and diverse array of facilities which are not available at other Hawaii resorts.

The primary rationale for the development of such a wide variety of resort facilities is to provide attractions which would make the resort a self-contained resort for transients and residents.

The major benefits of the planned resort activity features are summarized as follows:

- Increased number of visitors and guests to the resorts' hotels.
- Increased marketing exposure for the Resorts' hotels and residential projects.
- Higher sales prices for residential projects due to the facilities, views, amenities and stronger market image afforded by the proposed Resort facilities.
- Substantial day-visitor traffic from self drives, tour buses, cruise ships and local residents who are attracted to the facilities of the Resort and greater patronage of the commercial and recreational facilities.

SUMMARY OF MARKET SUPPORT FOR THE HAWAIIAN RIVIERA RESORT

The market support for hotel, condominium, single-family and commercial land uses at the Hawaiian Riviera Resort has been based on the anticipated market appeal of the proposed developments at the Hawaiian Palace Resort and the Hawaii Ka'u Aina Resort. The support to each segment is described in Chapters III through V. Factors which were considered in this assessment included:

- The intended project concept for the two resorts and the Hawaiian Riviera Resort as a whole which envisions a master plan and individual development components which are of a caliber unique to Hawaii and most other resorts in the world.
- The proposed market plan and facility development schedule as set forth by the Resort owners and project planners.
- The market attractiveness of the Resort which will appeal to existing Hawaii visitor markets as well as create newer small, but elite, international visitor markets not previously served in Hawaii.

The market assessment for the proposed land uses at the Hawaiian Riviera Resort is summarized in Exhibit I-C. As shown in the exhibit, all of the planned 2,227 residential units at the Palace Resort and the 1,700 units at the Ka'u Aina Resort are projected to be supported by the period beginning in the year 2012, or about 20 to 25 years after the proposed start of development at the resort. The bulk, or 98%, of these units should be supported during the previous five-year period from 2007 to 2011.

In regards to commercial space, about 104,000 square feet of retail and commercial area are supported at the Palace Resort and 40,000 square feet at the Ka'u Aina Resort.

Residential demand at the support community is projected at 705 units, segmented by market at 40 managerial units, 325 supervisory and service level units, 280 indirect Resort employee units and 60 other units.

HAWAIIAN RIVIERA RESORT

Projected Market Support for the Hawaiian Riviera Resort

	Cumulative market support					Total master planned units/area
	1992 - 1996	1997 - 2001	2002 - 2006	2007 - 2011	2012 and later	
Hawaiian Palace Resort:						
Hotel	900	900	900	900	900	900
Condominium	250	580	900	975	975	975
Single-family	-	75	165	265	352	352
Total units	1,150	1,555	1,965	2,140	2,227	2,227
Commercial area (square feet)	66,000	78,000	95,000	99,000	104,000	120,000
Hawaii Ka'u Aina Resort:						
Hotel	600	800	1,200	1,200	1,200	1,200
Condominium	50	100	150	200	200	200
Single-family	30	105	205	300	300	300
Total units	680	1,005	1,555	1,700	1,700	1,700
Commercial area (square feet)	15,000	25,000	35,000	35,000	40,000	40,000
Support community:						
Single-family and multifamily units	N/A	N/A	N/A	N/A	N/A	N/A
Commercial area (square feet)	42,000	48,000	51,000	N/A	N/A	40,000

N/A Not available.

Single-family units are projected to range from 1,000 to 1,500 square feet and from $70,000 to $165,000. Multifamily units will range from 900 to 1,300 square feet in size at $55,000 to $140,000.

Additionally, commercial space demand at the support community could be considerably greater than the 40,000 square feet planned, as also shown in the exhibit.

II - STATE AND ISLAND OF HAWAII VISITOR MARKET REVIEW

This chapter reviews recent trends in the visitor market for the state and island of Hawaii in terms of visitor arrivals, travel patterns, characteristics and expenditures. The chapter also presents projections of visitor arrivals to the state.

VISITOR ARRIVAL TRENDS

Visitors were the largest source of income for the state of Hawaii in 1986. The Hawaii Visitors Bureau (HVB) surveys and estimates visitors to the state, separating visitors in terms of travel direction for statistical purposes. "Westbound" visitors are defined as those arriving from the Americas and Europe and traveling to Hawaii or to other destinations in the Pacific and Asia. "Eastbound" visitors are defined as those visitors traveling from Asia (primarily Japan) and the Pacific to Hawaii or beyond. This section reviews trends in the visitor industry in the state and on the neighbor islands.

Statewide Visitor Arrivals

Overnight visitor arrivals to Hawaii totaled 5.6 million in 1986, of which 4.3 million were westbound travelers and 1.3 million were eastbound travelers, as shown in Exhibit II-A. The 1986 arrivals represented a significant 14.8% increase over 1985, while 1985 was virtually unchanged from 1984 and 1987 appears to be showing little growth over 1986. The lack of growth in 1985 was primarily caused by a five-week labor strike which stopped operations at United Air Lines.

Visitor growth to Hawaii has been historically strong with an annual average increase of 19.4% in the 1960s, 8.5% in the 1970s and 6.1% for 1980 through 1986. The declining percentages do not indicate fewer arrivals, rather an ever-increasing visitor base advancing from 300,000 in 1960 to 5,600,000 in 1986, reflecting the maturing development of Hawaii as a visitor destination.

Both west- and eastbound visitors have contributed to this healthy growth, as shown in Exhibit II-B and discussed below:

- Westbound - Over the past ten years westbound visitors have made up about 79% of state visitor arrivals. Westbound arrivals have increased at an average annual growth rate of 18.1% from 1960 through 1970, 8.7% from 1970 through 1980 and 5.7% from 1980 through 1986.

- Eastbound - Although a significantly smaller segment of the visitor market, eastbound arrivals grew at a faster rate than westbound arrivals in the 1960s and 1980s, with average annual increases of 24.9% and 7.2%, respectively.

The visitor industry in Hawaii is currently benefiting from a number of favorable short- and long-term factors:

HAWAIIAN RIVIERA RESORT

Overnight Visitors to the State of Hawaii

1960 to May 1987

Year	Westbound Number	Westbound Percentage growth(1)	Eastbound Number	Eastbound Percentage growth(1)	Total Number	Total Percentage growth(1)
1960	250,795	- %	45,722	-%	296,517	- %
1965(2)	567,218	17.7	119,710	22.3	686,928	18.6
1970	1,326,135	18.5	420,835	28.6	1,746,970	20.5
1975	2,207,417	12.1	621,688	15.4	2,829,105	13.0
1976	2,551,601	15.6	668,550	7.5	3,220,151	13.8
1977	2,763,312	8.3	670,355	.3	3,433,667	6.6
1978	3,030,999	9.7	639,310	4.6	3,670,309	6.9
1979	3,139,455	3.6	821,076	28.4	3,960,531	7.9
1980	3,046,132	(3.0)	888,372	4.4	3,934,504	(0.7)
1981	2,974,791	(2.3)	959,832	8.0	3,934,623	-
1982	3,278,519	10.2	964,400	.5	4,242,919	7.8
1983	3,395,880	3.6	972,000	0.8	4,367,880	2.9
1984	3,721,380	9.6	1,134,200	16.7	4,855,580	11.9
1985	3,708,610	(0.3)	1,175,500	3.6	4,884,110	.3
1986	4,257,200	14.8	1,349,320	14.8	5,606,520	14.8
1987 (January to May)	1,719,860	(3.9)	578,000	13.7	2,298,160	0.5
Compounded annual percentage increase:						
1960 to 1970		18.1		24.9		19.4
1970 to 1980		8.7		7.8		8.5
1980 to 1986		5.7		7.2		6.1

(1) Annually compounded average annual rate of growth since previous date shown.
(2) Visitor statistics collection system was revised in 1964.

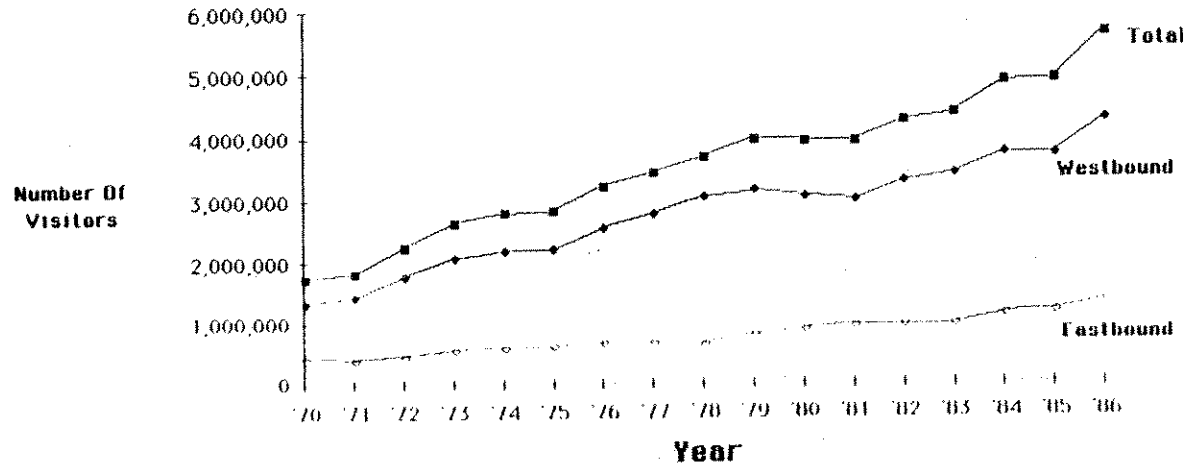
Source: Hawaii Visitors Bureau, annual and monthly reports.

Exhibit II-A

HAWAIIAN RIVIERA RESORT

Overnight Visitors to the State of Hawaii

1970 to 1986



Source Hawaii Visitors Bureau Annual Research Report, annual

Exhibit II-B

- Short-term factors:
  - Weak U. S. dollar and strengthening foreign currencies, particularly the Japanese yen which tends to reduce interest in foreign travel by U. S. vacationers and encourages travel to Hawaii by the Japanese.
  - Increased air capacity and expanded service at both points of origin and destination.
  - Lower air fares and affordably priced tours which are being promoted by major tour wholesalers and airlines.
  - European travel uncertainties.
- Long-term factors:
  - More effective and aggressive marketing by Hawaii counties, resort destination associations and airlines.
  - Introduction of new U. S. travel markets to Hawaii.
  - Development of new resort destination areas on the neighbor islands.
  - Development of new and competitive hotel facilities.
  - Attraction of more internationally known hotel management companies.

Neighbor Island Visitor Arrivals

Visitor statistics are available by island for westbound travelers only. Recent trends in travel to the four major islands are depicted in Exhibit II-C. Although Oahu, and in particular the famous Waikiki resort area, continues to attract the most visitors, since 1970 the neighbor islands collectively averaged faster growth in westbound visitor arrivals than did Oahu. According to the HVB, the neighbor islands experienced an average annual growth rate of 6.9% from 1970 through 1986 compared to 5.9% for Oahu. However, considering the 1980s alone, growth has been about evenly distributed between Oahu and the neighbor islands. Furthermore, the neighbor island performance has been due largely to the success of Maui county, which averaged a 9.8% growth rate per annum since 1970. The island of Hawaii experienced the lowest growth rate over the period, averaging 3.6%, while Kauai achieved a 5.8% growth rate. The neighbor islands are expected to outpace Oahu in terms of future growth due to:

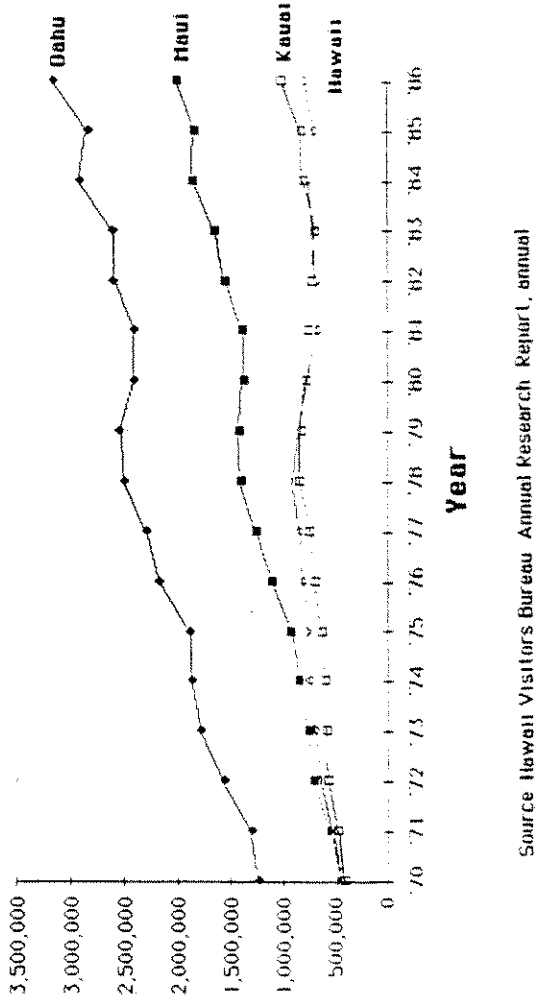
- Relatively smaller bases of current visitors to the neighbor islands.
- Increased air service and more effective marketing of the neighbor islands, with three major interisland carriers and direct flights to Kauai, Maui and Hawaii from major mainland destinations.
- Greater numbers of repeat visitors to the state seeking new visitor destinations.

Exhibit II-C

HAWAIIAN RIVIERA RESORT

Westbound Visitors to the Neighbor Islands

1970 to 1986



Source Hawaii Visitors Bureau Annual Research Report, annual

- Greater development of visitor accommodations on the neighbor islands with an emphasis on creating internationally reputable destination resorts.

- Slower development on Oahu due to the high density of Waikiki and relative lack of developable lands.

Exhibit II-D presents the percentages of the state's westbound visitors who indicated an intention to visit the various neighbor islands in surveys conducted by the HVB. Due to multiple responses indicating intentions to visit more than one island, total percentages for the state add to more than 100%.

Prior to the full development of resort infrastructure on the neighbor islands, most visitors stayed in Waikiki. Although it is still the most visited island in the state, Oahu has shown a decline in its market share. In 1986 the island captured only 74% of westbound visitors to the state, compared to 94% in 1970. This loss in market share was largely due to the gains on Maui. The neighbor islands' experiences and outlooks are discussed as follows:

- Maui - Nearly half of all westbound visitors indicated an intention to visit the island of Maui in 1986, as compared with 34% in 1970. Maui's visitor growth has been supported through the growth and market successes of its three major resorts, Kaanapali, Wailea and Kapalua. In addition, a fourth resort is being established at Makena, where the 310-room Maui Prince Hotel opened in June 1986.

- Kauai - Kauai is estimated to have received 24% of the state's westbound visitors in 1986, down from about 31% in 1970. Kauai has many dispersed visitor areas, including Princeville, Coconut Plantation, Kiahuna, Poipu Kai, the Poipu area and the recently completed Hanamaulu resort. Kauai's market share can be expected to increase significantly, however, following completion of a major resort now under construction at Nawiliwili.

- Hawaii - The island of Hawaii attracted the lowest percentage of westbound visitors with about 19% indicating an intention to visit the island in 1986 compared to 36% in 1970. This decline in share, however, is due in part to changes in interisland air traffic patterns, where previously the town of Hilo was a major stopover point. There are many new resorts proposed for the west and south coastal areas of the island which could serve to spur Hawaii island's future growth.

Exhibit II-E presents the number of westbound visitors by the island visited. Comparable information on the interisland travel patterns of eastbound visitors is not available, but survey data collected by the HVB suggests that they presently remain primarily on Oahu except for day trips to the neighbor islands.

Island of Hawaii Visitors

Hawaii county, which includes the entire island of Hawaii, attracted 787,000 westbound visitors in 1986. Eastbound visitors to the island of Hawaii are primarily day visitors.

Although westbound visitor arrivals declined in 1985, visitor arrivals in 1986 increased 12.8% and are expected to continue to increase in 1987.

HAWAIIAN RIVIERA RESORT

Percentage of Westbound Visitors
Visiting the Major Hawaiian Islands

1970 to May 1987

Year	Oahu	Hawaii	Maui(1)	Kauai
1970	94.0%	35.6%	33.8%	30.9%
1975	85.6	34.9	42.2	28.7
1976	85.0	32.0	43.5	27.4
1977	83.1	30.4	45.5	26.8
1978	82.3	30.0	46.3	27.6
1979	81.0	27.4	45.2	26.3
1980	78.7	25.0	45.2	25.7
1981	80.6	22.6	45.2	24.6
1982	79.0	20.7	49.1	23.2
1983	76.3	21.0	50.1	21.1
1984	76.4	22.5	53.7	23.7
1985	74.5	20.2	55.1	24.2
1986	73.8	18.5	47.0	23.8
1987 (January to May)	71.3	19.9	45.7	24.4

(1) Includes the island of Molokai.

Sources: Hawaii Visitors Bureau, Annual Research Report, annual and monthly. Figures reported represent percentage of the state's visitors who intended to visit each island; most visit more than one island during their stay in Hawaii.

Exhibit II-E

HAWAIIAN RIVIERA RESORT

Westbound Visitors by Island Visited

1970 to May 1987

Year	Oahu	Hawaii	Maui(1)	Kauai	Neighbor island total
1970	1,246,970	445,401	447,985	410,075	1,303,461
1971	1,311,426	522,166	554,799	472,663	1,549,628
1972	1,572,380	637,562	710,050	565,386	1,912,998
1973	1,785,485	694,170	766,791	590,475	2,051,436
1974	1,877,845	742,839	852,204	601,703	2,196,746
1975	1,889,790	769,779	931,863	632,821	2,334,463
1976	2,169,850	816,514	1,110,726	699,275	2,626,515
1977	2,295,310	839,008	1,257,142	740,501	2,836,651
1978	2,494,890	908,983	1,403,054	837,712	3,149,749
1979	2,542,720	860,940	1,419,773	825,366	3,106,079
1980	2,398,740	761,103	1,378,189	781,409	2,920,701
1981	2,398,480	672,683	1,389,892	757,811	2,820,386
1982	2,589,190	678,170	1,550,080	733,295	2,961,545
1983	2,591,635	714,030	1,645,720	692,130	3,051,880
1984	2,901,320	760,940	1,854,690	814,590	3,430,220
1985	2,828,640	697,380	1,831,110	832,580	3,361,070
1986	3,143,510	786,940	2,001,970	1,014,590	3,803,500
1987 (January to May)	1,227,260	343,790	786,970	420,770	1,551,530
Compounded annual percentage increase:					
1970 to 1986	5.9%	3.6%	9.8%	5.8%	6.9%
1980 to 1986	4.6	.6	4.4	1.3	4.5

(1) Includes the island of Molokai.

Source: Includes westbound visitors to and beyond Hawaii, as reported by the Hawaii Visitors Bureau, tabular release dated July 1984 and Annual Research Report, annual and records.

Visitor arrival growth has been inconsistent for a number of reasons, including:

- Former emphasis on developing Hilo as the main gateway to the island.
- Until the advent of nonstop flights from the U. S. mainland, the county was the most distant and therefore the most expensive island to visit.
- Hotel facilities are primarily oriented toward group travelers, although several well-known luxury hotels have been developed.

Hawaii county has the potential for rapid growth in visitor arrivals for a number of reasons, including:

- Nonstop air service to Kona from Chicago, Los Angeles, San Francisco and Seattle/Tacoma.
- Increased visitor industry and public awareness since the opening of the Mauna Lani Bay Hotel and the construction of the Hyatt Regency Waikoloa Hotel.
- Development of a number of resort destination complexes to be competitive with those on Maui (Exhibit II-F).
- Wide range of scenic attractions.

The primary characteristics of westbound visitors to Hawaii county in 1986 were:

- Males, 44.9%; females, 55.1%.
- Median age - 45.9 years compared to state average of 39.7 years.
- Average length of stay of 4.2 days.
- Average party size - 1.88 persons.
- Free, independent travelers/packaged independent travelers - 73.4%, group travelers - 22%.
- Repeat visitors - 50.1%.
- Condominium accommodations - 14.6%.
- High percentage of retirees - 21.5% compared to state average of 13.4%.

Visitor Transportation

The success of a resort destination relies on convenient, comfortable and affordable access. The island of Hawaii provides access to its scenic interior and shorelines by utilizing air, sea and land transportation.

Air Service

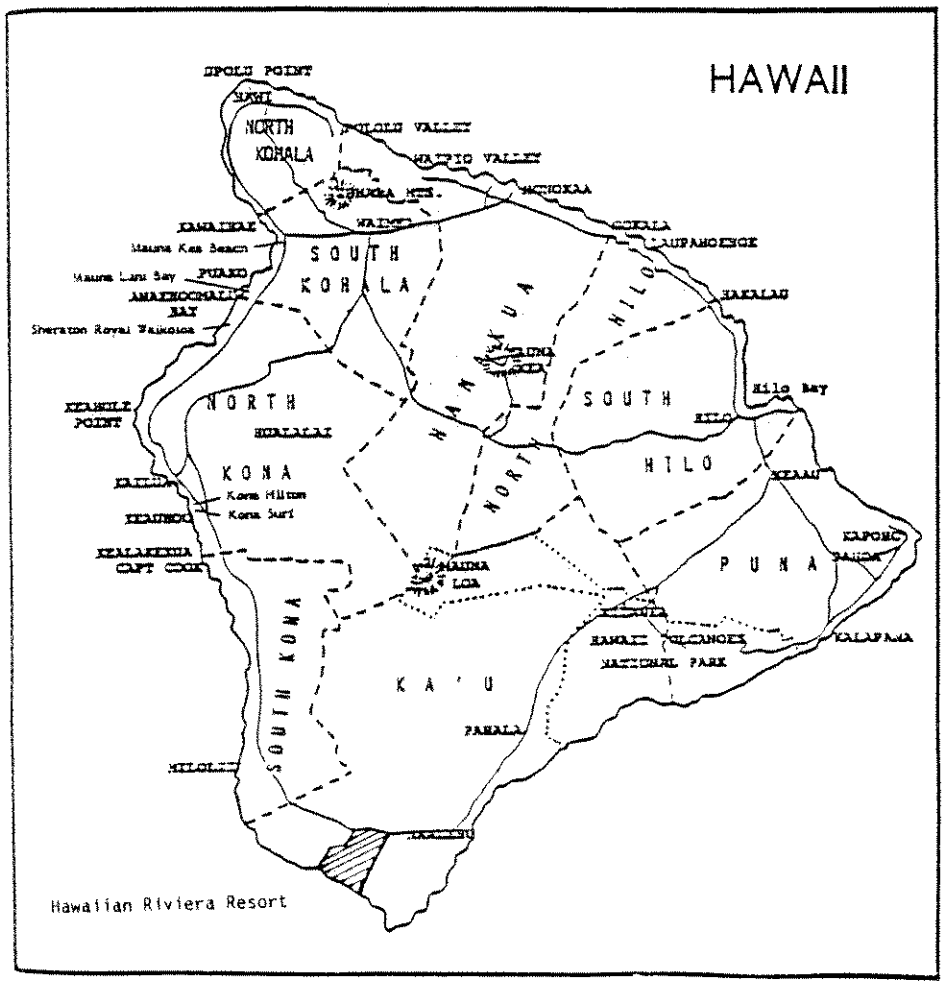
The state of Hawaii enjoys excellent international air services with nonstop or direct flights from more than 50 cities worldwide. The Keahole airport at Kailua, Kona, has nonstop service from Chicago, Los Angeles, San Francisco and Seattle/Tacoma. Both Kona and Hilo airports receive multiple flights daily from Honolulu and service from all other Hawaiian islands as well.

Exhibit II-F

HAWAIIAN RIVIERA RESORT

Location of the Hawaiian Riviera Resort
Phase I - Resort Market Complex

May 1, 1987



II-5

Aviation demand forecasts in the year 2000 for Hawaii county envision strong tourism growth as shown below:

Air Arrivals in Hawaii County

	1986	2000	Compounded annual percentage increase
Hilo:			
Overseas	10,301	20,000	4.9%
Interisland	565,647	655,000	1.1
Kona:			
Overseas	85,686	450,000	12.6
Interisland	752,918	1,407,000	4.6

Source: Hawaii State Airport System Plan, June 1986.

Air taxi and helicopter services are readily available in the county for both commuter and sightseeing flights.

Sea Service

Two ocean liners offer cruises among the islands of Hawaii on weekly schedules, calling at both Hilo and Kona. Additionally, sightseeing boats operate out of Kailua, along the South Kona Coast, to Lanai and Molokai, with sunset and dinner cruises also available.

Land Transportation

Land transportation is dependent on motorcoach and rental cars, but once-a-day public bus transportation is also available.

Activity Patterns

Hawaii county offers a greater combination of natural attractions and commercial activities than any other single island in Hawaii.

The majority of visitors stay in the western part of the island but usually include the attractions of the eastern part in their itineraries in one of two ways:

- Arriving at either Hilo or Kona and departing from the other airport.
- Circle island sight-seeing coach or self-drive tours.

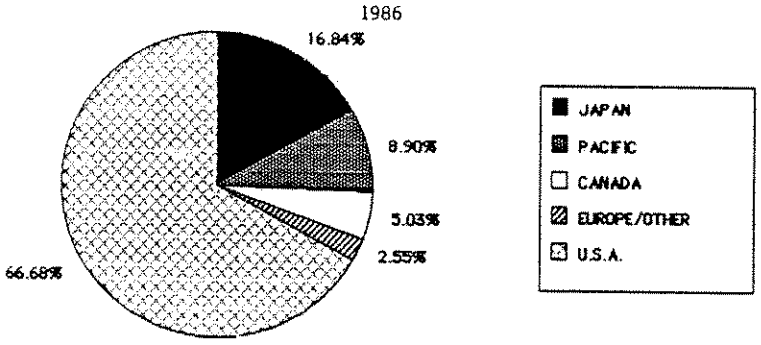
VISITOR TRAVEL PATTERNS

This section discusses the travel patterns of total or westbound visitors to the state in terms of their places of origin, travel purpose, usage of accommodations, length of stay, travel status and interisland visitation patterns.

Places of Origin

Two-thirds of all visitors to the state reside in the continental United States, as shown in the chart below:

Visitor Arrivals by Country of Origin



Source: Hawaii Visitors Bureau, 1987.

Among westbound travelers, the largest segment is residents of the west coast states and Alaska, representing 35% of all westbound visitors.

The next largest visitor-generating region is Japan, which accounted for 17% of visitor arrivals in 1986, followed by the various countries and territories of the Pacific at 9%.

Areas that have sent increasing numbers of visitors over the past five years have been the U. S., Japan and the Pacific. Visitor arrivals have declined from Canada and Europe due to unfavorable currency exchange rates. Visitor growth from the Pacific region countries of Australia and New Zealand could have been substantially higher if not for low rates of exchange.

Purpose of Trip

Westbound visitors to Hawaii tend to be primarily vacationers. About 82% of westbound travel to the state in 1986 was for pleasure and another 10% combined business with pleasure. The percentage of pleasure trips to Hawaii has generally increased since 1970, as shown in Exhibit II-G.

Participant sports opportunities have expanded with a concentration on golf, tennis and aquatic activities. As the resort and repeat visitor market continue to grow, the demand for activities and planned recreational opportunities are expected to continue to increase.

Exhibit II-G

HAWAIIAN RIVIERA RESORT

Westbound Visitor Travel Patterns

1970 to 1986

	1970	1975	1980	1985	1986
Purpose of trip:					
Pleasure	74.6%	76.4%	75.4%	80.2%	82.2%
Business and pleasure	9.9	10.7	13.3	10.6	10.1
Business	3.8	2.6	2.9	2.0	2.1
Military/government	.6	.3	.4	.5	.5
Relatives	6.3	3.7	4.1	2.7	2.4
Convention	4.5	6.2	3.5	3.6	2.4
Other	.3	.1	.4	.4	.3
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Accommodations:					
Hotel	84.2	91.7	71.2	67.7	66.5
Rented home or condominium	.8	.5	16.4	20.9	22.2
Friends or relatives	12.6	6.8	10.6	7.7	7.5
Other	2.4	1.0	1.8	3.7	3.8
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Length of stay in state:					
1 - 6 days	14.3	9.0	8.3	7.7	8.9
7 - 12 days	55.7	61.1	61.2	67.8	68.2
13 - 18 days	23.8	24.9	23.9	19.5	18.2
19+ days	6.2	5.0	6.6	5.0	4.7
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Average stay in state (days)	10.3	10.5	10.6	10.2	10.1

Source: Hawaii Visitors Bureau, Annual Research Report, annual.

Accommodations Usage

Accommodations usage patterns have shifted significantly over the last ten years. Although hotels continue to serve the majority of visitors, condominium usage has increased to represent 22.2% of visitor accommodations in 1986, as compared with less than 1% in 1975, as also shown in Exhibit II-G. The increase in condominium usage is attributed to:

- Improved management and marketing of condominium pools, along with companies specializing in this field.
- Increases in repeat visitors and larger visitor party sizes, including families that prefer accommodations with cooking facilities and multiple rooms per unit.
- Development of condominium units which are designed to be operated in rental pools.
- Greater condominium unit availability and ownership.

Visitors reported to stay in places other than hotels, rented homes or condominiums stay mostly in noncommercial accommodations such as with friends or relatives. The segment of the market staying in such noncommercial accommodations is now estimated to be about 7.5% of westbound travelers and to be even less among eastbound travelers.

Average Length of Stay

Two-thirds of westbound visitors to Hawaii stay between 7 and 12 days. The average length of stay in the state has remained relatively stable over the last ten years at approximately 10 days for most westbound travelers, as shown in Exhibit II-G. Average length of stay is also estimated at 6 days for Japanese and about 15 days for Canadians.

Within the state, the average length of stay in 1986 was longest on Oahu at 7.2 days and shortest on the island of Hawaii at 4.6 days, as shown in Exhibit II-H. The varying lengths of stay reflect the magnitude and variety of visitor activities and attractions on each island.

The greatest nominal growth in the average length of stay has occurred on Maui where the average length of stay increased by 3.3 days between 1970 and 1986 and currently averages 6.3 days.

The average length of stay varies slightly by time of year. Winter visitors tend to stay longer than summer visitors since cold weather often brings the more affluent visitors and second homeowners, some of whom stay in their favorite hotel or vacation home for several weeks or months.

Travel Status

Four major travel status market segments represent more than 99% of visitors to the state. Trends in these market segments are shown in Exhibit II-I and are discussed as follows:

Exhibit II-H

HAWAIIAN RIVIERA RESORT

Average Length of Stay of Westbound Overnight and Longer Visitors by Island

1970 to 1986

(Days)

Year	Oahu	Hawaii	Maui	Kauai
1970	6.03	2.94	2.97	2.68
1975	5.97	3.08	3.42	2.35
1976	5.99	3.04	3.50	2.35
1977	5.88	3.13	3.62	2.97
1978	5.83	3.25	3.77	3.08
1979	5.85	3.39	4.01	3.27
1980	5.78	3.46	4.08	3.40
1981	5.91	3.56	4.13	3.48
1982	5.77	3.62	4.26	3.51
1983	6.96	4.52	5.61	4.22
1984	7.49	3.64	6.47	4.91
1985	7.24	4.21	6.20	5.03
1986	7.25	4.58	6.26	5.34
Increase from 1970 to 1986	1.22	1.64	3.29	2.66

Source: Hawaii Visitors Bureau, Research Department, July 1986.

Exhibit II-I

HAWAIIAN RIVIERA RESORT

Major Westbound Visitor Market Segments

1978 to May 1987

Year	FIT	GIT	Incentive group	Convention	Total westbound visitors to Hawaii(1)
1978	1,563,746	738,897	68,750	230,273	2,698,831
1979	1,826,895	632,817	101,639	178,753	2,805,813
1980	1,934,393	410,646	100,367	230,891	2,718,863
1981	1,914,140	412,370	90,972	181,662	2,611,142
1982	2,163,210	396,797	126,615	167,558	2,896,255
1983	2,272,080	344,386	127,340	211,764	3,088,020
1984	2,482,360	367,388	189,800	255,152	3,385,880
1985	2,560,190	482,530	166,520	122,600	3,386,530
1986	3,277,280	626,130	219,420	95,310	4,257,200
1987 (January to May)	1,332,960	334,630	- (2)	139,126	1,719,860
Compounded annual percentage increase (decrease) - 1978 to 1986	9.7%	(2.0)%	15.6%	(10.4)%	5.8%

(1) Excludes visitors traveling beyond Hawaii.
(2) Combined with GIT.

Source: Hawaii Visitors Bureau, Annual Research Report, annual.

- Free and independent travelers - Free, independent travelers (FITs) are those that travel and plan their itineraries individually rather than with a group. This category also includes packaged independent travelers (PITs) who may purchase "packaged" travel arrangements such as air fare, hotel and car rentals that are sold together at a discounted price. FITs typically have higher-than-average incomes, patronize higher priced visitor accommodations and are often repeat visitors. Westbound FITs have increased by over 9% per year over the current decade from 58% in 1978 to 77% in 1986, with a substantial increase occurring in 1986.

- Group inclusive tours - The group inclusive tour (GIT) traveler market comprises visitors who travel together in organized tours with preset travel arrangements. Group travelers have declined as a percent of all westbound visitors over the present decade from 27% in 1978 to 15% in 1986, although they were fewest in 1983. This represents an average decline in GIT arrivals of about 2% per year over the period.

- Incentive travelers - Incentive travelers are a small but relatively new market segment consisting of individuals and groups who have won or earned all-expenses paid Hawaii vacations. This market has only recently emerged since about 1980 with the development of new hotels such as the Hyatt Regency Maui with facilities to cater to and serve this highly sought after market. These travelers generally stay in higher priced hotels, have higher food and beverage expenditures and are more likely to return as visitors. In 1984 Maui captured 61% of the state's total in this market. This market has grown an average of close to 16% per year since 1978 and represented 5% of westbound visitors in about 600 groups in 1986.

- Convention attendees - The convention market consists of those attending meetings or conventions. This market has fluctuated, ranging from 4% to 9% of total westbound visitors in recent years. This market is often considered part of the group traveler market and is quite irregular, as a large group can distort figures for a given year. Convention attendees have not represented a major visitor market for Hawaii due to the current lack of a large, convenient convention facility in the state.

In summary, individual and package travelers remain the largest market segment to Hawaii. The fastest rates of growth since 1978 occurred among incentive groups and FITs. The strength of the FIT market is due in part to the increase in repeat visitors to the state and the emergence of individual packaged tours at group or bulk rates mass-marketed by tour wholesaling organizations.

Like most recreational or resort destinations, the Hawaii market is notably price driven. Low-cost, well-advertised, year-around individual tour packages have been available over the past two years and were an important factor in the 1986 visitor increases, especially from California. While bargain packages may remain for years to come, air fares are likely to move upward as intense air carrier competition brought about by deregulation gradually reaches equilibrium.

These travel changes apply more or less equally to visitors from Asia and the Pacific as well as North America. This eastbound market is currently showing rapid expansion, with Japanese visitors comprising some 20% of all visitors to

Hawaii. The Japanese are predominantly younger people, but the mature market is also expanding. Importantly, Japanese travel companies are now strongly marketing the neighbor islands as overnight destinations after two decades of concentrating on Waikiki.

Island Destinations

Between 1975 and 1985, those visitors whose final destination was only Oahu remained relatively constant at 30%. In contrast, visitors seeing Oahu and at least one neighbor island decreased from 60% in 1975 to 44% in 1985. Those visiting the neighbor islands only increased from 10% in 1975 to 26% in 1985.

WESTBOUND VISITOR CHARACTERISTICS

This section discusses the characteristics of westbound visitors to the state, with findings summarized in Exhibit II-J.

Average Party Size

Average persons per party has slowly increased over the last ten years, moving from an average of 1.55 persons in 1970 to about 1.84 persons in 1986, as shown in Exhibit II-J. This increase may be attributable to more families visiting the islands and easier access to the state from mainland destinations.

Age

The age structure of westbound visitors to Hawaii has changed little in the last decade and a half. Visitors aged 30 to 49 are by far the largest age group to visit Hawaii, representing nearly 41% of all westbound arrivals in 1986. Next largest were the 20 to 29 and 60 and older age groups which account for approximately 18% and 16%, respectively, in 1986. The median age of westbound visitors has fluctuated between 40 and 44 since 1970.

Occupation

Since 1970 Hawaii has experienced a slight shift to the higher salaried professional/technical and business/managerial occupations. Persons employed in professional and technical occupations were the largest employment segment to visit the state in 1986 at approximately 37%. They were followed by visitors employed in business, managerial and official occupations at 25%. Thus these two segments accounted for 63% of all visitor occupations to the state.

Number of Visits to Hawaii

Slightly more than 50% of Hawaii's visitors are first-time visitors to the state. However, the number of repeat visitors has increased dramatically from only 33% in 1970 to 47% in 1986, indicating Hawaii's desirability as a visitor destination. Repeat visitors typically stay in condominiums or hotels with the reputations, ambience, service and amenities that encourage them to return year after year.

HAWAIIAN RIVIERA RESORT

Westbound Visitor Characteristics

1970 to 1986

	1970	1975	1980	1985	1986
Average party size	1.55	1.74	1.79	1.85	1.84
Age:					
Under 20	11.6%	9.2%	10.5%	10.3%	10.8%
20 - 29	22.9	16.2	17.6	18.6	18.0
30 - 49	34.0	36.0	38.0	36.9	40.7
50 - 59	18.9	22.8	19.4	18.9	14.9
60 and older	12.6	15.8	14.5	15.3	15.6
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Median age (years)	40.7	44.5	41.3	39.7	39.7
Occupation:					
Professional and technical	27.9%	33.5%	35.8%	36.6%	37.5%
Business, managerial and official	21.6	26.9	26.2	25.5	25.3
Clerical, office and sales	12.2	11.2	9.7	9.8	9.3
Military and dependents	13.7	.9	1.0	1.0	1.3
Other employed	7.2	8.0	7.6	7.0	6.0
Retired	7.6	12.5	11.5	13.4	13.8
Students and unemployed	9.8	7.0	8.2	6.7	6.8
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Trips to Hawaii:					
First	67.2	60.3	51.6	53.7	50.8
Second	14.7	17.1	18.8	18.8	19.3
Third	5.6	7.2	9.1	8.7	9.3
Fourth	12.5	15.4	20.5	18.8	20.6
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Repeat visitors	32.8%	39.7%	48.4%	46.3%	47.2%

Source: Hawaii Visitors Bureau, Annual Research Report, annual.

Neighbor Island Visitors

As compared to Oahu westbound visitors, visitors to the neighbor islands can be characterized as slightly more experienced and "upscale" travelers. As shown in Exhibit II-K, neighbor island visitors are characterized as follows:

- Higher percentage of pleasure visitors
- Longer average length of stay in state
- Slightly older
- Higher percentage of high status occupations
- Greater percentage of repeat visitors

VISITOR EXPENDITURES

This section presents recent data on westbound and Japanese visitor expenditures.

Westbound Visitors

Westbound visitor expenditures for 1986 have been tracked by the HVB at $95 per person per day, up from $86 in 1983. The bulk of these visitor expenditures were for lodging at $37, and food and beverage expenditures at $22 per day, as shown in Exhibit II-L. Average expenditures on lodging and entertainment have increased in recent years, while those on dining have changed nominally and most other expenditure items have declined.

Japanese Visitors

The HVB estimates that in 1986 the average Japanese visitor to Hawaii spent $257 per day, or nearly three times that of the typical westbound visitor. The 21% of Japanese visitors who were honeymooners are estimated to have spent $340 per person per day. Japanese visitors tend to select first-class to luxury hotels, prefer a true resort experience and purchase top of the line personal items and gifts.

HAWAIIAN RIVIERA RESORT

Selected Characteristics of Westbound Visitors to the Major Hawaiian Islands

1985

	State of Hawaii	Oahu	Hawaii	Maui	Kauai	Molokai
Pleasure visitors	80.0%	80.4%	80.5%	83.0%	85.6%	85.2%
Travel status:						
FIT	76.5	74.3	73.4	75.8	75.1	66.4
GIT	18.0	21.3	22.3	18.3	21.4	30.1
Incentive	5.0	3.8	4.1	5.8	3.3	3.3
Other	.5	.6	.2	.1	.2	.2
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Average length of stay (days):						
In state	10.2	10.3	11.5	10.6	11.2	12.3
On island	-	7.20	4.20	6.40	5.30	2.74
Median age (years)	39.7	40.1	45.9	40.7	43.0	49.6
Higher level occupations(1)	61.5%	59.2%	59.8%	65.6%	61.9%	53.1%
Repeat visitors	46.0	41.9	48.3	43.1	43.3	44.0

(1) Professional, technical, business, managerial and official occupations.

Source: Hawaii Visitors Bureau, A Study of Westbound Visitors to the State of Hawaii and Islands of Oahu, Maui, Kauai, Hawaii and Molokai, 1985.

Exhibit II-L

HAWAIIAN RIVIERA RESORT

Average Daily Expenditures Per Visitor

1983 and 1986

	1983	1986	Percentage change(1)
Food and beverage:			
Restaurant	$ 15.65	15.37	(2)%
Nightclub	1.41	1.80	28
Dinner shows	1.95	2.28	17
Groceries	2.46	2.55	4
Total food and beverage	21.47	22.00	3
Entertainment:			
Attractions	3.96	6.34	60
Other	1.14	1.40	23
Total entertainment	5.10	7.74	52
Transportation(1):			
Ground transportation	1.44	1.01	(30)
U-drive	4.18	2.87	(31)
Interisland travel	2.73	1.90	(30)
Sightseeing tours	1.26	1.21	(4)
Total transportation	9.61	6.99	(27)
Clothing	7.18	8.06	12
Gifts and souvenirs	7.32	8.21	12
All other	3.89	4.10	5
Lodging	29.94	36.60	22
Adjustment factor amount(2)	1.37	1.70	24
Total	$ 85.88	95.40	11

(1) Does not include cost of transportation to Hawaii.

(2) A per day estimate made by each visitor concerning the dollar amount that may have been neglected to be included in the listed categories.

Source: Hawaii Visitors Bureau, 1986 Visitor Expenditure Survey.

III - HOTEL MARKET ASSESSMENT

This chapter describes resort areas in the state of Hawaii and discusses the statewide hotel market in terms of the existing and planned inventory of visitor units, historical occupancy rates and average room rates. The last section of the chapter concludes with the market assessment for hotel development of the Hawaiian Riviera Resort.

HAWAII RESORT OVERVIEW

Hawaii could well be called the world's finest resort destination. It enjoys a tropical south seas mystique, a near-perfect year-around climate, constant ocean temperatures in the high 70s, a wide variety of land forms and vegetation among its islands, highly developed and extensive tourism facilities and a stable economic and political system. It also enjoys low humidity, in contrast to most other tropical resort destinations.

Facilities and Amenities

There are currently 15 major resort areas in the state, located as shown in Exhibit III-A. With a few exceptions, Hawaiian resorts tend to be located on the protected leeward, or southern and western coasts of their respective islands. From this vantage point, they enjoy sunny weather, calm wind and ocean conditions and beautiful sunsets.

Exhibits III-B, III-C and III-D present characteristics of 12 Hawaii resorts with regard to site area, site characteristics, existing development, visitor facilities, room rates and prices, market appeal and visitor profile. All but two of the resorts, Keauhou and Punalu'u on the island of Hawaii, have excellent swimming beaches. Developments completed to date range between 95 units at Punalu'u Resort on the island of Hawaii, to 5,300 units at Kaanapali, Maui. Resort amenities generally include golf, tennis, extensive water sports and retail shopping centers.

Market Appeal

Market appeal differs markedly between resorts. Three of the five resorts on the island of Hawaii cater to the first-class and luxury markets with high-end flagship hotels and residential properties. These are the Mauna Kea, the Mauna Lani and the Waikoloa Beach Resorts. The other two resorts on the island of Hawaii, Keauhou and Punalu'u, cater to the tourist and the first-class markets.

The Kapalua and Wailea Resorts on Maui cater most exclusively to the first-class and luxury markets. The Kaanapali Beach Resort on Maui caters to the broadest range of visitors, with hotel facilities ranging from tourist to luxury class.

The Princeville Resort on Kauai has a first-class market orientation, while existing resorts on Molokai and Oahu cater to the tourist to first-class markets.

Resorts that cater to the luxury travel market typically host older, independent travelers who return year after year, while those catering to the first-class or tourist markets generally appeal to a broader range of travelers that includes group and package tourists.

Exhibit III-A

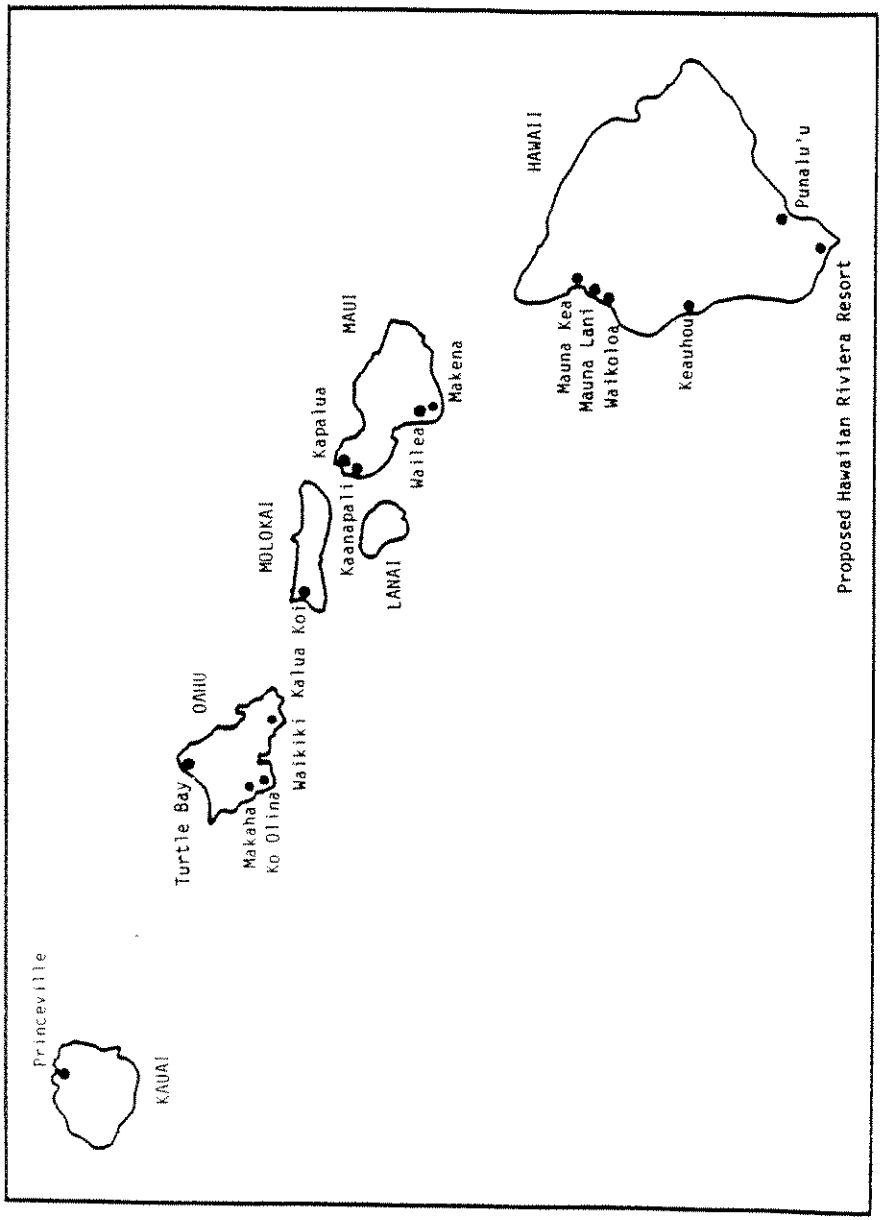


Exhibit III-B

HAWAIIAN RIVIERA RESORT

Characteristics of Oahu, Kauai and Molokai Resorts

	Oahu resorts: Makaha	Oahu resorts: Turtle Bay	Kauai - Princeville	Molokai - Kalua Koi
Site area (acres)(1)	617	808	[illegible]	3,688
Distance from interisland airport	31 miles	37 miles	28 miles Lihue	[illegible] miles Hoolehua
Special site characteristics	Secluded valley with equestrian trails	Protected bay, waterbird sanctuary, equestrian center (planned	Coastal plateau with cliffs	Rock promontory, deeded heiaus
Existing development:				
Hotel rooms	195	487	[illegible]	290
Condominium units	611	368	[illegible]	198
Single-family lots	-	-	[illegible]	N/A
Total units	806	855	[illegible]	N/A
Proposed at completion (units)	N/A	4,350	N/A	N/A
Amenities:				
Beach	No ocean frontage, Makaha Beach shuttle bus	Mostly rocky; limited swimming except for Kawela Bay	Sandy beaches, bay below cliffs; seasonally rough waters	White sand; seasonally rough waters
Shoreline (linear feet)	-	26,400	14,[illegible]	[illegible]
Commercial space in shopping centers	-	40,000 sq. ft. (planned)	66,[illegible]	-
Golf course holes	36	18, 18 planned	[illegible]	18
Tennis courts	4	10	-	-
On-site activities	Horseback riding	Snorkeling, scuba diving horseback riding, dune cycling	Fishing, horseback riding, rodeos, hiking, boating	-
Hotel developments:				
Hotel class	Tourist	Tourist/first-class	First-class	Tourist first-class
1987 average hotel room rates(2):				
Single	$80 - $250	$80 - $[illegible]	$[illegible] - $[illegible]	$80 - $[illegible]
Double/triple	80 - 250	80 - [illegible]	[illegible] - 250	80 - [illegible]
Typical condominium unit sales prices (1986)(3)	N/A	$60,000 - $[illegible],000	$100,[illegible] - $[illegible],000	N/A
Market appeal	Secluded, heavily oriented to golf, tennis, horseback riding. Operations hampered by lack of beach access and locational attributes.	Planned to be a major destination resort which would compete directly with neighbor island resorts. Close to major visitor attractions.	Oriented to condominiums and single-family lot sales, with only one hotel. Resort has a rural appeal with few nighttime activities.	Appeals to visitors who prefer undiscovered destinations and golf, fishing or hunting activities.
Typical visitor profile	FIT visitors represent 70%. Resort guests include: 30% - 35% (local) 35 - 40 (westbound) 25 - 35 (Japanese)	Oriented to both FIT and GIT guests from the mainland and Oahu.	Oriented to upper and middle income travelers and second homeowners including GIT and FIT travelers. Greater primary homeownership than elsewhere	Oriented to Hawaii and mainland and FIT visitors and package tours.

N/A Not available.

(1) Includes all master-planned areas, including nondesignated or conservation and buffer areas. Portions may not be master-planned for development at this time.

(2) Undiscounted room rates for major hotels or condominiums as published by the Hawaii Visitors Bureau, Member Accommodations Guide, 1986.

(3) Hawaii Real Estate Investor, Multiple Listing Service and discussions with developers or realtors in the respective resorts.

Sources: Compiled by Peat Marwick Main & Co., based on discussions with developers, the Hawaii Resort Development Conference, [illegible] Resort Development, 1983 and other published sources.

Exhibit III-C

HAWAIIAN RIVIERA RESORT

Characteristics of Maui Resorts

	Kaanapali Beach	Wailea	Kapalua
Site area (acres)	1,169	1,450	750
Distance from interisland airport	28 miles (Kahului)	15 miles (Kahului)	32 miles (Kahului)
Special site characteristics	Long stretch of sand beach Rock promontory	Arcuate beaches	Isolated beaches Old fishing village Historic sites
Existing development:			
Hotel rooms	3,756	950	194
Condominium units	1,330	656	528
Single-family lots	210	190	100
Total units	5,296	1,796	822
Amenities:			
Beach	Long white sand; excellent swimming conditions	White sand bays, excellent swimming conditions	Three sandy bays
Shoreline (linear feet)	10,400	7,900	9,500
Percent usable for swimming	94%	N/A	39%
Commercial space in shopping centers	79,000	40,000	22,000
Golf course holes	36	36	36
Tennis courts	30	14	10
On-site activities	Sailing, catamaran cruises, surfing	Scuba diving, excursion boats	All water sports
Hotel developments:			
Hotel class 1987 average hotel room rates(1): Single Double/triple	Luxury/first-class/tourist $64 - $300 85 - 300	First-class/luxury $145 - $175 165 - 195	Luxury/first-class $175 - $300 175 - 300
Typical condominium unit sales prices (1986)(2)	$150,000 - $290,000	$185,000 - $1,000,000	$180,000 - $400,000
Market appeal	Oriented towards hotels. Promoted as an integrated resort with many attractions.	Low-density, well-manicured resort with strong recreational appeal due to prominent golf and tennis facilities.	Remote, high-end resort with an overall high quality of hotel, condominium and recreational developments.
Typical visitor profile	About evenly divided between package and GIT/FIT visitors. Primarily younger, travelers from west coast and Canada.	Wide variety of visitors including FIT, package and GIT guests. Currently has a family and older visitor appeal.	Geared to affluent, older individual visitors who return annually.

N/A Not available.

(1) Undiscounted room rates for major hotels or condominiums as published by the Hawaii Visitors Bureau, Member Accommodations Guide, 1986.

(2) Hawaii Real Estate Investor, Multiple Listing Service and discussions with developers or realtors of the respective resorts.

Sources: Compiled by Peat Marwick Main & Co., based on discussions with developers, the Hawaii Resort Developer's Conference, Economics of Resort Development, 1983 and other published sources.

Exhibit III-D

HAWAIIAN RIVIERA RESORT

Characteristics of Hawaii Island Resorts

	Keauhou	Waikoloa Beach	Mauna Kea Beach	Mauna Lani	Puna...
Site area (acres)(1)	890	500	1,100	814	595
Distance from interisland airport	12 miles (Keahole)	17 miles (Keahole)	25 miles (Keahole)	20 miles (Keahole)	87 miles (Hilo)
Special site characteristics	Protected bay Several heiaus Burial grounds Ancient settlement areas	Protected bay 2 fish ponds Petroglyphs Burial caves Ancient trail	Isolated beaches Several heiaus Historic surfing	6 major fish ponds Numerous archaeolo... sites and artifacts Ancient trail	Lagoons and black lava beach
Existing development:					
Hotel rooms	1,302	548	313	35...	-
Condominium units	832	66	33	1...	1...
Single-family lots	109	-	58	-	1...
Total units	2,243	614	388	1...	1...
Amenities:					
Beach	Rocky, poor swimming; public beach nearby	White sand, good swimming	White sand, excellent swimming	Sandy, rocky bottom, ...manade beach area	Black sand and rocks; ...rough for swimming
Shoreline (linear feet)	13,000	7,000	14,00...	14,...	-
Percent usable for swimming	-	32%	32%	1...	-
Commercial space in shopping centers	22,088	-	-	-	-
Golf course holes	36	18	18	1...	1...
Tennis courts	18	6	9	1...	-
On-site activities	Fishing, hunting, snorkeling, scuba diving	Deep-sea fishing, scuba diving, catamaran cruises, sailing, windsurfing	Deep-sea fishing, scuba diving, catamaran cruises, horseback riding, hunting	Jogging course, fishing, scuba diving, horseback riding	Nearby recreation...
Hotel developments:					
Hotel class 1987 average hotel room rates(2): Single Double/triple	Tourist/first-class $50 - $115 65 - 130	Luxury/first-class $55 - $110 55 - 110	Luxury $300 - $360 35... - 380	Luxury $2... 220 - 295	Tourist $75 - ... 85 - ...
Typical condominium unit sales prices (1986)(3)	$95,000 - $170,000	$200,000 - $560,000	$750,000 - $1,100,000	$300,000 - $380,000	n.a.
Market appeal	Activity-oriented resort which benefits from proximity to the Kailua-Kona resort area and area visitor attractions.	Golf-oriented single hotel property expected to significantly broaden its market appeal following completion of a 1,244-room Hyatt in 1988.	World-class destination resort which enjoys a wide reputation and loyal visitor base.	Quality hotel, condominium and golf course development incorporated into unique natural setting including 3 lava fields and ancient fish ponds.	Currently ... attracts visitors ... to the active ... isolated from other visitor activities.
Typical visitor profile	Oriented to package, GIT and FIT visitors from middle to upper income groups.	Currently oriented to package and GIT visitors and convention groups. Planned development to cater to a more upscale market including convention and incentive groups.	Caters to travelers who are generally mature, very affluent and return annually.	Marketed to younger, affluent individual visitors and recreational groups.	Currently ... attracts ... from north, west and west coast visitors.

N/A Not available.

(1) Includes all master-planned areas, including nondesignated or conservation and buffer areas. Portions may not be marketed ... development at this time.

(2) Undiscounted room rates for major hotels or condominiums as published by the Hawaii Visitors Bureau, Member Accommodations Guide, 198...

(3) Hawaii Real Estate Investor, Multiple Listing Service and discussions with developers or realtors of the respective resorts.

Sources: Compiled by Peat Marwick Main & Co., based on discussions with developers, the Hawaii Resort Developer's Conference, Economics of Resort Development, 1983 and other published sources.

Over time, resorts establish a market image within their communities and among travelers. This image is subject to change based on factors such as:

- Quality of additional developments and reputation of new facility operators.
- Level of maintenance and/or upgrading of facilities, amenities and service.
- Visibility and market images associated with promotional events such as major golf tournaments.
- Experiences of many travelers and the word-of-mouth publicity generated.
- Formation of a critical mass and support structure of hotels and other facilities that maintain market visibility and enhance the visitor's resort experience.

VISITOR ACCOMMODATIONS INVENTORY

Hawaii's visitor accommodations consist primarily of hotel units and those condominium units which are utilized for transient visitors. In 1986 almost 90% of Hawaii's visitors indicated that they intended to stay in a hotel or condominium. This section discusses the inventory of existing and planned visitor accommodations throughout the state and on the Big Island.

State and Island Inventories

The HVB reports the number of hotels and condominium units available for transient visitor use. As reported by the HVB, there are currently about 450 visitor facilities in the state with about 65,300 visitor units. This represents a 5.2% per annum increase over the 1970 inventory of about 27,500 units, as shown in Exhibit III-E.

Between 1970 to 1987, visitor rooms in the county of Hawaii grew at an annual average rate of 5%, which approximates the growth rate of the state as a whole for the same period. Currently, the inventory of rooms available on the Big Island accounts for about 11% of the state's total inventory.

About 59% of the state's visitor units are now located on Oahu, primarily in Waikiki. This represents a decrease in Oahu's share from the 69% noted in 1970 due to significant construction on the neighbor islands over the period. Over the past decade development activity focused on the neighbor islands rather than on Waikiki because of:

- The relative shortage of developable new sites on Oahu and public moratoriums on new hotel development in Waikiki.
- The relatively larger oceanfront private land holdings available on the neighbor islands, enabling the master planning of major resort areas.
- The maturing of the state visitor industry bringing:

HAWAIIAN RIVIERA RESORT

Visitor Rooms in Hawaii

1970 to 1987

Year	Oahu	Hawaii county	Kauai county	Maui county(1)	Total state
1970	19,050	3,182	2,567	2,720	27,519
1975	25,428	5,386	3,145	6,018	39,977
1980	34,393	6,260	4,435	10,483	55,571
1985	38,600	7,511	5,656	14,152	65,919
1986	39,010	7,280	5,922(2)	14,096	66,308
1987	38,185(3)	7,328	5,956	13,849	65,318
Percent of state:					
1970	69.2%	11.6%	9.3%	9.9%	100.0%
1987	58.5	11.2	9.1	21.2	100.0
Compounded annual percentage increase - 1970 to 1987	4.2	5.0	5.1	10.0	5.2

(1) Includes Molokai and Lanai.

(2) Major facility changes since February 1986 include the closing of the 553-unit Kauai Surf and the openings of the 487-unit Kauai Hilton and Beach Villas, the 300-unit Sheraton Princeville, the 92-unit Prince Kuhio and about 110 additional visitor units at Poipu Kai.

(3) The removal of condominium units from visitor rental pools accounted for most of the decrease on Oahu, declining from 9,838 units in 1986 to 9,236 units in 1987.

Sources: Figures for 1970 to 1984 represent number of visitor units as of June of the year indicated, as reported by the Hawaii Visitors Bureau, Annual Research Report, 1984. Figures for 1985 to 1987 are as of February as reported by the Hawaii Visitors Bureau, Visitor Plant Inventory, 1985 to 1987.

- More repeat visitors seeking new experiences and destinations beyond Oahu.

- Relatively more affluent visitors seeking more complete services and amenities than are available in Waikiki.

HOTEL MARKET PERFORMANCE

This section summarizes the recent market performance of hotels throughout the state in terms of achieved room and occupancy rates.

Published Room Rates

Published room rates in Hawaii for first-class and luxury resorts vary by resort, as shown in Exhibit III-F. Room rates range from $80 for a standard room at the Sheraton Royal Waikoloa to $2,000 for a suite at the Halekulani. Discounts, group and corporate rates, incentive plans, seasonal and kamaaina rates all affect rates actually charged to the hotel guest. Thus published room rates typically exceed room rates actually achieved by a hotel when discounting is considered.

Achieved Room Rates

Hawaii hotels achieved an average room rate of $73 in 1986, as shown in Exhibit III-G. As of May 1987, hotel room rates increased by almost 16% over 1986 to about $85, as also shown in the exhibit.

Room rates vary significantly by island and region, reflecting the relatively newer visitor plant on the neighbor islands, the completion of several high-quality projects and the higher occupancy levels achieved by different regions, most notably on West Maui. In 1986 West Maui achieved the highest rates in the state, at about $125. In contrast, average room rates were lowest on Oahu at an average daily rate of $62 and even lower at Waikiki off-beach facilities with no restaurants.

Achieved room rates have increased by about 9.4% annually since 1980. Relatively faster rates of increase were experienced on Maui and Hawaii and lower increases on Oahu and Kauai.

Achieved Occupancy Rates

Occupancy levels indicate the demand for visitor accommodations relative to room supply. Occupancy levels, including both hotel and visitor condominium units, are surveyed monthly.

In general, occupancy levels improved significantly in 1985 and 1986 over previous years. In 1985 and 1986 the average annual occupancy levels for visitor accommodations in the state were 78% and 82%, respectively, as shown in Exhibit III-H. These rates are significantly higher than the 68% to 70% experienced from 1980 to 1983. The recently improved occupancies are attributed to a decline in construction of new visitor units coupled with the 15% increase in visitor arrivals in 1986. During the first five months in 1987, hotel occupancies continued to be strong at about 83%.

HAWAIIAN RIVIERA RESORT

Published Room Rates of Selected Hawaii
First-Class and Luxury Resort Hotels

1987

	Island	Double occupancy room rates(1) Standard/ superior	Deluxe	Suites
Luxury hotels:				
Mauna Kea Beach(2)	Hawaii	$ 300 - 360	340 - 380	420 - 760
Mauna Lani Bay	Hawaii	195	220 - 295	400 - 425
Kahala Hilton	Oahu	155 - 255	255 - 355	465 - 1,200
Halekulani	Oahu	165 - 185	210 - 225	250 - 2,000
Kapalua Bay	Maui	175 - 300	-	400 - 950
First-class hotels:				
Hyatt Regency Waikiki	Oahu	95 - 160	145 - 210	325 - 1,200
Royal Hawaiian	Oahu	140 - 180	215 - 225	230 - 1,200
Hyatt Regency Maui	Maui	175 - 275	290 - 320	250 - 1,500
Maui Marriott	Maui	170	-	400 - 1,200
Stouffer's Wailea Beach	Maui	-	215 - 350	450 - 1,000
Wailea Intercontinental	Maui	145 - 175	165 - 195	250
Sheraton Royal Waikoloa	Hawaii	80 - 180	100 - 200	-
Waiohai	Kauai	125 - 170	190 - 200	280 - 720
Princeville Sheraton	Kauai	-	160 - 250	500 - 1,000

(1) Rack room rates without discounts.
(2) American plan hotel room rate includes breakfast, lunch and dinner.

Source: Hawaii Visitors Bureau, Member Accommodations Guide, 1987.

HAWAIIAN RIVIERA RESORT

Average Room Rates of Hawaii Visitor Accommodations

1980 to 1987

Location	1980	1981	1982	1983	1984	1985	1986	1987(1)	Percentage increase 1980-1986
Waikiki:									
On beach	$ 59.01	61.05	61.15	62.69	69.15	85.01	94.80	110.68	10.1%
Off beach (w/restaurant)	34.78	33.90	35.69	36.32	39.56	46.84	49.74	56.46	7.7
Off beach (w/o restaurant)	27.67	27.40	28.70	30.21	31.10	33.51	37.93	47.19	8.5
Other Oahu	45.45	49.26	51.89	56.42	55.26	59.01	64.65	73.61	7.7
Island of Oahu	$ 42.70	43.05	44.88	46.93	50.06	57.00	62.13	73.07	8.6%
Hilo	33.71	30.53	30.01	30.41	32.30	34.88	37.23	36.39	1.2
Kona	49.96	52.81	53.49	55.42	65.22	71.76	82.02	100.54	11.3
Island of Hawaii	$ 46.40	47.16	47.25	48.84	58.13	65.35	75.19	87.53	10.3%
West Maui	63.19	77.82	81.19	89.52	97.12	105.84	125.40	149.02	14.0
Other Maui	55.30	53.49	51.50	52.82	61.26	72.16	77.87	102.47	9.9
Island of Maui	$ 61.34	73.27	75.02	81.60	88.89	96.75	113.66	137.02	13.1%
East Kauai	52.66	54.67	55.65	56.54	57.85	60.48	65.33	77.89	6.2
South Kauai	66.36	61.90	67.53	72.41	82.88	86.22	93.61	103.19	7.0
Island of Kauai	$ 55.16	56.06	58.51	59.78	65.09	69.51	75.37	85.55	7.0%
Total state	$ 47.37	49.73	51.87	54.78	59.84	65.66	73.20	84.77	9.4%

(1) January to May.

Source: Pannell Kerr Forster, Trends in the Hotel Industry, monthly.

Exhibit III-5

HAWAIIAN RIVIERA RESORT

Occupancy Levels of Hawaii Visitor Accommodations

1980 to 1987

Location	1980	1981	1982	1983	1984	1985	1986	1987(1)
Waikiki:								
On beach	73.9%	72.1%	72.7%	74.7%	81.6%	82.9%	84.2%	87.9%
Off beach (w/restaurant)	73.2	73.8	80.6	79.1	85.7	83.8	86.0	87.3
Off beach (w/o restaurant)	66.5	76.1	80.1	74.4	80.4	79.4	86.9	87.5
Other Oahu	74.6	75.3	79.4	73.3	85.0	82.7	83.0	86.9
Island of Oahu	72.3%	74.1%	77.8%	75.8%	83.3%	81.9%	85.4%	87.5
Hilo	34.4	35.3	37.7	39.2	58.2	57.8	54.6	59.0
Kona	59.0	49.5	46.9	47.0	54.9	58.7	64.6	69.7
Island of Hawaii	51.0%	44.9%	44.0%	44.7%	55.6%	58.5%	62.8%	67.2%
West Maui	74.8	73.7	78.0	77.8	84.1	83.2	85.8	83.4
Other Maui	67.4	58.1	61.4	67.0	70.3	67.3	70.9	70.8
Island of Maui	73.0%	70.3%	73.9%	75.2%	80.5%	78.2%	81.5%	79.7%
East Kauai	75.1	68.5	63.4	59.3	63.0	64.1	75.4	74.5
South Kauai	52.5	46.2	44.2	50.2	63.0	73.5	82.1	81.0
Island of Kauai	69.6%	62.7%	57.5%	57.2%	63.0%	67.1%	77.6%	76.3%
Total state	69.3%	68.3%	70.4%	69.7%	76.0%	77.7%	81.7%	83.1%

(1) January to May.

Source: Pannell Kerr Forster, Trends in the Hotel Industry, monthly.

Exhibit III-6

Like room rates, occupancy rates differ significantly by island, as discussed below:

- Oahu and Maui - Oahu, particularly Waikiki, has historically experienced the highest occupancy levels in the state, but Maui is now approaching Oahu's levels. In 1986 Maui experienced an annual occupancy level of 82% while Oahu experienced a level of 85%.

- Hawaii and Kauai - Occupancy levels on the islands of Hawaii and Kauai are significantly lower than the state average. In 1986 visitor units on Hawaii experienced an average annual occupancy of 63% while Kauai's occupancy stood at 78%. These two islands have not yet established the strong market identity that Oahu and Maui have, but development has persisted in anticipation of their expected growth as visitor destinations.

In contrast to most of the mainland United States or international resorts, Hawaii experiences relatively less pronounced seasonality of occupancy rates. Monthly occupancy rates may vary by about 10% to 12% above or below the average occupancy rate for the year, as shown in Exhibit III-I. Occupancy rates are the highest during the winter months from January to April and lowest in the months of May to July, September and December.

In general, hotel facilities experience significantly higher occupancies than condominium facilities. This is especially true during the slower spring and fall months.

PLANNED BIG ISLAND HOTELS

Five hotels are planned for development on the island of Hawaii over the next five or six years. Although many other hotels have been master planned at both existing and proposed resort areas, only the five hotels which are listed below and shown in Exhibit III-J are considered eminent.

A brief description of the five planned luxury hotels follows:

- Hyatt Regency Waikoloa (1,244 rooms) - The largest concurrently planned hotel project, this hotel complex will consist of three separate hotels and be a high-activity property connected by a massive intra-project transportation system, including lakes and waterways. The complex is being developed at a cost of $360 million and will be completed by 1988.

- Ritz-Carlton Mauna Lani (450 rooms) - Developed by the Ritz-Carlton Hotel Company, this hotel would be patterned after the famous Ritz-Carlton at Laguna Niguel, California. The hotel is expected to be developed at a cost of about $155 million and to be ready for occupancy by about 1990. The 32-acre site at the Mauna Lani Resort is planned to be extensively landscaped, including lagoons and other water features.

- Unnamed South Kohala Resort hotel (350 rooms) - Developed by a subsidiary of Allegis Corporation, this luxury hotel is planned to be part of an exclusive hotel and condominium development at Hapuna Beach on the Kohala Coast, Hawaii. The hotel is expected to be completed by about 1992 and will be managed by Westin.

HAWAIIAN RIVIERA RESORT

Monthly Hawaii Hotel Occupancy Rates

1985 and 1986

Month	1985 Percent occupancy	1985 Monthly index(1)	1986 Percent occupancy	1986 Monthly index(1)
January	84.0%	1.08	81.3%	1.00
February	92.9	1.20	92.6	1.13
March	87.1	1.12	86.5	1.06
April	73.4	.94	80.7	.99
May	67.4	.87	77.5	.95
June	66.3	.85	78.0	.95
July	76.3	.98	79.5	.97
August	82.1	1.06	87.3	1.07
September	69.2	.89	72.8	.89
October	75.9	.98	77.4	.96
November	76.5	.98	81.1	.99
December	68.7	.88	71.8	.88
Average annual occupancy rate	77.7		81.7	

(1) Monthly occupancy as compared to average annual occupancy.

Source: Pannell Kerr Forster, Trends in the Hotel Industry, monthly.

- Princess Hotel (600 rooms) - This hotel is currently being designed for the proposed Kaupulehu Resort in South Kohala, Hawaii. Plans for the hotel are considered tentative.

- Sheraton Royal Waikoloa (400-room addition) - This existing hotel is expected to be expanded to cater to a more upscale market and a greater share of convention and incentive groups.

All of the new luxury hotels will be operated by well-known luxury hotel management companies. These include the Hyatt, Ritz-Carlton, Westin, Princess and Sheraton hotel chains. Thus the island's luxury hotel inventory and the level of service at luxury hotels on the Big Island is expected to be significantly upgraded in the near future as well as enhancing the marketing of the total destination.

SUPPORTABLE HOTEL ROOMS AT HAWAIIAN RIVIERA RESORT

Five hotels with a total of 2,100 rooms are proposed for development at the Hawaiian Riviera Resort. This section assesses the market for hotel development at the resort in terms of the number of hotel rooms which could be supported at the Hawaiian Riviera Resort.

Historical Room Demand

The successful development of hotel accommodations at the Resort is related to the overall demand for hotel rooms on the island of Hawaii over the next 20 years. The demand for hotel rooms on the island of Hawaii is indicated by the number of occupied hotel rooms on the island of Hawaii, as shown in Exhibit III-K. As presented in the exhibit, the hotel room inventory on the island of Hawaii remained relatively stable between 1980 and 1986. During the same period, the average annual occupancy rate increased from 51% in 1980 to about 63% in 1986. Thus hotel room demand on the island of Hawaii increased from about 2,700 rooms in 1980 to nearly 3,300 in 1986, or an average annual increase of 3.4%.

Projected Room Demand

Projected hotel room demand has been estimated based on the current hotel room demand on the island of Hawaii and the anticipated growth of visitor arrivals to the island.

Between 1970 and 1986, the growth in visitor arrivals to the island of Hawaii has averaged 3.6%, as shown in Exhibit III-L. Growth projections for the island of Hawaii have been developed by several governmental departments including the Department of Transportation, Airports Division; Department of Planning and Economic Development; and the County of Hawaii. These visitor projections are summarized as follows:

- The Department of Transportation's study indicates that growth projections to the island of Hawaii in terms of airport passenger arrivals at the Keahole Airport are estimated to average 5.3%, with much of the growth in the first half of the projection period.

Exhibit III-J

HAWAIIAN RIVIERA RESORT

Projected Inventory of Hotel Rooms
on the Island of Hawaii

Hotel name	Resort location	Expected date of unit completion 1988	1989	1990	1991	1992	Indefinite	Total
Luxury hotels:								
Hyatt Regency Waikoloa	Waikoloa Beach	1,244	-	-	-	-	-	1,244
Ritz-Carlton Mauna Lani	Mauna Lani	-	-	450	-	-	-	450
Unnamed hotel	South Kohala resort	-	-	-	-	350	-	350
Unnamed Princess Resorts hotel	Kaupulehu resort	-	-	-	-	600	-	600
Subtotal		1,244	-	450	-	950	-	2,644
First-class hotel - Sheraton Royal Waikoloa addition	Waikoloa Beach	-	-	-	400	-	-	400
Total		1,244	-	450	400	950	-	3,044

Sources: Compiled by Peat Marwick Main & Co. based on interviews with resort developers and information published by the Hawaii Visitors Bureau, Visitor Plant Inventory, February 1987.

Exhibit III-K

HAWAIIAN RIVIERA RESORT

Historical Big Island Hotel Room Demand

1980 to 1986

Year	Hotel room inventory(1)	Average annual occupancy(1)	Estimated hotel room demand(2)	Annual change
1980	5,268	51.0%	2,687	N/A
1981	5,446	44.9	2,445	(9.0)%
1982	5,683	44.0	2,501	2.3
1983	5,700	44.7	2,548	1.9
1984	5,247	55.6	2,917	14.5
1985	5,232	58.5	3,061	4.9
1986	5,228	62.8	3,283	7.3
Compounded annual percentage increase - 1980 to 1986				3.4

N/A Not available.
(1) Hawaii Visitors' Bureau, Annual Research Report, 1980 to 1986.
(2) Hotel room inventory multiplied by average annual occupancy.

Source: Hawaii Visitors' Bureau.

Exhibit III-_

HAWAIIAN RIVIERA RESORT

Indicators of Projected Big Island Visitor Arrivals

	Visitor arrivals	Percentage increase
Historical arrivals to Hawaii/Kona(1):		
1970	445,401	-%
1986	786,940	3.6
Projected airport arrivals to Hawaii/Kona(2):		
1985	1,485,313	-
1995	3,120,000	7.7
2005	4,160,000	2.9
1985 to 2005		5.3
Projected visitor census(3):		
1985	9,300	-
1995	17,900	6.1
2005	22,800	2.4
1985 to 2005	-	4.3
Projected westbound visitors to Hawaii county(4):		
Low growth:		
1985	837,000	-
1995	1,337,000	4.8
2005	1,553,000	1.5
1985 to 2005	-	3.1
Medium growth:		
1985	837,000	-
1995	1,396,000	5.2
2005	1,800,000	2.6
1985 to 2005	-	3.9
High growth:		
1985	837,000	-
1995	1,500,000	6.0
2005	1,973,000	2.8
1985 to 2005	-	4.4

(1) Hawaii Visitors' Bureau.

(2) Hawaii State Airport Systems Plan, Department of Transportation, Airports Division.

(3) State of Hawaii, Department of Planning and Economic Development, Series M-F projections.

(4) County of Hawaii, Hawaii County General Plan (draft).

- The Department of Planning and Economic Development's study has a similar outlook for the island of Hawaii with a growth projection of 4.3% over the same time period.

- The County of Hawaii has projected three scenarios ranging from low to high growth. These 20-year projections range from 3.1% to 4.4%, as also shown in Exhibit III-L.

Based on these visitor growth projections, the islandwide hotel room demand has been projected for the 15-year period from 1992 to 2007, when the Hawaiian Riviera Resort is proposed to be developed. Over the next four five-year periods, hotel room demand is expected to increase by 6.5% annually to 1992, 5% to 1997, 4% to 2002 and 2.5% to 2007, as shown in Exhibit III-M.

This declining rate of growth is expected as the island of Hawaii matures as a visitor destination and the base of visitor arrivals grows. Thus, hotel room demand is projected to increase from 3,280 occupied rooms as experienced in 1986 to about 8,420 rooms by 2007, or a 4.6% rate of growth over the 21-year period.

Based on the projected hotel room demand, the number of hotel rooms which are required to meet the demand have been estimated based on an assumed occupancy level of 70% to 80%. Typically, 70% to 80% occupancy levels permit visitors choices in selection of accommodations and allow hotels to efficiently maintain and operate their facilities profitably through busy and slower visitor months. Thus, based on an island occupancy rate between 70% to 80%, the island of Hawaii's projected hotel room requirements are estimated to range between 10,500 and 12,000 hotel units in 2007, as shown in Exhibit III-N.

Projected Supportable Rooms
at the Hawaiian Riviera Resort

The estimated number of rooms that can be supported at the Resort is dependent on the market position of the Resort in relationship to overall room demand on the island of Hawaii. Additionally, achieved market capture rates for resorts are usually directly related to factors such as the:

- Perceived attractiveness and quality and range of facilities provided.
- Maturity of development and the reputation the resort has earned.
- Number of established competitive resorts.
- Relative size of the islandwide visitor room demand.
- Sales and marketing efforts by the resort.

For major destination resort areas, market capture rates have varied from as little as 3% to as much as 47% of the total room demand on the neighbor islands, as shown in Exhibit III-O.

On Oahu, visitor room demand is dominated by Waikiki hotels which have about 93% of the market. In comparison to Oahu resort areas, the market shares of neighbor island resort areas are more evenly distributed.

An 18% market share of visitors to the island of Hawaii can be projected, implying that although the numbers of visitors to the island's resort areas may continue to increase, their respective shares of the island's total market may decline somewhat. In particular, the Hilo and Volcano areas could be expected

HAWAIIAN RIVIERA RESORT

Projected Big Island Hotel Room Demand

1986 to 2007

	Projected hotel room demand	Compounded annual percentage increase
Historical - 1986	3,280	N/A
Projected:		
1992	4,790	6.5%
1997	6,110	5.0
2002	7,440	4.0
2007	8,420	2.5
1986 to 2007	-	4.6

N/A Not available.

Sources: Based on projections by the State of Hawaii, Department of Planning and Economic Development, Department of Transportation, Airports Division, and the Hawaii Visitors' Bureau.

Exhibit III-N

HAWAIIAN RIVIERA RESORT

Projected Big Island Hotel Room Requirements

1992 to 2007

Year	Projected hotel room demand(1)	Projected hotel room requirements At 80% occupancy	Projected hotel room requirements At 70% occupancy
1992	4,790	5,990	6,840
1997	6,110	7,640	8,740
2002	7,440	9,300	10,630
2007	8,420	10,520	12,020

(1) As shown in Exhibit III-M.

Exhibit III-O

HAWAIIAN RIVIERA RESORT

Estimated Market Share of Visitor
Room Nights in Selected Neighbor Island Resort Areas

1985

	Estimated visitor room nights(1)	Island market share
Hawaii:		
Keauhou Resort	1,220	29
Kailua-Kona	1,290	30
Mauna Kea/Mauna Lani/Waikoloa(2)	930	22
Hilo/Ka'u/Volcano	800	19
	4,240	100%
Maui:		
Kaanapali	4,490	42
Napili/Honokowai/Lahaina	1,820	17
Kapalua	320	3
Wailea	900	9
Kihei/Maalaea	2,660	25
Kahului/Wailuku/Hana/Kula	400	4
	10,590	100%
Kauai:		
Princeville	640	17
Poipu/Kalaheo/Kokee	1,390	36
Wailua/Kapaa/Lihue	1,800	47
	3,830	100%

(1) Estimated based on the number of visitor units as reported by the Hawaii Visitors Bureau and the occupancy rate for the areas based on surveys conducted by Peat Marwick Main & Co.

(2) Smaller resorts have been combined with larger regions to preserve confidentiality of occupancy rates of individual facilities.

to capture relatively less of the new growth, while the Ka'u area expands in market capture. Further assuming an islandwide occupancy rate of 70%, the Hawaiian Riviera Resort is estimated to be able to support development of about 1,200 rooms in 1992, increasing to nearly 2,200 in 2007, as shown in Exhibit III-P. Thus the Hawaiian Riviera Resort's 2,100 planned hotel rooms are estimated to be supported at the Resort by the year 2007.

Projected Occupancy Rates at the Hawaiian Riviera Resort

The Hawaiian Riviera Resort is planned as a world-class destination with extensive facilities and amenities catering to distinct target markets. As described in Chapter I, the marketing synergy provided by the combination of the Hawaiian Palace Resort and the Hawaii Ka'u Aina Resort would serve to enhance the diversity of activities and experiences of the Ka'u region.

Based on a market share of 18% of the island's hotel room demand and the anticipated phasing of hotel rooms, the Resort is estimated to achieve an occupancy rate of about 58% in the first year of operation, as shown in Exhibit III-Q. This occupancy rate is projected to fluctuate between 1997 and 2002 as additional hotel rooms are added to the room inventory. For years thereafter, the occupancy rate is projected to increase to a stabilized rate of 72% in 2007.

Occupancy Rates by Resort

Hotel occupancy rates for the Palace and Ka'u Aina Resorts were estimated based on an allocation of the aggregate occupancy rates projected for the Hawaiian Riviera Resort as a whole, as presented in the previous section. In projecting the occupancy rates at the two resort areas, the following factors were considered:

- The number of hotel rooms at the individual resorts in relation to the Hawaiian Riviera Resort as a whole.
- Anticipated room rates estimated at the new hotels in relation to other hotels on the site.
- The depth of the intended guest markets expected at the hotels in terms of independent travelers, group travelers, incentive and other visitor markets.

Additional factors influencing the projected occupancy rates include:

- The emerging awareness of the island of Hawaii as a visitor destination due to the reputation of the Kohala coast and the opening of the Hyatt Regency Waikoloa by 1988.
- Start-up occupancy levels of recently completed hotels such as the Sheraton Royal Waikoloa, Princeville Sheraton, Mauna Lani Bay and Maui Marriott Hotels.
- Relative distance from airports at Keahole and Hilo.

HAWAIIAN RIVIERA RESORT

Projected Hawaiian Riviera Resort
Hotel Room Market Support

1992 to 2007

Year	Market share	Hawaiian Riviera Resort market share: At 80% occupancy	Hawaiian Riviera Resort market share: At 70% occupancy
1992	18%	1,078	1,232
1997	18	1,376	1,572
2002	18	1,674	1,913
2007	18	1,894	2,164

Exhibit III-Q

HAWAIIAN RIVIERA RESORT

Projected Hawaiian Riviera Resort Occupancy Rate

1992 to 2007

Year	Island of Hawaii hotel room demand(1)	Hawaiian Riviera Resort Room demand at 18%	Hawaiian Riviera Resort Projected hotel room completions(2)	Hawaiian Riviera Resort Projected occupancy rate
1992	4,790	862	1,500	57.5%
1997	6,110	1,101	1,700	64.7
2002	7,440	1,339	2,100	63.8
2007	8,420	1,515	2,100	72.1

(1) As shown in Exhibit III-M.

(2) Based on the proposed development schedule as estimated by the project owners.

- An assumed international reputation, professional management practices and extensive marketing program to promote the Resort as a world-class destination vacation area.

Based on these factors, hotel room occupancies at the Palace Resort are projected to increase from about 55.5% in 1992, when the Resort's two hotels are expected to be built, and stabilize at about 72% by 1998, or six years after the start of operation, as shown in Exhibit III-R.

At the Ka'u Aina Resort, hotel room occupancies are projected at a higher initial occupancy rate of 60.5% in 1992 due to the smaller number of rooms planned for the Resort and the broader market appeal of the high-activity hotel due to its lower anticipated room rates and target markets. Thereafter, the hotel room occupancies at the Ka'u Aina Resort are projected to fluctuate yearly reflecting both the strengthening market awareness of the completed hotels as well as the lower start-up occupancies of the Resort's two new hotels as they are completed in 1997 and 2002.

HAWAIIAN PALACE RESORT HOTEL MARKET ASSESSMENT

This section assesses the market support for hotel development at the Hawaiian Palace Resort in terms of market positioning, intended target markets and room rates.

Market Positioning

The market characteristics of the Hawaiian Palace Resort described in Chapter I are viewed as key elements in terms of successfully entering the luxury hotel market and for achieving the projected occupancy and room rates. The market appeal of the Resort is based on the planned Mediterranean marina village, the luxury villa suite complex and the high level of other guest amenities that would be provided:

- Luxurious hotel facilities, quality hotel operator and level of personal service suggestive of the grandeur and quality of fine European hotels.
- An attractive promenade for shopping and dining featuring a variety of retail shops, assorted restaurants and outdoor cafes.
- A cruise ship terminal to encourage visits to the Resort by this market segment and also capable of accommodating alternative transportation entry by sea.
- Utilization of the marina for private and commercial ocean activities such as deep-sea fishing, sailing, scuba diving and boat cruises.
- Extensive equestrian facilities including polo fields and riding stables.
- New, local airstrip.
- Recreational activities such as golf and tennis.

- Limited recognition of the Ka'u area as a visitor destination.

- Lower number of retirees in the area due to the distance to relatives, supporting health care and other community facilities.

- In future years, lot sales are expected to increase due to the number of repeat visitors to the resort and the expected growing recognition of the area as a resort destination area. Thus, between 2007 and 2011 lot sales are projected to increase to 20 lots per year at the Palace Resort and 25 lots at the Ka'u Aina Resort.

- Lot sales at Palace Resort are expected to be relatively slower than at the Ka'u Aina Resort due to the anticipated higher lot prices (and thus narrower purchaser markets) and the relatively greater amount of condominium development and sales at that resort.

As shown in the exhibit, all 300 planned lots are expected to sold at the Ka'u Aina Resort over the approximately 20-year period ending in 2011. At the Palace Resort, lot sales are expected to take an additional five years to be absorbed and all 352 planned lots are projected to be sold by 2016.

Estimated Lot Sizes

Three district types of residential developments have been planned at the Hawaiian Riviera Resort, as described in Exhibit V-F. Lot sizes have been estimated based on the desired lot characteristics of the intended target markets for single-family resort lots.

Golf course lots are typically purchased by relatively affluent individuals who intend to build vacation homes. Thus, these lots should be large enough to permit the development of 2,000 to 4,000 square foot homes and maintain a feeling of privacy among the private residences. In addition, the lots should be large enough to permit the construction of swimming pools if desired. Golf course lots are proposed to range from about 14,000 to 16,000 square feet as shown in Exhibit V-F.

Equestrian lots are similarly oriented to wealthy individuals who enjoy an active outdoor lifestyle. These purchasers are expected to be accustomed to wide open spaces and privacy. These lots are proposed to be the largest in size and range from about 15,000 to 25,000 square feet.

Interior lots are purchased by both vacation home owners and full-time resort residents. Their primary motivation in purchasing a lot is to obtain an affordable lot of adequate size and reasonable price with less emphasis on size or view orientation of the lot. Interior lots are proposed to range from 10,000 to 13,000 square feet.

Estimated Lot Prices

Residential lot prices have been based on a review of sales prices at the surveyed resorts and are proposed to range from about $12 to $16 per square foot for golf course lots, $10 to $12 for the equestrian lots and $5 to $6 for interior lots. Thus, individual lot prices are estimated to range from between $40,000 and $225,000, as also shown in Exhibit V-F.

HAWAIIAN RIVIERA RESORT

Single-Family Lot Development
at the Hawaiian Riviera Resort

	Hawaiian Palace Resort			Hawaii Ka'u Aina Resort
Facility concept	Residential fairway homesites (224 lots)	Equestrian estates (33 lots)	Residential lots (95 lots)	Hawaii Ka'u Aina Resort residential lots (300 lots)
	Golf front lots oriented to vacation or future retirement home purchasers.	Larger "estates" lots for vacation home or full-time homeowners. Gated and and secured community with an equestrian theme.	More affordable lots oriented to full-time resort residents.	Golf front and interior lots oriented to longer-staying resort guests as well as full-time residents.
Representative projects	Keauhou Estates Pineapple Hill Wailea Golf Estates	Mauna Kea Fairways Keauhou Estates	Waikoloa Village lots Princeville lots	Wailea Kialoa Waikoloa Village lots Princeville lots
Site characteristics	Three interior sites fronting golf fairways.	Interior site near stable complex.	Interior site at western boundary site.	Various sites.
Estimated year of completion	1997 - 60 lots 1999 - 60 lots 2002 - 60 lots 2005 - 44 lots	1997 - 33 lots	2004 - 50 lots 2007 - 45 lots	1994 - 100 lots 2000 - 100 lots 2005 - 100 lots
Estimated lot sizes (square feet)	14,000 to 16,000	15,000 to 25,000	10,000 to 13,000	10,000 to 15,000
Estimated average lot price (1987 dollars)	Fairway lots - $170,000 to $220,000 Interior lots - $90,000 to $120,000	$150,000 to $225,000	$45,000 to $65,000	Fairway lots - $150,000 to $180,000 Interior lots - $40,000 to $60,000
Price per square foot	Fairway lots - $12 to $16 Interior lots - $6 to $8	$10 to $12	$5 to $6	Fairway lots - $12 to $15 Interior - $4 to $5

to begin in 1994, two years after the development of the resort's first hotels. The subsections below address prospective buyer market segments, the projected lot sales absorption, lot sizes and pricing for residential lot development.

Prospective Buyer Market Segments

The major market for single-family lot development at the Hawaiian Riviera Resort is expected to come from West Coast and other mainland visitors to the resort who are purchasing the lots for a part-time vacation home. These purchasers are likely to have stayed at the resort and possibly owned condominiums previous to purchasing lots at the Hawaiian Riviera.

The tranquil lifestyle of the Ka'u region, along with the strong recreational appeal of especially the Palace Resort, are expected to be major attractions to lot ownership in the area. At the Ka'u Aina Resort, the low-density development and emphasis on a Hawaiian vacation experience are seen as the major draw for lot purchasers at that resort.

In addition to the part-time vacation home purchasers, both the Palace and Ka'u Aina resorts are expected to have about 15% to 20% of their lots purchased by full-time residents of the area. This is based on an estimate of 260 new managerial or professional housing units required in the region (as projected by Community Resources, Inc.) and a 40% to 50% market share of these new households. This would include both employees of the resort (mainly management or professional employees) and entreprenuers or transplants to the region. These purchasers are expected to be attracted by the convenience of commuting to the resort to work or other businesses in the area which are indirectly supported by the two resorts.

Projected Sales Absorption

The sales absorption of single-family units at the Hawaiian Riviera Resort is based on the historical rate of new single-family lots at the surveyed resorts.

Over the past decade, typically about 20 to 50 lots have been sold annually at the surveyed resorts. As discussed previously, these sales rates include both visitor and resident purchasers and are influenced by lot pricing and maturity and stage of development of a resort as well as the overall appeal of the resort as a vacation home community.

The average annual sales for the Hawaiian Riviera Resort are presented in Exhibit V-E have been based on the following assumptions:

- Based on the developers' estimated completion dates, lot sales are projected to commence in 1994 at the Ka'u Aina Resort and in 1997 at the Palace Resort.
- Lot sales at the Ka'u Aina Resort are expected to be relatively low during the Phase I period. Lot sales during this period are estimated at 10 lots per year due to:
    - Limited number of repeat visitors and trade-up market purchasers during the resort's initial years of development.

HAWAIIAN RIVIERA RESORT

Projected Resort Residential Lot Sales
at the Hawaiian Riviera Resort

	Hawaiian Palace Resort			Hawaii Ka'u Aina Resort			Cumulative
	Annual	Period	Cumulative	Annual	Period	Cumulative	total
1994 to 1996	-	-	-	10	30	30	30
1997 to 2001	15	75	75	15	75	105	180
2002 to 2006	18	90	165	20	100	205	370
2007 to 2011	20	100	265	25	95	300	565
2012 to 2016	20	87	352	-	-	300	652

- Occupation - Occupational profiles vary according to the quality and price of the subdivision. Purchasers of lots within the $150,000 to $350,000 range, such as at Wailea Golf Estates I, were typically professionals, business executives or self-employed entrepreneurs and small businessmen.

  Purchasers of the lots within the $60,000 to $140,000 range, such as at Kaanapali Hillside, Princeville and Keauhou Estates I, additionally include mainland and local contractors or financial institutions. The latter buyers are often investor-builders who purchase and develop lower-priced lots in areas which are residential-oriented.

- Age - Buyers are typically 40 to 55 years of age. Purchasers of higher-priced lots tend to be older while purchasers of less expensive property, including the speculative builders, tend to be younger.

- Income - The annual incomes of purchasers range from as low as $30,000 a year at Princeville (where an extensive employee discount plan has been implemented) to as high as $250,000 a year at the Keauhou Estates I, as also shown in the exhibit. In general, buyers of the most expensive resort lots are believed to have income in excess of double of what would be needed to qualify to purchase the lot since the investment is typically for a vacation or future retirement home which is a second or third residence.

- Place of primary residence - Purchasers from California represented the majority of the buyers, typically comprising between 20% and 60% of the total purchasers. Purchasers from other west coast states represented the next largest segment.

  Residents of the island on which the resort is located also represent between 10% and 56% of total lot buyers. In comparison to other resort areas, Keauhou Estates I, Kaanapali Hillside, Waikoloa Village and Princeville attracted a relatively higher proportion of island residents due to their relatively lower prices. As lot prices continue to rise, the potential market for lots from local residents is expected to be reduced due to the smaller proportion of residents who can qualify for financing of the property.

- Buyer profile by preference for view lots - Given equal pricing, ocean view lots are the preferred type. However, interior and golf course lots without views have recently been successfully marketed at Princeville, Wailea and Waikoloa Village resorts.

  Purchasers who are willing to forego ocean views include buyers who visit the resort frequently, Hawaii residents and those intending to retire. This market segment tends to be more price sensitive than do the view lot purchasers. Purchasers who require ocean views are typically mainland residents who visit infrequently and for whom an ocean view represents Hawaii. These purchasers are often accustomed to acquiring prestigious property and are generally in higher income brackets than purchasers of nonview lots.

- Other characteristics - Nearly all of the purchasers of lots at the selected resorts had previously vacationed at the hotel or condominium facilities of the resort. They are repeat visitors who have typically stayed at the resort two to five times before they purchase a resort lot. Many already own a condominium unit or interior lot at the resort and are trading up.

Purchase Motivations

Historically, the majority of purchasers have been motivated to buy resort residential lots for future improvement as a vacation or retirement home, investment or speculative building. These market segments are discussed below:

- Vacation or retirement home - Individuals purchasing a lot for a vacation or retirement home tend to buy at resorts that are well developed in terms of visitor facilities and amenities. These buyers are generally mainland residents who vacation regularly at the resort, know its facilities well and have friendship ties among its clientele. Those seeking a vacation home typically purchase the higher-priced, well-located lots.

  Such buyers are believed to value the privacy of a single-family dwelling in choosing a lot over a condominium. They may also prefer a custom-designed home and are willing and able to pay for it.

- Investment - Investment purchasers seek long-term appreciation. This group includes local as well as mainland residents. Investor purchases represented a sizable segment of lot buyers at Wailea Kai and Princeville where the majority of lots were sold between 1980 and 1981. Such purchases are highly elastic with respect to the anticipated appreciation of resort real estate values.

- Speculative building - Speculative builders are a relatively recent segment of the resort lot buyer market. These purchasers include both Hawaii and mainland financial institutions, developers or home contractors who begin construction almost immediately and price the improved property with the expectation of realizing a profit.

During the last three to five years, there has been a significant reduction in the number of investor lot purchases and an increase in the proportion of intended vacation home and retirement purchases. This trend is attributed to the stabilization of real estate values in recent years, high interest rates and the higher quality and prices of the more recently marketed subdivision.

In addition, Hawaii is just beginning to follow the California trend in the emergence of an upscale primary home market for resort residential markets. The Wailea Fairways subdivision has the highest percentage of full-time residents with about 25% claiming a primary home exemption. Princeville is next most likely to include year-round residents with about 8% of lot owners claiming a home exemption.

MARKET ASSESSMENT FOR THE HAWAIIAN RIVIERA RESORT

This section assesses the market support for single-family lot development at the Hawaiian Riviera Resort. About 352 resort lots are planned at the Palace Resort and 300 lots at the Ka'u Aina Resort. The marketing of lots is assumed

Except for the Mauna Kea Resort, the typical resort sold an average of about 20 to 50 lots each year, as also shown in Exhibit V-C. The resort with the highest average rate of sales was Waikoloa, where rapid sales may be attributed to the relatively low prices of lots and the very active real estate market of the late 1970s. More recently, Pineapple Hill at Kapalua Resort has also experienced strong sales. This is attributed to the high quality of the Pineapple Hill development, the relative maturity of Kapalua Resort, the recovering national economy and the improved Hawaii real estate market. In very high price ranges the volume of resort lot sales has been less. For instance, an average of only about two lots were sold annually at the Mauna Kea Resort, which has lots priced from $400,000 to $600,000.

Lot sales tend to be strong at mature or developed resorts and range from about 20 to 40 lots per year at the established Maui resort areas of Kaanapali, Wailea and Kapalua. At the Kauhou Resort, lot sales have been similarly strong at 43 lots per year over the past two years due to the popularity of the Kona area and the view lots offered in a quality resort setting.

Prices

Resort lots currently being offered for sale range from $35,000 for interior lots at Waikoloa Village to $600,000 for fairway lots at the Fairways at Mauna Kea North, as shown in Exhibit V-D. The prices of resort lots are primarily related to three factors: lot type and view, lot size and the quality of the resort in which the lots are located.

Prices for golf-course-fronting lots are typically 20% to 50% higher than for interior lots in the same subdivision. For example, at the Wailea Golf Estates I, interior lots are currently selling for $9.00 to $13.00 per square foot, while the golf course lots with views of Haleakala command $17.70 to $20.30 per square foot and golf course lots with ocean views are priced at $20.00 to $26.40 per square foot. The typical lot at this subdivision, with good golf and ocean view orientation, is selling for about $14 to $17 per square foot, as also shown in Exhibit V-D.

The size of resort lots also affects the sales price. Large lots may command a greater total price per lot than the typical-sized lot but a lower price per square foot.

The quality of a resort and its reputation and ability to attract a given target market also affects the lot prices. For example, the Mauna Kea and Kapalua resorts appeal to the upscale traveler who returns year after year. Thus these resorts are able to command higher average lot prices than other resorts due to their established affluent visitor bases, five-star hotels and extensive recreational amenities.

Buyer Profile

The buyers of residential lots in resort areas are characterized in terms of their occupation, age, income, residence and other characteristics. These characteristics are outlined as follows:

HAWAIIAN RIVIERA RESORT

Sales Prices and Sizes of Lots at
Selected Resort Subdivisions

1986 to 1987

Resort subdivision	Location and view orientation	Typical lot size (square feet)	Typical sales price	Price per square foot
Keauhou Resort - Keauhou Estates:				
Interior lots(some view obstruction)	Hillside/ocean view	16,500	$ 94,000 to 120,000	$ 6.10 to 10.00
Interior lots(180° view)	Hillside/ocean view	16,500	150,000 to 165,000	8.00 to 10.20
Fairway	Fairway	16,500	190,000 to 225,000	9.40 to 13.64
Waikoloa Resort - Waikoloa Village(lot resales)	Not available	11,000 to 13,000	35,000 to 45,000	3.40 to 4.20
Mauna Kea Resort - Fairways at Mauna Kea North	Interior	24,000 to 30,000	395,000 to 495,000	10.00 to 21.00
	Fairway	24,000 to 30,000	495,000 to 595,000	17.00 to 23.00
Wailea Resort:				
Wailea Golf Estates	Golf/ocean views	14,000 to 18,000	240,000 to 255,000	14.20 to 17.10
Wailea Kai	Interior	10,000 to 11,000	80,000 to 90,000	8.20 to 10.00
Wailea Kialoa	Interior, some ocean view	10,800	110,000 to 125,000	10.00 to 13.00
Kaanapali Hillside	Hillside/ocean view	10,500 to 11,500	130,000 to 140,000	11.50 to 12.50
Kapalua Resort - Pineapple Hill	Fairway	10,000 to 11,000	240,000 to 290,000	22.70 to 26.00
	Interior	10,000 to 11,000	170,000 to 220,000	16.00 to 20.00
Princeville Resort(1): Increment II, Unit I and II	Interior	10,000 to 13,000	55,000 to 60,000	4.50 to 5.40
Sunset Drive	Fairway/interior	15,500 to 20,000	87,000 to 105,000	4.80 to 5.70

Exhibit V-D

Source: Discussions with realtors or representatives of the respective projects.

Exhibit V-8

HAWAIIAN RIVIERA RESORT

Master Planned Resort Residential Lots
on the Island of Hawaii

Resort	Planned 1987 to 1992	Proposed/ indefinite	Total
Existing resorts:			
Mauna Kea Resort - The Estates	26	-	26
Mauna Lani Resort	-	240	240
Keauhou Resort	50	680	730
Waikoloa Beach Resort	-	-	N/A
Planned resorts:			
Planned South Kohala resort	-	110	110
Kukio Beach Resort	-	774	774
Kohana-Iki Resort	-	200	200
Total	76	2,004	2,080

Source: Discussions with developers of the respective resorts, public documents filed with the State Land Use Commission or other published sources.

Exhibit V-C

HAWAIIAN RIVIERA RESORT

Annual New Sales of Residential Lots
at Selected Hawaii Resorts

1978 to 1987

	First year offered for sale	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987(1)	Total	Average annual lot sales(2)
Keauhou Estates I	1985	-	-	-	-	-	-	-	-	27	58	85	43
Waikoloa Village	1978 to 1980	16	185	36	26	28	26	11	-	-	-	328	47
Mauna Kea - Fairways at Mauna Kea North	1982	-	-	-	-	1	4	2	1	-	N/A	8	2
Wailea Resort	1981 to 1987	-	-	-	68	5	19	20	3	21	95	231	33
Kaanapali Hillside	1983	-	-	-	-	-	24	27	30	17	9	107	21
Pineapple Hill, Kapalua	1986	-	-	-	-	-	-	-	-	40	38	78	39
Princeville	1978 to 1984	149	40	11	11	1	5	21	6	27	N/A	271	30
Total		165	225	47	105	35	78	81	40	132	200	1,108	110

N/A Not available.
(1) Annualized estimate based on sales experience through July.
(2) During periods with inventory available.

Sources: Hawaii IMK Service and discussions with developers of the respective subdivisions or their representatives.

Exhibit V-A

HAWAIIAN RIVIERA RESORT

Location and View Orientation of Residential Lots
at Selected Hawaii Resorts

Resort subdivision	Primary view orientation	Ocean-front	Golf course	Hillside ocean/ valley views	Interior	Total lots
Keauhou Estates I & II	Hillside ocean view	-	22	113	-	135
Waikoloa Village	Interior	-	N/A	N/A	N/A	968
Fairways at Mauna Kea:						
South	Golf course	-	16	-	17	33
North	Golf course	-	17	-	15	32
Wailea Resort:						
Fairway homesites	Golf course	-	31	-	-	31
Wailea Kai homesites	Interior	-	-	-	100	100
Wailea Golf Estates I & II	Golf course	-	71	26	20	117
Wailea Kialoa	Interior	-	-	25	77	102
Kaanapali Hillsides I & II	Hillside/ocean view	-	-	62	-	62
Pineapple Hill	Golf course	-	25	50	24	99
Princeville:						
Increment I	Interior	40	144	84	282	550
Increment II	Interior	-	-	25	72	97
Sunset Drive	Golf course	-	15	-	11	26
Kauhale Park	Interior	-	-	-	68	68
Lot 5	Interior	-	-	-	5	5
Total(1)		40	341	385	691	2,425
Percent(1)		2.7%	23.4%	26.4%	47.4%	100.0%
Hawaiian Palace Resort:						
Number	Golf/ocean view	-	157(2)	145(3)	50(3)	352
Percent		-	44.6%	75.0%	25.0%	100.0%
Hawaii Kau Aina Resort:						
Number	Golf/ocean view	-	120	135(3)	45(3)	300
Percent		-	40.0%	75.0%	25.0%	100.0%

N/A Not available.
(1) Excludes Waikoloa Village lots except for totals.
(2) Includes 33 lots with equestrian orientation next to the stable complex.
(3) Estimated based on 75% of the interior lots having ocean views.

The Sunset Drive subdivision in Princeville is the only existing subdivision which has private recreational facilities for its residents. The 26-lot subdivision has a recreation center which features a private pool, tennis court and pavillion. Pineapple Hill, a luxury subdivision currently being marketed in Kapalua, will also feature extensive condominium-like recreational amenities including a full-time, on-site resident manager, two tennis courts and a swimming pool.

Private security has not been a significant feature of the existing resort subdivisions in Hawaii. However, security is a major selling point of the new Keauhou Estates I subdivision where access will be controlled by a private entry with an autogate during the day and manned security at night.

Planned Resort Residential Lots on the Big Island

Over about the next two decades, about 2,000 resort lots are proposed at seven existing and planned resorts on the Big Island, as shown in Exhibit V-B. However, of this number only about 4% are planned for development over the next five years. Additionally, over 1,000 lots are proposed in planned resort areas which have not received all necessary state, county and federal approvals for resort development and are thus considered very speculative.

MARKET PERFORMANCE OF RESORT LOTS

This section examines the market performance of the selected resorts. Market performance is examined in terms of historical sales and price trends, buyer profile and purchase motivations.

Historical Sales

Since 1978 an average of about 110 resort residential lots in the state were sold annually, as shown in Exhibit V-C. Lot sales were relatively brisk in 1978, 1979 and 1981 as new inventory was offered at Princeville, Wailea and Waikoloa resorts.

From 1982 through 1985 lot sales have been relatively weak, ranging from 35 to 80 annual sales, as also shown in the exhibit. This decline is primarily due to the decrease in purchases by investors. In the past, investors represented a major market segment, but investor purchases were limited by the high interest rates and the economic slump of 1981 to 1983 when resort real estate values declined. Since 1986 sales have increased again and resort real estate values have stabilized.

Lots that have sold since 1982 have typically been either lower-priced lots or those which were offered at discounted sales prices or with attractive financing terms. For instance, in 1983 the 24 lots at Kaanapali Hillside, priced between $120,000 and $125,000, sold within an eight-month sales period with 50% of the lots being sold to a California financial institution that plans to build homes for speculative purposes and offer long-term financing to prospective house and lot purchasers. Sales discounts of 10% at Wailea Golf Estates I and between 5% and 10% for multiple lot sales at Princeville also produced increased sales activity compared to prior periods. In addition, Princeville credited a financing plan which featured 7% to 9% interest-only payments during 1984 to increased sales rates for the year.

V - RESORT RESIDENTIAL LOT MARKET ASSESSMENT

This chapter reviews the development trends and sales performance of existing and planned residential lot subdivisions at selected comparable resort areas in Hawaii and assesses the market support for residential lot development at the Hawaiian Riviera Resort.

DEVELOPMENT TRENDS

Resort residential lots are differentiated from other residential lots by their integration within a master-planned and self-supporting resort community. Resort communities are oriented towards recreational activities and usually include golf and tennis facilities. In addition, homes built on resort lots are primarily used as secondary or vacation homes rather than as a primary residences.

Resort residential lots have been developed at all major neighbor island resorts with the exception of the three newest Hawaii resorts, the Mauna Lani and Waikola Beach resorts (Hawaii) and the Makena Resort (Maui). Due to the customization possible for resort homes, resort lots help expand the range and types of visitor and resident accommodations at a resort and contribute to a more low-density and residential appeal to a resort.

While the majority of resorts developed to date have emphasized hotel, condominium and commercial facilities, the Waikoloa Village and Princeville Resort have focused their development on the production of single-family lots. The next sections review resort residential lot developments at the following resorts:

- Island of Hawaii:
  - Keauhou
  - Waikoloa Village
  - Mauna Kea
- Island of Maui:
  - Wailea
  - Kaanapali Beach
  - Kapalua
- Island of Kauai - Princeville

Location and Type

Resort residential lots are differentiated by their location with respect to the following amenities within a resort:

- Oceanfront
- Golf course
- Hillside, offering ocean or valley views
- Other interior lots

The majority, or 47%, of the existing resort lots have interior view orientations, as shown in Exhibit V-A. Lot developments that abut golf course fairways or greens and hillside lots are the next most common type with 23% of all lots, while oceanfront lots represent only about 3% of lots developed or planned at the selected resorts. Oceanfront sites are typically used for hotel or condominium development where more units may benefit from the ocean frontage. The 40 oceanfront resort lots developed to date are on a cliff at Princeville.

Historically, each resort has developed the better quality lots (including golf course and oceanfront lots) early in the development of the resort and the lower quality (interior) lots later as the resort matures. This trend is particularly evident at Princeville which developed subdivisions with a greater number of ocean and golf course frontages during 1971 to 1975 and mainly interior lots after 1979. In contrast, Wailea Resort's strategy was to offer an alternating quality of lots in each successive subdivision development to appeal to different buyer markets at any given time.

Lot View

View orientations are also a primary consideration of buyers in this market. Ocean or mountain views may compensate for the locational disadvantages of a resort lot or contribute to its desirability. For example, the majority of lots at the Wailea Golf Estates has lush fairway frontage as well as ocean or mountain views. Similarly, many interior lots at Wailea and Princeville Resorts command ocean or mountain views which compensate for their lack of fairway or ocean frontage.

The importance of views is illustrated by the experience at the Wailea Golf Estates where interior lots sold more quickly than fairway lots due to ocean views and substantially lower prices compared to the fairway lots.

With respect to views, the resort lots at the Hawaiian Riviera Resort are expected to have ocean views present from the majority of its lots due to the slope of the resort land. About 50% of the interior lots are expected to command ocean views, as also shown in Exhibit V-A. This could be a distinct marketing advantage of the Hawaiian Riviera Resort as compared to other Hawaiian resorts.

Lot Size

Typical lots at the selected projects range from 9,500 to 20,000 square feet. The lots average about 10,000 to 14,000 square feet and are larger than non-resort lots in Hawaii which are often only 6,000 to 9,000 square feet. In general, the higher priced golf course lots are larger than the interior or hillside view lots because purchasers of golf-front lots are more willing to pay for the luxury of additional space.

Amenities

Private recreational facilities and security are major features of successful resort lot developments on the mainland U. S. These features have generally not been incorporated in the existing first-class resort subdivisions in Hawaii. Instead, most of the subdivisions offer short-term, complimentary or voluntary memberships at the resorts' golf or tennis facilities to suggest their inclusion in the resort community.

HAWAIIAN RIVIERA RESORT

Development Concept for Condominium Development
at the Hawaiian Riviera Resort

	Hawaiian Palace Resort			Ka'u Aina Resort
	Luxury residential villas suites (375 units)	Marina garden apartments (300 units)	Townhouses (300 units)	Multifamily (200 units)
Facility concept	Private and exclusive medium-rise retreat villas, some with full hotel maid service, room service and other support services catering to vacation home purchasers.	Medium-rise apartment condominiums clustered near the marina complex and connected to marina activities by walkways.	Moderately priced, lower rise complex catering to both vacation homeowners and full-time residents.	Oceanfront and interior projects catering to broad spectrum of both vacation homeowners and full-time resort residents. To be rented initially, then redeveloped for sale in later years.
Representative projects	Costa Esmeralda Villas at Mauna Kea Wailea Point	Marina Del Rey condominiums Royal Sea Clif Resort	Wailea Ekolu Keauhou Akahi	Waikoloa Village condominiums Princeville Resort condominiums Kanaloa at Keauhou
Site characteristics	Site A: Prime oceanfront site adjacent to the luxury resort hotel. Site B: Inland site adjacent to the polo field and golf fairways.	Sites C and D directly mauka of the marina commercial complex and boat and boat marina.	Interior sites E, F and G fronting golf fairways or park areas.	Various oceanfront and interior sites. Interior sites front golf course fairways.
Estimated year of completion	Site A: 1994 - 250 units Site B: 1999 - 125 units	1995 - 150 units 2002 - 150 units	1994 - 75 units 1998 - 105 units 2002 - 120 units	1993 - 50 units 1996 - 50 units 1998 - 50 units 2000 - 50 units
Estimated unit size (square feet)	Site A: 2,500 - 3,000 Site B: 2,000 - 2,500	1,000 - 2,000	900 - 1,300	Oceanfront: 1,300 - 2,000 Interior: 700 - 1,300
Estimated average unit price (1987 dollars)	Site A: $750,000 - $1,200,000 Site B: 300,000 - 450,000	$200,000 - $350,000	$100,000 - $180,000	Oceanfront: $250,000 - $350,000 Interior: 80,000 - 150,000

Exhibit IV-P

Unit Prices

Based on a review of condominium unit sales prices at comparable resorts, condominium units are proposed to exhibit a wide range of prices depending on the target market and view orientations for the respective projects. At the Hawaiian Palace Resort condominium unit prices are projected to be significantly higher than at the Hawaiian Ka'u Aina Resort due to the greater project amenities, image appeal and more upscale guest markets of the resort.

Oceanfront unit prices are projected to range from $200,000 to $1,200,000, as shown in the exhibit. Interior projects are estimated to range from $100,000 to $450,000 depending on the project concept and amenities.

Condominium sales prices at the Ka'u Aina Resort are projected to range from $250,000 to $350,000 for oceanfront projects to $80,000 to $150,000 in interior projects, as also shown in the exhibit.

Potential Buyer Markets

The Hawaiian Riviera Resort as a whole is expected to attract a wide variety of potential buyers due to the different market orientations of the two resort areas. The potential buyer markets for condominium units are expected to be from buyers seeking the following:

1. Part-time vacation home - To be kept primarily for the owner's personal use. Purchasers in this category are expected to typically be:
   - Successful entrepreneurs or officers of both small and large corporations with annual household incomes of $150,000 or more.
   - Between the ages of 40 to 50.
   - From a wide geographic area in the United States; a minority from Europe and Japan.
   - Repeat FIT visitors to the Resort who have stayed at the luxury hotels.
   - Persons seeking prime oceanfront and ocean view sites.
2. Part-time vacation home and rental property - Buyers in this category could be expected to be persons who seek vacation homes or investments, who depend on rental income from their units to help defray the holding costs of their units. These buyers are expected to be more familiar with Hawaii and to not insist on ocean views. Additionally, these purchasers exhibit the following characteristics:
   - Couples, huis or limited partnerships.
   - Persons between the ages of 40 to 55.
   - Entrepreneurs and professionals such as hotel industry executives, real estate developers or doctors with annual household incomes of $75,000 or more.
   - Mainly from the western United States, limited number from Hawaii.
   - Repeat visitors to the island of Hawaii or the Resort.
3. Primary residence - This market is expected to consist mostly of retirees or employees of the Resort. They can be characterized as:
   - Mostly couples or families.
   - Between the ages of 35 and 60.
   - Visitor industry managers or retirees.
   - Immigrants to the Ka'u area.
   - More predominant at the more affordable projects at the Ka'u Aina Resort and at the interior sites at the Palace Resort.

Condominium purchasers at the Palace Resort are expected to include primarily more affluent individuals who keep their units for use as a Hawaii vacation home due to the following considerations:

- The proposed luxury class market orientation of the hotels planned for the Resort.
- The greater number of oceanfront condominium sites or sites which are closer to the oceanfront, promenade or activity areas of the Resort.
- Preliminary project concepts for the individual condominium projects which include maid service, room service and other hotel services which would be made available to unit owners of the residential villa complexes.
- Specifically built-to-suit condominium projects which contain unit features specifically targeted to the potential buyer markets.

Based on this analysis, the potential buyer markets for resort condominiums at the Hawaiian Riviera Resort are estimated by type of project as follows:

Potential Purchaser Markets
at the Hawaiian Riviera Resort

	Luxury villa suites	Garden apart-ments	Town-houses	Ka'u Aina condo-miniums
Part-time homes	70%	35%	35%	25%
Part-time homes/visitor rentals	15	50	50	50
Full-time homes	15	15	15	25
	100%	100%	100%	100%

Development Concept

The condominium concept for the Hawaiian Riviera Resort is to develop a mix of transient and residential accommodations ranging from the ultraluxurious villa suites at the Palace Resort to more modest units in the Ka'u Aina Resort as well as the marina garden apartments in the Palace development. This range of units will appeal to a wider buyer base and contribute significantly to the total resort community ambience of the entire Hawaiian Riviera complex.

Unit Sizes

Unit sizes have been estimated for the proposed projects based on the facility concept and the intended target markets. For interior condominium projects, unit sizes are proposed to range from about 700 to 1,300 square feet and marketed as rental or full-time occupied homes, as shown in Exhibit IV-P. Oceanfront vacation homes which are typically held for the exclusive use of unit owners are targeted to a more upscale buyer market and are proposed to be larger, ranging from 1,000 up to 3,500 square feet.

- As the Hawaiian Riviera Resort matures, it could support increased primary residential unit owners who work at the Resort or are supported by jobs generated by the Resort.

- Ultimately, the Hawaiian Riviera Resort could be expected to support about 60 condominium unit sales per 100 hotel units, comparable to the Wailea, Keauhou or Mauna Lani Resorts, due to:

  - A wide mix of units ranging from moderately priced full-time residential units to super-luxury resort condominiums.

  - Higher income clientele with a high propensity for vacation home ownership, especially at the Palace Resort.

  - Sales of lower priced, full-time, resident oriented condominiums at both resorts, which typically have broader potential buyer markets and thus faster sales rates.

  - Greater maturity of the Hawaiian Riviera Resort and broader exposure to potential visitors and repeat guests.

Based on these rates of condominium sales, the Hawaiian Riviera Resort is estimated to support and market about 300 units by the end of Phase I, or 1996, as also shown in Exhibit IV-N. By the end of the last five-year period, sales of all of the 1,175 condominium units planned for the Resort are projected to be supportable.

Thus, over the entire Resort marketing period, an average of about 60 to 70 units are projected to be sold annually. This total rate is equivalent to about 32 units sold annually at each of the two resorts. In comparison, other Hawaii condominium projects have achieved sales rates of about twice as much at 62 condominium unit sales per year, as shown previously in Exhibit V-G. However, this lower rate is considered reasonable for the Hawaiian Riviera Resort considering new tax law changes with the Tax Reform Act of 1986, more stable real estate values and the less established market image of the Ka'u region as a visitor destination.

Condominium Sales Absorption by Resort

Total condominium sales have been allocated to each of the two resort areas within the Hawaiian Riviera Resort based on the following criteria:

- Preliminary project phasing.

- Quality of the individual projects and their appeal to potential purchaser markets based on their preliminary project concept, view orientations and estimated unit pricing.

- Sales rates of comparable other condominium projects.

Annual condominium unit sales are estimated to range from between 30 and 120 units per year for an average of about 73 units annually over the entire marketing period, as shown in Exhibit IV-O.

HAWAIIAN RIVIERA RESORT

Estimated Condominium Sales by Project

1994 to 2009

Year	Hawaiian Palace Resort: Luxury residential villas	Hawaiian Palace Resort: Marina garden apartments	Hawaiian Palace Resort: Town-houses	Ka'u Aina resort condo-miniums	Total units sold: Annual	Total units sold: Cumula-tive
1994	40	-	20	25	85	85
1995	40	35	20	25	120	205
1996	40	35	20	-	95	300
1997	30	35	15	-	80	380
1998	30	35	25	-	90	470
1999	30	10	20	-	60	530
2000	30	-	20	25	75	605
2001	30	-	20	25	75	680
2002	20	30	20	-	70	750
2003	20	30	20	-	70	820
2004	20	20	20	-	60	880
2005	20	20	20	25	85	965
2006	20	20	20	25	85	1,050
2007	5	20	20	-	45	1,095
2008	-	10	20	-	30	1,125
2009	-	-	-	50	50	1,175
Total	375	300	300	200	1,175	

- Real estate cycles - Condominium development has been more extensive at resorts which were ready to meet market sales demand with numerous available condominium units during the peak real estate years. These resorts included Keauhou, Kapalua and Wailea, where the majority of the condominium units were developed in the peak speculative real estate market of 1978 to early 1980.

- Relative emphasis on hotel development - The Kapalua and Princeville resorts have both emphasized a lower profile and more residential character than other Hawaii resorts. At Princeville, the first hotel was built some 10 years after the first condominium developments. This lesser emphasis on early hotel development tends to distort the current ratio of condominium development at these two resorts.

- Availability of new condominium projects on the market - Although condominium sales on Maui were brisk between 1978 and 1980, the Kaanapali Beach Resort did not have new projects available for sale in this period and thus experienced relatively low sales rates during those years. Similarly, the Mauna Kea Resort could potentially have sold more units if product were available during the early 1980s.

- Characteristics of resort clientele - The Wailea, Kapalua and the Mauna Lani Resorts tend to host older travelers with higher incomes than the Kaanapali, Keauhou or Coconut Plantation Resorts. Their markets tend to include more repeat and FIT guests, who represent major condominium purchaser markets. Thus Wailea, Kapalua and Mauna Lani Resorts have experienced higher market support for condominium development than have other resorts.

After adjusting for these factors for the Hawaiian Riviera Resort, new condominium sales ratios are projected for the 20-year period ending in 2012, as shown in Exhibit IV-N. Between 1992 and 1996, new sales are estimated at about 20 units per 100 completed hotel units, or comparable to the lower range experienced by the Hawaii resorts. This assessment is based on the following considerations:

- The Hawaiian Riviera Resort would be a new and unique resort destination area on the island.

- Sales rates in relatively new areas could be expected to be limited compared to areas which are mature or are associated with nearby resort areas (such as Mauna Lani which benefited from its proximity and association with the Kohala coast area and the nearby Mauna Kea Resort).

- The first phase of units offered at the Palace Resort include higher priced residential villa suites which typically experience lower sales absorption rates as they have a narrower buyer market.

In the next three five-year periods, the Hawaiian Riviera Resort is expected to achieve higher rates of condominium sales, or about 40, 50 and 60 condominium sales per 100 developed hotel units in the successive periods, respectively, as shown in Exhibit IV-N. This assessment is based on the following factors:

- The Ka'u area would have achieved greater market recognition, maturity and a repeat clientele base upon which it could attract a pool of condominium unit purchasers.

HAWAIIAN RIVIERA RESORT

Supportable Condominium Units at the
Hawaiian Riviera Resort

	1992 - 1996	1997 - 2001	2002 - 2006	2007 - 2009
Hotel units completed (cumulative)	1,500	1,700	2,100	2,100
Condominium unit demand per 100 hotel units	20	40	50	60
Supportable condominium units:				
Total cumulative unit sales	300	680	1,050	1,260(1)
Average unit sales per year	60	68	70	65(2)
Net additional units	300	380	370	125

(1) A combined maximum of 1,175 condominium units are planned for the Hawaiian Riviera Resort.

(2) Average rate of sales over 18 years.

MARKET SUPPORT FOR CONDOMINIUM DEVELOPMENT AT THE HAWAIIAN RIVIERA RESORT

A total of 1,175 condominium units are planned for the Hawaiian Riviera Resort. About 83%, or 975 units (of which 375 will be luxurious villa suites unique to Hawaii and an elegant feature of the development), are planned for the Palace Resort and 200 units at the Ka'u Aina Resort.

Condominium sales at the Resort have been estimated based on the following general assumptions:

- The Resort is developed in a timely and quality manner as scheduled and is represented by the Palace Development Corporation and Hawaii Ka'u Aina. Especially critical to the market support is the development of the planned hotels from which potential condominium buyers could be expected to emerge and the development of the Resort amenities and infrastructure, including the marina, shopping promenade, cultural park, golf course and other recreational amenities, which would distinguish the resort from other Hawaii resorts and make it a true visitor "destination."

- Condominium sales are estimated to begin in about 1994 or two years after the development of both resorts' first hotels.

This section assesses the market support for condominium development at the Hawaiian Riviera Resort in terms of sales absorption, buyer profiles, unit sizes and unit prices.

Sales Absorption

The anticipated market support for resort condominium units at the Hawaiian Riviera Resort is related to the emergence of the area as a major visitor destination. Condominium unit demand is to a large extent related to a resort's ability to attract a base of repeat visitors from which resort condominium buyers may emerge.

The market support for condominium units at the Hawaiian Riviera Resort were based on two approaches:

- The development experience of competitive Hawaii resort areas.
- Annual sales rates of recently completed Hawaii condominium projects.

Eight major Hawaii resorts were surveyed to determine the ratio of completed condominium units per 100 hotel units, as shown in Exhibit IV-M. In this analysis, the inventory of condominium units is considered largely reflective of market demand since very few unsold condominium units remain at the surveyed resorts. Additionally, the analysis recognizes that the more hotel units a resort has, the greater the number of visitors who are exposed to the resort.

As shown in the exhibit, an average of 62 condominium units have been completed per 100 hotel units at the surveyed resorts. Although there appears to be a wide variation in these condominium sales ratios, these ratios appear to be influenced by:

HAWAIIAN RIVIERA RESORT

Ratio of Developed Condominiums
Per 100 Hotel Units

Resort	Completed condominiums	Hotel units	Condominiums per 100 hotel units
Hawaii:			
Keauhou	832	1,302	64
Mauna Kea	40	310	13
Mauna Lani	196	351	56
Maui:			
Kaanapali	1,330	3,756	35
Wailea	656	950	69
Kapalua	528	194	272
Kauai:			
Princeville	1,180	300	393
Coconut Plantation	161	751	21
Total all projects	4,923	7,914	62
Total excluding Kapalua and Princeville	3,215	7,420	34

Source: Hawaii Resort Developers Conference, Economics of Resort Development, 1986.

Exhibit IV-1

HAWAIIAN RIVIERA RESORT

Distribution of Resort Condominium Purchasers on the Island of Hawaii by Place of Residence

	Distribution(1)		
	Kona	Kohala	Total
United States:			
California	36.6%	33.3%	36.3%
Other west coast	17.6	36.7	19.1
Hawaii	27.4	13.3	26.2
Other	16.3	10.0	15.9
Subtotal	97.9	93.3	97.5
Foreign:			
Canada	1.5	-	1.4
Japan	.3	6.7	.8
Other Far East	-	-	-
Other	.3	-	.3
Subtotal	2.1	6.7	2.5
Total	100.0%	100.0%	100.0%

(1) Based on a sample of 366 resort condominium units sold from January 1982 to July 1984.

Source: Peat Marwick Main & Co. based on information provided by Monitor Hawaii, An Analysis of Hawaii's Resort Condominium Market, November 1984.

Hawaii buyers are also an important market segment, representing about 26% of total island sales. Foreign resident buyers have been more prevalent in Kohala than in Kona due to increasing interest in high-quality resort projects by the Japanese. In Kona, by contrast, the few foreign buyers that have been observed are most likely to have been Canadians who bought in prior years when their currency was stronger than the U. S. dollar.

In the future, foreign condominium purchasers are expected to become a greater part of the market and more closely approximate Maui, which has about 7% foreign condominium owners. This is due to:

- Increased visitor awareness of Hawaii island as the industry matures and sees the development of more master-planned resort areas.
- Increased emphasis on the development of luxury condominium projects within these resorts.
- Increased awareness of the neighbor islands by the Japanese as the number of repeat visitors and investments in hotels and other real estate increase.

Sales Outlook for the Island of Hawaii

Condominium unit sales on Hawaii island since 1982 have averaged from 200 to 350 per year as shown previously. This market is expected to expand in future years due to the expected:

- Strengthening of the island economy
- Increase in visitor arrivals to the island
- Increase in condominium product development and diversity
- Lower and more stable interest rates
- Increased market awareness of the island and of individual resorts

Condominium market demand and unit production will be affected in the near-term by several factors:

- Changes in tax law in 1986, such as the elimination of investment tax credits and prolonged depreciation periods.
- Reduction in the marginal personal income tax rates which reduces the investment value of housing compared to the past.
- Changes in competitive rates of return in alternative forms of investment, especially financial assets.

Future condominium demand is likely to be derived more predominantly from visitors to Hawaii desiring units for full-time or vacation use, rather than as speculative investments as they have in the past 1974 and 1979 real estate boom periods. As such, well located oceanfront and golf-front projects as well as reasonably priced interior units in prestigious resort areas could be expected to be in demand over the foreseeable future.

Buyer Profiles

The characteristics of resort condominium buyers are profiled for first-class and luxury projects. The characteristics of the typical buyers in each category are summarized in Exhibit IV-K and discussed as follows:

- Purchase motivation - In the middle-priced, first-class market, buyers are often motivated by investment opportunities as well as the desire for a vacation or retirement home. Such purchasers typically require rental income to cover a portion of their unit holding costs and seek to realize capital gains upon the resale of their units. In contrast, the primary purchase motivation in the luxury or higher priced market is to have a vacation or retirement home in Hawaii.

- Typical age - The typical age of purchasers is comparable for both categories with an average age of 45 to 50. However, the first-class market tends to include buyers of a greater range of ages than does the luxury market.

- Occupation - The resort condominium purchaser is typically a professional such as an attorney or doctor, an officer of a large corporation, a successful entrepreneur or a corporate executive. Purchasers of first-class condominiums, however, include a greater share of professionals who tend to earn less than do the entrepreneurs or high-ranking corporate executives.

- Household income - Average annual household incomes range from about $100,000 to $250,000 in the first-class market and from $200,000 and up at the more luxurious properties.

- Investor sophistication - Buyers in both markets are generally experienced investors. However, the luxury condominium buyers are even more likely to already own one or more vacation homes.

- Place of origin - In both markets, buyers are typically from the western United States, especially from California, Washington, Oregon and Alaska. Buyers from within the state are relatively more common in the less expensive condominium markets. The place of origin of buyers is discussed further below.

- Purchasing entity - Married couples are a major market segment in both markets; however, the first-class market also includes small "huis" or groups of friends or relatives.

- Other characteristics - The typical resort condominium buyer has visited the resort on previous occasions. The luxury condominium buyer tends to be a frequent visitor to the resort or area who has decided to make a commitment to the area as a vacation destination. As previously mentioned, first-class condominium purchasers are often also motivated by investment considerations.

- Buyer origins - Nearly all resort condominium buyers on the island of Hawaii are U. S. residents. In the Kona district, U. S. residents are estimated to represent nearly 98% of the market, while in Kohala they represent about 93%, as shown in Exhibit IV-L. California and other west coast residents represent the majority or about 55% of all buyers.

HAWAIIAN RIVIERA RESORT

Typical Buyer Characteristics by Class of Condominium

	First-class	Luxury
Example condominium projects	Kapalua Bay, Golf and Ridge Villas Wailea Ekolu and Elua Kanaloa at Keauhou Waikoloa Shores	The Villas at Mauna Kea Mauna Lani Terrace and Point Wailea Point Kapalua Ironwoods
Approximate unit price	$175,000 to $450,000	$450,000+
Purchase motivation	Investment, vacation or retirement home	Vacation or retirement home
Typical age range	35 to 60 years	40 to 55 years
Occupation	Professionals, entrepreneurs and developers	Chief executive officers and self-employed entrepreneurs
Household income	$100,000 to $250,000	Over $200,000
Investor sophistication	Experienced investors. Many own vacation homes elsewhere	Experienced investors. May be "trading up" and most own one or more vacation homes elsewhere
Origin	Mainland; majority from California. Few from Hawaii	Mainland; majority from west coast. Hawaii buyers rare
Purchasing entity	Couples, limited partnerships and huis	Couples
Other characteristics	Has been a visitor to the resort and the area and would like to make an investment with the benefit of a vacation home	Typically has been a frequent visitor to the resort and has decided to purchase a vacation or possible retirement home

Source: Discussions with realtors or representatives of Hawaii condominium projects.

Exhibit IV-I

HAWAIIAN RIVIERA RESORT

Average Condominium Sales Prices for
Selected Hawaii and Maui Condominium Projects
by Project Location

1986 to June 1987

Project	Resort	Location	Average sales price
Luxury projects:			
Villas at Mauna Kea	Mauna Kea	Golf-front	$ 947,000
Mauna Lani Terrace	Mauna Lani	Oceanfront	619,700
Mauna Lani Point	Mauna Lani	Oceanfront	550,000
The Shores at Waikoloa	Waikoloa Beach	Golf-front	395,000
Wailea Point	Wailea	Oceanfront	600,000
Ironwoods	Kapalua	Oceanfront	719,000
Range			$ 395,000 - 947,000
First-class projects:			
Oceanfront:			
Kanaloa at Keauhou	Keauhou	Oceanfront	166,800
Wailea Elua	Wailea	Oceanfront	412,100
Wailea Ekahi	Wailea	Oceanfront	201,600
The Whaler	Kaanapali	Oceanfront	288,200
Kapalua Bay Villas	Kapalua	Oceanfront	290,000
Range			$ 166,800 - 412,000
Golf-front or interior:			
Wailea Ekolu	Wailea	Golf-front	200,550
Kapalua Golf Villas	Kapalua	Golf-front	187,400
The Ridge	Kapalua	Golf-front	201,800
Kaanapali Royal	Kaanapali	Golf-front	264,200
Country Club Villas	Keauhou	Golf-front	179,210
Range			$ 179,000 - 264,000

Sources: Hawaii TMK Service and Multiple Listing Service computer runs.

Exhibit IV-J

HAWAIIAN RIVIERA RESORT

Average Sales Prices of Condominium Units
in Kona and Kohala by Number of Bedrooms

1982 to July 1987

	1982	1983	1984	1985	1986	1987
Kona:						
Studio	$ 70,362	51,200	55,833	51,167	49,333	-
One-bedroom unit	104,781	78,541	82,684	60,523	64,049	75,802
Two-bedroom unit	147,750	159,402	133,556	122,341	118,156	128,239
Three- or more bedroom unit	-	211,600	178,000	328,250	145,250	117,500
Average	$ 134,244	125,400	115,940	106,157	93,055	102,310
Kohala:						
Studio	-	-	-	-	-	-
One-bedroom unit	-	94,000	189,333	112,000	109,000	-
Two-bedroom unit	-	120,425	54,416	253,208	528,754	440,958
Three- or more bedroom unit	-	-	175,000	-	-	301,000
Average	$ -	113,218	106,950	217,906	486,778	405,969

Source: Compiled by Peat Marwick Main & Co., based on Hawaii TMK Service and Multiple Listing Service computer runs.

- New unit sales prices - Average prices of condominium units sold in the North Kona and South Kohala districts have increased at an average of 9.6% annually since 1972, averaging about $160,800 in 1987, as shown in Exhibit IV-H. The average reflects projects located in the master-planned resorts of Kona and Kohala, as well as many stand-alone projects located in the Kailua area that do not offer private access to golf.

  High new unit sales prices in the South Kohala district have contributed significantly to the overall price increases due to the high quality of recent developments in the district and their locations in prestigious, master-planned resorts that offer golf, sandy white beaches and other amenities. The average prices of new units sold in South Kohala have ranged from about $300,000 for one-bedroom units to over $900,000 for three- and four-bedroom units. These high average prices are due in particular to sales at the following high-quality projects:

  - Mauna Lani Terrace
  - Mauna Kea Villas
  - Mauna Lani Point
  - The Shores at Waikoloa

- Prices by project location - Unit sales prices are strongly affected by a project's location with respect to ocean and golf frontage. However, the Mauna Kea Villas demonstrates that, a golf-front project that offers panoramic ocean views, location in a prestigious luxury resort and large, very high-quality units can also support very high prices. Excluding this very exceptional "golf-front" project, recent unit sales prices among the selected luxury projects have averaged $395,000 at the golf-front shores at Waikoloa, compared to $550,000 to $719,000 at oceanfront projects, as shown in Exhibit IV-I. Among first-class resort condominium projects, unit prices ranged from an average of $166,800 to $412,000 for oceanfront located projects, compared to $179,000 to $264,000 at golf or interior located projects, as also shown in the exhibit.

  In addition, within projects of comparable location and quality, prices are strongly affected by the view orientation of particular units. Analysis of recent sales at ten ocean- and golf-front projects indicates that compared to units fronting the ocean, average unit sales prices within projects were 23% and 62% less at units offering partial ocean and golf views, respectively.

- Prices by number of bedrooms - Prices also vary considerably by unit size and number of bedrooms. Currently, average unit prices in Kona range from about $76,000 for one-bedroom units to $128,000 for two-bedroom units. In Kohala, no one-bedroom units have been sold in 1987, but two-bedroom units averaged about $440,000 while three-bedroom units averaged about $300,000, as shown in Exhibit IV-J. Three-bedroom units averaged lower prices than two-bedroom units because the larger units include many primary residential units located outside of resort areas. In contrast, the more luxurious resort properties are typically aimed at couples or small families seeking a second or vacation unit, and hence are typically one- or two-bedroom units.

HAWAIIAN RIVIERA RESORT

Average Condominium Prices in Kona and Kohala

1972 to 1987

Year	Average sales price	Percentage increase/ decrease
1972	$ 40,723	- %
1973	48,073	18.0
1974	52,323	8.8
1975	67,860	29.7
1976	49,310	(27.3)
1977	63,524	28.8
1978	75,761	19.3
1979	95,792	26.4
1980	113,203	18.2
1981	136,332	20.4
1982	108,233	(20.6)
1983	125,512	16.0
1984	111,041	(11.5)
1985	117,770	6.1
1986	125,219	6.3
1987	160,846	28.5
Compounded annual percentage increase - 1972 to 1987		9.6

Source: Compiled by Peat Marwick Main & Co. based on Multiple Listing Service computer runs.

Exhibit IV-F

HAWAIIAN RIVIERA RESORT

Condominium Sales in Kona and Kohala

1975 to 1987

Year	Annual sales	Three-year moving average
1975	84	-
1976	199	-
1977	218	167
1978	220	163
1979	626	212
1980	349	398
1981	453	476
1982	250	351
1983	196	300
1984	292	246
1985	215	234
1986	351	286
1987(1)	386	317
Average	295	-

(1) Annualized estimated based on 193 sales reported as of July 1987.

Source: Hawaii TMK Service and Multiple Listing Service computer runs.

Exhibit IV-G

HAWAIIAN RIVIERA RESORT

Market Time for Selected
Resort Condominium Projects

Year first offered	Project	Number of units sold	Number of semi-annual marketing periods	Average annual sales
1975	Wailea Ekahi I	100	2	100
	Wailea Ekahi II	90	1	180
	Kapalua Bay Villas	141	1	282
	Total	331	4	166
1976	Wailea Ekahi III	104	2	104
	Wailea Elua I	54	3	36
	Total	158	5	63
1977	Wailea Elua IB	32	3	22
	Kapalua Golf Villas	186	1	372
	Total	218	4	109
1978	Wailea Ekolu	148	4	74
	Kapalua Ironwoods	40	1	80
	Kapalua Ridge	161	1	322
	Total	349	6	116
1979	Kaanapali Royal	105	1	210
	Wailea Elua II	65	8	17
	Total	170	9	57
1981	Kaanapali Alii	264	8	66
1983	Mauna Lani Terrace	79	6	27
1984	The Villas at Mauna Kea - Phase I	23	2	23
1985	Mauna Lani Point	47	3	21
	Wailea Point	91	3	61
	The Villas at Mauna Kea - Phase II	17	5	7
	The Shores at Waikoloa	86	4	43
	Total	241	15	32

Sources: Discussions with representatives of the respective projects.

Exhibit IV-E

HAWAIIAN RIVIERA RESORT

Average Unit Sizes of Selected
Resort Condominium Projects

	Unit size (square feet)			
	One-bedroom	Two-bedroom	Three- or more bedroom	Total
Island of Hawaii:				
Kanaloa at Keauhou	1,292	1,776	-	1,534
Country Club Villas	-	1,150	-	1,150
Keauhou Kona Surf and Racquet Club	600	1,180	1,180	980
Mauna Lani Terrace	1,150	1,450	2,200	1,600
Mauna Kea Villas	-	2,700	3,700	3,200
Mauna Lani Point	1,129	1,516	1,988	1,544
The Shores at Waikoloa	841	1,269	1,865	1,325
Island average	1,002	1,577	2,186	1,619
Island of Maui:				
Kapalua Bay Villas	1,050	1,500	-	1,275
Wailea Elua Village	950	1,400	-	1,175
Kapalua Golf Villas	950	1,300	-	1,125
Kapalua Ridge Villas	1,150	1,800	-	1,475
Kapalua Ironwoods	-	1,900	2,550	2,225
Wailea Ekolu	900	1,300	-	1,100
Wailea Point	-	1,600	2,559	2,080
Island average	1,000	1,543	2,555	1,494
Average	1,001	1,602	2,371	1,557

Source: Hawaii TMK Service, Condominium Guide and discussions with realtors of the respective projects.

Hawaii Island Unit Sales Absorption

Estimation of annual condominium unit sales absorption on the island is based on information provided by the Hawaii TMK Service and the Multiple Listing Service (MLS) for condominiums sold in the Kohala and Kona areas. Since less than 5% of the resort condominiums on the island are located outside of these two districts, condominium sales in these areas are representative of the island of Hawaii resort condominium market.

Annual condominium sales have fluctuated dramatically since 1975 between 200 to 600 units or an average of about 300 units per year over the period, as shown in Exhibit IV-F. Using a three-year moving average to smooth the fluctuations, between 163 and 476 units were sold annually. Condominium unit sales have slowed in recent years due to the:

- Lack of new inventory development on the island, except in a few high-end projects such as at Mauna Kea, Mauna Lani and Waikoloa Beach Resorts.
- Relatively slow visitor and real estate markets throughout the state until 1986.
- Relatively high interest rates until 1986.
- Uncertainty over the effects of Federal tax law changes on real estate investment deductions and amortization periods.

The most limiting factor to new condominium sales absorption on the island has been the lack of new inventory, except in the luxury market. However, because of the ongoing and expected improvements in the visitor arrivals to the island and the recent drop in mortgage interest rates, new condominium development in the region is expected to be met with improved rates of unit sales absorption. Potential effects of the changes in Federal tax law in the resort condominium market are most likely to be experienced at those projects targeted at investor-buyers who primarily seek tax shelters.

Resort Condominium New Unit Sales Absorption

Exhibit IV-G focuses on new unit sales absorption by project for selected condominium projects located in resorts on Maui and Hawaii. As shown in the exhibit, average sales absorption has ranged from about 17 units per year at Wailea Elua II, marketed between 1979 and 1983, to 161 units within six months at the Kapalua Ridge in 1978. Island of Hawaii resort projects are a relatively recent development in South Kohala, where average sales absorption has ranged from 7 units per year at Phase II of the Mauna Kea Villas to 43 units per year at the Shores at Waikoloa.

Unit Sales Prices

Condominium unit sales prices are analyzed three ways. The first discussion summarizes trends in new resold unit sales prices in the Kona and Kohala areas of the island. The two following analyses consider prices by project location and by number of bedrooms per units at the selected resort projects on Maui and Hawaii.

- Location in a master-planned resort on Maui or Hawaii
- Proximity to golf course and hotel developments within the resort
- Location on the ocean or fronting a golf course
- Low-rise development (three or fewer stories)
- First marketed since 1975

Based on these criteria, 14 projects were selected for study and comparison to potential development at the Hawaiian Riviera Resort. These projects are discussed in the following subsections.

Project Characteristics

The selected comparable projects range in size from 40 to 186 units with an average size of 122 units. This represents 1.3 to 13.6 units per gross acre, as shown in Exhibit IV-D. Units are generally clustered, with 4 to 13 per two- to three-story building, as also shown in the exhibit. The Mauna Kea Villas, a very luxurious project developed on the island of Hawaii, are free-standing, single-story buildings that are paired to resemble single-family duplexes.

Among the selected projects, the Hawaii island projects are slightly smaller and of lower densities than are the Maui projects, as also shown in the exhibit.

Unit Mix

Most projects include a majority of one- and two-bedroom units. The projects generally do not include three- and four-bedroom units and even luxury projects generally include no more than 10% of this type. Studio units are increasingly rare and are found mostly at older projects such as in Kaanapali Beach Resort or in areas outside of master-planned resorts which cater to a less upscale market segment. None of the projects selected for study included studio units.

Unit Size

Excluding lanais and garage spaces, average unit sizes range from about 1,000 net square feet for one-bedroom units to about 2,400 square feet for three- and four-bedroom units, as shown in Exhibit IV-E. Except at the Waikoloa Shores, the selected comparable Hawaii island units have been somewhat larger than comparable units on Maui, as also shown in the exhibit.

Facilities and Amenities

Resort condominiums have become increasingly competitive in the provision of recreational and other project amenities. Amenities of recently completed projects include recreation centers, swimming pools, jacuzzis, saunas, tennis courts, meeting rooms and barbecue areas. Many also offer special provisions for memberships or preferential usage of the resort's facilities such as for golf and/or tennis.

REVIEW OF MARKET TRENDS

This section reviews condominium market trends on the island and for the selected comparable projects in terms of sales absorption, prices, buyer profiles and buyer origins. The section concludes with an assessment of the market outlook for condominium unit sales on the island.

Exhibit IV-D

HAWAIIAN RIVIERA RESORT

Project Characteristics of Selected
Resort Condominium Projects

	Number of units	Units per gross acre	Average units per building	Maximum story story height
Island of Hawaii:				
Kanaloa at Keauhou	166	9.6	4	3
Mauna Lani Terrace	80	6.0	7	3
Mauna Kea Villas	40	1.3	1	1
Mauna Lani Point	116	6.3	13	3
The Shores at Waikoloa	114	10.0	10	3
Island average	103	6.6	7	3
Island of Maui:				
Kapalua Bay Villas	141	8.5	5	3
Wailea Elua Village	152	6.4	6	2
Kapalua Golf Villas	186	11.8	12	3
Kapalua Ridge Villas	161	7.4	6	3
Kapalua Ironwoods	40	4.3	4	2
Wailea Ekolu	148	13.6	9	2
Wailea Point	116	6.3	13	3
Island average	135	8.3	8	3
Average	122	7.6	8	3

Exhibit IV-B

HAWAIIAN RIVIERA RESORT

Resort Condominium Inventory
for the Island of Hawaii

February 1987

	Number of properties	Number of units(1)	Percent of island
Kona	43	1,752	83.3%
Kohala	6	169	8.0
Hilo	1	147	7.0
Ka'u	1	34	1.7
	51	2,102	100.0%

(1) Includes only units used for visitor use exclusive of units not placed in the visitor rental pool.

Source: Hawaii Visitors Bureau, Visitor Plant Inventory, February 1987.

Exhibit IV-C

HAWAIIAN RIVIERA RESORT

Planned Condominium Units on the Island of Hawaii

District and project	Location	Number of units	Comments
South Kohala -The Shores at Waikoloa	Waikoloa Beach Resort	120	Last phase expected to be completed by mid-1988.
North Kona - Hale Keauhou	Keauhou Resort	28	Completion planned for 1988.
Total		148	

Sources: Interviews with resort representatives; Hawaii Visitors Bureau, Visitor Plant Inventory, February 1987; and Pacific Business News (various).

Exhibit IV-A

HAWAIIAN RIVIERA RESORT

Private Multifamily Housing Authorizations
for the State and Island of Hawaii

1970 to 1986

Year	State of Hawaii Number of units	State of Hawaii Average value(1)	Island of Hawaii Number of units	Island of Hawaii Average value(1)
1970	5,241	$ 20,913	395	$ 14,522
1971	5,788	17,234	858	14,850
1972	9,356	17,834	854	15,287
1973	12,374	21,064	479	17,948
1974	15,474	25,101	994	25,256
1975	7,269	34,083	507	27,012
1976	3,560	32,144	129	15,837
1977	3,193	36,100	133	25,789
1978	4,657	41,357	334	35,734
1979	4,989	50,536	734	47,500
1980	6,758	73,544	739	76,218
1981	3,321	76,797	285	94,533
1982	3,070	50,071	245	110,780
1983	1,479	66,815	96	141,969
1984	1,280	48,938	181	90,834
1985	2,633	54,772	190	133,379
1986	2,735	51,637	39	N/A

N/A Not applicable.
(1) Value of permits granted for new construction, in current dollars.

Source: Bank of Hawaii, Construction in Hawaii, 1987.

Existing Units

The island of Hawaii presently includes about 51 condominium projects, most of which are located in resort areas. These projects represent over 2,100 units, about 83% of which are located in the Kona area, as shown in Exhibit IV-B. According to a 1984 survey on resort condominiums by Monitor Hawaii, Inc., an average of 49% of units at these resort condominium projects are kept in transient visitor rental pools. The remaining 51% of condominium units are either kept for full-time or part-time use by unit owners.

Planned Units

Two projects are now planned for development in West Hawaii. These planned developments total 148 units, as shown in Exhibit VI-C.

In addition, there is significant existing zoned capacity for condominium development at Waikoloa, Mauna Lani and Keauhou Resorts and there are numerous proposed resorts currently seeking County and/or State approvals which would include condominium developments.

OTHER CONDOMINIUM PROJECTS REVIEW

This section discusses types of resort condominium sites and reviews the characteristics of selected comparable resort condominium developments on the islands of Hawaii and Maui.

Site Location

Visitors to Hawaii tend to associate ocean views, beaches, golf course views and lush landscaping with the islands. Thus market conditions for individual projects are strongly affected by their location with respect to these elements. Three types of condominium sites are differentiated in this study:

- Oceanfront - Ocean frontage is normally the most desirable location as it may offer spectacular views and access to the ocean and beaches. As a result, projects with ocean frontage usually command the highest unit prices and sell most rapidly.

- Golf-front - Golf-front sites are attractive in that they may provide views over a well-maintained, landscaped area. Many golf-front projects such as at the Kapalua, Wailea and Keauhou Resorts also offer ocean views because of the topography of the site. Golf-front sites with ocean views are generally preferred to those with only fairway views.

- Interior - Interior resort locations are the least desirable and, as a result, usually support significantly lower unit prices than do projects with ocean frontage, ocean views or golf frontage. In order to compensate for this locational disadvantage, interior projects may offer manmade views such as water features or gardens.

Comparable Project Definition

Characteristics of selected condominium projects located in resort areas on the islands of Hawaii and Maui are reviewed in order to provide a context for the condominium development program proposed for the Hawaiian Riviera Resort. Projects were selected for review based on the following criteria:

IV - CONDOMINIUM MARKET ASSESSMENT

This chapter assesses the market support for condominium development at the Hawaiian Riviera Resort. The sections below review condominium development trends, the current and planned inventory of units on the island of Hawaii, comparable project characteristics and market trends relating to buyer profiles, absorption and prices. Based on this overview, the last section of the chapter presents the condominium market assessment for the Hawaiian Riviera Resort.

CONDOMINIUM DEVELOPMENT TRENDS

Condominium development and ownership in the state was legalized with the passage of the Horizontal Property Regime Act (Act) by the Hawaii State Legislature in 1961. The Act defines a condominium as a structure or structures that offer ownership of single units in a multiunit development with fractional ownership of the projects' common elements.

Transient Condominium Development

Condominiums are an important force in the visitor accommodations industry and, in many cases, are competitive with hotels. Currently about 22,000 units, or 34%, of the state's 65,000 visitor units are condominium units reserved for transient visitor use as part of rental pool.

Reasons for the rapid increase in the number of condominium units in visitor use include:

- Their generally lower construction costs due to the relatively minimal amenities and common areas such as administrative areas, food and beverage facilities, retail shopping areas, meeting/banquet rooms and support facilities.
- The relative ease in obtaining financing since cash flow may be established from individual investors and buyers even before construction begins.
- Historically, the favorable tax benefits to investors and buyers. However, many of these incentives were reduced or eliminated by the Federal tax law changes in 1986.
- Their use in time-sharing as a sales marketing approach.
- Their appeal to repeat and family visitors who seek more space and cooking facilities.

Due to these reasons and to the increase in repeat visitors to the state who often patronize these units, condominiums are expected to continue to be a dominant force in the visitor accommodations industry.

The island of Maui has the greatest percentage of visitor units in condominium projects due to the island's relatively new visitor inventory and greater emphasis on condominium development in master-planned resorts. The island of Oahu has the lowest percentage of condominium units due to its early emphasis on hotel construction in Waikiki, as shown in the following table:

Percentage of Total Visitor Units

February 1987

	Total visitor units	Condominium units Number	Condominium units Percent
Oahu	38,185	9,236	24.2%
Hawaii	7,328	2,102	28.7
Maui and Lanai	13,274	7,673	57.8
Kauai	5,956	2,631	44.2
Molokai	575	254	44.2
Total	65,318	21,896	33.5%

Source: Hawaii Visitors Bureau, Visitor Plant Inventory.

Private Multifamily Authorizations

Condominium development statewide was very rapid in the early to mid-1970s, but has slowed considerably in the early 1980s in response to slower growth in the national economy and temporarily overbuilt situations in some areas on Kauai and Hawaii. Although data on unit completions are not readily available, condominium development trends in the state and the island of Hawaii are reflected in private multifamily housing authorizations, shown in Exhibit IV-A. Statewide, there were record numbers of authorizations, totaling more than 12,000 and 15,000 new units in 1973 and 1974, respectively, but a significant slowdown in new construction permit authorizations in the years since.

Authorization trends on the island of Hawaii have been more irregular than those statewide. More than 700 units per year were approved on the island in 1971 to 1972, 1974, 1979 and 1980. In 1984 and 1985, new construction authorizations represented 180 and 190 units, respectively, as also shown in the exhibit. In 1986, however, there were few authorizations on the island.

A very strong trend on the island has been the increasing average permit value of unit authorizations. This reflects the high quality of development occurring in resort areas of the island, most notably in South Kohala.

For 1987, condominium development has slowed and developers have exhibited more cautious behavior, reflecting a reduced speculative market for condominiums. Due to uncertainties in tax law impacts with the Tax Reform Act of 1986, it appears that there has been a shift from the past buildup of inventory to building condominium units only to the extent that they can be sold prior to or shortly after project completion.

ISLAND OF HAWAII INVENTORY

This section reviews existing and planned condominium projects on the island of Hawaii.

HAWAIIAN RIVIERA RESORT

Development Concept for Hotel Development
at the Hawaiian Riviera Resort

	Hawaiian Palace Resort		Ka'u Aina Resort		
	Luxury hotel (275 rooms)	Deluxe hotel (625 rooms)	High-activity hotel (600 rooms)	Deluxe retreat hotel (200 rooms)	First-class hotel (400 rooms)
Facility concept	The ultimate exclusive, high-service hotel featuring a European-style theme, decor and level of service catering to the international elite.	Higher activity hotel with the full complement of activities associated with a larger incentive and FIT hotel.	Large low-rise hotel which would be the major activity generator and a focal point for the Resort. Caters to FIT, incentive and meeting groups.	Clustered hales with an all-inclusive room rate catering to couples, families and repeat visitors. Gourmet meals and wide variety of activities included in room rate.	Low-rise polynesian, caters to a wide spectrum of hotel guests including families and wholesale incentive and meeting groups.
Representative project	Costa Smeralda (Sardinia) Chelsea Harbor (London) Port Grimaud (San Topez) George V Hotel (Paris) Mauna Kea Beach Kapalua Bay Ritz-Carlton Laguna Niguel	Hyatt Regency Maui Westin Kauai	Hyatt Regency Maui Westin Kauai Westin Maui	Kona Village Hotel Hana Maui Manele Bay (Lanai)	Coco Palms Sheraton Molokai Sheraton Kauai Waiohai
Site characteristics	Oceanfront site located east of the boat marina and commercial complex.	Oceanfront site located west of the boat marina and commercial complex.	Prime middle oceanfront site at Pohue Bay east of the Kanonohe Oasis.	Oceanfront site west of the Kanonohe Oasis.	Oceanfront site west of the petroglyph park.
Estimated year of completion	1992	1992	1992	1997	2002
Estimated average room rate (1987 dollars)	$210	$175	$140	$160	$100

Exhibit III-5

oriented guests, in addition to independent travelers. The hotel is also anticipated to service groups that require facilities to accommodate small meeting and corporate functions.

Room Rates

As previously shown in Exhibit III-5, the Hawaii Ka'u Aina Resort Hotel is projected to have an average room rate ranging from $100 to $160 at its three hotels. The wide range of room rates can be attributed to the broad mix of hotel guests as well as discounts given to group and incentive visitors.

Exhibit III-R

HAWAIIAN RIVIERA RESORT

Projected Hotel Occupancy Levels at the
Hawaiian Riviera Resort by Resort

1992 to 2007

Year	Hawaiian Palace Resort		Ka'u Aina Resort		Total rooms	Weighted projected occupancy percentage
	Cumulative room inventory	Projected occupancy	Cumulative room inventory	Projected occupancy		
1992	900	55.5%	600	60.5	1,500	57.5%
1993	900	58.5	600	63.5	1,500	60.5
1994	900	61.5	600	66.5	1,500	63.5
1995	900	64.5	600	69.5	1,500	66.5
1996	900	67.5	600	72.5	1,500	69.5
1997	900	70.0	800	58.7	1,700	64.7
1998	900	72.0	800	62.0	1,700	67.3
1999	900	72.0	800	65.0	1,700	68.7
2000	900	72.0	800	68.0	1,700	70.1
2001	900	72.0	800	71.0	1,700	71.5
2002	900	72.0	1,200	57.7	2,100	63.8
2003	900	72.0	1,200	60.0	2,100	65.1
2004	900	72.0	1,200	64.0	2,100	67.4
2005	900	72.0	1,200	67.0	2,100	69.1
2006	900	72.0	1,200	70.0	2,100	70.9
2007	900	72.0	1,200	72.1	2,100	72.1

The Mediterranean theme and a commensurate level of service are also important in distinguishing the hotel from other properties in the state, as the market being targeted is accustomed to this level of comfort and surroundings.

Target Markets

The Hawaiian Palace Resort would initially be developed with a luxury hotel featuring service, amenities, decor and a Mediterranean style capable of catering to an international elite market. The target market is expected to include a predominently FIT guest profile that are expected to be affluent, successful individuals who have experienced many of the world's finest resorts.

Room Rates

Standard room rates for luxury resort hotels throughout the state range from $165 at the Halekulani to over $300 at the Mauna Kea Beach, as previously shown in Exhibit III-F. Based on comparable luxury resort hotels throughout the state and the extensive planned facilities and ambiance of the proposed hotels, average room rates for the Palace Resort's two hotels are estimated to range between $175 and $210, as shown in Exhibit III-S.

HAWAII KA'U AINA RESORT HOTEL
MARKET ASSESSMENT

This section assesses the market support for hotels at the Ka'u Aina Resort on the basis of the Resort's anticipated market position, intended target markets and room rates.

Market Positioning

The Hawaii Ka'u Aina Resort plans to offer a complementary alternative to the adjacent Hawaiian Palace Resort, while also offering its own recreational amenities. The projected occupancy and room rates of the initial high-activity hotel project have been estimated according to the visitor experiences that would be available:

- The relative privacy available in contrast to the Hawaiian Palace Resort, while able to share its features.
- The opportunities for an education in Hawaiian heritage through observation of the archaeological sites.
- A low-rise retreat atmosphere coupled with the low-density sense of wide open, natural space.

The emphasis on relaxation and the Polynesian theme that would be associated with the Hawaii Ka'u Aina Resort has a broad market appeal, but is especially desired by couples, families and repeat visitors.

Target Markets

The Hawaii K'au Aina Resort Hotel is expected to cater to a broader range of guests than that found at the Hawaiian Palace Resort Hotel. This wide spectrum of visitors is expected to include group, incentive travelers and famil-

Lot prices are expected to be somewhat lower at the Ka'u Aina Resort as compared to the Palace Resort due to the greater isolation of some of the residential parcels from major activity areas, the lower density atmosphere which appeals to a more resident-oriented rather than visitor-oriented market and lesser project amenities such as marinas, polo fields, stables and greater commercial areas which contribute to the market attractiveness, view orientations and market image of the Palace Resort.

VI - COMMERCIAL MARKET ANALYSIS

The commercial facilities planned at the Hawaiian Riviera Resort are intended to be among the finest and most unique resort specialty shopping complexes in the state. As planned they will be more than a resort amenity, but rather a major marketing tool and attraction. This chapter reviews other resort shopping centers in Hawaii and presents the market assessment for commercial development at the Resort.

RESORT SHOPPING CENTER OVERVIEW

This section reviews the characteristics of five selected comparable resort shopping centers in Hawaii. Resort shopping centers examined include: Whaler's Village and Wailea Shopping Village on the island of Maui, Coconut Plantation Marketplace and Princeville Center on the island of Kauai and Keauhou Shopping Village on the island of Hawaii.

Description

The selected shopping centers were reviewed with respect to physical characteristics such as:

- Site area and gross leasable area
- Floor area ratios
- Number of tenant spaces
- Parking
- Architectural themes and building types

A summary of the characteristics of the selected shopping centers is found in Exhibit VI-A, which is discussed as follows:

- Site and gross leasable area - Total site area ranged from 6.9 acres at Princeville Center to 10.5 acres at Wailea Shopping Village. Gross leasable areas ranged from 40,000 square feet at Wailea Shopping Village to 79,000 square feet at Whaler's Village. The site at Wailea also has room for expansion to a planned 70,000 to 80,000 square foot facility.

- Floor area ratios - Floor area ratio is defined as the ratio of gross leasable area to the total site area. A typical neighborhood shopping center has a floor area ratio of about 20% to 25%. The floor area ratios of the selected centers (except Wailea Shopping Village which has undeveloped land for future expansion) ranged from 18.3% at Coconut Plantation Marketplace to 22.1% at Keauhou Shopping Village.

- Architectural themes and building types - Architectural themes of the selected resort shopping centers are related to the themes of the resorts they are associated with. The outdoor bazaar theme and numerous kiosks at the Coconut Plantation Marketplace are consistent with the Coconut Plantation resort. The Whaler's Village museum and exhibits recall the whaling history of the Lahaina area and its ocean frontage adds to the ambiance of its waterfront restaurants.

Exhibit VI-A

	Year Completed	Site area (acres)	Gross leasable area (square feet) Retail	Office	Total	Floor area ratio(1)	Number of tenant spaces Retail	Office	Total	Parking spaces	Parking ratio(2)	Building description
Maui:												
Whaler's Village	1970 and 1984	8.5	73,600	5,400	79,000	21.3%	45	8	53	410	5.2	Oceanfront, one- and two-story complex contained in 12 concrete and wood buildings. Whale museum located on a third floor building.
Wailea Shopping Village	1977	10.5	35,500	4,500	40,000	8.8	24	5	29	151	3.8	One story plus mezzanine, wood frame with stucco siding. Luxury resort style.
Kauai:												
Coconut Plantation Marketplace	1972	8.0	63,600	-	63,600	18.3	73	-	73	354	5.6	Seven main one- and two-story buildings, with kiosks in interior courtyard.
Princeville Center	1977 and 1983	6.9	50,829	15,324	66,153	22.0	23	20	43	234	3.5	Eight 2-story wood frame buildings. Turn-of-the-century architecture.
Hawaii:												
Keauhou Shopping Village	1985	7.5	57,700	14,388	72,088	22.1	20	15	35	N/A	N/A	Six 1-story buildings and one 2-story office building. Freestanding supermarket.

N/A Not available.
(1) Ratio of gross leasable area to site area.
(2) Parking spaces per 1,000 square feet of gross leasable area.

Source: Discussions with shopping center management and International Council of Shopping Centers, Hawaii Shopping Center Directory, 1985.

Building construction typically consists of single or multi-stories retail shops in separate buildings. Second floor tenants are generally office users, but Whaler's Village is an exception with numerous second floor retail tenants.

Resort Tenant Mix

This section describes the tenant mix at the selected resort shopping centers. Resort shopping centers are typically oriented towards the visitor market; however, the Princeville Center and Keauhou Shopping Village cater to both their resort markets and the resident markets in surrounding communities. Office tenants are included in the mix of five of the selected centers. The tenant mix at the selected resort shopping centers are shown in Exhibit VI-B:

- Retail tenants - Retail tenants at the selected resort shopping centers, except Princeville as mentioned above, tend to be concentrated in a few retailing categories. The apparel, gift, craft or jewelry store, and restaurant categories generally represent 85% to 95% of the total retail space. Whaler's Village and Coconut Plantation Marketplace also offer examples of specialty tenants like theater complexes which comprise 4% and 10%, respectively, of total retail space at these centers.

  In contrast, shopping centers that also have a resident orientation like Princeville Center and Keauhou Shopping Village have varying tenant mixes. Princeville Center has a supermarket, hardware store and bank, comprising more than two-thirds of the total retail space. Keauhou Shopping Village is anchored by a large supermarket which accounts for over one-half of the total retail space.

- Office tenants - Office tenants represent a portion of the tenant mix at each of the selected resort shopping centers except Coconut Plantation Marketplace. Office tenants represent 6% of total leasable space at Whaler's Village, 17% at Wailea Shopping Village, 23% at Princeville Center and 10% at Keauhou Shopping Village. The relatively large portion of office space at Princeville Center reflects its residential market orientation. Generally, office tenants at resort centers are oriented toward the visitor market with travel agencies or real estate sales companies being typical office tenants.

Market Performance

This section examines market performance of the selected resort shopping centers in terms of occupancy and retail sales levels.

- Occupancy levels - Occupancy levels at the selected shopping centers are very high, with weighted averages of 96% to 99%. Coconut Plantation Marketplace has increased its occupancy rates to almost 100% through aggressive marketing strategies such as the busing of cruise ship passengers to the center. Wailea Shopping Village has increased its occupancy level to about 99% in 1985, despite receiving little off-resort customer traffic. Whaler's Village has been 100% occupied since 1983 and currently has a waiting list of more than a hundred prospective tenants. Princeville Center's occupancy rate was 97% in 1985 with most of the vacancies attributed to second floor office space. The Keauhou Shopping Village is currently estimated at 86% occupancy after the completion of the major portion of the center in the summer of 1985.

- Retail sales levels - Retail sales levels are stated in dollars per square foot of gross leasable area per year. Sales levels at the selected resort shopping centers are significantly higher than levels experienced at neighborhood or regional shopping centers. The weighted average of retail sales for the selected resort shopping centers increased an average of 18% per year, from $320 per square foot in 1983 to $445 per square foot in 1985. Annual sales per square foot at the various centers, however, varied by as much as 60% from these averages.

  Shopping centers that experienced higher sales per square foot were those which cater to the upscale visitor markets, have a tenant mix that is complementary to rather than competitive with hotel shops, and have strong traffic generators such as oceanfront dining establishments. Shopping centers with lower sales per square foot provided for a greater amount of resident-oriented space such as supermarkets, hardware stores and home furnishings.

Supportable Commercial Space Indicators

As shown in Exhibit VI-C, commercial space available at six selected resort shopping centers in Hawaii range from about 22,000 square feet at The Shops in Kapalua, Maui, to about 79,000 square feet at Whaler's Village in Kaanapali, Maui. The ratio of commercial space per visitor unit at each resort ranges from 15 square feet per unit at Whaler's Village to 70 square feet per unit at Coconut Plantation on Kauai. Based on a weighted average of mature and emerging resorts, the average was about 27 square feet per unit.

Whaler's Village has relatively little commercial space per unit as compared to the other selected Hawaii resort shopping centers. However, 1986 sales per square foot at Whaler's Village was about $720 which is significantly higher than the weighted average of $445 per square foot previously discussed, indicating that the potential supportable commercial space may be greater than current supply.

Shopping centers in selected mainland resorts are presented in Exhibit VI-D. As shown in the exhibit, commercial space per unit at the selected mainland resorts is significantly less than the Hawaii examples, with commercial space per unit ranging from 19 to 27. Some of these differences can be explained by factors such as the seasonality of the resort, type of tenants, type of merchandise offered, visitor characteristics and location. However, the selected mainland resorts tend to be far from population centers and thus do not have significant market support from major residential markets near the resort.

HAWAIIAN RIVIERA RESORT
COMMERCIAL MARKET ASSESSMENT

This section assesses the potential retail market support at the proposed Hawaiian Riviera Resort in terms of target markets, total supportable square feet and tenant mix. The next section describes the recommended distribution of the supportable space between the two resort areas.

Exhibit VI-B

HAWAIIAN RIVIERA RESORT
Tenant Mix of Selected Resort Shopping Centers

	Whaler's Village	Wailea Shopping Village	Coconut Plantation Marketplace	Princeville Center	Keauhou Shopping Village
Total gross leasable square feet	79,000	40,000	63,600	66,153	72,088
Retail:					
Apparel	27%	46%	40%	5%	8%
Gifts/Jewelry/Art	15	22	24	4	13
Drug/Sundry	4	2	4	2	-
Restaurant	42	28	22	19	16
Snack Food	2	-	-	4	2
Theater	4	-	10	-	-
Supermarket	-	-	-	52	54
Hardware	-	-	-	11	-
Other retail	6	2	-	3	9
Total retail space	100%	100%	100%	100%	100%
Percent of total:					
Retail	94%	80%	100%	73%	76
Office	6	17	-	23	10
Vacant	-	3	-	4	14
	100%	100%	100%	100%	100%
Major tenants	El Crab Catcher Leilani's Rusty Harpoon R. M. S. Bounty Chico's Cantina Ming Court Cinemas	Suzu's Boutique Wailea Pantry Sandcastle Restaurant	Liberty House Plantation Prime Rib Andrade's Farrell's	Foodland Bank of Hawaii Chuck's Steak House Tru-Value Hardware	KTA Supermarket Mitchell's Restaurant Dryadale Restaurant Keauhou Resort/ Bishop Estate offices

Source: Discussions with shopping center management.

HAWAIIAN RIVIERA RESORT

Shopping Center Retail Space at Selected Hawaii Resort Areas

1987

Resort shopping	Units	Commercial space (square feet)	Commercial space per unit	Comments
Hawaii resorts:				
Whaler's Village (Kaanapali, Maui)	3,756 hotel 1,330 condominium 210 single-family lots 5,296 total	79,000	14.9	Kaanapali is also serviced by numerous shopping centers in nearby Lahaina town. This market is underserved as indicated by the extremely high sales per square foot at the center which is almost twice that of other centers.
Wailea Shopping Village (Wailea, Maui)	950 hotel 656 condominium 190 single-family lots 1,796 total	40,000	22.2	Expansion plans are for another 40,000 square feet by about 1972.
The Shops (Kapalua, Maui)	194 hotel 528 condominium 100 single-family lots 822 total	22,000	26.7	Small shopping complex with little roadside visibility.
Keauhou (Keauhou, Hawaii)	1,302 hotel 832 condominium 109 single-family lots 2,243 total	72,088	32.1	Keauhou is also serviced by other retail establishments in Kona.
Princeville Center (Princeville, Kauai)	300 hotel 1,180 condominium 200 single-family lots 1,680 total	66,153	39.4	Princeville Center also serves as a community center for Kilauea, Hanalei and Haena.
Coconut Plantation Market Place (Coconut Plantation, Kauai)	751 hotel 161 condominium - single-family lots 912 total	63,600	70.0	Coconut Plantation also serves other condominiums and hotels in the Waialua-Kapaa area as well as pass-by tourists.

Sources: Compiled by Peat Marwick Main & Co. based on the Hawaii Resort Developer's Conference, Economics of Resort Development, 1985, and discussions with representatives of the respective Hawaii resorts.

Exhibit VI-C

HAWAIIAN RIVIERA RESORT

Shopping Center Retail Space at Selected Mainland Resort Areas

1984

Resort shopping	Units	Commercial space (square feet)	Commercial space per unit	Comments
Kiawah Island (South Carolina)	150 hotel 700 condominium 265 single-family lots 1,115 total	27,800	24.9	Kiawah Island is a self-contained resort that is severely underserved by retail facilities. The Kiawah Development group is preparing to open another 20,000 square feet in order to provide a better balance of retail space per dwelling unit.
Keystone (Colorado)	192 hotel 846 condominium 1,038 total	28,000	27.0	While Keystone draws a significant number of day visitors to the ski area, there is not a lot of day visitors spending at the Keystone Village. The village is self-contained and away from the ski area and primarily serves the Keystone's residents/overnight guests. Keystone's commercial facilities are in good balance with the lodging facilities/residential units.
Snowbird (Utah)	170 hotel 675 condominiums 845 total	18,240	21.6	Snowbird appears to have a good balance of commercial facilities to residential units.
Sunriver, (Oregon)	210 hotel 500 condominiums 860 single-family 1,570 total	27,400	18.6	Sunriver is a self-contained resort with strong winter orientation. The commercial space to dwelling unit ratio is distorted by the high percentage of single-family units which have low year-round occupancy relative to the other accommodation types. Increased population recently has led them to double existing space.

Source: Urban Land Institute, Retail Experience in Resort Locations, September 1984.

Exhibit VI-2

Target Markets

The target markets for the proposed commercial centers at the Hawaiian Riviera Resort are expected to be derived primarily from resort guests and residents, and secondarily from cruise ship, tour bus and rental day visitors and local residents. As is typical with resorts, a significant percentage of the support for commercial activity is expected to be derived from hotel guests seeking personal goods, convenience items and services.

Supportable Commercial Space at the Hawaiian Riviera Resort

The Hawaiian Riviera Resort is expected to emerge as a visitor destination with amenities and services comparable to the world's leading resorts destinations. Accordingly, commercial space at the Resort will be required to serve the many needs of the guests, especially since the resort will be located away from the island's existing major commercial centers.

Supportable commercial space is estimated for the Hawaiian Riviera Resort as a whole based on the expected development of hotel, condominium and single-family units and on commercial space per unit factors observed at other destinations, as reviewed previously.

The Hawaiian Riviera Resort is expected to have 1,500 transient units in 1992 increasing to about 3,000 units in 2007, as shown in Exhibit VI-E. The range of required square feet for the commercial shopping center was selected based on a review of comparable resort operations, with requirements at the Hawaiian Riviera Resort being estimated at about 50 square feet per resort unit in 1992, and decreasing to 35 square feet in 2007 and the years thereafter.

The higher initial ratio is based on the marketing strategy of using the commercial areas as a means of attracting day time as well as overnight visitors and the estimated critical mass of shopping areas needed to achieve this effect. In subsequent years, this ratio is assumed to decrease as the resort matures and becomes more established.

Based on the number of units projected to be built and the commercial space per unit ratios, the estimated supportable commercial space at the resort generated by the resort population is about 75,000 square feet in 1992 and increasing to 127,000 square feet by 2012.

Secondary commercial support from off-resort visitors and local residents is estimated to account for an additional 8% to 12% of supportable commercial space, amounting to about 6,000 additional supportable square feet in 1992 and increasing to 17,000 square feet in 2012.

Thus, the total supportable resort commercial space has been estimated at 81,000 square feet in 1992, 103,000 square feet in 1997, 130,000 square feet in 2002, 134,000 square feet in 2007 and 144,000 square feet in 2012 as shown in the exhibit.

Representative Tenant Types and Mix

Representative types of tenants that could be attracted to the Resort shopping centers and the estimated aggregate tenant mix is described in the following bullet items. A key element of the Hawaiian Palace Resort commercial concept

HAWAIIAN RIVIERA RESORT

Estimated Required Commercial Area at the Hawaiian Riviera Resort

1992 to 2012

Year	Hotel	Condo	Single-family	Total units	Commercial space per unit (square feet)	Estimated supportable commercial space (square feet) On resort	Off-resort Percent of on-resort	Off-resort Square feet	Total
1992	1,500	-	-	1,500	50	75,000	8%	6,000	81,000
1997	1,700	380	10	2,090	45	94,000	9	9,000	103,000
2002	2,100	750	70	2,920	40	117,000	10	13,000	130,000
2007	2,100	1,095	190	3,385	35	118,000	12	16,000	134,000
2012	2,100	1,175	340	3,615	35	127,000	12	17,000	144,000

is an emphasis on outdoor seating which increases the total commercial floor space by 25% to 30% from the leasable areas shown below. The smaller unit sizes also reflect the anticipated high-ticket items that would be carried by small specialty retail shops targeting the upper income market.

- Restaurants - A variety of restaurant operations are seen as potential anchor tenants to the commercial centers of both resorts. Restaurants should include those capable of generating interest and traffic in the commercial areas. Restaurant spaces are estimated to average about 3,000 square feet each, including outdoor seating. Potential restaurant types or themes include:

  - European (Italian, French, German, English, Spanish)
  - Mexican (Sit-down and fast food)
  - American (Sit-down and fast food)
  - Asian (Japanese, Chinese, Thai, Korean)
  - Specialty (Ice cream, pizza parlor)

  Restaurant space is estimated to account for about 15% to 20% of the total tenant mix.

- Bars/pubs - The bars and pubs will lend themselves to the festive, Mediterranean atmosphere of the development and are estimated to average about 1,000 square feet each. Potential types or themes include:

  - Beer garden
  - Sailor's pub
  - Candlelit, romantic lounge
  - Rock/jazz
  - Wine bar
  - French bistro

  The bar/pub tenants are estimated to account for about 5% to 10% of the total tenant mix.

- Convenience goods - Tenants providing basic convenience goods are expected to require larger spaces, averaging about 10,000 square feet. Potential tenants include:

  - Food mart/grocery store
  - Drugs, cosmetics and sundries store
  - Fisherman's/seafood market (fresh catches from marina boats)

  Convenience goods tenants are estimated to account for about 5% to 10% of the tenant mix.

- Clothing, jewelry and gift boutiques - Boutiques averaging about 1,000 square feet are seen as a significant part of the visitor-oriented portion of the tenant mix. Boutique concepts could include:

  - Jewelry (fine and mid-market)
  - Swimwear
  - Resort and sportswear
  - Designer and fashion
  - Luggage and bags

  - Assorted leather goods
  - Fur shop
  - Hawaiiana
  - Art and crafts

  Boutique tenants are estimated to account for about 15% to 20% of the tenant mix.

- Other retail - Other stores, averaging about 1,000 square feet each, could feature a variety of themes and product lines. Some store concepts include:

  - Candies and nuts
  - Cards and gifts
  - Packaged liquor store
  - Dive shop
  - Boating/fishing supplies
  - TV and videocassette rentals
  - Books and stationary
  - Video games parlor
  - Hardware and housewares
  - Ships' chandlery

  The above store tenants could account for about 15% to 20% of the tenant mix.

- Services and offices - Various service businesses are also important to the tenant mix at a resort shopping facility. Service space users averaging about 800 square feet each could include:

  - Beauty/barber shop
  - Cleaners and laundry
  - Financial services
  - Real estate
  - Post office/shipping and mailing
  - All faiths chapel

  Service tenants are estimated to account for about 8% to 12% of the tenant mix.

In addition to the above tenants to be located in the resort shopping complexes, other commercial space would be needed to accommodate gas stations for both cars and boats, boat storage and repair facilities, and rental car/tour bus facilities.

DEVELOPMENT CONCEPTS BY RESORT AREA

The commercial facilities at the Hawaiian Riviera Resort are envisioned to offer a complementary array of quality goods and services, and to provide a rich variety of sounds, scents and experiences. This section presents development concepts and recommended commercial space allocations for the Hawaiian Palace Resort and the Ka'u Aina Resort separately.

Hawaiian Palace Resort
Development Concept

A primary attraction of the entire Hawaiian Riviera area will be the marina and promenade at the Hawaiian Palace Resort, which is envisioned to integrate the hotels, marina and shopping complex. This area will feature restaurants, sidewalk cafes, and an arcade of boutique and specialty shops. The area is anticipated to be a gathering and meeting place for international guests, other visitors and local residents.

Based solely on unit development at the Hawaiian Palace Resort, supportable commercial space at the Hawaiian Palace Resort is estimated at about 48,600 square feet in 1992. However, as previously stated, the Hawaiian Palace Resort is planned to include a greater emphasis on commercial development than the Ka'u Aina Resort. Thus, the allocation of supportable space between the two resort areas has been adjusted to reflect development of about 66,000 square feet at the Hawaiian Palace Resort in 1992, as shown in Exhibit VI-F.

On this adjusted basis, the supportable commercial area is estimated to increase to 78,000 square feet in 1997, 95,000 in 2002, 99,000 in 2007 and 104,000 in 2012. The recommended commercial area is intended to fulfill the needs of hotel guests, balance the commercial area with the hotel sizes and considers practical tenant space needs. A representative allocation of commercial space at the Hawaiian Palace Resort during its initial stage of development is shown in the following table:

Hawaiian Palace Resort
Representative Allocation of Commercial Area

1992

Type of tenant	Square Feet
Restaurants (four)	12,000
Bars/pubs/cafes (six)	6,000
Convenience goods (two)	20,000
Stores (ten)	10,000
Boutiques (ten)	10,000
Services (ten)	8,000
Total	66,000

Included in the allocation category of convenience goods is an estimated 8,000 square foot fisherman's market that would feature fresh catches brought in by fishing boats in the marina.

Hawaii Ka'u Aina Resort
Development Concept

Commercial facilities at the Hawaii Ka'u Aina Resort are anticipated to be along a rustic, Hawaiian theme and in a more passive atmosphere than at the Hawaiian Palace Resort. This will allow for an interesting contrast from the bustling activity of the marina shopping village. It is anticipated that a greater emphasis in tenant mix will be placed on restaurant and specialty retail stores, such as Hawaiiana, jewelry and arts and crafts.

Exhibit VI-F

HAWAIIAN RIVIERA RESORT

Recommended Distribution of Commercial Space at
the Hawaiian Riviera Resort

1992 to 2012

Year	Total	Allocation based on unit development: Hawaiian Palace Resort	Allocation based on unit development: Hawaii Ka'u Aina Resort	Recommended distribution(1): Hawaiian Palace Resort	Recommended distribution(1): Hawaii Ka'u Aina Resort
1992	81,000	48,600	32,400	66,000	15,000
1997	103,000	60,900	42,100	78,000	25,000
2002	130,000	70,600	59,400	95,000	35,000
2007	134,000	76,800	57,200	99,000	35,000
2012	144,000	81,500	62,500	104,000	40,000

(1) As recommended for development, based on development concepts for the two Resorts and critical mass requirements.

Guests of the Hawaii Ka'u Aina Resort are expected to represent a broader and more diverse cross-section of guests than those visiting the Hawaiian Palace Resort, but the commercial areas could draw less traffic from the off-resort segment.

The supportable commercial space at the Hawaii Ka'u Aina Resort is estimated at about 32,400 square feet in 1992 based on unit development. However, the recommended space to be developed at Ka'u Aina Resort reflects a greater allocation of the total Hawaiian Riviera supportable commercial space to the Hawaiian Palace Resort, as shown in Exhibit VI-F and explained previously.

On this adjusted basis, the supportable commercial area is estimated to increase to 25,000 in 1997, 35,000 in 2002, 35,000 in 2007 and 40,000 in 2012, as also shown in the exhibit. A representative allocation of commercial space at the Hawaii Ka'u Aina Resort during the initial stage of development could be as follows:

Hawaii Ka'u Aina Resort
Representative Allocation of Commercial Area

1992

Type of Tenant	Square Feet
Restaurants (two)	6,000
Stores (five)	5,000
Boutiques (two)	2,000
Services (two)	2,000
Total	15,000

The adjusted commercial area has been based on the concept of a low-density project that emphasizes an "escape retreat." Guests at the Hawaii Ka'u Aina Resort would also have the option to visit the adjacent marina shopping complex at the Hawaiian Palace Resort for more extensive shopping activities.

VII - SUPPORT COMMUNITY MARKET ASSESSMENT

The Hawaiian Riviera Resort will provide direct and indirect employment opportunities for the Ka'u region, increasing the need for residential, commercial and public facilities in the area. This chapter assesses the market for a support community near the Hawaiian Riviera Resort.

DEVELOPMENT CONCEPT

The planned support community would be located on 800 acres of land on the makai side of the Volcano Road, about five miles above from the Palace and Ka'u Aina Resorts on Mamalahoa Highway. The initial plans for residential development include a mix of single-family and multifamily residential units, as well as commercial space and sites for public facilities such as fire and police stations, schools, a library, parks and a community center.

The primary market for the residential community is projected to consist of existing and new residents in the region who are employed either directly or indirectly by the Resorts. A secondary residential market could be expected from independent households (self-employed, semiretired and retired) and second home buyers attracted to the community by its support facilities and amenities, proximity to the Resort area and the rural nature of the surrounding region.

RESIDENTIAL MARKET SUPPORT

This section reviews current conditions and recent trends in the residential housing market of Ka'u and presents the market analysis for residential development within the support community.

Current Residential Market Conditions

According to the County of Hawaii, General Plan, Preliminary Draft dated May 1986, there were approximately 1,650 housing units in the Ka'u district in 1985 of which nearly 90% were single-family homes, as shown in the table below:

Housing Unit Inventory in the Ka'u District

1985

Type of unit	Number	Percent distribution
Single-family	1,439	87.4%
Multifamily:		
Duplex	20	1.2
Apartment/condominium	154	9.4
Subtotal	174	10.6
Other/unknown	34	2.0
Total	1,647	100.0%

Source: County of Hawaii, General Plan, Preliminary Draft May, 1986

Currently, the Ka'u real estate market is characterized by a significant supply of vacant lots that are mainly in the partially serviced subdivisions of Hawaiian Oceanview Estates and Hawaiian Ranchos. These areas lack water, electricity and/or other public utilities and services. The single-family lot inventory represents an estimated 17,280 lots as of 1985 with about 15,450 lots or 90% of the total inventory being vacant, although nearly all have been sold by the original developers.

Housing Development Trends

According to unpublished data provided by the Hawaii County Planning Department in July 1987, the 1985 housing inventories reported above represent 208 new units since 1981, distributed as follows:

Housing Completions in the Ka'u District

1981 to 1985

	Single-family	Multi-family	Total
Oceanview Estates and Hawaiian Ranchos	95	-	95
Kamaoa	2	-	2
Mark Twain Estates and Discovery Harbor	44	-	44
Waiohinu-Naalehu	6	25	31
Pahala	11	-	11
Volcano	25	-	25
Total	183	25	208
Percent distribution	88%	12%	100%

Source: County of Hawaii, Planning Department, unpublished data, 1987.

As shown in the table, nearly 90% of new homes completed were single-family units and the majority were constructed in the partially serviced subdivisions, Oceanview Estates and Hawaiian Ranchos.

In addition, a joint effort of State, County, union and private interests completed a 24-unit single-family home project in Pahala in 1986. Homes at Pahala Village average about 1,050 square feet and $57,900, or about $55 per square foot. Development and economic activity of the Kona to North Kohala areas have lent some of the stimulus to the housing market in the Ka'u area. According to realtors and subdivision project representatives, there has been greater interest in Ka'u house lots because of the still affordable land prices, yet relative proximity to the employment and population centers of Kona and Hilo. Also, the demand for rental housing has increased at a faster rate than supply has become available, mainly from young, working people who choose to commute or retirees who own property in Ka'u and may be in the process of building homes.

Characteristics of Selected Subdivisions

As discussed above, the regional housing inventory, including recent developments, consists of nearly all single-family units, whereas multifamily projects have been very few. Thus, four Ka'u single-family residential subdivisions were chosen for review, which together provide the majority of available housing inventory near the proposed Hawaiian Riviera Resort.

The Discovery Harbor and Mark Twain Estates subdivisions have significant infrastructure improvements and are referred to as fully serviced subdivisions, while the Hawaiian Oceanview Estates and Hawaiian Ranchos subdivisions are generally without infrastructure and are referred to as partially serviced subdivisions. The Kula Kai View Estates, Kona South Estates and Kona Gardens subdivisions were also examined for comparative purposes, but not selected for discussion due to the limited amount of development that has occurred in them. Characteristics of the selected subdivisions are summarized in Exhibit VII-A and discussed as follows:

- The subdivisions include a total of 13,200 lots. Lots at the Discovery Harbor, Mark Twain Estates and Hawaiian Ranchos range between 700 to 1,300, while Hawaiian Oceanview Estates contains 10,400 lots.
- Less than 5% of the lots have been improved with homes. About 12,600 lots could still be available to home builders.
- Typical lot sizes range from 14,000 square feet at Discovery Harbor to three acres at Hawaiian Ranchos.
- Current lot selling prices range from about $3,500 to $18,000. Based on the typical lot size within each subdivision, the range is about $5,000 to $8,000 per acre for partially serviced subdivisions with no utilities.
- The initial lot offerings at all four subdivisions have been fully absorbed, with current market activity limited to resales of homes and vacant lots.

Projected Regional Housing Demand

Through expansion of the visitor industry in the Ka'u area, an estimated 1,027 housing units could be needed during the period 1992 to 2009 and an additional 250 housing units could be required through natural increase based on existing households of the region, according to projections developed by Community Resources, Inc. The bulk of the required housing demand is projected for the 1992 to 1997 period when a total of 940 units are projected to be needed to accommodate the direct employment created by the Resort, as shown in the following table:

Summary of Additional Housing Units
Needed in the Study Region by Source of Demand

1992 to 2009

Projection period	Resort-related	Existing households	Total
1992 to 1997	812	128	940
1998 to 2002	168	49	217
2003 to 2009	47	73	120
Total	1,027	250	1,277

Source: Community Resources, Inc., 1987.

The projected housing unit demand has been further segmented according to estimated employment type. The categories and estimated allocations for housing demand have been defined as managerial and professional workers (8% to 10%), supervisory, service and other workers (43% to 47%) and indirect and induced employment (43% to 47%).

Total Supportable Housing Units

The estimated number of supportable housing units at the proposed Hawaiian Riviera Resort support community has been based on factors that would help to distinguish this project from others in the area, including completed infrastructure, proximity to the resort areas and availability of public and commercial facilities. Exhibit VII-B shows the projected housing unit demand in the study area and total supportable housing units for the support community, which is discussed as follows:

- New housing demand has been estimated by Community Resources, Inc. based on resort-related direct, indirect and induced employment and expected future household formation among existing households.
- The housing units are assumed to be completed homes that are effectively marketed and designed, and priced in accordance with the markets targeted.
- Managerial and professional employment housing is estimated at about 40 units, based on a capture rate of 40% of total demand from this segment.
- Supervisory, service and other employment housing is estimated at about 325 units, based on a capture rate of 70% of total demand from this segment.
- Indirect and induced employment housing is estimated at about 280 units, based on a capture rate of 60% of total demand from this segment
- Existing resident housing is estimated at about 60 units, based on a capture rate of 25% of total demand from this segment.

The projected capture rates are based on the following factors:

- Market attractiveness of a master planned community, in contrast to the largely undeveloped and little planned subdivisions of the area.
- Prestige and convenience of location near to the resort area which will include substantial infrastructure and facilities, such as schools, police/fire station, community center and a commercial shopping facility.
- The convenience of and greater economies of scale possible in a finished unit product as compared to a lot sales program where buyers would have to construct their own homes.

In summary, based on the above assumptions, a total of about 540, 655 and 700 supportable housing units are projected at the support community by 1997, 2002, and 2009, respectively.

Exhibit VII-A

HAWAIIAN RIVIERA RESORT

Characteristics of Selected Ka'u Residential Subdivisions

	Number of lots	Number of Homes built(1)	Number of vacant lots	Typical lot size	Estimated current lot selling prices	Estimated prices per acre(2)
Fully serviced subdivisions(3):						
Discovery Harbor	800	60	740	14,000 square feet	$ 9,000 to 15,000	$ 28,100 to 46,900
Mark Twain Estates	706	25	681	1/2 acre	4,000 to 6,000	8,000 to 12,000
Partially serviced subdivisions (4):						
Hawaiian Oceanview Estates	10,400	500	9,900	1 acre	3,500 to 5,500(5) 8,000 to 10,000(6)	3,500 to 5,500 8,000 to 10,000
Hawaiian Ranchos	1,299	30	1,269	3 acres	15,000 to 18,000	5,000 to 6,000
Total	13,205	615	12,590			

(1) May include some homes that are not built according to building code requirements.
(2) Based on typical lot size at the project.
(3) Water, utilities and roads available.
(4) Unpaved roads; property owners typically install own utilities.
(5) Lots at higher elevations, without utilities.
(6) Lots being sold with electricity available.

Source: Discussions with real estate brokers and project representatives.

Housing Unit Type Preferences

Residents of the Island of Hawaii have expressed a strong preference for the traditional detached two- to four-bedroom home on a quarter acre or larger lot. In a 1983 survey of residents prepared for the County of Hawaii, 83% of the respondents indicated that if they were to move, they would prefer a single-family home and 74% of the respondents felt they could afford such a home. A lot size of 10,000 square feet or greater was preferred by 65% of the respondents and thought affordable by 54%. The survey findings regarding housing preferences and affordability are summarized in the table below:

Distribution of Housing Unit-Type
Preferences and Affordability Indicators for
Residents of the Island of Hawaii

	Preference(1)	Affordability(2)
Single-family home:		
On greater than 10,000-square foot lot	65%	54%
On 7,500-square foot lot	13	12
On 5,000-square foot lot	5	8
Subtotal	83	74
Multifamily unit	15	20
Do not know/refused	2	6
Total	100%	100%

(1) Respondents were asked, "If you were to move, which of the following housing units would you prefer?"

(2) Respondents were asked, "Which do you feel you could best afford, given your current income and expectations?"

Source: Based on a survey of 1,055 residents conductec by Hawaii Opinion, Inc., Survey of Big Island Resicents on Planning and Housing Concerns, 1983.

The housing market assessment for the support community assumes that among the 705 households projected to purchase a home at the support community, a greater share could be expected to be able to afford a single-family home than among households countywide. Thus, about 80% of those demanding housing for purchase at the proposed community could be anticipated to seek a single-family unit, and the remaining 20% could seek a multifamily unit. Thus, over the 15-year period from 1992 to 2009, about 560 single-family and 145 multifamily units could be estimated to be supportable at the support community, as shown in Exhibit VII-C.

The proposed support community is expected to have the following characteristics:

HAWAIIAN RIVIERA RESORT

Projected Housing Unit Demand in the
Proposed Support Community by Market Segment

1992 to 2009

Household type	1992 - 1997 Addi-tional	1992 - 1997 Cumu-lative	1998 - 2002 Addi-tional	1998 - 2002 Cumu-lative	2003 - 2009 Addi-tional	2003 - 2009 Cumu-lative
Resort-related employment housing demand(1)	414	414	93	507	14	521
Capture rate	70%	-	70%	-	70%	-
Resort-related employment housing, rounded	290	290	65	355	10	365
Indirect and induced employment housing demand(2)	370	370	70	440	30	470
Capture rate	60%	-	60%	-	60%	-
Subtotal, indirect and induced housing, rounded	220	220	40	260	20	280
Existing resident housing unit demand(3)	128	128	49	177	73	250
Capture rate	25%	25%	25%	-	25%	-
Subtotal, existing resident housing, rounded	30	30	10	40	20	60
Total supportable housing units(4)	540	540	115	655	50	705

(1) Projected housing impact resulting from Hawaiian Riviera Resort development employment generation, as estimated by Community Resources for the study area of Ka'u and South Kona.

(2) Estimated allocation of housing unit demand by resort-related employment type.

(3) Projected housing unit demand resulting from natural increase in existing resident population as estimated by Community Resources.

(4) Figures shown are rounded.

Exhibit VII-C

HAWAIIAN RIVIERA RESORT

Projected Mix of Housing Demand at
Proposed Support Community by Unit Type

1992 to 2009

Type of unit	1992-1997	1998-2002	2003-2009	Total
Additional units in period:				
Single-family	430	90	40	560
Multifamily	110	25	10	145
Total	540	115	50	705
Cumulative unit demand:				
Single-family	430	520	560	
Multifamily	110	135	145	
Total	540	655	705	

- Multifamily units of about 900 to 1,300 square feet.
- Single-family homes of about 1,000 to 1,500 square feet on lots ranging from about 10,000 to 15,000 square feet.
- Landscaping and park areas.
- Completed infrastructure, including roads, utilities and water.
- Part of a master-planned community.
- Proximity to a resort area.
- Proximity to shopping, schools, a library, community center and police and fire protection.

Although no comparable planned community currently exists in the region, the most similar development reviewed was Discovery Harbor. Discovery Harbor is a fully serviced subdivision, where typical 14,000-square foot lots are selling at $9,000 to $15,000 but where there have been few home resales. Lots at Discovery Harbor have views of the golf course within the subdivision as well as good proximity to shopping at Naalehu.

Based on the expected incomes ranges of households projected to seek to purchase homes at the support community, and the other housing developments of the region, units could be expected to find market support at prices ranging approximately as follows:

Projected Residential Unit Prices
at the Proposed Support Community

1987 dollars

	Low	High
Single-family	$ 70,000	165,000
Multifamily	55,000	140,000

COMMERCIAL SPACE MARKET SUPPORT

This section projects the potential market support for the development of a 40,000 square foot commercial facility in the resort area. Market support is based on the anticipated increases to the residential and visitor populations of Ka'u and the Hawaiian Riviera Resort.

Existing and Planned Commercial Space Facilities

Existing commercial space in the study area is currently limited due to the small population base. The towns of Naalehu and Pahala have some commercial space for key tenants such as a financial institutions, grocery stores, gift/-merchandise shops and professional offices. There is a small strip shopping center at the Hawaiian Ranchos project which caters to neighborhood needs.

A commercial development is also planned on two acres of land at the Hawaiian Oceanview Estates. Total planned commercial space is estimated at about 15,000 square feet for use by a lumber/hardware store and post office, and for office space.

Potential Resident Market Expenditures

The projected number of households in the study area supported directly and indirectly by economic development and through growth of the existing household base have been shown previously in the table on page VII-3. These data were used to derive the projected supportable housing units in Exhibit VII-B. Household formation is also used to estimate the projected expenditures by existing and additional regional residents that form the potential consumer market for the planned commercial facilities.

Expenditures on selected retail items including food, clothing, personal care and other consumer goods for a four-person family on Oahu were found to range from 30% to 40% of total family budgets, depending on income level.

Based on a median annual household income for the island of Hawaii of $26,030 (1984 dollars) and an estimated 35% of household income spent on the selected goods and services, annual expenditures throughout the region by these households are projected to amount to $22.5 million in 1997, $24.3 million in 2002 and $25.4 million in 2009, as shown in Exhibit VII-D.

Commercial Space Market Support

Although there is presently no large-scale development of commercial facilities in the study area, potential future facilities could be developed through expansion of the resident population. Residents in the study area may also drive to more developed commercial areas in Kona and Hilo for shopping, especially if it is close to their place of employment.

Based on factors such as potential future competition and consumer behavior patterns, it is estimated that commercial facilities at the support community could capture about 30% of the total projected resident shopping expenditures.

Exhibit VII-D also shows the projected shopping expenditures and supportable commercial space for the support community. Projected annual shopping expenditures at the support community are estimated at about $6.7 million in 1997, $7.3 million in 2002 and $7.6 million in 2009.

Annual sales revenues of $190 per square foot of gross leasable area, in 1984 dollars, were used to estimate the total supportable commercial space. Based on the projected shopping expenditures at the support community, the estimated supportable commercial space amounts to about 35,000 square feet by 1997, 38,000 square feet by 2002 and 40,000 square feet by 2009.

HAWAIIAN RIVIERA RESORT

Projected Resident Commercial Space Demand in the Study Area

1992 to 2009

(1984 dollars)

	1992 - 1997 Additional	1992 - 1997 Cumulative	1998 - 2002 Additional	1998 - 2002 Cumulative	2003 - 2009 Additional	2003 - 2009 Cumulative
Annual household income(1)	$ 26,030	-	26,030	-	26,030	-
Percentage spent on selected goods and services (2)	35%	-	35%	-	35%	-
Estimated shopping expenditures per household	$ 8,677	-	8,677	-	8,677	-
Households in the study area(3)	2,590	2,590	217	2,807	120	2,927
Estimated annual shopping expenditures in study area (millions)	$ 22.47	22.47	1.88	24.35	1.04	25.39
Projected annual shopping expenditures at the Ka'u support community at 30% capture rate (millions)(4)	$ 6.74	6.74	0.56	7.31	0.31	7.62
Projected supportable commercial space at 30% capture rate (square feet)(5)	35,000	35,000	3,000	38,000	2,000	40,000

(1) Average annual household income for the island of Hawaii, 1979. U. S. Bureau of the Census, 1980, adjusted to 1984 dollars.

(2) Expenditures on items that would be available at a shopping center, such as food, clothing, personal care and other family consumption categories. Based on U. S. Bureau of Labor Statistics, 1981 Urban Family Budgets and Comparative Indexes for Selected Urban Areas, 1982.

(3) Ka'u area households projected to be directly or indirectly supported by the Hawaiian Riviera Resort development and projected growth of existing resident households as estimated by Community Resources. Existing households estimated at 1,650 based on County of Hawaii General Plan, Preliminary Draft dated May 1984.

(4) Based on sales of $190 per gross leasable square foot in 1984 dollars. Based on Urban Land Institute, Dollars and Cents of Shopping Centers, 1984 and Hastings, Martin, Gamboy, Brady and Associates, Ltd., 1986. Figures shown are rounded.

APPENDIX I

Water Supply Alternatives

WATER SUPPLY ALTERNATIVES
for the
Hawaiian Riviera Resort
in Ka'u, Hawaii

by
Tom Nance
Belt Collins & Associates

September 1987

INTRODUCTION

Plans are being developed for a large-scale resort near South Point in the Ka'u District on the Island of Hawaii (refer to Figure 1). The resort would include 3900 hotel and residential units, three golf courses, other recreational features, and a nearby 800 residential unit support community. Its implementation would ultimately require a water supply of 5.2 million gallons per day (MGD) in an area where no water supply exists at present. This brief report presents alternatives for the development of water sources and provides order-of-magnitude cost estimates.

GROUNDWATER POTENTIAL BY DEVELOPMENT OF DEEP WELLS

Obtaining the necessary water supply will require the development of deep wells. An assessment of their chances for success can be derived from information developed from an onsite test well, an analysis of potential rainfall recharge to groundwater, and an interpretation of geologic influence on groundwater conditions. Each of these is briefly discussed below.

Hawaii Ka'u Aina Test Well

In 1983, a test well was drilled within the resort property at elevation 1040 feet. The well, identified as State No. 0246-01, is located 3.3 miles from the shoreline. Careful water level measurements, several modifications made to the well, and the pump tests conducted for various configurations of well depth and casing perforations all illustrate the existence of a thin basal lens at this location. The groundwater level at the well is 3.4 feet above mean sea level (msl). The well's chloride content is 300 milligrams per liter (MGL) when pumped at 50 gallons per minute (GPM). With the well deeper or pumped at a greater rate, the chloride content is higher. (All information is from reports of October 23, 1984 and March 20, 1985 by S.P. Bowles.)

Results of this well are consistent with those of the other drilled wells in the region. State test well (No. 0953-01) located 10 miles to the north at Okoe encountered groundwater of 700 to 900 MGL chlorides in a thin basal lens with a water level of 3.8 feet (msl). This well is 1.7 miles from the shoreline. To the south, a well at South Point Airport also encountered brackish water (600 MGL chlorides). Reliable water level data is not

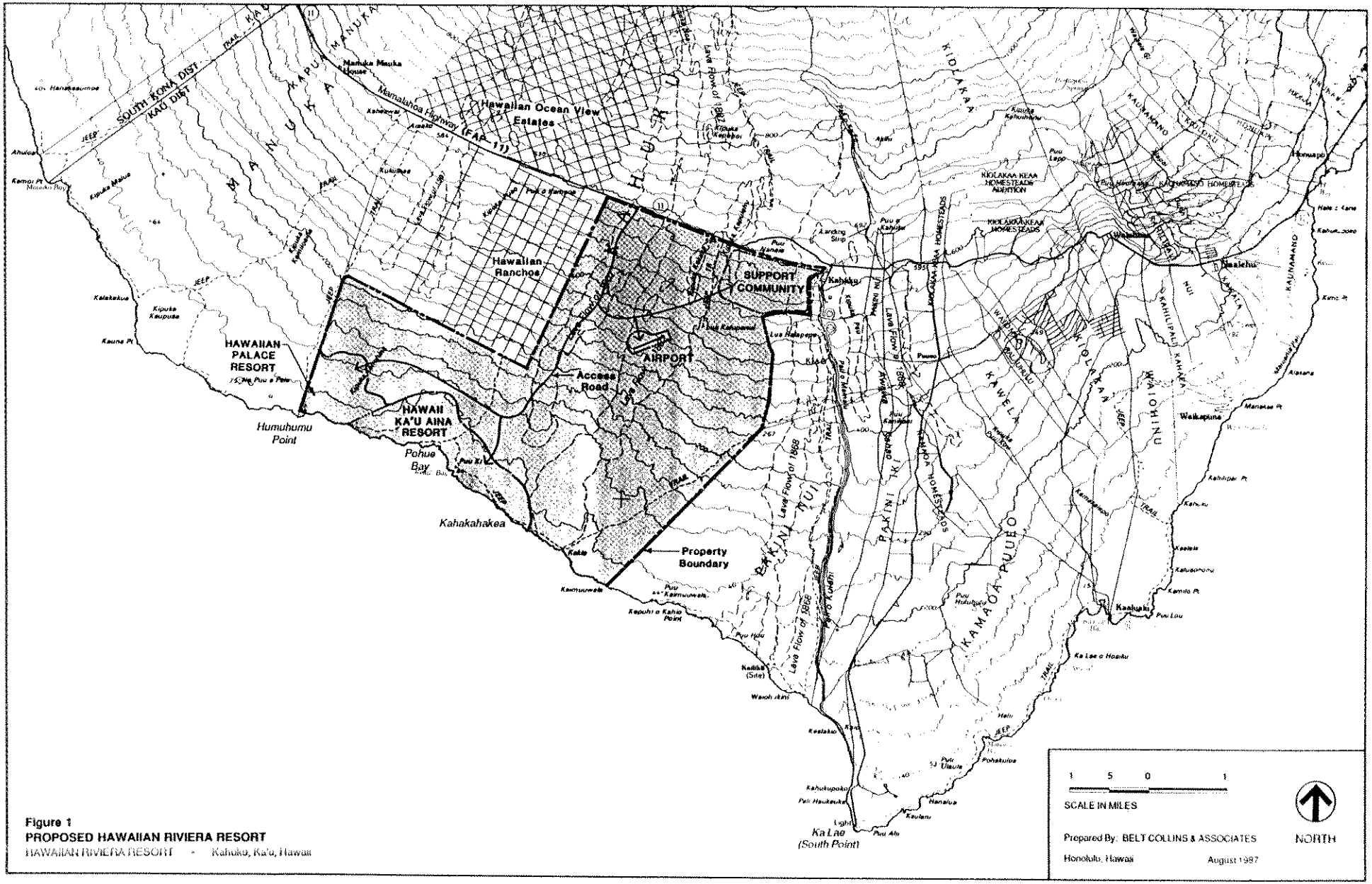


Figure 1
PROPOSED HAWAIIAN RIVIERA RESORT
HAWAIIAN RIVIERA RESORT - Kahuku, Ka'u, Hawaii

available. This well is 0.3 miles from the shoreline. By contrast, wells located to the east have encountered fresh water standing at a higher level. Well 0335-01 between Waiohinu and Naalehu, for example, pumps 10 MGL chloride water at a level of 10 feet (msl). Its location is east of Mauna Loa's southwest rift zone. The presence of older, Kahuku series lavas in this area is significant.

Potential Groundwater Recharge by Rainfall

Figure 2 depicts the extent of the watershed which is considered likely to be contributing to groundwater recharge. In the absence of specific data on geologic control of the flow of groundwater, surface topography has been used to delineate the extent of the watershed. The basin has 48 square miles above Highway 11, 18 square miles from the highway to the 1000-foot contour, and 26 square miles below the 1000-foot contour. A capsule summary of rainfall and potential recharge on this 92-square mile area is tabulated below. Long-term rain gaging stations in the region were used to draw the rainfall isohyets on Figure 2 and establish the rainfall volume. Based on the daily rainfall pattern established by recording rain gage No. 3.9 at Hawaii Ocean View Estates, the negligible soil covering in the upland portion of the watershed above Highway 11, and the absence of soil in the lower portion, groundwater recharge is likely to be in the range of 10 to 20 percent of rainfall. For this report, groundwater recharge is estimated as equivalent to 15 percent of the rainfall volume above Highway 11, 10 percent of rainfall between the highway and 1000-foot contour, and 7 percent of rainfall below the 1000-foot contour.

Summary of Rainfall and Potential Groundwater Recharge

Location	Area (Sq. Miles)	Average Rainfall		Potential Groundwater Recharge (MGD)
		Inches Per Year	Equivalent MGD	
Basin Above Highway 11	47.8	47.0	107	16.0
Basin Between Highway 11 and the 1000' Contour	18.2	40.0	35	3.5
Basin Below the 1000' Contour	25.7	29.0	35	2.5
Total	91.7	40.0	177	22.0

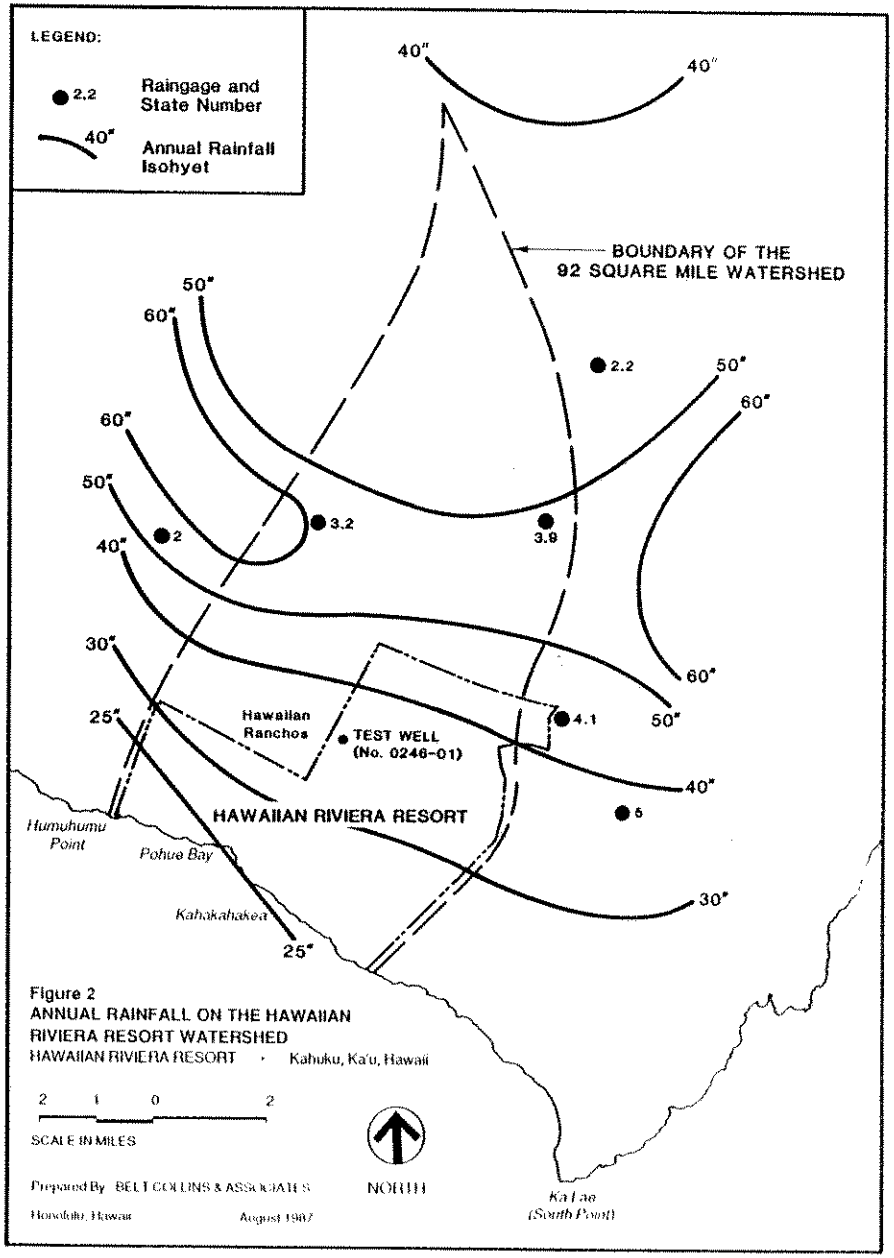


Figure 2
ANNUAL RAINFALL ON THE HAWAIIAN RIVIERA RESORT WATERSHED
HAWAIIAN RIVIERA RESORT · Kahuku, Ka'u, Hawaii

As a preliminary guideline for groundwater development, it has been assumed that draft by wells of not more than half of the recharge occurring on the watershed above Highway 11 can be achieved without significant deterioration of the basal lens. This would amount to a maximum groundwater draft of about five to not more than eight MGD if the wells were appropriately spaced across the entire six- to seven-mile width of the watershed.

Well Locations and Quality of Water Developed

Where seawater intrusion is the primary contaminant, a maximum chloride concentration of 250 MGL has traditionally been used as the criterion of potability. In Hawaii, however, a lower concentration of 160 MGL has been used as a "palatability" criterion for municipal systems. Results of the Hawaii Ka'u Aina test well and the magnitude of potential groundwater recharge both suggest that groundwater of this quality may exist within the boundaries of the resort property. The most promising location for such quality is in the northeast corner next to Highway 11. This location is favored for the following reasons: (1) it would have the furthest distance from the shoreline (6.5 miles), minimizing seawater intrusion; (2) it would be closest to Mauna Loa's southwest rift zone and possible beneficial effect of intrusive geologic structures associated with the rift zone; (3) it may encounter groundwater inland of Pahala ash deposits or a weathered surface of flow lavas at sea level, either of which would inhibit seawater intrusion; and (4) it would be directly upstream of the notable groundwater discharge which occurs along the shoreline between Kakio and Waialua (Fischer, Davis, & Sousa, 1966).

To illustrate the extent of well development necessary to supply the proposed resort, the following assumptions on well location and resulting water quality have been made:

- Wells arrayed parallel to and just makai of Highway 11 would produce water of acceptable quality (chlorides of 160 MGL or less). Maximum pumping capacity in any such well should be 1200 GPM. The pumping lift would be approximately 2000 feet.

- Wells arrayed along the 1000-foot contour would ultimately stabilize at a chloride content of 500 MGL. Wells at this elevation should have a maximum pumping rate of 800 GPM.

- Spacing between the wells should ensure that long-term average groundwater withdrawal does not significantly exceed 1.0 MGD per coastal mile. For the pump capacities stated above, and allowing for a 21-hour pumping day to produce a maximum daily use rate equal to 1.5 times the long-term average, spacing should be 5200 feet for wells in the vicinity of Highway 11 and about 3500 feet for wells along the 1000-foot contour.

- If and when the initial wells establish geologic and groundwater conditions with greater confidence, well locations, pumping rates, and spacing can be adjusted accordingly.

SOURCE DEVELOPMENT ALTERNATIVES

Several source development alternatives warrant consideration: (1) an all potable system with wells arrayed along Highway 11; (2) an all potable system with brackish wells along the 1000-foot contour and desalinization of the brackish well water; and (3) a dual system delivering potable and non-potable water separately. The dual system alternative would use wells at 1000 feet for non-potable supply. It could develop potable water with 2000-foot wells near Highway 11 or by desalinizing brackish water from the wells at 1000 feet. An extensive financial analysis would be required to determine the most economic of these alternatives. The analysis should include the substantial energy recovery possible for all of the alternatives.

The preliminary design and cost comparisons necessary to decide among alternatives are beyond the scope of this report. However, to illustrate the extent of improvements and magnitude of costs, the preliminary layout for an all potable system utilizing 2000-foot deep wells arrayed parallel to Highway 11 will be presented here. The presentation will begin with an estimate of the total water supply required.

Water Supply Requirements

Table 1 presents a relatively detailed projection of the ultimate water requirements of the resort. The summary of requirements tabulated below differentiates between the initial and ultimate supply amounts: 3.2 MGD is required for the initial phase of the resort, most of it for resort uses near the shoreline (95%) and a lesser amount for the mauka support community (5%). The ultimate requirement is 5.2 MGD.

Water Supply Requirements for the Initial Phase

Area	Average Water Demand (MGD)		
	Potable	Non-Potable	Total
Hawaiian Palace Resort	0.58	1.15	1.73
Hawaii Ka'u Aina	0.38	0.88	1.26
Support Community	0.18	0.02	0.20
Total	1.14	2.05	3.19

Ultimate Water Supply Requirements

Area	Average Water Demand (MGD)		
	Potable	Non-Potable	Total
Hawaiian Palace Resort	0.99	1.24	2.23
Hawaii Ka'u Aina	0.73	1.69	2.42
Support Community	0.53	0.02	0.55
Total	2.25	2.95	5.20

Table 1

Estimated Water Supply Requirements for Hawaiian Riviera Resort

Land Use	No. of Sites	Area (Acres)	No. of Living Units	Average Water Demand		
				Potable (MGD)	Non-Potable (MGD)	Totals (MGD
Hawaiian Palace Resort						
Hotel	4	104	1275	0.459	0.306	0.765
Resort Residential	5	69	600	0.210	0.090	0.300
Single Family Residential	5	163	352	0.264	0.000	0.264
Commercial	1	8	--	0.014	0.010	0.024
Golf Course	1	208	--	0.015	0.600	0.615
Recreation Areas & Facilities	5	116	--	0.015	0.074	0.089
Admin. & Maintenance	3	17	--	0.010	0.017	0.027
Roads & Transportation Center	--	99	--	0.000	0.139	0.139
Subtotals for Palace Resort	24	784	2227	0.987	1.236	2.223
Hawaii Ka'u Aina Resort						
Hotel	3	116	1200	0.432	0.288	0.720
Resort Residential	13	346	500	0.175	0.075	0.250
Commercial	2	32	--	0.058	0.038	0.096
Golf Course	2	526	--	0.030	1.200	1.230
Recreation Facilities	6	332	--	0.025	0.000	0.025
Admin. & Maintenance	2	16	--	0.010	0.016	0.026
Roads & Miscellaneous Open Space	--	192	--	0.000	0.070	0.070
Subtotals for Ka'u Aina Resort	28	1560	1700	0.730	1.687	2.417
Support Community						
Residential	7	700	800	0.320	0.000	0.320
Commercial	1	20	--	0.060	0.000	0.060
Parks	2	40	--	0.080	0.000	0.080
Civic	2	10	--	0.030	0.000	0.030
School	1	10	--	0.030	0.000	0.030
Roads	--	20	--	0.000	0.000	0.000
Airport	1	100	--	0.010	0.020	0.030
Subtotals for Support Community	14	900	800	0.530	0.020	0.550
Totals for Hawaiian Riviera Resort	66	3244	4727	2.247	2.943	5.190

Sources for an All Potable System With 2000-Foot Wells

Figure 3 illustrates the basic layout for an all potable system using 2000 feet deep wells. Initially, four 1200 GPM wells arrayed parallel to Highway 11 would be installed. Two of these would pump exclusively to the makai Resort. The other two would supply both the Support Community and the Resort. Future phases would add three more wells. Capital costs are summarized below. Operating costs would be approximately $1.50 per thousand gallons.

Summary of Capital Costs for Source Development

Initial Phase	
Four 2000' Wells With 1200 GPM Pumps	$ 6,800,000
Transmission Pipelines	6,050,000
Head Tank and Pressure Breaking Stations	1,000,000
Subtotal	$ 13,850,000
Engineering and Contingency	2,650,000
Total	$ 16,500,000
Future Phases	
Three 2000' Wells With 1200 GPM Pumps	$ 5,100,000
Transmission Pipelines	1,300,000
Subtotal	$ 6,400,000
Engineering and Contingency	1,200,000
Total	$ 7,600,000

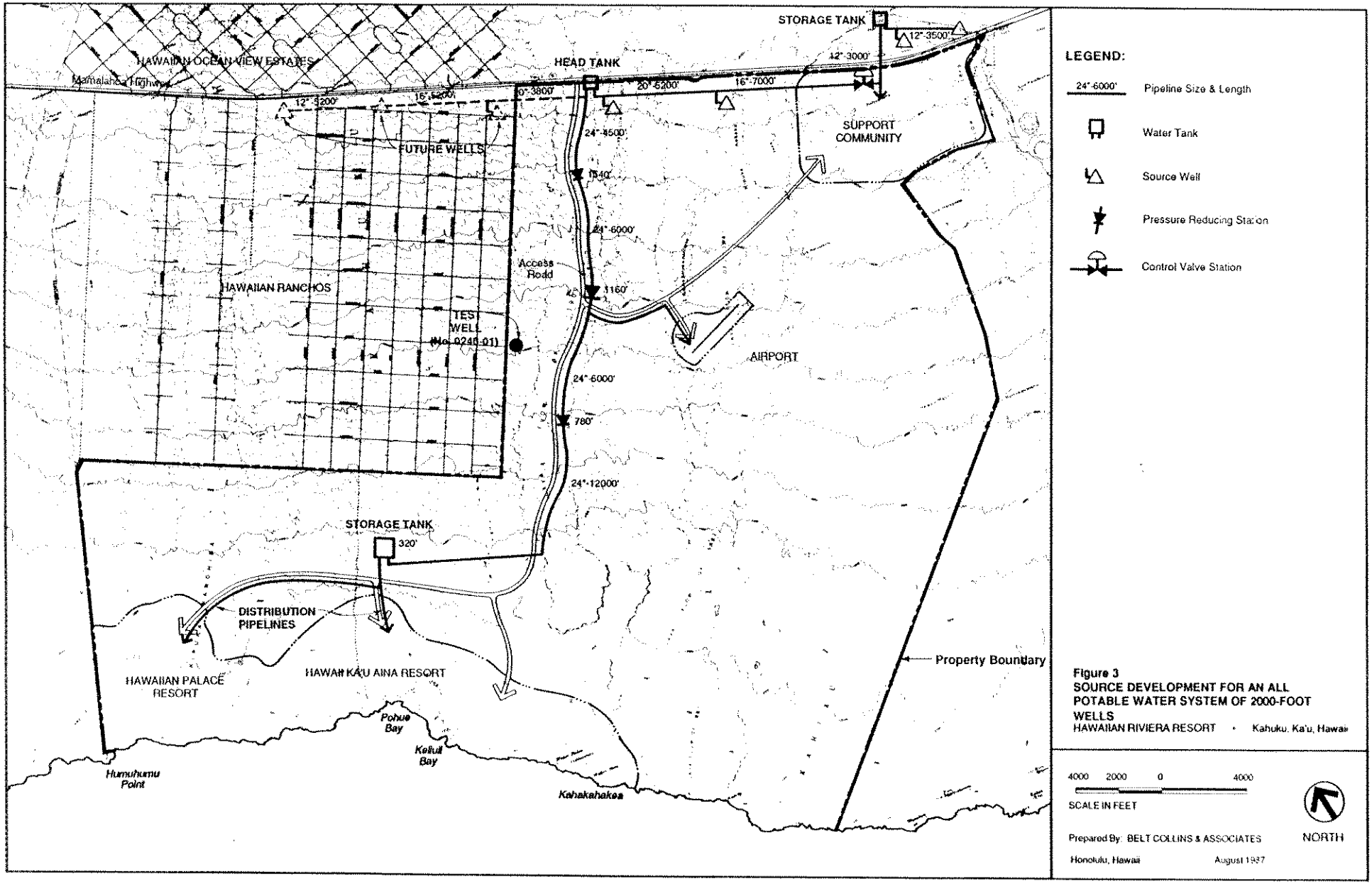


Figure 3
SOURCE DEVELOPMENT FOR AN ALL POTABLE WATER SYSTEM OF 2000-FOOT WELLS
HAWAIIAN RIVIERA RESORT • Kahuku, Ka'u, Hawaii

SUMMARY CONCLUSIONS

Although hydrologic information for the resort site is limited, the following conclusions can reasonably be made:

1. A thin, brackish basal lens exists under the makai half of the resort property. No information is available for the mauka half but it is reasonable to assume that the quality and quantity of groundwater improves with distance from the shoreline.

2. Apparent groundwater recharge indicates that five to eight MGD might be developed without deterioration of the basal lens if wells are adequately spaced and appropriately designed.

3. For the Resort and Support Communities now planned, both capital and operating costs will be substantially greater than for similar resort development elsewhere in West Hawaii.

4. A 2000-foot deep test well would be necessary to demonstrate whether potable-quality groundwater exists in the vicinity of the inland boundary of the property near Highway 11.

5. Energy recovery and possible use of a dual water system should be evaluated when more detailed planning and engineering for this project is undertaken.

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APPENDIX J

Traffic Impact Analysis

TRAFFIC IMPACT REPORT

HAWAIIAN RIVIERA RESORT

KA'U, ISLAND OF HAWAII

PREPARED BY

BELT COLLINS AND ASSOCIATES

SEPTEMBER 29, 1987
REV. DECEMBER 1987

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INTRODUCTION

THIS REPORT ASSESSES THE TRAFFIC IMPACT OF;

1. HAWAIIAN RIVIERA PROJECT,
2. HAWAIIAN RIVIERA PROJECT PLUS THE PUNALUU PROJECT.

FOR THE YEARS 1992 AND 1997. THE EXISTING CONDITION (1987), USING ADJUSTED 1984 DEPARTMENT OF TRANSPORTATION TRAFFIC COUNTS, WAS USED AS THE BASELINE FOR COMPARISON.

IMPROVEMENTS THAT COULD BE MADE TO THE ROADWAY NETWORK AND TRAFFIC MANAGEMENT SYSTEMS TO IMPROVE TRAFFIC FLOW ARE IDENTIFIED IN THIS REPORT.

SUMMARY OF RESULTS

TRAFFIC FROM THE SUPPORT COMMUNITY AT THE HAWAIIAN RIVIERA RESORT, HAWAIIAN RIVIERA AND PUNALUU PROJECTS WILL HAVE A REGIONAL IMPACT BECAUSE EMPLOYEES, VISITORS, CONSTRUCTION WORKERS, MATERIAL SUPPLIERS AND OTHER TRAVELLERS WILL BE COMING FROM AND GOING TO ALL PARTS OF THE ISLAND. THE TRAFFIC IMPACT OF THE PROJECTS WILL BE MOST NOTED ON MAMALAHOA HIGHWAY.

TO DESCRIBE THE OPERATIONAL CONDITIONS OF ROADWAYS AND INTERSECTIONS, LEVEL OF SERVICE (LOS) WAS CALCULATED FOR THE AFTERNOON (PM) PEAK HOUR. LOS IS A QUALITATIVE MEASURE DESCRIBING THE OPERATIONAL CONDITION RANGING IN RATING FROM "A" TO "F" WITHIN A TRAFFIC STREAM.

LOS "A" REPRESENTS FREE FLOW CONDITIONS.

LOS "B" IS IN THE RANGE OF STABLE FLOW, BUT THE PRESENCE OF OTHER USERS IN THE TRAFFIC STREAM BEGINS TO BE NOTICEABLE.

LOS "C" IS IN THE RANGE OF STABLE FLOW, BUT MARKS THE BEGINNING OF THE RANGE OF FLOW IN WHICH THE OPERATION OF INDIVIDUAL USERS BECOMES SIGNIFICANTLY AFFECTED BY INTERACTIONS WITH OTHERS IN THE TRAFFIC STREAM.

LOS "D" REPRESENTS HIGH-DENSITY, BUT STABLE FLOW.

LOS "E" REPRESENTS OPERATING CONDITIONS AT OR NEAR THE CAPACITY LEVEL.

LOS "F" IS USED TO DEFINE FORCED OR BREAKDOWN FLOW. THIS CONDITION EXISTS WHEREVER THE AMOUNT OF TRAFFIC APPROACHING A POINT EXCEEDS THE AMOUNT WHICH CAN TRAVERSE THE POINT.

THE ESTIMATED PM PEAK HOUR TRAFFIC WAS ANALYZED FOR THE EXISTING CONDITION AND VARIOUS DEVELOPMENT SCENARIOS FOR THE YEARS 1992 AND 1997. THE SCENARIOS STUDIED WERE;

EXISTING (1987) PM PEAK HOUR TRAFFIC CONDITION

SCENARIO 1 - TRAFFIC GENERATED BY THE HAWAIIAN RIVIERA RESORT AND SUPPORT COMMUNITY ADDED TO THE "EXISTING" TRAFFIC FOR THE YEAR 1992, I.E. IMPACT OF HAWAIIAN RIVIERA RESORT.

SCENARIO 2 - TRAFFIC GENERATED BY THE HAWAIIAN RIVIERA RESORT, SUPPORT COMMUNITY AND PUNALUU PROJECT ADDED TO THE "EXISTING" TRAFFIC FOR THE YEAR 1992, I.E. CUMULATIVE IMPACT OF PROJECTS IN KAU.

SCENARIO 3 - IMPACT OF HAWAIIAN RIVIERA RESORT AND SUPPORT COMMUNITY FOR THE YEAR 1997.

SCENARIO 4 - IMPACT OF HAWAIIAN RIVIERA RESORT, SUPPORT COMMUNITY AND PUNALUU PROJECT FOR THE YEAR 1997.

THE OPERATIONAL CONDITION (LOS) FOR EACH OF THE MAMALAHOA HIGHWAY SEGMENTS FOR THE EXISTING CONDITION AND FOR EACH SCENARIO ARE LISTED ON TABLE 1.

THE LOS DURING THE PM PEAK HOUR FOR MAMALAHOA HIGHWAY IS CURRENTLY IN HILO IS "C", FROM KEAAU TO SOUTH KONA "A-B" AND IN SOUTH KONA "C".

TRAFFIC FROM THE HAWAIIAN RIVIERA RESORT PROJECT (SCENARIO 1 & 3) WOULD CAUSE THE LOS OF MAMALAHOA HIGHWAY;

FROM HILO TO VOLCANO TO BE REDUCED TO LOS "C".

FROM VOLCANO TO HAWAIIAN RIVIERA RESORT TO BE REDUCED TO LOS "B-C".

TO BE AT LOS "B-C" FROM HAWAIIAN RIVIERA RESORT TO SOUTH KONA.

TO BE REDUCED LOS "E" IN SOUTH KONA.

TRAFFIC FROM THE HAWAIIAN RIVIERA RESORT AND PUNALUU PROJECT (SCENARIO 2 & 4) WOULD CAUSE THE LOS OF MAMALAHOA HIGHWAY;

FROM HILO TO KEAAU TO BE LOS "C-D".

FROM VOLCANO TO HAWAIIAN RIVIERA RESORT TO BE LOS "B-C".

TABLE 1
HAWAIIAN RIVIERA RESORT TRAFFIC STUDY
MAMALAHOA HIGHWAY
ROADWAY LEVEL OF SERVICE

ROADWAY SECTION	SCENARIO	YEAR 1987	1992	1997
HILO TO KEAAU	EXIST.	C		
	SCENARIO 1		C	
	SCENARIO 2		C	
	SCENARIO 3			C
	SCENARIO 4			D
KEAAU TO VOLCANO	EXIST.	B		
	SCENARIO 1		C	
	SCENARIO 2		C	
	SCENARIO 3			C
	SCENARIO 4			C
VOLCANO TO PAHALA	EXIST.	A		
	SCENARIO 1		B	
	SCENARIO 2		B	
	SCENARIO 3			B
	SCENARIO 4			C
PAHALA TO PUNALUU	EXIST.	A		
	SCENARIO 1		B	
	SCENARIO 2		B	
	SCENARIO 3			C
	SCENARIO 4			C
PUNALUU TO HONOAPU	EXIST.	B		
	SCENARIO 1		B	
	SCENARIO 2		C	
	SCENARIO 3			C
	SCENARIO 4			C
HONOAPU TO NAALEHU	EXIST.	B		
	SCENARIO 1		B	
	SCENARIO 2		C	
	SCENARIO 3			C
	SCENARIO 4			D
NAALEHU TO MAIOHINU	EXIST.	A		
	SCENARIO 1		B	
	SCENARIO 2		B	
	SCENARIO 3			C
	SCENARIO 4			C
MAIOHINU TO SOUTH POINT	EXIST.	A		
	SCENARIO 1		B	
	SCENARIO 2		B	
	SCENARIO 3			C
	SCENARIO 4			C

TABLE 1
HAWAIIAN RIVIERA RESORT TRAFFIC STUDY
MAMALAHOA HIGHWAY
ROADWAY LEVEL OF SERVICE

ROADWAY SECTION	SCENARIO	YEAR 1987	1992	1997
SOUTH POINT TO HAWAIIAN RIVIERA RESORT	EXIST.	A		
	SCENARIO 1		B	
	SCENARIO 2		B	
	SCENARIO 3			C
	SCENARIO 4			C
HAWAIIAN RIVIERA RESORT HAWAIIAN OCEAN VIEW	EXIST.	A		
	SCENARIO 1		B	
	SCENARIO 2		B	
	SCENARIO 3			C
	SCENARIO 4			C
HAWAIIAN OCEAN VIEW TO MILOLII	EXIST.	A		
	SCENARIO 1		B	
	SCENARIO 2		B	
	SCENARIO 3			B
	SCENARIO 4			C
MILOLII TO HONAUNAU	EXIST.	A		
	SCENARIO 1		B	
	SCENARIO 2		B	
	SCENARIO 3			B
	SCENARIO 4			C
HONAUNAU TO CAPTAIN COOK	EXIST.	C		
	SCENARIO 1		E	
	SCENARIO 2		E	
	SCENARIO 3			E
	SCENARIO 4			E

TABLE 2
HAWAIIAN RIVIERA RESORT TRAFFIC STUDY
UNSIGNALIZED INTERSECTION LEVEL OF SERVICE ANALYSIS

DESCRIPTION	SCENARIO MOVEMENT	YEAR 1987	1992	1997
MAMALAHOA HIGHWAY AND HAWAIIAN RIVIERA RESORT ENTRANCE ROAD	EXISTING			
	NB LEFT	-		
	RIGHT	-		
	WB LEFT	-		
	SCENARIO 1			
	NB LEFT		B	
	RIGHT		A	
	WB LEFT		A	
	SCENARIO 2			
	NB LEFT		C	
	RIGHT		A	
	WB LEFT		A	
	SCENARIO 3			
	NB LEFT			F
	RIGHT			A
	WB LEFT			A
	SCENARIO 4			
	NB LEFT			F
	RIGHT			A
	WB LEFT			B

NOTE: NB LEFT DENOTES TRAFFIC TURNING LEFT FROM RESORT ENTRANCE ROAD ONTO WEST BOUND MAMALAHOA HIGHWAY.
NB RIGHT DENOTES TRAFFIC TURNING RIGHT FROM RESORT ENTRANCE ROAD ONTO EAST BOUND MAMALAHOA HIGHWAY.
WB LEFT DENOTES WEST BOUND TRAFFIC ON MAMALAHOA HIGHWAY TURNING LEFT ONTO RESORT ENTRANCE ROAD.

FROM HAWAIIAN RIVIERA RESORT TO SOUTH KONA TO BE LOS "B-C".

TO BE LOS "E" IN SOUTH KONA.

THE PROPOSED INTERSECTION OF HAWAIIAN RIVIERA RESORT ENTRANCE ROAD AND MAMALAHOA HIGHWAY WILL BE AFFECTED BY THE ANTICIPATED TRAFFIC INCREASE. INTERSECTION LOS IS SUMMARIZED ON TABLE 2 AND LISTED BELOW.

THE LOS OF RIGHT TURNS OUT OF THE RESORT ENTRY ROAD ONTO MAMALAHOA HIGHWAY IS "A" FOR SCENARIOS 1, 2, 3 AND 4.

THE LOS OF LEFT TURNS OUT OF THE RESORT ENTY ROAD ONTO MAMALAHOA HIGHWAY IS "B" FOR SCENARIO 1, "C" FOR SCEANRIO 2 AND "F" FOR SCENARIOS 3 AND 4.

THE LOS OF LEFT TURNS FROM MAMALAHOA HIGHWAY ONTO THE RESORT ENTRY ROAD IS "A" FOR SCENARIOS 1, 2 AND 3 AND "B" FOR SCENARIO 4.

TO IMPROVE TRAFFIC FLOW ON MAMALAHOA HIGHWAY, TRAVELLED LANES AND SHOULDERS COULD BE WIDENED IN THE VOLCANOS NATIONAL PARK, FROM HONUAPO TO HAWAIIAN OCEAN VIEW ESTATES AND IN SOUTH KONA AND THE PROPOSED INTERSECTION OF MAMALAHOA HIGHWAY AND HAWAIIAN RIVIERA RESORT COULD BE CHANNELIZED. A CHANNELIZED INTERSECTION WOULD FACILITATE TURNING INTO AND OUT OF THE RESORT AND MINIMIZE DISRUPTION OF TRAFFIC FLOW ON MAMALAHOA HIGHWAY.

TRANSPORTATION SYSTEM MANAGEMENT MEASURES SUCH AS STAGGERING WORK HOURS AND DELIVERY TIMES, CAR POOLING OF EMPLOYEES AND PROVIDING BUS SERVICES FOR EMPLOYEES COULD BE IMPLEMENTED TO LESSEN THE ANTICIPATED TRAFFIC IMPACT.

EXISTING CONDITIONS

EXISTING ROADWAY SYSTEM

THE EXISTING ROADWAY SYSTEM IS SHOWN ON FIGURE 1. MAMALAHOA HIGHWAY, A TWO-LANE STATE HIGHWAY EXCEPT FROM HILO TO KEAAU WHERE THE HIGHWAY HAS FOUR LANES, IS THE SINGLE MAJOR HIGHWAY WHICH SERVES THE KAU DISTRICT. MAMALAHOA HIGHWAY LINKS HILO TO KAILUA KONA. THE HIGHWAY LANE WIDTHS VARY BETWEEN 10' AND 12' WITH SHOULDERS OF 0' TO 8' DEPENDING ON LOCATION ALONG THE SOUTHERN PORTION OF THE ISLAND.

HISTORIC TRAFFIC

TRAFFIC VOLUMES HAVE BEEN COUNTED BY THE HIGHWAYS DIVISION, DEPARTMENT OF TRANSPORTATION, STATE OF HAWAII, AT LOCATIONS ALONG MAMALAHOA HIGHWAY FROM 1974 TO 1984. SOME OF

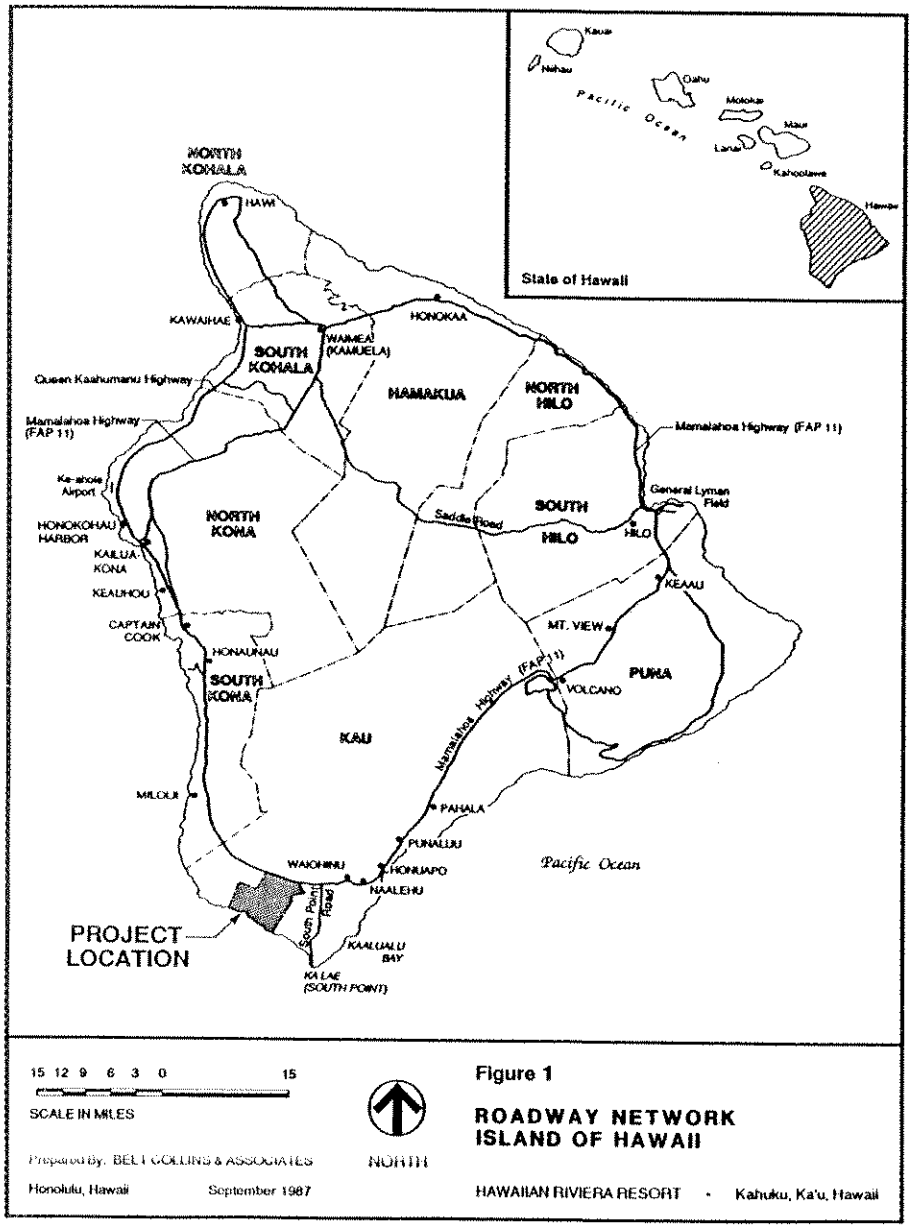


Figure 1

ROADWAY NETWORK
ISLAND OF HAWAII

Prepared By: BELT COLLINS & ASSOCIATES
Honolulu, Hawaii September 1987

HAWAIIAN RIVIERA RESORT - Kahuku, Ka'u, Hawaii

THE COUNT STATIONS ARE LISTED BELOW. THESE COUNTS HAVE BEEN TAKEN AT AN AVERAGE OF EVERY TWO YEARS AND DONNOT INCLUDE TURNING MOVEMENTS.

STATION NO.	DESCRIPTION
1-A	HILO TO KEAAU
3-D	KEAAU TO VOLCANO
3-B	VOLCANOS NATIONAL PARK
4-A	PUNALUU
5	HONUAPO
5-B	SOUTH POINT
5-C	MILOLII
6	HONAUNAU
7	CAPTAIN COOK

HISTORIC TRAFFIC DATA INDICATES THAT TRAFFIC ON MAMALAHOA HIGHWAY HAS INCREASED BY TWO HUNDRED PERCENT FROM 1974 TO 1984 AT SOUTH POINT ROAD, BY ONE HUNDRED SEVENTY PERCENT FROM 1974 TO 1984 IN THE VOLCANOS NATIONAL PARK.

CURRENT BACKGROUND TRAFFIC

TRAFFIC COUNTS TAKEN BY THE DEPARTMENT OF TRANSPORTAION, STATE OF HAWAII WERE USED TO COMPUTE BACKGROUND TRAFFIC VOLUMES.

FUTURE CONDITIONS

FUTURE BACKGROUND TRAFFIC

TRAFFIC LEVELS IN THE REGION HAS GROWN AT DIFFERENT RATES AS MENTIONED PREVIOUSLY. TRAFFIC GROWTH IS ATTRIBUTED TO DEVELOPMENT ON THE ISLAND, AGING OF THE POPULATION, INCREASE IN VEHICLE REGISTRATION, GREATER MOBILITY OF THE POPULATION AND OTHER FACTORS. DATA FROM DATA BOOK, 198-, DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT, STATE OF HAWAII INDICATED THAT VEHICLE REGISTRATION GREW APPROXIMATELY 60% FROM 1975 TO 1985. REGRESSION ANALYSIS OF THE DATA INDICATED THAT VEHICLE REGISTRATION GREW LINEARLY. THE CORRELATION COEFFICIENT OF THE DERIVED LINEAR REGRESSION EQUATION IS 0.93 WHICH INDICATES THAT THE DATA IS VERY CLOSE TO A STRAIGHT LINE. SINCE THE HAWAIIAN RIVIERA RESORT AND PUNALUU PROJECTS ADD TO TRAFFIC GROWTH, THE 5% GROWTH FACTOR APPEARED TO BE TOO HIGH A FACTOR TO INCREASE BACKGROUND TRAFFIC. HOWEVER, SINCE THIS DEVELOPMENT IS IN A REMOTE AREA WHICH PROBABLY WOULD NOT HAVE COMPETING DEVELOPMENTS LIKE IN THE KONA-KOHALA DISTRICTS, A LESSER GROWTH RATE SUCH A 3% MAYBE TOO SMALL. FOR THIS ANALYSIS, A 5% PER YEAR GROWTH RATE FOR BACKGROUND TRAFFIC WAS ASSUMED. TO DERIVE

1987, 1992 AND 1997 BACKGROUND TRAFFIC THE 1984 TRAFFIC WAS INCREASED BY 18%, 48% AND 78% RESPECTIVELY.

PROPOSED DEVELOPMENT

THE TRAFFIC STUDY ASSUMED THE FOLLOWING DEVELOPMENT WOULD OCCUR THE YEARS 1992 AND 1997. IT SHOULD BE NOTED THAT THE HAWAIIAN RIVIERA RESORT INCLUDES HAWAIIAN PALACE RESORT AND HAWAII KAU AINA RESORT.

	YEAR	
HAWAIIIAN PALACE RESORT	1992	1997
LUXURY HOTEL	275 UNITS	275 UNITS
DELUXE HOTEL	625 UNITS	625 UNITS
RESIDENTIAL CONDOS	250 UNITS	375 UNITS
MARINA VILLAGE APTS	150 UNITS	300 UNITS
TOWNHOUSES	75 UNITS	300 UNITS
MARINA COMMERCIAL	80 1000 SF	80 1000 SF
SINGLE FAMILY		352 UNITS
HAWAII KAU AINA RESORT		
HOTEL	400 UNITS	400 UNITS
SINGLE-FAMILY	100 UNITS	300 UNITS
MULTI-FAMILY	200 UNITS	200 UNITS
COMMERCIAL	10 1000 SF	40 1000 SF
SUPPORT COMMUNITY	100 UNITS	800 UNITS
PUNALUU		
DELUXE HOTEL	438 UNITS	438 UNITS
RESIDENTIAL CONDOS	126 UNITS	232 UNITS
SINGLE FAMILY	35 UNITS	66 UNITS

TRIP GENERATION

TRIP GENERATION RATES FOR LUXURY HOTELS WERE DERIVED FROM TRAFFIC COUNTS TAKEN AT THE ENTRANCE TO MAUNA LANI AND MAUNA KEA RESORTS ON JANUARY 21, 1987. THE PEAK HOUR TRAFFIC WAS CORRELATED WITH THE NUMBER OF HOTEL ROOMS TO DERIVE PEAK HOUR GENERATION RATES. TRIP GENERATION RATES FOR DELUXE HOTELS, COMMERCIAL, SINGLE FAMILY AND MULTI-FAMILY UNITS ARE BASED ON RATES PUBLISHED IN TRIP GENERATION THIRD EDITION, 1982, INSTITUTE OF TRANSPORTATION ENGINEERS. TRIP GENERATION RATES ARE SHOWN ON TABLE 3.

THE SUPPORT COMMUNITY IN THE HAWAIIAN RIVIERA RESORT IS EXPECTED TO HOUSE EMPLOYEES OF THE RESORT, HOWEVER, IT IS ANTICIPATED THAT NOT ALL RESIDENTS OF THE SUPPORT COMMUNITY WILL WORK IN THE RESORT. ESTIMATED TRIPS THAT WOULD BE TAKEN BY WORKERS LIVING IN THE SUPPORT COMMUNITY AND NOT EMPLOYED BY THE RESORT WAS MADE BY PEAT, MARWICK, MITCHELL &

TABLE 3
TRIP GENERATION RATES

	ENTER	EXIT
SINGLE FAMILY PER UNIT		
AM PEAK HOUR	0.06	0.17
PM PEAK HOUR	0.19	0.11
MULTI-FAMILY PER UNIT		
AM PEAK HOUR	0.02	0.11
PM PEAK HOUR	0.11	0.05
DELUXE HOTEL PER UNIT		
AM PEAK HOUR	0.28	0.05
PM PEAK HOUR	0.24	0.35
LUXURY HOTEL PER UNIT		
AM PEAK HOUR	0.23	0.04
PM PEAK HOUR	0.20	0.29
COMMERCIAL PER 1000 SQUARE FEET		
AM PEAK HOUR	1.40	1.30
PM PEAK HOUR	3.20	3.40

SOURCE: TRIP GENERATION, THIRD EDITION, INSTITUTE OF TRANSPORTATION ENGINEERS, 1983

NOTE: TRIP GENERATION RATES ARE ADJUSTED FOR UNIT OCCUPANCY.

CO. BASED ON 2.6 WORKERS PER HOUSEHOLD. THE TRAFFIC SPLIT ESTIMATED BY PEAT, MARWICK, MITCHELL & CO. (50% TO KONA, 20% TO KAU AND 30% TO HILO) WAS BASED ON THE RATE OF FUTURE JOB GROWTH.

TRIPS GENERATED BY THE PLANNED PROJECTS ARE SHOWN ON TABLE 4.

TRIP DISTRIBUTION

THE TRIPS GENERATED BY THE HAWAIIAN RIVIERA RESORT AND PUNALUU PROJECTS WERE DISTRIBUTED FROM HILO TO SOUTH KONA ON MAMALAHOA HIGHWAY BY THE FOLLOWING PERCENTAGES FOR THE PM PEAK HOUR;

DESTINATION	HAWAIIAN RIVIERA	SUPPORT COMMUNITY	PUNALUU
HILO	6	15	10
PUNA	7	15	15
PAHALA	10	7	20
PUNALUU	0	3	0
HONOAPU	0	0	10
NAALEHU	8	7	20
WAIOHINU	4	3	10
SUPPORT COMMUNITY	45	0	0
HAWAIIAN OCEAN VIEW ESTATES	10	25	10
KONA	10	25	5

TRAFFIC ANALYSIS

THE PM PEAK HOUR TRAFFIC WAS ANALYZED FOR THE EXISTING CONDITION, AND TWO SCENARIOS EACH FOR 1992 AND 1997. PM PEAK HOUR TRAFFIC WAS ANALYZED TO MEASURE THE PERIOD WHEN THE TRAFFIC IMPACT OF THE PROJECTS WOULD BE THE GREATEST BECAUSE THE PM PEAK HAS HIGHER TRAFFIC LEVELS THAN THE AM PEAK. THE SCENARIOS ANALYZED ARE AS FOLLOWS;

EXISTING TRAFFIC LEVEL (1987) - 1984 DOT COUNTS MULTIPLIED BY 1.18.

SCENARIO 1 - TRAFFIC GENERATED BY THE HAWAIIAN RIVIERA RESORT AND SUPPORT COMMUNITY IN 1992 ADDED TO BACKGROUND TRAFFIC (1984 COUNT * 1.48), I.E. IMPACT OF HAWAIIAN RIVIERA RESORT.

SCENARIO 2 - TRAFFIC GENERATED BY THE HAWAIIAN RIVIERA RESORT, SUPPORT COMMUNITY AND PUNALUU PROJECT IN 1992 ADDED TO BACKGROUND TRAFFIC (1984 COUNT * 1.48), I.E., CUMULATIVE IMPACT OF PROJECTS IN KAU.

TABLE 4
TRIP GENERATION

PROJECT	AM PEAK HOUR ENTER	AM PEAK HOUR EXIT	PM PEAK HOUR ENTER	PM PEAK HOUR EXIT
1992				
HAWAIIAN RIVIERA	246	69	277	350
PUNALUU	110	42	126	163
SUPPORT			7	9
1997				
HAWAIIAN RIVIERA	577	330	698	778
PUNALUU	131	59	143	172
SUPPORT			71	86

SCENARIO 3 - TRAFFIC GENERATED BY THE HAWAIIAN RIVIERA RESORT AND SUPPORT COMMUNITY IN 1997 ADDED TO BACKGROUND TRAFFIC (1984 COUNT * 1.78).

SCENARIO 4 - TRAFFIC GENERATED BY THE HAWAIIAN RIVIERA RESORT, SUPPORT COMMUNITY AND PUNALUU PROJECT IN 1997 ADDED TO BACKGROUND TRAFFIC (1984 COUNT * 1.78).

THE IMPAX TRAFFIC MODEL, DEVELOPED BY PRC ENGINEERING, ORANGE, CA., IS AN INTEGRATED PACKAGE OF COMPUTER PROGRAMS USED IN THIS ANALYSIS TO ANALYZE INCREMENTAL TRAFFIC LOADS ON STREET NETWORKS RELATED TO SPECIFIED LAND USE. INPUT TO THE COMPUTER PROGRAM DESCRIBES THE STREET SYSTEM, EXISTING TRAFFIC, TRIP GENERATION FROM PROJECTS, INTERSECTION INFORMATION, AND DISTRIBUTION OF THE PROJECT TRAFFIC ON SPECIFIED TRAVEL PATHS. TRAFFIC GENERATED BY THE PROJECTS WERE ASSIGNED TO THE ROAD SYSTEM IN THE STUDY AREA, ANALYSES WERE PERFORMED FOR STREET VOLUMES AND INTERSECTION TURN VOLUMES.

LEVEL OF SERVICE FOR UNSIGNALIZED INTERSECTION AND ROADWAYS WERE CALCULATED USING THE METHODS OUTLINED IN HIGHWAY CAPACITY MANUAL TRANSPORTATION RESEARCH BOARD, 1985. HIGHWAY CAPACITY SOFTWARE U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION, JANUARY 1987, ARE COMPUTER PROGRAMS DEVELOPED TO PERFORM CALCULATIONS FOR PROCEDURES OUTLINED IN THE HIGHWAY CAPACITY MANUAL.

THE LEVEL OF SERVICE (LOS) AT THE INTERSECTION OF THE RESORT ENTRANCE ROAD AND MAMALAHOA HIGHWAY WAS ANALYZED FOR THE EXISTING CONDITION AND FOR THE FOUR SCENARIOS DURING THE PM PEAK HOUR.

THE ESTIMATED PM PEAK HOUR TURNING VOLUMES AND LEVEL OF SERVICE AT THE INTERSECTION OF HAWAIIAN RIVIERA RESORT ENTRANCE ROAD AND MAMALAHOA HIGHWAY ARE SHOWN IN THE APPENDIX. LOS OF TURNING MOVEMENTS ARE SUMMARIZED IN TABLE 2.

FOR SCENARIO 1, THE LOS FOR LEFT TURNS FROM THE MAJOR ROAD (MAMALAHOA HIGHWAY) ONTO THE MINOR ROAD (RESORT ENTRANCE ROAD) IS "A", FOR RIGHT TURN OUT OF MINOR ROAD ONTO MAJOR ROAD IS "A" AND "B" FOR LEFT TURNS OUT OF MINOR STREETS ONTO MAJOR STREETS.

FOR SCENARIO 2, THE LOS OF LEFT TURNS FROM THE MAJOR ROAD ONTO THE MINOR ROAD IS "A", FOR RIGHT TURNS OUT OF MINOR ROAD ONTO MAJOR ROAD IS "A" AND FOR LEFT TURNS OUT OF THE MINOR ROAD ONTO THE MAJOR IS "C".

FOR SCENARIO 3, THE LOS OF LEFT TURNS FROM MAJOR STREETS TO MINOR STREETS IS "A", RIGHT TURNS OUT OF MINOR ROAD ONTO MAJOR ROAD IS "A" AND FOR LEFT TURNS FROM MINOR STREETS ONTO MAJOR STREETS IS "F".

FOR SCENARIO 4, THE LOS OF LEFT TURNS FROM MAJOR STREETS TO MINOR STREETS IS "B", RIGHT TURNS OUT OF MINOR ROAD ONTO MAJOR ROAD IS "A" AND FOR LEFT TURNS FROM MINOR STREETS ONTO MAJOR STREETS IS "F".

PM PEAK HOUR LOS FOR ROADWAYS SEGMENTS ARE SHOWN ON TABLE 1 FOR THE EXISTING CONDITION AND THE FOUR SCENARIOS. LOS AND VOLUMES FOR EACH SEGMENT ARE SHOWN IN THE APPENDIX.

FOR THE EXISTING CONDITION (1987), MAMALAHOA HIGHWAY ALONG THE SOUTHERN PART OF THE ISLAND IS OPERATING AT LOS "C" IN HILO, LOS "A-B" FROM KEAAU TO SOUTH KONA AND AT LOS "C" IN SOUTH KONA.

FOR SCENARIO 1, (1992 HAWAIIAN RIVIERA + SUPPORT + BACKGROUND) MAMALAHOA HIGHWAY WILL BE OPERATING AT LOS "C" FROM HILO TO VOLCANO, LOS "B" FROM VOLCANO TO SOUTH KONA AND AT LOS "D" IN SOUTH KONA.

FOR SCENARIO 2, (1992 HAWAIIAN RIVIERA + SUPPORT + PUNALUU + BACKGROUND) MAMALAHOA HIGHWAY WILL BE OPERATING AT LOS "C" FROM HILO TO VOLCANO, LOS "B-C" FROM VOLCANO TO SOUTH KONA AND LOS "E" IN SOUTH KONA.

FOR SCENARIO 3, (1997 HAWAIIAN RIVIERA + SUPPORT + BACKGROUND) MAMALAHOA HIGHWAY WILL BE OPERATING AT LOS "C" FROM HILO TO KEAAU, LOS "B-C" FROM KEAAU TO SOUTH KONA AND LOS "E" IN SOUTH KONA.

FOR SCENARIO 4, (1997 HAWAIIAN RIVIERA + SUPPORT + PUNALUU + BACKGROUND) MAMALAHOA HIGHWAY WILL BE OPERATING AT LOS "D" FROM HILO TO KEAAU, LOS "C" FROM KEAAU TO SOUTH KONA AND LOS "E" IN SOUTH KONA.

IMPROVEMENT ANALYSIS

MAMALAHOA HIGHWAY WILL BE OPERATING BELOW CAPACITY FOR ALL SEGEMENTS BETWEEN HILO AND SOUTH KONA FOR THE EXISTING (1987) CONDITION AND FOUR SCENARIOS AND AT CAPACITY IN SOUTH KONA. SINCE MAMALAHOA HIGHWAY FROM HILO TO SOUTH KONA WILL BE OPERATING BELOW CAPACITY WITH OR WITH THE HAWAIIAN RIVIERA RESORT AND PUNALUU PROJECTS, IT APPEARS THAT IMPROVEMENTS TO THE HIGHWAY ARE NOT NECESSARY EXPECT IN SOUTH KONA. ALTHOUGH IMPROVEMENTS TO INCREASE CAPACITY ARE GENERALLY NOT NEEDED, THERE ARE PORTIONS OF THE HIGHWAY THAT NEEDS TO BE IMPROVED TO FACILITATE SMOOTHER FLOW OF TRAFFIC AND FOR SAFETY. THE PORTIONS THAT NEED IMPROVEMENT ARE LOCATED IN THE VOLCANOS NATIONAL PARK, BETWEEN HONUAPO AND HAWAIIAN OCEAN VIEW ESTATES, AND IN SOUTH KONA.

THE PROPOSED INTERSECTION OF THE HAWAIIAN RIVIERA RESORT ENTRANCE ROAD AND MAMALAHOA HIGHWAY NEEDS TO BE CHANNELIZED FOR SMOOTH FLOW OF TRAFFIC INTO AND OUT OF THE RESORT AND TO MINIMIZE DISRUPTION OF TRAFFIC FLOW ON MAMALAHOA HIGHWAY. WITH CHANNELIZATION, THE TURNING MOVES INTO AND OUT OF THE RESORT ENTRY ROADWAY WILL BE OPERATING BELOW CAPACITY EXCEPT FOR THE LEFT TURN FROM THE RESORT ENTRANCE ROAD ONTO MAMALAHOA HIGH IN SCENARIOS 3 AND 4 WHICH WILL BE OPERATING ABOVE CAPACTIY DURING THE PM PEAK HOUR.

CONCLUSIONS

THE HAWAIIAN RIVIERA RESORT WOULD INCREASE TRAFFIC ON MAMALAHOA HIGHWAY AND WOULD RESULT IN REDUCTION OF LOS BUT NOT TO A POINT WHERE THE CAPACITY OF THE HIGHWAY IS REACHED OR EXCEEDED EXCEPT, IN SOUTH KONA WHERE THE CAPACITY OF THE HIGHWAY IS REACHED.

THE CUMULATIVE IMPACT OF THE HAWAIIAN RIVIERA RESORT AND PUNALUU WILL RESULT IN REDUCTION IN LOS BUT NOT TO A POINT WHERE THE CAPACITY OF MAMALAHOA HIGHWAY IS REACHED EXCEPT IN SOUTH KONA WHERE THE CAPACITY IS REACHED.

IMPROVEMENTS TO MAMALAHOA HIGHWAY SUCH AS ADDITION AND WIDENING OF ROADWAY LANES AND SHOULDERS, INTERSECTION IMPROVEMENTS AND TRANSPORTATION SYSTEM MANAGEMENT MEASURES SUCH AS CAR POOLING, STAGGERED WORK HOURS, BUSSING OF EMPLOYEES MAY BE NEEDED AND SHOULD BE APPROACHED ON A REGIONAL BASIS.

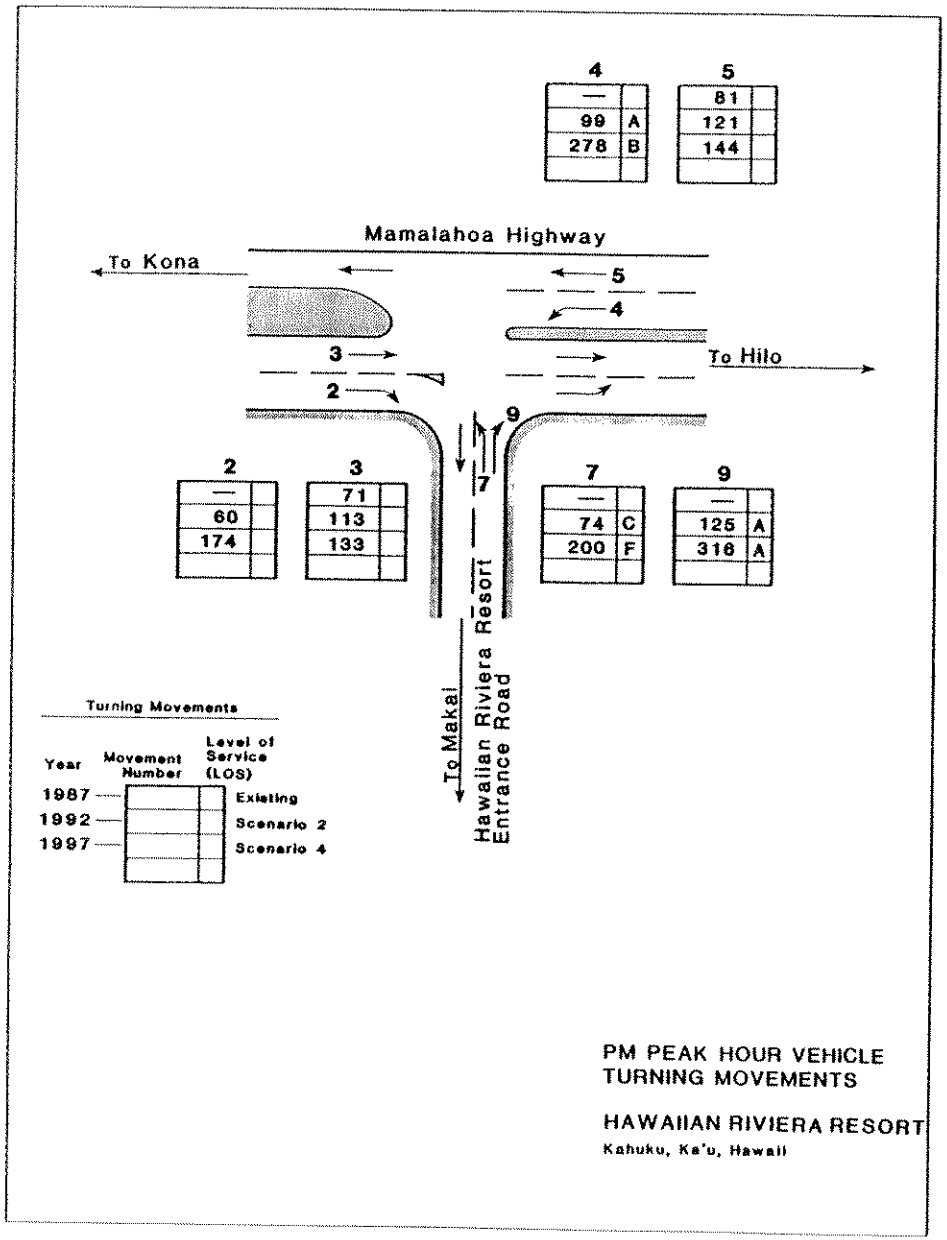
SUMMARY
HAWAIIAN RIVIERA RESORT TRAFFIC STUDY
MAMALAHOA HIGHWAY LEVEL OF SERVICE ANALYSIS PM PEAK HOUR
SCENARIO 1 & 3
HAWAIIAN RIVIERA RESORT + SUPPORT + BACKGROUND TRAFFIC

DESCRIPTION		YEAR/SCENARIO NUMBER 1987	1992/1	1997/3
HILO TO KEAAU	LOS	C	C	D
	NB	892	1141	1406
	SB	951	1210	1487
KEAAU TO VOLCANO	LOS	B	C	C
	NB	184	279	405
	SB	172	320	371
VOLCANO TO PAHALA	LOS	A	B	B
	NB	109	184	291
	SB	68	124	215
PAHALA TO PUNALUU	LOS	A	B	C
	NB	54	152	294
	SB	146	250	407
PUNALUU TO HONOAPU	LOS	B	B	C
	NB	53	151	294
	SB	176	287	453
HONOAPU TO NAALEHU	LOS	B	B	C
	NB	53	151	294
	SB	176	287	453
NAALEHU TO WAIOHINU	LOS	A	B	C
	WB	74	206	395
	EB	63	167	343
WAIOHINU TO SOUTH POINT	LOS	A	B	C
	WB	74	221	429
	EB	63	179	373
SOUTH POINT TO HAWAIIAN TO RIVIERA RESORT	LOS	A	B	C
	WB	61	206	401
	EB	47	187	388
HAWAIIAN RIVIERA RESORT TO HAWAIIAN OCEAN VIEW	LOS	A	B	C
	WB	48	132	328
	EB	71	104	273
HAWAIIAN OCENAN VIEW TO MILOLII	LOS	A	B	B
	WB	48	156	247
	EB	71	177	306
MILOLII TO HONAUNAU	LOS	A	B	B
	NB	110	158	287
	SB	101	177	258
HONAUNAU TO CAPTAIN COOK	LOS	C	E	E
	NB	287	340	532
	SB	452	592	769

NOTE: NB DENOTES TRAFFIC HEADING NORTH
SB DENOTES TRAFFIC HEADING SOUTH
WB DENOTES TRAFFIC HEADING WEST
EB DENOTES TRAFFIC HEADING EAST

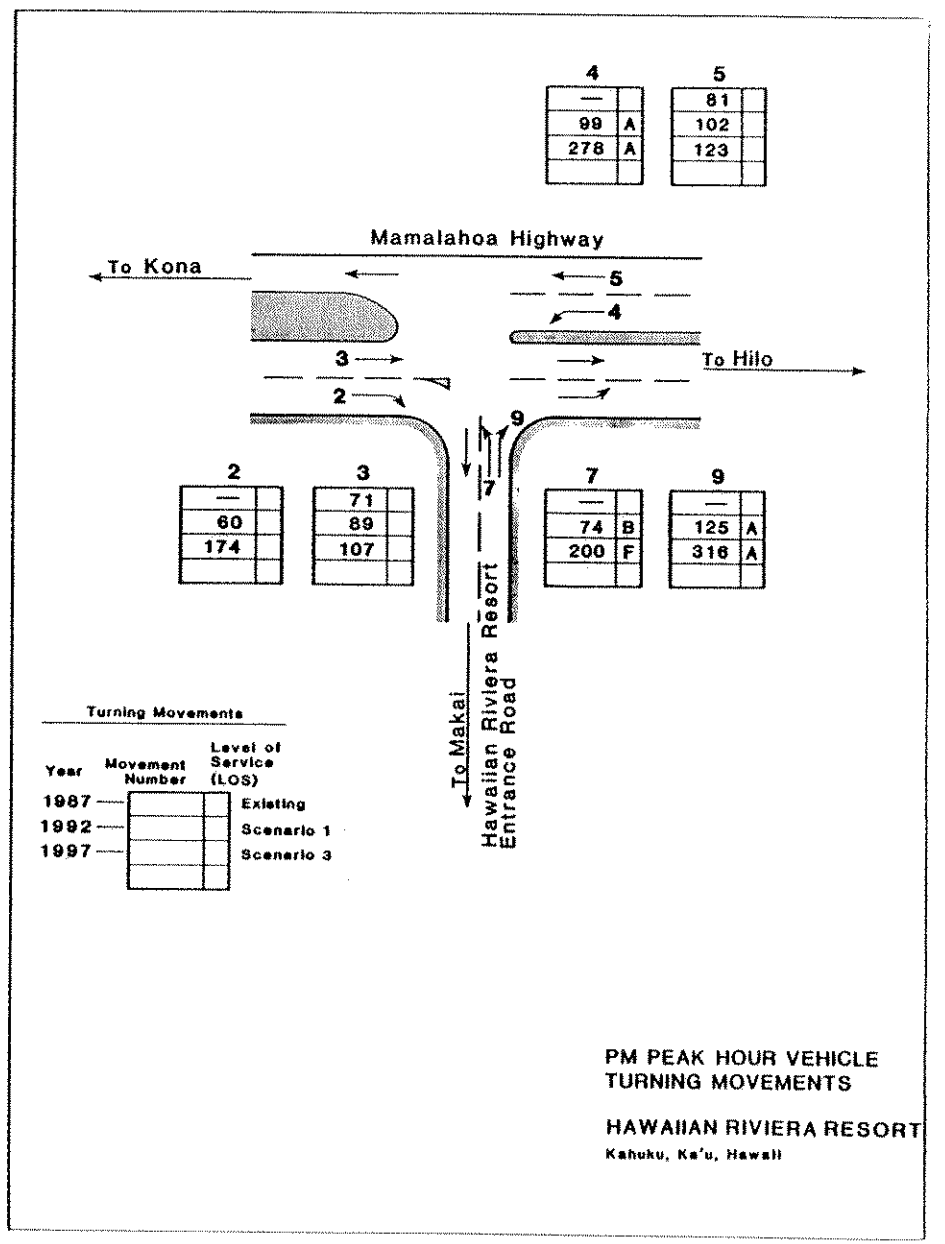
SUMMARY
HAWAIIAN RIVIERA RESORT TRAFFIC STUDY
MAMALAHOA HIGHWAY LEVEL OF SERVICE ANALYSIS PM PEAK HOUR
SCENARIO 2 & 4
HAWAIIAN RIVIERA RESORT + SUPPORT + PUNALUU
+ BACKGROUND TRAFFIC

DESCRIPTION		YEAR/SCENARIO NUMBER 1987	1992/2	1997/4
HILO TO KEAAU	LOS	C	C	D
	NB	892	1157	1423
	SB	951	1223	1501
KEAAU TO VOLCANO	LOS	B	C	C
	NB	184	320	448
	SB	172	286	407
VOLCANO TO PAHALA	LOS	A	B	C
	NB	109	225	334
	SB	68	156	250
PAHALA TO PUNALUU	LOS	A	B	C
	NB	54	225	371
	SB	146	307	471
PUNALUU TO HONOAPU	LOS	B	C	C
	NB	53	221	372
	SB	176	376	548
HONOAPU TO NAALEHU	LOS	B	C	D
	NB	53	208	358
	SB	176	360	531
NAALEHU TO WAIOHINU	LOS	A	B	C
	WB	74	238	450
	EB	63	208	386
WAIOHINU TO SOUTH POINT	LOS	A	B	C
	WB	74	240	450
	EB	63	203	399
SOUTH POINT TO HAWAIIAN TO RIVIERA RESORT	LOS	A	B	C
	WB	47	227	427
	EB	81	206	409
HAWAIIAN RIVIERA RESORT TO HAWAIIAN OCEAN VIEW	LOS	A	B	C
	WB	48	164	360
	EB	71	119	314
HAWAIIAN OCEAN VIEW TO MILOLII	LOS	A	B	C
	WB	48	184	367
	EB	71	166	294
MILOLII TO HONAUNAU	LOS	A	B	C
	NB	101	205	334
	SB	110	193	267
HONAUNAU TO CAPTAIN COOK	LOS	C	E	E
	NB	287	340	539
	SB	452	592	778



PM PEAK HOUR VEHICLE
TURNING MOVEMENTS

HAWAIIAN RIVIERA RESORT
Kahuku, Ka'u, Hawaii



PM PEAK HOUR VEHICLE
TURNING MOVEMENTS

HAWAIIAN RIVIERA RESORT
Kahuku, Ka'u, Hawaii