2002 - Kauai - FEIS -
Ocean Bay

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Ocean Bay Plantation
at Hanamā'ulu

Hanamā'ulu, Kaua'i, Hawai'i
TMK 4-3-7-3:1; 4-3-9-5:5

Final Environmental Impact Statement

Applicant:
EWM Kaua'i, LLC
c/o Walton D. Y. Hong
3135-A Akahi Street
Līhu'e, HI 96766

June 2002

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Prepared By:

GROUP 70
INTERNATIONAL

Group 70 International, Inc.
Architecture • Planning • Interior Design • Environmental Services
Honolulu, HI

This environmental document is prepared pursuant to Chapter 200 of Title 11, Administrative Rules, Department of Health, "Environmental Impact Statement Rules."

Norman Hong, AIA

6/12/02
Date

June 2002

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To facilitate the readers' ability to distinguish the revisions made from the Draft EIS to the Final EIS, substantive changes and additions are underlined. Text that has been deleted is indicated by a ~~strikethrough~~. New sections and revised figures are noted.

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TECHNICAL APPENDICES

A. Ocean Bay Plantation at Hanamā'ulu: Impact on Agriculture (Decision Analysts Hawai'i, Inc., October 2001).

B. Ocean Bay Plantation at Hanamā'ulu Preliminary Engineering Report for Storm Drainage (Kodani & Associates, September 2001).

C. Assessment of the Potential Effects on Surface and Groundwater of the Ocean Bay Plantation at Hanamā'ulu (Tom Nance Water Resource Engineering, March 2002).

D. An Assessment of Potential Effects to the Marine Environment in the Vicinity of the Proposed Ocean Bay Plantation at Hanamā'ulu Līhu'e, Kaua'i, Hawai'i (Marine Research Consultants, December 2001).

E. Botanical Survey-Hanamā'ulu Plantation, Līhu'e District, Kaua'i (Char & Associates, September 2001).

F. A Survey of Avian and Terrestrial Mammalian Species Conducted for the Ocean Bay Plantation at Hanamā'ulu Master Plan, Līhu'e District, Kaua'i (Rana Productions, Ltd., September 2001).

G. Archaeological Inventory Survey Ocean Bay Plantation at Hanamā'ulu, Land of Hanamā'ulu, Līhu'e District, Island of Kaua'i (PHRI, Inc., March 2002).

H. Cultural Impact Assessment Study Ocean Bay Plantation at Hanamā'ulu, Land of Hanamā'ulu, Līhu'e District, Island of Kaua'i (PHRI, Inc., October 2001).

I. Traffic Impact Analysis Report for the Proposed Ocean Bay Plantation at Hanamā'ulu (Randy Okaneku, ~~March 2002~~ June 2002 rev.).

J. Ocean Bay Plantation at Hanamā'ulu Preliminary Engineering Report for Roadways, Mass Grading, On-Site Wastewater (Kodani & Associates, December 2001).

K. Ocean Bay Plantation at Hanamā'ulu Preliminary Engineering Report for Water (Kodani & Associates, December 2001).

L. Conceptual Engineering Report for Wastewater Treatment and Effluent Disposal, Ocean Bay Plantation at Hanamā'ulu (Gray Hong Bills Nojima & Associates, Inc., November 2001).

M. Memorandum: Hanamā'ulu Project (Albert Chong Associates, Inc., December 2001)

N. Market and Economic Impact Studies, Ocean Bay Plantation at Hanamā'ulu, Līhu'e District, Kaua'i (SMS, March 2002).

O. A Condensed Integrated Golf Course Management Plan (IGCMP) for the Proposed Ocean Bay Plantation at Hanamā'ulu Golf Course (Wm. Kent Alkire II, November 2001).

Section 1.0

SUMMARY

1.0 SUMMARY

Section 1.0 provides an overview of the contents and purpose of this Draft Environmental Impact Statement (EIS) along with a description of the public consultation process. In this section, the proposed project and its potential impacts, the appropriate mitigative measures, as well as alternatives to the selected proposed action are discussed.

1.1 PROJECT INFORMATION SUMMARY

Applicant:	EWM Kaua'i, LLC, c/o Walton D.Y. Hong 3135-A Akahi Street Līhu'e, HI 96766 Contact: Walton D.Y. Hong, Tel. (808)-245-4757
Accepting Authority:	County of Kaua'i, Planning Department 4444 Rice Street, Suite 473 Līhu'e, HI 96766-1399 Contact: Keith Nitta, Planner, Tel. (808)-241-6699
Name of Action:	Ocean Bay Plantation at Hanamā'ulu
Planning/Environmental Consultant:	Group 70 International, Inc. 925 Bethel Street, 5th Floor Honolulu, Hawaii 96813 Contact: Jeff Overton, Tel. (808) 523-5866, ext. 104
Tax Map Key:	4-3-7-3:1; 4-3-9-5:5
Land Area:	465 acres (approximate)
Project Location:	Project is located in the Hanamā'ulu area, makai of the intersection of Kūhiō Highway and Kapule Highway. Project area is bounded on its eastern end by the Pacific Ocean and a small portion of Hanamā'ulu Bay.
Landowner:	EWM Kaua'i, LLC
Request:	Applicant would like to develop the Ocean Bay Plantation project that consists of a mix-use residential and golf course community integrated with minimal commercial activity.
State Land Use District:	Agricultural; Urban; Conservation
County of Kaua'i Zoning:	Agriculture; Open; and Open/ST-R
Special Management Area:	Portion of site is located within the SMA

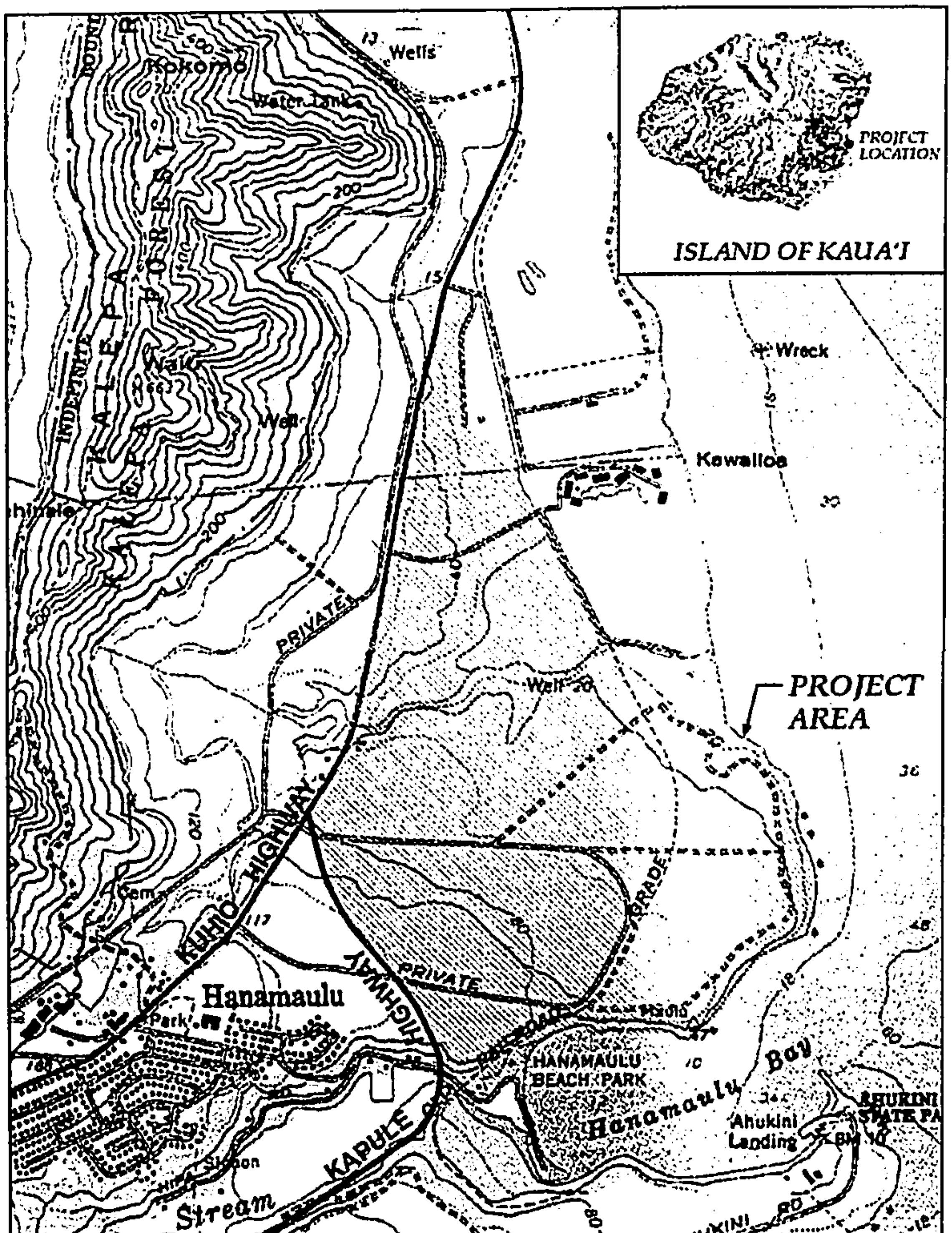


FIGURE 1-1 PROJECT LOCATION MAP

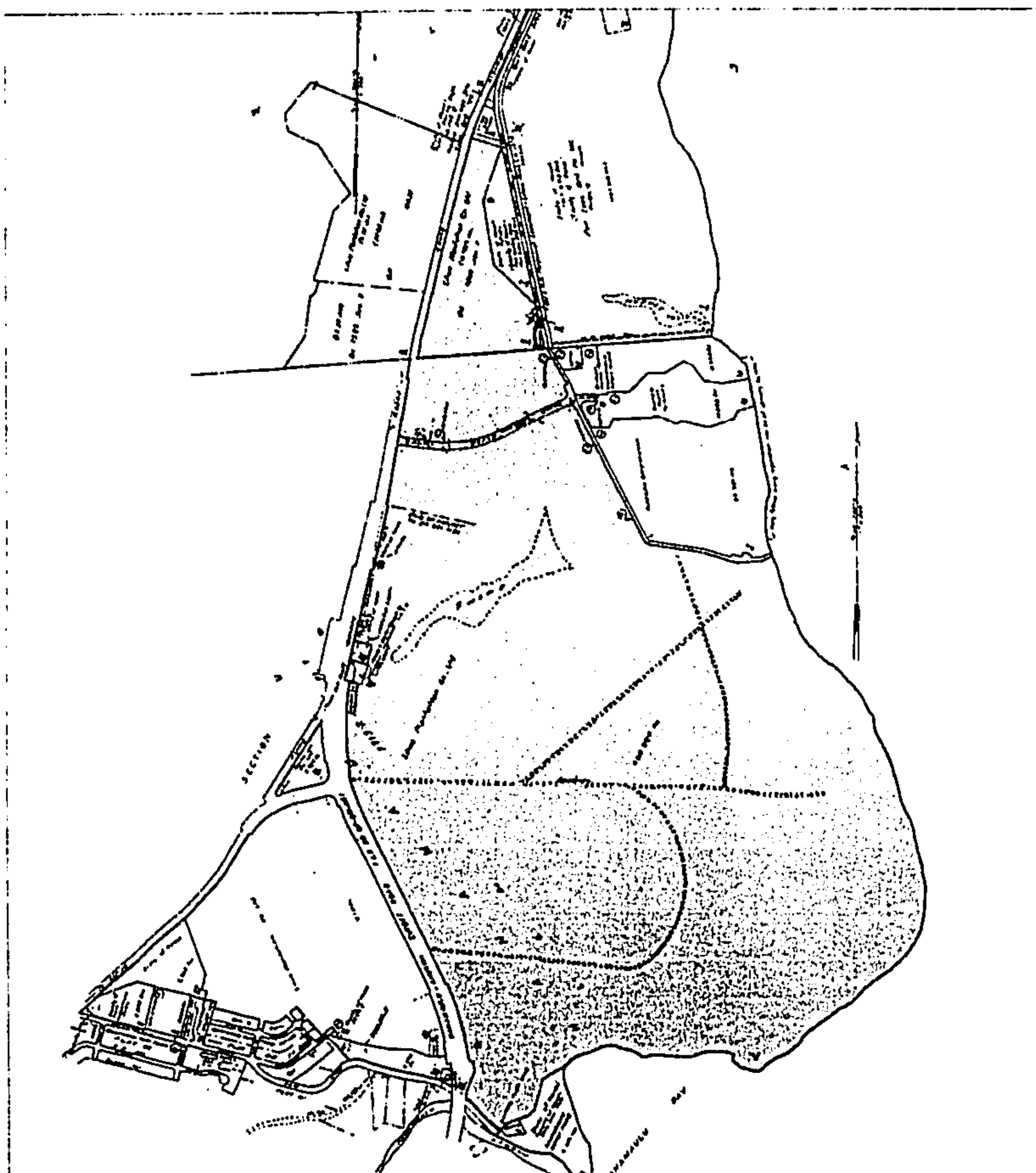


FIGURE 1-2 TMK PARCEL MAP: 4-3-7-3:1; 4-3-9-5:5

0' 600' 1200' 2400'

FIGURE 1-3 AERIAL LOCATION PHOTO

0' 600' 1200' 2400'

1.2 PROPOSED ACTION

The proposed Ocean Bay Plantation at Hanamā'ulu is located about 5 miles north of Līhu'e Airport on approximately 465 acres. The project area is located along the northern rim of Hanamā'ulu Bay extending north along the coastline to the beach just south of the Kaua'i Radisson Hotel. EWM Kaua'i, LLC, the applicant, is seeking the necessary approvals to develop a master-planned residential community of approximately 420 single and multi-family homes planned around an 18-hole championship golf course. Plans for the project include a small-scale retail commercial center, a beach club and ocean cabanas, tennis facility, and a wetlands preserve.

Plans for this proposed low-density master-planned community will include maintaining the open space character of the area by enhancing and maintaining a natural corridor along the coastline, the wetlands, and a highway buffer zone.

Construction of the project's roads, utilities, golf course, and building sites will require soil disturbances such as clearing, grubbing, grading, and excavation. Building construction will involve the wastewater treatment facility, golf clubhouse, tennis center, maintenance building, beach club and ocean cabanas, and the residential units. Infrastructure requirements that will be constructed include: roadways; wastewater collection, treatment, and disposal facilities, potable water and non-potable irrigation water supply and distribution systems; and other utility installations.

The project will create both beneficial and adverse effects on the natural and human environment. A detailed description of the existing environmental conditions was prepared for each potential factor, whereupon an assessment of the potential benefits and adverse effects was conducted.

1.3 SIGNIFICANT BENEFICIAL & ADVERSE IMPACTS

There is a wide range of features associated with this project that will be beneficial to residents of Kaua'i, especially those in the Līhu'e-Hanamā'ulu-Kapa'a region. Anticipated beneficial impacts of the proposed project are listed below.

1.3.1 Beneficial Impacts

1. Approximately 420 new homes will be built, with a significant portion of the lots anticipated to be sold in the price range that would be affordable to moderate-income households.

2. The Ocean Bay Plantation at Hanamā'ulu will improve and maintain two designated public access routes extending from public parking areas located within the developed area to the shoreline access trails.

3. Approximately 31.4 acres of the property is comprised of a wetlands area. The lack of open water limits the quality of the habitat. Enhancements to improve water flow and habitat quality are being proposed to improve the overall conditions of the wetlands area.

4. Overall, approximately 51 percent of the property will be dedicated to enhancing the area's natural and landscaped open spaces and supporting outdoor recreational use.

5. Archaeological resources have been inventoried on the property. Consultation with the State Historic Preservation Division of the Department of Land and Natural Resources for sites requiring further recovery or preservation work will be conducted.

6. A Cultural Impact Assessment has been conducted for the property. Of a potential list of 56 potential informants, a total of 41 informants were able to share information regarding the types of cultural practices that occur within the area, most of which are associated to the immediate shoreline area and inshore waters.

7. Approximately 925 direct construction jobs will be created over the short-term period between 2003 and 2015, and approximately another 400 indirect jobs will create over the same period.

8. Approximately 250 direct operational jobs will be created by time of anticipated project completion in 2015.

9. Net fiscal benefits to the State government as a result of this project are expected to be $12 million (2001 dollars). Net annual fiscal benefits to the County of Kaua'i are projected to be $1.5 million (2001 dollars).

10. Job training will be provided for interested local residents for positions available at the Ocean Bay Plantation golf course, clubhouse, tennis center, and maintenance operations, as well as the retail center.

1.3.2 Adverse Impacts and Proposed Mitigative Measures

Project development activities will involve the construction of residential units, a golf course, roadways, utilities, and support facilities. Short-term construction-related impacts on the environment will be generated by the project. To minimize these impacts, mitigative measures will be implemented.

Short-term Impacts

1. Soils will be disturbed for grading and excavation, and additional soil will be imported for golf course turf and landscaping ground cover. Some soil erosion

will occur during construction but will be controlled on-site. An erosion control plan for the construction activity will be prepared for the project, which must be approved by the County of Kaua'i Department of Public Works. Proposed mitigation will include soils management measures and drainage controls that will minimize soil erosion and control it on-site.

2. Wildlife species, primarily avifauna, in the area will be displaced temporarily to undisturbed areas. Landscape plantings are expected to provide a permanent replacement habitat for some wildlife species in conjunction with plans to improve existing conditions of the wetlands preserve. A coastal renaturalization plan will be implemented that will enhance the existing natural habitat of the property. Over 236 acres of the site will be undisturbed land, landscaped areas and golf course, all of which provide habitat areas for wildlife.

3. Trucks and worker vehicles will create a short-term effect on traffic conditions on local roadways, mainly Kūhiō Highway and its nearby intersections. Mitigative measures that will be implemented to minimize short-term traffic effects will include off-peak truck use of highways and possibly staggering working hours on-site.

4. Noise will be generated by construction activities on the project site. Compliance with existing State and County regulations will mitigate construction noise generated by the project to acceptable levels.

5. Air quality will be affected by the generation of fugitive dust, construction equipment, and worker vehicle emissions. Dust conditions will be controlled by frequent watering of roadways and equipment will be maintained in proper working order to minimize emissions.

6. Construction activities will be most visible along the highway area of the project site. The construction operations will be visible at several points. A setback from the Kūhiō Highway right-of-way may be proposed, which will help buffer construction activities from the highway. Views of the construction operations on-site will be minimized by proper equipment and materials storage, immediate re-vegetation, and non-intrusive security lighting.

<u>Long-term Impacts</u>

1. Grading changes will only be undertaken where necessary and will be coordinated with drainage control improvements. A County of Kaua'i Grading Permit must be obtained prior to construction, and proposed grading changes will be reviewed and approved. The Ocean Bay Plantation at Hanamā'ulu will preserve the wetlands areas, the shoreline conservation area, and other natural buffer areas.

2. Approximately 196 acres of existing land will be cleared of vegetation in the course of constructing the proposed development. Extensive landscaping will be performed to re-establish vegetation zones across much of the area, including the use of native plant species.

3. Existing habitat for birds and other wildlife species will be affected over the 196 acres of cleared area. Some wildlife species will leave these areas and relocate to adjacent open spaces within the project site or neighboring sites. Landscape plantings will re-establish some habitat areas in the golf course perimeter and other planted areas around roadways and buildings.

4. Minor concentrations of nitrates from treated wastewater effluent and fertilizer and pesticides could enter the groundwater through percolation of precipitation and irrigation water. Application of irrigation water, fertilizers, and pesticides will be carefully controlled by a Certified Golf Course Superintendent to avoid over-application. The installation of groundwater monitoring wells will be required to establish baseline pre-project conditions and periodically assess groundwater quality to detect potential degradation of the aquifer.

5. Minor contributions of fertilizer constituents and pesticides will enter storm water runoff generated on the project site. Detention basins, landscaped areas, and golf course turf will collect this runoff during peak precipitation periods. Fertilizers and approved pesticides will be carefully controlled in applied amounts adhering to an Integrated Golf Course Management program. No applications will be made preceding or during high precipitation periods. A Certified Golf Course Superintendent will supervise irrigation and maintenance activities.

6. Non-potable water will be withdrawn from two on-site wells and stored in a series of irrigation ponds. Irrigation demand is projected at between 0.5 to 1.0 million gallons per day (mgd), depending upon precipitation intensity. Use of on-site ground water would initially average about .47 mgd and declining to a long-term average of about .35 mgd.

7. Noise will be generated by vehicles travelling to and from the project on local roadways, and by the operation of maintenance equipment.

8. Parts of the project will be visible from Kūhiō Highway and from some areas along the shoreline. However, due to the distance and slope of the land, the project will generally not be visible from Hanamā'ulu Bay Park.

9. By complete buildout, the total population increase associated to the project development will be approximately 429 persons that includes full-time and vacationing residents.

10. Public services such as police and fire protection, emergency medical facilities, and recreational facilities will be required by the project, but with only minor effects anticipated upon these services. Property tax revenues generated by the project are expected to cover any increase in operational costs caused by the project.

1.4 UNRESOLVED ISSUES

There are several unresolved issues that remain at the time of the preparation of this document, including:

1. Non-potable water source for the project may also include surface water supply from the mauka lands, reservoirs and ditch systems.
2. Traffic improvements planned for Kūhiō Highway and Kapule Highway by the State of Hawaii may or may not be completed over the next 20 years.

1.5 COMPATIBILITY WITH LAND USE PLANS & POLICIES

The planned improvements are compatible with and supportive of State and County of Kaua'i land use policies, plans, and controls related to the natural and social environment. The proposed project is consistent with and permitted by applicable land use designations and, as discussed in Chapter 6, will contribute in a wide variety of ways to furtherance of established public goals, objectives, and policies.

1.6 ALTERNATIVES CONSIDERED

1.6.1 No Action Alternative

The no-action alternative will maintain the site in its present condition as a privately owned agricultural parcel. Continued non-use of the property will result in increased environment impacts associated to the overgrowth of invasive species, soil degradation and erosion, and infestation of vermin in the area.

1.6.2 Alternative Site Development Configurations

Alternative site development configurations included applying a single use to the area such as an exclusive resort or commercial area. The proposed site configuration is designed to create a master planned community that is built to a scale that is complementary to the project surroundings and provides multiple uses that creates a new local community.

1.6.3 Alternative Site Selections

It is the desire of EWM Kaua'i, LLC to revitalize its holdings within the Hanamā'ulu area. Given this objective, no other site selections were considered.

1.7 LISTING OF REQUIRED PERMITS OR APPROVALS

Section 8.0 details the approvals and permits required to implement the proposed Ocean Bay Plantation at Hanamā'ulu project. The entitlements, as shown in Table 8-1, include an amendment to the County of Kaua'i General Plan and an issuance of a Special Management Area (SMA) Use Permit. All necessary ministerial permits such as grading and building will be obtained prior to construction.

Permit or Approval	Authority
Conservation Land Sub-Zone Designation	State of Hawai'i, Board of Land and Natural Resources
Conservation District Use Permit (Landscape)	State of Hawai'i, Board of Land and Natural Resources
Environmental Impact Statement Acceptance	HRS Chapter 243, County of Kaua'i, Department of Planning
County of Kaua'i General Plan Amendment	County of Kaua'i, Planning Commission, County Council
Re-zone or Project District Approval	County of Kaua'i, Planning Commission, County Council
State Land Use Boundary Amendment	State of Hawai'i, Land Use Commission
Special Management Area (SMA) Use Permit	County of Kaua'i, Planning Commission, County Council
Use and Zoning Permits	County of Kaua'i, Planning Commission
Construction Permits	County of Kaua'i, Department of Public Works, Building Division

Section 2.0

PURPOSE & NEED FOR THE PROPOSED ACTION

2.0 PURPOSE FOR THE PROPOSED PROJECT

EWM Kaua'i, LLC is proposing development of approximately 460 acres at Hanamā'ulu, Kaua'i. The proposed project will include a golf course, golf clubhouse, single-family and multi-family residences, recreational amenities, and a small commercial area. The name of the project will be Ocean Bay Plantation at Hanamā'ulu. A detailed project description is included in Section 3.0.

The development schedule for the project is for construction to start in 2003, with the opening of the golf course and occupancy of the first increment of homes by 2005.

The purpose of the proposed project is to create a new world-class golf and residential community at this shoreline property, providing spectacular views of Hanamā'ulu Bay and the east Kaua'i mountains and coastline. Further, the intent of the project is to integrate with the local Kaua'i setting, providing a master-planned community with new homes, and substantial economic benefits including new jobs and expanded tax revenues to the County.

This section provides an overview of the major project elements (golf, housing and commercial) and the purpose and need for each of these planned uses at Hanamā'ulu. Market demand for the proposed project elements is presented in a study completed by SMS (March 2002 rev., Appendix N).

2.1 Golf Course

The new 18-hole golf course at Hanamā'ulu will be a high-quality facility that will be unique in Kaua'i and Hawai'i due to its location and design. Plans call for the golf course to be integrated with the residential areas of the project, to enhance the quality and open space character of the development. As a daily-fee golf course, the facility will be open to visitors and Kaua'i residents. Project residents will be members of the golf course and other recreational amenities of the development.

Golf has a strong appeal to both residents and visitors to Kaua'i. The island's nine courses are all open to the public. Municipal golf courses are found at Wailua, just north of the project site, and two small courses at the Grove Farm Golf Course at Puakea and Kukuiolono Golf Course at Kalaheo on the south side of Kaua'i. There are three resort golf areas, including Princeville (45 holes), Po'ipū (36 holes) and the Kaua'i Lagoons (36 holes), and more golf is planned at Kukui'ula and Waimea. There should be ample demand for the golf course at Hanamā'ulu based on anticipated increases in both resident and visitor populations. Future demand can be anticipated based on projections of population growth, in proportion to increases in the resident and overseas visitor populations, as reflected in Table 2-1 and 2-2.

Table 2-1
Current and Anticipated Demand for Golf on Kaua'i

	1999-2001	2005	2010	2015	2020
Residents	300,000	306,954	326,136	355,166	388,302
Interisland Visitors	25,000	25,000	25,000	25,000	25,000
Overseas Visitors	150,000	171,464	201,096	227,519	252,433
Total Rounds (1)	475,000	503,418	552,232	607,685	665,735

Source: SMS, March 2002

Table 2-2
Net Demand for Golf Over and Above the Proposed Plantation Course

	1999-2001	2005	2010	2015	2020
Total Rounds	475,000	503,418	552,232	607,685	665,735
Growth over Current Demand		28,418	77,232	132,685	190,735
Proposed Project Rounds		10,000	33,571	40,000	40,000
Remaining Demand		18,418	43,661	92,685	150,735

Source: SMS, March 2002

Given the anticipated strong demand for golf on Kaua'i, the data indicate that there will be net additional demand after play at the proposed project. Projected demand could support a similar course opening around 2005, and at least one more course by 2010.

2.2 Residential

Ocean Bay Plantation at Hanamā'ulu will be a distinctive residential community. It's prominent location along the scenic east Kaua'i shoreline, and direct access to a premier golf course will provide a unique setting for these homes. The proposed development of up to 40 single-family homes and 33 lots for custom homes is planned in the initial residential phases. The initial phases will also include development of up to 250 multi-family residences, to be built in increments. Later phases of residential development will provide up to 100 single-family house lots.

The target market will be both resident buyers and the vacation home market. The vacation home market is anticipated to be primarily from the U.S. mainland. The proximity to the island's center at Līhu'e provides the potential for current residents to move into a new planned community at Hanamā'ulu. In relation to potential competition, the project will have advantages due to it's golf course attraction, convenient location, and benefits of being part of a planned community.

Table 2-3 presents data on residential sales and projected demand for Kaua'i, including both resident housing demand and vacation home demand. Refer to SMS (March 2002 rev., Appendix N) for additional details on housing demand and the anticipated market and absorption rates. Sales of single-family homes have been more consistent in the single-family market. The data for sales projection indicate that the single-family homes and house lots will take up to 10 years to sell. Given the current trend, the multi-family units will take longer to sell: however, sales incentives including access to the golf course may improve the absorption rate for these units.

Table 2-3
Projected Resident and Vacation Housing Demand on Kaua'i

2-2 (a) Projected Resident Population Growth (2000-2025 projection)

	Resident Population	Population Growth	Average HH Size	Households	Cumulative Demand
2000	57,200		2.87	19,930	
2005	60,500	3,300	2.80	21,621	1,690
2010	65,800	8,600	2.73	24,134	4,203
2015	72,000	14,800	2.66	27,085	7,154
2020	78,700	21,500	2.59	30,384	10,454
2025	85,400	28,200	2.53	33,816	13,886

Source: SMS, March 2002

2-3 (b) Annual Visitor Count and Vacation Unit Demand (2000-2025 projection)

	AVC	Visitor Plant	Units for Seasonal Use (1)	Vacation or Second Homes (2)		Cumulative Demand	
				Low	High	Low	High
2000	18,500	7,159	3,850	1,925	2,888		
2005	21,800	8,436	4,537	2,268	3,403	343	515
2010	24,800	9,597	5,161	2,581	3,871	656	983
2015	27,500	10,642	5,723	2,861	4,292	936	1,405
2020	30,500	11,803	6,347	3,174	4,760	1,249	1,873
2025	33,800	13,080	7,034	3,517	5,276	1,592	2,388

Source: SMS, March 2002

2-3 (c) Kaua'i Resident and Vacationer Housing Demand (2005-2015 projection)

	2005	2010	2015	2020
Resident New Demand	1,690	2,513	2,951	3,299
Vacation New Demand				
Low	343	312	281	312
High	515	468	421	468
Competition				
Resident Market	400	800	1,100	1,100
Visitor Market	450	650	650	650
Net Demand				
Low	1,184	1,375	1,482	1,862
High	1,355	1,531	1,623	2,018

Source: SMS, March 2002

2.3 Gateway Village Commercial Center

A small commercial area is planned at the project entrance with Kūhiō Highway. With it's location on the major roadway north of Līhu'e, the commercial area will serve a mix of residents and visitors to Kaua'i. A visitor information center is planned as one of the tenants, indicating the anticipated primary revenue source for the center.

Historical data show that visitor expenditures on Kaua'i can be conservatively forecast to grow by 1.5 percent annually over the next five years, and then by 1 percent annually for the next 10 years. Resident spending will grow at about the same rates in each period.

Existing shopping centers are shown in the following Table 2-4, along with the projected additional gross leasable area supported by the anticipated growth in expenditures.

Table 2-4
Existing Shopping Centers on Kaua'i

Shopping Centers on Kauai	Year Opened	GLA
Kukui Grove Shopping Center	1982	314,702
Kukui Marketplace	1994	145,812
Wal-Mart	2000	150,000
Kauai Village Shopping Center	1990	112,000
Princeville Center	1983	66,188
Coconut Marketplace	1975	65,500
Eleeele Shopping Center	1955	61,009
Kukui Grove Phase II (K Mart, Borders)	1998	60,000
Kapaa Shopping Center	1961	53,995
Ching Young Village	1981	41,000
Rice Shopping Center	1973	39,143
Poipu Village Shopping Center	1985	37,312
Pacific Ocean Plaza	1978	31,762
Old Koloa Town	1984	23,493
Anchor Cove Shopping Plaza	1989	20,647
TOTAL		1,222,563

Based on the growth projections for expenditures on Kaua'i, the additional commercial space gross leasable area (GLA) that can potentially be supported is shown below.

Year	Growth (sq. ft.)
2005	73,100
2010	102,500
2015	154,900

About 40,000 sq. ft of commercial space is planned at the Gateway Village center. The total amount of square footage includes approximately 30,000 in occupied retail space with the remaining footage reserved for office space and a gas station. By 2010, there will no doubt be competing stores and expansion of some centers, but there is likely to be ample demand for additional retail space. As illustrated in Table 2-4, the proposed Gateway Village center is similar in size to the Ching Young Village center in Hanalei (41,000 sq. ft) and the Po'ipū Village Shopping Center (37,312 sq. ft.).

It is anticipated that the Gateway Village Commercial Center would capture approximately 15% of visitor traffic and an estimated 2% of residential traffic that pass by the project site along Kūhiō Highway each day. As such, it is estimated that 90% of the retail space would be supported by highway visitor traffic. These estimates do not include local residential traffic from within the project area. Refer to SMS (March 2002 rev., Appendix N) for additional detail.

As mentioned, another logical component of the Gateway Village commercial area would be the inclusion of office space for businesses that could be supported at this location. Various local service businesses could establish offices here, such as law offices, real estate, and consulting practices. The office component also allows for traveling business people that own a second home at the project to establish a functional remote office space. There is a fiber optic line installed along Kūhiō Highway at the project site, and this facility would allow for broadband communications links to mainland and international business sites. Depending upon the type of business, some may eventually find that they may be able to spend more time on Kaua'i and still stay involved with their business responsibilities. In turn, additional local employment opportunities may result.

Section 3.0
PROJECT DESCRIPTION

3.0 PROJECT DESCRIPTION

This section presents a discussion of the proposed Ocean Bay Plantation at Hanamā'ulu, including elements of the Master Plan. Also discussed in this section are construction activities, infrastructure, a preliminary development timetable, public access, and open space/preservation areas.

3.1 OVERVIEW OF MASTER PLAN

EWM Kaua'i, LLC, intends to develop the subject property to provide a mixed-use residential and golf course community on approximately 460 acres of coastal land in Hanamā'ulu, Kaua'i. This low-density master-planned community will include large open space areas to preserve the coastline strand, open space and wetland resources, and maintain the open space character and sense of place of the surrounding area. The project will include a small retail commercial center at its access to Kūhiō Highway.

The Ocean Bay Plantation at Hanamā'ulu is a new master-planned community that will serve the U.S. mainland, international, the local Kaua'i and Hawai'i market for single-family custom homes and quality multi-family housing.

The proposed components of the Master Plan (*Figure 3-1*) for the Ocean Bay Plantation at Hanamā'ulu include:

- 18-hole golf course, golf clubhouse, driving range and tennis facility
- Approximately 73 lots for single-family homes (a mix of lots ranging from 15,000 to 30,000 sq. ft.)
- Up to 250 multi-family condominium homes (8 units/acre) built in three areas
- Up to 100 single-family house lots on 55 acres (0.5-acre lots)
- An open space corridor along the coastline, wetlands and highway buffer
- A small-scale retail commercial center on approximately 12.5 acres
- Infrastructure facilities to support the overall development
- Beach club and ocean cabanas

Details of each of the project components are presented in the following section.

3.2 Golf Course, Driving Range and Clubhouse

Approximately 153 acres of the property will be used to create an 18-hole golf course and surrounding landscaped areas. An 18-hole championship golf course has been designed for this site in Hanamā'ulu by Robin Nelson (Nelson & Hayworth). The golf course is the signature element of the development, with dramatic ocean and coastline settings on five holes. The golf course will weave through the site with residential frontage along much of its length.

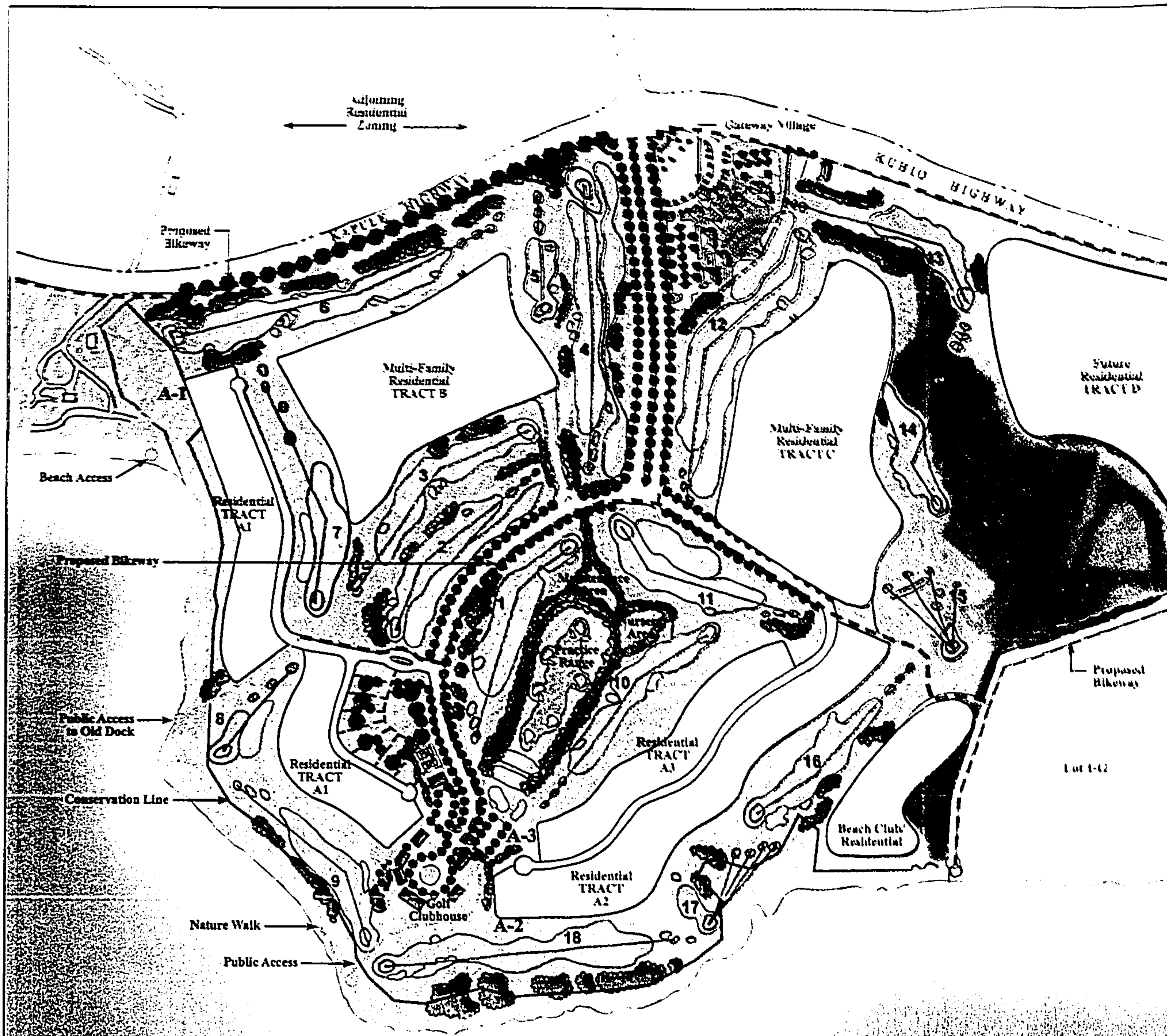


Figure 3-1 (Revised) Overall Master Plan

Ocean Bay Plantation
at Hanamā'ulu

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

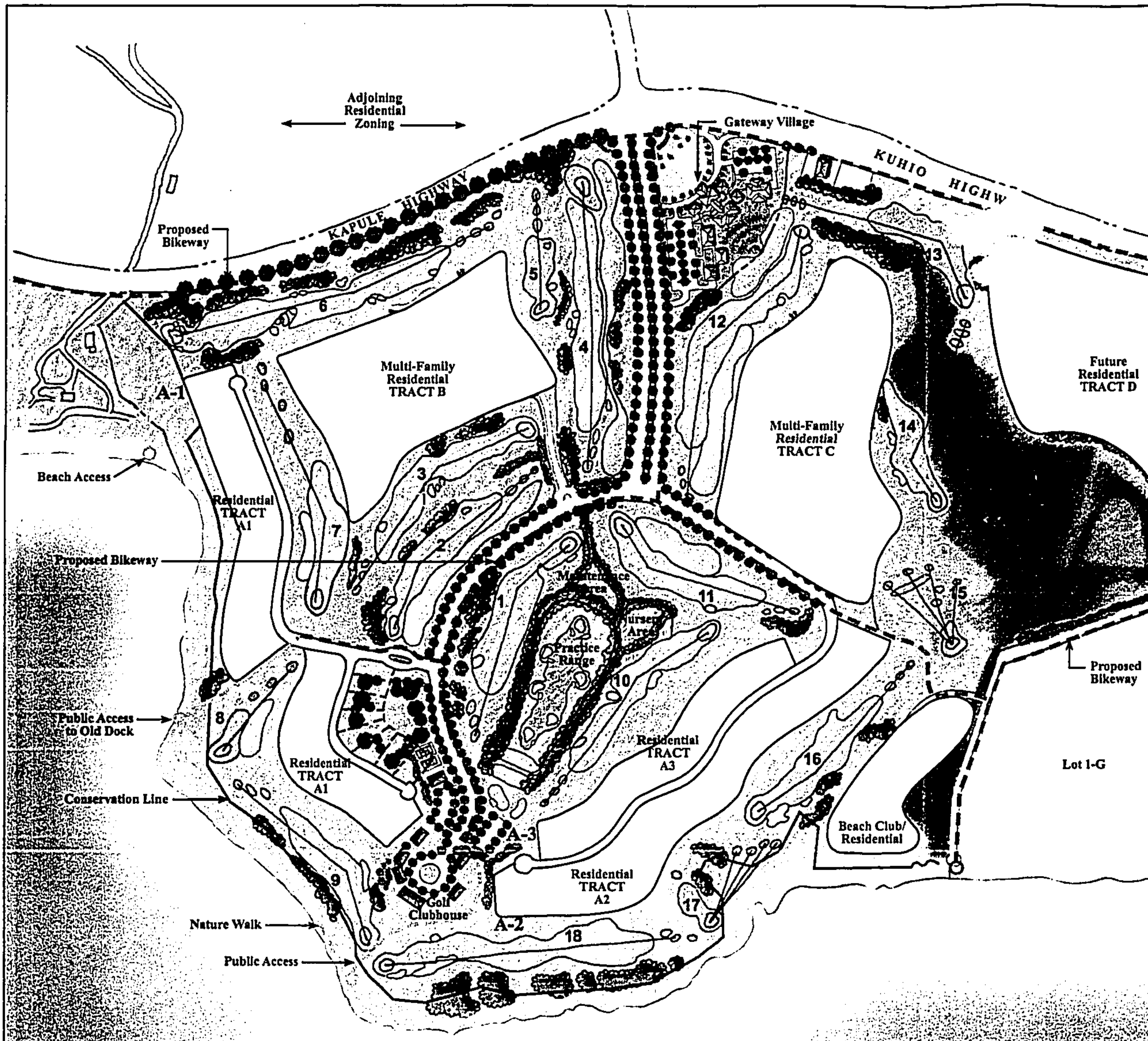
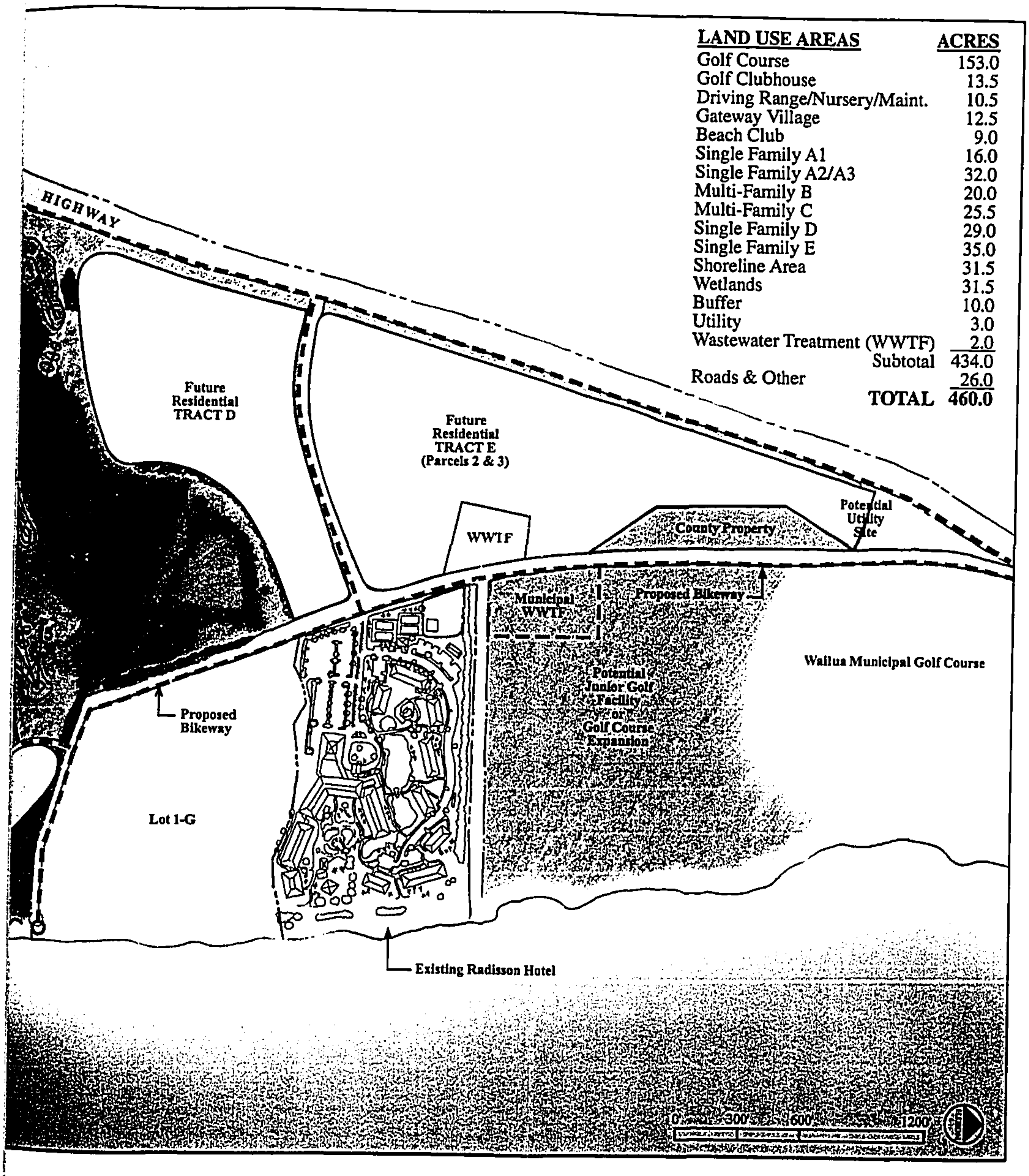


Figure 3-1 (Revised) Overall Master Plan

Ocean Bay Plantation
at Hanamā'ulu



LAND USE AREAS	ACRES
Golf Course	153.0
Golf Clubhouse	13.5
Driving Range/Nursery/Maint.	10.5
Gateway Village	12.5
Beach Club	9.0
Single Family A1	16.0
Single Family A2/A3	32.0
Multi-Family B	20.0
Multi-Family C	25.5
Single Family D	29.0
Single Family E	35.0
Shoreline Area	31.5
Wetlands	31.5
Buffer	10.0
Utility	3.0
Wastewater Treatment (WWTF)	2.0
Subtotal	434.0
Roads & Other	26.0
TOTAL	460.0

GROUP 70
INTERNATIONAL
June 2002

The Master Plan (Figure 3-1) shows the proposed layout for the golf course. There will be ponds constructed as water features on several golf holes, which will serve as aesthetic features along with providing storm water detention and irrigation water storage functions. The golf course will utilize native plant materials along the makai edges to be consistent with the coastline area plantings.

The golf course will have a golf clubhouse and golf operations support facility located at the southeastern corner of the property. The clubhouse will have clubrooms, snack bar, office, lockers, a kitchen, dining and lounge areas, meeting rooms, a pro-shop and administrative offices. The building will have a total floor area of approximately ~~12,000~~ 25,000 sq. ft. Golf carts will be stored and maintained in a garage area on the ground floor.

A golf driving range and practice putting green are associated with the clubhouse site. The driving range will have up to 35 tee positions and a small manager's office. Additional amenities in the clubhouse area include tennis courts and landscaped gardens.

A golf course/grounds maintenance area and nursery are located on approximately one acre adjacent to the golf driving range. This facility will serve as the base for maintenance operations for the overall development.

3.3 Single-Family Residential

The current plan is to develop up to 173 single-family homes in several increments. As shown in Figure 2-1, four areas have been designated as single-family housing areas.

The first phase of approximately 16 acres will include up to 31 homes, each on lots ranging from 15,000 to 20,000 sq. ft., fronting the 8th and 9th golf course holes along Hanamā'ulu Bay. These homes overlooking the bay will be built as a single development with a consistent design theme.

Another increment of 42 homes is planned along the ocean side of the property, fronting the golf course holes 16/17/18. Approximately 32 acres have been allocated for this phase, with individual lot sizes ranging from 15,000 to 30,000 sq. ft. Custom homes will be built in this increment following the design guidelines established for the overall community.

At the northern portion of the property, two areas totaling approximately 55 acres are planned for future increments of single-family housing. The current plan for this area is for up to 100 homes to be developed, on house lots of approximately 0.5-acre. These homes are anticipated in the later phases of the development process, in a five to 10 year time horizon, and will be marketed primarily to the Kaua'i resident buyers.

3.4 Multi-Family Residential

Two areas of approximately 20.0 acres and 25.5 acres are planned for development of up to 210 multi-family homes. A third multi-family housing area of up to 40 units is planned for about 5.0 acres adjacent to the beach club. The multi-family housing areas are shown in Figure 3-1.

The multi-family developments will be planned with a density approaching 8 units per acre. The relatively low-density scale of development in the multi-family increments will afford large areas of landscaped open space surrounding the two-story buildings. The style of construction will follow the design guidelines established for the overall community.

Each of the multi-family housing areas will include a recreation center, including tennis courts, swimming pool and rooms for games, parties and other gatherings. The interior roadways will be low-traffic areas that will be safe for walking and bicycle riding.

3.5 Gateway Village Commercial Center

A small commercial development is planned for about 12.5 acres at the project entrance to Kūhiō Highway. At this location, the residents and guests to the project, as well as visitors traveling on Kūhiō Highway, would have convenient access to a variety of retail and service businesses. This part of the project is named Gateway Village due to its prominent location at the intersection of Kapule Highway and Kūhiō Highway, at the "gateway" to the windward and north coast. Access to the Gateway Village Center would be provided from the Main Access Road, servicing the commercial and retail portion of the project. An additional entry and exit would be provided along Kūhiō Highway.

Gateway Village would provide a total gross leasable area of approximately 40,000 sq. ft. Possible tenants for this location would include a visitor information center, restaurants, gift shops, real estate office, bank, gas station, and a convenience store. Several small office buildings are included in the plan to provide a convenient place of business for visiting business activities or resident executives that require office space.

3.6 Beach Club

The beach club is envisioned to be a small recreational facility, providing access for residents and guests to the community. The facility is planned as a 5,000 sq. ft. beach club main facility, including a swimming pool, kitchen and dining area, meeting and game rooms, and large covered lanais. There will be rest rooms with showers and changing areas. As part of the beach club, four to six small (approximately 600 sq. ft.) beach cottages are planned for day use, with private quarters that will be reserved for member gatherings. Vehicular access to the beach club would be via a driveway off the main circulation roadway network, with service truck access off Kaua'i Beach Drive.

3.7 Shoreline Areas and Public Access

Most of the existing shoreline area is part of the State-designated Conservation District, which consists of a dense stand of ironwood trees that were planted during the plantation era to serve as a salt spray buffer. A coastal renaturalization plan has been submitted for approval by the County Department of Planning, allowing for the removal of the many diseased or dead ironwood trees and the restoration of this conservation habitat with specific plantings of natural native and non-evasive plant species. The overall goal of this effort is to revitalize the natural conditions of the area's habitat prior to influence of the sugarcane industry.

The shoreline area will be accessible via ~~two~~ a number of designated public access routes extending from public parking areas located inside the development, as shown in Figure 3-1 (revised). Signage indicating directions to the public parking areas and shoreline access trails will be installed along each of the main roadways.

One public access route extends from the residential area, leading to a walking path that crosses along the edge of the 8th golf course hole. This pedestrian trail leads down the low bluff to the landing area at Hanamā'ulu Bay.

A second public access is located at the golf clubhouse. This walking path extends from a parking lot, across the clubhouse grounds, through the golf course between the 9th and 18th holes, leading to the dramatic ocean point at the entrance to Hanamā'ulu Bay.

Two additional accesses to the shoreline are already available from public lands or right-of-ways at both the northern and southern portion of the project area.

3.8 Wetlands Preserve

There is a total of 31.4 acres of wetlands located within the property, as shown in Figure 3-1. The wetlands area will remain undeveloped as a wildlife preserve area, as it provides habitat for three of the endangered Hawaiian waterbirds. The wetlands boundary has been surveyed and mapped, and the boundary map has been submitted to the US Army Corps of Engineers for certification.

There is very limited open water found in the wetlands, which is a function of the very dense growth of sedges and other water-dependant plants. The lack of open water limits the quality of the habitat for foraging and nesting activities of these waterbirds. Some enhancement could be proposed to improve water flow and habitat quality, and enhance the character of the wetlands with grass removal and the creation or open water areas. It is possible that portions of one or two golf course holes will be built over small areas of wetlands, with placement of some small areas of fill.

3.9 Other Open Space Areas

There are several large space areas around the perimeter of the project site that will remain as undeveloped open space. The largest of these areas includes the slope of the valley at the southwest corner (Līhu'e-side) of the parcel, fronting Hanamā'ulu Stream and Hanamā'ulu Bay Park. This area contains mostly non-native vegetation.

A portion of the site to the north of the project entrance is also sloped woodland, which will largely remain intact and undisturbed. This wooded area may be used for passive park and trails, connecting with the adjoining wetlands area.

3.10 Highway Buffer

Lands along the project boundary fronting the Kapule Highway and Kūhiō Highway will be reserved as highway buffer area. A buffer strip of up to 50 feet in width will be provided along the highway, which will be excluded from development of golf course, structures and project landscaping. This highway buffer strip will be available for the County to extend its landscaping project to the north from the Hanamā'ulu Stream bridge.

3.11 Roadways and Bike Routes

The interior roadway system consists of asphalt concrete roadways providing roadway connection to the various residential areas, the golf course clubhouse, and other project uses. The entry roadway will be a divided road with a landscaped median and 24 ft. width on both sides. The interior collector and smaller service roadways will all have two lanes, and vary in widths from 20 to 24 feet according to the intensity of use. The project roadways are planned to be without curbs, and include grassed shoulders. Sidewalks will be provided on one or both sides of the road in the residential areas.

Bicycle routes will be established within the interior roadway system, as shown in Figure 3-1. The regional bikeway route will extend along the project frontage along Kapule Highway and along Kūhiō Highway. This bikeway will have a designated extension into the project site along the main access road, continuing to the north toward the Kaua'i Radisson Hotel. The bikeway route would continue along Kūhiō Highway to the neighboring hotel entrance.

3.12 Potable Water Supply System

The project site is located at the south end of the Wailua-Kapa'a Water System. This system is interconnected with the Puhi-Līhu'e-Hanamā'ulu water system. The project water system planned to serve the project is anticipated to connect to this County water system. The details of the water system are described in Appendix K prepared by Kodani & Associates, Inc. (December 2001).

The water supply system will be extended from Kūhiō Highway through the project's roadway network. Potable water demand for the project is estimated to range between 200,000 to 250,000 gpd (average daily demand) at full development.

3.13 Non-Potable/Irrigation Water System

Irrigation water will be provided through two on-site wells. Non-potable water will be withdrawn from these wells, and stored in a series of irrigation ponds. Irrigation demand is projected at between 500,000 to 1.0 million gpd, depending upon the seasonal rainfall conditions.

The first of two irrigation wells to be developed on the property has been installed at the mauka portion of the project near Kūhiō Highway, within the proposed Gateway Village area. Preliminary testing results from this well have shown adequate capacity and satisfactory water quality to meet the demands of the golf course and landscaping plantings of the project.

The golf course, multi-family residential areas and landscaped grounds will be irrigated with non-potable water from a series of storage ponds that are fed by the on-site wells and treated wastewater effluent (see Section 3.5). It has not been determined if a dual water system will be installed for use on individual single-family residential properties.

Refer to Appendix C prepared by Tom Nance Water Resources Engineering (December 2001) for detailed information regarding the irrigation water supply source.

3.14 Wastewater System

The master-planned community of approximately 420 homes, commercial and recreational uses is anticipated to generate a maximum of 260,000 gpd of wastewater at full development. A wastewater collection system will be installed throughout the circulation roadways, with gravity flow to a pump station, located between the golf course holes 15/16.

The wastewater pump station will convey raw wastewater via force main to an on-site treatment facility, located on 2.0 acres adjacent to the mauka boundary of the existing wastewater facility serving the Kaua'i Radisson Hotel (Figure 3-1). Back-up facilities such as emergency power supply and redundant pumps will be installed to insure continuous service in the event of power outages. A 24-hour/day system of monitors, alarms and signals will be used to remotely alert the plant management personnel of service interruptions.

A sequential batch reactor is the type of wastewater treatment facility proposed for use at this community. This is a very effective mechanical treatment process that has a proven track record in Hawai'i. This is a secondary treatment process that includes sand filtration and ultraviolet light disinfection, to produce R-1 effluent quality. Effluent disposal is planned through golf course irrigation as the primary disposal system, and injection well system as the back-up disposal system.

The proposed plan for wastewater management and facilities design will involve review and approval by the State Department of Health (DOH). The DOH has issued their conceptual acceptance of the planned wastewater treatment and reuse system (Letter dated November 19, 2001). A description of the wastewater collection and treatment facilities is included Appendix L, prepared by Gray Hong Bills Nojima & Associates, Inc. (November 2001).

3.15 Drainage System

The development of the property from its current fallow agricultural state will involve the creation of impervious surfaces (parking lots, roadways, buildings, play courts, etc.) that will not allow for direct infiltration of rainfall. Drainage of storm water runoff will be managed through a series of on-site detention basins and ponds. The Master Plan (Figure 3-1) shows the planned location of ponds on the property. Runoff will be collected on-site through a series of grassed swales, and drainage collection structures installed in the project roadway system. As compared to the current runoff conditions at the site, the volume and rate of discharge from the landscaped project will be lower.

Runoff will be discharged to the drainage channel along Kaua'i Beach Road, and another drainage area shoreline area. The drainage routing plan is shown in the Drainage Report prepared by Kodani & Associates, Inc. (Appendix B).

3.16 Generalized Summary of Construction Activities

3.16.1 Clearing, Grubbing, Grading and Excavation.

The areas planned for new development will be cleared of the remnant sugarcane and invasive exotic plants to prepare for the installation of infrastructure and construction of the golf course, new homes and support facilities. The site clearing will be done incrementally, according to the approved plans for the Grading Permit, including a detailed Erosion Control Plan and application for a National Pollutant Discharge Elimination Systems (NPDES) permit. The former use of the site for sugarcane cultivation has left the majority of the property in a generally open character, with little mature vegetation and no unique landforms beyond the shoreline area.

Approximately 180 acres will be graded for the new golf course, driving range, clubhouse and support facilities. About 125 acres will be graded for the new residential development. Over 12 acres will be graded for the Gateway Village commercial center. Preliminary areas for development are shown on the Master Plan (Figure 3-1). The earthwork quantities involved in grading are not known at this time, pending more detailed site topographic survey, site design and civil engineering calculations.

There will also be substantial excavation required in the construction of the project's storm water drainage system, including detention basins and ponds along the golf course. The project will utilize excavated material on-site within the overall project grading operations, and no off-site transport is anticipated. Trenching and excavation will be required along the planned roadway routes and elsewhere along planned utility routes within the project. The installation of drainage, potable and non-potable water lines, wastewater collection lines, and electrical and communications conduit will require trenching. Trenching depths depending upon the individual utility requirement and site conditions (24 to 36 inch depth minimum).

3.16.2 Roadway Construction

The project's internal roadway system includes approximately 19,500 ft of asphalt concrete roadways, which will be built in phases. The main entrance to the project at Kūhiō Highway will require improvements for turning lanes and the acceleration and deceleration lanes. Intersection improvements at this location are also anticipated to allow for smooth traffic flow once the project is operating.

3.16.3 General Construction

The development of the single-family homes, multi-family homes, golf clubhouse, Gateway Village and the beach club will require general construction services. Typical general construction activities include excavation, grading, masonry, carpentry, plumbing, electrical, roofing, and painting. The residential build-out will be phased.

3.16.4 Planting and Landscaping

Landscaping will be generous throughout the project. Aside from the building architecture, the landscaping is the most important component to establishing aesthetic quality and character. The entrance to the project and the main access road will have extensive planting, as will grounds surrounding the golf course and clubhouse, and the residential areas. The theme for the overall landscaping will be the use of native species as much as possible. The theme along the coastal areas will be re-naturalization of the native vegetation species.

3.17 Estimated Construction Costs

Preliminary estimates of construction cost for the development are based upon the major cost categories, including site construction, mass grading and excavation, infrastructure (roads, sewers, water, drainage), electrical utilities/communications, and building construction of the residential, commercial and recreational facilities. The total development cost for the project is estimated at $250 million.

3.18 Preliminary Project Schedule

Current plans anticipate the development of the project to be phased over a period of 10-15 years. The first phase would involve construction of the golf course, clubhouse, 73 single-family homes and the Gateway Village commercial area. Under the present schedule, site clearing, grading and infrastructure would begin in 2003. The golf course and clubhouse would be built in the first two years, along with the first phases of the residential component, including approximately 73 single-family house lots. The remaining 100 single-family and 250 multi-family residential units would be developed in increments over the following 5 to 10 years.

Section 4.0
ENVIRONMENTAL SETTING

4.0 ENVIRONMENTAL SETTING

This section presents background information on the existing natural and man-made environment. Utilizing this background, the proposed project is evaluated for its potential to generate significant environmental impacts, which are reviewed in Section 5.0. Technical studies have been prepared to analyze the existing environmental conditions and the potential impacts on the environment that could be generated by the proposed project. Findings of these reports are summarized in this section with the full consultant studies presented in the Appendices.

4.1 REGIONAL OVERVIEW

The island of Kaua'i is the fourth largest island in the Hawaiian chain, comprised of a land area of 555 square miles. The highest point on the island is Kawaikini, with a peak of 5,243 feet. Throughout its history, this island has been blessed with a vast supply of fresh water emanating from its cloud-catching mountain peaks that bring life down below through extensive waterfalls, streams, and other natural features. With this accessible supply of fresh water, Kaua'i has been documented from traditional through contemporary times as an agriculturally based island community.

Over the past 20-30 years, Kaua'i has become the resort destination with centers at Po'ipū, Wailua-Kapa'a, and Princeville. Līhu'e has historically been the center of commerce with Nawiliwili Harbor as its main distribution and services port. The town of Hanamā'ulu primarily served as the residential community for workers involved in the nearby agricultural operations.

4.2 CLIMATE

Winds from the northeast, known as tradewinds, are the most predominant over the Hawaiian Islands. Tradewinds are the results of wind circulation patterns that follow the North Pacific anticyclone, increasing in activity during the summer months. In the winter, there is a shift in the wind patterns characterized by the arrival of the westerlies and frontal influences from the North Temperate Zone becoming more prevalent. Westerly winds typically are characterized by the presence of strong winds and high wave activity from the southwestern sector of the Pacific. The Ocean Bay Plantation project area is exposed to both onshore tradewinds averaging 18 knots and sea spray carried by the wind.

The climate of Kaua'i is mild and semitropical with these prevailing northeast trade winds. Average daily minimum and maximum temperatures range from the low 60's to the low 90's degrees Fahrenheit (F), depending upon the time of day and the season. Precipitation is seasonal with the most rainfall typically occurring from October through April. Climatic conditions around the project area yield temperatures ranging from 74 F to 85 F in the summer months, and from 65 F to 78 F in the winter months.

Annual rainfall on Kaua'i varies greatly with elevation and geography from an average rainfall of 444 inches at the top of Mount Wai'ale'ale, considered the wettest place in the world, to approximately 39-59 inches of rain near the project area, which is located on the eastern side of the island. Rainfall within the project area averages less than 2 inches per month in the summer as compared to 5 inches per month during the winter.

4.3 GEOLOGY, TOPOGRAPHY, AND SOILS

Soil classifications and agricultural concerns are documented in a report by Decision Analysts Hawai'i (October 2001) and are included in Appendix A. An analysis of erosion and sediment control within the project area was conducted by Kodani and Associates, Inc. and is provided in Appendix B (December 2001).

4.3.1 Geological Formation

Geologically, Kaua'i is the oldest island of the main island chain, emerging from the ocean during the Tertiary Period (65 to 1.6 million years ago). The island formed around its primary volcano of Wai'ale'ale. Extensive erosion of the primary caldera over geologic time resulted in deep river valleys and rugged mountainscapes that characterize the island today.

The geology of the east region of Kaua'i is dominated by a large depression, or basin, approximately 42.47 miles^2. The depression is known as the Līhu'e Basin, a flat low-lying region bounded by steep cliffs on the north, south, and west sides of its oval shape. The basin is floored by post-erosional lava of Kōloa volcanics. The Kōloa volcanics define the rejuvenation stage of lava flows and explosive vent deposits that erupted approximately 3.65-0.52 million years ago.

4.3.2 Topography

One of the salient features of the project area is its topography. The area can be described as a spacious coastal plain resting upon low sea cliffs, rising sharply from the ocean's edge. Varying in slope, the topography of the project area is predominantly a relatively flat area with moderate to steep slopes at the ocean's edge, ranging from 0 feet to about 80 feet above sea level.

4.3.3 Soil Classification

There are three studies or documents that classify soil type and designate agricultural viability. Soil types or classifications for the project area are based on soil surveys by the USDA Soil Conservation Service (SCS) and are shown in Figure 4-1. The University of Hawai'i Land Study Bureau (LSB) classifications and the Agricultural Lands of

Importance to the State of Hawai'i (ALISH) designations are used to show agricultural viability of the land considering its soils.

USDA Soil Conservation Service
The SCS system classifies soils by type, capability classification (SCS rating), and permeability characteristics including run-off and erosion. Soil type describes the composite material of the soil. The SCS rating defines the limitations on the choice of crops that can be grown within the soil, with a higher Roman numeral corresponding to stricter limitations on its use. Run-off pertains to the corresponding amount of erosion that can be expected with that particular soil type. The project area consists of 14 soil types and is categorized by their qualities in Table 4-1.

Agricultural Lands of Importance in the State of Hawai'i (ALISH)
Developed by the University of Hawai'i College of Tropical Agricultural and Human Resources and the State of Hawai'i Department of Agriculture, the ALISH systems classifies agricultural lands in three categories: prime, unique, or other. Prime agricultural land are lands that are best suited for the production of crops because of its ability to sustain high yields with relatively little input and with the least damage to the environment. Unique agricultural lands are non-prime agricultural lands that area currently being used for specific high value crops. The remaining agricultural lands designated as "other" refers to non-prime, non-unique agricultural parcels that are of importance to crop production.

Within the project area, approximately 343 acres (74%) of the soils are rated prime, 62 acres (13%) are rated Other, and about 61 acres (13%) do not have an ALISH rating. The ALISH designations are shown in Figure 4-2.

Overall Productivity Rating (LSB)
Developed by the University of Hawai'i Land Study Bureau, the LSB rating classifies soils according to five alpha levels, with an 'A' rating corresponding to the class of highest productivity and 'E' the lowest.

Within the project area, approximately 326 acres (70%) of the soils are rates 'B', 56 acres (12%) are rated 'C', 28 acres (6%) are rated 'D', and 55 acres (12%) are rated 'E'. The LSB ratings are illustrated in Figure 4-3. The overall summation of these three soil-rating systems indicates that about 340 acres (73%) of the project site has soils that are good for cultivating crops.

Covered primarily by fields of abandoned sugar cane parcels, the project site is susceptible to significant erosion and sediment losses during periods of rain. During the area's production years in the sugar industry, sediment ditches and basins were constructed to minimize the transportation of sediment to the downstream areas. These ditches and basins are still in place and functioning. According to the analysis, the current rate of soil loss within the project area is approximately 1,342 tons per year.

Table 4-1
SCS Classification and Soil Characteristics for the Ocean Bay Plantation Project Area

Soil	Soil Type	SCS Rating	Acres	Run-off	Erosion Hazard
HIGH QUALITY					
Hanalei Silty Clay, 0-2% slopes (HnA)	Dark gray silty clay	IIw	10	Slow	Slight
Līhu'e Gravelly Silty Clay, 0-8% slopes (LIB)	Dark yellowish brown silty clay with ironstone-gibbsite pebbles	IIe	60	Slow	Slight
Līhu'e Silty Clay, 0-8% slopes (LhB)	Red silty slay	IIe	272	Slow	Slight
MODERATE QUALITY					
Kōloa Stony Silty Clay, 15-25% slopes (KvD)	Silty Clay	IVe	19	Medium	Moderate to Severe
Kōloa Stony Silty Clay, 8-15% slopes (KvD)	Silty Clay	IIIe	3	Medium	Moderate
Līhu'e Gravelly Silty Clay, 8-15% slopes (LIC)	Dark yellowish brown silty clay with ironstone-gibbsite pebbles	IIIe	23	Slow	Slight
Līhu'e Silty Clay, 8-15% slopes (LhC)	Red silty clay	IIIe	8	Slow	Slight
Mokuleia Clay Loam, poorly drained variant (Mta)	Dark mottled clay	IIIw	26	N/A	N/A
Mokuleia fine sandy loam (Mr)	Dark mottled clay with a variant texture of the surface layer	IIIs	4	Slow	Slight
LOW QUALITY					
Beaches (BS)	Sand	VIIIw	9	Rapid	Severe
Fill Land (Fd)	Bagasse & Slurry fill	N/A	7	N/A	N/A
Līhu'e Silty Clay, 25-40% slopes, eroded (LhE2)	Red silty clay, thin surface layer	VIe	15	Rapid	Severe
Rock Outcrop (rRO)	Basalt, bedrock, andesite	VIIIs	3	Rapid	Severe
ough Broken Land (RR)	Weathered rock	VIIe	8	Rapid	Severe

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

Importance to the State of Hawai'i (ALISH) designations are used to show agricultural viability of the land considering its soils.

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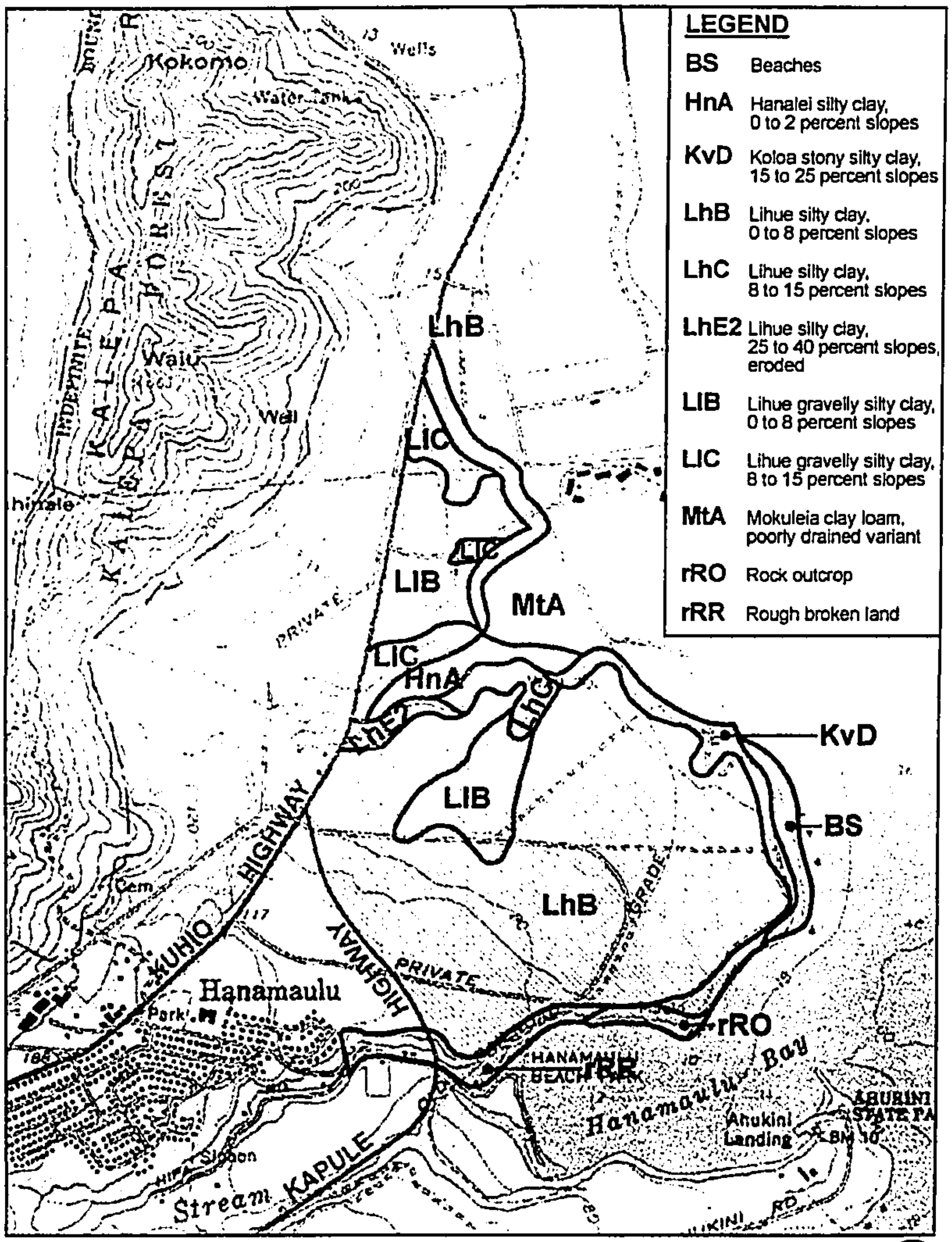


FIGURE 4-1 SCS CLASSIFICATION

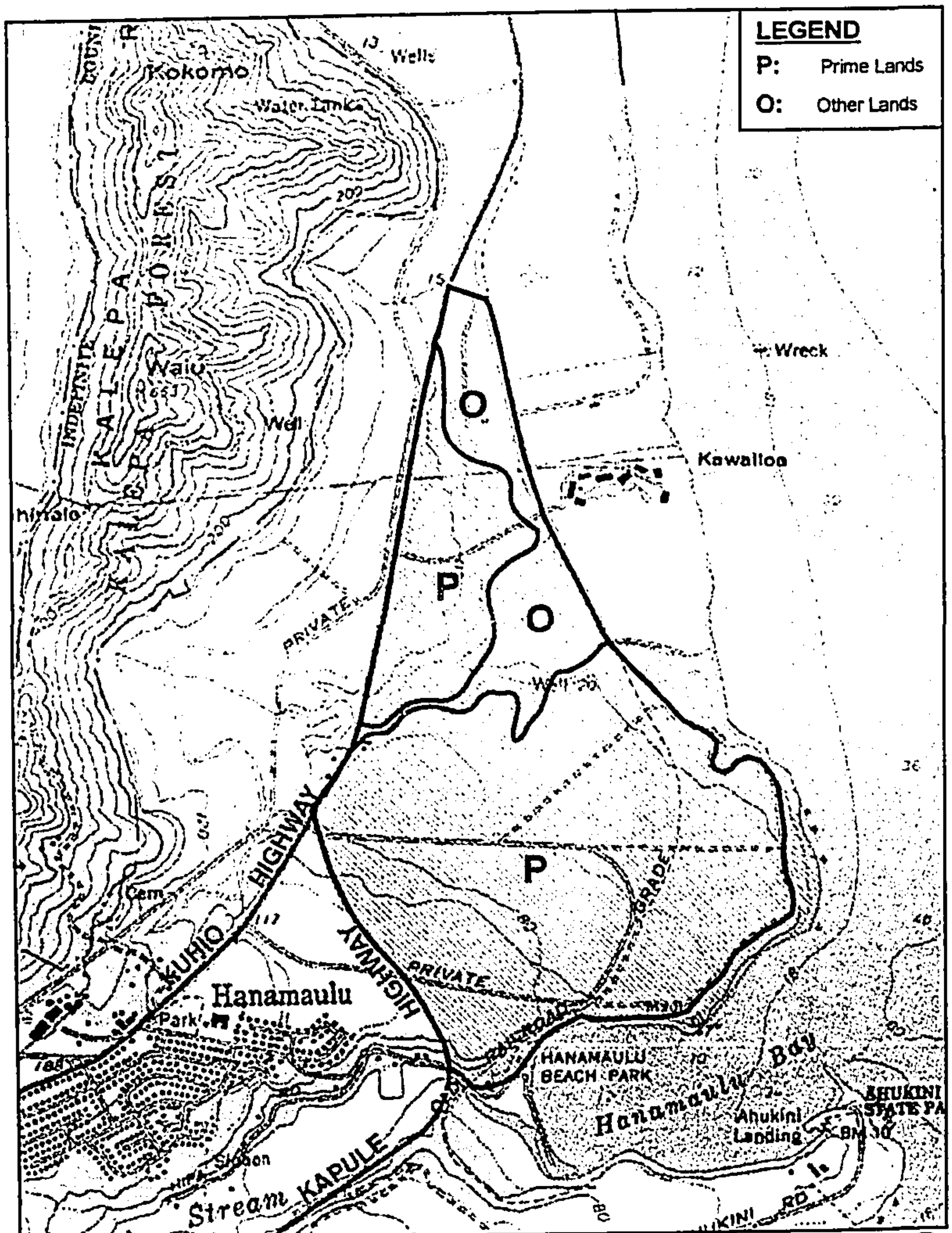


FIGURE 4-2 ALISH CLASSIFICATION

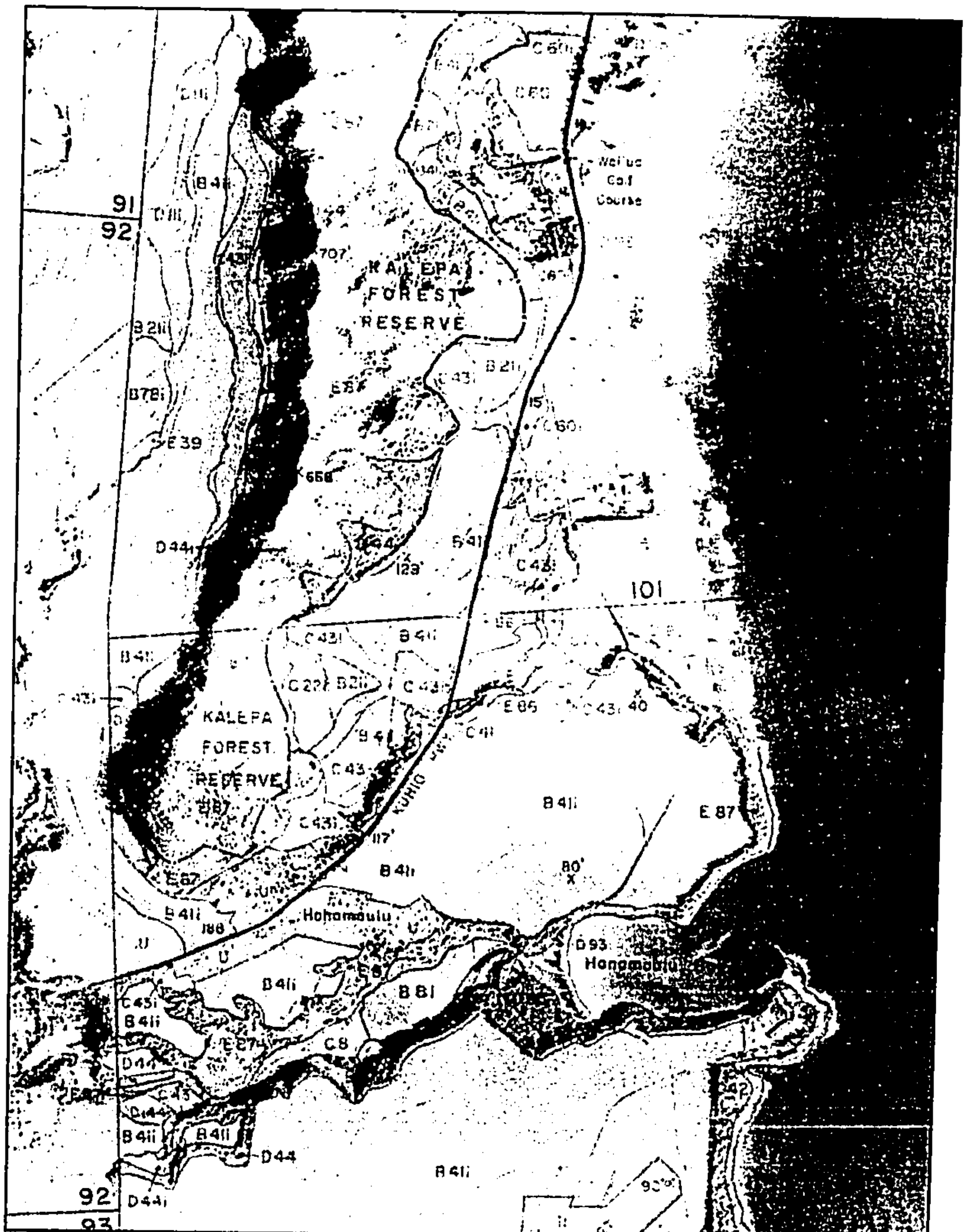


FIGURE 4-3 LSB CLASSIFICATION

4.4 GROUNDWATER RESOURCES

An assessment of surface water resources in the project area was prepared by Tom Nance Water Resource Engineering (March 2002) and is included in Appendix C.

Three geologic formations control the occurrence and movement of groundwater in the near vicinity: the older Waimea series, the younger Kōloa series, and the alluvial deposits that form the coastal plain north and east of the project site. Kalepa Ridge is an outcrop of the older Waimea lavas that also exist beneath the site at an unknown depth. Typically, the flows of the Waimea series are highly permeable. In Kalepa Ridge, however, numerous intruded dikes locally compartmentalize groundwater and reduce the overall permeability of the formation. Figure 4-4 illustrates the offsite drainage areas and well locations.

The two wells in the ridge directly inland of the project (Nos. 0021-01 and 5921-01), which have only moderate yields with relatively large drawdowns, are examples of this dike-influenced reduced permeability. Further to the north and at a lower elevation on the flank of the ridge, Well 0120-01 has significantly better hydraulic performance, apparently because it is not as significantly influenced by intruded dikes.

On-site drilling was conducted (No. 0020-03) and reached a total depth of 240 feet, approximately 170 feet below sea level. Water was encountered about 30 feet above sea level in the soil and sapporite that comprised the first 100 feet of drilling. Groundwater in these moderately permeable strata of Kōloa lavas at these depths has a significant tidal response.

The results of onsite borehole drilling indicates that there is a significant hydraulic connection between the shallow groundwater in the soil and sapporite and the deeper groundwater located in the more permeable strata encountered in the last 50 feet of drilling. It appears that most of the shallow groundwater moves laterally and discharges into the gulch area, the man-made perimeter ditch along the northeast boundary of the project, or into the wetlands.

Other drilling tests at the Radisson Resort (No. 0020-02) site revealed that there is a change from gray marine silt and sand to relatively unweathered Waimea Series lavas at approximately 140 feet below sea level. At this site, no Kōloa lavas were found between the alluvium and Waimea lavas.

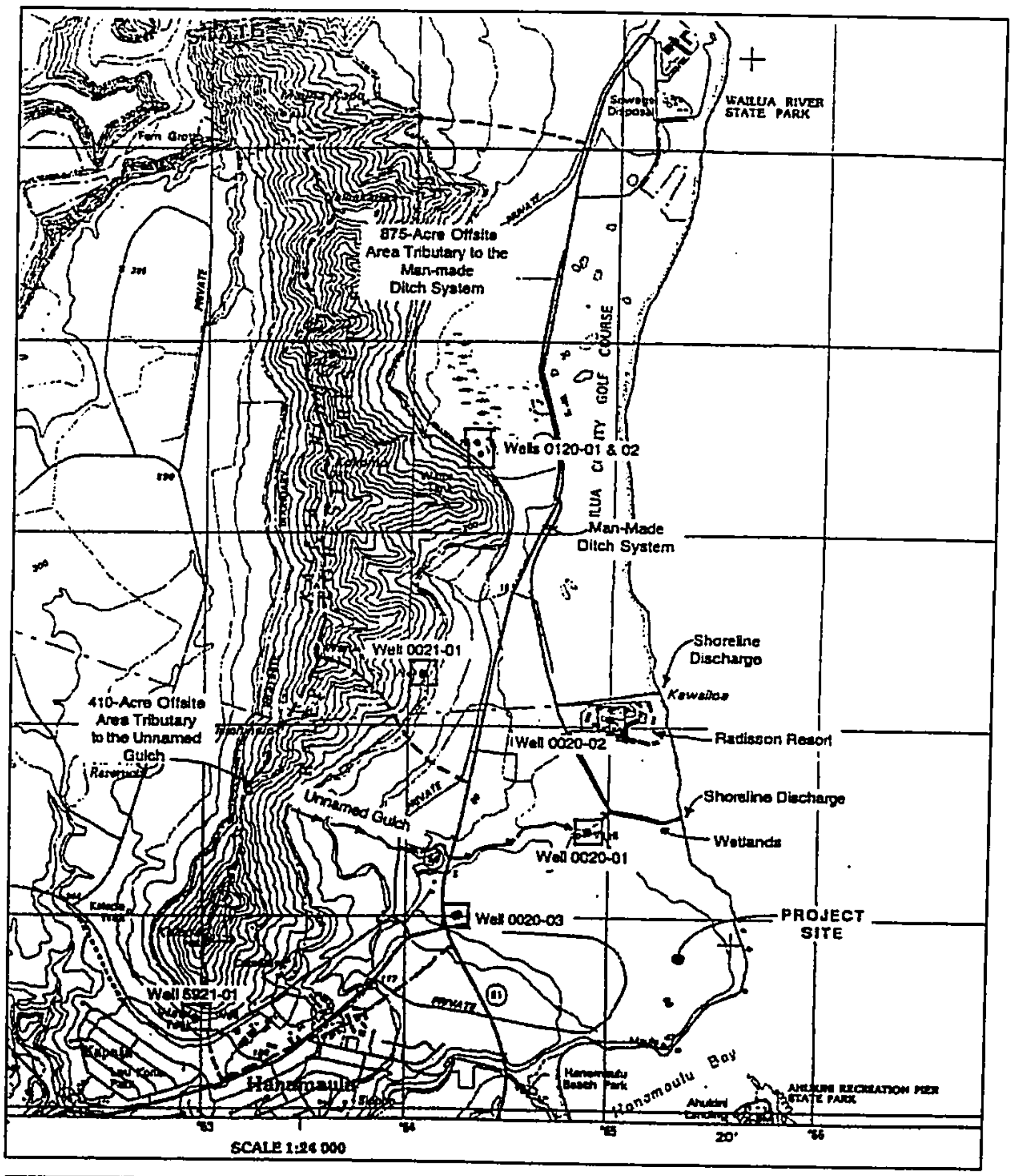


FIGURE 4-4 OFFSITE DRAINAGE AREAS & WELL LOCATIONS

The following aspects of groundwater occurrence should be noted:

- It is not known whether a hydraulic connection between groundwater in the Waimea lavas of Kalepa Ridge and the permeable Kōloa lavas at depth beneath the project site exists. The relative water levels suggest that discharge from the Waimea formation into the Kōloa lavas is possible. However, the water quality results, specifically the lower levels of salinity and silica in the downgradient Kōloa formation well suggest that this may not be the case.

- It is worth noting that Kōloa lavas, in flowing around the south end of Kalepa Ridge to form the peninsula, which comprises the project site, appears to have stopped at that point. Well 0020-02 at the Radisson Resort clearly taps directly into Waimea lavas below the coastal alluvium without encountering intervening Kōloa lavas. The Waimea lavas at this location are at a shallower depth than the depth of Kōloa lavas within the project site as established by Well 0020-03. This suggests that the later-stage Kōloa lavas banked against the pre-existing Waimea lavas on the north side of the peninsula.

4.5 STORM RUNOFF/DRAINAGE AND SURFACE WATER QUALITY

A review of existing and future storm runoff flows and drainage patterns in the project area was prepared by Kodani and Associates (December 2001) and is presented in its entirety in Appendix B.

4.5.1 Storm Runoff/ Drainage

The fallow cane fields are no longer irrigated and vegetation within the project area is sparse with little or no groundcover. The wetlands currently receive runoff from the mauka areas near the highway. The existing drainage areas within the project area are illustrated in Figure 4-5.

Drainage Area A is the area mauka of Kūhiō Highway extending to the ridge line of Kalepa Ridge and is comprised of Kūhiō Highway, abandoned sugar cane fields mauka of the highway, brush areas along Kalepa Ridge, the wetlands area, and the hillside areas adjacent to the wetland. The highway provides an effective barrier that stops runoff from entering other drainage areas makai of the road.

Drainage Area B (103.8 acres) is located immediately south of the wetlands and consists of abandoned sugar cane fields. Runoff from this drainage area is to the wetlands.

Drainage Area C (99 acres) is located south of Drainage Area B, along the middle portion of the plateau region and is also comprised of abandoned sugar cane fields. Runoff from this area is to a small cove on the east side of the project site.

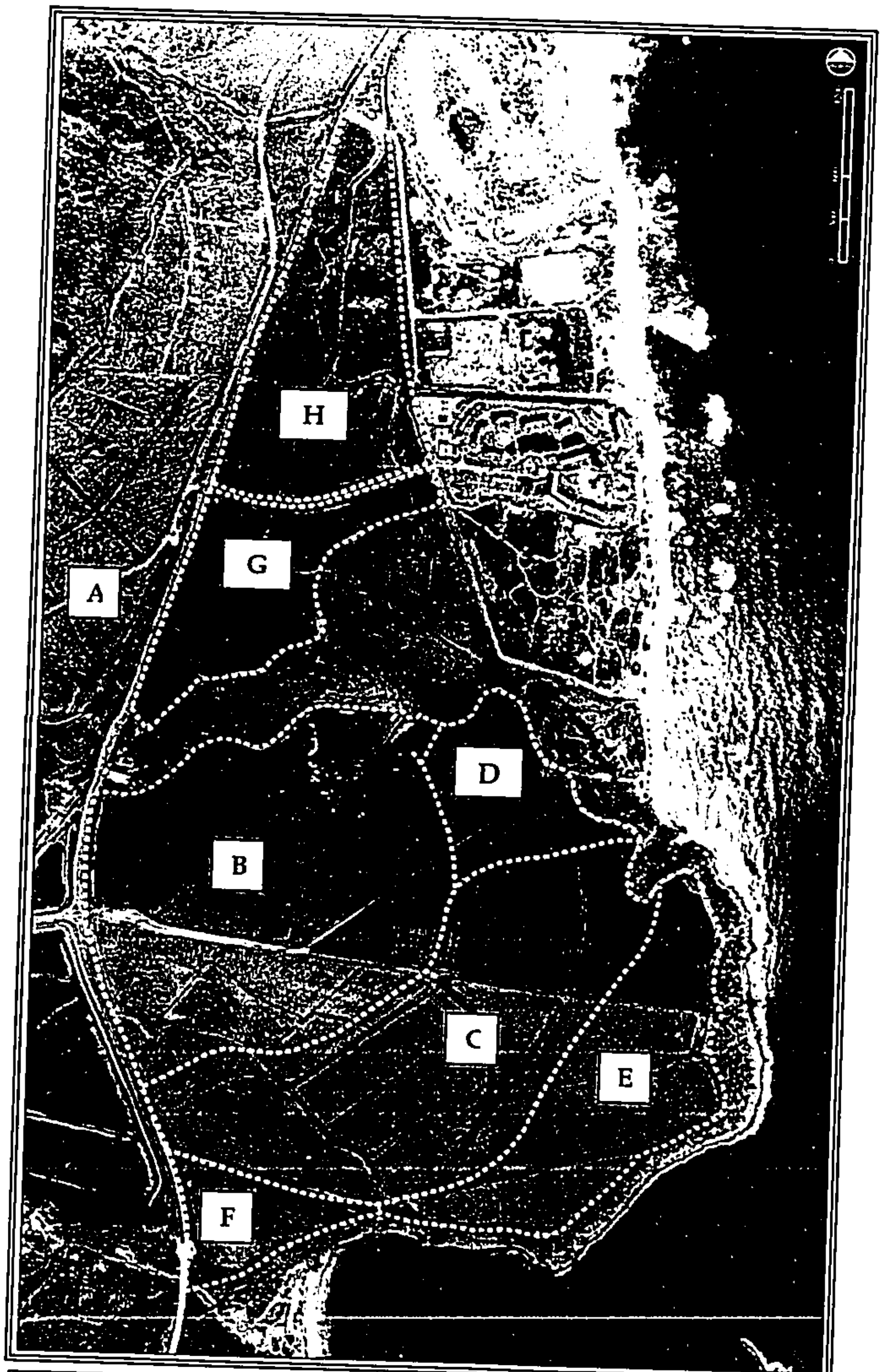


FIGURE 4-5 DRAINAGE AREAS

Drainage Areas D (31 acres), E (37.7 acres), and F (9.9 acres) are located on the perimeter of the southern plateau and all comprised of abandoned sugar cane fields. Runoff from these areas flows directly to the ocean.

Drainage Areas G (35.57 acres) and H (50.02 acres) are located north of the wetlands between Kūhiō Highway and the Radisson Kaua'i Resort Hotel. These drainage areas are comprised of abandoned sugar cane fields flowing either to the wetlands area or to a drainage canal located mauka of the hotel property.

The property has sparse vegetation cover over much of the former cane field. Existing total peak discharge rates from the 460-acre property in its fallow agricultural state is estimated 3,433 cubic feet per second.

4.5.2 Surface Water Quality

Hydrological studies have demonstrated that three surface water features of significance exist within and around the project site. One feature is the unnamed gulch, which originates on the flank of Kalepa Ridge, crosses the project site, and then discharges into the man-made ditch just above the wetlands. Above Kūhiō Highway, the gulch is relatively dry except during and immediately following substantial rainfall. Below the highway, the gulch typically contains pools of water sustained by slow seepage of shallow groundwater from the thick soil mantle across the project site.

The second surface water feature is the man-made channel which originates on the mauka side of Kūhiō Highway north of the project site, runs along the northeast boundary of the site, and loses topographic definition in the wetlands. There are two ocean outlets to this ditch system. The first is located along the north side of the Radisson Resort and the other is downstream of the wetlands at the northeast corner of the project site. Both outlets are normally closed off from direct exchange with the ocean by wave-built beach berms. Direct exchange with the ocean only occurs if the berms are overtopped by storm surf or eroded during a substantial period stormwater runoff. During the field study, the Līhu'e area was subjected to approximately 5.45 inches of rain whereupon one of the berms had eroded allowing direct ocean discharge of runoff to occur for over three days of the storm rainfall.

The third surface water feature is the wetlands area that exists in the low-lying areas of the unnamed gulch and man-made ditch. Standing water in a portion of this area is sustained by shallow groundwater seepage and by surface runoff during and following rainstorms.

A series of temperature and salinity measurements were conducted throughout the three surface features. The following observations are of note:

- As demonstrated with the concentrations of silica concentrations, most of the water in the surface water features originated as groundwater during the area's dry periods.

- During dry weather, there are two exceptions to the predominance of groundwater in the surface water features:

  1) Water in the unnamed gulch is ponded surface water from above the project site.
  2) Water in the open pool between the wetlands and beach berm is two-thirds to three-quarters seawater.

- Some of the contrasts between the wet and dry weather measurements are:

  1) The salinity of water in the pool between the wetlands and shoreline beach berm was considerably reduced by the input of surface runoff.
  2) Runoff from the project site into the unnamed gulch had relatively high salinity, high silica, and high nitrogen. This is likely to be the result of the washing of residual salts on the ground surface.

4.6 OCEAN WATER QUALITY AND MARINE COMMUNITIES

A baseline assessment of the nearshore marine environment was conducted by Marine Research Consultants (December 2001) and is included as Appendix D. The primary objective was to assess nearshore water quality changes brought about by groundwater nutrient and chemical inflow. In addition, qualitative assessments of the nearshore biological communities inhabiting the area were conducted in order to evaluate the potential for changes to biota from any potential alteration of water chemistry.

<u>Physical Structure</u>
The geologic structure of the coastal area off the project site is comprised of sandy beaches grading into a shallow, gentling sloping nearshore limestone platform. An exposed, weathered beachrock ledge forms the intertidal area between the sand beach and a subtidal limestone platform. Numerous sand-filled channels are oriented perpendicular to the shoreline, bisecting the beachrock ledge and limestone platform. Due to the shoreline's east-northeast alignment, the nearshore area is subjected to near constant impact of wave stress.

Along the seaward edge of the boulder zone lies a uniformly flat pavement of limestone that is covered with a fine layer of sandy sediment, which reaches a water depth of approximately 60 feet. Sandy sediment on the limestone pavement is in a constant state of resuspension by wave and current forces. As such, this constant scouring prevents the establishment of any extensive coral communities. Rather, the major colonizer of the limestone pavement includes various species of algae.

The bottom of Hanamā'ulu Bay is comprised of red sandy mud and large colonies of plating coral (*Montipora spp.*) are the dominant biotic component of the bay floor. These colonies do not occur in regions beyond the mouth of the bay.

Water Chemistry

Several major points are apparent from the evaluation of gradients of water chemistry constituents, specifically 1) there is a small input of groundwater mixing with ocean water into a small natural inlet that occurs at the juncture of the sand beach and rocky coastline, resulting in distinct decreases in salinity and increases in groundwater nutrients; 2) mixing of groundwater in the ocean at all sites is thorough, even during the calmest of conditions, resulting in virtually no zone of mixing within the nearshore area; and 3) water within Hanamā'ulu Bay contains little groundwater, but does have a component of surface runoff attributable to discharge emanating from Hanamā'ulu Stream.

Coral and Marine Life

Within the shoreline area, there is a variety and abundance of marine life determined largely by wave energy, and by the topography and bathymetry of the shoreline that affords shelter to aquatic life. Nearshore subtidal marine communities are generally defined by the physical nature of the bottom substrate. Unconsolidated sand or rubble will support a relatively low population of surface dwelling invertebrates and fish. Hard substrate may either be basalt or calcareous in nature and in general provides more niches for fish and invertebrate habitation.

Due to the high frequency of intense wave action, few species of benthic reef organisms are capable of settling on the nearshore boulder zone. Identifiable corals within this zone include an abundance of *Pollicopora meandrina*, as well as the *Porites lobata* and the *Montipora patula*.

In addition to the identified corals, the limestone pavement region is comprised of benthic algae and seaweed including *Caulerpa spp.*, *Codium spp.*, *Enteromorpha spp.m*, *Halimeda spp.*, which are varieties of green algae. The area is also consists of brown algae and varieties of red seaweed.

Within the area, the major taxa of motile benthic organisms were sea urchins (*Echinoidea*) and sea cucumbers (*Holothuroidea*). Several individuals of larger species of urchins such as the *Tripneustes gratilla* and the *Heterocentrotus mammillatus* were also observed. Most of these organisms were established along the limestone pavement.

Reef Fish Communities
The abundance and diversity of the reef fish community that exists off the project area are typical of wave-swept exposed coastlines in Hawai'i. Most of the fish observed on the reef flat were located near small crevices and holes and include: the damselfish species (*Chromis vanderbilti, C. hanui, and C. ovalis*), the hawkfish (*Parracirrhites arcatus*), and wrasses (*Coris gaimard and Thalassoma duperrey*). Along areas of the ocean bottom, other species of fish were observed including the triggerfish (*Sufflamen fraenatus*) and a wrasse (*Coris ballieui*). Schools of akule (*Trachiurop crumenophthalmus*) and 'opelu (*Decapterus pinnulatus*) were also observed but are considered as transient species that move along the coastline.

Threatened or Endangered Species
Within Hawaiian waters, four species of marine animals have been identifed as either threatened or endangered including the green sea turtle (*Chelonia mydas*), the hawksbill turtle (*Eretmochelys imbricata*), the endangered humpback whale (*Megaptera novaeangliae*), and the Hawaiian monk seal (*Monachus schlauslandi*). The sea turtle is found along the shoreline areas of the major Hawaiian Islands. The hawksbill turtle is found more infrequently than the sea turtle. The humpback whale spends only the winter months in the Hawaiian Islands. The Hawaiian monk seal predominantly is found in the Northwest Hawaiian Islands but has been sighted with the waters and shorelines of the major islands.

Fishery Resources/Ocean Resources
The coastal area surrounding the project area is natural fishery area that provides a wide variety of ocean delicacies including fish, opihi, and limu. The coastal area hosts several ocean activities such as fishing, surfing, and canoe paddling.

4.7 BOTANICAL RESOURCES

A survey of botanical resources was conducted by Char & Associates (September 2001) and their report is detailed in Appendix E.

The vegetation on the project site is dominated by introduced or alien species due in part to the extensive use of the site by Līhu'e Plantation for sugar cane cultivation. To describe the botanical resources within the project area, the vegetation cover patterns are categorized by their terrain characteristics.

Abandoned sugar cane fields comprise the majority of land within the project site. These fields are dominated by Guinea grass and other weedy species. Within this relatively level to gently sloping area are a few clusters of trees such as Java plum (*Syzygium cumini*), ironwood (*Casuarina equisetifolia*), and koa haole.

Within the wetlands and pasture area, located within a shallow and broad gulch, mats of California grass can be found. Parts of this area are used for grazing cattle. Within the sloping areas of the pasturelands that border the wetland areas, thickets of hau (*Hibiscus tiliaceus*) can be found. The area is also comprised of Guinea grass, java plum trees, koa haole, ironwood, Christmas berry, and sourbush.

Various types of coastal vegetation form a band along the seaward facing slopes of the property. Three variants of the coastal vegetation are recognized based on the differences in substrate type and slope.

Sand Substrate

A sandy beach is found along the northern portion of the project area, where the stream from the wetlands empties into the ocean. The sandy substrate consists of naupaka (*Scaevola sericea*) and taller tree heliotrope (*Tournefortia argentea*). 'Aki'aki grass (*Sporobolus virginicus*) and pōhuehue (*Ipomoea pes-caprae*) form low mats, especially on the seaward facing portions of the naupaka shrubs. Other species associated with this substrate include nanea (*Vigna marina*), hala (*Pandanus tectorius*), Bermuda grass (*Cynodon dactylon*), and wedelia (*Sphagenticola triloba*).

Rocky Outcrops

The coastal vegetation is comprised of large stands of ironwood trees. Along the upper slopes, adjacent to the abandoned sugarcane fields, the ironwood trees are 30 to 50 feet tall. Along the exposed steeper slopes, the ironwood trees are low and windsheared, 10 to 12 feet tall. There a few native species associated with this substrate including: naupaka, 'ilima papa (*Sida fallax*), pā'ūohi'iaka (*Jacquemontia ovalifolia ssp. Sandwicensis*), 'aki'aki grass, and 'ākulikuli (*Sessuvium portulacastrum*).

Other Slopes

On the more protected slopes facing Hanamā'ulu Bay, the coastal vegetation consists of varying densities of koa haole shrubs, approximately 12 to 15 feet tall. Other species within this substrate include: kolomona (*Senna surattensis*), java plum trees, ironwood, and hau. Guinea grass is the most abundant ground cover, forming robust clumps 2 to 3 feet tall.

Situated along the northern tip of the project site, near the Wailua Municipal Golf Course, a dense thicket of koa haole shrubs can be found. Within the thicket are scattered trees of java plum, tropical almond, coconut, and Chinese banyan. Not much ground cover exists in this area due to heavily shaded conditions.

In total, 135 plant species were inventoried on the project site of which 113 (84%) are introduced. Four species were originally of Polynesian introduction, and 18 species (13%) are native. Of the native species, 17 are indigenous, meaning that these plants are native to the Hawaiian Islands and elsewhere. One species, the pā'ūohi'iaka (*Jacquemontia ovalifolia ssp. Sandwicensis*) is endemic, meaning that it is only found in the Hawaiian Islands. This species was found in the abandoned sugar cane fields and along the coastal vegetation areas.

4.8 AVIAN AND TERRESTRIAL FAUNA

A survey of avian and terrestrial mammalian species was conducted by Rana Productions, Ltd (September 2001) and their report is included in Appendix F.

Mammals

Mammalian species found within the project area include cats (*Felis catus*), horses (*Equss caballus*), and domestic cattle (*Bos taurus*). Recorded signs and scat of two other mammalian species include the domestic dog (*Canis f. familiaris*) and pig (*Sus scrofa*). Although no live rodents were detected during the course of the fieldwork, it is likely that roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*), and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use various resources found within the project site. All of these mammalian species are harmful to avian populations.

Studies were conducted within the project area to detect the presence of endangered Hawaiian hoary bats (*Lasiurus cinereus semotus*), or the 'ōpe'ape'a, as it is known in Hawaiian. Visual recordings documented the presence five separate animals foraging along the coastline, and over Hanamā'ulu Bay. All other observations of mammalian species were of an incidental nature. With the exception of the Hawaiian hoary bat, all terrestrial mammals found on the island of Kaua'i are alien species.

Avifauna

Twenty-seven avian species were recorded within the project area either during station counts, nocturnal visits, or incidental encounters. Of the 27 species detected, the 'Alae ke'oke'o, or Hawaiian coot (*Fulica alai*) is an endemic species that is listed as an endangered species, under the Endangered Species Act of 1973, as amended, and by the State of Hawai'i under its endangered species program. Other indigenous or endemic avifauna located within the project area include: the koa'e kea (*Phaethon lepturus dorothea*), the 'auku'u (*Nycticorax nyticorax hoactli*), the kōlea (*Pluvialis fulva*), the 'ūlili (*heteroscceles incanus*), the 'alea'ula (*Gallinula chloropus sandvicensis*), and the ae'o (*himantopus mexicanus knudseni*). Additionally, three seabird species were recorded flying over the site including the endangered endemic Hawaiian subspecies of the 'ua'u (*Pterodroma phaeopygia sandwichensis*), the threatened endemic subspecies of the 'a'o (*Puffinus auricularis newelis*), and the 'ua'u kani (*Puffinus pacificus*). The three endangered water species were seen within the wetland area located in the center of the project site and in the adjacent drainage canals.

The remaining species of avifauna are alien to the Hawaiian islands. Avian diversity and densities were relatively low. Two species, the Japanese White-eye (*Zosterops japonicus*), and Zebra Dove (*Geopelia striata*) accounted for 32% of the total sighting of birds recorded within the project area.

4.9 VISUAL RESOURCES

Within the objectives of the Līhu'e Development Plan, there is an emphasis placed upon recognizing and identifying key scenic resources within the Līhu'e Area. Scenic resources located within or near the project area include the coastline along the eastern edge as well as the Kalepa Ridge stretching from Hanamā'ulu to Wailua River.

Additional emphasis is placed upon maintaining the visual structure of the surrounding area. Visual structure is intended to be a description of the landscape as it is seen and remembered by the community, and does not evaluate visual quality. The major elements of visual structure include paths, edges, nodes, districts, and views. Visual districts are large definable areas of one general character determined by development or physiographic form. Within or near the project area, major paths and visual districts characterize the visual structure. Major paths include Kūhiō Highway and Kapule Highway, which are circulation corridors that provide both physical and visual access throughout the immediate community and to several more districts. Visual districts within the project site include the Kalepa Plain and Hanamā'ulu Bay, as illustrated in Figure 4-6 through 4-10.

4.10 NATURAL HAZARDS

4.10.1 Hurricanes and Tropical Storms

Hurricanes are tropical storms that attain a minimum speed of 74 mph. The term hurricane is given to tropical cyclones that churn in the Eastern and Central Pacific Waters. Hurricane are giant whirlwinds in which air moves around a center of low pressure, reaching maximum velocity in a circular band extending outward 20 or 30 miles from the rim of the eye. Tropical Storms have rotating winds of 39-73 mph and usually are accompanied by heavy rains and thunderstorms. The movement pattern of these systems can erratic and unpredictable. The major hazards posed by a hurricane include violent winds, torrential rainfall, flooding, storm surge, and high surf. The general season for hurricanes is between the months of June to December.

4.10.2 Earthquake

The majority of earthquakes in Hawai'i are directly related to volcanic activity, particularly to the movement of magma beneath Kīlauea and Mauna Loa, on the island of Hawai'i. Other earthquakes are the result of exerted pressures released by magma that never reaches the surface. Areas are zone-designated to evaluate the seismic hazard for that region. The entire island of Kaua'i lies in Zone 1, meaning that this area is least susceptible to earthquakes.

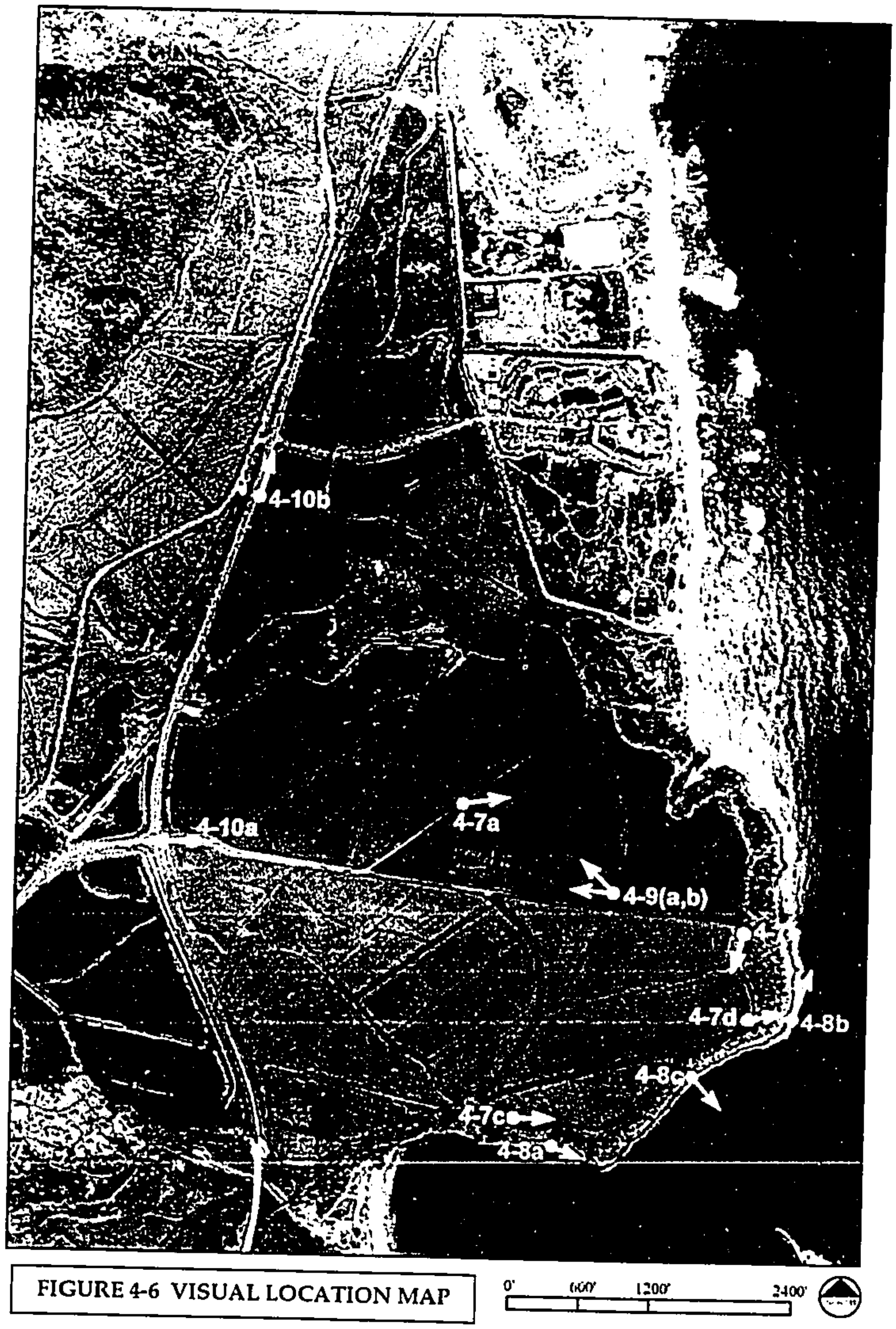


FIGURE 4-6 VISUAL LOCATION MAP

FIG 4-7a

FIG 4-7b

FIG 4-7c

FIG 4-7d

FIG 4-7e

FIGURE 4-7 EXISTING CONDITIONS

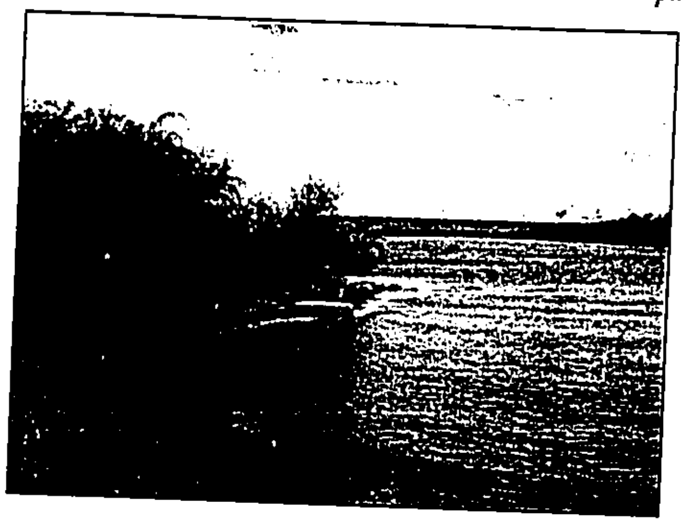


FIG 4-8a

FIG 4-8b

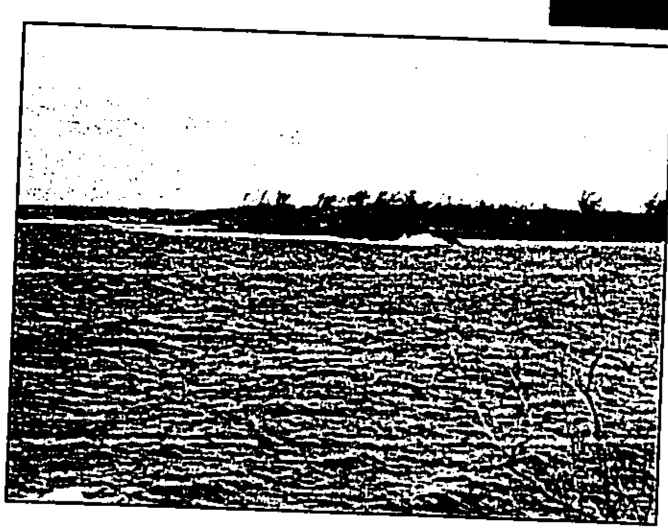


FIG 4-8c

FIGURE 4-8 SHORELINE VIEWS

FIG 4-9a

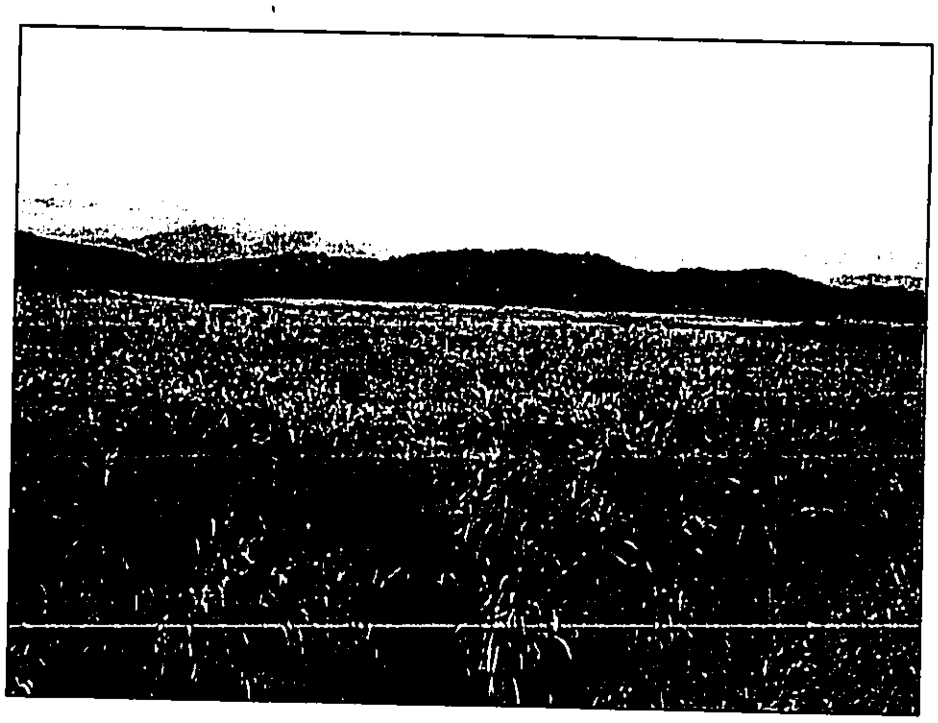


FIG 4-9b

FIGURE 4-9: MAUKA VIEWS

FIG 4-10a

FIG 4-10b

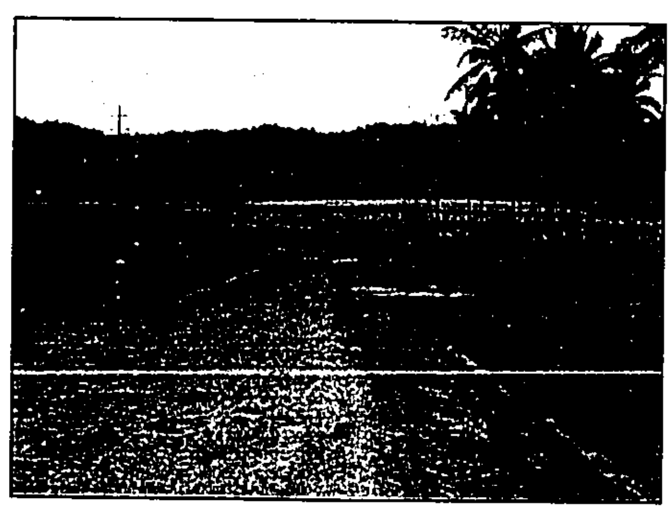


FIGURE 4-10 ROAD ACCESSES

FIG 4-10c

4.10.3 Flooding

According to the National Flood Insurance Program Flood Insurance Rate Map (Community Panel Number: 150002 0140 D), most of the shoreline area of the project site is designated as Zone VE. This designation refers to special 100-year coastal flood zone areas with velocity hazards. Base flood elevations for the project area are within a 10 to 12 foot range. As illustrated in Figure 4-11, the FIRM indicates that most of the project site is within Zone X-Other Areas, referring to areas determined to be outside the 500-year flood plain.

4.10.4 Tsunami Inundation

A tsunami is a series of waves generated in a body of water by an impulsive disturbance that vertically displaces the water column. Tsunamis are characterized as shallow-water waves, with long periods and wavelengths. A tsunami possesses the potential to have a wavelength in excess of 100 km and period on the order of one hour.

Generators of tsunamis include earthquakes, landslides, volcanic eruptions, and explosions. The effects of a tsunami can be devastating, having the potential to cause severe property damage and loss of life along coastlines hit by these waves. The existing demarcation of the tsunami inundation zone for the project area is illustrated in Figure 4-12.

4.11 ARCHAEOLOGICAL, HISTORICAL, AND CULTURAL RESOURCES

In traditional times, the island of Kaua'i, originally named Kamawaelualani, was divided up into six moku, or land districts. The project area lies in the traditional moku of Puna (known today as the Līhu'e District), in the ahupua'a of Hanamā'ulu, which literally translates as "tired bay" and is located along the eastern coast of Kaua'i. The traditional boundary markers of the moku of Puna include the majestic terrain of Wai'ale'ale to the west, the ocean to the east, the mountains of Makaleha to the north, and the Hā'upu range to the south, as shown in Figure 4-13. The pristine nature of this area was accentuated by its extensive tributary system that emanated from the upper slopes of Wai'ale'ale, considered to be one of the wettest spots in the world averaging 444 inches of rain per year.

Since the Development Period (300-600 AD), Kaua'i was traditionally known as an independent and political stronghold. The names of ruling chiefs such as Moikeha, Kila, Kawelo, and La'amaikahiki resound the rich history and political stronghold of this island community. The rich cultural legacy of Kaua'i as a center or agricultural productivity began with Manokalanipo, a ruling chief in the 15th century. Manokalanipo is noted for the elaborate design and development of irrigation systems that impressed early western contacts for their productive yields in agricultural.

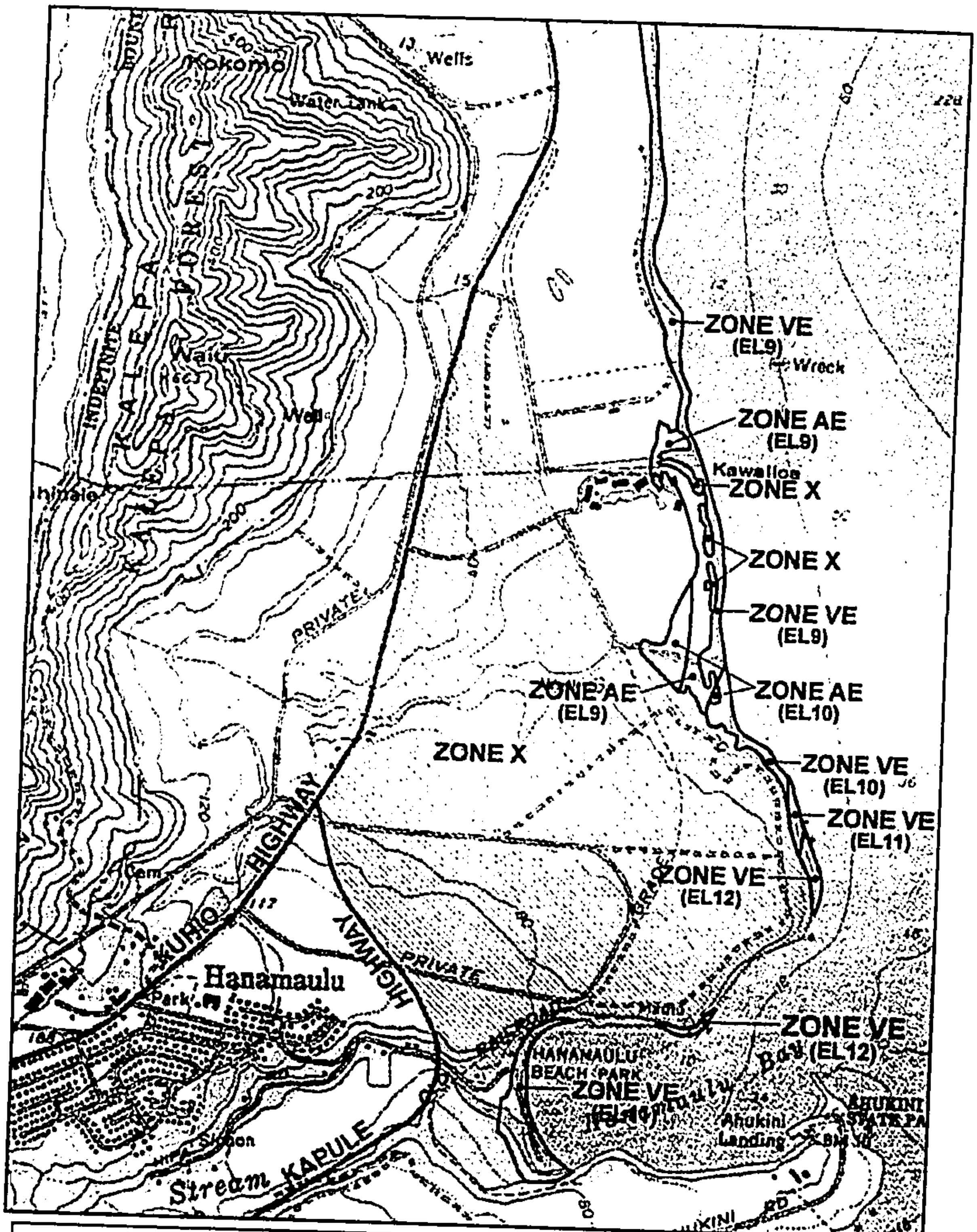


FIGURE 4-11 FLOOD INSURANCE RATE MAP

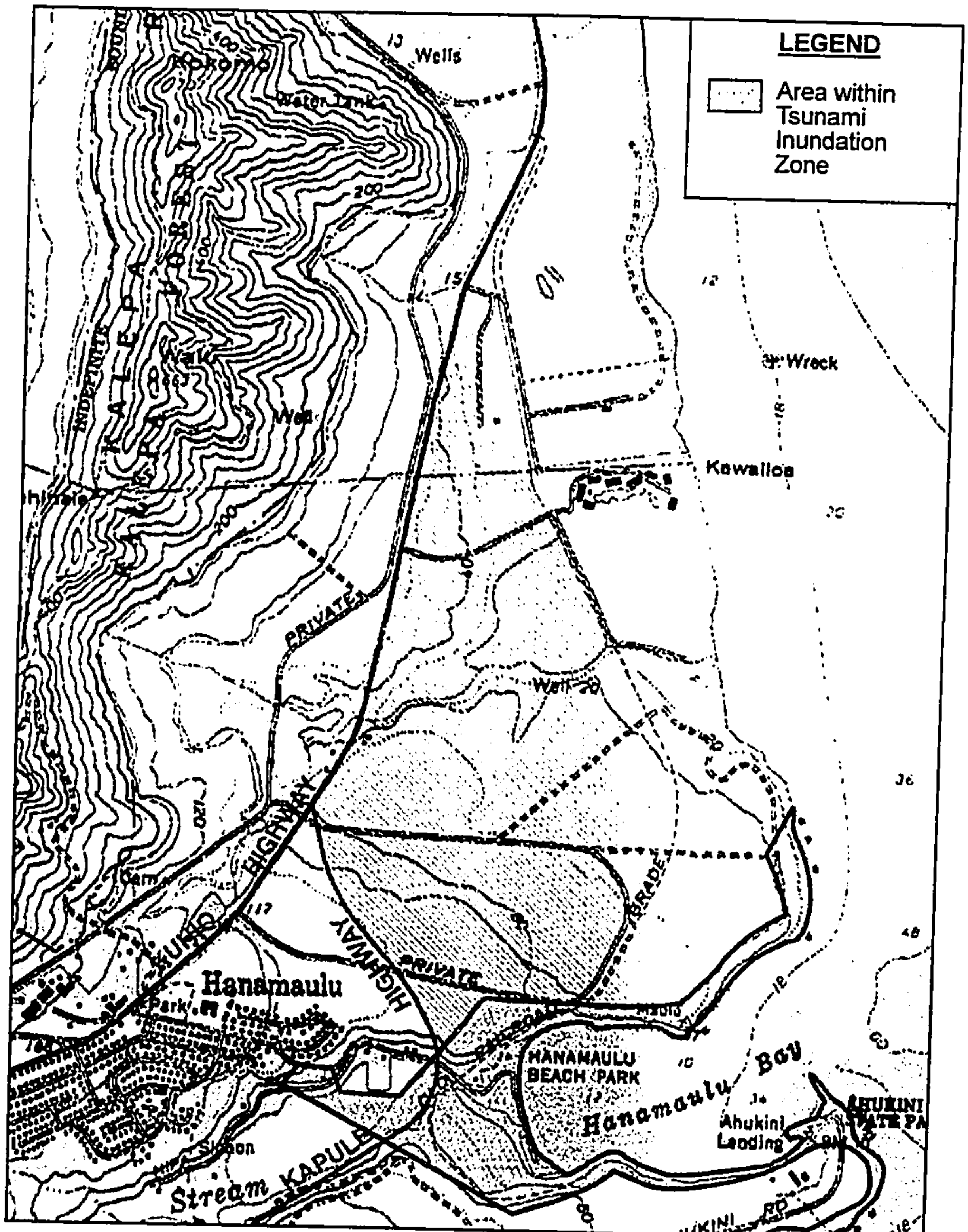


FIGURE 4-12 TSUNAMI INUNDATION ZONE

According to some early journals of early western visitors, production yields within the Wailua and Hanamā'ulu areas consisted of a variety of kalo (*Colacasia esculenta*), 'uala (*Ipomoea batatas*), 'ulu (*Artocarpus altilis*) and niu (*Cocos nucifera*). These terraced agricultural systems utilized the natural gravity flow of water that emanated from extended upland sources of Wai'ale'ale. The benevolent and prosperous rule of Manokalanipo is reflected through the poetical attributes given to his name in oral traditions. One of the most significant points in Kaua'i's early political history is that it remained politically independent up to 1824. The island was never conquered, though in 1810, the ruling ali'i, Kaumuali'i, formally "acknowledged" the sovereign reign of Kamehameha I, whereupon the island was ceded to the latter to prevent an invasion. However, it is Kaumuali'i's death in 1824 that marks the end of Kaua'i's political independence. In 1824, an insurrection attempt by several Kaua'i chiefs resulted with a lost of their holdings to relatives and retainers of the Kamehameha line.

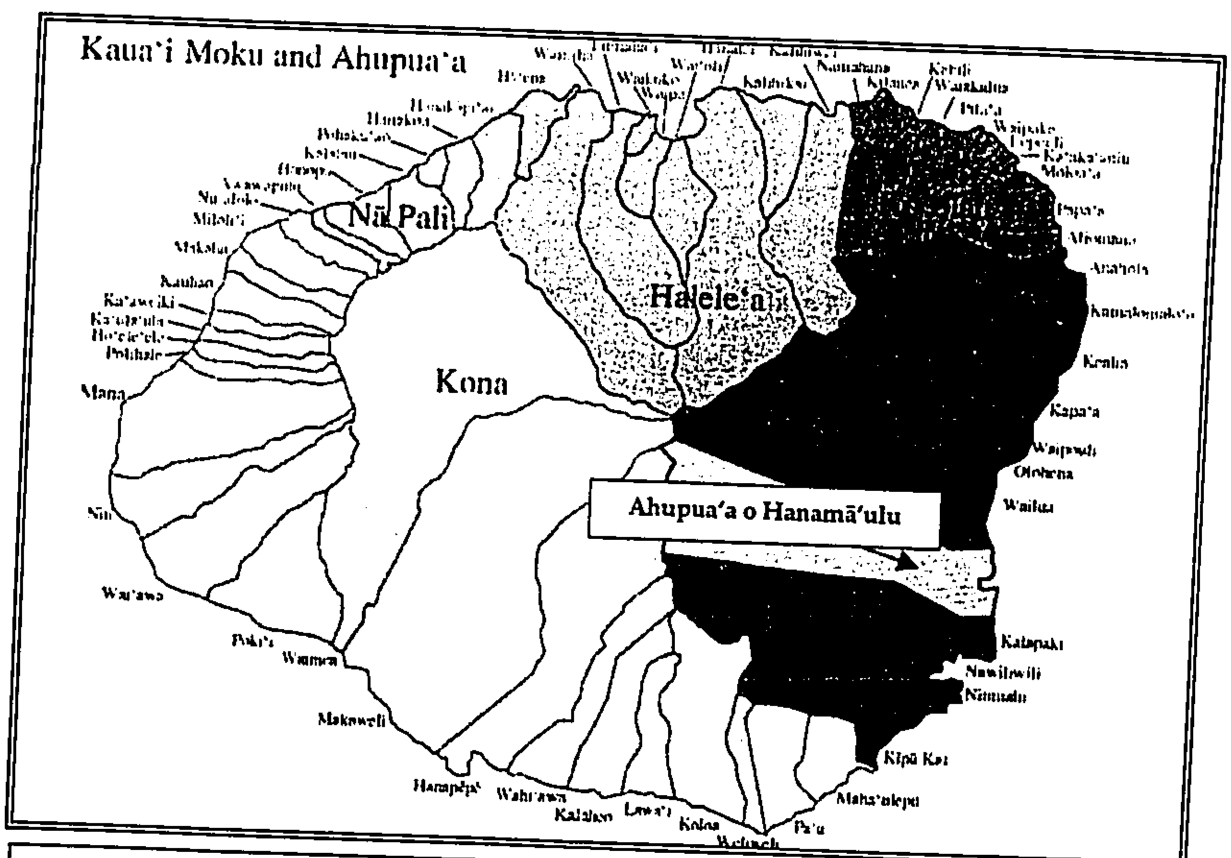


FIGURE 4-13 MOKU & AHUPUA'A MAP

Great Māhele

In 1848, during the reign of Kamehameha III, the Māhele, a western concept of land tenure derived into legislation, created a land reformation in Hawai'i. It was the first time a system of separation and identification of the associative rights of the king and the chiefs to the land was created. The result of the Māhele led to the division and distribution of land, thus creating a system of possession rights and private title to land. During this process, all lands were placed into one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and Konohiki Lands. The ahupua'a of Hanamā'ulu, including the project area, became crown lands

As shown in Table 4-2, the Indices to Land Commission Awards (Board of Commissioners 1929) indicate that over 9,000 acres of land in the ahupua'a of Hanamā'ulu were awarded to Victoria Kamāmalu in 1862, daughter of chief Matatio Kekūanaō'a and sister of Alexander Liholiho (King Kamehameha IV), Lot Kamehameha (King Kamehameha V), Moses Kekuāiwa, and half sister of Ruth Ke'elikolani.

Table 4-2
Land Commission Awards for Hanamā'ulu

LCA	Awardee	Acreage
3648	Kala	1.25 Acs 30 rods
3650	Kaluhiwaha	3 roods, 35 rods
3649	Kamalo	1.75 Acs 20 rods
7713	V. Kamamalu	9177 Acs (Ap 2) ahp
3644	Kaualupa	1.25 Acs 23 rods
3558	Keke	3 roods 1 rod
3600	Keolanui	1.75 Acs 30 rods
3653	Kolu	1 Ac 37 rods
5089	Kuhaimoana	3 roods 17 rods
3640	Kumakahaohao	1 Ac 1 rood 12 rods
3271	Lalahilimoku, Leimoku	1 Ac 1 rood 21 rods
3657	Niho	1 Ac 1 rood 13 rods
3423	Paka	1.50 Acs 33 rods
3426	Pelekane	1 Ac 17 rods
3371	Naehu	1.25 Ac 19 rods (Kapaia)
3647	Kapuohi	4 Acs 32 rods (Moala)
3647	Kapuohi	38 rods (Papuaa)

Early Land Use

Within recent history, the use of the project area was centered primarily upon the development of the sugarcane industry. In 1849, the Līhu'e Plantation established itself as an emerging leader in Hawai'i's sugar industry. Founded by A. Pierce, Wm. L. Lee, and C.R. Bishop, the plantation quickly began expanding its land base and developing an intricate water irrigation and allocation system. The plantation was the most modern sugar company in Hawai'i for its time, being the first to use steam power to operate its equipment.

In 1863, Paul Isenberg, manager of the Līhu'e Sugar Plantation, leased the ahupua'a of Hanamā'ulu from Kamāmalu. After the death of the princess in 1870, Isenberg bought 17,000 acres of the ahupua'a, including the project area. In 1877, Mrs. A.S. Wilcox was given a contract to plant cane in the Hanamā'ulu lands. By 1933, Līhu'e Plantation held approximately 7200 acres for cane production and possessed a total reservoir capacity of 700 million gallons.

The roots of Līhu'e Plantation's ownership under its last owner can be traced back to a ship chandlery, Hackfield & Company, started on Kaua'i by Hendrick Hackfield, a German sea captain. Hackfield & Company provided supplies, credits, and loans to the plantation and eventually took over the operations. The firm was seized by the U.S. government during World War I and auctioned off to a group of Hawai'i businessmen who changed the name to American Factors. In 1966, the firm was purchased by JMB Realty of Chicago, whereupon the name was changed to Amfac/JMB.

Demise of Sugar Cane Industry

By 1994, Amfac/JMB consolidated various aspects of its operations, shared by the Līhu'e Plantation and the Kekaha Sugar Company, in an effort to address the failing market in Hawai'i's sugar industry due to fierce competition from foreign producers. As a result of consolidating operations, selected parcels of land and their adjoining irrigation systems were no longer maintained and utilized due to expected lower production yields. During the week of November 16, 2000, Amfac/JMB harvested its last sugar cane crop just north of Hanamā'ulu and closed the last of its plantation holdings on Kaua'i.

4.11.1 Archaeological Resources

Existing historical and cultural resources within the project area are detailed in an archaeological inventory survey completed by Paul H. Rosendahl, Ph.D., Inc (March 2002) and are presented in Appendix G. The findings are summarized below.

Given the extensive nature of sugarcane cultivation that occurred within the project area, the present survey confirmed that only a limited number of archaeological sites were present. Four complexes and six single-feature sites were identified either within or near the vicinity of the project area, as shown in Figure 4-14. The sites include four complexes and six single-feature sites, and are comprised of the following functional types: habitation, transportation, burial, and a refuse disposal. The overall physical condition of these sites varied from poor to good. These sites with their tentative functional interpretation, and chronology are listed in Table 4-3.

Table 4-3
Existing Archaeological Resources

State Inventory of Historic Properties No.	Feature Type	Tentative Functional Interpretation	Chronology
1838	Complex: Cultural Deposit (A), Cultural Deposit (B)	Habitation	(A): Prehistoric, poss. AD 1170-1400 (B): Recent
1839	Complex: Wall (A), Terrace (B)	Temporary Habitation	Prehistoric; exact age unknown
1840	Retaining Wall	Transportation	Historic
1841	Possible Auto Road/Trail	Transportation	Historic
1843	Complex: Concrete Foundation (A), Cane Road (B), and Concrete Wall (C)	Transportation	Historic
1845	Railroad Bridge	Transportation	Historic
1846	Concrete Railroad Bridge	Transportation	Historic
2066	Complex: Upright (A), Cane Road (B), Foundation (C)	Possible Burial, Transportation, Possible Habitation	Historic & Possibly Historic
2067	Historic Cemetery	Burial	Historic
2068	Historic Trash Dump	Trash Dump	Historic

Two general patterns exist in the overall distribution of the formal and functional types, and it appears the patterns are directly influenced by historic period activity. First, of the ten identified sites, all are located in areas that are minimally modified or unmodified by historic land alteration attributed to primarily agricultural production. Second, all of the historic period sites are located along or near the coast. These historic sites were all probably connected by a historic road or trail that followed the coastline and which may be associated with Ahukini Landing, located on the south side of Hanamā'ulu Bay.

Of the 10 identified sites, two sites, 1838 and 1839 are considered to be prehistoric. Radiocarbon sampling suggests that occupation within the project area may have occurred as early as AD 1170-1400. This time period is known as the Expansion Period, as is characterized by numerous developments, including a rapid increase in population and intensified agricultural practices such as large-scale irrigation, dryland cultivation, and aquaculture. Based upon historical documentary research, prehistoric settlement in the immediate vicinity of the project area seems to have taken place in the Hanamā'ulu Stream gulch and along the coast. On the coast of Wailua and with the sandy beach area of Hanamā'ulu Bay, burials in sand dunes have been documented as well as habitation

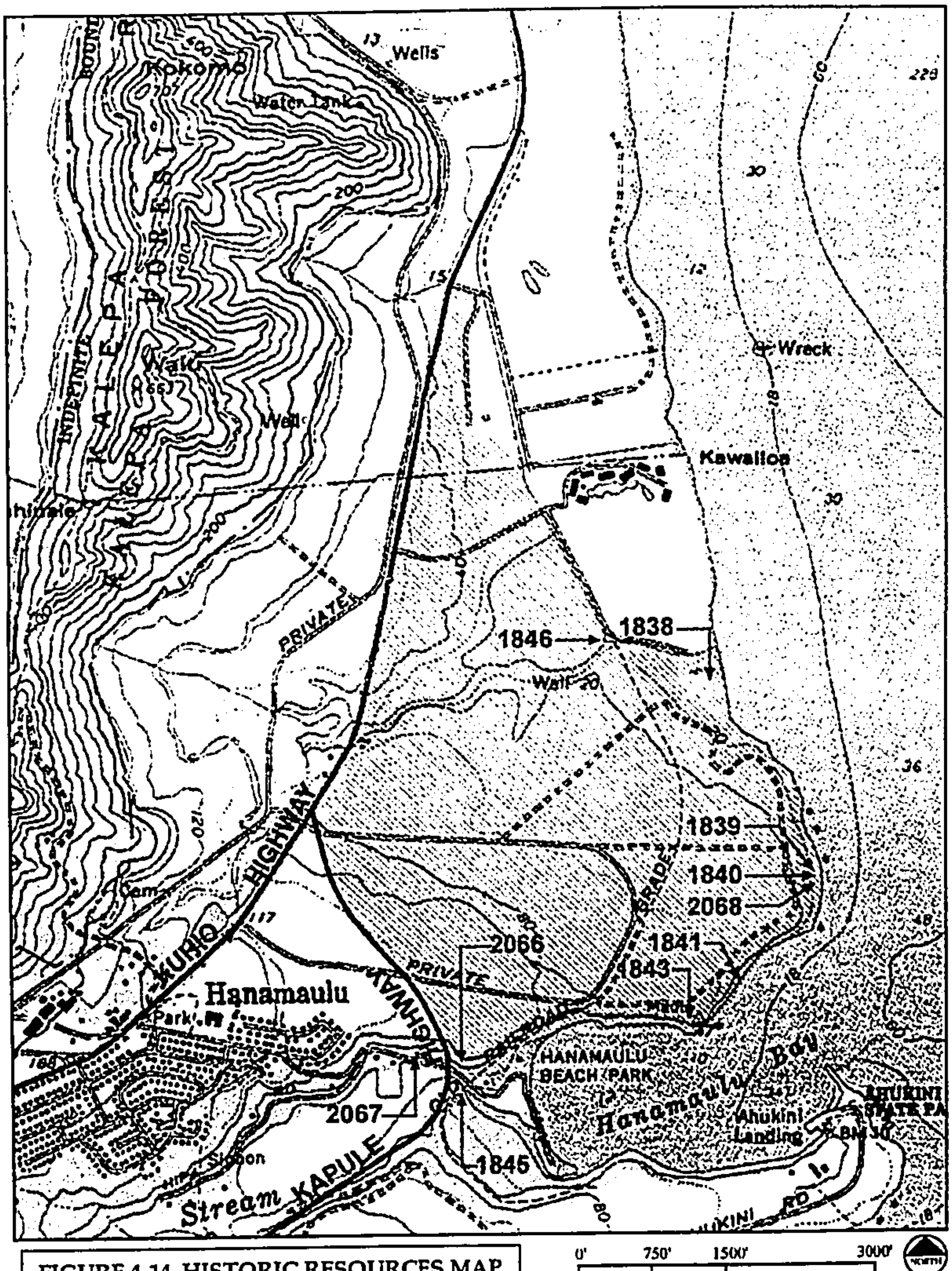


FIGURE 4-14 HISTORIC RESOURCES MAP

activities (Bennett, 1931; Cox, 1977). Because the coast between Hanamā'ulu Bay and the Wailua Golf Course consists of a rocky shoreline, activities along the coast of the present project area were probably restricted to fishing and temporary habitation activities.

4.11.2 Cultural Resources and Traditional Practices

A Cultural Impact Assessment was conducted by PHRI, Inc. (December 2001) and is presented in Appendix H.

The purpose of conducting a cultural impact assessment is to assess the potential impacts the proposed project may have upon cultural resources that include established practices, beliefs, and physical features that are associated to either native Hawaiians or any other ethnic group. Of some 56 potential information sources, 41 individuals were contacted and consulted. The identified cultural practices occurring within and immediately adjacent to the project area are entirely associated with the immediate shoreline area and inshore waters. These practices primarily involve fishing activities and other ocean recreational activities, with no activities or practices identified in the modified and altered inland portion of the project area.

The identifiable traditional cultural practices were characterized as specific activities with inherent values or beliefs that are distinctly associated to that activity. As such, no additional information was shared regarding any known cultural practices or beliefs associated to the non-tangible features of the project area. Further, no potential traditional cultural properties of any kind were identified by any of the contacted individuals or organizations. The only identified cultural practice that can be characterized as a contemporary rather than a traditional and customary cultural practice was the funerary practice of scattering cremated remains into shoreline waters.

4.12 TRAFFIC CIRCULATION

A traffic impact assessment was conducted by the Traffic Management Consultant (November 2001) and is presented in Appendix I.

<u>Kapule Highway</u>
This highway is a two-way, two-lane arterial highway between Hanamā'ulu and Līhu'e. To the north, Kapule Highway continues on as Kūhiō Highway. Kapule Highway bypasses Hanamā'ulu to the north and Līhu'e to the south. The highway is signalized at its intersection with Kūhiō Highway. Exclusive left-turn and right-turn lanes are provided on northbound Kapule Highway and southbound Kūhiō Highway, respectively.

<u>Kūhiō Highway</u>
This two-way arterial highway extends from Līhu'e to East Kaua'i. North of Kapule Highway, Kūhiō Highway is a two-way, three-lane highway, with two lanes in the

northbound direction and one land in the southbound. During the AM peak period, Kūhiō Highway is coned to provide a southbound contra-flow lane, resulting in two lanes in the southbound direction and one in the northbound. Kūhiō Highway (north and west legs) intersects Kapule Highway (south leg) in Hanamā'ulu. The east leg of the intersection would become the access to the project site.

Kaua'i Beach Drive

This roadway is a two-lane local road, located to the north of the project site. Kaua'i Beach Drive provides access to the Radisson Kaua'i Beach Resort. The Drive is stop-controlled at its T-intersection with Kūhiō Highway. An exclusive left-turn storage lane and a median left-turn shelter lane are provided on the southbound route of Kūhiō Highway at Kaua'i Beach Drive. A right-turn deceleration lane is provided on northbound Kūhiō Highway at Kaua'i Beach Drive.

Existing Traffic Circulation

The intersections were analyzed using the methodologies for unsignalized intersections outlined in the 2000 Highway Capacity Manual. Operational conditions at an intersection are expressed as a qualitative measure known as level of service (LOS), which are determined by speed, travel time, freedom to maneuver, traffic interruptions, driver comfort, and convenience. Letter designations ranging from 'A' to 'F' are used as a rating system with LOS A-C considered as satisfactory levels of service. LOS D is considered the minimum level of desirable levels of service. However, LOS E is an undesirable condition with LOS F considered to be an unacceptable level of service. Manual traffic counts were conducted at the Kūhiō Highway intersections at Kapule Highway and at the Kaua'i Beach Drive in September 2001.

Existing A.M. Peak Hour Traffic

The direction of the A.M. peak hour traffic is southbound, occurring between 7:00 - 8:00 a.m. and accounting for 71% of all traffic flow. The left-turn movement from eastbound Kūhiō Highway to northbound Kūhiō Highway operates at a LOS D level, with the remaining traffic movements at the intersections operating at satisfactory levels of service. Figure 4-14 illustrates the existing A.M. peak hour traffic volumes.

Existing P.M. Peak Hour Traffic

The direction of the P.M peak hour traffic is northbound, occurring between 4:15-5:15 p.m. and accounting for 63% of all traffic flow. The left-turn movement from eastbound Kūhiō Highway to northbound Kūhiō Highway operates at a LOS D level, similar to the morning peak conditions. The Kaua'i Beach Drive operates at a LOS E level at Kūhiō Highway. Figure 4-15 illustrates the existing P.M. peak hour traffic volumes.

State Department of Transportation Plan

The following are proposed State traffic improvements as recommended in the Kaua'i Long Range Land Transportation Plan (KLRLTP) to mitigate future highway deficiencies that are anticipated along the roadways nearby the project area:

1) Year 2010 Traffic Improvements Without Project

1. Northbound approach of Kapule Highway should be widened at Kūhiō Highway from one lane to two through lanes to match the existing north leg of Kūhiō Highway.
2. Eastbound Kūhiō Highway should be widened at Kapule Highway to provide double left-turn lanes to northbound Kūhiō Highway.
3. The intersection of Kūhiō Highway and Kaua'i Beach Drive should be signalized to mitigate existing and future deficiencies.

2) Year 2020 Traffic Improvements Without Project

1. Kapule Highway should be widened from a two-lane highway to a four-lane divided roadway between Rice Street and Kūhiō Highway, as proposed in the KLRLTP.
2. Kūhiō Highway should be widened from a three-lane highway to a four-lane divided highway from Kapule Highway to Mailihuna Road in Kapa'a, as proposed in the KLRLTP.

4.13 NOISE

Noise is defined as unwanted sound. Sound may be classified as noise when it damages hearing ability, causes other bodily effects detrimental to health and safety, disturbs sleeps and rest, interferes with conversation or other forms of communication, or is simply annoying or irritating.

The Day-Night Average Sound Level (Ldn or DNL) method, developed by the Environmental Protection Agency, is the most widely used to describe environmental noise. The measurement is weighted so that late night noises are penalized. The assumption is that nighttime noises are more objectionable than daytime noises due to sleep disturbances.

In Hawai'i, the State Department of Health (DOH) regulates noise from fixed mechanical equipment and construction activities. State DOH noise regulations are expressed in maximum allowable noise limits rather than Ldn. Although they are not directly comparable to noise criteria expressed in Ldn, State DOH noise limits for single-family residential lands equate to approximately 55 Ldn. For multifamily residential, commercial, and resort lands, the State DOH noise limits equate to approximately 60 Ldn. For light and heavy industrial lands, the State DOH noise limits equate to approximately 76 Ldn, respectively. Construction activities, which are typically noisier than the State DOH noise limits, are regulated through the issuance of permits for allowing excessive construction noise during limited time periods.

In regards to the project site, the primary noise sources are related to wind, surf, aircraft, traffic from the nearby highways, and ocean recreational activities. Generally, the rural character of the area does not generate extended periods of unacceptable levels of noise.

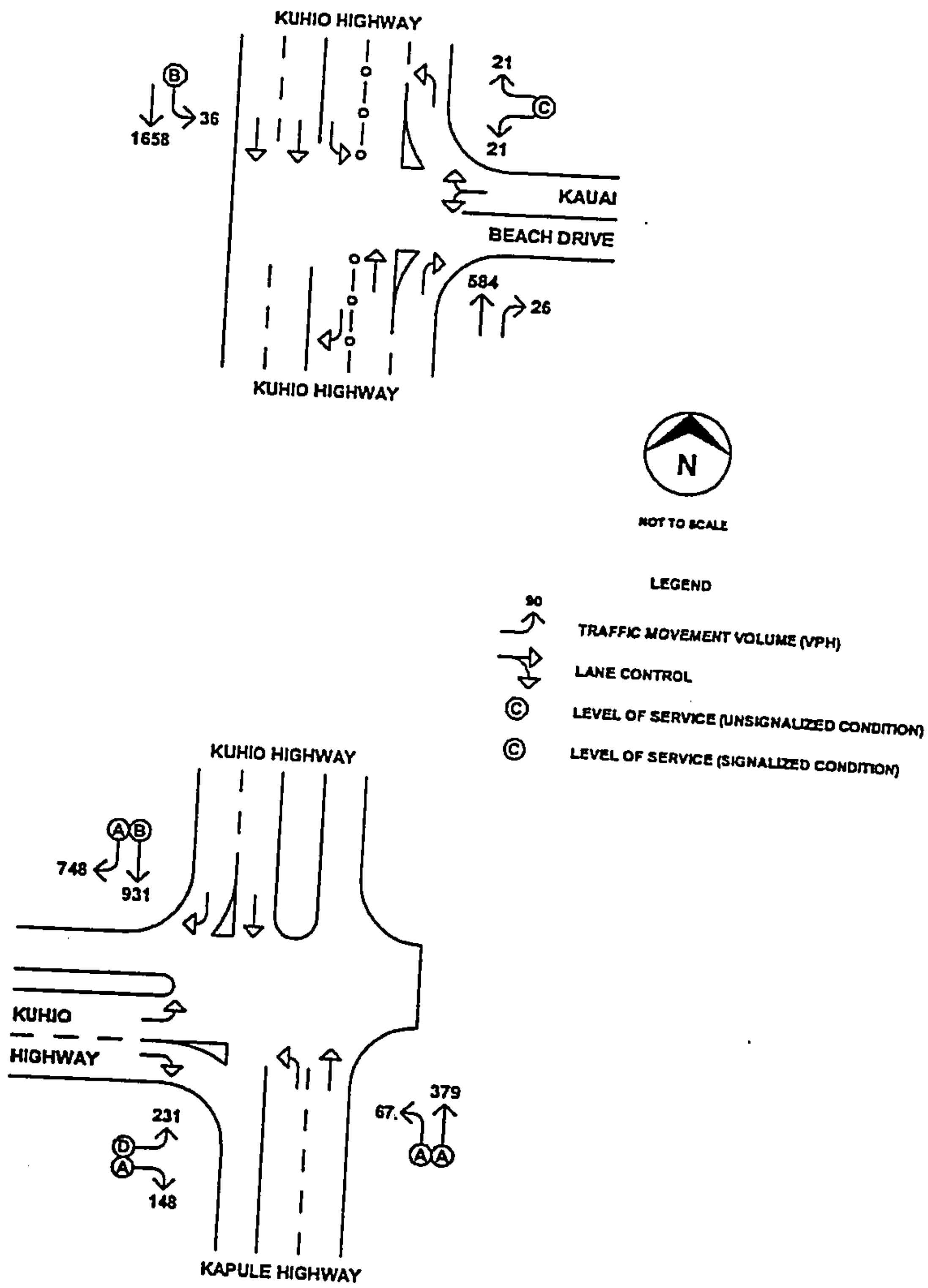


FIGURE 4-15 EXISTING AM PEAK HOUR TRAFFIC

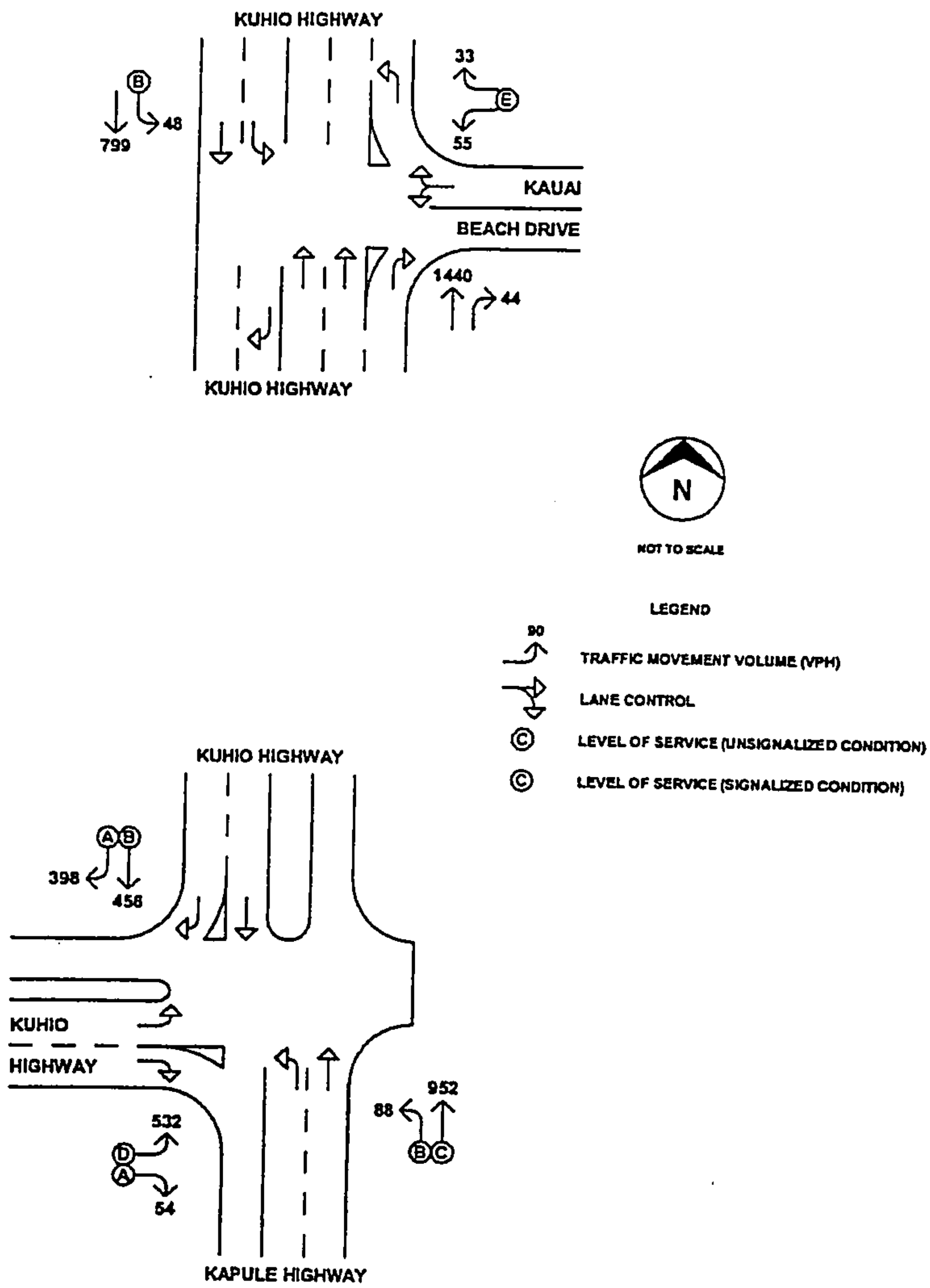


FIGURE 4-16 EXISTING PM PEAK HOUR TRAFFIC

The most significant existing noise source in the project site is air traffic associated with the Līhu'e Airport. Jet airplane departures are quite noticeable on the south side of the property. Noise generated by helicopter flights can also be detected on-site. The transition of Hawai'i's interisland jet fleet to quieter aircraft, such as Boeing 717, will help reduce noise levels experienced at the site.

4.14 AIR QUALITY

The State Department of Health, Clean Air Branch regularly samples ambient air quality at monitoring stations throughout the State and publishes the information in *Hawai'i Air Quality Data*. For the island of Kaua'i, there is a monitoring station in downtown Līhu'e, located within a commercial and residential area with nearby agricultural parcels. The station monitors levels of PM_{10}, particulate matter that includes dust, soot, smoke, and liquid droplets from sources such as factories, power plants, motor vehicles, construction activities, agricultural activities, and fires. However, there are no monitoring stations for carbon monoxide on Kaua'i.

Air quality in the Līhu'e area is good, with pollution levels below State standards. Typically, the particulate counts in Līhu'e range between 20 to 40 ug/m3 and can be attributed primarily to automobiles and activity at Līhu'e Airport. The particulate counts do peak at levels much higher than this, usually during periods of adverse weather conditions.

4.15 INFRASTRUCTURE AND UTILITIES

The existing conditions of public infrastructure and services are identified in this section. Engineering reports for roadways, mass grading, on-site wastewater, and water were prepared by Kodani and Associates and are presented in their entirety as Appendix J and K, respectively. An engineering report for wastewater treatment and effluent disposal was prepared by Gray, Hong, Bills, Nojima, and Associates, Inc. and is presented in Appendix L.

4.15.1 Access On-Site Fronting Roadways

The existing accessways on the project site are comprised of a series of integrated dirt roads that once served as on-site access for cane hauling. The project site has several highway frontages that serve as entry points to the project area. One entry point is at the intersection of Kapule and Kūhiō Highways, while the other two are located at Kaua'i Beach Road and the entryway to the Radisson Kaua'i Hotel.

4.15.2 Water Supply

The Wailua-Kapa'a (WK) and Puhi-Līhu'e-Hanamā'ulu (PLH) water systems, the two largest systems on the islands transmit source supply for the Hanamā'ulu area. These two systems are interconnected by a 16-inch water main, thereby increasing service reliability by providing alternate flow routes and stabilizing water pressure during periods of heavy usage. The WK Water System services an area that extends south from Kealia to just north of Hanamā'ulu and accommodates resort, commercial, industrial, and residential uses.

The WK Water System is supplied by 10 wells located in the inland areas of the system, as well as three storage facilities ranging in capacity from .5 to 2 million gallons. Water is transported from these storage facilities to the various service areas via a series of transmission mains that range in size from 6 to 16 inches in diameter. According to the County's Water Plan 2020, these storage facilities are estimated to have 590,000 gallons more capacity than the estimated volume required in 2020.

The project area is located within the County designated 214-service zone. However, with the current classification and zoning of the project area primarily for agricultural use, the project site has not been identified as part of the Department of Water's service area in the County's determination of capacity and requirements for its water systems.

4.15.3 Gas

The Gas Company (GASCO Inc.) services utility and non-utility consumers statewide, as well as providing technical support services to potential clients with their energy needs. Utility consumers on all neighbor islands are serviced by propane gas, which is either piped underground from a central storage facility or delivered directly to the client. Gas is consumed primarily by a variety of industrial and commercial customers, particularly in the hotel and restaurant sectors as an energy source for cooking, water heating, drying, and lighting.

4.15.4 Wastewater Treatment and Disposal

There are no existing facilities for wastewater treatment and disposal within the project area. Further, the project area does not have an existing sewer system and lies outside the Līhu'e Wastewater Collection and Treatment District. To meet the service needs of wastewater treatment, there are plans to provide on-site wastewater collection and treatment facilities, which are regulated by the Department of Health Wastewater Branch in accordance with Hawai'i Administrative Rules (HAR), Title 11, Chapter 62, Wastewater Systems.

One of the features of the new on-site wastewater treatment facilities will be the reuse of treated effluent for golf course irrigation. The regulatory authority for the treatment and use of reclaimed effluent is under the jurisdiction of the State of Hawai'i Department of Health Wastewater Branch.

4.15.5 Power and Communications

An utility analysis was conducted by Albert Chong Associates, Inc. (December 2001) and is included in Appendix M.

Overhead power, telephone, and cable television lines exist overhead along Kūhiō Highway. The overhead lines are located on the project side of the highway from the northern end to the north side of the Kapule Highway and Kūhiō Highway intersection. Just before the intersection, the overhead lines transition to the opposite side of Kūhiō Highway and follow the highway to the town of Līhu'e.

Electrical

Electrical service is provided by Kaua'i Electric, an independent electric utility, for over 30,000 customers on the island of Kaua'i. Power is generated from a 96 megawatt, diesel-fired power plant. Kaua'i Electric also has purchase power agreements with the remaining sugar producer, Gay and Robinson. Approximately 6% of Kaua'i Electric's power output is generated from renewable energy sources including hydroelectric generating power. Currently, Kaua'i Electric has developed a contract agreement with Kaua'i Power Partners, an independent power producer, to produce 26 megawatts of additional power through the installation of a naptha-fired (jet fuel) combustion turbine generation unit.

Telephone

Telephone service in the project area is provided by Verizon of Hawai'i, formerly GTE-Hawaiian Telephone Company. Record information obtained from Verizon indicates the telephone system in the area consists of overhead facilities along Kūhiō Highway. The available services range from local dial tone (voice) to high-speed fiber optic lines (voice/data).

Cable

Independently owned and operated, Garden Isle Telecommunications provides cable TV service to approximately 21,000 customers across the entire island of Kaua'i with a state of the art two-way, 870 Mhz capacity system. Garden Isle Telecommunications has underground co-axial cables feeding from an aerial plant in the immediate vicinity to the Wailua Golf Course, the Kaua'i Correctional Facility across from the golf course, and the Radisson Kaua'i Hotel. All else in the nearby area is aerial on the ocean side of the highway. Garden Isle Telecommunications also has an aerial fiber trunk in the area, as does Verizon Hawai'i.

4.16 SOCIO-ECONOMIC CONDITIONS

An analysis of market and economic impacts was conducted by SMS (September 2001) and is presented in Appendix N.

4.16.1 Demographic Characteristics of Kaua'i County

The island of Kaua'i has nearly 60,000 residents and supports, on average, 16,000 visitors each day. Of the four counties within the State of Hawai'i, the County of Kaua'i is the least populated. As of 2000, the Census Designated Place of Hanamā'ulu indicated a population of 3,272 with a median age of 35.3 years, most living in large households. The region has seen an increase in construction activity of homes and infrastructure.

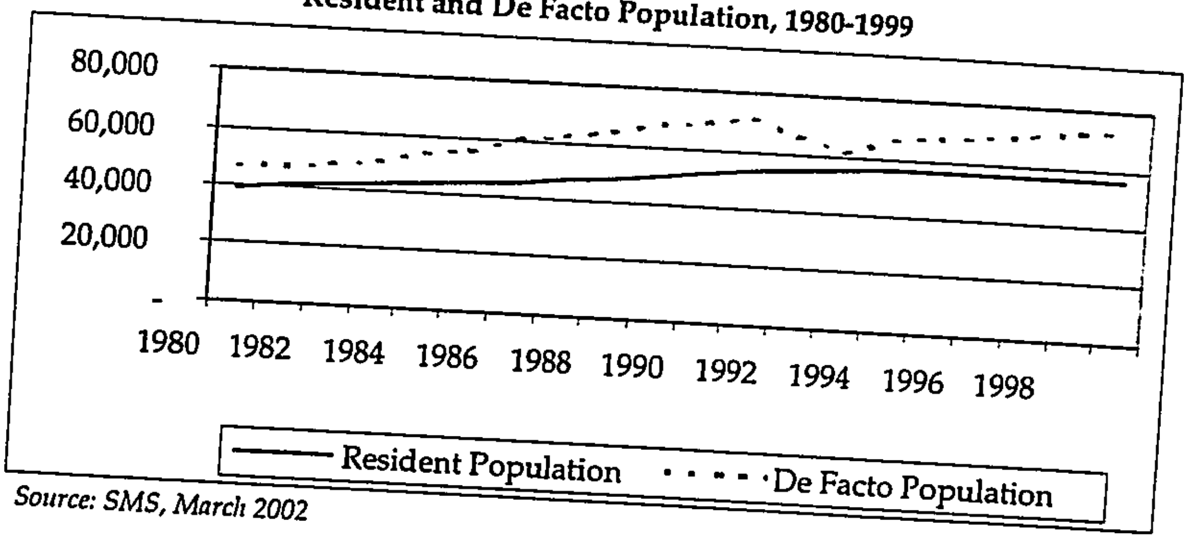
For most of the 20th century, the economy of the island was based upon sugar cultivation. However, with the closure of Līhu'e Plantation in 2000, the only existing sugar producer, Gay and Robinson, is based in West Kaua'i. Over the past ten to fifteen years, the area of Līhu'e-Hanamā'ulu has seen resurgent growth in commercial activity as well as increases in the visitor industry and related services sector. The closure of area sugar mills has emphasized the need for continued economic diversification and new employment opportunities.

Tourism has brought additional revenue to the island. The visitor industry on Kaua'i emerged with small resorts such as the Coco Palms at Wailua, offering guests an exotic tropical destination, then expanding to large-scale resorts as the areas of Princeville and Po'ipū were developed. Visitor accommodations have also been developed in Waimea, to the south, along the east coast from Hanamā'ulu through Kapa'a, and along the North Shore. The magnitude of industry is exemplified when the de facto population, the average number of residents and visitors actually on the island, and resident population are compared, as shown in Table 4-4. In 1970, the de facto population was only 7% greater than the resident population. That figure grew to 18% by 1980, then 34% by 1990. By 1990, one person in four on Kaua'i was a visitor.

In 1983 and 1992, the island of Kaua'i was badly hit by two hurricanes, Hurricane 'Iwa and 'Iniki, respectively. Properties on the south and north shores of the island were destroyed, and much effort was needed to begin the clean-up process and begin to rebuild both people's lives and the island community.

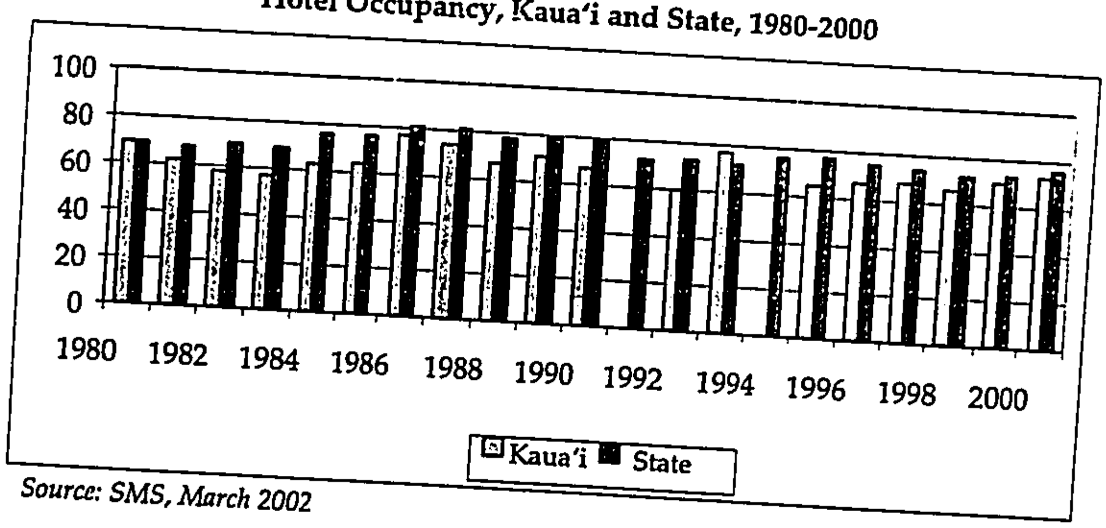
Hurricane 'Iniki set back tourism, reducing the visitor plant by 40%. The room inventory as of 2000 has only reached 92% of the 1992 peak. The visitor count has similarly returned to about the same level as before 'Iniki, as shown in Table 4-5. The most damaged hotels closed their doors. Most, but not all, have re-opened. Hotel room occupancy, a key indicator of prosperity for tourism, consequently returned to levels near that of 1994 State figures.

Table 4-4
Resident and De Facto Population, 1980-1999



Source: SMS, March 2002

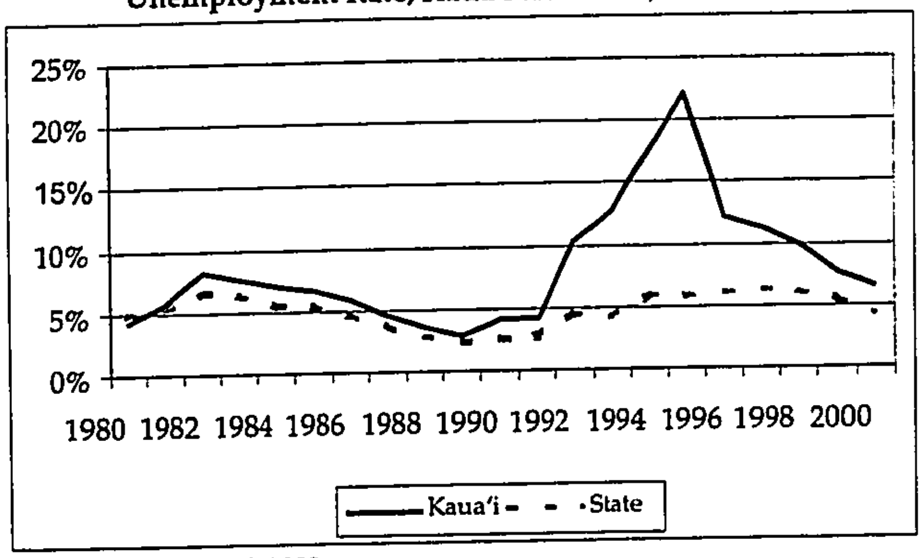
Table 4-5
Hotel Occupancy, Kaua'i and State, 1980-2000



Source: SMS, March 2002

In the 1990s, the rebuilding effort of the island community resulted with much of the existing housing and visitor facilities being repaired and put back into operation. The damage sustained from the aftermath of the hurricane created new jobs within the island community to begin the process of renewal. However, as a result of Federal Emergency Management funding dollars being no longer provided, unemployment peaked in 1996. Thus, unemployment continues to remain high, as compared to State averages, with Table 4-6 illustrating these figures through the end of 2000.

Table 4-6
Unemployment Rate, Kaua'i and State, 1980-2000



Source: SMS, March 2002

4.16.2 Public Services and Facilities

Police
Police protection for Hanamā'ulu is provided by the Kaua'i County Police Department from its central headquarters in Līhu'e town. The police station is located approximately 5 miles from the project area.

Fire
The Kaua'i County Fire Department will provide fire protection services to Hanamā'ulu out of the Līhu'e station, which is the island's central station. The Līhu'e Fire Station is located on Rice Street. It is presently composed of one engine company, a hazmat unit, and a rescue unit.

Health Care Services
Emergency ambulance service is provided by the State Department of Health. Advanced life support ambulance units are located at Wilcox Memorial Hospital in Lihue town. The Harry and Jeanette Weinberg Emergency Center provides triage area, a waiting area that accommodates 30 people, twenty beds, and range of new equipment. A high tech communication system allows the hospital to be in constant communication with Emergency Medical Teams as well as triage centers on Oahu. The Lihue Fire Department is also presently equipped to handle emergencies with a rescue unit component as part of their service.

The Wilcox Health System is comprised of the Wilcox Memorial Hospital and the Kaua'i Medical Clinic. With a staff of over 600 people and an established partnership with

Queen's Health Systems and Kapiolani Heath, the hospital offers a full range of in-patient and outpatient services, as well as access to highly specialize medical care such as neurosurgery, open-heart surgery, and neonatal intensive care. The hospital is the island's only full time health care facility with a long-term care unit comprised of 110 beds. The hospital also offers 75 acute care private rooms and seven fully monitored Intensive Care Units.

The second component of the Wilcox Health System is the Kaua'i Medical Clinic, an outpatient clinic adjacent to the hospital. The clinic has 62 examination rooms, 17 special procedure rooms, 19 patient preparation rooms, a contagious waiting area, a patient education area, and a radiology department and lab. The clinic has a staff of 60 physicians and health care professionals representing over 19 specialties in orthopedic surgery, cardiology, dermatology, gastronenterology, nuclear medicine, OB/GYN, oncology, pediatrics, and urology.

Schools

The Hanamā'ulu area is serviced by three public schools. The major public high school for the region is Kaua'i High School. The project area would be serviced by Kaumuali'i Elementary School and Kamakahelei Middle School, which is a new addition to the area. Classroom availability exceeds the Department of Education standards. Classrooms are 115% of DOE standard at the elem. school, 122% at middle, and 160% at the high school.

With the opening of the middle school, the other two schools had a drop in student enrollment. For the year 2001, the enrollment at Kaumuali'i Elementary was at 80.6 percent from the year before. The enrollment at Kaua'i High School was a 66.1 percent of year 2000 figures. The total attendance for the enrollment year 2001 for these schools was over 2,800 students.

4.17 AGRICULTURE PRODUCTION

An agriculture study for the project site was completed by Decision Analysts Hawai'i (2001) and is presented in Appendix A.

4.17.1 Island Market

Farmers in the Hanamā'ulu area are well located for servicing the Kaua'i island market because of the short distance to Lihu'e town, which is the commercial, industrial, distribution, and transportation center of the island. However the island market is comparatively small with approximately 60,000 residents in the year 2000.

4.17.2 Honolulu Market

Farmers on Kaua'i are at a distinct disadvantage with competing against farmers on the island of O'ahu due to the extra interisland shipping costs, delays, and extra handling.

Barge and air-cargo services are the primary transportation modes to ship the island's goods to Honolulu. Comparatively, barge is less expensive but shipments are slow and infrequent. Conversely, air-cargo is faster and more frequent, but with higher shipping costs, and limited cargo-hold capacities.

The Honolulu market is comparatively large with approximately 876,200 residents in the year 2000.

4.17.3 Mainland Market

Similar to distributing to the Honolulu market, farmers on Kaua'i are dependent upon either air-cargo or container ship to transport their goods. In supplying the mainland market with products that have a long-shelf life, such as canned fruit, Kaua'i farmers are competitive with farmers in Honolulu due to the fact that Matson's overseas shipping service includes interisland barge service at no additional fee, except for minor port charges. However, in distributing fresh products that must be shipped via air-cargo, Kaua'i farmers are at a disadvantage because mainland air cargo is shipped via Honolulu International Airport. This creates additional costs, delays and extra handling to transfer Kaua'i goods from interisland to overseas aircraft.

The mainland market is comparatively enormous to the local markets with approximately 281.4 million people living in the mainland U.S.

4.17.4 Potential Agricultural Uses

From around 1890 until 2000, about 326 acres (70%) of land in the project area were used for growing sugarcane, but currently now are fallow. About 340 acres (73%) of the project has good farmland based upon evaluations of soil conditions and ratings, topography, climate, and available irrigation water. However, strong on-shore winds and salt spray limit the choice of crops. Aside from sugarcane, other crops that can be grown at the site include a variety of tropical fruits, herbs, and foliage and nursery products.

Section 5.0

PROBABLE IMPACTS & MITIGATIVE MEASURES

5.0 PROBABLE IMPACTS AND MITIGATIVE MEASURES

Two types of probable impacts on the environment are discussed in this section: short-term or construction-related impacts, and long-term or operational-related impacts. Also described are mitigative measures that are proposed for implementation, where appropriate and feasible, to minimize any adverse impacts. Areas where there potentially could be adverse impacts, but where none are actually anticipated are also discussed.

Where there could be significant differences between short-term and long-term impacts (e.g., in the case of impacts on coastal water quality) separate discussions of both types of impacts are provided. Where little or no difference is anticipated, or is not considered to be significant (e.g., in the case of impacts on views) the entire discussion is included in the sections addressing long-term impacts.

5.1 POTENTIAL SHORT-TERM IMPACTS

5.1.1 Topography, Soils, and Drainage

Probable Impacts
The short-term impact of the proposed action on soils is limited to the small potential for erosion during construction. All grading operations will be conducted in compliance with dust and erosion control requirements of the County of Kaua'i. A Grading Permit must be obtained from the County of Kaua'i in order to begin construction. During Grading Permit review and approval the grading plans for the site are reviewed by the Department of Public Works and specific conditions may be attached.

Mitigative Measures
A. Dust Controls. Primary fugitive dust control methods that will be implemented include regular watering of exposed soil areas, good housekeeping on the job site, and prompt landscaping, covering or paving of bare soils in areas where construction is completed.

B. Erosion and Sediment Controls. The management of surface water and drainage control measures during the project's construction and operation will meet County of Kaua'i standards. Site design will minimize runoff and collection through on-site dispersal and filtering methods. Increased surface runoff from newly paved parking and pedestrian areas will be minimized through these methods. The impact of construction activities on soils will be mitigated by practicing strict erosion control and dust control measures, particularly those specified in the following:

- County of Kaua'i Grading Ordinance
- State of Hawai'i, Department of Health, Water Quality Standards, Chapter 37-A, Public Health Requirements (1968)
- USDA Soil Conservation Service, Erosion and Sediment Control Guide for Hawai'i (1968)

The construction period will have the greatest potential for generating suspended sediments in runoff. In estimating the potential soil loss attributable to construction activity, it was calculated that the project site would be graded over a one-year period, with no more than 10 acres being graded at any one time. Both temporary and permanent grassing would be employed for each 10 acres to minimize soil erosion. It is estimated that each 10 acres of land would take less than a month to grade and would take another month before the temporary or permanent grassing would become established. During construction, the estimated soil loss for one year is approximately 2,313 tons. This amount exceeds the existing conditions of 1,342 tons per year but will only occur at this higher rate as long as grading is on-going. Once permanent landscaping is in place, the soil losses will drop to levels significant lower than present conditions. Extensive measures will be implemented to minimize soil erosion from the construction site. The incremental load of suspended sediment is predicted to increase for all potential storms. However, the use of waste bunkers and drywells distributed throughout the project site will restrict constituent loads to the property. Natural filtering processes of the drywells will remove suspended solids prior to entering groundwater. Best management practices such as sediment basins, filter fences, diversion swales, and biofiltration swales will be used to minimize the amount of soil transported off-site to the wetlands or the ocean.

5.1.2 Ocean Water

Probable Impacts
Development of the project site could have potential short-term impacts to surface water quality and discharge to the ocean. It is possible that there will be soil erosion and loss during construction, with transport of suspended sediment to the marine environment. The potential for impacts is minimal due to the existence of natural sands and the normal conditions of coastal ocean turbulence, which continually resuspends natural sediment. Organisms that exist in the region are adapted to this stress, and are capable of withstanding large sediment loads due to natural events.

Mitigative Measures
Mitigation proposed under the previous section, addressing erosion control during construction is directly applicable to the control of potential impacts to coastal waters. An NPDES permit will be required for construction activities, which will emphasize effective measures to avoid soil loss and silt runoff in storm water discharged from the project site. Much of the sediment generated during construction will be trapped on-site in the drainage system and ponds created for the project.

5.1.3 Flora

Probable Impacts
Development of the project site will provide new landscaped areas, trees and plantings that may serve as habitat for area wildlife. None of the plants found during the field studies are considered a threatened or endangered species or a species of concern. The proposed landscaping within the Conservation District is not expected to have a significant negative impact on the botanical resources or the site or the general region.

Mitigative Measures
Areas cleared of vegetation will be revegetated with appropriate groundcover as soon as possible. This will prevent soil loss and potential discharge of sediments into the ocean and wetland area.

5.1.4 Fauna

Probable Impacts
It is expected that during construction, birds that frequent the landscaped edge of the site will move to nearby undisturbed areas and will return when disturbances cease. Stray domestic animals and other pest mammals will pass through the site during and after construction.

Mitigative Measures
No adverse impacts are anticipated, and no mitigative measures are proposed.

5.1.5 Cultural Historic and Archaeological Resources

Probable Impacts
The discovery of burials in Hawai'i during recent construction projects has been a cause for concern over the last few years. Previous archaeological studies reveal that there were known dune burials in sand dunes that run along the nearby shoreline area halfway between Hanamā'ulu and Wailua River. A review of the historic, archaeological, and cultural records indicate that to date, no burials have been identified within the immediate project area other than the known historic period cemetery (Site 2067). Another site area comprised of an upright, a road, and a foundation (Site 2066) may contain a possible burial site. However, both sites area located outside the defined project area.

Prior to the establishment of the burial laws (Native American Graves Protection and Repatriations Act of 1990 and State of Hawai'i burial laws (1990)), there was no agreed upon methodology to the effective treatment of inadvertent discoveries. However, the establishment of these laws has helped to facilitate a process that provides a guideline for agencies and communities to derive an appropriate plan of action in the event of an inadvertent discovery of ancestral remains.

Mitigative Measures
Given the area's previous alteration and modification as an agricultural parcel, the inadvertent discovery of burials is not anticipated. As stated, no known burial sites have been identified. However, the sandy areas and soil areas makai (seaward) of the former sugarcane cultivation limits have been identified by cultural informants, which include current and former members of the Kaua'i/Ni'ihau Burial Council, as areas that would have the greatest potential of containing traditional burials. Efforts will be made to minimize the level and degree of work conducted in these areas. Further, the following cultural recommendations are made as to how to respond in the event that burials are encountered during subsurface work in the project area.

The following recommendations speak to cultural concerns the Hawaiian community in general has regarding proper handling of iwi, of ancestral remains, consultation with appropriate parties and final disposition of any burial should they be encountered within the project area. It is stressed that utmost sensitivity, caring and understanding be employed when dealing with burial issues and iwi.

1. In the event of an inadvertent discovery of ancestral remains, the applicable processes outlined in existing State regulations, specifically those provided in the Hawai'i Administrative Rules, Title 13, Chapter 300, Section 40 and Section 33, will be employed.

2. If, for some reason, iwi must be moved or touched, it is highly recommended that this be conducted by a cultural monitor, a lineal/cultural descendant or someone of Hawaiian ancestry.

3. Notify and consult with known and potential lineal and cultural descendants related to any burial discovery.

4. Consult with appropriate agencies and organizations including: State Department of Land and Natural Resources, Historic Preservation Division (DLNR/SHPD), SHPD Burial staff, the Kaua'i Island Burial Council (OIBC), the Office of Hawaiian Affairs (OHA), Hui Mālama I Nā Kupuna o Hawai'i Nei, and other interested Hawaiian organizations.

5. Prepare and implement a Burial Treatment Plan to be developed in consultation with the above agencies, the appropriate organizations and parties wishing to be consulted, including lineal and/or cultural descendants.

5.1.6 Roadways and Traffic

Probable Impacts
There will be short-term impacts from trucks, heavy equipment and other vehicles that will use existing roads for access to the project site, especially for the purpose of delivering construction materials. While construction vehicles are relatively slow and difficult to maneuver, it is anticipated that they will only marginally affect overall traffic flow. With the absence of previously used agricultural vehicles, the operation of heavy machinery traffic should have a minimal impact on local traffic.

Commuting construction workers will increase traffic levels slightly but their impact is anticipated to be minor. Space will be provided within the project site area for parking all construction workers' cars and for other construction-related vehicles.

Mitigative Measures
Construction activities will be appropriately scheduled to avoid unnecessary impacts on traffic. Contractors will be responsible for providing necessary traffic controls and precautions to maintain traffic safety on roadways bordering the construction site.

5.1.7 Air Quality

Probable Impacts

Construction activities are expected to generate short-term impacts to air quality primarily, from fugitive dust emissions. Site preparation will create particulate emissions, as will on-site building construction.

Primary fugitive dust control measures include wetting down loose soil areas, good housekeeping on the job site and the prompt paving or landscaping of bare soil areas. In addition, State of Hawai'i Air Pollution Control Regulations require that fugitive dust emissions be controlled to such an extent that no visible emissions of fugitive dust from construction activity should occur beyond the property line.

There is the potential for air pollution from construction equipment and vehicles, and from vehicular emissions due to traffic disruptions from construction equipment. On-site mobile and stationary construction equipment will also emit some air pollutants in the form of engine exhausts. The larger types of equipment are usually diesel-powered. Nitrogen oxide emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are very low and should be relatively insignificant compared to normal vehicular emissions.

Mitigative Measures

The impact of construction activities on air quality will be mitigated by conforming to strict dust control measures, particularly those specified in the~~-State Department of Health's (DOH) Water Quality Standards, Chapter 37-A, Public Health Regulations, 1968~~ applicable provisions of Chapter 60.1-33, HAR, Air Pollution Control; and the U.S. Soil Conservation Service's Erosion and Sediment Control Guide for Hawai'i, 1968. These measures include soil wetting during grading activities and use of dust fences adjacent to existing homes and businesses as appropriate.

Short-term increases in vehicular emissions due to disruption of traffic by construction equipment mobilization will be alleviated by moving equipment and personnel to the site during off-peak traffic hours. Increased traffic volumes in the long term may increase vehicular emissions; however, the region is generally rural and undeveloped. Air quality conditions in the region are not anticipated to decline and no mitigative measures are required. Contractors will also be encouraged to properly maintain construction equipment to minimize exhaust emissions.

5.1.8 Noise

Probable Impacts

Development of the project site will involve construction activities, such as grading and paving which will generate significant noise levels during working hours. Earth moving equipment, such as bulldozers and diesel trucks will probably be the loudest equipment used during construction, generating noise levels as high as 95 dB, as shown in Figure 5-1. However, such exposures are only a short-term condition, occurring during normal working hours.

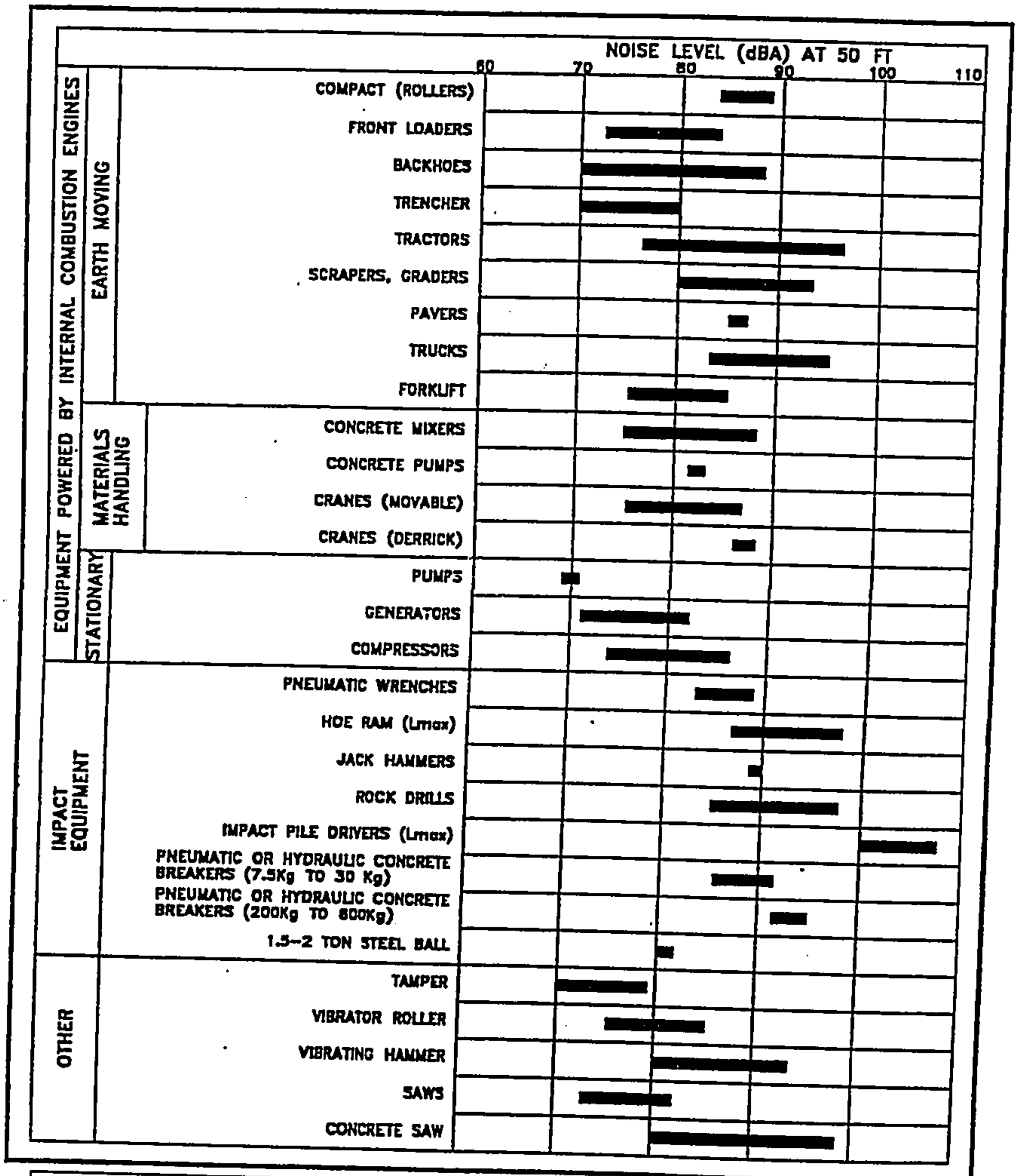


FIGURE 5-1 NOISE LEVELS OF CONSTRUCTION EQUIPMENT

Mitigative Measures
Construction-period noise will be mitigated in accordance with Title 11, Administrative Rules, Chapter 46, Community Noise Control of the State Department of Health. All construction equipment and on-site vehicles will be equipped with mufflers as required in Section 11-46-(b)(1)(A). Required permit conditions for construction activities, regarding hours and days of operation, will also be met.

Construction noise prevention measures are not expected to exceed allowable levels. Noise emanating from operational equipment such as air conditioning systems will be limited through facility design consistent with the Department of Health's Administrative Rules, Chapter 11-46, "Community Noise Control ".

5.1.9 Visual Resources

Probable Impacts
Construction activities will create some adverse effects on the views of the project site. Potential effects are expected to be visible from Kūhiō Highway, Kapule Highway, Kaua'i Beach Drive, and upslope areas. Vegetation clearing and grading involved with construction will be visible, as well as the construction of buildings and the installation of utilities. Construction of the retail and portions of the residential components are expected to be visible from Kapule Highway and Kūhiō Highway. Cleared vegetation, bare soils in graded areas and stored construction equipment will be evident on-site until construction is completed.

Mitigative Measures
During construction, equipment will generally be contained in storage areas, which are set back from roadways and nearby residences. To minimize a variety of impacts including visual effects, work on the most visible areas along existing roadways will be completed in the shortest possible time period.

Construction dust control measures will be implemented to avoid dust generation and off-site impacts. Re-vegetation and new landscape planting will be accomplished as soon as possible to protect bare soils.

5.1.10 Employment

Probable Impacts
The project will create short-term benefits as a result of design and construction employment. Total construction spending for the project will be approximately $123.4 million. The project will create up to an estimated 773 person-years of direct employment over the entire construction period between 2003 through 2015. This employment will have a multiplier effect on local material suppliers and retail businesses that can expected to benefit from the proposed project. A more detailed discussion of employment impacts is provided in Section 5.2.12.

Mitigative Measures
No mitigative measures are necessary in response to increased short-term employment.

5.1.11 Agricultural

Probable Impacts
The project will not adversely affect any existing farm operation since none currently exists on the property. The former sugar cane lands are fallow.

Mitigative Measures
No mitigative measures are necessary. Former agricultural workers will be employed during the construction phase of the project.

5.2 POTENTIAL LONG-TERM IMPACTS

5.2.1 Climate

Design of the proposed project will be typical for a tropical climate with extensive use of outdoor facilities and amenities. The proposed project will not have an affect on climatic conditions and no mitigative measures are required.

5.2.2 Topography and Soils

Probable Impacts
The development of commercial, residential and golf course areas will require disturbance of the natural grades in some areas to create level building surfaces for the structures. To the extent practicable, the Ocean Bay Plantation project will be designed to minimize significant changes to topography.

Preparation of the land for construction will involve grading and clearing operations. At the same time, the proposed plans include a coastal renaturalization that will enhance the existing natural setting and improve the visual quality of the Conservation District. Other measures will be employed to improve and maintain the conditions of the designated wetlands area. There will be a beneficial impact resulting from the project's landscaping and erosion control program.

Total excavation for the project (cut and fill) will approach 1.0 million cubic yards. There is expected to be a net fill of approximately 40,000 cubic yards.

Mitigative Measures
A. On-site Distribution and Balance of Materials. Cut material from grading will mostly be retained on the project site. The amounts of cut and fill will be balanced in the grading plan to minimize the need to import fill or to export excavated material. In addition, soil stockpiling will be conducted to contain excavated earth in controllable areas prior to its use elsewhere on the site.

B. Approved Grading Plan. Grading and related construction activities will be conducted in a manner which will insure full compliance with the dust and erosion control requirements of applicable County, State, and Federal regulations. Prior to issuance of a grading permit, the applicant will submit an erosion control plan for approval by the County of Kaua'i, Department of Public Works, as part of this process. These measures include but are not limited to use of temporary ground covers, cut off ditches, and detention ponds.

C. Landscaping. Implementation of landscaping will generally re-establish the soil retention value of removed crops and vegetation. The Ocean Bay Plantation will have extensive plantings throughout its grounds, and establish control over existing erosion areas on slopes. This continuous, long-term management of the property will significantly reduce erosion from existing conditions.

D. Facility Siting. The various project components will be sited on areas with gentle to moderate slopes to minimize site grading and excavation (cut and fill) requirements.

5.2.3 Drainage

Storm water runoff at the project site was evaluated in a engineering report prepared by Kodani & Associates, Inc (September 2001) and is presented in Appendix B.

Probable Impacts
The development of the Ocean Bay Plantation will result in some changes of the basic characteristics of the landscape. The overall drainage pattern will remain the same as present conditions with drainage to the north end of the property. With the proposed construction of buildings and roads, there will be an increase in the amount of impermeable surface area within the project site. Much of the abandoned cane fields will become part of the proposed golf course. Existing drainage patterns will basically remain the same with only minor changes in the areas of each drainage basin, as discussed below.

Drainage Area A will not be affected by the development. The areas mauka of the highway are not a part of this project and the wetland areas makai of the highway will not be developed.

Drainage Area B (103.8 acres) will include portions of the golf course, multi-family housing, commercial buildings, and roadway areas. Runoff will still flow to the wetlands area.

Drainage Area C (99 acres) will include portions of the golf course, a golf clubhouse and driving range, both single and multi-family units, and roadway areas. Runoff will continue to flow to the cove.

Drainage Area D (31 acres), E (37.7 acres), and F (9.9 acres) will includes portions of the golf course area with small pockets of single-family residences.

Drainage Area G (35.57 acres) and H (50.02 acres) will consist of single-family residences.

While an increase in impermeable surface areas may result in the generation of additional runoff, the replacement of many acres of abandoned sugar cane fields with a well-maintained golf course will result in a decrease of storm runoff. Overall, there is projected reduction in the total peak discharge of about five percent. With the given existing conditions, the total peak discharge is approximately 3,433 ft^3/second. The project future conditions are expected to have a total peak discharge of approximately 3,261 ft^3/second.

For all but one of the drainage areas, the peak discharge rates are being reduced. No downstream properties are anticipated to be adversely affected. One drainage area is projected to generate more runoff (Drainage Area C), where the runoff discharges to a grassed swale and the ocean.

Mitigative Measures
A. Irrigation and Landscaping Management. Golf course and common area irrigation and landscaping management is critical to minimizing fertilizer and pesticide impacts on surface waters. If excessive irrigation water is applied, there is a potential for increased levels of nitrate and pesticides is surface waters. Irrigation scheduling will follow the recommendations in the Integrated Golf Course Management Plan provided in its entirety in Appendix O.

B. Drainage System. In combination with measures taken to reduce fertilizers and pesticides usage on the golf course, sinks for runoffs will be developed at detention basins and a grassy swale. The sink areas will allow for the detention, dilution, uptake, breakdown of nutrients and chemicals, and capture most of the suspended sediments. Vegetation and organic soil material in the swale will capture much of the nutrients, pesticides, and sediment related to storm water runoff.

5.2.4 Erosion and Sediment Control

Probable Impacts & Mitigative Measures
Soil loss for the proposed development is expected to decrease due to the substantial increase in the landscaping, groundcover and increased impermeable areas. There will be more efficient management and maintenance of the vegetated and landscaped areas. The estimated total soil loss for the project area is 115 tons per year. Compared to the existing conditions of 1,342 tons per year, the estimate future conditions represent a dramatic improvement in sediment control.

5.2.5 Ground Water Resources

Probable Impacts
Multiple aspects of the project have the potential to affect surface and groundwater resources. Each of these potential impacts are discussed below.

A. Potable Supply From the County's Department of Water Wells in Nonou Ridge. The use of potable water from the Department of Water's system is expected to be about 0.21 million gallons per day (mgd). According to Kodani and Associates, Inc. water report, there is sufficient available capacity in the Department's three wells in Nonou Ridge (see Figure 4-5: Nos. 0320-01, 0320-03, and 0321-01). Supplying this project would be an essentially perpetual commitment of 0.21 mgd of this resource. It would also diminish the discharge of groundwater into the marine environment in the Wailua area by a similar amount. However, this latter effect would not be significant because the discharge is likely to be diffused and occur offshore at a significant depth. The adjacent discharge of the Wailua River, which averages more than 120 mgd, is the dominant fresh water input into the marine environment in the region.

B. Use of Onsite Wells for Irrigation. The use of onsite groundwater for irrigation would average about 0.47 mgd. However, during the dry years, the average usage for irrigation could near 0.7 mgd, reaching periods of 1.0 mgd during critical periods. The availability of treated effluent will initially be negligible but will gradually increase to about 0.12 mgd at the project's full build-out. Use of onsite groundwater would be diminished accordingly, ultimately declining to a long-term average of about 0.35 mgd.

There are three active offsite wells in the general vicinity of the project: Well 5921-01 which supplies a portion of the potable supply to Hanamā'ulu; Well 0120-01 which provides irrigation supply to the Wailua golf course; and Well 0020-02 which provides circulation water to the Radisson Resort's lagoon. Use of onsite wells for irrigation is not expected to affect any of the three actively used wells for the following reasons:

- All three of the actively used wells draw from the Waimea series lavas whereas the onsite irrigation wells will draw from the Koloa lavas.
- Locations of the onsite irrigation wells are downgradient (from Well 5921-01) or far across gradient (from Wells 0020-02 and 0120-01) from the actively used wells; and
- The 7 to 8 ft (MSL) water levels in the Koloa lavas tapped by the onsite wells is lower than the 10 to 15 ft (MSL) levels in the actively used wells that tap the Waimea series lavas.

C. Fertilizer and Pesticide Use on Golf Course. The proposed golf course is comprised of approximately 153 acres of total maintained turf. Turfgrass, as part of a healthy ecosystem creates a buffer zone, which helps to maintain soil stability, reduces erosion potential, and filters and deactivates conventional and alternative pesticide and fertilizer products. For the Ocean Bay Plantation project, the use of an on-site weather station, proper irrigation, controlled drainage, effective traffic control, appropriate thatch control, balancing of the soils, macro/micro nutrients, pH, and salinity, are all best management practices that will reduce overall pesticide use.

The Ocean Bay Plantation golf course will use proven Bermuda grass varieties in the putting green surfaces and Tifgreen 328 for the fairways, rough, driving range, and tees. These types of grasses will not require the use of growth regulators or post emergent herbicides to control its growth. These hybrid grasses are more adaptable to wear, low mowing heights, shade, and saline impacted water. Additionally, the landscaped areas will include a mix of native and non-native plants that are suitable for dryland conditions.

D. Infiltration of Fertilizer Nutrients to Underlying Groundwater. In the Integrated Golf Course Management Plan (Appendix O) prepared by Wm. Kent Alkire II (November 2001), the application rates of fertilizers are discussed. Of the nutrients in these fertilizers, only nitrogen has any potential to pass through the site's thick soil mantle and reach the shallow groundwater in significant quantities. As such, the assessment focused on the release rates of nitrogen.

Slow-release nitrogen fertilizers will be utilized on the golf course, landscaped common areas, and residential lots. These fertilizers release nitrogen at rates comparable to turf plant uptake rates, so the actual amount that passes below the root zone of the turf grass is minimal.

Upon buildout, it is projected that for approximately 173 acres of land that would require fertilizer maintenance, an estimated 42,600 pounds/year of fertilizer nitrogen would be needed. It is expected that approximately 5% of this amount, or 2100 pounds/year would be carried downward into the underlying shallow groundwater.

The potential impact of this nitrogen addition can be approximated as follows. Percolation of nitrogen-enriched irrigation water will reach the shallow groundwater and then move laterally. The shallow groundwater flowrate is primarily a function of local rainfall recharge. Approximating this recharge as one-third of the rainfall across the 460-acre site amounts to 230 million gallons a year or an average of about 0.63 mgd. The addition of 2100 pounds of nitrogen a year to this flowrate would increase the concentration in groundwater by 1.1 milligrams per liter.

Over about 340 acres of the 460-acre site, the shallow groundwater discharges into the man-made ditch, unnamed gully, or directly into the wetlands. Thus, approximately 0.47 mgd of the nitrogen-enriched shallow groundwater would ultimately end up in the wetlands. Most of the nitrogen would be utilized by the grasses and other vegetation in the wetlands rather than be discharged into the marine environment.

The remaining 0.16 mgd of nitrogen-enriched shallow groundwater would discharge into the marine environment along the east and south shores of the project site. The quantity of discharge is relatively small and would be spread out along a 5,500-foot long shoreline.

E. Stormwater Runoff Into the Gulch, Ditch System, and Wetlands. During field studies in late November 2001, samples were collected from the Radisson Resort and Kaua'i Lagoons golf courses to assess the likely quality of runoff from the project area. Results from these studies show that nitrogen concentrations from landscaped and parking areas of the Radisson Resort and from both Kaua'i Lagoons golf courses were less than nitrogen levels in runoff from the presently unused site. These nitrogen levels were also less than nitrogen in the runoff discharged to the ocean north of the Radisson Resort. Additionally, phosphorus levels in the Radisson Resort and Kaua'i Lagoons golf courses were higher than in runoff from the present site or discharged to the ocean.

Owning to the design of the project's drainage system and the stormwater retention capacity of the man-made ditch system and wetlands, most stormwater runoff would be retained onsite within golf course lakes or in the down gradient wetlands. Nutrients in retained runoff would either be recycled on the golf course or utilized in the wetlands. Only during severe storms, similar to irregular conditions experienced during the field study, will direct discharge to the ocean occur. When such infrequent discharges occur, the contribution to the marine environment from the developed project site will not be significant in comparison to the nutrient input by the Wailua River and Hanamā'ulu Stream north and south of the project site.

Mitigation Measures

A. Integrated Golf Course Management Plan. An Integrated Golf Course Management Program will be instituted to minimize the frequency and amounts of pesticides and fertilizers being applied at the proposed golf course. When the systematic use of alternative control management techniques fail and the results threaten the growth of turfgrass, it will be necessary to prevent further damage to healthy turf with the use of pesticides.

For the project area, only pesticides with short residual activity periods and that decompose quickly will be used as a first measure. Wherever possible, weeds will be removed by hand. For spot treatment applications, a low volume backpack sprayer will be employed. These maintenance techniques should minimize potential impacts to groundwater quality. All applications of fertilizers and pesticides will be conducted under the supervision of a Class "A" Golf Course Superintendent. All products will be EPA approved and registered by all pertinent U.S. and Hawai'i State agencies.

B. Non-potable Irrigation Water Control. Irrigation water use will be strictly controlled to amounts that area necessary to maintain the golf course and the common landscaped areas and the common landscaped areas. A Certified Golf Course Superintendent will be employed to ensure proper irrigation water use along the golf greens.

C. Advanced Secondary Treatment of Wastewater. Treated wastewater effluent will be disposed through the dilution of irrigation water and application to the golf course. Irrigation scheduling will be closely managed to avoid over-irrigation, thus minimizing any infiltration excess of nutrients. The use of advanced secondary-treated wastewater effluent for golf course irrigation will be coordinated with the County of Kaua'i, Department of Public Works and the State Department of Health. The Department of Health has issued a letter of conceptual approval of the proposed wastewater management and effluent disposal program.

D. Groundwater Monitoring Program. In addition to proper turf selection, annual irrigation water quality analyses will be conducted. Strict management practices will be employed to avoid excess irrigation that serves to pass the fertilizing nutrients beyond the turf root zone, where it provides little benefit to turf growth. The periodic testing of groundwater samples will be undertaken to assess the potential degradation of the groundwater aquifer.

5.2.6 Ocean Quality and Marine Communities

Probable Impacts

The proposed project does not include plans for direct alteration of the shoreline or offshore areas. Potential impacts to the marine environment could be considered due to project activities that deliver materials to the ocean through infiltration to groundwater and surface water runoff. Three activities may be considered relative to potential effects to the marine environment: use of groundwater for water supply, introduction of fertilizer nutrients in groundwater, and storm water discharge to the ocean.

Potable water use through the County system will diminish the discharge of groundwater into the marine environment in the Wailua area by the same volume as required for the project, approximately 0.21 million gallons per day. Such a change in groundwater discharge is inconsequential because oceanic mixing processes effectively eliminate the groundwater input at the shoreline.

Another activity of potential concern is the application of fertilizer nutrients to the golf course, including treated wastewater effluent. Typical golf courses have a loss rate of about 5 percent of the applied fertilizer that enters groundwater, which would increase groundwater nitrogen by about 1.1 milligrams per liter. About 75% of shallow groundwater on this site discharges into the on-site ditches and gullies, which discharge to the wetlands. The subject wetlands are adapted to receive high nutrient input, and most nitrogen is taken up by plants and recycled water within the wetland. The remaining 25 % of fertilizer nutrients would be discharged to the marine environment along the 5,500-foot shoreline fronting the project.

The effects to the marine environment from the discharge of fertilizers/effluent nitrogen will be insignificant due to the strong mixing dynamics of the coastal waters along this shoreline. The limited subsidies of nutrients in groundwater would be mixed to background levels essentially instantaneously. Further, Hanamā'ulu Bay does not appear to receive input of groundwater from the project site. There will be no adverse effect to the marine water quality anticipated to result from fertilizer nutrient subsidies in groundwater leaving the project site.

Stormwater runoff conditions at the project site currently contains greater nitrogen and less phosphorus than runoff measured from the nearby Radisson Resort and Kaua'i Lagoons Golf Courses. Elevated nutrients in runoff from the project site result from leaching from the vacant fields that were previously planted in sugarcane.

Most of the storm water runoff will be detained within the planned drainage system of the project on-site, including the water features on the golf course, and the storm water detention capacity of the drainage ditch system and wetlands. Nutrients in detained runoff will either be recycled on the golf course or utilized in the wetlands.

Only during severe storms, such as the 5-year event on November 26-27, 2001, will there be direct discharge to the ocean. During such events, however, several factors will negate the potential for impacts to the marine environment. Storm winds and waves are generally more intense, which results in greater mixing forces in the near shore marine environment. Further, during storm conditions, the discharge of surface water from the project site is insignificant in comparison to discharge from the Wailua River to the north of the project site, and Hanamā'ulu Stream to the south of the site.

Sediment in storm water is another potential input to the marine environment. During the construction phase of the project, there may be some soil erosion during storms. However, if sediment should enter the marine environment, the potential impacts are minimal. With the existence of natural sands and the normal patterns of coastal ocean turbulence, the marine biotic community is presently adapted to extremes in sediment stress from natural conditions.

Although there are several protected marine species that may inhabit the offshore area of the project site, there is little potential for impacting these species. There are no plans for blasting or excavation that might affect the behavior of marine mammals. Further, it is not anticipated that there will be a change in the water quality that differs from existing conditions.

Mitigative Measures

In general, as long as reasonable steps are taken during in construction practices and operational procedures that prevent unanticipated changes in material delivery to the nearshore ocean, there should be no adverse impacts to the marine environment from the proposed project.

1. Drainage System. The design of the project's drainage system will retain the majority of stormwater onsite within built ponds on the golf course and within the wetlands located down gradient from the project. Nutrients in retained runoff would either be recycled on the golf course or utilized in the wetlands. Only during severe storms will the potential for direct ocean discharge occur. However, the marine biotic community is able to adapt to infrequent stresses associated to storm events.

2. Reduced Levels of Nutrients in Runoff. The Integrated Golf Course Management Plan will systematically monitor the levels of nutrients that are applied to the landscaped areas, thereby decreasing the potential of over saturation of fertilizers and approved pesticides.

3. Groundwater Discharge. It is anticipated that approximately 75 percent of the shallow groundwater on-site will discharge to the wetlands area, which is capable of absorbing high nutrient water from surface or groundwater flow. The remaining 25 percent would be discharged to the marine environment along the 5,500-foot shoreline fronting the project. However, studies have shown that impacts related to an inflow of nutrient ground water to semi-enclosed bodies of marine waters, like Hanamā'ulu Bay, are negligible due to rapid harbor flushing. Further, from this study, it does appear that the bay receives any groundwater input from the project area. As a result, no effects to the bay from nutrient filled runoff is expected.

5.2.7 Natural Hazards

5.2.7.1 Hurricanes and Tropical Storms

Probable Impacts
Since 1955, five major hurricanes or tropical storms have caused major damage to Hawai'i.

- Hurricane Nina (1957): produced record winds in Honolulu.
- Hurricane Dot (1959): caused major damage on Kaua'i.
- Hurricane 'Iwa (1982): caused extensive damage on Kaua'i and O'ahu.
- Hurricane Estelle (1986): caused flooding on O'ahu.
- Hurricane 'Iniki (1992): caused extensive damage on Kaua'i and Leeward O'ahu.

Although three of the major storms have inflicted damage on the island of Kaua'i, the effects of these past storm events have cause minimal to no damage within the project area. However, as the result of unpredictability, frequency of occurrences, intensity, and movement patterns, the potential threat of hurricanes in the project area cannot be estimated beyond the fact that hurricanes will probably hit Hawai'i as frequently as they have in the past.

Mitigative Measures
Potential mitigative measures include complying with recommended building design standards that will help to maintain the structural integrity during the course of a hurricane. Further mitigative measures also include the proper training of staff at the golf-course facility and the project's retail center in assisting visitors if a hurricane watch or warning is issued.

5.2.7.2 Earthquakes

Probable Impacts
Seismic hazards are usually associated with causing structural damage including landslides, ground cracks, rock falls, and tsunamis. The classification of seismic hazards related to building construction is specified in the Uniform Building Code (UBC) provisions. The potential for earthquake damage is rated on a scale of Zone 0, no damage, through Zone 4, major damage.

In 1992, the United States Geological Survey (USGS) designated the County of Kaua'i with a rating Zone 1. This designation suggests that potential earthquakes emanating within the islands are expected to have very little impact in this zone.

Mitigative Measures
The project area will be in compliance with the UBC and the County of Kaua'i standards, including earthquake design provisions. Further mitigative measures can be implemented in training procedures for both retail and golf facilities.

5.2.7.3 Tsunami Inundation

Probable Impacts
In general, all coastal areas of Kaua'i are vulnerable to sustain impacts from a tsunami. However, the actual impacts of tsunami upon a particular area cannot be estimated beyond the possibility of the area sustaining heavy damage.

The ability for a structure to be able to withstand the effects of a tsunami are dependent upon several factors including: the size and speed of the wave as it is transformed while approaching the shore, the type of structure, the site design and orientation of the structure and its surroundings, and the amount of debris that is swept in the movement of the wave.

Mitigative Measures
Several mitigative measures can be considered in the site planning including the orientation of the building to the shoreline and the inclusion of open spaces. Finally, measures can be taken ensure that staff are properly trained to assist guests during an evacuation.

5.2.8 Flora

Probable Impacts
The proposed Ocean Bay Plantation should not have a significant negative impact on botanical resources of the site or the general region. All identified plants can be found in similar environmental habitats throughout the main Hawaiian Islands.

Mitigative Measures
A. Removal of Non-Native Plant Species. The overgrowth of ironwoods along the project area's shoreline has displaced the natural habitat. The ironwoods preclude the growth of native plants, shrubs, ground cover and trees that formerly flourished along this coast, such as naupaka, ilima papa, pōhuehue, pā'uohi'iaka, and other coastal varieties such as hala and coconut. Plans for the project area include the restoration of the native vegetation character of the shoreline that existed prior to the sugar plantation.

B. Coastal Renaturalization Plan. A coastal renaturalization plan will be implemented in phases, including a comprehensive plan for tree removal, re-landscaping and maintenance. The first phase consists of clearing identified diseased, damaged, and dying ironwood trees, and a phased removal of these remaining ironwoods over time. The removed trees will be chipped on-site to create mulch for the landscaping. The second phase will landscape the near-shore area with selected species of native and non-invasive introduced plants, with emphasis on enhancing the quality of the existing ecosystem.

C. Soil Erosion Controls. Measures will be taken to alleviate runoff and soil erosions effects on undisturbed vegetation throughout the project site. Steps will be taken during the construction phase to minimize erosion tendencies. Revegetation will be appropriately integrated so minimize periods of potential soil exposure.

D. Integrated Golf Course Management Plan (IGCMP). An IGCMP will be implemented to minimize the frequency and amounts of pesticides being applied at the golf course. The plan will involve extensive monitoring of turf conditions, which enables early detection of pest conditions that could become widespread and affect the natural habitat.

E. Wetlands Preserve. The wetlands area has been altered by an extended use of the area for agricultural production over the last hundred years. However, with the application of the Coastal Renaturalization Plan, the IGCMP, and other best management practices regarding soil erosion and drainage, the overall flora conditions of the wetlands preserve will also improve. The wetlands preserve will serve to maintain a balanced ecosystem for the area's natural flora.

5.2.9 Fauna

Probable Impacts

Mammalian

There are no known endangered mammalian species within the project area. It is unlikely that the development of the project site will result in any deleterious impacts on mammalian species. The detection of the Hawaiian hoary bat within the development site was not unexpected. This species is seen regularly in and around the area. Unlike nocturnally flying seabirds, which often collide with man-made structures, bats are uniquely adapted to avoid collision with obstacles, man-made and natural due to the use of ultrasonic echolocation.

Avian

Both the 'ua'u (Dark-rumped Petrel) and the 'a'o (Newell's Shearwaters) can become disoriented by exterior lighting during the course of their navigation to the open ocean during the fall months. Disorientation leads to collisions with man-made structures, often times, either dazing, injuring, or killing the bird. Collision with utility structures is considered to be the second most significant cause of mortality for these two bird species.

Three endangered waterbird species were identified within the wetland area, located in the center of the project site: the 'alae ke'oke'o (Hawaiian coot), the 'alea 'ula (Common Moorhen), and the ae'o (Hawaiian Stilt). Through survey work, indications are that the 'alea 'ula breeds within the larger wetland area. However, the wetland habitat does not favor the 'alae ke'oke'o, which prefers more open water than is currently present on site. The mats of California grass within the wetlands and canals represents a favorable habitat for the ae'o.

There is a total of 31.4 acres of wetlands located within the property. The wetlands area will ultimately be set aside as a preserve area, as it is habitat for three of the endangered

Hawaiian waterbirds. Construction of the golf course in the vicinity of the wetland area will involve consultation with the United States Fish and Wildlife Service.

Mitigative Measures
External Lighting Designs. Man-made structures or naturally occurring features that extend higher than the surrounding mean vegetation height on the island of Kaua'i may pose a threat either seabird species. Planned lighting designs will be implemented to minimize glare effects to reduce the possibility of these nocturnally flying bird species becoming disoriented and colliding with a variety of vertical elements such as buildings, walls, fences, and trees.

Landscaping/Renaturalization Plan. An overall master landscape plan will be implemented to revegetate cleared areas and to revitalize areas currently subjected to overgrowth and unkempt conditions. It is anticipated that these landscape areas will better serve as habitat areas for the various wildlife species within the project area.

Integrated Golf Course Management Plan. Use of pesticides will be controlled on-site with special care to avoid potential impacts to wildlife. Only approved pesticides will be applied.

Wetlands Management Plan. Enhancements to the wetlands area include the removal of overgrown grass and either creating or opening up existing water areas to improve water flow. This management plan should improve the quality of the environmental surrounds, thereby providing new nesting grounds for birds and habitats for other wildlife species. Any modification required to construct golf greens within the delineated wetland will require consultation with the United States Fish and Wildlife Service, under the aegis of the Endangered Species Act of 1973, as amended.

Environmental/Educational Component. Plans are underway to develop an educational component that will serve to provide information as to the various wildlife species that use the wetlands area for their habitat. These plans include developing appropriate information signage to be placed in selected areas of the project.

5.2.10 Cultural, Historic and Archaeological Resources

5.2.10.1 Cultural Resources

Probable Impacts
Upon identification and evaluation of information gathered by various cultural sources and informants, the majority of active behaviors related to cultural practices involve the use of the shoreline and inland shores for a variety of subsistence and ocean recreational activities. However, regarding the potential impacts on passive behaviors in general is more difficult to measure and assess. It should be noted that none of the informants contacted and informally interviewed explicitly identified any specific example of these types of behaviors.

Mitigative Measures
The present identification study has concluded that the proposed golf course and residential development project in the planned area is within the existing limits of the inland portion of the project area that was previously altered and modified. Therefore, the proposed project should have no significant or adverse effect on the existing cultural practices currently identified as associated with the shoreline areas and immediately adjacent inshore waters. Right associated with access and gathering practices would not be constrained, restricted, prohibited, or eliminated. Future recommended action would involve a formal recordation of the native Hawaiian cultural practices and potential traditional cultural property that have been identified as associated with the Hanamā'ulu project area.

5.2.10.2 Historic and Archaeological Resources

Probable Impacts
Significance assessments and recommended general treatments for all identified sites are based upon the Rules Governing Procedures for Historic Preservation Review in the Hawai'i Administrative Rules, Chapter 284. According to these regulations, an evaluation of significance is conducted based upon whether or not the historic property possesses integrity of location, design, setting, materials, workmanship, feeling, association. Further the historic property must meet one of the following criterion:

Criterion A) Be associated with events that have made an important contribution to the broad patterns of history.

Criterion B) Be associated with the lives of persons important in our past.

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

Criterion D) Have yielded, or likely to yield, information important for history or prehistory.

Criterion E) Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations of cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts.

All ~~the~~ ten sites within or near vicinity of the project area (9 on-site) have been determined to be potentially significant resources that meet significance criterion D. Two of the sites (1845-Railroad Bridge, 1846-Concrete Bridge) were considered significant under criterion A. Site 1845 is also considered significant under Criterion C. Other sites (2066-Upright, Road, and Foundation, 2067-Historic Cemetery) were considered as culturally significant, under criterion E.

Mitigative Measures
No further work is recommended for Site 1838 (Cultural Deposit) since it has been previously tested and is now eroded to such a degree that further research would not be feasible.

Sites 1839 (Wall and Terrace) and 1840 (Retaining Wall) have been tested, and data collected from these sites during the survey work is considered sufficient.

Site 2068, a historical refuse dump, has been measured, described, photographed, and plotted; ~~however, future work is recommended in the form of surface collection since it might contain important information on the early 1900s use of this area.~~ Date recovery work has been completed with no further protection required.

Sites 1841 (Road) and 1843 (Foundation, Road, and Concrete Wall) have been recorded and described to the extent that no further work is necessary.

Site 1845 (Historic Bridge) is considered as significant under Criteria A, C, and D due to its multiple-arched style of construction. However, the site is outside of the project area and will not be impacted by the project.

Site 1846 (Concrete Bridge) is assessed as significant under Criterion A and will not be impacted by project development.

Site 2066 (Upright, Road, and Foundation) will not be impacted by the proposed project.

Site 2067 (Historic Cemetery) is located outside the current project and is recommended to be left in a state of "as-is" preservation.

The evaluations and recommendation presented in the archaeological inventory survey are based upon a variable-coverage surface and limited subsurface inventory. In the event that any previously unidentified surface or subsurface cultural remains are encountered during site work and construction phases, archaeological consultation will be sought immediately. As necessary, an appropriate plan for the remaining eight sites will be prepared and submitted to the SHPD for their review and approval.

5.2.11 Roadways and Traffic

Probable Impacts

Site Generated Traffic

The interim phase at year 2010 is expected to generate a total 201 vehicle trips per hour (vph) during the A.M. peak hour of traffic, 107 vph entering the site and 94 vph exiting the site. During the P.M. peak hour of traffic, the proposed project is expected to generate a total of 499 vph, 242 vph entering the site and 257 exiting the site. At complete build-out, the proposed Master Plan is expected to generate a total of 378 vph during the A.M. peak hour of traffic, 143 vph entering the site and 235 vph exiting the area. During the P.M. peak hour of traffic, the proposed site is expected to generate a total of 725 vph, 391 vph entering the site and 334 vph exiting the area. Of the total 551 vph generated during the P.M. peak hour of traffic, 174 vph are expected to be pass-by trips and 377 vph are expected to be primary trips. Table 5-1 and 5-2 summarizes the trip generation characteristics.

Table 5-1
Interim Phase (Year 2010) Trip Generation Characteristics (REVISED)

Peak Hour		Single Family	Multi Family	Retail	Golf	Tennis Courts	Total
AM	Enter	15	0	56	~~36~~ 29	7	107
	Exit	45	0	36	~~13~~ 10	3	94
	Total	60	0	92	~~49~~ 39	10	201
PM	Enter	52	0	165	~~25~~ 18	7	242
	Exist	29	0	178	~~50~~ 35	15	257
	Total	81	0	343	~~75~~ 53	22	499

Table 5-2
Master Plan (Year 2020) Trip Generation Characteristics (REVISED)

Peak Hour		Single Family	Multi Family	Retail	Golf	Tennis Courts	Total
AM	Enter	33	18	56	~~36~~ 29	7	143
	Exit	98	88	36	~~13~~ 10	3	235
	Total	131	106	92	~~49~~ 39	10	378
PM	Enter	113	88	165	~~25~~ 18	7	391
	Exist	63	43	178	~~50~~ 35	15	334
	Total	176	131	343	~~75~~ 53	22	725

External Traffic

The future external peak hour traffic forecasts were based upon the Kūhiō Highway and Kapule Highway volumes with the committed improvements as presented in the Kaua'i Long Range Transportation Plan (KLRTP) for the Hanamā'ulu area. This plan was prepared for the State of Hawai'i Department of Transportation in cooperation with the County of Kaua'i Department of Public Works and Planning Department. According to the forecast, 24-hour traffic demands are expected to increase by an average of 3.75% annually to the south of the intersection of Kūhiō Highway and Kapule Highway. North of the intersection of Kūhiō Highway and Kapule Highway, 24-hour traffic demands are expected to increase by an average of 4.4% annually through a projected forecast through 2020.

Mitigative Measures
The following traffic improvements are recommended to mitigate future highway deficiencies that are expected to occur with the development of the proposed project. The analysis evaluates an interim phase in the year 2010 and a complete buildout phase in the year 2020.

Proposed 2010 Interim Phase Access Improvements

1. Southbound Kūhiō Highway should be widened/restriped at Kapule Highway to provide an exclusive left-turn lane to the Main Access Road.
2. The Main Access Road should provide an exclusive left-turn lane and a shared through/right-turn lane at Kūhiō Highway and Kapule Highway.
3. ~~The traffic signal system at the intersection of Kūhiō Highway and Kapule Highway should be modified to accommodate the Main Access Road.~~ The Main Access Road should provide an exclusive left-turn lane and a shared through/right-lane at Kūhiō Highway and Kapule Highway.
4. Northbound Kūhiō Highway should be widened to provide a right-turn acceleration land and a right-turn deceleration lane ~~to~~ at the proposed Retail Access Road.

Proposed Master Plan Access Improvements

1. Northbound Kapule Highway should be widened at Kūhiō Highway to provide an exclusive right-turn lane to the ~~Project~~ Main Access Road.
2. Eastbound Kūhiō Highway should be widened at Kapule Highway to provide an exclusive right-turn lane to Kapule Highway and a through-only lane to the Main Access Road.
3. The Main Access Road should be widened to provide separate left-turn, through-only, and right-turn lanes at Kūhiō Highway and Kapule Highway.
4. Kaua'i Beach Drive should be widened to provide separate left-turn and right-turn lanes at Kūhiō Highway.

Traffic Impact Analysis
Future highway improvements on Kapule Highway and Kūhiō Highway, as recommended in the State's Kaua'i Long Range Land Transportation Plan as well as the proposed project-related improvements are expected to mitigate the traffic impacts resulting from the development of the Ocean Bay Plantation at Hanamā'ulu project. With the given traffic improvements, the projected levels of services are as follows:

1) 2010 Interim Phase: With the implementation of the proposed traffic improvements, the intersections within the study area are expected to operated at satisfactory levels of service during the AM peak hour traffic period. During the PM peak hour of traffic, the left-turn movement from eastbound Kūhiō Highway to northbound Kūhiō Highway, and the through and left-turn movements on the Project Access Road at Kapule Highway/Kūhiō Highway are expected to operate at LOS C. The other intersections within the project area are expected to operate at satisfactory

Table 5-3
Comparison of Levels of Service – 2010 Interim Phase

Intersection	2010- Without Development		2010- With Development	
	AM Peak Hour LOS	PM Peak Hour LOS	AM Peak Hour LOS	PM Peak Hour LOS
Left turn movement from EB Kūhiō Highway to NB Kūhiō Highway	E	E	C	C
NB movement on Kapule Highway/Main Access	A	E	C	C
Kaua'i Beach Drive turning onto/ Kūhiō Highway	C	F	B	C

levels of service. Table 5-3 and Figures 5-2 and 5-3 illustrate the projected levels of service in the 2010 interim phase for the AM and PM peak hour of traffic.

2) 2020 Buildout of the Master Plan: During the AM peak hour of traffic, the intersections are expected to operate at satisfactory levels of service, under the proposed traffic improvements. During the PM peak hour of traffic, the left-turn movement from eastbound Kūhiō Highway to northbound Kūhiō Highway, and the through and left-turn movements on the Project Access Road at Kapule Highway/Kūhiō Highway are expected to operate at LOS D. The overall intersection is expected to operate at LOS C. The other intersections within the study area are expected to operate at satisfactory levels of service. Table 5-4 and Figures 5-4 and 5-5 illustrate the projected levels of service during the AM and PM peak hour of traffic.

Table 5-4
Comparison of Levels of Service – 2020 Buildout

Intersection	2020- Without Development		2020- With Development	
	AM Peak Hour LOS	PM Peak Hour LOS	AM Peak Hour LOS	PM Peak Hour LOS
Left turn movement from EB Kūhiō Highway to NB Kūhiō Highway	B	D	C	D
NB movement on Kapule Highway/Main Access	A	A	B	C
Kaua'i Beach Drive turning onto/ Kūhiō Highway	B	F	A (north)/C (south)	A (north)/C (south)

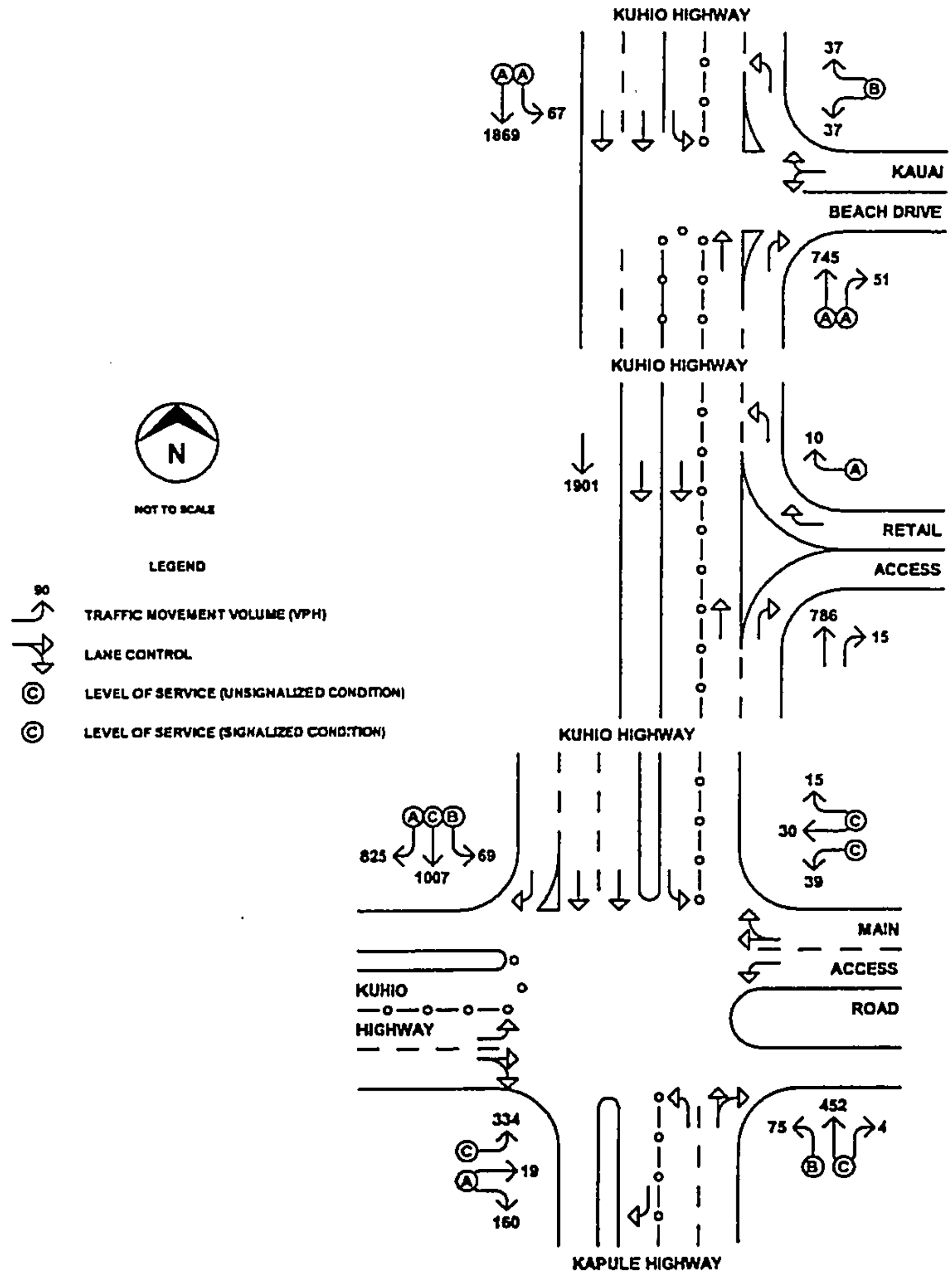


FIGURE 5-2 2010 AM PEAK HOUR TRAFFIC WITH PROJECT

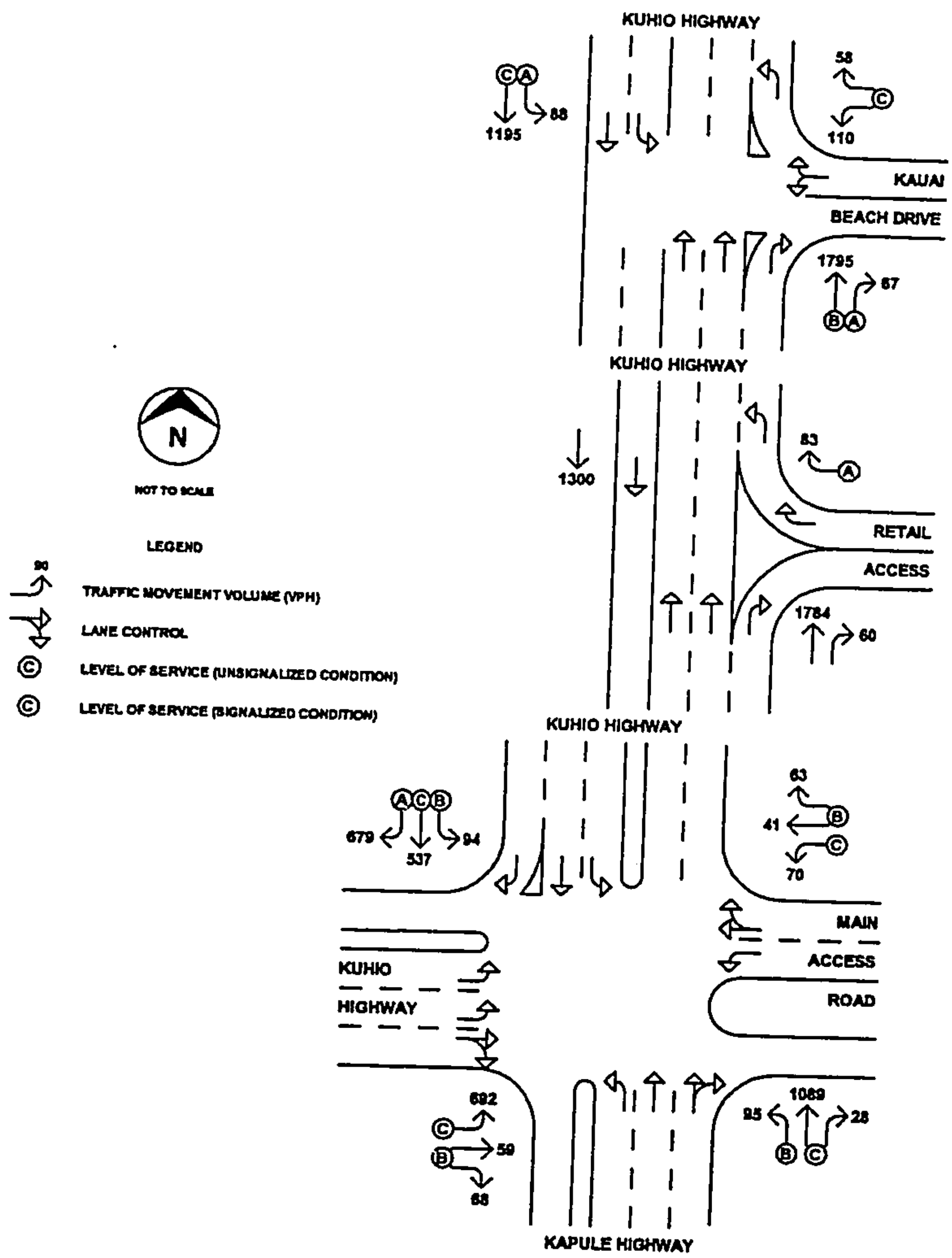


FIGURE 5-3 2010 PM PEAK HOUR TRAFFIC WITH PROJECT

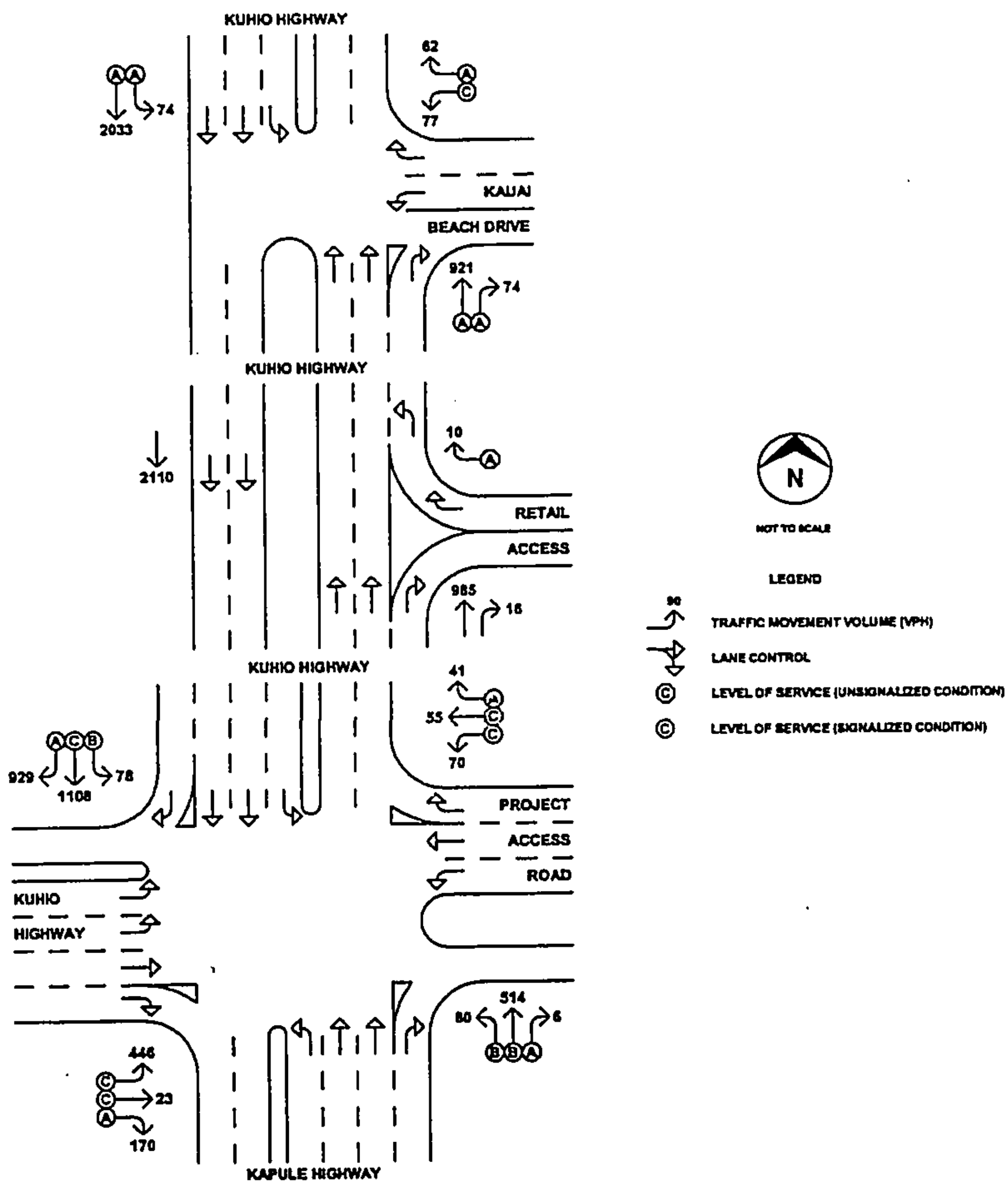


FIGURE 5-4 2020 AM PEAK HOUR TRAFFIC WITH PROJECT

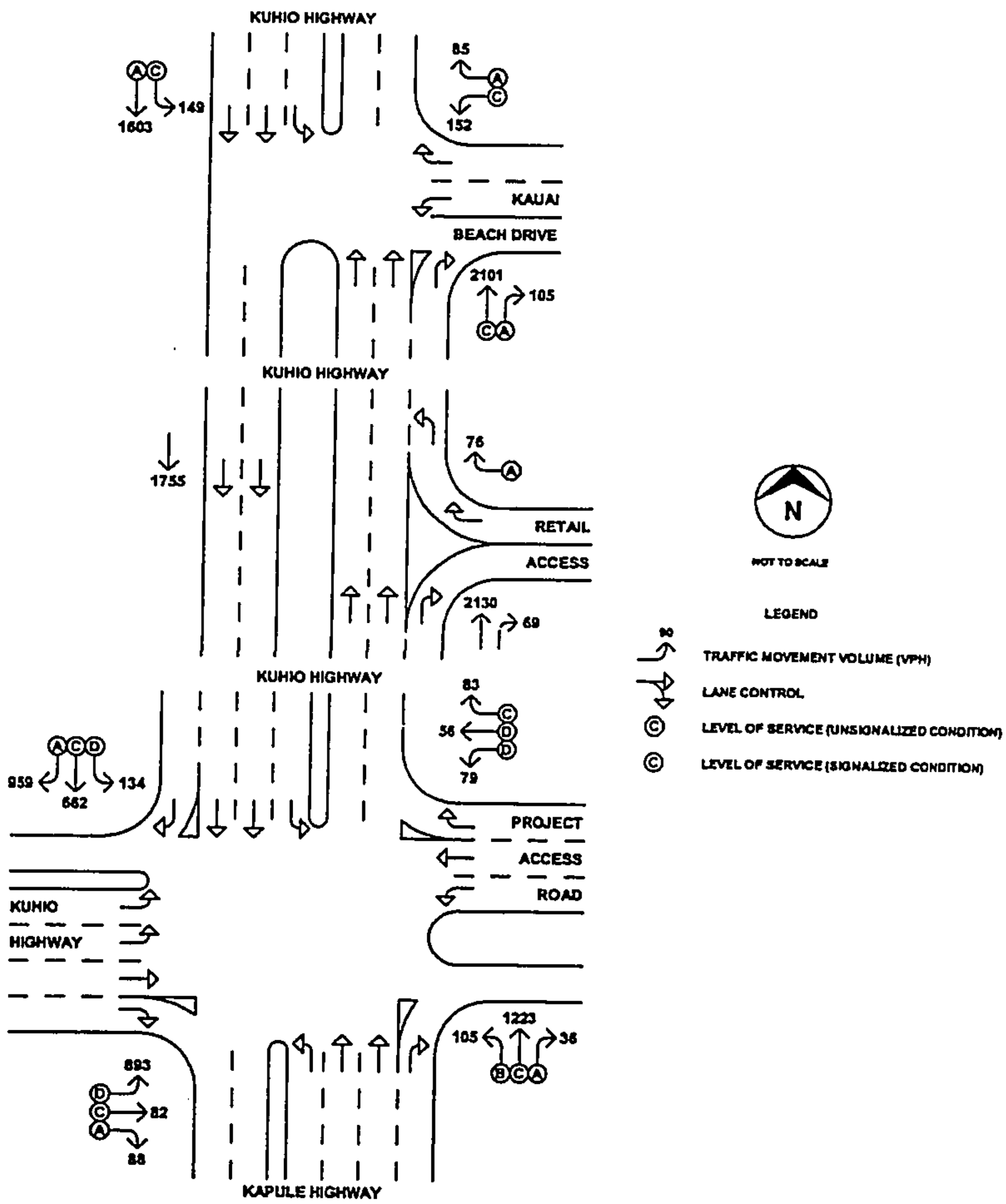


FIGURE 5-5 2020 PM PEAK HOUR TRAFFIC WITH PROJECT

5.2.12 Air Quality

Probable Impacts
Air quality conditions in the region are not anticipated to decline as a result of operations relating to the new Ocean Bay Plantation. Potential air quality impacts may result from the traffic activity at the retail center, as well as some golf industry uses.

Increased traffic volumes in the long term may increase vehicular emissions; however, the region is generally rural and undeveloped, and is exposed to consistent tradewinds. Traffic flow at the project entrances intersections will cause vehicle delays, with the potential for idling vehicles to create a concentration area for vehicle emissions. Due to air circulation at the Hanamā'ulu area, vehicle emissions are not anticipated to cause an adverse effect to air quality for neighboring residents or businesses.

Mitigative Measures
A. Pesticide and Fertilizer Use. The use of low spray pressure equipment should reduce the potential for creating airborne fine droplets. Spray applications will be made only during the hours in which there is little activity on the golf course to minimize the risk exposure of people to airborne spray particles.

On-site long-term direct air quality impacts are not expected to be significant. Application of chemical fertilizers and pesticides will be directed for use, as deemed necessary by a certified Golf Course Superintendent. Precautions will be taken in the application of these chemicals to ensure the safety of the applicator and any nearby receptor sites downwind.

B. Vehicular Traffic. There will be potential long-term indirect impacts on air quality along the project area's roadways due to project-related traffic. By serving as an attraction for increased motor vehicle traffic, the project is considered to be a potential indirect air pollution source. However, the recommended traffic improvements for the area would be signalized intersection of Kūhiō Highway and Kaua'i Beach Drive. Therefore, the anticipated higher concentrations of vehicular emissions due to increased congestion and vehicle queuing will still occur even if the project is not built. It is anticipated that the overall one-hour concentrations in the project area should remain well within the State and national AAQS standards. To help mitigate the effects of vehicular emissions, traffic patterns at the retail center will be designed to minimize traffic congestion, which will reduce vehicle delays and exhaust emission effects.

C. Electrical Demand. The annual peak demand of the project when fully developed is not expected to exceed 5.5 megawatts. The present generating capacity on the island of Kaua'i is 96 megawatts with most of its power supplied by oil-burning generating units. As a consequence of electrical power usage, the proposed project will contribute to indirect air pollution emissions from power generating facilities, emanating from expanding and/or additional burning of fuel in oil-fire generators. However, there are plans for an independent power producer to build a jet-fueled generating facility that will create an additional 26 megawatts of power. Thus, the overall indirect air quality impact related to electric demand is relatively small.

D. Wastewater Treatment Facility Odors. The proposed wastewater facility will utilize a secondary treatment process that provides excellent effluent quality. Effective odor control measures will be in place at the main treatment facility and the pump stations throughout the project. No odors should be detected anywhere outside the boundary of the wastewater treatment area.

E. Commercial Center Activity. Business selection criteria and design & management guidelines will be enforced in the development and operation of businesses at the retail center. These criterion and guidelines will encourage the establishment of businesses that do not generate noxious odors, smoke or dust.

5.2.13 Noise

Probable Impacts

Long-term traffic noise levels at adjacent residences should not be excessive. Additional traffic noise from the Ocean Bay Plantation will not contribute significantly to the overall acoustical environment at adjacent areas such as the Kaua'i Radisson, the Wailua Municipal Golf Course, and the nearby town of Hanamā'ulu.

Noise associated with ground maintenance equipment, such as lawn mowers and leaf blowers, could have an adverse on the proposed residential areas, particularly when the equipment is near the housing. Noisy equipment is also incompatible and disruptive with golf play.

Noise sources from clubhouse operations could include kitchen equipment, fans, air conditioners, refrigeration equipment, pool pumps, as well as sound systems for announcements or music. Noise from the clubhouse could potentially impact the nearby future residential areas in the immediate vicinity. The sound from the mentioned sources should not create a significant noise impact to the closest possible future residences of neighboring projects, which would be at least 2,000 feet distance.

Noise from air conditioning equipment, pool pumps, exhaust fans, trash compactors, and any other stationary equipment at the golf clubhouse, beach center, and residences will not exceed the noise levels allowable by the State Department of Health's noise regulations. Noise from equipment at the project's buildings will not be audible off-site. Trash pick-up and delivery vehicles are normally scheduled to cause minimal disturbance to neighboring residential units.

Noise generated from the air traffic at Līhu'e Airport will continue to affect the surrounding area. Future residents of the Ocean Bay Plantation and visitors to the site will be exposed to noticeable noise during jet departures and helicopters passing nearby. The transition of Hawai'i interisland jet fleet to quieter Boeing 717 models will help reduce noise levels experienced at the site. Future and prospective residents will be made aware of this pre-existing condition.

Mitigative Measures
A. Long-term Operational Noise Control. Design of the Ocean Bay Plantation facilities will include noise mitigation measures in the planning and location and orientation of air conditioning equipment, exhaust fans, pumps and other equipment, such that local noise regulations will be satisfied. The site planning for facilities shall incorporate adequate setback distances. Proper sound insulation measures shall be incorporated into the building design.

Ground maintenance equipment will be powered by internal combustion engines with exhaust mufflers. Schedules for maintenance will be arranged so noisier operations do not occur near residences (on and off the project area) before 7:00 a.m. or after 5:00 p.m.

B. Golf Clubhouse and Community Facility Noise Control. The site planning for the golf clubhouse, beach center, and other recreational or community facilities shall incorporate adequate setback distances, respecting future residential areas. Proper sound insulation measures shall be incorporated into the building design. Outdoor events that propose the use of amplified sound will be arranged at reasonable and convenient hours so as to limit the disruption of residential areas in and around the project site.

5.2.14 Visual Resources

Probable Impacts
The proposed project will be beautiful, replacing an abandoned commercial agricultural property with low-density residential units, a retail center, golf course landscaping and green open areas. Long-term visual impacts will result from the construction of the proposed structures and the addition of new landscaping of the Ocean Bay Plantation project. Residential units and the retail center will be visible from Kūhiō Highway. All new structures will generally be visible from upslope areas. The range of views from the project site is expected to be enhanced through the creation of an open space and trail system open to the public.

Mitigative Measures
Buildings and adjoining facilities will be constructed in a manner that is aesthetically pleasing, focusing on an architectural and landscape design that maintains the quality of this area's country feeling. To preserve existing views, vegetation clearing and the removal of existing mature trees will be limited to only those areas that are necessary. Important mauka and makai view corridors will be reflected in the siting of structures and their design. Locating structures and facilities to fit the landscape and grading of the site, and limiting their prominence, will minimize adverse visual impacts. Building heights, locations, materials, colors and surrounding landscaping will be restricted through design standards reflecting the rural-country project theme.

Lighting of the Ocean Bay Plantation will be limited to necessary areas including entrances, structures, parking and interior streets. Lighting will be subdued to avoid adverse glare and other lighting effects on nearby properties and nighttime visibility in the general area. Sensitive lighting design will be applied to minimize potential off-site lighting impacts.

5.2.15 Economic and Fiscal Impacts

5.2.15.1 Employment and Incomes

Probable Impacts

The project will generate short-term jobs, due to construction, and long-term employment associated with operations. Employment associated with both construction and operations falls into three broad types:

- Direct jobs are immediately involved with construction of a project or with its operations. Direct jobs are not necessarily on-site: construction supports construction company personnel in offices and base yards, as well as on site.
- Indirect jobs are created as businesses directly involved with a project purchase goods and services in the local economy.
- Induced jobs are created as direct and indirect workers spend their income for goods and services.

<u>Construction</u>

Construction will involve a major effort in the first few years of activity, to build the golf course, clubhouse, and project infrastructure. The rest of the project will build out in time over later years, as homes are sold.

Forecasting the number of construction jobs that will be created as a result of this project is estimated by calculating projected spending on construction-related materials and services. The ratio of jobs per million dollars of spending varies on the type of work and the stage of the project. Table 5-5 illustrates the estimated number of construction jobs that will be created with this project and estimates incomes in 2001 dollars.

According to Table 5-5, an estimated 929 person-years of direct employment are expected on the project over the entire construction period. In the early years, the average number of workers on the project site would usually be about 90 persons at a time, assuming about 20% of the construction workforce to be off-site.

Indirect jobs would be located both on Kaua'i, where construction firms would buy some materials and supplies, and on O'ahu, the source of many materials and parts used throughout Hawai'i. If about half of the indirect jobs are on Kaua'i, the total number of direct and indirect construction-related jobs would be about 1,130 person-years, or 85% of the total direct and indirect jobs. Indirect jobs are supported by workers' spending, so these tend to be located in the general area of the work site. If nearly 85% of the induced jobs, about 1,000 person-years are Kaua'i-based, the total Kaua'i job impact would come to about 2,140 person-years. Over the entire construction period, the

Table 5-5
Construction Employment and Incomes

	2003-2005	2006-2010	2011-2015	2016-2020	Cumulative to Buildout
Construction Spending (Millions 2001 $s)	$ 64.1	$ 41.4	$ 26.0	$ 13.6	$ 151.0
Direct Construction Employment					
Jobs (person-years)	337	290	182	120	929
Income (total for period)	$11.9	$ 10.2	$ 6.4	$ 4.2	$ 32.7
Indirect Construction Employment					
Jobs (person-years)	148	128	80	53	409
Income (total for period)	$ 5.6	$ 5.2	$ 3.3	$ 2.1	$ 16.2
Induced Construction Employment					
Jobs (person-years)	437	375	235	145	1,192
Income (total for period)	$ 13.4	$ 11.5	$ 7.2	$ 4.5	$ 36.6

Source: SMS, March 2002

Table 5-6
Direct Operations Employment, By Location

	2005	2010	2015	2020	Buildout
Golf Course					
Maintenance	4	4	4	4	4
Golf Course Landscaping	11	11	11	11	11
Pro Shop	5	5	5	5	5
Clubhouse	29	29	29	29	29
Commercial Area					
Retail	0	100	100	100	100
Gas Station	0	6	6	6	6
Offices	0	15	15	15	15
Restaurant	0	25	25	25	25
Housing Areas					
Household Services Single Family	0	2	4	6	7
Household Service Multi-Family	0	2	3	3	3
Security (Total)	3	3	3	3	3
Landscaping/Maintenance SF	0	1	3	4	5
Landscaping/Maintenance MF	1	5	8	8	8
Total	54	208	215	218	220

Source: SMS, March 2002

Table 5-7
Direct, Indirect, and Induced Operations Employments and Incomes

	2005	2010	2015	2020	Buildout
Direct Employment					
Jobs (person-years)	54	208	215	218	220
Income (total for period)	$1.6	$ 4.5	$ 4.6	$ 4.7	$ 4.8
Indirect Employment					
Jobs (person-years)	6	14	15	15	15
Income (total for period)	$ 0.2	$ 0.4	$ 0.4	$ 0.4	$ 0.4
Induced Employment					
Jobs (person-years)	6	50	52	53	54
Income (total for period)	$ 0.2	$ 1.5	$ 1.5	$ 1.6	$ 1.6

Source: SMS, March 2002

impact of construction would support an average of approximately 100 jobs per year on Kaua'i and an additional 15 jobs annually off-island.

Operations

Operations jobs will be created throughout the project. The major job centers will be at the golf course and commercial area, but some jobs will be located in the residential areas as well. Table 5-6 shows direct jobs by location within the project, while Table 5-7 translates these numbers into industry categories, to estimate direct, indirect and induced jobs and incomes .Upon full operation of the facilities, including the golf course and Gateway Village, an estimated 220 operation jobs would be created. The majority of these jobs would be new opportunities in the retail sector as well as the completely new golf course facility. However, some of the retail market would stem from existing services looking to relocate. The total number of jobs on Kaua'i associated with operations at the project would be about 250, which includes both indirect and induced jobs.

5.2.15.2 Population and Housing

The project will attract primarily people who consider Kaua'i a prime resort destination as well as new residents, many of whom may have considered alternative locations of residence if the project were not built. Accordingly, the resident population growth can be considered as a new source of jobs, revenue, and expenditures at the county level.

The population within the project area is expected to consist of a mix of full-time residents and vacationers. It is anticipated that the multi-family housing and golf-adjacent homes would be used as vacation homes, while most of the full-time island residents would occupy the single family area to be offered on the north side of the property.

By the year 2010, it is estimated that the resident population within the project area will be about 150 persons, and would eventually come to 330 persons at buildout. Table 5-8 illustrates the expected residential population and the average on-site population in the residential parts of the project, including vacationing owners and their guests. The average on-site population would come to about 430 at buildout.

Table 5-8
Ocean Bay Plantation Resident and Average On-site Population

	2005	2010	2015	2020	Buildout
Housing Built					
SF (golf adjacent)	6	9	2	0	0
SF (other)	0	0	9	9	10
MF	29	29	0	0	0
Cumulative	35	224	345	391	423
Resident Population					
New	16	17	17	17	
Cumulative	16	103	190	273	333
Average On-Site Population					
New Vacationers	10	11	1	1	
Cumulative Vacationers	10	64	94	97	99
Cumulative Residents + Vacationers	26	167	284	370	431

Source: SMS, March 2002

The new construction of homes will impact the demand for housing. The project will impact not only the physical inventory of the new homes built but serves as an indirect catalyst for project workers to perhaps start their own households, thereby increasing housing demand. The net addition to the housing stock on Kaua'i (less workforce demand) will be about 370 to 390 units.

5.2.15.3 Fiscal Impacts

State of Hawai'i
For the State, new revenues attributable to the project come from construction. Table 5-9 illustrates the expected State revenues that will be associated with the project's construction, estimated at $12 million by the end of the construction phase. Additionally, new business operations and residential units will provide increased revenue from excise and income taxes.

County of Kaua'i
For the County of Kaua'i, the Hanamā'ulu project will bring a major increase in property tax revenues, as fallow agricultural land is converted to urban uses. Appendix N details the projected changes in land values and taxes associated with the proposed development. The annual taxes would amount to approximately $1.5 million annually

as the project is fully built out, for a cumulative increase in taxes of $19.3 million (constant 2001 dollars) by 2020.

Since the project will bring to Kaua'i residents and visitors who might have considered alternate locations of residence, the additional population can be viewed as a source of new costs for the County. Comparing projected revenues and cost, the project is expected to provide an estimated net gain to the County of Kaua'i that would result in the accumulation of $800,000 annually, with a cumulative net gain of approximately $15.5 million by the end of year 2020. Table 5-10 shows the projected net increase for the County of Kaua'i.

Table 5-9
State Revenues Anticipated With Project Implementation

	2003-2005	2006-2010	2011-2015	Cumulative to Buildout
(In Millions $s)				
Total Construction Spending	$64.1	$41.4	$26.0	$151.0
Excise Taxes				
Construction Spending	$2.6	$1.7	$1.0	$6.0
Construction RelatedWorkforce Spending	$0.3	$0.3	$0.2	$0.9
Corporate Income Tax				
Construction	$0.2	$0.1	$0.1	$0.4
Personal Income Tax				
Construction-Related workforce Incomes	$1.7	$1.5	$0.9	$4.7
Total	$4.7	$3.5	$2.2	$12.0

Source: SMS, March 2002

Table 5-10
Net Revenue Increases Associated with Ocean Bay Plantation Project, County of Kaua'i

Dollar Values in $1,000s	2005	2010	2015	2020	Buildout
County Real Property Increase	$ 521.3	$ 1,086.9	$ 1,418.3	$ 1,538.8	$ 1,565.6
On-Site Population					
Residents	16	106	190	273	333
Vacationers	10	64	94	97	99
TOTALS	26	167	284	370	431
Average Cost of County Services					
Residents	$ 21.3	$ 138.0	$ 254.6	$ 366.0	$ 446.3
Vacationers	$ 15.0	$ 97.3	$ 165.3	$ 215.3	$ 251.2
TOTALS	$ 36.3	$ 235.3	$ 419.9	$ 581.3	$ 697.5
Net Gain in Revenues					
Annual	$ 485.0	$ 851.6	$ 998.3	$ 957.5	$ 868.2
Cumulative	$ 781.9	$ 4,629.1	$ 9,928.5	$ 15,494.9	

Source: SMS, March 2002

Mitigative Measures
Economic indicators suggest that the project will yield an overall positive economic benefit to the local region as well as the general island community. As such, there are no proposed mitigative measures.

5.2.15.4 Public Services and Facilities

Probable Impacts

Police
The Ocean Bay Plantation at Hanamā'ulu project will increase the population and therefore increase the demand for police protection services. The new residential development will be served by a private security force, thus eliminating the need for expanded police patrols by County police onto the project. Police will be called to the site only under emergency conditions.

Fire
The proposed project will increase the demand for firefighting capabilities in the area. However, tax revenues generated by the project should more than cover the cost of additional services required of a fire station attributable to the development.

Health Services
The project will place a small additional demand on emergency health care services due to the added population in the area. The proposed project could also add to the number

of patients treated at the Wilcox Health System due to the expanded population that will be located in the service area.

Schools

With the addition of a new middle school near the project area, the existing enrollment in the nearby elementary and high school has dropped. After buildout, it is estimated that about 75 to 100 new students will be attending the nearby schools, approximately 75 from Ocean Bay Plantation households and the remainder coming from workforce households. The maximal project residential population in the Department of Education schools would amount to 2.6% of the current enrollment in Kaumuali'i Elementary, Kamakahelei Middle, and Kaua'i High Schools, which have 115%, 122%, and 160% of the classrooms they need for their enrollment. Therefore, there is more than enough space to accommodate future enrollment from school-age children that are associated with project households.

Mitigative Measures

Tax revenues generated by the project should more than cover the cost of any additional police and fire protection, emergency health care and hospital services attributable to the development.

5.2.16 Agricultural Production

Probable Impacts

Hawai'i's sugar and pineapple industries have decline substantially over the past three decades, resulting in an enormous and growing supply of farm lands available for diversified agriculture and other land uses. Further, land requirements to accommodate the growth of diversified crops are modest compared to the available supply as well as previous land acreage use during plantation productions. Although the project will commit about 340 acres of good agricultural land to a non-agricultural use, this use will not adversely affect the growth of diversified agriculture.

Mitigation Measures

Ample land is available for diversified agriculture. The amount of land released from plantation agriculture since 1968 has been close to 236,000 acres. This supply of available agricultural land outweighs existing land demand for diversified agricultural operations (approximately 38,500 acres over the same period). While some of the existing available land has been converted or is scheduled to be converted to non-agricultural use, most of it remains available for diversified agriculture. The limiting factor to the growth of diversified agriculture is not the land supply, but rather the size of the market for those crops that can be grown for profitability in Hawai'i.

5.2.17 Utilities

Water Supply

Probable Impacts

The project uses will require up to 250,000 gallons per day of potable water. The proposed project will require water being brought from the main lines from Kūhiō

Highway to the project site. Improvements to the transmission mains will be required as the interior roadways within the project area are constructed.

The County of Kaua'i Department of Water's (DOW) Master Plan does not include any projections for water demands generated by the proposed project. Infrastructure requirements and improvements are currently being discussed with the County. When water is ultimately made available for the project, the applicant will address requirements or "source credits" for resource development, transmission and daily storage. On-site fire protection requirements will be coordinated with the County's Fire Department and the Department of Water during the design phase of the project.

Mitigative Measures
1. County Coordination. More detailed investigation and consultation with the Department of Water and the Fire Department will be conducted during the engineering design of the proposed project to determine specific requirements for domestic service consumption, static pressure, and on-site fire protection.

2. Non-Potable Irrigation Water. The project will have an on-site well for irrigation water and on-site wastewater treatment facility that will provide treated effluent for reuse. These efforts will save on the project's demand for potable water and create less of a demand on the public water system.

Wastewater Disposal
Probable Impacts & Mitigation Measures
Ultimate buildout of the project is expected to generate up to 260,000 gallons per day (gpd) of wastewater flow, all of it classified as domestic. The proposed wastewater treatment system is comprised of three main components: a gravity sewer system, a pump station and force main system, and the wastewater treatment facility. The treatment facility is estimated to cost $3.8 million.

The treatment facility is comprised of 8-inch main and sewer manhole system, which will conform to the County's standards. The collection system will convey sewage to a centrally located sewage pump station designed to deliver all sewage to the wastewater treatment facilities. Based upon the projected maximum flow of 260,000 gpd of wastewater flow, the pump station will be designed to transfer 900 gallons per minute. The pump station will be a duplex system comprised of a running pump and one standby pump.

As illustrated in Figure 5-6, the major elements of the wastewater treatment process include flow monitoring, screening, a secondary treatment process, sand filtration, disinfection, and effluent disposal. A detailed discussion of the entire process is provided in Appendix K (Gray, Hong, Bills, and Najima, November 2001).

The most environmentally sensitive approach for this project to dispose of the effluent is in golf course or other land irrigation, rather than through an ocean outfall, septic tanks, or the use of injection wells as a primary means of disposal. For the Ocean Bay

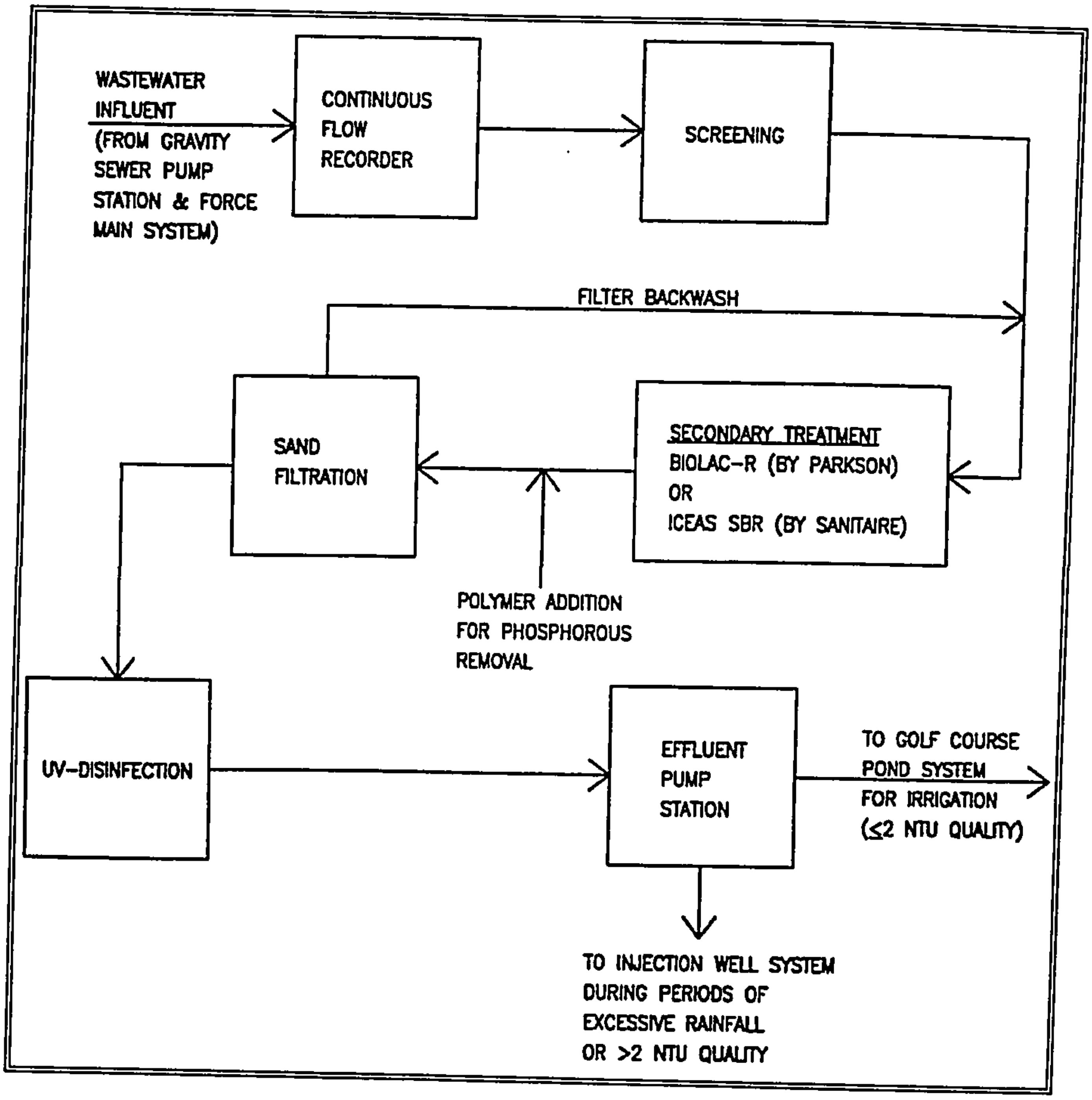


FIGURE 5-6 PROPOSED WASTEWATER SYSTEM FLOWCHART

Plantation project, the primary disposal system of treated effluent will be golf course irrigation. Effluent discharge from the UV disinfection system will enter a receiving wet well at the wastewater treatment plant sites. Within the wet well, pumps will deliver the treated effluent to the golf course pond system. This primary disposal system will be utilized as long as storage capacity is sufficient and the quality of the effluent is less than the regulatory limit of 2 NTU. Storage capacity will be monitored and controlled by liquid level sensors located within the pond. The State Department of Health has provided a letter of conceptual approval for the proposed wastewater treatment and disposal concept.

In scenarios where the golf ponds are filled to capacity or the quality of treated effluent exceeds the regulatory limit, effluent discharge will be redirected to an injection well system located within the treatment plant site. Each injection well will be approximately 150 feet deep. Preliminary consultation with the State of Hawai'i Department of Health Safe Drinking Water Branch has confirmed that the proposed siting of these wells is acceptable subject to installation and performance testing.

<u>Power and Communications</u>
Probable Impacts and Mitigative Measures
Kaua'i Electric is the provider of power to the area. The development's projected electrical load is estimated at 5.5 megawatts. It is anticipated that Kaua'i Electric will require right-of-way access to install and maintain their primary distribution, which will feed the various facilities within the project area. All new power lines will be installed underground ductlines and manholes. Utility pad-mounted transformers will be required for specific locations. Three-phase service is anticipated for the non-residential entities while single-phase service is anticipated for the single-family units.

New underground facilities consisting of concrete-encased ductlines and manholes will be cable service throughout the project area.

5.3 SUMMARY OF PROBABLE IMPACTS

5.3.1 Interrelationships and Cumulative Environmental Impacts

Cumulative and interrelated impacts are those associated with existing, approved and foreseeable future projects that may produce related or additive impacts. Projects that have some approvals or are under construction could generate cumulative effects on the environment in the direct vicinity of the project.

The proposed project at Hanamā'ulu may add to the cumulative effect of the increased population, school children, traffic and potable water use in the region. In addition to the project, other development proposed in the area includes up to 250 condominium time-share units to be built on the so-called "30-acre parcel" to the north of the subject property. Other developments in the area of Hanamā'ulu could potentially include the former Grove Farm properties, however, no development plans a have been put forward at present.

The traffic study prepared for the Ocean Bay Plantation project addresses the potential traffic from the proposed project and the neighboring time-share project. Implementation of highway improvements along the fronting highway system, as proposed in the State's Highway Master Plan, and the entrance improvements planned by the owners, are expected to accommodate the increased traffic in the region.

The increased population due to the two projects, and the associated increase in the number of school-age children, is not expected to be significant. The neighboring project will be a time-share development and will only generate visitor population. Approximately 100 homes at the Ocean Bay Plantation project are expected to be marketed to the local Kaua'i resident market, creating a small additional burden to local public schools.

Potable water use by the proposed project and the neighboring time share development can be accommodated in the County's water system, with their participation in proportional facility charges to offset source development, storage and transmission costs.

5.3.1 Potential Secondary Effects

This section evaluates the potential for the new development to induce growth outside the project area. Examples of these types of effects include the stimulation of additional development in an area, or a higher density development, as a result of the construction of public facilities such as a new highway or sewerage system.

The improvements to the water system and highway intersection are the only public infrastructure improvements that are anticipated as a result of the project. These improvements are not anticipated to provide additional development capacity for the nearby vacant lands and fallow agricultural lands. New growth will not be enabled as a result of the project's modest infrastructure improvements at the highway intersection.

It is quite possible that the proposed development will stimulate spin-off employment outside of the project area. The project may also increase the demand for housing inside and outside the project area that are close to the employment centers. Employees of the project may live in housing in Līhu'e, Hanamā'ulu and Kapa'a.

5.3.2 Relationship Between Local Short-term Uses of the Environment and the Maintenance and Enhancement of Long-term Productivity

These relationships are described below in the context of the following four specific areas of potential concern: (1) Narrowing of the range of beneficial uses of the environment; (2) Long-term risks to health and safety; (3) Foreclosure of future options; and (4) Trade-offs among short-term and long-term gains and losses. The following discussion addresses each of these potential areas of concern.

(1) Narrowing of the range of beneficial uses of the environment: The planned improvements are considered to be beneficial uses of the environment. The master plan areas utilize lands that have been previously used for intensive sugarcane cultivation. The planned improvements will increase and enhance, rather than narrow, the range of

beneficial uses of the environment. The project will increase the opportunity for people to experience and enjoy Hawai'i's special natural environment through the addition of walking trails along the coastline area. Landscaping will be established across the entire property through the golf course, residential and open space areas, thereby reducing the erosion.

(2) Long-term risks to health and safety. The project will not generate risks to health and safety. Health and safety risks will be reduced by creating safe trails and access points to the coastline, where some steep drop-offs and narrow unmarked trails currently are found.

(3) Foreclosure of future options. The foreclosure of future options is very limited. There is little likelihood that the majority of the land could be returned to its natural condition or be converted to large-scale agricultural use.

(4) Trade-offs among short-term and long-term gains and losses. There is no known significant "trade-off" involved in implementing the planned improvements for the use of the site. Potential short-term impacts and long-term impacts are offset by the planned mitigative measures. The short-term and long-term gains due to the project development outweigh any short-term or long-term losses.

In summary, the planned improvements are expected to help maintain and enhance the long-term productivity of the environment, rather than adversely affect it.

5.3.3 Irreversible and Irretrievable Commitments of Resources

The proposed project will remove approximately 340 acres from potential agricultural use. It will also reduce the amount of open space on the site with the addition of residential, retail and golf-related buildings.

Water and fuel will be expended in the construction process. Fuel will be expended in the generation of electricity, supporting the project's long-term operation. Tremendous capital resources will be committed to the development and operation of the project.

5.3.4 Adverse Environmental Effects That Cannot be Avoided

Adverse impacts can be divided into short- and long-term effects. Short-term effects are generally associated with construction, and prevail only for the duration of the construction period. Long-term effects generally follow completion of the improvements, relate either simply to their existence or to the operation of the new facilities, and are permanent. Effects that can be considered both adverse and unavoidable are discussed below.

Unavoidable Adverse Short-Term Effects

- Soils will be temporarily disturbed by grading, excavation and mounding activities at the project sites during construction.

- Despite onsite mitigation measures, temporary increases in soil erosion will also result from construction operations, and minor amounts of soil may be carried beyond the construction site in surface runoff water.
- Wildlife utilizing the project sites and immediate adjacent areas will be displaced, most likely into nearby undeveloped lands such as the wetlands, by construction activities. Such operations will also temporarily discourage wildlife from feeding at or migrating through the project sites.
- Operation of construction equipment, trucks and worker vehicles may temporarily impede traffic in the areas during the construction period.
- Negligible releases of air contaminants will occur from construction equipment emissions. Small amounts of dust may be generated during dry periods as a result of construction operations.
- Minor increases in noise levels may result from construction activities.

Unavoidable Adverse Long-Term Effects

- Minor modifications to the current topography will be made to accommodate the planned improvements and facilities.
- Utilization of potable and non-potable groundwater.
- Treated wastewater will be disposed through effluent irrigation, and, along with golf course fertilizers, will add nutrients to the shallow groundwater.
- There will be added population to the area through the occupancy of new homes, and some homes will have school-age children that may attend local public schools.
- Traffic will increase slightly along Kūhiō Highway, Kapule Highway, and Kaua'i Beach Road.
- The added emissions from an increase in vehicles associated with the new facilities will have a negligible effect on air quality in the area.
- There will be a slight increase in demand for police and fire protection as well as other County services as a result of the project.

5.3.5 Unresolved Issues

There are several unresolved issues that remain at the time of the preparation of this document, including:

1. Non-potable water sources for the project may also include surface water supply from the mauka lands, reservoirs and ditch systems.

2. Traffic improvements planned for Kūhiō Highway and Kapule Highway by the State of Hawai'i may or may not be completed over the next 20 years.

Section 6.0

RELATIONSHIP TO STATE OF HAWAI'I AND THE COUNTY OF KAUA'I LAND USE POLICIES & CONTROLS

6.0 RELATIONSHIP TO FEDERAL, STATE, COUNTY OF KAUA'I LAND USE PLANS, POLICIES AND CONTROLS

6.1 OVERVIEW

An important consideration in evaluating the potential impacts of a proposed action on the environment is how it may conform or conflict with approved or proposed land use plans, policies and controls for the affected area. In addition to State of Hawai'i policies and controls, the Draft EIS addresses applicable Federal regulation regarding coastal zone management issues. Also discussed is the consistency of the project with respect to the County of Kaua'i General Plan, the Līhu'e Development Plan, and Special Management Area guidelines.

6.2 FEDERAL PLANS AND CONTROLS

In 1972, the Federal government enacted the Coastal Zone Management Act to protect and preserve the natural resources, land and water uses of the coastal zone. This process is achieved by providing assistance to coastal states, including Hawai'i, to develop and manage Coastal Management Programs. Enforcement authority for the Federal Coastal Management Program (Public Law 104-150, as amended in 1996) has been delegated to the State of Hawai'i (Hawai'i Revised Statutes (HRS), Chapter 205A).

The proposed project involves shoreline property and coastal wetlands that are addressed in Coastal Zone Management policies regulated at the State and County levels. Section 6.4.4 addresses coastal resource issues relative to the Special Management Area.

6.3 STATE OF HAWAI'I PLANS AND CONTROLS

This section assesses how the proposed project addresses and adheres to the applicable goals, objectives and policies of the Hawai'i State Plan, HRS, Chapter 226 (1996) and functional plan policies, as well as compliance to State designated land use.

6.3.1 State Land Use Districts

Under the HRS, Chapter 205, all lands of the State are to be classified in one of four categories: urban, rural, agricultural, and conservation lands. The State Land Use Commission (LUC), an agency of the Department of Business, Economic Development, and Tourism, is responsible to set the standards for determining the boundaries of each district (HRS, Chapter 205-2(a)). The LUC is also responsible to administer all requests for district reclassifications and/or amendments to district boundaries, pursuant to HRS Chapter 205-4 and the Hawai'i Administrative Rules, Title 15, Chapter 15 as amended.

Discussion: The proposed Ocean Bay Plantation at Hanamā'ulu project contains lands within various State land use districts, including lands designated as Agricultural, Urban, and Conservation. The appropriate uses and activities of these districts are enumerated in the ordinances and regulations of the County of Kaua'i, and are discussed further in Section 6.4.

6.3.2 Hawai'i State Plan

In order to insure that individuals and groups make steps toward attaining desired levels of self-reliance and self-determination, it is the goal of the State, under the Hawai'i State Planning Act (HRS, Chapter 226), to achieve the following:

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

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

(3) Physical, social, and economic well being, for individuals and families in Hawai'i, that nourishes a sense of community responsibility, of caring, and of participation in community life (HRS, Chapter 226-4).

The objectives and policies of the State Plan that are pertinent to the Ocean Bay Plantation at Hanamā'ulu project are discussed below.

A) Population

The objective in planning for the State's population is to guide population growth to be consistent with the achievement of physical, economic, and social objectives. In order to achieve the population objective, it is the policy of the State to:

- Encourage an increase in economic activities and employment opportunities on the neighbor islands consistent with community needs and desires.
- Promote increased opportunities for Hawai'i's people to pursue their socio-economic aspirations throughout the islands (HRS, Chapter 226-5).

Discussion: The population within the project area is expected to consist of a mix of full-time residents and vacationers. It is anticipated that the multi-family housing and golf-adjacent home to be used as vacation homes, while most of the full-time island residents would occupy the single-family area on the north side of the property. By the year 2010, it is estimated that the resident population within the project area will be about 150 persons, and would eventually come to 330 persons at buildout. The average on-site population would come to about 430 at buildout.

The Ocean Bay Plantation will generate both short and long-term economic growth for the Hanamā'ulu area including construction, landscaping, retail, recreational, dining and professional service-related job opportunities. It is anticipated that the project will provide approximately 925 person-year construction jobs over a 12-year period. The project is also expected to create approximately 250 person-year jobs for long-term operations employment. The development is intended to reflect the needs and desires of the island community through the creation of a commercial center and recreational facility that is appropriate in scale and theme for the area.

B) Economy: General

The objectives for planning the State's economy include increasing and diversifying employment opportunities to provide a better economic quality of life for Hawai'i's people. It is also the objective of the State to create a diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands. It is the policy of the State to:

- Promote Hawai'i as an attractive market for environmentally and socially sound investment activities that benefit Hawai'i's people.
- Seek broader outlets for new or expanded Hawai'i business investments.
- Expand existing markets and penetrate new markets for Hawai'i's products and services.
- Promote and protect intangible resources in Hawai'i, such as scenic beauty and the aloha spirit, which are vital to a healthy economy (HRS, Chapter 226-6).

Discussion: The Ocean Bay Plantation is envisioned to promote the unique resources of the area and provide an impetus for future economic growth and employment opportunities with the proposed Gateway Village Center. The Gateway Village will consist of retail, service, dining, and professional offices. Additionally, a portion of the center complex will be suited to serve office needs for small businesses and firms, with existing fiber optic services providing the potential to attract businesses focusing on the technological market.

The Ocean Bay Plantation will feature an 18-hole championship golf course covering over 200 acres of green space. Appropriate conservation management practices within the natural coastal region will be employed, further maintaining the area as a valuable resource that indirectly contributes to the vitality of island's economic growth.

C) Economy: Visitor Industry

It is the objective of the State to create and maintain a visitor industry that constitutes a major component of steady growth for Hawai'i's economy. It is the policy of the State to:

- Ensure that visitor industry activities are in keeping with the social, economic, and physical needs and aspirations of Hawai'i's people (HRS, Chapter 226-8).

Discussion: With its location on major roadways north of Līhu'e, the Gateway Village commercial area will serve a mix of residents and visitors to Kaua'i. It is anticipated that the Gateway Village will attract approximately 15% of an estimated average visitor count of 8,300 cars and 2% of resident traffic generated by travel along Kūhiō Highway. The results provide an average daily customer count of 1,100 parties that will frequent the Gateway Village. Expected expenditures from the daily count of visiting parties will sufficiently generate a revenue stream to support the Center's economic stability.

Demands for golf on the island of Kaua'i are expected to increase by 40% by the year 2020. Although not promoted exclusively as a visitor industry activity, the signature golf course is expected to partially meet the demand for recreational golf from neighboring islands and oversea visitors.

D) Economy: Potential Growth Activities

It is the objective of the State to increase and diversify Hawai'i's economic base through the development and expansion of potential growth activities. It is the policy of the State to:

- Enhance and promote Hawai'i's role as a center for international relations, trade, finance, services, technology, education, culture, and the arts.

- Promote Hawai'i's geographic, environmental, social, and technological advantages to attract new economic activities into the State (HRS, Chapter 226-10).

Discussion: The integrated mixed use of the project area will avail new opportunities of economic growth in commercial, recreational, and professional services. Mainland residents that purchase vacation homes will capitalize on the advantages of the Kaua'i setting and environment, and some will integrate their business affairs with their life in Hawai'i. Additionally, the Gateway Village will provide facilities designed to meet the needs of emerging technology-related businesses that could further diversify the island's economic base.

E) Physical Environment: Land Based, Shoreline, & Marine Resources

It is the objective of the State to make prudent use of Hawai'i's land-based, shoreline, and marine resources as well as to establish effective measures to protect Hawai'i's unique and fragile environmental resources. It is the policy of the State to:

- Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.

- Take into account the physical attributes of areas when planning and designing activities and facilities.

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

- Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai'i.

- Pursue compatible relationships among activities, facilities, and natural resources (HRS, Chapter 226-11).

Discussion: *The recreational facilities and activities for the Ocean Bay Plantation include a new golf course and integrated bike paths which will complement the adjacent recreational uses of Hanamā'ulu Beach Park, an area noted for pole fishing, canoeing, picnicking, and camping.*

There are three endangered species of waterbirds identified within the project area that primarily use the wetlands area as their natural habitat. The approximate 31.5 acres of wetlands will be set aside as a preserve area, serving to continue its function as a natural habitat for these and other bird species.

E) Physical Environment: Scenic, Natural Beauty, & Historic Resources

In protecting and maintaining the natural resources of the State, it is the objective of the State to enhance Hawai'i's scenic assets, natural beauty, and multi-cultural/historical resources. It is the policy of the State to:

- Provide incentives to maintain and enhance historic, cultural, and scenic amenities.

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

- Protect those special areas, structures, and elements that are an integral and functional part of Hawai'i's ethnic and cultural heritage.

- Encourage the design of developments and activities that complement the natural beauty of the islands (HRS, Chapter 226-12).

Discussion: *The planning and design of the Ocean Bay Plantation reflects the history, location, topography and setting of the site. The historical setting of the region as a former part of the island's plantation legacy will be reflected in the planning, architecture, site amenities and operation of the Gateway Village, golf course facilities, and residential units.*

Prominent view corridors and major topographical features will be maintained and highlighted in the design of the golf clubhouse, residential units, and commercial center along with *approximately 216 acres of green and open space for the golf course, wetlands, and shoreline areas. The Gateway Village is intended as a local and visitor destination of compatible commercial, retail, and dining activities and facilities representative of Hanamā'ulu's sense of place and unique setting.*

F) Physical Environment: Land, Air, & Water Quality

It is the objective of the State to maintain and improve the quality of Hawai'i's land, air, and water resources as well as to create greater public awareness and appreciation of Hawai'i's environmental resources. It is the policy of the State to:

- Encourage design and construction practices that enhance the physical qualities of Hawai'i's communities.

- Encourage urban developments in close proximity to existing services and facilities (HRS, Chapter 226-13).

***Discussion:** The Ocean Bay Plantation is a planned destination of compatible activities. Located within the County-designated Līhu'e Planning District, the architectural style and landscaping design will enhance the physical qualities of this district. Līhu'e serves as the hub of the island's transportation system, its government center, and its commercial center.*

G) Socio-Cultural Advancement: Housing

It is the objective of the State to promote an orderly development of residential areas sensitive to community needs and other land uses. It is the policy of the State to:

- 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.

- Foster a variety of lifestyles traditional to Hawai'i through the design and maintenance of neighborhoods that reflect the culture and values of the community (HRS, Chapter 226-19).

***Discussion:** The subject property is currently a fallow agricultural land, located along the main transportation route on Kaua'i. The proposed residential community is located between Kapa'a, Hanamā'ulu, and Līhu'e towns and is in close proximity to existing schools, parks, and other public facilities. Approximately 173 single-family homes and 250 multi-family homes will be built in incremental stages. The design and location of the housing developments will take into account the area's unique coastal and open space setting, and reflect the culture and values of the Kaua'i community. Additionally, the residential units will be situated in close proximity to the Gateway Village Center's new commercial and retail services.*

H) **Socio-Cultural Advancement: Leisure**

It is the objective of the State to adequately provide resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations. It is the policy of the State to:

- Provide a wide range of activities and facilities to fulfill the cultural, artistic, and recreational needs of all diverse and special groups effectively and efficiently.
- Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.
- Ensure opportunities for everyone to use and enjoy Hawai'i's recreational resources.
- Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.

Discussion: *The Ocean Bay Plantation will host a new golf course facility totaling 200 acres, including 18-holes golf course, a clubhouse, driving range, and surrounding landscaped areas. A new bike path will create a new recreational activity that promotes the project area's scenic and open space character. Additionally, public access to the shoreline will be maintained, allowing opportunities for people to access the coastal area, particularly along Hanamā'ulu Bay.*

6.3.3 State of Hawai'i Functional Plans

Part of the overall Hawai'i State Plan system is the development of State Functional Plans, which are approved by the Governor. While the Hawai'i State Plan establishes long-term objectives for Hawai'i, the purposes of the Functional Plans are to identify major statewide concerns, define current strategies for the functional area, and to provide strategies for departmental policies, programs, and priorities. The Functional Plans are designed to address issues pertaining to physical resource needs and development.

<u>State of Hawai'i Recreation Functional Plan</u>

The State Recreation Functional Plan focuses on six issues areas critical to maintaining the plan's overall objectives of (1) assessing present and potential supply of and demand for outdoor recreational resources, (2) guiding State and County agencies in acquiring or protecting lands of recreational value, (3) provide adequate recreational facilities and programs, and (4) assuring public access to recreation areas.

The overview of the plan includes objectives and potential implementing actions regarding issues of ocean and shoreline recreation, mauka and urban opportunities, public access to shoreline and upland recreation areas, resource conservation and management, management of recreation programs and facilities, and wetlands protection and management. The applicable objectives, associative policies, and recommended implementing actions that are applicable to the Ocean Bay Plantation at Hanamā'ulu project are discussed below.

Objective II-C: Improve and expand the provision of recreation facilities in urban areas and local communities.

Policy: Meet the demand for recreational opportunities in local communities.

Implementing Action II-C(1)a: Develop bikeways in residential areas.

Implementing Action II-C(1)f: Provide opportunities for golf at reasonable cost by assuring that privately developed courses have provision for play by residents at "kama'āina rates."

Discussion: *A new bikeway and bike paths will be integrated into the design of the residential area, creating an alternative transportation alternative and recreational opportunity.*

The overall total number of available rounds for the championship golf course will be limited to maintain less congested playing conditions. However, provisions will be made for residents to play on the championship course at prescribed "kama'āina rates." In addition, special events and fund raising tournaments for non-profit organizations will be hosted, providing further opportunities of recreation and leisure that benefits the local community.

Objective VI-C: Assure the protection of the most valuable wetlands in the state.

Policy VI-C(1): Develop a coordinated approach to wetlands protection, acquisition, and management, as well as the provision of public education programs.

Implementing Action VI-C(1)c: Establish partnerships with the private sector for the acquisition, restoration, and management of wetlands.

Discussion: *Existing plans for the Ocean Bay Plantation project include maintaining the approximate 31.5 acres of wetlands as a preserve area, supporting the area's natural ecosystem. There is a long-term plan to enhance the value of the wetlands habitat through the creation of open water areas and thinning overgrown vegetation areas. Work associated with wetlands would be consistent with recommended wetlands management practices, and involve approval from the appropriate Federal agencies.*

__State of Hawai'i Conservation Functional Plan__

The Conservation Lands Functional Plan addresses the impacts of population growth and economic development on the natural environment and provides a framework for the preservation and protection of pristine lands and shorelines. The overview of this plan includes objectives and implementing actions regarding continued efforts to broaden public use of natural resources and lands while protecting and preserving those lands from overuse. The plan has been divided into three issue areas directly related to planning and management: Inventories of resources, management, and education. The applicable objectives, policies, and recommended implementing actions to the project are discussed below.

Objective IIB: Protection of fragile or rare natural resources.

Policy IIB(3): Develop a coordinated approach to the wetlands protection, acquisition, and management.

Implementing Action IIB(3)c: Establish partnerships with the private sector for the acquisition, restoration, and management of wetlands.

Discussion: As stated above, the management plans for the wetlands areas includes setting aside its 31.5 acres as a preserve area. Wetland enhancement projects may be proposed, with the approval of the appropriate Federal agencies. A collaborative effort will be employed between private and public organizations to continue to maintain the natural resources within the wetland system.

Objective IIC: Enhancement of natural resources.

Policy IIC(2): Expand and enhance outdoor recreation opportunities and other resource uses.

Implementing Action IIC(2)e: Provide and improve public access to the shoreline and to mauka areas as condition on leases, executive orders, easements, and other encumbrances on lands with recreation and/or educational potential.

Discussion: Improvements derived from the coastal renaturalization plan will help to improve the overall conditions of the natural habitat while providing public accesses to the shoreline area.

6.3.4 Coastal Zone Management Act, Hawai'i Revised Statutes, Chapter 205A

The Coastal Management Program (CMP) is a comprehensive state plan that establishes and enforces standards and policies to guide the development of public and private lands within the coastal areas. In the State of Hawai'i, the CMP is articulated in the State Coastal Zone Management (CZM) Law (Hawai'i Revised Statutes, Chapter 205A). The Hawai'i CZM Law charges the counties with designating and administering Special Management Areas (SMA) within the State's coastal areas. Any "development", as defined by the CZM Law, that is located within the SMA requires a SMA Use Permit. The relationship of the Ocean Bay Plantation at Hanamā'ulu project to the County of Kaua'i's policies and controls is discussed below.

6.3.5 Hawai'i Model Energy Code

As the State of Hawai'i continues to grow, there are increasing demands for energy resources, which must be met either through the creation of new energy generating facilities or through the application of energy efficiency measures. The Hawai'i Model Energy Code (HMEC) is a building efficiency standard for the State of Hawai'i intended to address the unique geographical and climate conditions of the islands while complying with regulations set by the National Energy Policy Act of 1992 (EPACT). Adapted partially from adopted California codes (Title 24) and ASHRAE 90.1-1989, a compliance standard of EPACT, the HMEC includes a set of requirements for the energy-efficient design of buildings and building systems. The strategy of the HMEC is to assure the application of cost-effective design practices and technologies while minimizing energy consumption that meets the needs of the consumer.

The HMEC applies to three types of buildings: residential, hotel guestrooms, and nonresidential buildings. The requirements for both residential and nonresidential buildings apply to lighting, heat gain in the ceiling or building envelope, natural ventilation, and the design of air conditioning and water heating systems. The intent of the HMEC is to create impacts that will reduce energy costs and emissions of greenhouse gases as well as the need to build more power plants to meet electricity demand during peak periods.

Discussion: Energy-saving measures will be incorporated into the design and construction of both residential and non-residential units, with consideration of the Hawai'i Model Energy Code. Additionally, a review of demand-side management strategies will be examined to consider and evaluate energy-efficient alternatives and options.

6.3.6 State of Hawai'i Water Code

Under Chapter 174-C of the Hawai'i Revised Statutes, the State of Hawai'i's Commission on Water Resource Management administers the State of Hawai'i Water Code. The Commission is responsible for the protection and management of water resources through appropriate measures such as setting policies, defining uses, establishing priorities while assuring rights and uses, and establishing regulatory procedures. The responsibility of the Commission is limited to protecting land-based surface waters and ground waters, and ensuring adequate levels of water quantity, not quality. Water quality standards are administered by the State of Hawai'i's Department of Health.

According to Chapter 174-C, Section 31 of the Hawai'i Revised Statutes, the Hawai'i Water Plan is comprised of four distinct sections. The first part of the plan is the development of a water resource protection plan prepared by the Commission. Second, the plan includes water use and development plans for each county which are prepared by each separate county and adopted by ordinance, setting forth the allocation of water to land use in that county. Third, the plan consists of a state water projects plan prepared by the agency that has jurisdiction over such projects in conjunction with other state agencies. Finally, the Hawai'i Water Plan consists of a water quality plan prepared by the Department of Health.

Discussion: *Conservation measures will be incorporated into the design and implementation of all project phases, contributing to an overall water management plan that will maintain acceptable levels of water use. During the engineering design phase of the project, the specific requirements will be calculated for domestic service connection, static pressure, and on-site fire protection.*

6.4 COUNTY OF KAUA'I PLANS AND CONTROLS

6.4.1 County of Kaua'i General Plan

The County of Kaua'i General Plan fulfills the legal mandates of State law and the Charter of the County of Kaua'i. It also provides guidance for land use regulations, the location and character of new development and facilities, and planning for County and State facilities and services. The General Plan is the primary policy directing long-range development, conservation, and the use and allocation of land and water resources within the County.

The policies of the General Plan are intended to guide County decision-making in determining the direction of future development for the entire island. The policies describe what kind of future development is desirable and helps to set the priorities for public improvements. The policies guide the County in making revisions to land development regulations, in deciding upon zone changes and development permits, and in setting strategies for capital improvements.

This section discusses how the Ocean Bay Plantation at Hanamā'ulu project addresses the applicable objectives and policies of the General Plan.

A) Scenic Views

Policy: The County of Kaua'i shall seek to preserve scenic resources and public views. Public views are those from a public place such as a park, highway, or along the shoreline. In the efforts of maintaining these scenic resources, the following general principles will be followed:

1) Preserve public views that exhibit a high degree of intactness or vividness.
2) Preserve the scenic qualities of mountains, hills, and other elevated landforms.
3) Preserve the scenic qualities of lowland and open space features such as the shoreline, coastal bluffs, marshes, fishponds, or a historic or cultural property.

Discussion: *The landscape of the golf course, particularly along the shoreline area, will be seamlessly integrated with the existing natural coastal habitat through the implementation of an* *environmentally sound coastal management plan. The project will be designed to preserve the open space features of the wetlands, shoreline and the coastal bluffs.*

B) Historic and Archaeological Resources

Policy: Preserve important archaeological and historic sites and provide: (1) a buffer area between the site and adjacent uses; and (2) public pedestrian access, as appropriate to the site.

Discussion: The proposed project will not have an adverse effect on historic or archaeological resources. An archaeological inventory survey was conducted on the property. Given the extensive nature of sugarcane cultivation that occurred within the project site, only a limited number of archaeological sites were documented. Ten (10) sites were identified within or near vicinity of the project site area (9 are on-site), of which two were considered prehistoric and are outside the development areas. All sites have been evaluated and recorded and will not be impacted by the project development. Data recovery work has been completed for one site (Site 2068) with no further protection required. As necessary, an appropriate plan for the remaining eight sites will be prepared and submitted to the State Department of Land and Natural Resources State Historic Preservation Division for their review and approval. In the event previously unidentified sites are discovered, the appropriate agencies will be notified to determine further courses of action.

C) Watersheds, Streams, and Water Quality

Policy: In developing County roads and drainage facilities, and in administering the grading, flood control, and drainage regulations, the County of Kaua'i shall carry out the following:

New Development
1) Reduce average annual post-development sediment in run-off so that is no greater than pre-development levels.
2) Maintain post-development peak runoff rate and average volume at levels similar to pre-development
3) Work with other government agencies and community organizations to seek ways of reducing all types of non-point source water pollutants.

Site Development
1) Protect areas that provide water quality benefits, i.e. wetlands
2) Protect areas that are particularly susceptible to erosion and sediment loss
3) Promote the use of permeable surfaces for driveways and parking and limit increases of impervious surfaces.
4) Limit land disturbance activities such as clearing and grading, and cut and fill to reduce erosion and sediment loss
5) Avoid disturbance of natural drainage features and vegetation.

Construction Site
1) Reduce erosion and retain sediment onsite during and after construction, to the extent possible.
2) Prior to land disturbance, prepare and implement an approved erosion and sediment control plan.

Watershed Management
1) Manage land use and earth-moving activities from the standpoint of the entire watershed.

Discussion: *The proposed project site is currently comprised of fallow sugar cane fields that provide poor ground cover conditions, thus making the area highly susceptible to erosion and sediment loss due to runoff from storms. Upon completion of the new golf course, residential areas, and commercial area, the amount of soil loss is expected to decrease significantly from the existing conditions. An increase in impermeable surface area and better maintenance and management of the vegetated areas will help to minimize further soil degradation, thereby improving existing conditions.*

D) Coastal Lands

Policy: When developing public facilities or granting zoning, land use permits, or subdivision for land development along the coast, the first priority shall be to preserve and protect sandy beaches.

Policy: The following are general guidelines for coastal development, including resorts and residential developments:

1) For resorts and other multi-building complexes, there should be a transition from low building heights along the shoreline to taller buildings on the interior of the property.
2) Provide an open vegetated buffer between the shoreline and buildings.
3) Provide a permanent pathway laterally along the coast located in the buffer zone mauka of the shoreline.
4) Maintain existing stands of trees or plant trees within the buffer zone to provide sun and wind protection and to moderate the appearance of large buildings.

Discussion: *An overall application of conservation management will help to maintain and enhance existing conditions of the natural shoreline area and its access. The proposed residential units, commercial center, and golf facility will be appropriately sited and built to a scale that does not infringe on the open space character of the area.*

A coastal renaturalization plan will be employed within the Conservation District to reintroduce a congenial mix of plants identified as appropriate to help rejuvenate and sustain existing ecosystems. Native plants of Hawai'i will be re-introduced to the shoreline area. The overall *conservation effort will help to restore some of the natural features and habitats within the project area prior to the introduction of plantation sugar in the area.*

E) Native Hawaiian Rights

Policy: The County of Kaua'i recognizes the rights of native Hawaiians and the laws concerning lands and waters that have been established through the State Constitution, State and Federal Laws, and State and Federal Court decisions. No County ordinance or rule shall modify or diminish these rights.

Discussion: For the most part, native Hawaiians maintain access rights in common with the general public. However, native Hawaiians also have unique access rights relating to the exercise of traditional and customary rights. Access to the shoreline areas for purposes of gathering resources or invoking traditional practices will be maintained and be coordinated with the appropriate cultural groups, organizations, or families, as deemed necessary.

F) High Technology

Policy: Encourage the development of the high technology business sector on Kaua'i, in order to diversify the economy and provide higher-paying jobs.

Discussion: Preliminary plans for the Gateway Village commercial center include provisions for offices that are designed to meet the needs of existing and developing technology-related businesses.

G) Commercial Development

Policy: Concentrate commercial development in Līhu'e, other urban centers, and in town centers.

Discussion: The Gateway Village commercial center will be located within the Līhu'e Planning District, an area considered to be the island's commercial and urban center. Although the site is outside the town centers of Līhu'e and Hanamā'ulu, the small scale of the facilities at Gateway Village will not detract from the commercial attraction of the larger town centers.

H) Enhancing Towns & Commercial Areas

Policy: Wherever possible, new large retail centers or stores shall be located contiguous to existing towns and within walking distance of residential development.

Policy: When zoning is granted for new commercial development at the edge of a town, it should be sited on an axis perpendicular to the highway or arterial road and screened from the road by a landscape buffer. Access to the shopping center should be provided via an access road off of the main road highway.

Discussion: The proposed Gateway Village commercial center will be located at the project entrance near Kūhiō Highway. The proposed center will be in close proximity to Kapa'a, Līhu'e and Hanamā'ulu towns and to the new residential community, providing convenient access to a variety of retail and service businesses.

I) Water Supply

Policy: Coordinate planning of future water system development and rate structures with general plan policies and guidelines.

Discussion: The project area lies just outside the Wailua-Kapa'a service area that consists of hotel, business, and urban residential uses clustered along sections of the coastal highway. For this new development, the County Department of Water will be consulted directly to meet the guidelines and policies of the General Plan and the Department's Water Plan 2020. Discussions are ongoing with the Department of Water to plan for the project requirements.

J) Wastewater Treatment

Policy: The County and private developers should coordinate planning, development, and operation and management of wastewater systems in accordance with long-range facility plans.

Policy: Wastewater effluent shall be reused for irrigation wherever economically feasible, in order to avoid costly and disposal facilities and to conserve potable water supplies.

Discussion: Plans for the Ocean Bay Plantation project include long-term facility plans for on-site wastewater collection and treatment facilities. The reuse of treated wastewater effluent for irrigating the golf course areas will be employed.

K) Drainage and Flood Control

Policy: Establish erosion control and drainage regulations that incorporate best management practices for controlling non-point source pollution.

Discussion: Best management practices such as sediment basins, filter fences, diversions swales, and biofiltration swales will be employed as erosion control measures and will be designed to meet drainage regulations.

L) Energy

Policy: Minimize health, safety, cultural and scenic impacts of electrical power installations. In particular, seek opportunities and economic methods to render power generation facilities and transmission lines inconspicuous in order to preserve and enhance a park-like appearance throughout the Garden Island.

Policy: Require new buildings to incorporate economically feasible design and equipment to save energy.

Discussion: *The project will have underground utilities installed. The siting and placement of the electrical utility transformers will take into account the preservation of the island's park-like appearance. As appropriate, the project's building designs will integrate energy-saving requirements and guidelines contained in the Hawai'i State Planning Act and State Energy Code.*

M) Solid Waste

Policy: Through a multi-faceted program of education, management measures, and financial incentives, the County shall support and stimulate Kaua'i businesses and residents to reduce their solid waste generation and increase the reuse and recycling of materials.

Discussion: *During the construction and implementation phase of the project, efforts to recycle, conserve, and re-use materials and resources will be incorporated where appropriate and feasible.*

N) Housing

Policy: Increase opportunities for moderate- and low-income households to become homeowners.

Discussion: *The proposed development includes approximately 100 individual lots for development of single-family homes. The anticipated market for these homes are the local Kaua'i residents. Significant portions of the lots are anticipated to be sold in the price range that would be affordable to moderate-income households.*

O) Education

Policy: Approve new residential developments only after the State DOE certifies that adequate school facilities, either at existing schools or at new school sites, will be available when the development is completed.

Policy: Have developers pay their fair share of all costs needed to ensure provision of adequate school facilities for the children living in their developments.

Discussion: *The project will be responsible for it's fair share contribution to offset the potential direct effects of new residential development. This evaluation will account for the different buyer groups, consisting of second-home/vacation home purchases by mainland and international buyers, and lot-sale/single-family homes for Kaua'i resident families.*

6.4.2 Līhu'e Development Plan

As stated in the General Plan policies regarding an integrated planning system, a development plan is intended to direct physical development and public improvements within a specific geographic area of the County within the framework of the General Plan. Development plans may contain detailed guidance for land use and zoning or other matters relating to the physical development of the planning area.

The Līhu'e Development Plan (LDP) was created to address the effects of change in Līhu'e and to maximize the public benefits from that change. The LDP was prepared for the area between the South Fork of the Wailua River and the Knudsen Gap toward Kōloa-Pō'ipū. The LDP consists of information about pertinent physical, social, and economic factors as well as prescribed recommendations that include timing, cost, and priority criteria. The applicable goals and objectives of the LDP include issues pertaining to maintaining a certain appearance and character to Līhu'e town, providing good planning, and improving existing conditions related to employment, transportation, housing, recreation, and health. The specific implementing actions of these goals and objectives are discussed below.

- Provide landscaping for public areas.
- Provide bicycle paths.
- Find means to dispose of future sewage effluent.
- Provide efficient and safe traffic circulation system.
- Provide for multiple family dwellings.
- Encourage a stable economy for more job opportunities.
- Provide access to the shoreline.

Discussion: The attraction of the Ocean Bay Plantation as a residential and recreational community is its geographical location and its environmental assets, particularly along the shoreline areas. A new livable community will be created, providing both single and multi-family residential units. New landscaping features will accentuate and blend elements of the built environment with the existing natural forms of the coastal region. Treated effluent from an on-site wastewater collection and treatment facility will be used as a source of irrigation water for the proposed golf course.

New accesses and entryways will be provided, helping to facilitate an efficient flow of traffic within and near the project area. Part of the built landscape will be a regional bikeway route that emanates from Kapule Highway and circulates through a designated extension into the project site along the main access road. The shoreline area will be accessible via two public access routes.

The Gateway Village commercial center will be a new stimulation of economic growth in the commercial, retail, professional, and technology sectors for long-term operations. It is projected that the project will create approximately 250 operational jobs directly associated to either the commercial center or golf facility. The development of the project area will invigorate short-term economic growth by creating approximately 925 jobs (person-years) directly related to construction activity on-site over a 12-year period.

6.4.3 County of Kaua'i Water Management

The Department of Water (DOW) is a semiautonomous agency of the County of Kaua'i responsible for the management, control, and operation of the County of Kaua'i's water system. The DOW consisting of a Board of Water Supply, Manager and Chief Engineer, and support staff is responsible to provide a reliable distribution system of water to accommodate the needs for the island of Kaua'i. Under the Hawai'i Revised Statutes, Chapter 54-33, the DOW is given the authority to alter, amend, and repeal rules and regulations related to the management, control, preservation, and protection of the county's water resources.

Under HRS, Chapter 174-C, a water use and development plan by each county is required. The water use and development plan for the County of Kaua'i, known as the Water Plan 2020 (WP) fulfills the requirements as mandated by the State Water Code. The WP consists of policies and strategies which guide the activities of the County of Kaua'i in areas of planning and management, use and allocation of Kaua'i's water resources.

Discussion: The design and implementation of the proposed project will be coordinated with the County of Kaua'i Department of Water to comply and be consistent with the Water Plan 2020.

6.4.4 Special Management Area

Within the County of Kaua'i, the Special Management Area (SMA) Use Permit application review is administered by the County Planning Department and its issuance is rendered by the Planning Commission of the County of Kaua'i.

It is the policy of the County of Kaua'i to preserve, protect, and to restore the natural resources of the coastal zone of Hawai'i. The SMA designation places special controls on development within an area along the shoreline. These controls are necessary to avoid permanent loss of valuable resources and to insure that adequate public access is provided to public owned or used beaches, recreation areas, and natural reserves.

Issuance of the SMA Use Permit is based on the consistency of the proposed development project with the policies and review guidelines specified in the CZM Law. A portion of the proposed Ocean Bay Plantation at Hanamā'ulu development lies within the SMA boundary (Figure 6-1) and is valued in excess of $125,000, thus a SMA Use

Permit is required. The applicable objectives, policies and guidelines to the project are discussed below.

A) **Recreational Resources Policies:** Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:
  (i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas.
  (ii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along the shorelines with recreational value;
  (iii) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters.
  (iv) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits, and crediting such dedication against the requirements of Section 46-6, HRS.

B) **Historic Resources Policies:**
  1) Identify and analyze significant archaeological resources.
  2) Maximize information retention through preservation of remains and artifacts or salvage operations.
  3) Support state goals for protection, restoration, interpretation, and display of historic resources.

C) **Coastal Ecosystems:**
  1) Preserve valuable coastal ecosystems of significant biological or economic importance.
  2) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs.
  3) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses that violate State water quality standards.

D) **Economic Uses Policies:** Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas.

E) **Coastal Hazards Policies:**
  1) Ensure that developments comply with requirements of the Federal Flood Insurance Program.
  2) Develop a coastal point and non-point source pollution control program.

F) **Scenic and Open Space Resources:**
   1) Identify valued scenic resources in the coastal zone management area.
   2) Insure that new developments are compatible with their visual environment by designing and locating such development to minimize the alteration of natural landforms and existing public views to and along the shoreline.
   3) Preserve, maintain, and where desirable, improve and restore shoreline open space and scenic resources.

G) **Managing Development:** Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life-cycle and facilitate public participation in the planning and review process.

SMA Guidelines

(1) All development in the special management area are subject to reasonable terms and conditions set by the authority in order to ensure:

- Adequate access, by dedication or other means, to publicly owned or used beaches, recreation areas, and natural reserves is provided to the extent consistent with sound conservation principles;

Discussion: Adequate access to the shoreline area and its resources will be provided and maintained.

- Adequate and properly located public recreation areas and wildlife preserves are reserved.

Discussion: The proposed recreational activities for the project will complement the existing uses along the nearby shoreline recreational areas. The wetlands area will be properly maintained as a natural preserve.

- Provisions are made for solid and liquid waste treatment, disposition, and management that will minimize adverse effects upon special management area resources.

Discussion: The project is not sewered and lies outside the Līhu'e Wastewater Collection and Treatment service area. Plans for the project include providing on-site wastewater collection and treatment facilities to serve the 460-acre area. Ultimate build-out of the project is estimated to generate up to 250,000 gallons per day of wastewater. All wastewater flow will be domestic in nature, and no industrial waste sources will be generated on-site. The project's wastewater treatment facility will produce R-1 treated effluent to be used for golf course irrigation. Section 5 of this EIS describes the project's collection and wastewater treatment process.

- Alterations to existing land forms and vegetation; except crops, and construction of structures shall cause minimum adverse effect to water resources and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation or failure in the event of earthquake.

Discussion: The project's design and operations will maintain safety standards to minimize the potential danger of natural hazards. Construction equipment and activity may have some short term impacts that may temporarily affect the visual quality, noise levels, and surface drainage within the project area. Upon completion of the project, no adverse effects are anticipated. Mitigative measures for potential impacts related to the alteration of the existing landscape are presented in Section 5 of this EIS.

(2) No development shall be approved unless the authority has first found:

- That the development will not have any substantial adverse environmental or ecological effect, except as such adverse effect is minimized to the extent practicable and clearly outweighed by public health, safety, or compelling public interests. Such adverse effects shall include, but not be limited to, the potential cumulative impact of individual developments, each one of which taken in itself might not have a substantial adverse effect, and the elimination of planning options;

Discussion: The proposed project is not anticipated to generate substantial adverse environmental or ecological effects as the result of construction. Potential impacts and mitigation measures are discussed in Section 5. Additionally, alternative planning options of the project's configuration and design are included in Section 7.

- That the development is consistent with the objectives, policies, and special management area guidelines of this chapter and any guidelines enacted by the legislature;

Discussion: The project remains consistent with the policies and objectives of the Hawai'i Revised Statutes, Chapter 205A (Coastal Zone Management) and its review guidelines, as well as the County of Kaua'i's Special Management Area guidelines.

- That the development is consistent with the county general plan and zoning. Such a finding of consistency does not preclude concurrent processing where a general plan or zoning amendment may also be required.

Discussion: The project is consistent with the County of Kaua'i General Plan, the Comprehensive Zoning Ordinance, and the Līhu'e Development Plan.

(3) The authority shall seek to minimize, where reasonable:

- Dredging, filling or otherwise altering any bay, estuary, salt marsh, river mouth, slough or lagoon;

Discussion: The proposed project involves no dredging, filling, or altering to any bay, estuary, salt marsh, river mouth, slough or lagoon.

- Any development which would reduce the size of any beach or other area usable for public recreation;

Discussion: The proposed project will not reduce the size of the beach or other public recreational area.

- Any development which would reduce or impose restrictions upon public access to tidal and submerged lands, beaches, portions of rivers and streams within the special management areas and the mean high tide line where there is no beach;

Discussion: The proposed project does not reduce or impose restrictions upon public access to tidal and submerged lands, beach areas, or to the mean high tide line.

- Any development which would substantially interfere with or detract from the line of sight toward the sea from the state highway nearest the coast;

Discussion: The proposed development does not interfere with or detract from the line of sight toward the sea from either Kapule or Kūhiō Highway.

- Any development which would adversely affect water quality, existing areas of open water free of visible structures, existing and potential fisheries and fishing grounds, wildlife habitats, or potential or existing agricultural uses of land.

Discussion: The project will use the drainage system design criteria of the County's Storm Drainage Standard, a conceptual drainage system layout along the major roadways near the project area. It is projected that upon completion of the project, soil loss resulting from erosion will dramatically decrease, as compared to existing condition. Best management practices will be employed such as the use of sediment basins, filter fences, diversion swales, and biofiltration swales to minimize potential soil run-off into the wetlands or ocean.

6.5 EIS Significance Criteria

Overall, the project will have a beneficial impact on the environment. The following is an assessment based on criteria established in Title 11 Administrative Rules, Chapter 200 Environmental Impact Statement Rules, Section 12.

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;*

It is anticipated that the project will not involve in any significant loss of natural or cultural resources. Archaeological, ethnographical, and botanical studies were conducted during the preparation of this ~~Draft~~ Final EIS to assess the potential existence of such resources and the findings are presented in Section 4 and 5 of this ~~Draft~~ Final EIS. Appropriate mitigative measures will be implemented, as recommended by the findings.

2. *Curtails the range of beneficial uses of the environment;*

The design of Ocean Bay Plantation at Hanamā'ulu project is intended to create opportunities for the Kaua'i island community to continue its endeavor towards sustainability. The project will enhance the scenic and visual capacity of the area while providing recreational services, housing and small business opportunities for local residents previously unable to utilize the parcel. EWM Kaua'i, LLC intends to include single-family and multi-family residential areas, a small retail commercial center with direct frontage along Kūhiō Highway, and a golf course complex. Much of the land will be converted to landscaped green open space, thus protecting it's scenic beauty and the environmental setting.

Preserving the natural quality of the coastline area and maintaining a sense of open space are important features of the proposed plan. In general, the added economic benefit of the project, the provision of maintaining the project area's open space character, and preserving the wetlands area will increase the range of beneficial uses on the property. The project preserves vital open spaces while allowing for appropriate growth to occur. Various uses, including the proposed project and alternatives, with their potential impacts are addressed in greater detail in *Section 5 and Section 7 of this* Draft EIS.

3. *Conflicts with the State's long term environmental policies or goals and guidelines as expressed in Chapter 344 (State Environmental Policy), HRS, and thereto, court decisions, or executive orders;*

The purpose of Chapter 344, HRS, is "to establish a state policy which will encourage productive and enjoyable harmony between man and his environment, promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, and enrich the understanding of the economical systems and natural resources important to the people of Hawai'i". The proposed project is expected to be consistent with Chapter 344 policies, goals, and guidelines.

4. *Substantially affects the economic or social welfare of the community or State;*

The creation of new opportunities to live and recreate is a realization of an island community's dream to be self-sustaining, self-achieving, and self-fulfilling. The project will positively affect the economic and social welfare of the island community by providing a new facility that encourages an outdoor recreational experience in a manner that is consistent with maintaining and preserving those natural elements that enhance that experience.

The integration of a golf course into a planned community will enhance the overall social and economic value of the surrounding area. The proposed golf course will generate revenue and provide permanent open space, creating a long-term commitment to protecting one of Kaua'i's treasured scenic vistas.

5. *Substantially affect public health;*

The impact of the development on public health is positive. The new golf facility will serve as an accessible recreational resource. Upon project completion, the site will be less prone to dust, erosion, heavy equipment traffic and other impacts related to agricultural use. The project will incorporate State Department of Agriculture and Department of Health guidelines to address conditional concerns related to appropriate landscaping maintenance efforts of golf course development.

6. *Involves substantial secondary impacts, such as population changes or effects on public facilities;*

The development is expected to have a minor impact on population in the area. There will be a moderate increase in population in the immediate area because of the single-family residential component and job opportunities related to the project. However, more substantial population impacts generally result from changes in fertility patterns, economic status, social values or immigration. There is no impact on these factors by the proposed project.

There will be positive impacts on the general rise of economic activity through the construction and long-term operation of the proposed retail commercial center and golf facility. These issues are discussed in greater detail in Section 5 of this EIS.

7. *Involves a substantial degradation of environmental quality;*

While the loss of agricultural land and possible habitat does represent a change to the existing environment, the loss is not considered a degradation nor substantial given the past intensive use of the property for agriculture for many decades. The intent of the project is to provide a master-planned community that provides residential space, a retail commercial center that promotes local small business development, and a multi-faceted golf facility that encourages recreational use of the area. The design of the project is centered upon creating a viable opportunity to create a new residential and golf course community that is harmoniously integrated into the greater island wide community. Within the scope of the design, a promoted conscious effort to maintain the beauty and allure of the natural and cultural landscape exists. Environmental quality impacts are discussed in greater detail in the Draft EIS.

8. *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;*

The proposed project is not a precursor for future actions and the full scope of the project is addressed in this EIS.

9. *Substantially affects a rare, threatened or endangered species, or its habitat;*

Investigations have identified three species of waterfowl that are categorized as endangered. These species predominantly use the existing wetland area as a natural habitat. Existing plans for the wetland area include a preserve, to maintain and enhance the existing habitat conditions. No endangered terrestrial fauna was identified. Further details of the proposed mitigative measures are presented in Section 5 of this EIS.

10. *Detrimentally affects air or water quality or ambient noise levels;*

Detailed discussions on ocean and ground water quality, including drainage and potential runoff, are presented in this EIS. These studies will take into account both short-term impacts, during construction, as well as proposing mitigative measures as appropriate to offset potential long-term impacts.

11. *Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;*

Coastal waters, flood zones, tsunami inundation zones, and beach areas are considered in the development plan. These issues are addressed in this EIS.

12. *Substantially affects scenic vistas and view planes identified in County or State plans or studies;*

Scenic views of the ocean as well as varying mountain regions abound on the project site. The design and development of the project will be a conscious application of siting and structuring that will promote and preserve the present on-site view planes. View planes are recognized as an important component of the success of this development. A specific site layout and impacts on views and scenic resources are presented in this EIS.

13. *Requires substantial energy consumption.*

The proposed project entails the development of a new residential and golf course community, thereby increasing electrical energy consumption. Infrastructure impacts, including energy consumption, are presented in this EIS.

6.6 Reason for EIS

An environmental review of the proposed project is warranted in accordance with Chapter 343, Hawai'i Revised Statutes due to a proposed amendment to the Kaua'i County General Plan, a proposed State Land Use Boundary Amendment, a proposed use of the State Conservation District (landscaping), and the SMA Use Permit requirements.

Section 7.0

ALTERNATIVES TO THE PROPOSED ACTION

7.0 ALTERNATIVES TO THE PROPOSED PROJECT

7.1 NO-ACTION ALTERNATIVE

The No-Action alternative would maintain the site in its present condition as a privately owned agricultural parcel bordered by Kūhiō Highway. The parcel's centralized and well-accessed location and agricultural isolation will continue to make the parcel a primary candidate for non-agricultural development. Continued non-use of this former sugarcane property will result in environmental impacts due to overgrowth of non-native evasive plant species, soil degradation and erosion, infestation of vermin to the area.

In this alternative, the Ocean Bay Plantation at Hanamā'ulu project would not be developed and the anticipated new housing and employment opportunities, community needs and services, provisions of open space, and a community recreational activity area and the associated economic benefits would not occur. No action at the project site would prevent socio-economic benefits for the entire island community.

Complete faith in land preservation and conservation will not work. Often unplanned futures avail opportunities for unguided land uses to occur without much public input. New spaces for enhancing the quality of life need to be consciously achieved through deliberate design and planning of these spaces. The No-Action Alternative accentuates a lack of vision to create livable and sustainable communities that adapt and harmoniously integrate themselves into their surroundings.

7.2 ALTERNATIVE SITE DEVELOPMENT CONFIGURATIONS

This alternative considers other land use configurations for the project site. Included are alternative site planning schemes, more and less intensive development plans and other project styles.

The proposed project is a mixed-use plan with uses chosen and designed to complement each other and the surrounding community. Alternative design scenarios include strictly single or multi-family residential, intensive commercial or retail-only development. The proposed site configuration is designed to create a master-planned community that incorporates the unique atmosphere of its surrounding landscape into the design of project components. The overall effect is essentially a new residential and golf course community that contributes to maintaining a localized sense of place. Promoting a single-use scenario at the site would likely reduce the consistency between site development and the rural quality of the area while incorporating the community values iterated in the 2020 Vision Statement of the County of Kaua'i General Plan. The County General Plan serves as a planning tool to oversee the economic and social sustainability of this island community.

The scale of the proposed project is considered compatible with its surroundings. A smaller project would reduce the social and economic viability of the project with less housing units available or opportunities to promote local business. Conversely, a larger project would infringe on preserving the open space character of the area and may place the development out of scale with its surroundings. While alternative project styles were considered in project concepts, the "Plantation" theme is considered the most appropriate style for the project location.

The 2020 Vision Statement of the County General Plan encourages a diversification of economic opportunities. The Vision emphasizes that small business is the foundation of the island's economy and specifically recognizes the opportunities of:

(a) Small retail businesses, meeting resident and visitor needs.
(b) Outdoor recreation, including environmental tourism and sports facilities.
(c) Conversion of former sugar mill areas that are transformed into commercial centers with shops, museums, crafts and artisan areas, and restaurants. These centers incorporate compatible architectural designs to preserve the historical character of the area while promoting local products and culture.

In addition, the Vision emphasizes that Kaua'i is a place where residents and local business recognize the value and inherently respect and nurture the natural environment. There is prevalent understanding that development must be managed in manner that is consistent to the core values of the community it intends to serve. An island wide emphasis recognizes that the environment is the economy, the natural capital, and the basis for economic survival and success.

The proposed project site is compatible with the Vision's statement of promoting growth in new developments near existing towns like Līhu'e. In the past two decades, the largest residential growth has occurred in development areas around Līhu'e town to the east and north, and filling around the airport and the town areas of Hanamā'ulu and Kapa'a. Plans for low-density residential development for the project area would remain consistent in preserving the character of the rural landscape. Designed infrastructure would be integrated with the natural environment in such a manner that the built environment does not visually dominate the natural landscape

The goal of the proposed project is to remain consistent with the Vision while providing residents with a location for modern conveniences at a traditionally styled gathering point. The proposed Ocean Bay Plantation at Hanamā'ulu project creates an opportunity to promote the beauty of the natural environment, while creating a livable community that provides economic growth.

7.3 ALTERNATIVE SITES SELECTIONS

Given the unique location, central orientation and excellent access of the site, establishing the project at an alternative location would change many of the project goals and design features. There are few areas in strategic locations and of sufficient size on the island of Kaua'i. Also, a mixed-use development of the proposed project's size would likely require similar environmental analyses and entitlement approvals anywhere in the region.

It is also the desire of EWM Hawaii, LLC to readapt its holdings, which are representative of a defunct sugar industry to become a master planned community that creates new opportunities for an island community to flourish. Given this objective, locating an alternative site is not a considered option at this time.

Section 8.0
REQUIRED APPROVALS & PERMITS

8.0 REQUIRED PERMITS AND APPROVALS

This section discusses the necessary approvals and permits required for the proposed project from governmental agencies, boards or commissions or other similar groups having jurisdiction, and the status of each identified approval.

8.1 STATE LAND USE DISTRICT BOUNDARIES

The State of Hawai'i Land Use Law regulates the classification and uses of lands in the State to accommodate growth and development, and to retain the natural resources of the area. The State Land Use Commission classifies all State lands with consideration given to the General Plan of the County, as Urban, Rural, Agricultural, or Conservation.

The project is within the Agricultural, Urban, and Conservation Districts of the area, as shown in Figure 8-1. There are no plans to alter or reclassify existing lands within the conservation district. However, the project will require approval for a boundary amendment by the State Land Use Commission to reclassify existing agricultural lands within the project area to a State Land Use Urban District Classification.

8.2 KAUA'I COUNTY GENERAL PLAN

The Kaua'i County General Plan is the primary policy governing long-range and comprehensive development, use and allocation of land within the County. The General Plan identifies areas that are intended to improve the physical environment of the County and the health, safety, and general welfare of the island community. The location of specific uses and development is organized by the Development Plans and regulated by the Comprehensive Zoning Ordinance. The County General Plan was last revised in 2000. The General Plan designation for the project site is Agricultural and Open Lands, as shown in Figure 8-2. The Open designation includes lands within the State Conservation District and is intended to preserve coastal bluffs, sandy beaches, and other natural features. The project will require an amendment to the County of Kaua'i General Plan to reclassify existing agricultural lands to a residential community designation.

8.3 LĪHU'E REGIONAL DEVELOPMENT PLAN

The Līhu'e Regional Development Plan, which is codified in the Kaua'i County Code, 1987 as Chapter 10, Article 5, provides detailed plans for administrative purposes and assists the Planning Department and Planning Commission to implement the County's General Plan. Adopted in 1977, it serves as a guideline for specific improvements and provides orderly direction for this region's future growth within the framework of the General Plan. The Development Plan designation for the project area is Open. As stated in the Plan, open land is designated as such because "it is desirable for physical or social reasons."

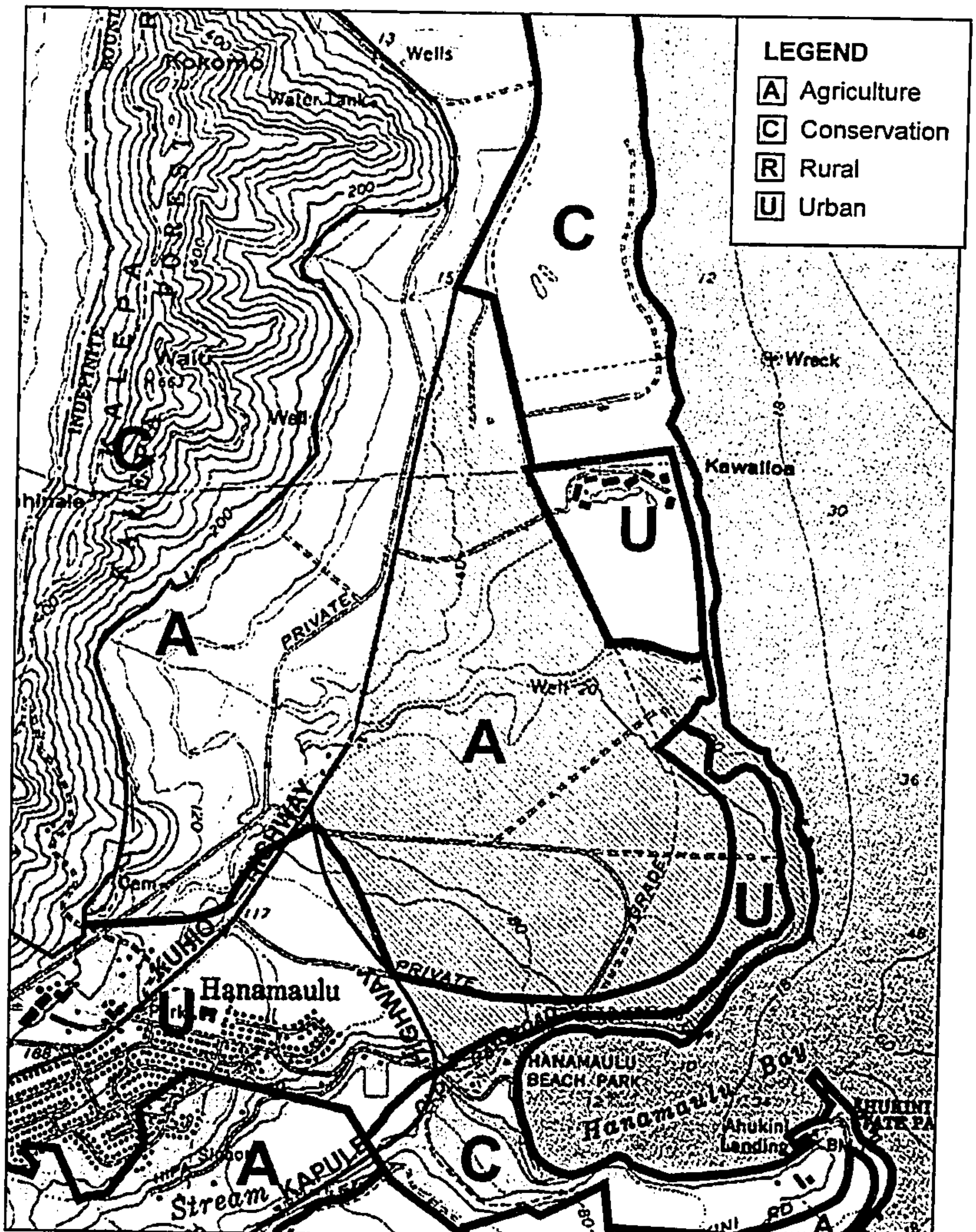


FIGURE 8-1 STATE LAND USE CLASSIFICATION

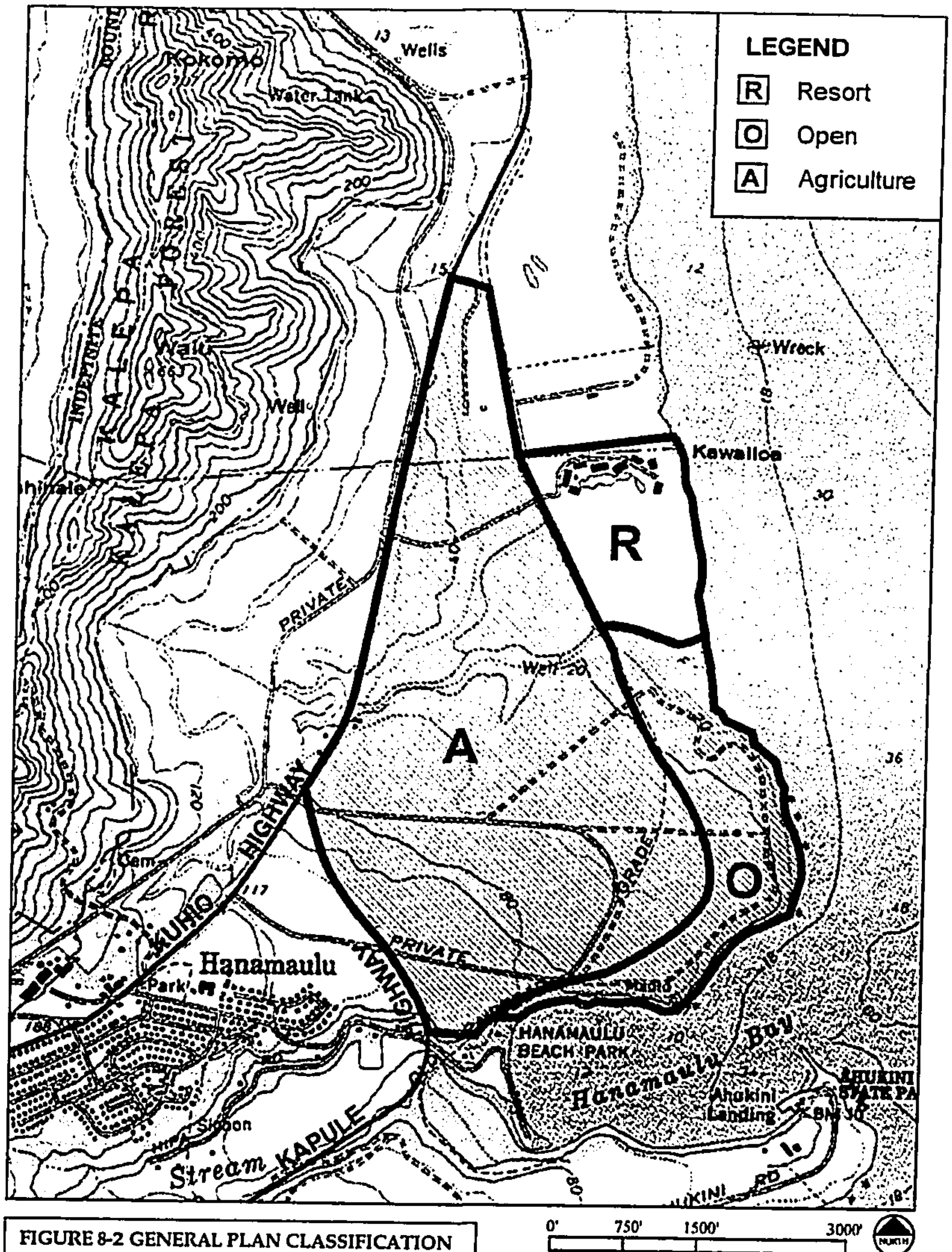


FIGURE 8-2 GENERAL PLAN CLASSIFICATION

8.4 COUNTY OF KAUA'I SPECIAL MANAGEMENT AREA

It is the policy of the County of Kaua'i to preserve, protect, and to restore the natural resources of its coastal areas. The County's Special Management Area (SMA) boundary is located along the coastal edge of the project area, as shown in Figure 8-3. The SMA designation places special controls on development within an area along the shoreline. These controls are necessary to avoid permanent loss of valuable resources and to insure that adequate public access is provided to public owned or used beaches, recreation areas, and natural reserves.

Issuance of a major permit is necessary if it is determined that a proposed use can be defined as "development." Under the Hawai'i Revised Statutes, Chapter 205A, and the County of Kaua'i Special Management Area Rules and Regulations, the proposed project will require a Special Management Area Use Permit. The County Planning Commission and County Council are the discretionary decision-making body for this approval.

8.5 COUNTY OF KAUA'I ZONING DISTRICTS

The purpose of the Comprehensive Zoning Ordinance (CZO) for the County of Kaua'i is to implement the General Plan and Regional Development Plans' policies for growth and development. The zoning designation within the project area is Agriculture, Open and Special Treatment-Scenic Ecological (ST-R), as illustrated in Figure 8-4.

The purpose of the Open Designation of the CZO is to preserve, maintain, and improve those characteristics of land and water areas that are (1) of significant value to the public as scenic or recreational resources, (2) important to the overall structure and organization of urban areas and which provide accessible and usable open areas for recreation or aesthetic purposes, and (3) necessary to buffer the public and places of residence from undesirable environmental factors caused by particular uses such as noise and dust.

The Special Treatment designation is intended to guide the development of areas that with unique or critical cultural, physical, or locational characteristics that have particular significance or value to the general public. The Scenic/Ecological Resources sub-designation includes lands and water areas that have unique natural forms, biological systems, or aesthetic characteristics that are of particular significance to the general public.

The project will require rezoning the area from Open to various zoning districts to accommodate the proposed golf course, commercial, and residential uses.

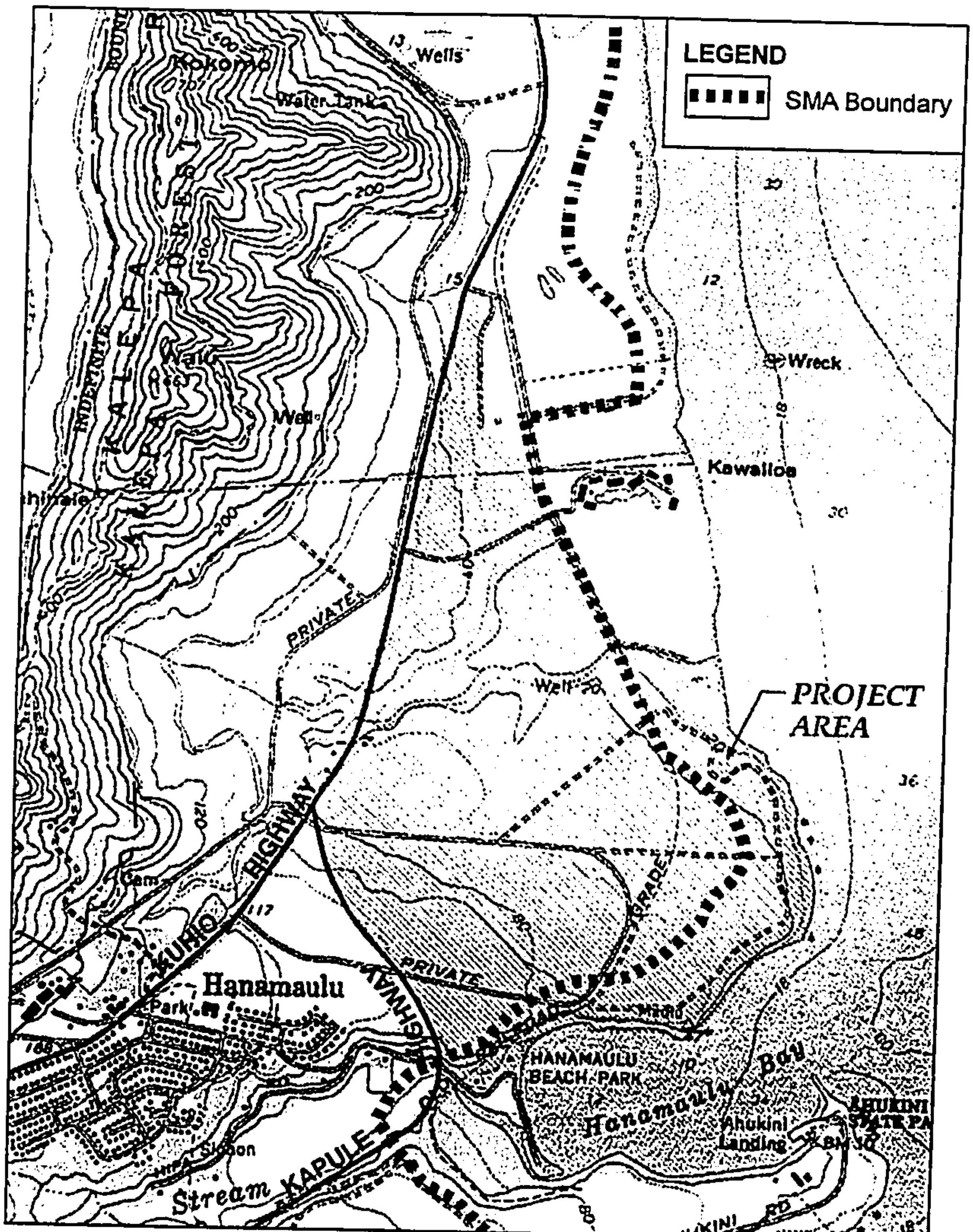


FIGURE 8-3 SPECIAL MANAGEMENT AREA

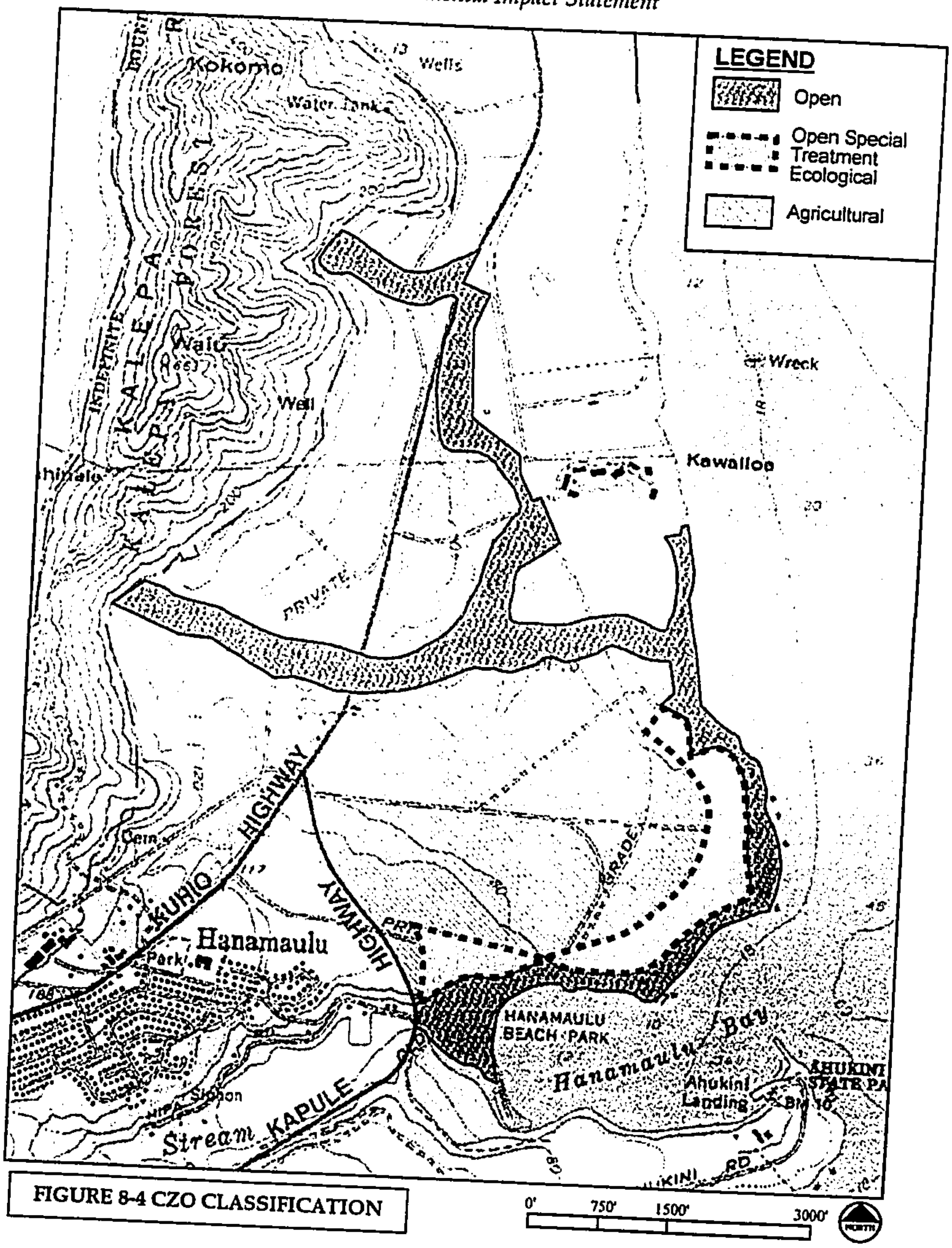


FIGURE 8-4 CZO CLASSIFICATION

8.6 REQUIRED APPROVALS

This section includes a description of the required approvals and permits to implement the proposed Ocean Bay Plantation project. The entitlements, as shown in Table 8-1, include an amendment to the County of Kaua'i General Plan and an issuance of a Special Management Area (SMA) Use Permit. All necessary ministerial permits such as grading and building will be obtained prior to construction.

Table 8-1
Permits and Approvals Required

Permit or Approval	Authority
Conservation Land Sub-Zone Designation	State of Hawai'i, Board of Land and Natural Resources
Conservation District Use Permit (Landscape)	State of Hawai'i, Board of Land and Natural Resources
Environmental Impact Statement Acceptance	HRS Chapter 343, County of Kaua'i, Department of Planning
County of Kaua'i General Plan Amendment	County of Kaua'i, Planning Commission, County Council
Re-zone or Project District Approval	County of Kaua'i, Planning Commission, County Council
State Land Use Boundary Amendment	State of Hawai'i, Land Use Commission
Special Management Area (SMA) Use Permit	County of Kaua'i, Planning Commission, County Council
Use and Zoning Permits	County of Kaua'i, Planning Commission
Construction Permits	County of Kaua'i, Department of Public Works, Building Division

Section 9.0

PARTIES CONSULTED IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

9.0 PARTIES CONSULTED DURING THE PREPARATION OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT

This section lists the agencies, organizations, and individuals that were either sent the Environmental Impact Statement Notice of Preparation and/or ~~this~~ the Draft Environmental Impact Statement (DEIS). A (✓) in the Received DEIS indicates that the DEIS was mailed to the party. The table also indicates which organizations and individuals provided comment letters to the EISPN and the DEIS. The comments and response letters are included in this section.

9.1 FEDERAL GOVERNMENT

	Received EISPN	Comments Received	Received DEIS	Comments Received
Department of the Interior, Fish & Wildlife Service, Pacific Islands Administrator	✓		✓	
National Marine Fisheries Services, Pacific Islands Area Office			✓	

9.2 STATE OF HAWAII

Department of Accounting and General Services			✓	✓
Department of Agriculture	✓		✓	
Department of Business, Economic Development and Tourism (DBEDT)			✓	
DEBDT -Energy, Resources, and Technology Division			✓	✓
DEBDT-Land Use Commission	✓	✓	✓	✓
DEBDT- Library			✓	
DEBDT- Office of Planning	✓		✓	
Department of Defense			✓	
Department of Hawaiian Home Lands			✓	
Department of Health	✓		✓ (3)	✓
Department of Land and Natural Resources (DLNR)- Forestry and Wildlife Division	✓	✓	✓	
DLNR- Land Division	✓	✓	✓	
DLNR- State Historic Preservation Division	✓	✓	✓	✓
Department of Transportation (DOT)	✓	✓	✓ (2)	✓

DOT- Highways Division, Kaua'i District			✓ (3)	✓
Kaua'i Community College Library	✓		✓	
Legislative Reference Bureau			✓	
Lihu'e Public/Regional Library	✓		✓ (2)	
Office of Environmental Quality Control (OEQC)	✓	✓	✓ (5)	✓
Office of Hawaiian Affairs (OHA)	✓	✓	✓	✓
State Main Library			✓	
UH Environmental Center	✓		✓ (4)	✓
UH Hamilton Library			✓	
UH Water Resources Research Center			✓	

9.3 COUNTY OF KAUA'I

Department of Planning	✓		✓	✓
Department of Public Works (DPW)	✓		✓	✓
DPW-Building Division, Bicycle Coordinator				✓
Department of Water	✓	✓	✓	✓
Fire Department	✓		✓	
Office of Economic Development	✓	✓	✓	✓
Office of the Mayor	✓		✓	
Police Department	✓		✓	

9.4 ELECTED OFFICIALS

Councilmember Bill Kaipo Asing			✓	
Councilmember Bryan Baptiste			✓	
Councilmember Daryl W. Kaneshiro			✓	
Councilmember Gary L. Hooser			✓	
Councilmember James Kunane Tokioka			✓	
Councilmember Randal G.B. Valenciano			✓	
Councilmember Ronald D. Kouchi			✓	
Representative Ezra Kanoho, 13th Representative District	✓		✓	

Senator Jonathan Chun, 7th Senatorial District	✓		✓	

9.5 ORGANIZATIONS AND INDIVIDUALS

Hanamā'ulu Beautification Committee	✓		✓	
The Sierra Club, Kaua'i Group of the Hawai'i Chapter				✓

9.6 MEDIA

The Garden Island Newspaper	✓		✓	
Honolulu Advertiser			✓	
Honolulu Star-Bulletin			✓	

9.7 PREPARERS OF THE ENVIRONMENTAL IMPACT STATEMENT

This environmental impact statement was prepared for the applicant, EWM Kaua'i LLC. The following list identifies the individuals and organizations involved in the preparation of this EIS and their respective contributions.

Group International, Inc.

Norman Hong, AIA: Project Architect
Steven Yuen, AIA: Project Architect
Jeffrey Overton, AICP: Project Manager/ Senior Planner
Kāwika McKeague: Planner
Kathryn A. Nam: Graphics Preparation
Joy Rabara: Graphics Preparation

Technical Consultants	Technical Area
Albert Chong Associates, Inc.	Utilities
Char & Associates	Botanical Survey
Decision Analysts Hawai'i, Inc.	Agriculture Analysis
Gray Hong Bills Nojima & Associates, Inc.	Wastewater Engineering
Kodani & Associates	Roadways, Mass Grading
Kodani & Associates	Storm Drainage
Kodani & Associates	Water
Marine Research Consultants	Marine Environment
PHRI, Inc.	Archaeology
PHRI, Inc.	Cultural Impacts
Rana Productions, Ltd.	Mammalian Survey
Randy Okaneku	Traffic
SMS	Social and Economic Impacts
Tom Nance Water Resource Engineering	Surface/Ground Water
Wm. Kent Alkire II	Golf Course Management

COMMENT AND RESPONSE LETTERS

Environmental Notice of Preparation
August 2001

BENJAMIN J. CAYETANO
GOVERNOR

ANTHONY J.H. CHING
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

September 17, 2001

Mr. Dee Crowell
Planning Director
County of Kauai
4444 Rice Street, Suite 473
Lihue, Hawaii 96766
Attn: Keith Nitta

Dear Mr. Crowell:

Subject: Environmental Impact Statement Preparation Notice (EISPN), Hanamaulu Plantation, Hanamaulu, Kauai, TMKs 3-7-03: 1; 3-9-05: 5

We have reviewed the subject EISPN and have the following comments:

1) We confirm that the project site, as generally represented on Figure 1-2, is located within the boundaries of the State Land Use Urban, Agricultural, and Conservation Districts. We acknowledge that a boundary amendment petition will be filed with the Land Use Commission for the subject project in the future.

2) We suggest that the Draft Environmental Impact Statement (DEIS) include a map showing the project site in relation to the State land use districts and the areas that are to be subject of the boundary amendment petition. Inasmuch as the specific location of the district boundaries in metes and bounds relative to the project site would need to be identified in the petition, we suggest that a boundary interpretation request be filed with our office pursuant to §15-15-22, Hawaii Administrative Rules.

3) Based on the representation of the project site, it appears to include the approximately 29 acres reclassified from the Urban District to the Conservation District under LUC Docket No. BR94-714/Office of State Planning for the protection of the area's scenic coastal resources. The project site also includes areas that were approved for sand mining and enlargement of an existing business structure under LUC Docket Nos. SP76-235/Lihue Plantation Co., Ltd., and SP74-167/Kauai Hardwood, Inc., respectively. Based on the files in these dockets, we are unable to confirm whether these special permit uses still exist on their respective sites. The DEIS should discuss the project's impact, if any, upon these uses.

   We also note that the project site is located across a portion of the petition area reclassified from the Agricultural and Conservation Districts to the Urban District under LUC Docket No. A94-703/The Lihue Plantation Company, Ltd., for residential, public and quasi-public facility, commercial, industrial, park, and open space uses.

4) We request that a copy of the DEIS be provided to our office for review and comment as soon as it becomes available.

We have no further comments to offer at this time. We appreciate the opportunity to comment on the EISPN.

Please feel free to contact Bert Saruwatari of my office at (808) 587-3822, should you require clarification or any further assistance.

Sincerely,

Anthony J.H. Ching

ANTHONY J.H. CHING
Executive Officer

c: Jeff Overton
   OEQC

GROUP 70

Francis S. Oda, Arch. D., AIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Hitoshi Hida, AIA
Roy H. Nihei, AIA, CSI
James I. Nishimoto, AIA
Ralph E. Portmore, AICP
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Paul P. Chorney, AIA
Wendy Lee Cook, AIA, CDT
Philip T. Cuccia
Sutobo Hatim
Jeremy C. Hsu, AIA
Roy A. [illegible], AIA, CSI
Stuart M. Jow, AIA
Charles Y. Kaneshiro, AIA
Dean H. Nakamura
Frank B. McCue
Kyle K. Nakamoto
Kathryn A. Nam
Jeffrey H. Overton, AICP
Christine M. Ruotola, AICP
Norma J. Scott
Scott Tangonan
Sharon Ching Williams, AIA

March 6, 2002

Mr. Anthony J.H. Ching, Executive Officer
State of Hawai'i
Department of Business, Economic Development, and Tourism
Land Use Commission
P.O. Box 2359
Honolulu, HI 96804-2359

Subject: Ocean Bay Plantation at Hanamā'ulu Project
EIS Preparation Notice

Dear Mr. Ching:

Thank you for your letter of September 17, 2001 to the County of Kaua'i Planning Department regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the Ocean Bay Plantation at Hanamā'ulu project.

In response to your comment letter, we affirm that a boundary amendment petition will be filed with the Land Use Commission at a later time. For this purpose and *for an imminent CDUA filing*, a boundary interpretation request has been filed with your office to determine boundary lines between State land use districts within the project area.

As requested, a map depicting the existing State land use districts within the project area and subject to the boundary amendment petition is provided in the Draft Environmental Impact Statement (DEIS).

The applicant is currently proposing a coastal renaturalization plan to improve the 29-acre coastline section. The two special permit uses referenced in your letter are no longer active. The applicant will also be submitting an application for a Special Permit for the proposed golf course and those areas classified (A) or (B) lands by the Land Study Bureau.

Your comments and this response letter will be included in the DEIS. We will also forward you a copy of the Draft EIS for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

GILBERT S. COLOMA-AGARAN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

JANET E. KAWELO
DEPUTY

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT
WATER RESOURCES MANAGEMENT

RECEIVED
SEP 14 2001
GROUP 70

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

September 11, 2001

Mr. Jeff Overtone
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overtone:

Subject: EISPN Hanamaulu Plantation, Kauai, Hawaii

We appreciate your efforts to include us in your review of the subject matter above. In regards to this project affecting any of our forestry or wildlife management programs, we have *no objections* to the proposed development at Hanamaulu Plantation, Kauai, Hawaii. Thank you for allowing us to comment on your project.

Sincerely yours,

Michael G. Buck
Administrator

C: DOFAW Kauai Branch

GROUP 70

Francis S. Oda, Arch D., AIA, AICP
Norman GY Hong, AIA
Sheryl B Seaman, AIA, ASID
Hitoshi Hida, AIA
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Kyle K Nakamoto
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Jeffrey H Overton, AICP
Christine M Ruotola, AICP
Norma J Scott
Scott Tangonan
Sharon Ching Williams, AIA

March 6, 2002

Mr. Michael G. Buck, Administrator
State of Hawai'i
Department of Land and Natural Resources
Fish and Wildlife Division
1151 Punchbowl Street
Honolulu, HI 96813

Subject: Ocean Bay Plantation at Hanamā'ulu Project
EIS Preparation Notice

Dear Mr. Buck:

Thank you for your letter of September 11, 2001 regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the Ocean Bay Plantation at Hanamā'ulu project.

Your comments and this response letter will be included in the Draft Environmental Impact Statement. We will also forward you a copy of the Draft EIS for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

Group 70 International, Inc • Architecture • Planning • Interior Design • Building Diagnostics • Assets Management • Environmental Services
925 Bethel Street, 5th Floor • Honolulu, Hawaii 96813-4307 • Ph (808) 523-5866 • Fax (808) 523-5874 • www.group70int.com • mail@group70int.com

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

GILBERT S. COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DEPUTIES
JANET E. KAWELO
LINNEL NISHIOKA

STATE OF HAWAII

COPY

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS

October 2, 2001

RECEIVED
OCT 10 2001
GROUP 70

LOG NO: 28167 ✓
DOC NO: 0109NM23

Mr. Dee Crowell, Director
Planning Department/County of Kauai
4444 Rice Street, Suite 473
Lihue, Kaua'i, Hawaii 96766

Dear Mr. Crowell:

SUBJECT: Chapter 6E-42, **EISPN - Hanamaula Plantation Group (Group 70 International Inc.)**, TMK: 3-7-3: 1, 3-9-5: 5 Kauai, Hawaii

There has been no archaeological inventory surveys or cultural studies conducted for these parcels. We have been informed by the community that an historic cemetery exists in the project area. House sites and agricultural terraces have been found in nearby parcels near the valleys, gullys and streams and burials in the sand substrate. Thus, it appears that historic sites are present.

The EISPN states that they will be conducting an archaeological inventory survey and a cultural impact assessment study for the project. We agree with this. We will await the findings of the survey and then provide comments to your office.

If you have any further questions, please contact Nancy McMahon of our office at 742-7033.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

c. Jeff Overton, Group 70 International Inc. 925 Bethel St, 5th Floor, Honolulu, HI 96813-4307

NM:amk

GROUP 70

Francis S. Oda, Arch D., AIA, AICP
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Christine M. Ruotola, AICP
Norma J. Scott
Scott Tangonan
Sharon Ching Williams, AIA

March 6, 2002

Mr. Don Hibbard, Administrator
State of Hawai'i
Department of Land and Natural Resources
Historic Preservation Division
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Subject: Ocean Bay Plantation at Hanamā'ulu Project
EIS Preparation Notice

Dear Mr. Hibbard:

Thank you for your letter of October 2, 2001 to the County of Kaua'i Planning Department regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the Ocean Bay Plantation at Hanamā'ulu project. Our office also provided you copies of the archaeological inventory survey and the cultural impact assessment in January 2002.

Your letter confirms our approach of conducting an archaeological inventory survey and a cultural impact assessment to determine the potential historic and cultural resources on the project site. PHRI, Inc., the consulting archaeologist for this project, has completed an archaeological inventory survey. From the results, a historic cemetery has been identified, as indicated in your letter. However, the cemetery is located outside the current project area and is recommended to be left in a state of "as-is" preservation. PHRI, Inc. has prepared revisions to the Archaeological Inventory Survey in response to your letter of February 19, 2002. The revised report is included in the DEIS.

Your comments and this response letter will be included in the Draft EIS. We will also forward you a copy of the Draft EIS for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffery H. Overton, AICP
Chief Environmental Planner

Group 70 International, Inc. • Architecture • Planning • Interior Design • Building Diagnostics • Assets Management • Environmental Services
925 Bethel Street, 5th Floor • Honolulu, Hawaii 96813-4307 • Ph (808) 523-5866 • Fax (808) 523-5874 • www.group70int.com • mail@group70int.com

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
P.O. BOX 621
HONOLULU, HAWAII 96809

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND DIVISION
STATE PARKS
WATER RESOURCE MANAGEMENT

September 28, 2001

RECEIVED
OCT 1 - 2001
GROUP 70

LD-NAV
Ref.: HANAMAULAEISPN.RCM

Group 70 International, Inc
Jeffery H. Overton, AICP
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

SUBJECT: Review: Environmental Impact Statement Preparation Notice
Project: Hanamaula Plantation
Location: Hanamaula, Island of Kauai, Hawaii
Tax Map Key: 4th/ 3-7-3: 1; 3-9-5: 5: 32nd/ 3-9-10: 077

Thank you for the opportunity to review and comment on the subject matter.

Copies of your Environmental Impact Statement Preparation Notice was submitted to the following Department of Land and Natural Resources Divisions for review and comment:

> Aquatic Resources - Forestry and Wildlife - State Parks - Boating and Recreation - Commission on Water Resource Management - Land Division Engineering Branch - Land Division Planning & Technical Services - Kauai District Land Office

Attached herewith is a copy of the Division of Aquatic Resources' comment.

The Department of Land and Natural Resources has no other comment to offer at this time.

Should you have any questions, please feel free to contact Nicholas A. Vaccaro of the Land Division Support Services Branch at 1-808-587-0438.

Very truly yours,

/HARRY M. YADA
Acting Administrator

c: Kauai District Land Office

Suspense Date: Tuesday June 9, 1998

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawaii

MEMORANDUM

To: William Devick, Administrator,
From: Richard Sixberry, Aquatic Biologist
Subject: Comments on EIS Preparation Notice

Comments Requested By: Harry Yada, Land Management

Date of Request: 9/10/01 Date Received: 9/11/01

Summary of Project

Title: Hanama'ulu Plantation

Proj. By: EWM Kauai LLC

Location: Hanama'ulu, Kauai

Brief Description:

The applicant proposes to develop approximately 465-acres, located at Hanama'ulu, Kauai into a project consisting of a mix-use residential and golf course community with a small commercial center.

Comments:

We will review the DEIS when it is completed and comment on any significant impacts adverse to aquatic resource values at a later date.

Although the EIS Preparation Notice describes briefly the proposed project, we suggest the forthcoming EIS discuss in detail potential short term impacts and propose specific means for averting or minimizing adverse effects, and provide possible mitigation for unavoidable damage to natural resource values.

Any shoreline improvements or modifications should be adequately described in the DEIS and the Department should have the opportunity to review all activities that may limit, restrict or discourage the public use of State shoreline land in this vicinity.

RECEIVED
LAND DIVISION

2001 SEP 24 P 1:20

DEPARTMENT OF LAND & NATURAL RESOURCES
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Land Division
Honolulu, Hawaii

September 10, 2001

DIVISION OF AQUATIC RESOURCES
01-634

LD/NAV
Ref.: HANAMAULAEISPN.COM

Suspense Date: 9/28/01

MEMORANDUM:

TO:
XXX Division of Aquatic Resources
XXX Division of Forestry & Wildlife
XXX Division of State Parks
XXX Division of Boating and Ocean Recreation
XXX Historic Preservation Division
XXX Commission on Water Resource Management
Land Division Branches of:
XXX Planning and Technical Services
XXX Engineering Branch
XXX Kauai District Land Office
XXX Shoreline Processing Services

RECEIVED
SEP 11 2001
DIV. AQUATIC RESOURCES

FROM: Harry M. Yada, Acting Administrator
Land Division

SUBJECT: Environmental Impact Statement Preparation Notice
Hanamaula Plantation (Group 70 International Inc.)
Tax Map Key: (4th) 3-7-3: 1; 3-9-5: 5 (Kauai, Hawaii)

Please review the attached document and submit your comment (if any) on Division letterhead signed and dated on or before the suspense date. Should you need more time to review the subject matter, please contact Nick Vaccaro at ext.: 7-0438.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

( ) We have no comments.

(X) Comments attached.

Signed: [signature]

Date: 9/20/01

GROUP 70

Francis S. Oda, Arch. D., AIA, AICP
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Christine M. Ruotola, AICP
Norma J. Scott
Scott Tangonan
Sharon Ching Williams, AIA

March 6, 2002

Mr. Harry M. Yada, Acting Administrator
State of Hawai'i
Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, HI 96809

**Subject: Ocean Bay Plantation at Hanamā'ulu Project
EIS Preparation Notice**

Dear Mr. Yada:

Thank you for your letter of September 28, 2002 to the regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the Ocean Bay Plantation at Hanamā'ulu project. We offer the following response to the comments shared by the Division of Aquatic Resources.

The Draft Environmental Impact Statement (DEIS) will discuss in detail the potential short term impacts and will propose specific mitigation measures to minimize their effects. We acknowledge your comment that the Department should be afforded the opportunity to review all proposed improvements or modifications to the shoreline area that might impact public use and access to the State shoreline areas.

Your comments and this response letter will be included in the DEIS. We will also forward you a copy of the Draft EIS for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton

Jeffrey H. Overton, AICP
Chief Environmental Planner

Group 70 International, Inc. • Architecture • Planning • Interior Design • Building Diagnostics • Assets Management • Environmental Services
925 Bethel Street, 5th Floor • Honolulu, Hawaii 96813-4307 • Ph (808) 523-5866 • Fax (808) 523-5874 • www.group70int.com • mail@group70int.com

BENJAMIN J. CAYETANO
GOVERNOR

BRIAN K. MINAAI
DIRECTOR

DEPUTY DIRECTORS
GLENN M. OKIMOTO
JADINE Y. URASAKI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
HWY-PS
2.4468

OCT 17 2001

Mr. Dee Crowell
Director
Planning Department
County of Kauai
4444 Rice Street, Suite 473
Lihue, Hawaii 96766

Attn: Mr. Keith Nitta

Dear Mr. Crowell:

Subject: Environmental Impact Statement Preparation Notice, Hanamaulu Plantation, TMK: 3-7-3: 1; 3-9-5: 5

Thank you for transmitting the subject document for our review and comment. Our comments on the proposed project are as follows:

1. Access to/from the State Highway shall only be gained thru existing access points marked A & B on the enclosed sketches. Point A is at the Kuhio Highway/Kapule Highway intersection and Point B is at the Kuhio Highway/Kauai Beach Drive intersection.

2. The existing access at Point A is an "Access Permitted for Agricultural Purposes Only". The applicant shall submit a request to the State Highways Division Rights of Way Office for any changes in location and width for the new access. The request shall be accompanied by a metes and bounds map of the new access, complete with written descriptions of the access openings. The applicant shall be informed that there may be additional fees assessed for granting of new, and/or, revised, access openings.

3. The existing access at Point B is an existing private roadway leading to a condominium complex (Kauai Beach Villas) and hotel project (Kauai Radisson Hotel). The applicant shall obtain approval to connect to the private roadway for access to/from Kuhio Highway.

4. The applicant shall dedicate a strip of land along the entire Kapule Highway and Kuhio Highway frontage for highway widening purposes. All dedication documents shall be prepared and processed at no cost to the State.

5. No site storm water runoff from the parcels in questions shall be permitted to flow onto the State Highway Right of Way.

6. At access point A, the applicant shall design and construct highway improvements consisting of, but not limited to, the following:

   a. Redesign and reconstruct intersection and traffic signal system;
   b. Design and construct acceleration & deceleration lanes, left turn storage lanes, and 6 feet wide paved shoulders;
   c. Install street lights;
   d. Design and construct drainage systems;
   e. Relocate utility facilities as necessary;
   f. Design and construct other highway improvements as necessary;
   g. Applicant shall dedicate necessary acreage to the State to install and construct the necessary highway improvements.

7. At access point B, the applicant shall design and construct highway improvements consisting of, but not limited to, the following:

   a. Design and install a traffic signal system;
   b. Design and construct acceleration lane, deceleration lane, left turn storage lane, and 6 feet wide paved shoulders;
   c. Install street lights along Kuhio Highway;
   d. Design and construct drainage system;
   e. Relocate existing utility facilities as necessary;
   f. Design and construct other highway improvements as necessary;
   g. Applicant shall dedicate necessary acreage to the State in order to install and construct the necessary highway improvements.

8. A fence, or hedge type landscaping shall be placed along the entire Kapule Highway and Kuhio Highway frontage. All such fencing and landscaping shall be placed entirely within the private property. Landowner shall be responsible for maintaining the fence or landscaping at no cost to the State.

9. The applicant shall prepare and submit a Traffic Impact Assessment Report (TIAR) to the State Highways Division for review.

10. All design and construction of highway facilities shall be in accordance with State Highways Division standards.

11. All highway improvement plans shall be submitted to the Highways Division for review/approval.

12. Applicant shall seek and obtain all required and necessary land use, zoning, SMA, CDUA, etc., and other permits required for the project.

13. EIS documents shall comply with all State (HRS Chapter 343) and Federal (NEPA and EPA) regulations.

14. This office reserves the right to add, and/or, impose additional conditions as required to mitigate adverse impacts to State highway facilities.

If you have any questions regarding our comments, please contact Steve Morikawa of our Highway Kauai District Office at (808) 274-3111.

Very truly yours,

Brian K. Minaai

BRIAN K. MINAAI
Director of Transportation

Enclosures

c: Group 70 International, Inc., Mr. Jeff Overton

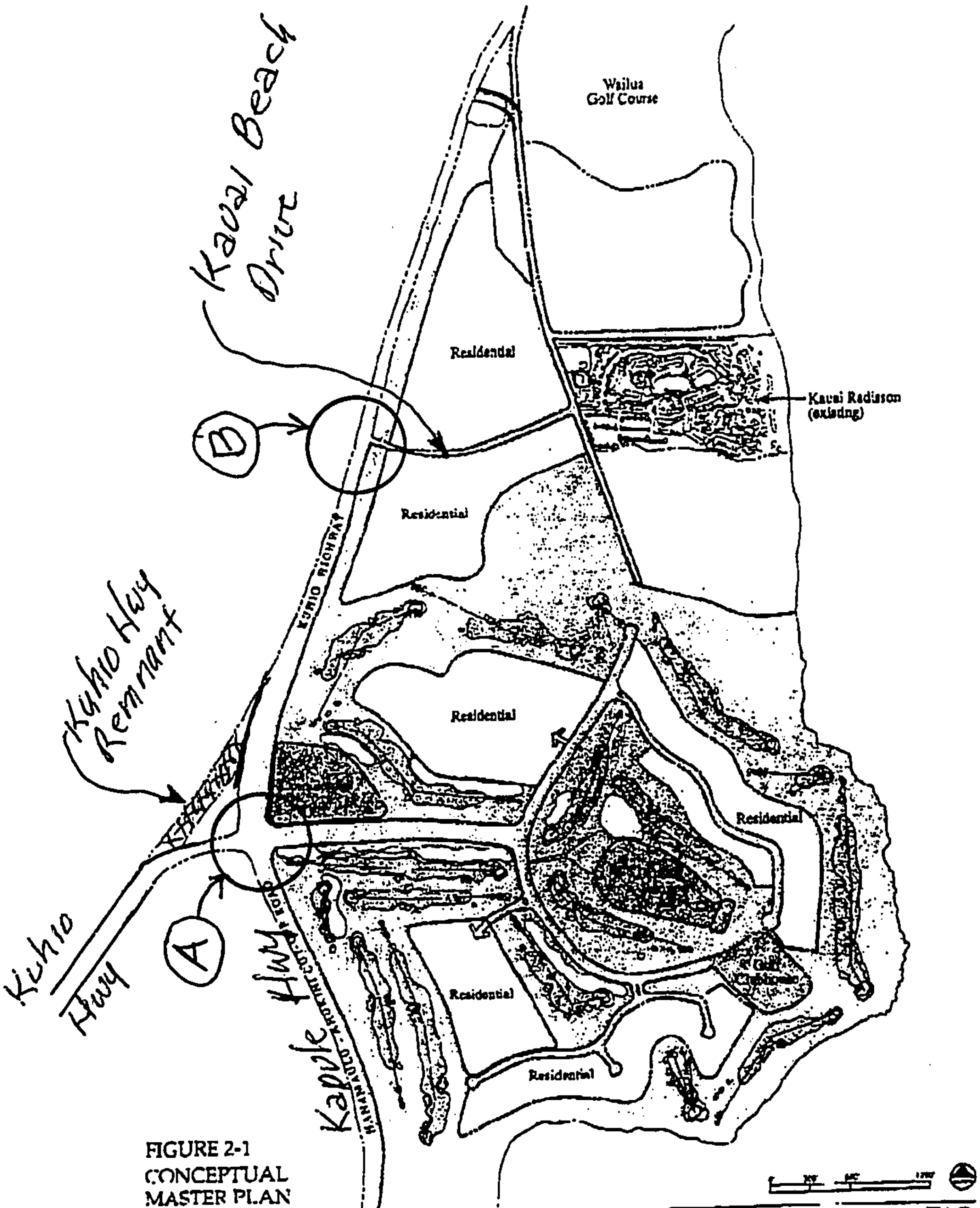
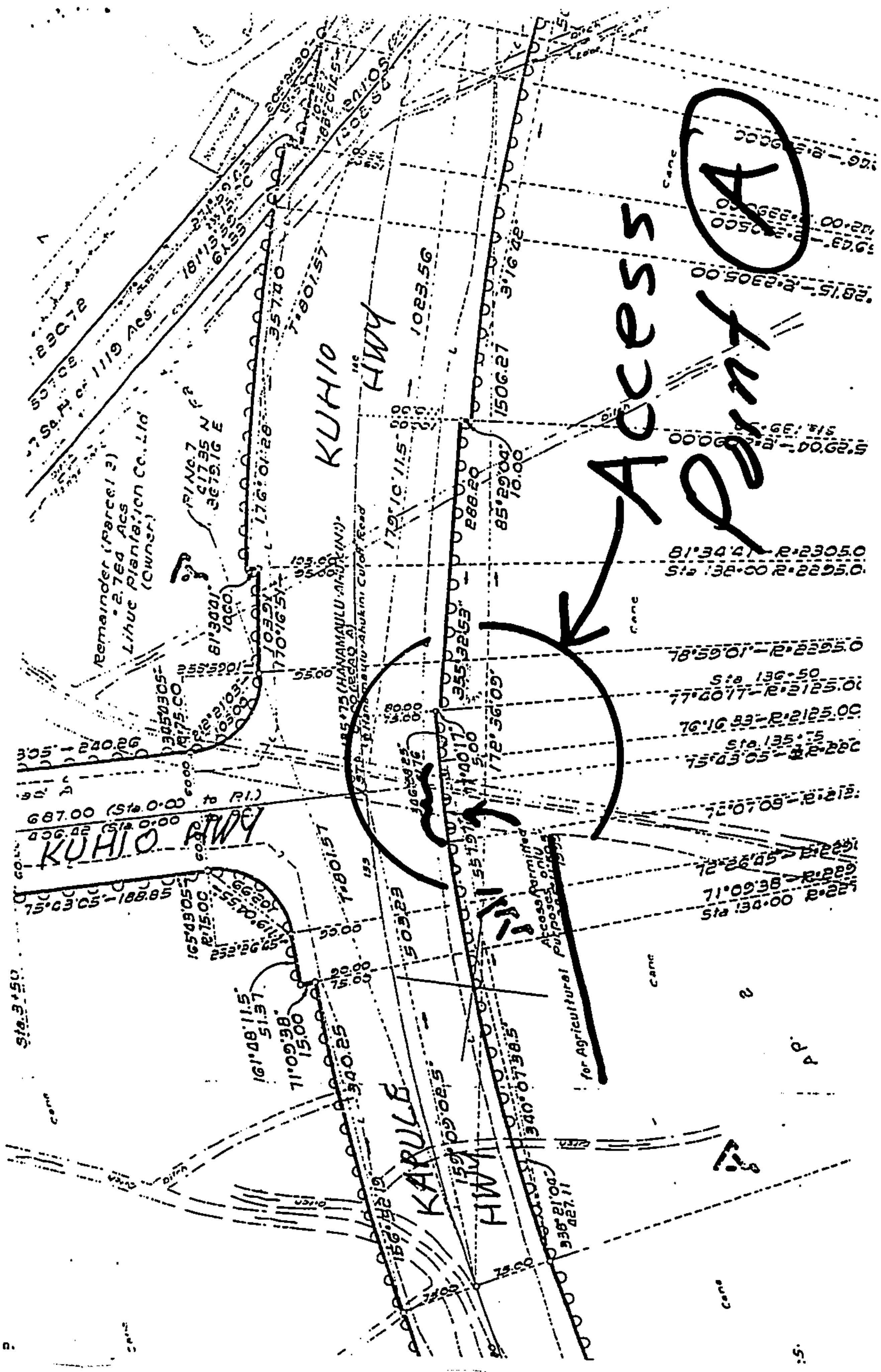


FIGURE 2-1
CONCEPTUAL
MASTER PLAN


Access Point A
KUHIO HWY
KUHIO HWY
KAHULE HWY
Remainder (Parcel 3) 2.764 Acs Lihue Plantation Co. Ltd (Owner)
Access Permitted for Agricultural Purposes only
687.00 (Sta. 0+00 to P.I.)
Sta. 136+00
Sta. 135+75
Sta. 136+50
Sta. 138+00
Sta. 3+50

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March 6, 2002

Mr. Brian K. Minaai, Director of Transportation
State of Hawai'i
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Subject: Ocean Bay Plantation at Hanamā'ulu Project
EIS Preparation Notice

Dear Mr. Minaai:

Thank you for your letter of October 17, 2001 to the County of Kaua'i Planning Department regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the Ocean Bay Plantation at Hanamā'ulu project. We have prepared the following responses to your specific comments for consideration in the Draft Environmental Impact Statement (DEIS).

1. We acknowledge your comment that access to/from the State Highway will be gained through existing access points of the Kūhiō Highway/Kapule Highway (A) and Kūhiō Highway/Kaua'i Beach Drive (B) intersections. The applicant is also proposing a right turn in/out just north of point A.

2. A request to the State Highways Division Rights of Way Office will be submitted for any changes in location and width for access at point A. The request will include the information required in your comment letter.

3. We acknowledge that the roadway extending from point B is a private road. We will discuss and coordinate proper access to the project area with the owners of this road.

4. We acknowledge that a strip of land fronting the project area along the Kapule and Kūhiō Highways will be dedicated for highway widening purposes, pending further discussions with your Department.

5. Given the project location in relationship to the existing highways and project design features, storm runoff is not anticipated to flow on the State Highway Right-of-Way.

6. The applicant would like to conduct further discussions with your Department to address the timing and extent of improvements necessary at access points A and B.

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7. See # 6.

8. Appropriate landscaping features will be placed along the area of the project fronting both highways. We acknowledge that maintenance of improvements placed within the project area will be the responsibility of the applicant.

9. A Traffic Impact Analysis Report (TIAR) has been prepared for the Draft EIS and has been submitted to the State Highways Division for review. The TIAR discusses appropriate measures to mitigate potential impacts on traffic conditions.

10. We acknowledge that the design and construction of highway facilities will be in accordance to established standards of the State Highways Division, and that the highway improvement plans will be submitted to the State Highways Division for review and approval.

11. See # 10.

12. The DEIA includes a discussion on the required permits and approvals needed to implement the proposed project.

13. The DEIS complies with all applicable federal, state, and county environmental reviews and processes.

14. We recognize that the Department of Transportation may have additional concerns regarding State Highway facilities.

Your comments and this response letter will be included in the DEIS. We will also forward you a copy of the Draft EIS for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

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

October 5, 2001

Mr. Dee M. Crowell, Director
Planning Department
4444 Rice Street, Suite 473
Lihue, Hawaii 96766

Dear Mr. Crowell:

Subject: EISPN for the Hanama'ulu Plantation, Kauai

Thank you for the opportunity to review the subject document. We have the following comments and questions.

1. Please consult with the DLNR – Land Division regarding the Conservation Land Sub-Zone Designation and Conservation District Use Permit for Landscaping.

2. Please consult with the State DOT – Airports Division concerning any conflict with present or future airport operations at Lihue.

3. Please describe in detail the shoreline areas of the property and consult with the DLNR Coastal Lands Program concerning the appropriate shoreline setback for this particular property. How will access to the shoreline areas be maintained?

4. Please consider applying sustainable building techniques as presented in the enclosed "Guidelines for Sustainable Building Design in Hawaii." In the DEIS include a description of any of the techniques you will implement.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

for Genevieve Salmonson
Director

c: Group 70
EWM Kauai, LLC

cc: NH
KM

Guidelines for Sustainable Building Design in Hawai`i

A planner's checklist

(Adopted by the Environmental Council on October 13, 1999)

Introduction

Hawai`i law calls for efforts to conserve natural resources, promote efficient use of water and energy and encourage recycling of waste products. Planning a project from the very beginning to include sustainable design concepts can be a critical step toward meeting these goals.

The purpose of the state's environmental review law (HRS Ch. 343) is to encourage a full, accurate and complete analysis of proposed actions, promote public participation and support enlightened decision making by public officials. The Office of Environmental Quality Control offers the following guidelines for preparers of environmental reviews under the authority of HRS 343 to assist agencies and applicants in meeting these goals.

These guidelines do not constitute rules or law. They have been refined by staff and peer review to provide a checklist of items that will help the design team create projects that will have a minimal impact on Hawai`i's environment and make wise use of our natural resources. In a word, projects that are *sustainable*.

A sustainable building is built to minimize energy use, expense, waste, and impact on the environment. It seeks to improve the region's sustainability by meeting the needs of Hawai`i's residents and visitors today without compromising the needs of future generations. Compared to conventional projects, a resource-efficient building project will:

I. Use less energy for operation and maintenance
II. Contain less *embodied* energy (e.g. locally produced building products often contain less *embodied* energy than imported products because they require less energy-consuming transportation.)
III. Protect the environment by preserving/conserving water and other natural resources and by minimizing impact on the site and ecosystems
IV. Minimize health risks to those who construct, maintain, and occupy the building
V. Minimize construction waste
VI. Recycle and reuse generated construction wastes

VII. Use resource-efficient building materials (e.g. materials with recycled content and low embodied energy, and materials that are recyclable, renewable, environmentally benign, non-toxic, low VOC (Volatile Organic Compound) emitting, durable, and that give high life cycle value for the cost.)

VIII. Provide the highest quality product practical at competitive (affordable) first and life cycle costs.

In order to avoid excessive overlapping of items, the checklist is designed to be read in totality, not just as individual sections. This checklist tries to address a range of project types, large scale as well as small scale. Please use items that are appropriate to the type and scale of the project.

Although this list will help promote careful and sensitive planning, mere compliance with this checklist does not confirm sustainability. Compliance with and knowledge of current building codes by users of this checklist is also required.

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I. Pre Design

___1. Hold programming team meeting with client representative, Project Manager, planning consultant, architectural consultant, civil engineer, mechanical, electrical, plumbing (MEP) engineer, structural engineer, landscape architect, interior designer, sustainability consultant and other consultants as required by the project. Identify project and sustainability goals. Client representatives and consultants need to work together to ensure that project and environmental goals are met.

___2. Develop sustainable guideline goals to insert into outline specifications as part of the Schematic Design documents. Select goals from the following sections that are appropriate for the project.

___3. Use Cost-Benefit Method for economic analysis of the sustainability measures chosen. (Cost-Benefit Method is a method of evaluating project choices and investments by comparing the present and life cycle value of expected benefits to the present and life cycle value of expected costs.)

___4. Include "Commissioning" in the project budget and schedule. (Building "Commissioning" is the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained in accordance with specifications that meet the owner's needs, and recognize the owner's financial and operational capacity. It improves the performance of the building systems, resulting in energy efficiency and conservation, improved air quality and lower operation costs. *Refer to Section IX.*)

II. Site Selection & Site Design

A. Site Selection

___1. Analyze and assess site characteristics such as vegetation, topography, geology, climate, natural access, solar orientation patterns, water and drainage, and existing utility and transportation infrastructure to determine the appropriate use of the site.

___2. Whenever possible, select a site in a neighborhood where the project can have a positive social, economic and/or environmental impact.

___3. Select a site with short connections to existing municipal infrastructure (sewer lines, water, waste water treatment plant, roads, gas, electricity, telephone, data communication lines and services). Select a site close to mass transportation, bicycle routes and pedestrian access.

B. Site Preparation and Design

___1. Prepare a thorough existing conditions topographic site plan depicting topography, natural and built features, vegetation, location of site utilities and include solar information, rainfall data and direction of prevailing winds. Preserve existing resources and natural features to enhance the design and add aesthetic, economic and practical value. Design to minimize the environmental impact of the development on vegetation and topography.

___2. Site building(s) to take advantage of natural features and maximize their beneficial effects. Provide for solar access, daylighting and natural cooling. Design ways to integrate the building(s) with the site that maximizes and preserves positive site characteristics, enhances human comfort, safety and health, and achieves operational efficiencies.

___3. Locate building(s) to encourage bicycle and pedestrian access and pedestrian oriented uses. Provide bicycle and pedestrian paths, bicycle racks, etc. Racks should be visible and accessible to promote and encourage bicycle commuting.

___4. Retain existing topsoil and maintain soil health by clearing only the areas reserved for the construction of streets, driveways, parking areas, and building foundations. Replant exposed soil areas as soon as possible. Reuse excavated soils for fill and cut vegetation for mulch.

___5. Grade slopes to a ratio of less than 2 : 1 (run to rise). Balance cut and fill to eliminate hauling. Check grading frequently to prevent accidental over excavation.

___6. Minimize the disruption of site drainage patterns. Provide erosion and dust controls, positive site drainage, and siltation basins as required to protect the site during and after construction, especially, in the event of a major storm.

___7. Minimize the area required for the building footprint. Consolidate utility and infrastructure in common corridors to minimize site degradation, and cost, improve efficiency, and reduce impermeable surfaces.

___8. For termite protection, use non toxic alternatives to pesticides and herbicides, such as Borate treated lumber, Basaltic Termite Barrier, stainless steel termite barrier mesh, and termite resistant materials.

III. Building Design

___1. Consider adaptive re-use of existing structures instead of demolishing and/or constructing a new building. Consult the State Historic Preservation Officer for possible existing historic sites that may meet the project needs.

___2. Plan for high flexibility while designing building shell and interior spaces to accommodate changing needs of the occupants, and thereby extend the life span of the building.

___3. Design for re-use and/or disassembly. (For recyclable and reusable building products, see Section VII).

___4. Design space for recycling and waste diversion opportunities during occupancy.

___5. Provide facilities for bicycle and pedestrian commuters (showers, lockers, bike racks, etc.) in commercial areas and other suitable locations.

___6. Plan for a comfortable and healthy work environment. Include inviting outdoor spaces, wherever possible. *(Refer to Section VIII.)*

___7. Provide an Integrated Pest Management approach. The use of products such as Termi-mesh, Basaltic Termite Barrier and the Sentricon "bait" system can provide long term protection from termite damage and reduce environmental pollution.

___8. Design a building that is energy efficient and resource efficient. *(See Sections IV, V, VII.)* Determine building operation by-products such as heat gain and build up, waste/gray-water and energy consumption, and plan to minimize them or find alternate uses for them.

___9. For natural cooling, use

a. Reflective or light colored roofing, radiant barrier and/or insulation, roof vents

b. Light colored paving (concrete) and building surfaces

c. Tree Planting to shade buildings and paved areas

d. Building orientation and design that captures trade winds and/or provides for convective cooling of interior spaces when there is no wind.

IV. Energy Use

___1. Obtain a copy of the State of Hawai'i Model Energy Code (available through the Hawai'i State Energy Division, at Tel. 587-3811). Exceed its requirements. (Contact local utility companies for information on tax credits and utility-sponsored programs offering rebates and incentives to businesses for installing qualifying energy efficient technologies.)

___2. Use site sensitive orientation to :

a. Minimize cooling loads through site shading and carefully planned east-west orientation.

b. Incorporate natural ventilation by channeling trade winds.

c. Maximize daylighting.

___3. Design south, east and west shading devices to minimize solar heat gain.

___4. Use spectrally selective tints or spectrally selective low-e glazing with a Solar Heat Gain Coefficient (SHGC) of 0.4 or less.

___5. Minimize effects of thermal bridging in walls, roofs and window systems.

___6. Maximize efficiencies for lighting, Heating, Ventilation, Air Conditioning (HVAC) systems and other equipment. Use insulation and/or radiant barriers, natural ventilation, ceiling fans and shading to avoid the use of air conditioning whenever appropriate.

___7. Eliminate hot water in restrooms when possible.

___8. Provide tenant sub-metering to encourage utility use accountability.

___9. Use renewable energy. Use solar water heaters and consider the use of photovoltaics and Building Integrated Photovoltaics (BIPV).

___10. Use available energy resources such as waste heat recovery, when feasible.

A. Lighting

___1. Design for at least 15% lower interior lighting power allowance than the Energy Code.

___2. Select lamps and ballasts with the highest efficiency, compatible with the desired level of illumination and color rendering specifications. Examples that combine improved color rendering with efficient energy use include compact flourescents and T8 flourescents that use tri-phosphor gases.

___3. Select lighting fixtures which maximize system efficacy and which have heat removal capabilities

___4. Reduce light absorption on surfaces by selecting colors and finishes that provide high reflectance values without glare.

___5. Use task lighting with low ambient light levels.

___6. Maximize daylighting through the use of vertical fenestration, light shelves, skylights, clerestories, building form and orientation as well as through translucent or transparent interior partitions. Coordinate daylighting with electrical lighting for maximum electrical efficiency.

___7. Incorporate daylighting controls and/or motion activated light controls in low or intermittent use areas.

___8. Avoid light spillage in exterior lighting by using directional fixtures.

___9. Minimize light overlap in exterior lighting schemes.

__10. Use lumen maintenance procedures and controls.

B. Mechanical Systems

___1. Design to comply with the Energy Code and to exceed its efficiency requirements.

___2. Use "Smart Building" monitor/control systems when appropriate.

___3. Utilize thermal storage for reduction of peak energy usage.

___4. Use Variable air volume systems to save fan power.

___5. Use variable speed drives on pumping systems and fans for cooling towers and air handlers.

___6. Use air-cooled refrigeration equipment or use cooling towers designed to reduce drift.

___7. Specify premium efficiency motors.

___8. Reduce the need for mechanical ventilation by reducing sources of indoor air pollution. Use high efficiency air filters and ultraviolet lamps in air handling units. Provide for regular maintenance of filtration systems. Use ASHRAE standards as minimum.

___9. Locate fresh air intakes away from polluted or overheated areas. Locate on roof where possible. Separate air intake from air exhausts by at least 40 ft.

__10. Use separate HVAC systems to serve areas that operate on widely differing schedules and/or design conditions.

__11. Use shut off or set back controls on HVAC system when areas are not occupied.

__12. Use condenser heat, waste heat or solar energy. (Contact local utility companies for information on the utility-sponsored Commercial and Industrial Energy Efficiency

Programs which offer incentives to businesses for installing qualifying energy efficient technologies.)

__13. Evaluate plug-in loads for energy efficiency and power saving features.

__14. Improve comfort and save energy by reducing the relative humidity by waste reheat, heat pipes or solar heat.

__15. Minimize heat gain from equipment and appliances by using:
- a. Environmental Protection Agency (EPA) Energy Star rated appliances.
- b. Hoods and exhaust fans to remove heat from concentrated sources.
- c. High performance water heating that exceeds the Energy Code requirements.

__16. Specify HVAC system "commissioning" period to reduce occupant exposure to Indoor Air Quality (IAQ) contaminants and to maximize system efficiency.

V. Water Use

A. Building Water

___1. Install water conserving, low flow fixtures as required by the Uniform Plumbing Code.

___2. If practical, eliminate hot water in restrooms.

___3. Use self closing faucets (infrared sensors or spring loaded faucets) for lavatories and sinks.

B. Landscaping and Irrigation

(See Section VI.)

VI. Landscape and Irrigation

___1. Incorporate water efficient landscaping (xeriscaping) using the following principles:
- a. <u>Planning, Efficient irrigation</u>: Create watering zones for different conditions. Separate vegetation types by watering requirements. Install moisture sensors to prevent operation of the irrigation system in the rain or if the soil has adequate moisture. Use appropriate sprinkler heads.
- b. <u>Soil analysis/improvement</u>: Use (locally made) soil amendments and compost for plant nourishment, improved water absorption and holding capacity.
- c. <u>Appropriate plant selection</u>: Use drought tolerant and/or slow growing hardy grasses, native and indigenous plants, shrubs, ground covers, trees, appropriate for local conditions, to minimize the need for irrigation.
- d. <u>Practical turf areas</u>: Turf only in areas where it provides functional benefits.

e. Mulches: Use mulches to minimize evaporation, reduce weed growth and retard erosion.

Contact the local Board of Water Supply for additional information on xeriscaping such as efficient irrigation, soil improvements, mulching, lists of low water-demand plants, tours of xeriscaped facilities, and xeriscape classes.

___2. Protect existing beneficial site features and save trees to prevent erosion. Establish and carefully mark tree protection areas well before construction.

___3. Limit staging areas and prevent unnecessary grading of the site to protect existing, especially native, vegetation.

___4. Use top soil from the graded areas, stockpiled on the site and protected with a silt fence to reduce the need for imported top soil.

___5. Irrigate with non-potable water or reclaimed water when feasible. Collect rainwater from the roof for irrigation.

___6. Sub-meter the irrigation system to reduce water consumption and consequently water and sewer fees. Contact the local county agency to obtain irrigation sub-metering requirements and procedures. Locate irrigation controls within sight of the irrigated areas to verify that the system is operating properly.

___7. Use pervious paving instead of concrete or asphalt paving. Use natural and man-made berms, hills and swales to control water runoff.

___8. Avoid the use of solvents that contain or leach out pollutants that can contaminate the water resources and runoff. Contact the State of Hawai'i Clean Water Branch at 586-4309 to determine whether a NPDES (National Pollutant Discharge Elimination System) permit is required.

___9. Use Integrated Pest Management (IPM) techniques. IPM involves a carefully managed use of biological and chemical pest control tactics. It emphasizes minimizing the use of pesticides and maximizing the use of natural process

___10. Use trees and bushes that are felled at the building site (i.e. mulch, fence posts). Leave grass trimmings on the lawn to reduce green waste and enhance the natural health of lawns.

___11. Use recycled content, decay and weather resistant landscape materials such as plastic lumber for planters, benches and decks.

VII. Building Materials & Solid Waste Management

A. Material Selection and Design

___1. Use durable products.

___2. Specify and use natural products or products with low embodied energy and/or high recycled content. Products with recycled content include steel, concrete with glass, drywall, carpet, etc. Use ground recycled concrete, graded glass cullet or asphalt as base or fill material.

___3. Specify low toxic or non-toxic materials whenever possible, such as low VOC (Volatile Organic Compounds) paints, sealers and adhesives and low or formaldehyde-free materials. Do not use products with CFCs (Chloro-fluoro-carbons).

___4. Use locally produced products such as plastic lumber, insulation, hydro-mulch, glass tiles, compost.

___5. Use advanced framing systems that reduce waste, two stud corners, engineered structural products and prefabricated panel systems.

___6. Use materials which require limited or no application of finishing or surface preparation. (i.e. finished concrete floor surface, glass block and glazing materials, concrete block masonry, etc.).

___7. Use re-milled salvaged lumber where appropriate and as available. Avoid the use of old growth timber.

___8. Use sustainably harvested timber.

___9. Commit to a material selection program that emphasizes efficient and environmentally sensitive use of building materials, and that uses locally available building materials. (A list of Earth friendly products and materials is available through the Green House Hawai`i Project. Call Clean Hawai`i Center, Tel. 587-3802 for the list.)

B. Solid Waste Management, Recycling and Diversion Plan

___1. Prepare a job-site recycling plan and post it at the job-site office.

___2. Conduct pre-construction waste minimization and recycling training for employees and sub-contractors.

___3. Use a central area for all cutting.

___4. Establish a dedicated waste separation/diversion area. Include Waste/Compost/Recycling collection areas and systems for use during construction process and during the operational life cycle of the building.

___5. Separate and divert all unused or waste cardboard, ferrous scrap, construction materials and fixtures for recycling and/or forwarding to a salvage exchange facility. Information on "Minimizing C&D (construction and demolition) waste in Hawai`i" is available through Department of Health, Office of Solid Waste Management, Tel. 586-4240.

___6. Use all green waste, untreated wood and clean drywall on site as soil amendments or divert to offsite recycling facilities.

___7. Use concrete and asphalt rubble on-site or forward the material for offsite recycling.

___8. Carefully manage and control waste solvents, paints, sealants, and their used containers. Separate these materials from C&D (construction and demolition) waste and store and dispose them of them carefully.

___9. Donate unused paint, solvents, sealants to non-profit organizations or list on HIMEX (Hawai`i Materials Exchange). HIMEX is a free service operated by Maui Recycling

Group, that offers an alternative to landfill disposal of usable materials, and facilitates no-cost trades. See web site, www.himex.org.

__10. Use suppliers that re-use or recycle packaging material whenever possible.

VIII. Indoor Air Quality

__1. Design an HVAC system with adequate supply of outdoor air, good ventilation rates, even air distribution, sufficient exhaust ventilation and appropriate air cleaners.

__2. Develop and specify Indoor Air Quality (IAQ) requirements during design and contract document phases of the project. Monitor compliance in order to minimize or contain IAQ contaminant sources during construction, renovation and remodeling.

__3. Notify occupants of any type of construction, renovation and remodeling and the effects on IAQ.

__4. Inspect existing buildings to determine if asbestos and lead paint are present and arrange for removal or abatement as needed.

__5. Supply workers with, and ensure the use of VOC (Volatile Organic Compounds)-safe masks where required.

__6. Ensure that HVAC systems are installed, operated and maintained in a manner consistent with their design. Use UV lamps in Air Handling Units to eliminate mold and mildew growth. An improperly functioning HVAC system can harbor biological contaminants such as viruses, bacteria, molds, fungi and pollen, and can cause *Sick Building Syndrome* (SBS).

__7. Install separate exhaust fans in rooms where air polluting office equipment is used, and exhaust directly to the exterior of the building, at sufficient distance from the air intake vents.

__8. Place bird guards over air intakes to prevent pollution of shafts and HVAC ducts.

__9. Control indoor air pollution by selecting products and finishes that are low or non-toxic and low VOC emitting. Common sources of indoor chemical contaminants are adhesives, carpeting, upholstery, manufactured wood products, copy machines, pesticides and cleaning agents.

__10. Schedule finish application work to minimize absorption of VOCs into surrounding materials e.g. allow sufficient time for paint and clear finishes to dry before installing carpet and upholstered furniture. Increase ventilation rates during periods of increased pollution.

__11. Allow a flush-out period after construction, renovation, remodeling or pesticide application to minimize occupant exposure to chemicals and contaminants.

IX. Commissioning & Construction Project Closeout

___1. Appoint a Commissioning Authority to develop and implement a commissioning plan and a preventative maintenance plan. Project Manager's responsibilities must include coordination of commissioning activities during project closeout.

___2. Commissioning team should successfully demonstrate all systems and perform operator training before final acceptance.

___3. Provide flush-out period to remove air borne contaminants from the building and systems.

___4. Provide as-built drawings and documentation for all systems. Provide data on equipment maintenance and their control strategies as well as maintenance and cleaning instructions for finish materials.

X. Occupancy and Operation

A. General Objectives

___1. Develop a User's Manual for building occupants that emphasizes the need for Owner/Management commitment to efficient sustainable operations.

___2. Management's responsibilities must include ensuring that sustainability policies are carried out.

B. Energy

___1. Purchase EPA rated, Energy Star, energy-efficient office equipment, appliances, computers, and copiers. (Energy Star is a program sponsored by U.S. Dep. Of Energy. Use of these products will contribute to reduced energy costs for buildings and reduce air pollution.)

___2. Institute an employee education program about the efficient use of building systems and appliances, occupants impact on and responsibility for water use, energy use, waste generation, waste recycling programs, etc.

___3. Re-commission systems and update performance documentation periodically per recommendations of the Commissioning Authority, or whenever modifications are made to the systems.

C. Water

___1. Start the watering cycle in the early morning in order to minimize evaporation.

___2. Manage the chemical treatment of cooling tower water to reduce water consumption.

D. Air

___1. Provide incentives which encourage building occupants to use alternatives to and to reduce the use of single occupancy-vehicles.

___2. Provide a location map of services within walking distance of the place of employment (child care, restaurants, gyms, shopping).
___3. Periodically monitor or check for indoor pollutants in building.
___4. Provide an IAQ plan for tenants, staff and management that establishes policies and documentation procedures for controlling and reporting indoor air pollution. This helps tenants and staff understand their responsibility to protect the air quality of the facility.

E. Materials and Products

___1. Purchase business products with recycled content such as paper, toners, etc.
___2. Purchase Furniture made with sustainably harvested wood, or with recycled and recycled content materials, which will not off gas VOC's.
___3. Remodeling and painting should comply with or improve on original sustainable design intent.
___4. Use low VOC, non-toxic, phosphate and chlorine free, biodegradable cleaning products.

F. Solid Waste

___1. Collect recyclable business waste such as paper, cardboard boxes, and soda cans.
___2. Avoid single use items such as paper or Styrofoam cups and plates, and plastic utensils.

XI. Resources

<u>Financing: Energy Efficiency in Buildings.</u> U.S. Department of Energy, DOE/EE-0152, May, 1998 (Call Tel.1-800-DOE-EREC or visit local office)

<u>Building Commissioning: The Key to Quality Assurance.</u> U.S. Department of Energy, DOE/EE-0153, May, 1998 (Call Tel.1-800-DOE-EREC or visit local office)

<u>Guide to Resource-Efficient Building in Hawaii</u>. University of Hawai`i at Manoa, School of Architecture and Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, October 1998. (Call Tel. 587-3804 for publication)

<u>Hawaii Model Energy Code</u>. Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, November 1997 (Call Tel. 587-3810 for publication)

<u>Photovoltaics in the Built Environment: A Design Guide for Architects and Engineers.</u> NREL Publications, DOE/GO #10097-436, September 1997 (Call Tel.1-800-DOE-EREC or visit local office)

Building Integrated Photovoltaics: A Case Study. NREL Publications #TP-472-7574, March 1995 (Call Tel.1-800-DOE-EREC or visit local office)

Solar Electric Applications: An overview of Today's Applications. NREL Publications, DOE/GO #10097-357, Revised February, 1997 (Call Tel.1-800-DOE-EREC or visit local office)

Green Lights: An Enlightened Approach to Energy Efficiency and Pollution Prevention. U.S. Environmental Protection Agency, Pacific Island Contact Office (Call Tel. 541-2710 for publication.)

Healthy Lawn, Healthy Environment. U.S. Environmental Protection Agency, Pacific Island Contact Office. (Call Tel. 541-2710 for this and related publications)

How to Plant a Native Hawaiian Garden. Office of Environmental Quality Control (OEQC), Department of Health, State of Hawai`i (Call Tel. 586-4185 for publication)

Buy Recycled in Hawai`i. Clean Hawai`i Center, Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, November 1997. (Call Tel. 587-3802 for publication)

Hawai`i Recycling Industry Guide and other recycling and reuse related fact sheets. Clean Hawai`i Center, Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, July 1999. (Call Tel. 587-3802 for publication)

Minimizing Construction and Demolition Waste. Office of Solid Waste Management, Department of Health and Clean Hawai`i Center, Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, February 1998. (Call Tel. 586-4240 for publication)

Contractor's Waste Management Guide and Construction and demolition Waste Management Facilities Directory. Clean Hawai`i Center, Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, 1999. (Call Tel. 587-3802 for publication)

Waste Management and Action: Construction Industry. Department of Health, Solid and Hazardous Waste Branch (Call Tel. 586-7496 for publication)

Business Guide For reducing Solid Waste. U.S. Environmental Protection Agency, Pacific Island Contact Office, Tel. 541-2710 (Call for publication.)

The Inside Story: A Guide to Indoor Air Quality. U.S. Environmental Protection Agency, Pacific Island Contact Office, Tel. 541-2710 (Call for this and related publications.) Additional information is available from the American Lung Association, Hawai'i, Tel. 537-5966

Selecting Healthier Flooring Materials. American Lung Association and Clean Hawai'i Center, February 1999. (Call Tel. 537-5966 x307)

Office Paper Recycling: An Implementation Manual. U.S. Environmental Protection Agency, Pacific Island Contact Office, Tel. 541-2710 (Call for publication.)

Acknowledgments

OEQC and the Environmental Council would like to thank Allison Beale, Gary Gill, Nick H. Huddleston, Gail Suzuki-Jones, Purnima McCutcheon, Virginia B. MacDonald, Steve Meder, Ramona Mullahey, Thomas P. Papandrew, Victor Olgay, Howard Tanaka, and Howard Wiig for their assistance with this project.

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March 6, 2002

Ms. Genevieve Salmonson
State of Hawai'i
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

**Subject: Ocean Bay Plantation at Hanamā'ulu Project
EIS Preparation Notice**

Dear Ms. Salmonson:

Thank you for your letter of October 5, 2001 to the County of Kaua'i Planning Department regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the Ocean Bay Plantation at Hanamā'ulu project, and the enclosed reference materials. We have prepared the following responses to your specific comments for consideration in the Draft Environmental Impact Statement (DEIS).

1. **Consult with the State Department of Land and Natural Resources (DLNR).** A request for a Conservation Land Sub-zone designation has been submitted to the Board of Land and Natural Resources. Additionally, a Finding of No Significant Impact has been issued for a Final Environmental Assessment (EA). The EA is a partial requirement of a Conservation District Use Permit application for a coastal renaturalization plan.

2. **Consult with the State Department of Transportation- Airports Division.** The Airports Division will be consulted in determining if there any potential conflicts with present or future operations at the Līhu'e Airport.

3. **Shoreline Areas of the Property.** A description of the project area, including the shoreline areas, will be provided in the DEIS. The determination of an appropriate shoreline setback will be part of the consultation with the DLNR Coastal Lands Program. Further, the DEIS will discuss mitigation measures as to the provision and maintenance of public access to the coastal area.

4. **Sustainable Building Techniques.** The site and building designs of the proposed project will consider energy-saving techniques and guidelines, as suggested in your attached reference materials.

Your comments and this response letter will be included in the DEIS. We will also forward you a copy of the Draft EIS for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton

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Chief Environmental Planner

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STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
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RECEIVED
OCT 17 2001
GROUP 70

October 11, 2001

County of Kauai
Department of Planning
4444 Rice Street, Suite 473
Lihue, HI 96766
Attention: Mr. Keith Nitta

HRD01/291

Subject: Environmental Impact Statement Preparation Notice (EISPN)
Hanamā'ulu Plantation
TMK: 4-3-7-3: 01; 4-3-9-5: 05
Kaua'i, Hawai'i

Dear Mr. Nitta:

Thank you for the opportunity to comment on the above referenced project. The Office of Hawaiian Affairs (OHA) offers the following comments.

Burials, Historical and Cultural Sites

In the event human burials, cultural or historical sites are discovered during any grading, excavation, or construction activities at the proposed project site, the State's Historic Preservation Division (SHPD) should be contacted immediately. In the event of any inadvertent discoveries of human burials or remains, OHA requests that a mitigation plan be developed in conjunction with SHPD, Kaua'i Island Burial Council, and Native Hawaiian individuals or organizations familiar with the proposed project area.

Access, Traditional and Customary Practices

OHA recommends an assessment of the traditional and customary practices and resources prevalent in the proposed project area that may be affected by the proposed development, the potential impacts the development may have on these traditional and customary practices and resources, and the necessary mitigation measures needed to minimize adverse impacts on these resources and practices.

Mr. Keith Nitta
County of Kauai
Department of Planning
October 11, 2001
Page Two

OHA also recommends that the DEIS be consistent with **Articles X-Sec. 9 and XIII-Sec. 2,** of the Hawai'i State Constitution, and other state laws such as Act 50, Hawai'i Session Laws 2000, ensuring the promotion and protection of the traditional and cultural practices and resources of native Hawaiians, as well as other ethnic groups.

Furthermore, OHA requests that the County Planning Department be mindful of its non-delegable responsibility to protect the traditional and customary gathering and access rights of Native Hawaiians. In *Ka Pa'akai O Ka Aina v. Land Use Commission*, 94 Hawaii 31, 7 P.3rd 1068 (2000), the Supreme Court was faced with a challenge by Hawaiian practitioners, among others, to the Land Use Commission's (LUC) decision to reclassify over 1000 acres of land in the ahupua'a of Ka'upulehu on Hawaii island from a Conservation to an Urban District designation. The issue on appeal was whether the LUC had met its duty to protect the traditional and customary practices asserted by native Hawaiians by approving the land reclassification.

The court found that the LUC had not fulfilled its statutory duties because it had not reviewed and analyzed the "1) the identity and scope of 'valued cultural, historical, or natural resources' in the petition area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area; 2) the extent to which those resources—including traditional and customary native Hawaiian rights—will be affected or impaired by the proposed action; and (3) the feasible action, if any, to be taken by the LUC to reasonably protect native Hawaiian rights if they are found to exist." *Kapa 'akai*, slip op. at p.15. The court vacated the LUC's decision to reclassify the land and remanded the matter for further proceedings.

Water Resources

The DEIS should address the impacts the proposed project will have on water resources on Kaua'i, and establish justification for this use in light of protected public trust purposes. The Supreme Court's Waiahole decision held that private commercial uses of water, as is the case here with the golf course, are subject to higher scrutiny and must be justified in light of bona fide public trust purposes such as traditional and customary practices, stream protection and domestic use.

The DEIS should also include a mitigation plan that incorporates measures such as using climate adapted native plants that retain water in landscaping and providing rain sensors on automated irrigation devices. Where appropriate, the applicant should investigate use of non-potable water sources.

Environmental Affects

As with any project involving grading, site clearing, and any other activities involved in the proposed development, OHA has concerns with the impacts to the natural and human environment such activities may cause. In addition, since the proposed project encompasses the shoreline, runoff from the project may impact ocean water quality and marine life. OHA urges the applicant of the project to adhere with environmental protection laws and use best management practices to minimize any potential impacts that the proposed development may cause.

If you have any questions, please contact Mark A. Mararagan, policy analyst at 594-1756, or e-mail him at markmararagan@hotmail.org.

Sincerely,

Colin Kippen Jr.

Colin C. Kippen, Jr.
Deputy Administrator

cc: Board of Trustees
Administrator
Kaua'i CAC
Mr. Jeff Overton – Group 70, International, Inc.

GROUP 70

March 6, 2002

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Mr. Colin C. Kippen, Jr., Deputy Administrator
State of Hawai'i
Office of Hawaiian Affairs
711 Kapi'olani Boulevard, Suite 500
Honolulu, HI 96813

Subject: Ocean Bay Plantation at Hanamā'ulu Project
EIS Preparation Notice

Dear Mr. Kippen:

Thank you for your letter of October 11, 2001 to the County of Kaua'i Planning Department regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the Ocean Bay Plantation at Hanamā'ulu project. We have prepared the following responses to your specific comments for consideration in the Draft Environmental Impact Statement (DEIS). Our office also provided you copies of the archaeological inventory survey and the cultural impact assessment in January 2002.

1. **Burial, Historic, and Cultural Sites.** Given the area's previous alteration and modification as an agricultural parcel, the inadvertent discovery of burials is not anticipated. However, as stated in your letter, in the event of any inadvertent discoveries of human burials or remains, a mitigation plan with appropriate agencies, organizations, and individuals will be developed. Further, an archaeological inventory survey was conducted by PHRI, Inc., the consulting archaeologist for this project. It is recommended that in the event that any previously unidentified sites or remains are encountered during site work and construction phases, work in the area will be suspended until further recommendations are made for the appropriate treatment of historic and cultural materials.

2. **Access, Traditional and Cultural Practices.** A Cultural Impact Assessment was conducted by PHRI, Inc. The DEIS outlines the potential impacts the proposed project may have traditional and customary practices and resources, and provides mitigation measures to minimize any adverse impacts. The DEIS will discuss measures to maintain and protect gathering and access rights of native Hawaiians, as well as other ethnic groups.

3. **Water Resources.** The DEIS will discuss the projected water requirements for the proposed project, the impacts on the island's water resources, and the proposed mitigation measures. As such, the DEIS will review plans for using treated effluent as an irrigation water source for common area and golf

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course landscaping. The DEIS will also provide proposed water-saving landscaping measures, including the use of native plants, which are designed to minimize overall water consumption.

4. **Environmental Affects.** The DEIS will provide an analysis of existing and projected impacts of shoreline runoff from the project area and will provide appropriate mitigative measures to maintain both ocean water quality and any existing marine communities.

Your comments and this response letter will be included in the DEIS. We will also forward you a copy of the Draft EIS for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton

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Chief Environmental Planner

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MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
ADMINISTRATIVE ASSISTANT

CESAR C. PORTUGAL
COUNTY ENGINEER
TELEPHONE 241-6600

IAN K. COSTA
DEPUTY COUNTY ENGINEER
TELEPHONE 241-6640

AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
MO'IKEHA BUILDING, SUITE 275
LIHU'E, KAUA'I, HAWAI'I 96766

September 18, 2001

Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, HI 96813

Attention: Mr. Jeffrey Overton

Gentlemen:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) HANAMAULU PLANTATION, TMK: 3-7-3:1; 3-7-9-5-5
PW9.037

We reviewed the subject preparation notice and offer the following comments in regards to drainage, flooding, and grading.

A. Grading

1. We believe a grubbing and grading permit will be required for this project.
2. Grading shall be done in phases not to exceed more than 10-acre increments per phase.
3. Temporary and permanent erosion control measures, as well as temporary dust control measures, needs to be a part of the grading and grubbing plans.
4. The wetland areas of the subject property needs to be identified. We believe the U.S. Army Corps of Engineers needs to review and approve the work in the wetland areas, and if necessary obtain an Army Corps Permit.

B. Flooding

1. Based on Panel No. 140D of the Federal Insurance Rate Maps (FIRM) dated September 30, 1995, the subject property has been identified to be susceptible to flooding. The flood zones are AE with a corresponding base flood elevation of 9 ft mean sea level (MSL) to 10 ft MSL, and zone VE with a corresponding base flood elevation that varies between 9 ft MSL to 12 ft MSL. Manmade alteration in the VE zone is prohibited by Ordinance No. 630.

2. All new structures need to comply with the flood requirements set forth by Ordinance No. 630 known as the County's flood plain management ordinance.

C. Drainage

1. There is a natural drainage way that traverses through the property. The natural drainage way should be maintained to preserve and protect the functions of the natural drainage way. Flood studies need to be prepared to identify the areas susceptible to flooding and protect and minimize new structures from flood damages.

2. Effects of drainage and runoff issues from the proposed development to the ocean and wetland areas will be addressed. We are reserving our comments when the Draft EIS is prepared. We would like to be considered as a consulted party during the draft EIS preparation.

Thank you for this opportunity to provide our comments. Should you have any questions, please feel free to contact Wallace Kudo of my staff at (808) 241-6620.

Very truly yours,

CESAR C. PORTUGAL
County Engineer

wk

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March 6, 2002

Mr. Cesar C. Portugal, County Engineer
Department of Public Works
County of Kauai
4444 Rice Street
Lihue, Kauai, HI 96766

Subject: Ocean Bay Plantation at Hanamā'ulu
EIS Preparation Notice

Dear Mr. Portugal:

Thank you for your letter of September 18, 2001 regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the above-referenced project. We have prepared the following responses to your comments for consideration in the Draft Environmental Impact Statement (DEIS).

At the appropriate point in project review, an application for a grading permit will be submitted to the County Department of Public Works. Mitigation measures will include the implementation of strict erosion and dust control measures. Additionally, a wetlands delineation report was submitted to the U.S. Army Corp of Engineers for their review and approval.

No structures are being proposed in the designated VE zone therefore, we anticipate no impact to flood zones and high hazard areas. Existing surface runoff pathways, including runoff from areas mauka of Kūhiō Highway, will be managed through the implementation of a County-approved drainage plan. An analysis of potential surface water and groundwater impacts is included in the DEIS.

Your comments and this response letter will be included in the DEIS. We will also forward you a copy of the Draft EIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

MARYANNE W. KUSAKA
MAYOR

VIRGINIA M. KAPALI
DIRECTOR

COUNTY OF KAUAI
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4444 Rice Street, Suite 200, Lihue, HI 96766
Tel: 808-241-6390 Fax: 808-241-6399

RECEIVED
OCT 4 - 2001
GROUP 70

October 1, 2001

County of Kauai
Planning Department
4444 Rice Street, Suite 473
Lihue, Hawaii 96766

Attn: Keith Nitta

Subject: Environmental Impact Statement Preparation Notice (EISPN)
Hanamaulu Plantation
TMK 4-3-7-3:1; 4-3-9-5:5 (Kauai, Hawaii)

Thank you for the opportunity to provide comments on the subject matter.

We ask that the applicant provide a comprehensive economic forecast as to the impact of a workforce sustainability for the proposed project from short term construction jobs to long term availability of job creation. We would like to see the projections of the job market as it relates to the applicant's proposed project roll out in 10 years, as indicated in the EISPN.

Should you have any questions please email me at gini@kauaioed.org or call the office at (808) 241-6390.

Sincerely,

Virginia M. Kapali

Virginia M. Kapali
Director

✓cc: Group 70 International, Inc.

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March 6, 2002

Ms. Virginia M. Kapali, Director
County of Kaua'i
Office of Economic Development
4444 Rice Street, Suite 200
Līhu'e, HI, 96766

Subject: Ocean Bay Plantation at Hanamā'ulu Project
: EIS Preparation Notice

Dear Ms. Kapali:

Thank you for your letter of October 1, 2001 to the County of Kaua'i Planning Department regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the Ocean Bay Plantation at Hanamā'ulu project.

The Draft Environmental Impact Statement (DEIS) will include a review of the projected economic growth that will result from the development of the project. The DEIS will elaborate on the anticipated short and long-term jobs attributed to construction and operational activity, respectively. The projections of the job market as it relates to the proposed project will also be provided.

Your comments and this response letter will be included in the DEIS. We will also forward you a copy of the Draft EIS for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

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DEPARTMENT OF WATER

County of Kauai

"Water has no Substitute – Conserve It!"

September 28, 2001

RECEIVED
OCT 3 - 2001
GROUP 70

Mr. Jeffrey H. Overton, AICP
Chief Environmental Planner
Group 70 International
925 Bethel Street, fifth Floor
Honolulu, HI 96813-4307

Dear Mr. Overton:

Subject: Environmental Impact Statement Preparation Notice (EISPN) for proposed mixed-use residential and golf course community, Hanamaulu Plantation, TMK: 3-7-03:001 & 3-9-05:005, Kapule/Kuhio Highway, Hanamaulu, Kauai.

Any actual subdivision or development of this area will be dependent on the adequacy of the source, storage and transmission facilities existing at that time. At the present time, the proposed development is located out side of the planned development area of the Department of Water's current General Plan for Domestic Water Use.

Prior to the Department of Water (DOW) recommending approvals for any development in this area, the applicant will be required to:

1. Submit for review and approval to the DOW a Water Master Plan for full development of the area. The Water Master Plan shall address but not be limited to: water source, storage and transmission facilities required for the proposed development, along with detailed water demand calculations.

2. Prepare and receive DOW's approval of construction drawings for necessary water system facilities and construct said facilities. These facilities shall include but not be limited to all water system facilities as required and approved in the Water Master Plan for development of the proposed area.

3. Pay the applicable charges in effect at the time payment is made to the DOW. These charges will be dependent on the approved Water master Plan and the approved construction drawings.

If you have any questions, please contact Mr. Edward Doi of my staff at 245-5417.

Sincerely,

Edward Tschupp
for/Ernest Y.W. Lau
Manager and Chief Engineer

ED/sas
D:\sas\docs\wrp\eddoi\21-318-Hanamaulu-Overton-EIS

— 4398 Pua Loke Street, Lihue, Kauai, Hawaii or P. O. Box 1706, Lihue, HI 96766-5706 —
Phone No. (808) 245-5400 – Administration FAX No. (808) 246-8628 – Engineering/Fiscal/Shop FAX No. (808) 245-5813

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March 6, 2002

Mr. Ernest Y.W. Lau, Manager and Chief Engineer
County of Kaua'i
Department of Water
P.O. Box 1706
Lihu'e, HI 96766-5706

**Subject: Ocean Bay Plantation at Hanamā'ulu Project
EIS Preparation Notice**

Dear Mr. Lau:

Thank you for your letter of September 28, 2001 regarding your review of the Environmental Impact Statement Notice of Preparation (EISPN) for the Ocean Bay Plantation at Hanamā'ulu project.

We acknowledge your comment that the site of the proposed project is located outside of the Department's current General Plan for Domestic Water Use. The applicant will complete a Water Master Plan for the project and submit this to the Department for review and approval. The Water Master Plan will address the requirements for water source, storage, and transmission facilities.

As required and prior to development, construction drawings of necessary water system facilities will be prepared and submitted to the Department of Water for approval. Further, upon approval of the Water Master Plan and construction drawings, the applicable fees will be paid.

The applicant's agents and civil engineers will continue to address the project requirements for potable water supply and fire protection with the Department of Water. Your comments and this response letter will be included in the DEIS. We will also forward you a copy of the Draft EIS for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

COMMENT AND RESPONSE LETTERS

Draft Environmental Impact Statement
March 2002

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

GLENN M. OKIMOTO
COMPTROLLER

MARY ALICE EVANS
DEPUTY COMPTROLLER

LETTER NO. PWD02.P204

APR 16 2002

Mr. Keith Nitta
County of Kauai
Department of Planning
4444 Rice Street, Suite 473
Lihue, Kauai, Hawaii 96766

RECEIVED
APR 17 2002
GROUP 70

Dear Mr. Nitta:

Subject: Ocean Bay Plantation at Hanamaulu, Kauai, Hawaii
Draft Environmental Impact Statement (DEIS)
TMK: 4-3-7-3:1; 4-3-9-5:5

Thank you for the opportunity to review the subject project's DEIS. The project does not directly impact any of the Department of Accounting and General Services' projects or existing facilities. Therefore, we have no comments to offer.

If there are any questions regarding the above, please have your staff call Mr. Bruce Bennett of the Planning Branch at 586-0491.

Very truly yours,

GORDON MATSUOKA
Public Works Administrator

BB:mo
c: Mr. Jeff Overton, Group 70 International, Inc.
Ms. Genevieve Salmonson, OEQC

GROUP 70

Francis S. Oda, Arch. D., AIA, AICP
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Scott Tangonan
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Sharon Ching Williams, AIA

June 3, 2002

Mr. Gordon Matsuoka, Public Works Administrator
State of Hawai'i
Department of Accounting and General Services
P.O. Box 119
Honolulu, HI 96810

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Matsuoka:

Thank you for your letter of April 16, 2002 to the County of Kaua'i Department of Planning regarding your review of the Draft Environmental Impact Statement for the Ocean Bay Plantation at Hanamā'ulu project. We acknowledge your statement that you do not have any comment to offer at this time regarding the proposed project.

Your letter and this response will be included in the Final Environmental Impact Statement. We will forward your office a copy of the Final EIS upon its completion.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

BENJAMIN J. CAYETANO
Governor
SEIJI F. NAYA
Director
SHARON S. NARIMATSU
Deputy Director
DAVID W. BLANE
Director, Office of Planning

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT, AND TOURISM

Energy, Resources, and Technology Division
235 South Beretania Street, Leiopapa A Kamehameha Bldg., 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804-2359
Web site: www.hawaii.gov/dbedt/ert

Telephone: (808) 587-3807
FAX: (808) 587-3820

March 25, 2002

County of Kauai
Department of Planning
444 Rice Street, Suite 473
Lihue, HI 96766

Attn: Mr. Keith Nitta

Subject: Draft Environmental Impact Statement (DEIS)
Ocean Bay Plantation at Hanamaulu, Kauai
Tax Map Key: 4-3-7-3:1; 4-3-9-5:5

Thank you for the opportunity to comment on the DEIS for the Ocean Bay Plantation project which includes a golf course, mixed-use residential and commercial activity. Our comments are addressed to: (1) State energy conservation goals, (2) energy saving design practices and technologies, and (3) recycling and recycled-content products.

(1) Energy conservation goals. Project buildings, activities, and site grounds should be designed with energy saving considerations. The mandate for such consideration is found in Chapter 344, HRS ("State Environmental Policy") and Chapter 226 ("Hawaii State Planning Act"). In particular, we would like to call to your attention HRS 226 18(c)(4) which includes a State objective of promoting all cost-effective energy conservation through adoption of energy-efficient practices and technologies.

We note that you have referenced the State's Model Energy Code for appropriate improvements. We also suggest that you contact Kauai Electric which may offer demand-side management rebates for energy efficient technologies.

(2) Energy saving design practices and technologies. In this project, we recommend that you specifically address energy efficient design practices and technologies similar to those used in the "BuiltGreen" energy efficient home in Waianae on Oahu.

Methods and technologies that could be considered during the design phase of the project include:

a. Use of site shading, orientation, and use of naturally ventilated areas to reduce cooling load;
b. Maximum use of day lighting;
c. Use of high efficiency compact fluorescent lighting;
d. Use of high wattage metal halide lighting for sports and recreational areas;
e. Exceed Model Energy Code requirements;
f. Technologies such as solar water heating systems, roof insulation, radiant barriers, and energy efficient windows
g. Use of light color or "green" roofs;
h. Use of landscaping for dust control and to minimize heat gain to area; and
i. Use of photovoltaics or other renewable energy sources should they prove cost effective.

(3) Recycling and recycled-content products.

a. Develop a job-site recycling plan for the construction phase of the project and recycle as much construction and demolition waste as possible;
b. Incorporate provisions for recycling into the built project – a collection system and space for bins for recyclable;
c. Specify and use products with recycled-content such as: steel, concrete aggregate fill, drywall, carpet and glass tile; and
d. Specify and use locally produced products such as plastic lumber, hydromulch, soil amendment and glass tile.

Please refer to the attached *Guidelines for Sustainable Building Design In Hawaii: A planner's checklist* and *A Contractor's Waste Management Guide*" for additional information.

Sincerely,

Maurice H. Kaya
Energy, Resources, and Technology
Program Administrator

Attachments

c: Group 70 International, Inc.
OEQC

GROUP 70

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June 3, 2002

Mr. Maurice H. Kaya, Energy, Resources, and Technology Administrator
State of Hawai'i
Department of Business, Economic Development, and Tourism
Energy, Resources, and Technology Division
P.O. Box 2539
Honolulu, HI 96804-2359

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Kaya:

Thank you for your letter of March 25, 2002 to the County of Kaua'i Planning Department regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project, and for the enclosed materials. We have prepared the following responses to your specific comments.

1. **State Energy Conservation Goals:** The design of the proposed project will fully consider energy-saving requirements and guidelines contained in both the State Environmental Policy and the Hawai'i State Planning Act. A review of demand-side management programs will also be considered in the overall design of the project.
2. **Energy Saving Design Practices & Technologies:** The design of the project will integrate applicable standards of the State Energy Code for residential and non-residential buildings. Accordingly, energy efficient design practices, as suggested in both your letter and the attached documents, will also be considered.
3. **Recycling & Recycled Content Products:** During the construction and implementation phase of the project, efforts to recycle, conserve, and re-use materials and resources will be incorporated where appropriate and feasible. The use of locally produced products will also be considered for on-site use.

Your comments and this response letter will be included in the Final EIS. We will also forward you a copy of the Final EIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

BENJAMIN J. CAYETANO
GOVERNOR

ANTHONY J.H. CHING
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION

P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

RECEIVED
MAY 10 2002
GROUP 70

May 8, 2002

Mr. Keith Nitta, Planner
Planning Department
County of Kauai
4444 Rice Street, Suite 473
Lihue, Hawaii 96766

Dear Mr. Nitta:

Subject: Draft Environmental Impact Statement (DEIS)
Ocean Bay Plantation at Hanamaulu
TMK No: 3-07-03:1; 3-9-05: 5

We have reviewed the subject DEIS transmitted by your letter dated March 19, 2002, and note that Figure 8-1 does not accurately represent the State land use district boundaries in the area surrounding the project site. We have enclosed a copy of a portion of the Commission's official map for the area (K-10, Kapaa) for your information.

We have no further comments to offer at this time. Thank you for the opportunity to comment on the subject DEIS. Please feel free to contact Bert Saruwatari of my office at 587-3822, should you require clarification or any further assistance.

Sincerely,

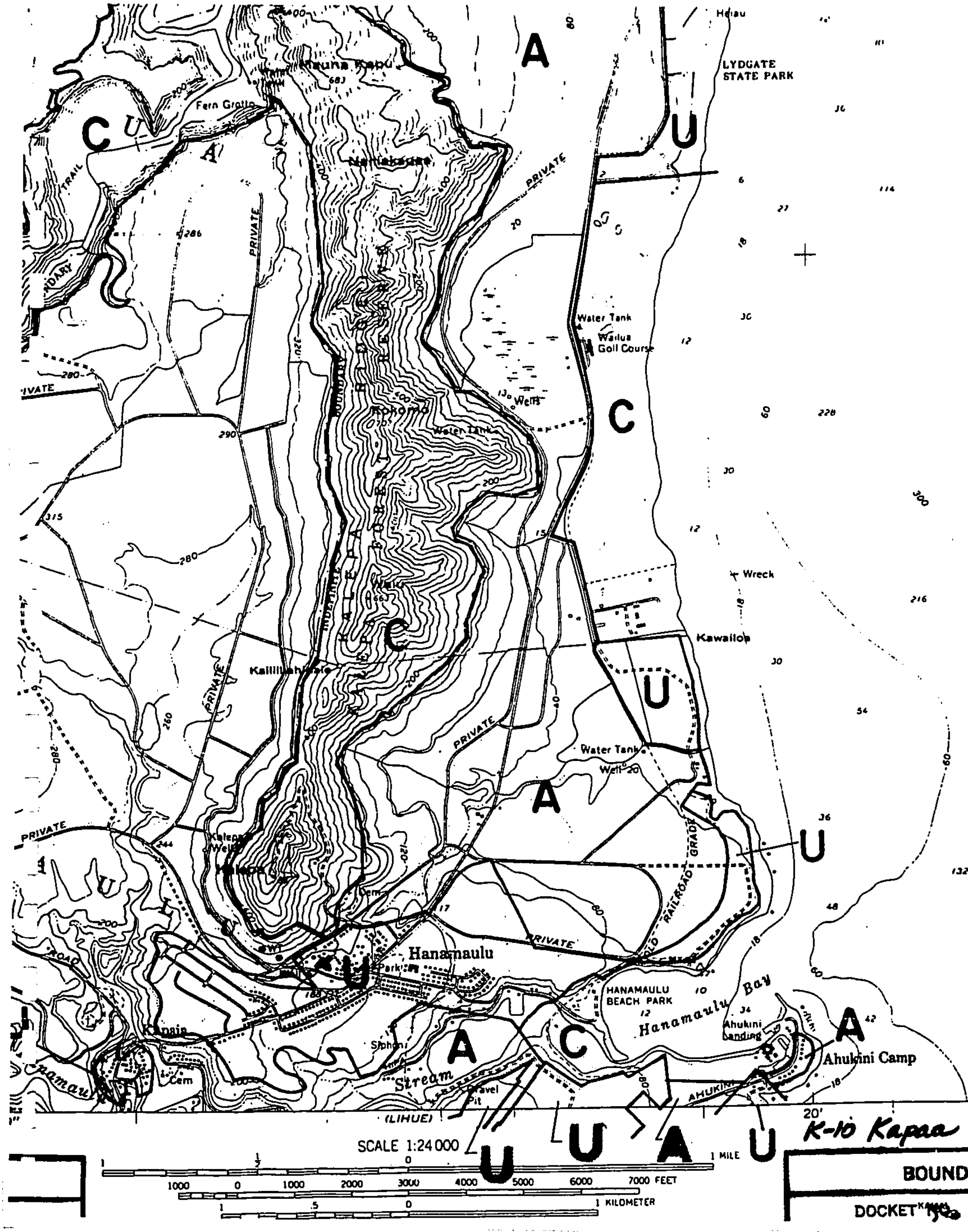
Anthony J H Ching

ANTHONY J. H. CHING
Executive Officer

Enclosure

c: Office of Environmental Quality Control (w/enclosure)
Jeff Overton, Group 70 (w/enclosure)

FAXED



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CORRECTION

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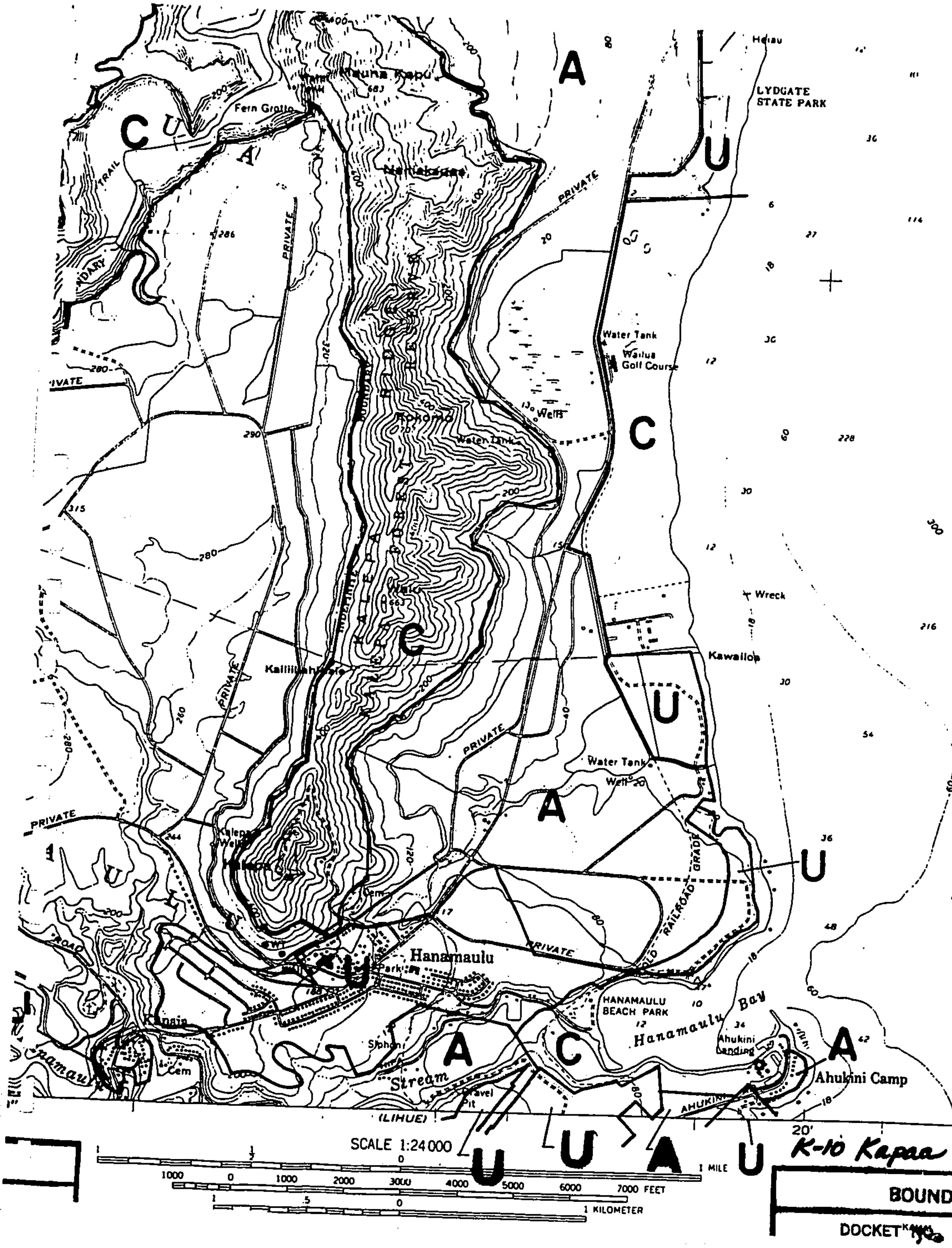

Mauna Kapu
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Nounou
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Wells
Kalepa Ridge
Kawailoa
Wreck
Water Tank
Well
PRIVATE
RAILROAD GRADE
Kalepa
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HANAMAULU
BEACH PARK
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GROUP 70
INTERNATIONAL

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June 3, 2002

Mr. Anthony J.H. Ching, Executive Officer
State of Hawai'i
Department of Business, Economic Development, and Tourism
Land Use Commission
P.O. Box 2359
Honolulu, HI 96804-2359

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Ching:

Thank you for your letter of May 8, 2002 to the County of Kaua'i Planning Department regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project, and the enclosed map.

Figure 8-1 of the DEIS will be revised according to the information provided in the official Commission map (por. of K-10, Kapa'a). This revised figure will be included in the Final EIS.

Your comments and this response letter will be included in the Final EIS (FEIS). We will also forward you a copy of the FEIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

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

In reply, please refer to:
File:
02-065/epo

RECEIVED
MAY - 2 2002
GROUP 70

April 30, 2002

Mr. Jeffrey H. Overton, AICP, Chief Planner
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

Subject: Draft Environmental Impact Statement (DEIS)
Ocean Bay Plantation at Hanama'ulu, Kaua'i
Tax Map Key: 3-7-003:1; 3-9-005:5

Thank you for the opportunity to review and comment on the subject proposal. The DEIS was routed to the various branches of the Environmental Health Administration. We have the following comments.

Clean Air Branch (CAB)

To correct the submitted DEIS in Section 5.1.7 on Air Quality, please note that construction activities must comply with the provisions of Hawai'i Administrative Rules, §11-60.1-33 on Fugitive Dust.

Due to the nature and location of the project, there is a significant potential for fugitive dust emissions during the removal, transport, and installation activities for this project. The project site will be at times within close proximity to neighboring residential and business establishments, major thoroughfares, and a state park. Therefore, implementation of adequate dust control measures during all phases of this project is warranted.

The contractor should provide adequate means to control dust from road areas and during the various phases of construction activities, including but not limited to:

a. Planning the different phases of construction, focusing on minimizing the amount of dust generating materials and activities, centralizing material transfer points and onsite vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;

b. Providing an adequate water source at the site prior to start-up of construction activities;

c. Landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;

d. Controlling of dust from shoulders, project entrances, and access roads;

e. Providing adequate dust control measures during weekends, after hours, and prior to daily startup of construction activities; and

f. Controlling of dust from debris being hauled away from the project site.

If there are any questions, please contact the Clean Air Branch at (808) 586-4200.

Solid and Hazardous Waste Branch (SHWB)

The project impacts on solid waste generation and management were not addressed in the DEIS. It is recommended that a solid waste management plan be developed of which encompasses all project phases including demolition, construction and occupation of the buildings.

Specific examples of elements that the plan should address include:

a. Recycling of green-waste during clear and grub activities;

b. Recycling construction and demolition wastes where appropriate;

c. Use of locally produced compost in landscaping;

d. Use of recycled content building materials; and

e. The provision of recycling facilities in the design of the project.

Wastewater Branch (WWB)

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems". We reserve the right to review the detailed wastewater plans for conformance to applicable rules.

If you have any questions, please contact the Wastewater Branch at (808) 586-4294.

Kaua'i District Health Office (KDHO)

Noise from the construction activities and the stationary sources could impact the nearby residents. The applicable requirements of Title 11, HAR, Chapter 11-46, on Community Noise Control, shall be complied with.

The injection wells that will serve as a backup sewer effluent disposal system shall comply with the applicable requirements of Title 11, HAR, Chapter 11-23, on Underground Injection Control.

The potable and non-potable water systems shall be designed, installed and operated in accordance with the applicable requirements of Title 11, HAR, chapter 11-21, on Cross-Connection and Backflow Control.

Due to the general nature of the DEIS submitted, we reserve the right to implement future environmental health restrictions when more detailed information is submitted.

If you have any questions, please contact the Kaua'i District Health Office at (808) 241-3323.

Sincerely,

GARY GILL
Deputy Director
Environmental Health Administration

c: CAB
SHWB
WWB
KDHO

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Sharon Ching Williams, AIA

June 3, 2002

Mr. Gary Gill, Deputy Director
Environmental Health Administration
State of Hawai'i
Department of Health
P.O. Box 3378
Honolulu, HI 96801

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Gill:

Thank you for your letter of April 30, 2002 regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. We have prepared the following responses to the comments shared by the various branches of your department.

Clean Air Branch

In the Final EIS, Section 5.1.7 will be revised to include the appropriate reference of the project's compliance with the applicable provisions of Hawai'i Administrative Rules, Title 11, Chapter 60.1-33, Air Pollution Control. As discussed in Section 5.1.7 of the DEIS, the expected air pollutant emissions generated on-site during the construction-period are due to vehicular movement, grading, and general dust-generating construction activities. The proposed mitigation measures presented in the DEIS employ adequate dust control measures that consist of, but are not limited to, frequent watering of unpaved roadways and areas of exposed soil; providing an adequate water source at the site prior to start up of construction activity; and using dust fences adjacent to existing neighboring properties. The mitigative measures provided in your comment letter will be considered in the preparation of a dust control management plan during the various phases of construction.

Office of Solid Waste Management

1. The applicant will prepare a solid waste management plan that will be consistently updated during all phases of construction and operation of the project. As such, the development of a recycling program, which would include provisions for on-site areas designated for the collection and temporary storage of recyclable materials and the use of locally produced compost materials, will be considered during the detailed design phases of the project.

Wastewater Branch

The detailed wastewater plans of the project will comply with the applicable provisions of Hawai'i Administrative Rules, Title 11, Chapter 62, Wastewater Systems. We acknowledge the right of the Wastewater Branch to review these plans for conformance to the applicable provisions.

Kaua'i District Health Office (KDHO)

As discussed in Section 5.1.8 and 5.2.13 of the DEIS, noise generated from construction activities and operation stationary sources will be mitigated in accordance to the applicable requirements of Hawai'i Administrative Rules, Title 11, Chapter 46, Community Noise Control.

Your letter and this response will be included in the Final Environmental Impact Statement. We will forward your office a copy of the Final EIS upon its completion.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

Group 70 International, Inc. • Architecture • Planning • Interior Design • Building Diagnostics • Assets Management • Environmental Services
925 Bethel Street, 5th Floor • Honolulu, Hawaii 96813-4307 • Ph (808) 523-5866 • Fax (808) 523-5874 • www.group70int.com • mail@group70int.com

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

GILBERT COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
ERIC T. HIRANO
LINNEL NISHIOKA

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

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FEB 25 2002

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BLVD., ROOM 555
KAPOLEI, HAWAII 96707

February 19, 2002

Mr. Jeff Overton
Group 70 International Inc.
925 Bethel Street 5th Floor
Honolulu, Hawaii 96813-4307

LOG NO: 29186
DOC NO: 0202RC25

Dear Mr. Crowell:

SUBJECT: **Historic Preservation Review -- Archaeological Inventory Survey Hanama'ulu Plantation Project
Hanamau'ulu, Lihue District, Island of Kauai
<u>TMK: 3-7-3: 1, 3-9-5: 5</u>**

This letter reviews this report which was submitted January 6, 2002 [Corbin 2001. Archaeological Inventory Survey Hanama'ulu Plantation Project, Land of Hanamau'ulu, Lihue District, Island of Kauai. PHRI ms.]. This report is related to a Draft EA for a Coastal Renaturalization Plan Ocean Bay Plantation.

The background section of this report does not meet our minimal standards. These standards require an overview of the ahupua'a settlement pattern and likely site patterns in the project area based on archival information (minimally Mahele land record information) and on prior archaeological information. Revision is needed (please see attachment). This section is very important for this project, because it will clarify likely sites formerly in the area impacted by sugarcane cultivation (and an assessment if they are indeed likely to be destroyed) and it will clarify likely precontact sites along the shore.

We are uncertain if the survey has identified all the sites in the project area. We first need to establish that all sites in the former cane areas are likely to have been destroyed. We also need to establish that all sand deposit areas along the shore have been tested for possible subsurface habitation deposits. The report must clarify these points to a satisfactory degree.

Ten historic sites were identified. The descriptions and interpretations of most of these sites need to be amplified. (Please see the attachment.) Also, the size of the subsurface habitation site 1838 needs to be clarified, as conflicting dimensions are presented.

We are unable to evaluate the significance of all these sites until the above information is included in the report. Most of the evaluations seem reasonable, but we also have some questions (see attachment). One of our concerns is that the habitation deposits at 1838 have a quite early date for the east coast of Kauai. This might make this site significant for broad patterns of history (criterion A), associated with the settlement of this shoreline.

The report's mitigation recommendations also need some re-evaluation. We wonder if site 1838 does not merit preservation or data recovery, given its early date and the rare survival of habitation sites along the shore in the Lihue -Hanamaulu area. The report recommends no mitigation for 6 sites, but discussions between our Kauai Archaeologist and the applicant took place about possibly preserving all the sites. If that is the case, then perhaps this report could be revised to include that information.

We will await the revised report. As always, if you disagree with our comments or have questions, please feel free to contact our review staff. If you have any further questions, please contact Nancy McMahon of our office at 742-7033.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

NM:jen

Attachment

c: Dee Crowell, County of Kauai
Paul Rosendahl, PHRI

ATTACHMENT

NEEDED REVISIONS
HANAMAULU PLANTATION PROJECT SURVEY

PHRI

Background Section – Establish the Settlement Pattern of the Ahupua'a and the Project Area's Site Patterns

1. Some bits and pieces of the information that should go in this section are scattered around the report and appendices. Only the information on Hanamaulu need be presented, not archival or archaeological information on Wailua and Nawiliwili unless it is felt that it is relevant to establishing Hanamaulu settlement patterns. (If not relevant, presenting Wailua and Nawiliwili information confuses the discussion of likely Hanamaulu patterns.)

2. Archival Information. Minimally, our minimal standards request a review of the LCA commoner land awards in the ahupua'a. Appendix B (p. 7 area) discusses these awards. However, in the text of the report's main body, there needs to be a background section which discusses these awards. This must include a map locating the awards and text that indicates the land use in the award locations. For example, if awards are all along the shore and along the stream, if the land use records indicate the shore pieces are houselots and the stream pieces are irrigated kalo fields, then this is the critical land use information that must be included.

3. Prior Archaeological work. There should be a map indicating where the previous research as taken place, particularly the Hanamaulu work. Also, for site 103 (the dune site), it needs to be clear whether this site is considered to be within Hanamaulu.

4. There also should be some background information included on the sugarcane operations in this area. The company, and when it operated.

5. There needs to be a concluding part to this background section which summarizes the likely settlement pattern for the ahupua'a based on the prior work and the likely site patterns in the project area. Pages 23 (para. 3-5) and 24 (para. 1) includes some of the ahupua'a pattern summary information, and it should be moved up in the report to this point.

Site Inventory – Descriptions, Interpretations, and Dating

1. Was the project area covered acceptably and are all sites likely to be found.
   a. There is a discussion about sugarcane cultivation of much of the project area making it unlikely that sites survive in these areas (p. 22, para 1). Work on a relatively nearby parcel is discussed. However, here the findings of the background section are vital. What types of sites would have been in the areas that underwent cane cultivation? For example, if irrigated kalo fields, some of these sites deposits can lie underneath the cane cultivation zone. If dryland fields or houses, then the deposits would be relatively shallow and likely be destroyed by the cane cultivation. This information needed inclusion, so it can be confirmed that sites are likely to have been destroyed. If irrigated kalo

deposits are likely to have survived in part, then test excavations would be needed to evaluate this possibility.
   b. The possibility of subsurface habitations and burials also exist in coastal sand areas. It is not clear from this report what parts of the project area include coastal sand areas which might have held such sites. This needs to be made clear. Then it must be clear how work attempted to identify whether subsurface habitation deposits were present. The report hints that dune exposures were checked. But it must be clear that all such environmental settings were checked for sites. (Clearly some may have been severely altered, making sites unlikely.)

2. p. 11, Table 2. This table mixes some functional and formal types, and some other points. See the comments below. When they are resolved, then this table could be tidied up a bit. Some points:
   a. For the Transportation function, it would be good to clarify Railroad vs. Automobile Road.
   b. 1843 – Here it says transportation, while the site description says agriculture. Actually, it seems to be a combination of wharf (pier) for cane and cane road. It should be better clarified under function.
   c. You have chronology under formal type in some cases. For consistency, do you want a column which addresses chronology for all sites? It would be clearer.

3. p. 13, 1839 excavations. Clarify which layer the terrace stonework is associated with.

4. P. 15-19, historic artifact analysis, site 1843.
   a. There is no chronological analysis of the ceramics. This needs to be included.
   b. Other than the Japanese medical bottle, there is no chronological analysis of the bottles. This needs inclusion.
   c. P. 19, Summary. How can it be concluded that this site's artifacts date to the late 1800s-early 1900s with only one item dated (and that to 1900-1918)? This is why the dating of the ceramics and other bottles needs to be done.

5. p. 22, para 3, 2068 (historic dump). There is no evaluation of the age of the glass in the report prior to this point, nor is this conclusion referenced to a page in the appendices.

6. p. A-1, 1838.
   a. The borders of this site are not clearly delimited. The text needs to make this clear. Right now the start of the site description says the site is 70 x 10 meters, but the description says there are only two features. Feature A is described as 2.4 x 0.6 meters, but then the update says it has eroded to 9 x 7 meters. Feature B is said to be 1.7 x 1.7 meters. Clearly, none of these measurements match. This description needs to be revised to clearly indicate the site's size and appearance. Also, is it possible that the site extends farther, as no testing was done – apparently only surface exposures were observed.
   b. No profiles are provided for the layers that were observed in the exposures. These need to be included with the layer descriptions (pp. 12).

c. Where is the functional analysis of this site? Is it concluded to be a permanent habitation or temporary habitation, or this cannot be distinguished yet? Provide evidence for conclusions.

6. A-2, A-5, site 1839, Feature B. Is this terraced faced with stonework? What is its shape? Where is the berm on the map? The map seems to indicate that this feature is 7 x 5 meters in area, not the 9.2 x 7.5 as indicated in the text. What is the evidence justifying the temporary habitation conclusion. Please resolve these points.

7. A-2, A-6, site 1840. What is the evidence to conclude that this is a retaining wall? For what type of transportation activity was the wall associated with, and the evidence?

8. Site 1841. What type of road is this, cane? What is its likely age?

9. A-10, Site 1843.
   a. Feature B. where does this road go to?
   b. Feature C. How is it concluded that this is transportation related?
   c. The overall interpretation for 1843. Why is this concluded to be Agriculture? A pier is present, and a road.

10. A-11, site 1845. How is it concluded that this is a railroad bridge? Where did the railroad line go? What was it affiliated with -- cane?, company? Age?

11. A-16, Site 2066.
   a. Feature A. If this upright was possibly associated with a cemetery based on oral informant information, why was there no testing to determine if burials were present and what the borders of the site were. What are the site borders?
   b. Feature B. If this is a cane road, we recommend that it be deleted from the site description, unless you want to identify every cane road in the project area as a site.
   c. Feature C. What are the dimensions of this structure? What evidence exists for a house foundation conclusion? What evidence exists for a historic age conclusion?

11. A-19, 2068 (dump). What is the basis for the age conclusion? There is no analysis of ceramic and bottle age. This could be done briefly.

12. p. 23 area, Conclusion. This should present a clear picture of pre-European sites that are present. 1838 actually has an early date for sites along the east coast of Kauai. The conclusion should also present a clear summary of Lihue Plantation sites -- roads, bridges and piers?

Significance Evaluations

1. Site 1838. With the earlier date, this site might be considered significant for broad patterns of history (criterion A), settlement of eastern Kauai.

2. Site 1845. Why is the bridge considered to be significant under criterion A? Explain this in the text.

3. Site 1846. Same question, why A?

Mitigation Recommendations

In general, we agree with the recommendations, with a few points noted below:

1. Site 1838. We believe that this site needs some mitigation. If the site is 70 x 10 meters, this is a sizable area. It has an early date. It clearly could still contain important information on the settlement of Hanamaulu and east Kauai in pre-European times. Data recovery or preservation seem like reasonable recommendations.

2. Site 2068, the historic dump. Why does this need no further work? Might it contain important information on the early 1900s use of this area. Minimally, some data recovery to recover representative objects (ceramics and bottles) would seem reasonable.

3. If the applicant is considering preservation of all the sites, perhaps this should be mentioned in this section.

PHRI
Paul H. Rosendahl, Ph.D., Inc.
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March 11, 2002
99-2182

Don Hibbard, Ph.D., Administrator
State Historic Preservation Division
601 Kamokila Blvd., Room 555
Kapolei HI 96707

Attention: Dr. Ross Cordy

Subject: ***Submission of PHRI Report 2192-030602***
Archaeological Inventory Survey
Ocean Bay Plantation at Hanamā'ulu
Land of Hanamā'ulu, Lihu'e District
Island of Kaua'i (TMK:4-3-7-3:1;4-3-9-5:5)

Dear Dr. Hibbard:

Enclosed is a copy of PHRI Report 2182-030602, a revised version of PHRI Report 2182-082101, which you recently reviewed (SHPD letter dated 19 February 2002; Log.29186, Doc.0202RC25; to J. Overton, Group 70). This latest report incorporates the suggestions and required revisions set forth in your review letter. For your convenience, each requested revisions is itemized below (numbering and headings are per your letter attachment), and is followed by text explaining how PHRI addressed each revision.

Background Section — Establish the Settlement Pattern of the Ahupua'a and the Project Area's Site Patterns

1. Some bits and pieces of the information that should go in this section are scattered around the report and appendices. Only the information on Hanamaulu need be presented, not archival or archaeological information on Wailua and Nawiliwili unless it is felt that it is relevant to establishing Hanamaulu settlement patterns. (If not relevant, presenting Wailua and Nawiliwili information confuses the discussion of likely Hanamaulu patterns.)
Response: Settlement pattern information for the *ahupua'a* has been added to the *Introduction* section. Discussion of adjacent areas are relevant to the settlement pattern for the project area.

2. Archival Information. Minimally, our minimal standards request a review of the LCA commoner land awards in the ahupua'a. Appendix B (p. 7 area) discusses these awards. However, in the text of the report's main body, there needs to be a background section which discusses these awards. This must include a map locating the awards and text that indicates the land use in the award locations. For example, if awards are all along the shore and along the stream, if the land use records indicate the shore pieces are houselots and the stream pieces are irrigated kalo fields, then this is the critical land use information that must be included.
Response: A discussion of LCAs has been added to the main text, along with a map showing the LCAs mentioned in the text.

3. Prior Archaeological work. There should be a map indicating where the previous research as taken place, particularly the Hanamaulu work. Also, for site 103 (the dune site), it needs to be clear whether this site is considered to be within Hanamaulu.
Response: A map showing previous archaeological research in the vicinity of the current project area has been added to the report. Concerning the dune site, 1838, it is now stated in the report that the Hanamā'ulu boundary runs between Feature A (outside current project boundaries), and Feature B (inside current project boundaries).

cc: Jeff Overton

4. There also should be some background information included on the sugarcane operations in this area. The company, and when it operated.

Response: Background information about the sugarcane operations (Lihue Plantation) has been added to the *Settlement Patterns* section; there is a brief history of Lihue Plantation in *Appendix B*.

5. There needs to be a concluding part to this background section which summarizes the likely settlement pattern for the ahupua'a based on the prior work and the likely site patterns in the project area. Pages 23 (para. 3-5) and 24 (para. 1) includes some of the ahupua'a pattern summary information, and it should be moved up in the report to this point.

Response: A *Settlement Pattern* section has been added to the report.

Site Inventory — Descriptions, Interpretations, and Dating

1. Was the project area covered acceptably and are all sites likely to be found.

a. There is a discussion about sugarcane cultivation of much of the project area making it unlikely that sites survive in these areas (p. 22, para 1). Work on a relatively nearby parcel is discussed. However, here the findings of the background section are vital. What types of sites would have been in the areas that underwent cane cultivation? For example, if irrigated kalo fields, some of these sites deposits can lie underneath the cane cultivation zone. If dryland fields or houses, then the deposits would be relatively shallow and likely be destroyed by the cane cultivation. This information needed inclusion, so it can be confirmed that sites are likely to have been destroyed. If irrigated kalo deposits are likely to have survived in part, then test excavations would be needed to evaluate this possibility.

Response: The *Settlement Pattern* section now mentions what types of sites were likely prehistorically to have been on the subject property (probably those associated with dryland taro cultivation). It also mentions that, due to the sugarcane cultivation, such areas are not likely to have survived.

b. The possibility of subsurface habitations and burials also exist in coastal sand areas. It is not clear from this report what parts of the project area include coastal sand areas which might have held such sites. This needs to be made clear. Then it must be clear how work attempted to identify whether subsurface habitation deposits were present. The report hints that dune exposures were checked. But it must be clear that all such environmental settings were checked for sites. (Clearly some may have been severely altered, making sites unlikely.)

Response: The extent of the sand dune deposits in the project area has been made clear in the text; all sand dune deposits were located and closely inspected during the previous investigations. The sand dune deposits extend for approximately 244 meters (800 ft) south in a narrow band along the coast. This area was surveyed 100%, and areas thought to possibly contain cultural materials were tested.

2. p. 11, Table 2. This table mixes some functional and formal types, and some other points. See the comments below. When they are resolved, then this table could be tidied up a bit. Some points:

a. For the Transportation function, it would be good to clarify Railroad vs. Automobile Road.

Response: The functional and formal types have been clarified and a column entitled "Chronology" has been added to the table.

b. 1843 — Here it says transportation, while the site description says agriculture. Actually, it seems to be a combination of wharf (pier) for cane and cane road. It should be better clarified under function.

Response: This has been clarified.

c. You have chronology under formal type in some cases. For consistency, do you want a column which addresses chronology for all sites? It would be clearer.

Response: A chronology column has been added to the table.

3. p. 13, 1839 excavations. Clarify which layer the terrace stonework is associated with.

Response: As indicated in the text, there is no associated terrace stonework for this feature; there are only several large and small rocks along the northern side.

4. P. 15-19, historic artifact analysis, site 1843.

a. There is no chronological analysis of the ceramics. This needs to be included.

Response: There were no chronological markers found. The ceramic collection was reexamined and this has been confirmed. As noted in the text, however, since the ceramics were found in association with other glass materials, they are probably of the same general age range. Although only one bottle was dated, the general appearance of the evidence at the site, and also at Site 2068, indicated a late 18th to early 19th century range.

b. Other than the Japanese medical bottle, there is no chronological analysis of the bottles. This needs inclusion.
Response: The medicine bottle was the only bottle that could be dated.

c. P. 19, Summary. How can it be concluded that this site's artifacts date to the late 1800s-early 1900s with only one item dated (and that to 1900-1918)? This is why the dating of the ceramics and other bottles needs to be done.
Response: Since no other datable materials were recovered, our conclusion is based on what the available evidence suggests. Page 35 of the current report states "In general, the assemblage. . . suggests that areas surrounding Site 1843 served as a periodic refuse areas during the late 19th and early 20th centuries."

5. p. 22, para 3, 2068 (historic dump). There is no evaluation of the age of the glass in the report prior to this point, nor is this conclusion referenced to a page in the appendices.
Response: The evaluation of the age of the glass is now included in the *Settlement Pattern* section, the *Conclusion* section.

6. p.A-1, 1838.
a. The borders of this site are not clearly delimited. The text needs to make this clear. Right now the start of the site description says the site is 70 x 10 meters, but the description says there are only two features. Feature A is described as 2.4 x 0.6 meters, but then the update says it has eroded to 9 x 7 meters. Feature B is said to be 1.7 x 1.7 meters. Clearly, none of these measurements match. This description needs to be revised to clearly indicate the site's size and appearance. Also, is it possible that the site extends farther, as no testing was done — apparently only surface exposures were observed.
b. No profiles are provided for the layers that were observed in the exposures. These need to be included with the layer descriptions (pp. 12).
Response: Feature A is approximately 65.0 m from Feature B. The total area of the two features combined is 70 m by 10 m. This has been made clear in *Appendix A*. Feature A (originally 2.4 x 0.6 m) has *eroded and spread out*; this is why it is now about 9 x 7 meters. This is made clear in the text. Feature B, once 1.7 x 1.7 m, was not reidentified; it has probably eroded to such a degree that it is indistinguishable from the area as a whole. A soil profile for Feature A is now included in the report. No profile for Feature B exists, as the feature was only scraped to 7 cmbs and contained only one surface layer.

c. Where is the functional analysis of this site? Is it concluded to be a permanent habitation or temporary habitation, or this cannot be distinguished yet? Provide evidence for conclusions.
Response: Feature A is now interpreted as functioning for habitation due to the presence of marine shell midden and an early C-14 date. There is inadequate information (e.g., stone structures, artifacts) to determine whether the site was for temporary or permanent habitation.

6. A-2, A-5, site 1839, Feature B. Is this terraced faced with stonework? What is its shape? Where is the berm on the map? The map seems to indicate that this feature is 7 x 5 meters in area, not the 9.2 x 7.5 as indicated in the text. What is the evidence justifying the temporary habitation conclusion. Please resolve these points.
Response: The terrace is not faced with stonework, but rather has several large and some small rocks on the north corner. The field map now shows the berm. An area of 7 x 5 m is more accurate, and the text has been amended appropriately. The temporary habitation conclusion is based on the presence of the wall and terrace.

7. A-2, A-6, Site 1840. What is the evidence to conclude that this is a retaining wall? For what type of transportation activity was the wall associated with, and the evidence?
Response: It is thought to be a retaining wall primarily due to the fact that the soil in back of the wall is built up much higher than the road on the other side of the wall (see *Figure A-7*). It is thought to be a historic retaining wall that may be connected to military activity since several foxholes were found in this area and the fact that an informant has said that military activities took place at Site 1838.

8. Site 1841. What type of road is this, cane? What is its likely age?
Response: This road is probably not a cane road since it is not wide, and is along the coast, whereas cane roads in this area would be further inland where it is not as rocky. It appears more a combination of a road and a trail (thus it is now designated a road/trail in the report). It could have functioned as a recreational road/trail for fishing. The feature is evident on *Figure 1*, a USGS quad map.

9. A-b, Site 1843.

a. Feature B. where does this road go to?

Response: The text now indicates the road begins at the concrete wharf (Feature A), runs east, turns around the north point of Hanamā'ulu Bay, and runs roughly north. From the wharf going west, it went to the Old Government Road, from which point it is only a short distance from the Hanamā'ulu Mill. The portion of the road going toward the west in evident in *Figure 2.*

b. Feature C. How is it concluded that this is transportation related?

Response: This feature is probably the remnants of a structure that is visible on *Figure 2.* Since the wharf, the road, and this remnant constitute a complex from which sugar was shipped (from informant), it was given a transportation function (now changed to transportation/agriculture).

c. The overall interpretation for 1843. Why is this concluded to be Agriculture? A pier is present, and a road.

Response: (see above)

10. A-I 1, Site 1845. How is it concluded that this is a railroad bridge? Where did the railroad line go? What was it affiliated with — cane?, company? Age?

Response: It was concluded that this is a railroad bridge due to a statement by the informant that the bridge was used by the Lihue Plantation to ship sugar until 1960. It is also marked on the USGS (*Figure 1*) as "old railroad grade."

11. A-16, Site 2066.

a. Feature A. If this upright was possibly associated with a cemetery based on oral informant information, why was there no testing to determine if burials were present and what the borders of the site were. What are the site borders?

Response: The informant did not mention that the discovered upright was connected to a cemetery; only that he used to play as a child around this cemetery. A thorough search found no evidence of a cemetery, and the connection between this upright and a cemetery is purely conjectural (the word "may" was used in the text). Also, uprights of this kind sometimes are to be found in Japanese cemeteries, sometimes inscribed, sometimes not. Since no surface signs or gravestones were apparent, and a more exact location of the cemetery is not known, no subsurface testing was conducted. The dimensions of the entire site, as stated in the report, are 25.00 by 20.00 m, and the site is located outside the development impact area.

b. Feature B. If this is a cane road, we recommend that it be deleted from the site description, unless you want to identify every cane road in the project area as a site.

Response: It was included as a feature since it runs through the middle of the site and relates to possible site function. The cane road on Site 1845 also was given a feature designation.

c. Feature C. What are the dimensions of this structure? What evidence exists for a house foundation conclusion? What evidence exists for a historic age conclusion?

Response: The dimensions are 8.00 m by 8.00 m (now in text). The foundation may be associated with the possible cemetery mentioned above; however, the rocks composing its northern side may be simply boulder push from the construction of the cane road. It may also be the remnants of a prehistoric terrace (building the cane road to the north may have destroyed the northern portion of the terrace). The site has been designated "indeterminate" as to function.

11. A-I 9, 2068 (dump). What is the basis for the age conclusion? There is no analysis of ceramic and bottle age. This could be done briefly.

Response: The age conclusion was based on visual examination only. The site has very likely been pot-hunted (there is a dug hole in the middle of the site). During our examination, no whole bottles were found; only fragments with no maker's marks. Based on visual examination of the remnant artifacts the dump appeared to date from the late 18th to early 19th centuries. This is the same range concluded for Site 1843 materials. Site 2068 is now recommended for further data recovery (in the form of a thorough search and collection of any datable materials, since it could contain information on the early 1900s use of this area).

12. p. 23 area, Conclusion. This should present a clear picture of pre-European sites that are present. 1838 actually has an early date for sites along the east coast of Kauai. The conclusion should also present a clear summary of Lihue Plantation sites — roads, bridges and piers?

Response: The *Conclusion* section has been amended to reflect these points.

Significance Evaluations

1. Site 1838. With the earlier date, this site might be considered significant for broad patterns of history (criterion A), settlement of eastern Kauai.
Response: It has been given a criterion A designation for that reason.

2. Site 1845. Why is the bridge considered to be significant under criterion A? Explain this in the text.
Response: Because it is a rare example in terms of architectural construction; it is rare (or non-existent) on other parts of Kaua'i. Also, the railroad and sugarcane era played a significant part in the history of Kaua'i. The fact that the bridge is a rare example of this kind of architecture is mentioned in *Appendix A*.

3. Site 1846. Same question, why A?
Response: (See above). This site has been designated significant for criteria A and D. Architecturally, it is not as significant as Site 1845.

Mitigation Recommendations

1. Site 1838. We believe that this site needs some mitigation. If the site is 70 x 10 meters, this is a sizable area. It has an early date. It clearly could still contain important information on the settlement of Hanamaulu and east Kauai in preEuropean times. Data recovery or preservation seem like reasonable recommendations.
Response: The area in general is so disturbed by dumping, picnicking, camping, and possibly previous military maneuvers (according to informant), that mitigation would likely not provide further reliable information. Feature B of the site is inside the present boundaries; Feature A is just outside (to the north). The project developer has stated that the site is to be preserved and will not impacted by development; the site is therefore recommended for preservation "as is."

2. Site 2068, the historic dump. Why does this need no further work? Might it contain important information on the early 1900s use of this area. Minimally, some data recovery to recover representative objects (ceramics and bottles) would seem reasonable.
Response: This site is now recommended for further data recovery.

3. If the applicant is considering preservation of all the sites, perhaps this should be mentioned in this section.
Response: This has been mentioned in this section.

Thank you for your suggestions and assistance on this project. If you have any questions or comments, please call me at our Hilo office, (808) 969-1763.

Sincerely yours,

Paul H. Rosendahl, Ph.D.
President and Principal
Archaeologist

AC: lk
Encl: One copy of PHRI Report 2182-030102
cc: Jeff Overton

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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COPY

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April 25, 2002

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GROUP 70

LOG NO: 29745
DOC NO: 0204RC52

Paul Rosendahl, Ph.D.
PHRI
224 Waianuenue Ave.
Hilo, Hawaii 96720

Dear Dr. Rosendahl:

SUBJECT: **Historic Preservation Review -- Revised Archaeological Inventory Survey Ocean Bay Plantation, Hanamau'ulu, Lihue District, Kauai**
TMK: 3-7-3: 1, 3-9-5: 5,

This letter reviews this revised report which was submitted April 10, 2002 (Corbin 2002. Archaeological Inventory Survey Ocean Bay Plantation at Hanama'ulu ... PHRI ms.). Revisions were made to address our February 19, 20002, review letter (Hibbard to Overton – Log: 29,186; Doc: 0202RC25).

The revisions have addressed our concerns.

The background section of the report now establishes the ahupua'a settlement pattern and the likely site patterns of the project area. It clearly documents the fact that dryland cultivation was likely to have occurred back from the shore in the project area and that sugarcane cultivation has severely altered the land in this area, making it unlikely that historic sites survive in this part of the project area.

We believe that the survey has adequately covered the project area, finding 9 historic sites within the project area. We agree that these sites have been acceptably described and interpreted. Most are associated with plantation era times (ruins of bridges, wharf, roads, etc.); two are pre-European in age (1838 and 1839, with 1838 a remnant subsurface habitation site in the sand area dating back to A.D. 1170-1400).

We agree with your significance evaluations. All nine sites are significant, 5 solely for their information content and 4 under multiple criteria.

We also agree with the mitigation proposals – preservation (as-is) for 8 of the sites and archaeological data recovery of a small historic dump (site 2068).

The next steps in the historic preservation review process are the preparation of a preservation plan for the 8 sites being preserved and a data recovery plan at site 2068.

If you have any further questions, please contact Nancy McMahon, our Kauai Archaeologist, at 742-7033.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

c. Dee Crowell, County of Kauai
Mr. Jeff Overton, Group 70 International Inc., 925 Bethel St, 5th Floor, Honolulu, HI 96813-4307

RC:amk

R

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HISTORIC PRESERVATION
LAND
STATE PARKS

April 25, 2002

Paul Rosendahl, Ph.D.
224 Waianuenue Ave.
Hilo, Hawaii 96720

LOG NO: 29746 2182
DOC NO: 0204RC53 2244

Dear Dr. Rosendahl:

SUBJECT: **Historic Preservation Review -- Archaeological Data Recovery, Site 2068 Ocean Bay Plantation, Hanamau'ulu, Lihue District, Kauai**
TMK: 3-7-3: 1, 3-9-5: 5,

This letter reviews this archaeological data recovery letter report which was submitted April 10 2002 (Rosendahl 2002). The letter notes this is an addendum to the survey; however, the work is called data recovery. Thus, we are going to treat this report as a data recovery report.

Site 2068 is a small historic trash dump. The data recovery plan for site 2086 was discussed by you and Dr. Cordy of our staff. The plan was essentially to recover a sample of datable historic artifacts, to improve the dating of this site.

Clearly, your work exceeded the aims of the plan by collecting all potentially diagnostic ceramic or bottle fragments on the surface of the site. The report analyzes the artifacts which were datable. The conclusions are that the site dated from the 1880s-early 1900s.

We find the report to be acceptable, with the understanding that you will send a few illustrations of the diagnostic artifacts (either photographs or line drawings) to be included with the report. Data recovery work is now concluded. The historic preservation review process for this site is complete, and site 2068 needs no further protection.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

c. D. Crowell, Planning Department, County of Kauai

RC:amk

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BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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STATE OF HAWAII

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LINNEL NISHIOKA

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HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

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COMMISSION ON WATER RESOURCE MANAGEMENT
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FORESTRY AND WILDLIFE
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May 14, 2002

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MAY 20 2002

LOG NO: 29885
DOC NO: 0205NM05

Mr. Dee Crowell, Director
Planning Department/County of Kauai
4444 Rice Street, Suite 473
Lihue, Kaua'i, Hawaii 96766

Dear Mr. Crowell:

SUBJECT: **Historic Preservation Review -- Z-IV-2002-30, U-2002-25 and SMA (U)-2002-11 EWM Kauai LLC dba Ocean Bay Plantation**
TMK: 3-7-3: 1, Kauai, Hawaii

An archaeological inventory survey has been conducted for the project area [Corbin, PHRI, Revised 2002]. The application states incorrectly the number of sites [page 3].

Ten significant historic sites were identified [sites 1838, 1839, 1840, 1841, 1843, 1845, 1846, 2066, 2067, 2068] in the 460 acres. Nine significant historic sites are in the project area. Most of these sites are associated with the plantation era times (ruins of bridges, wharf, roads, etc.).

All 9 historic sites are significant -- 6 sites [1838, 1839, 1840, 1841, 1843, and 2068] are significant solely for their information content (Criterian D of the Hawaii Register of Historic Places) and 3 are significant under multiple criteria [1845, 1846, and 2066].

Site 2068 an historic dump has been data recovered, and it needs no further protection. It has been agreed to preserve the other 8 sites.

Given the above, we recommend the following condition be attached to any approved permit, to ensure preservation of the sites:

1) A preservation plan for the 8 significant historic sites committed to preservation in the project area shall be submitted to the State Historic Preservation Division for review and approval. That Division must verify in writing to the County that the preservation plan has been successfully executed.

If you have any further questions, please contact Nancy McMahon of our office at 742-7033.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

c. Dee Crowell, County of Kauai
Mr. Jeff Overton, Group 70 International Inc.
925 Bethel St, 5th Floor,
Honolulu, HI 96813-4307

NM:amk

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Scott Tanganan
Sharon Ching Williams, AIA

June 3, 2002

Mr. Don Hibbard, Administrator
State of Hawai'i
Department of Land And Natural Resources
Kākuhihewa Building, Room 555
601 Kamokila Blvd.
Kapolei, HI 96707

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Hibbard:

Thank you for the dialogue presented in your letters of February 19th, April 25th, and May 14th of 2002 to the County of Kaua'i Department of Planning and the archaeological consultant, PHRI, Inc. regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. The following is provided as a response and synopsis of the key issues presented in your letters.

An archaeological inventory survey was completed and submitted to the State Historic Preservation Division (SHPD) for your review. The letter of February 19, 2002 provided a series of comments and concluded that revisions to the report were necessary. A response letter and a revision of the archaeological inventory survey was provided by PHRI, Inc., dated March 11, 2002.

As stated in the letter of April 25, 2002, we acknowledge your statement that the revisions to the report adequately address your department's previous concerns in its scope, evaluation, and proposals for mitigation for the project area. An additional letter, also dated April 25, 2002, was provided by your department in its review of the archaeological date recovery work for Site 2068. We acknowledge your statement that recovery work for the site has been concluded and that the historic preservation review process for this site is complete and requires no further action.

As stated in your letter of May 14, 2002, ten significant historic sites had been identified within or near the project area. We confirm that nine of these sites are within the project area, with the remaining identified site (Site 2067) located outside the project boundary. Of the nine significant historic sites, data recovery has been completed for one site (Site 2068) with no further protection required. As necessary, an appropriate plan for the remaining eight sites will be prepared and submitted for SHPD's review and approval.

Your comments and this response letter will be included in the Final EIS (FEIS). We will also forward you a copy of the FEIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

BENJAMIN J. CAYETANO
GOVERNOR

BRIAN K. MINAAI
DIRECTOR

DEPUTY DIRECTORS
JEAN L. OSHITA
JADINE Y. URASAKI

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MAY 2 1 2002
GROUP 70

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
STP 8.0285

May 8, 2002

Mr. Dee M. Crowell
Director
Department of Planning
County of Kauai
4444 Rice Street, Suite 473
Lihue, Hawaii 96766

Attention: Keith Nitta

Dear Mr. Crowell:

Subject: Ocean Bay Plantation at Hanama'ulu
Draft Environmental Impact Statement (DEIS)
TMK: 4-3-7-3: 1; 4-3-9-5: 5

We are in receipt of Group 70 International's March 19, 2002 letter requesting our review and comment of the subject document. We are unable to properly review and comment on the March 11, 2002 Traffic Impact Analysis Report (TIAR) for the subject project since it does not provide adequate documentation. The subject TIAR should, therefore, be revised and resubmitted for our review. Specific concerns with the March 11, 2002 TIAR are as follows:

1. The report understates project generated impacts by overstating the improvements needed in the "Without Project" conditions, taking advantage of the added capacity in the "With Project" condition, and understating the benefits received and proportionate share contribution of these necessary improvements by the proposed project. The report should be revised to more appropriately identify the potential project generated impacts and the project's proportionate share contribution to local and regional traffic improvements. The report should then be resubmitted for our review, evaluation, and comment.

2. The report makes reference to the Kauai Long Range Land Transportation Plan (KLRLTP) and assumes that recommendations in that report will be in place for the proposed development to benefit from. The KLRLTP identifies anticipated long-range needs and recommends proposed improvements but it is not a commitment that these improvements will be in place by in the time frames identified. Because of statewide needs and resources limitations, it is unlikely that Kapule/Kuhio Highway will be widened to a four-lane divided roadway by 2020 and the report should be revised

accordingly. The KLRLTP also was based on assumed land uses that did not include the proposed Ocean Bay Plantation development. The TIAR must, therefore, be revised to include an assessment of the potential project generated impacts and identify the projects fair share contribution to local and regional traffic improvements.

3. The report recommends that the Kuhio Highway/Kauai Beach Drive intersection "should be signalized to mitigate future deficiencies" then inappropriately takes advantages of this "Without Project" improvement in assessing the "With Project" condition. The report fails to provide sufficient documentation and justification for this recommendation. Traffic signal warrants must be met before installation of a traffic signal is considered. The report should include this technical evaluation and justification. Furthermore, the proposed project will greatly benefit from the proposed signalization of the Kuhio Highway/Kauai Beach Drive intersection, contributing a significant share of the minor street traffic served by the recommended traffic signal. The report should identify the project's fair share contribution to this recommended improvement.

4. The report proposes to create a four-way signalized intersection at Kuhio Highway and Kapule Highway. This additional leg will take away capacity from the other movements at the intersection. The report also recommends improvements in the "Without Project" condition that will increase capacity through this intersection, significantly benefiting the proposed project. The report should identify the benefit the project receives from these proposed improvements and identify the project's fair share contribution to these recommended improvements.

5. The report fails to adequately discuss and document the operations at the proposed retail-commercial center driveway connection to Kuhio Highway. The report must include a discussion of this operation and the potential project generated impacts. While some of the trips to the retail-commercial center will be pass-by and diverted trips, these pass-by and diverted trips must be properly reflected in the turning movements into and out from the proposed driveways. The assumptions made for pass-by and diverted trips to the retail-commercial center should be shown graphically.

6. The report should identify the specific date when existing traffic counts were taken. If taken on or after September 11, 2001, additional traffic counts should be taken since the terrorist attack on September 11, 2001 significantly impacted national travel behavior. The raw data from the traffic counts taken in September 2001 should also be included in the report.

7. The report should identify the specific trip generation rate categories used, document whether average trip rates or equations were use to calculate the trips, and should include a tabular summary of the calculations.

8. The project documents described the 40,000 square-foot retail-commercial center as including office space and a gas station. The report should use the appropriate trip generation rates for the retail, office space, and gas station portions of this proposed retail-commercial development rather than using only one rate for the entire 40,000 square foot retail-commercial center. The report must clearly document the proper trip generation rates used for this proposed retail-commercial center

9. We find the 51-percent pass-by trip assumption to be overly optimistic and question its reasonableness. The report must provide better justification on the assumed 51-percent pass-by trips. The specific table in the Trip Generation Manual should be referenced and a discussion as to why the 51-percent is a reasonable assumption should be included.

10. The report indicates that the proposed golf course will include tennis courts, clubhouse, and driving range. The report must clearly document that the trip generation rate used appropriately accounts for these amenities.

11. The report should include an explanation of the distribution pattern assumed for project generated trips and it should be shown graphically.

12. The report should describe how project generated trips were assigned on to the surrounding roadway system and it should be shown graphically.

13. The actual calculations conducted in conjunction with the intersection capacity analyses should be included in the report for the existing, future without project, future without project mitigated, future with project, and future with project mitigated conditions.

14. The report should provide a summary table of the intersection operations for the existing, future without project, future without project mitigated, future with project, and future with project mitigated conditions.

15. The report should properly document the trips generated by, assumed distribution of, and assigned of project generated trips on to the surrounding roadway for the 250-room time share resort assumed to be developed on Kauai Beach Drive in the future without project condition.

16. Tables 2 and 3 should identify the year that "Interim" and "Master Plan" refers to.

Please contact Robert Miyasaki at 587-5685 should you have any questions. It is also our understanding that the Kauai District Office of our Highways Division has also provided comments to Group 70 by their letter of April 15, 2002 (HWY-K 4.020358). Thank you for providing us with the opportunity to review and comment on the subject documents.

Very truly yours,

BRIAN K. MINAAI
Director of Transportation

c: Mr. Jeff Overton, Group 70 International, Inc.

GROUP 70

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June 3, 2002

Mr. Brian K. Minaai, Director of Transportation
State of Hawai'i
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Minaai:

Thank you for your letter of May 8, 2002 to the County of Kaua'i Planning Department regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. The following is offered in response to your comments regarding the Traffic Impact Analysis Report (TIAR), dated March 11, 2002, for the subject property.

1. As the project progresses to a more detailed design phase, coordination with the Department of Transportation (DOT) will be required in determining what specific highway improvements and their associated costs will be needed and become the responsibility of the property owner.

   As stated in the TIAR, the DOT forecasts and 24-hour traffic demands provided in the Kaua'i Long Range Land Transportation Plan (KLRLTP) were used in the project analysis. The "Without Project" conditions also assume that an adjacent development of a 250-room timeshare will have been completed. The revised TIAR will include an assessment of the identified impacts that will be generated by the Ocean Bay Plantation project. Further, an evaluation of the necessary highway improvements that will be employed by the property owner, EWM Kaua'i LLC will also be provided.

2. In the Conclusions and Recommendations section of the TIAR, it is stated that if the proposed improvements in the KLRLTP were not implemented, then interim traffic improvements would be required to mitigate the potential deficiencies in highway infrastructure. Further coordination with the DOT will be required to address the consideration of project-related improvements.

3. The DOT long-range plan calls for the signalization of the Kūhiō Highway/Kaua'i Beach Drive Intersection. The signal warrant analysis required for technical evaluation and justification of the new signal should be completed at the appropriate time in the future. However, this

project will affect this intersection except for the last phases, which is 8-10 years in the future. The applicant will address impacts relative to traffic according to the phasing of development.

4. A 4-way signalized intersection currently exists at Kapule Highway and Kuhio Highway, although the project access is only an agricultural road at present. The proposed improvement of the four-way signalized intersection at Kūhiō Highway and Kapule Highway will improve the traffic conditions within the project area. The applicant will contribute it's fair share to making this improvement, as determined in subsequent coordination with the State and County.

5. The calculations of pass-by and diverted trips to the retail-commercial center were based upon ITE methodologies.

6. Manual traffic count surveys were conducted at the Kuhio Highway intersections at Kapule Highway and at Kauai Beach Drive in September 18-19,2001, during the peak periods of traffic - from 6:30 AM to 8:30 AM and from 3:30 PM to 5:30 PM. The raw data results will be included in the revised TIAR.

7. The TIAR includes specific trip generation rate categories in Tables 2 and 3. These totals are based on calculations following ITE trip rates.

8. Commercial space areas have not been set at this time. The study uses an overall average of trip generation for commercial/retail uses.

9. The analysis was based upon ITE methodology for commercial centers.

10. The trip generation rates were developed by correlating the total vehicle trip generation data with the known activities and land use characteristics designed for the project area including the proposed golf course facilities and amenities.

11. The TIAR will be revised to illustrate the distribution pattern assumed for project-generated trips.

12. The TIAR will be revised to include the assignments of project-generated trips on the surrounding roadway system.

13. The revised TIAR will include an appendix section that includes the series of actual calculations performed for this analysis.

14. A summary table will be included in the revised TIAR.

15. The revised TIAR will include further discussion on the assignment of generated trips associated to the proposed 250-room timeshare resort.

16. Tables 2 and 3 will be revised to include the Interim and Master Plan study dates.

Your letter and this response will be included in the Final Environmental Impact Statement. We will forward your office a copy of the Final EIS upon its completion.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

BENJAMIN J. CAYETANO
GOVERNOR

FILE

BRIAN K. MINAAI
DIRECTOR

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JADINE Y. URASAKI
JEAN L. OSHITA

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
KAUAI DISTRICT
3060 EIWA STREET, ROOM 205
LIHUE, HAWAII 96766

IN REPLY REFER TO:

HWY-K 4.020358

April 15, 2002

Mr. Kawika McKeague
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. McKeague:

Subject: Hanamaulu Plantation Phase II
Draft Environmental Impact Statement
Hanamaulu, Kauai, Hawaii
TMK: (4)3.-7-03:1 & 3-9-05:5

Review of the DRAFT Environmental Impact Statement for the project has been completed and our comments are noted below.

1. **Refer to attachment marked EXH. A1 & A2 :**

   The BIKE PLAN HAWAII proposed a bicycle path along the shoreline of the subject parcel. The proposed bike route/path noted on Fig. 3-2 of EXH. A2 , shows a different bike path route through the subject parcel. The final bike route/path should not be selected until the County of Kauai Planning Department, other agencies/organizations, and the general public, has completed review/approval of the proposed project.

2. **Refer to attachment marked EXH. B1 & B2 :**
   Fig. 5-25 depicts a RETAIL ACCESS connection to Kuhio Highway.
   This RETAIL ACCESS location is not shown on Fig.3-2. Please clarify by text and on Fig. 3-2 the location of this access connection to Kuhio Highway.
   Other that the main entrance located at the Kuhio Hwy/Kapule Hwy intersection, and at the Kuhio Hwy/Radisson Hotel entrance, no other access connection to the project site will be permitted.

3. **Refer to attached EXH. C1 :**
As indicated in (2) above, the only access to the project site that will be permitted is marked (A) and (B) on Fig. 3-2 of EXH. C1 . No other access connection to the project site will be permitted.

Notwithstanding the conclusions/recommendations noted in the DRAFT EIS (Sec. 5.2.11) and in the Traffic Impact Assessment Report contained in the DRAFT EIS for the project, the following highway improvements will be required at the Kuhio Hwy/Kapule Hwy/Main Access Road intersection, and at the Kuhio Hwy/Kauai Beach Drive intersection.

A. <u>At the Main Access Road at the Kuhio Highway/Kapule Highway intersection:</u>

a. The existing access at the intersection is an "Access for Agricultural Purposes Only". The applicant shall submit a request to the State Highways Division Rights of Way Branch for any changes in location, or size, of the new access connection. The request shall be accompanied by a metes and bounds map of the access, complete with written descriptions of the access opening. The applicant shall be informed that there may be additional fees assessed for granting new, and/or, revising, access openings;
b. Modify existing traffic signal system to accommodate the Main Access Road to the project site;
c. Widen/restripe Southbound Kuhio Highway at the intersection to provide an exclusive left turn storage lane into the project site;
d. Provide an exclusive shared thru/right turn acceleration lane, and an exclusive left turn lane on the Main Access Road leg of the intersection.
e. Widen Northbound Kuhio Highway at the intersection to provide an exclusive right turn/deceleration lane into the project site.
f. Provide double left turn lane Eastbound Kuhio into Northbound Kuhio Highway. Widen eastbound Kuhio Highway as necessary.
g. Provide 6' wide paved shoulders/gutters along the widened highway areas;
h. Provide street lights at the intersection and along the acceleration/deceleration lanes;
i. Provide drainage facilities at the intersection as required. No runoff from the project site shall be directed onto the State Highway R/W.
j. Restripe and install new raised pavement markers as required;
k. Install/relocate all traffic signs as required;
l. Relocate existing utility facilities as necessary;

m. The applicant shall landscape all areas that have been graded to accommodate the new work. All landscaping within the state Highway R/W shall "match" the landscaping "theme" on the SW corner of the intersection. A new irrigation system shall be designed and installed within the State Highway R/W and shall be connected to the existing Kapule Highway irrigation system. Developer shall maintain the landscaping within the State Highway R/W along the Kuhio Hwy/Kapule Hwy frontage of the project;
n. Dedicate lands to the State that will be necessary to accommodate the new highway work. The construction plans shall delineate new Right of Way requirements to accommodate the new work;
o. Install fencing, and/or, provide hedge type landscaping along the entire Kapule Hwy/Kuhio Hwy frontage of the development. All such fencing/landscaping shall be located entirely within the private property;
p. All highway improvements shall be designed to conform to State Highways Division Standards. All highway improvement plans shall be submitted to the State Highways Division for review/approval;
q. Requests for changes to access rights to the State Highway must be submitted to the Highways Division Rights of Way Branch. An administrative cost to process the request, and enhancement fees may be charged for any changes in size, location, or use of the new access to the State Highway. Additional fees may be imposed for any new, or for any changes to existing access openings;
r. No work shall commence within the State Highway right of way unless a "Permit to Perform Work Upon State Highways" have been issued to cover such work;

B. <u>At the Kuhio Highway/Kauai Beach Drive intersection (existing entrance to the Radisson Hotel):</u>

a. The applicant shall obtain permission to use the existing private roadway servicing the Radisson Hotel and condominiums for access to the portions of the proposed development;
b. Install new traffic signal system at the intersection;
c. Widen/restripe Southbound Kuhio Highway at the intersection to provide a higher capacity exclusive left turn storage lane into the hotel and project site;
d. Provide right turn/acceleration lane, and an exclusive left turn lane on the Kauai Beach Drive leg of the intersection;
e. Widen Northbound Kuhio Highway at the intersection to provide an exclusive right turn/deceleration lane into the hotel/project site.

f. Provide 6' wide paved shoulders and gutters along the widened highway areas;
g. Provide street lights at the intersection and along the acceleration/deceleration lanes.
h. Provide drainage facilities at the intersection as required. No runoff from the project shall be directed onto the State Highway R/W;
i. Restripe and install new raised pavement markers as required;
j. Install/relocate all traffic signs as required;
k. Relocate existing utility facilities as necessary;
l. Landscape/hydro-mulch all areas that have been graded to accommodate the new work. Applicant shall maintain the landscaping within the State highway R/W along the frontage of the development;
m. Dedicate lands to the State that will be necessary to accommodate the new highway work. The construction plans shall delineate new Right of Way requirements to accommodate the new work;
n. Install fencing, and/or, provide hedge type landscaping along the entire Kapule Hwy/Kuhio Hwy frontage of the development. All such fencing/landscaping shall be located entirely within the private property;
o. The applicant shall establish and strip of land along the entire Kapule Hwy/Kuhio Hwy frontage for future road widening purposes;
p. All highway improvements shall be designed to conform to State Highways Division Standards. All highway improvement plans shall be submitted to the State Highways Division for review/approval;
q. Requests for changes to access rights to the State Highway must be submitted to the Highways Division Rights of Way Branch. An administrative cost to process the request, and enhancement fees may be charged for any changes in size, location, or use of the new access to the State Highway. Additional fees may be imposed for any new, or for any changes to existing access openings;
r. No work shall commence within the State Highway right of way unless a "Permit to Perform Work Upon State Highways" have been issued to cover such work;

To reiterate, all of the intersection improvements noted in (3) above shall be designed and constructed in the first phase of the development. Applicant shall be responsible for design and construction of all the highway improvements noted above.

HWY-K 4.020358

The Traffic Impact Assessment Report (TIAR) contemplates that the State will construct highway improvements on Kuhio Highway and Kapule Highway (in the vicinity of the project) in accordance with the timetable noted in the KLRLTP. Due to funding, and perhaps, political, constraints, the highway improvements proposed in the KLRLTP may never be constructed in a timely manner to accommodate all of the project's Immediate, Interim, and Master Plan Improvements.

The TIAR should analyze impacts to the EXISTING highway system for all phases of the project. If levels of service, with the project, for the Immediate, Interim (2010), and Master Plan Phase (2020) indicates deficiencies, phases of the of the subject project may have to be delayed until such time that the highway improvements noted in the KLRLTP are constructed, or the applicant/developer may have to construct the highway improvements himself in order to proceed with the initial and all subsequent phases of the project. (Refer to EXH. D1)

In short, the timetable for highway improvements noted in the KLRLTP should not be relied upon for purposes of analyzing the traffic impacts of the project on the state highway system.

4. Applicant shall seek and obtain all required and necessary land use, zoning, SMA, CDUA, etc., and other permits required for the project.
5. This office reserves the right to add, or impose, additional conditions as necessary to mitigate adverse impacts to state highway facilities.

Revisions to the DRAFT EIS shall be made to address all of the above concerns. If you have any questions, please call Steve Morikawa at the Kauai District Office at 274-3118.

Sincerely,

STEVEN M. KYONO, P.E.
District Engineer

SM:es
Encl.

cc: HWY-PS (w/o encl.)
STP (w/o encl.)
HWY-T (w/o encl.)
Kodani & Associates, Inc. (w/o encl.)

3.10 Highway Buffer

Lands along the project boundary fronting the Kapule Highway and Kūhiō Highway will be reserved as highway buffer area. A buffer strip of up to 50 feet in width will be provided along the highway, which will be excluded from development of golf course, structures and project landscaping. This highway buffer strip will be available for the County to extend its landscaping project to the north from the Hanamā'ulu Stream bridge.

3.11 Roadways and Bike Routes

The interior roadway system consists of asphalt concrete roadways providing roadway connection to the various residential areas, the golf course clubhouse, and other project uses. The entry roadway will be a divided road with a landscaped median and 24 ft. width on both sides. The interior collector and smaller service roadways will all have vo lanes, and vary in widths from 20 to 24 feet according to the intensity of use. The oject roadways are planned to be without curbs, and include grassed shoulders. dewalks will be provided on one or both sides of the road in the residential areas.

3-2 ?

Bicycle routes will be established within the interior roadway system, as shown in Figure [redacted]. The regional bikeway route will extend along the project frontage along Kapule Highway and along Kūhiō Highway. This bikeway will have a designated extension into the project site along the main access road, continuing to the north toward the Kaua'i Radisson Hotel. The bikeway route would continue along Kūhiō Highway to the neighboring hotel entrance.

3.12 Potable Water Supply System

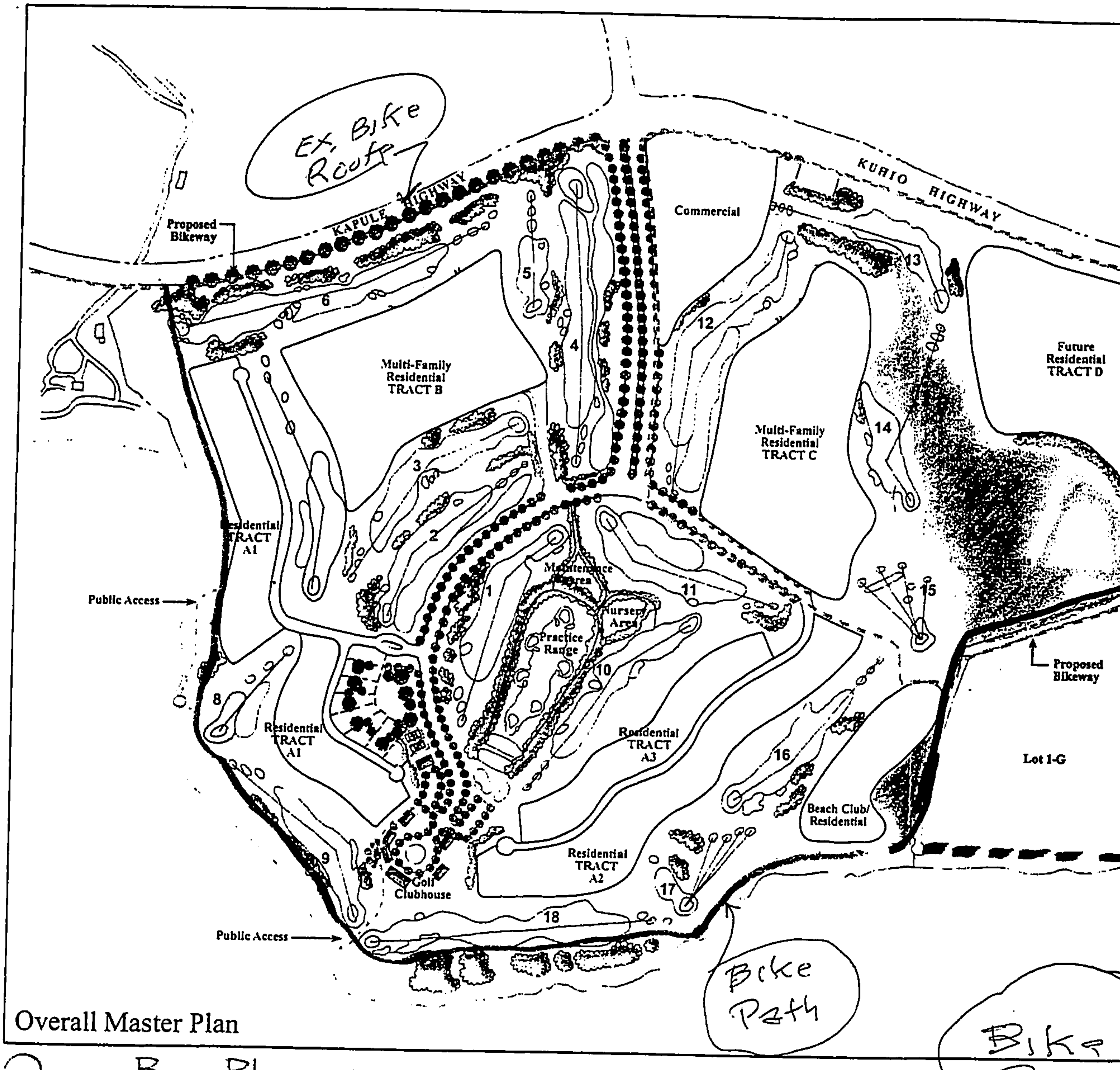
The project site is located at the south end of the Wailua-Kapa'a Water System. This system is interconnected with the Puhi-Līhu'e-Hanamā'ulu water system. The project water system planned to serve the project is anticipated to connect to this County water system. The details of the water system are described in Appendix K prepared by Kodani & Associates, Inc. (December 2001).

The water supply system will be extended from Kūhiō Highway through the project's roadway network. Potable water demand for the project is estimated to range between 200,000 to 250,000 gpd (average daily demand) at full development.

3.13 Non-Potable/Irrigation Water System

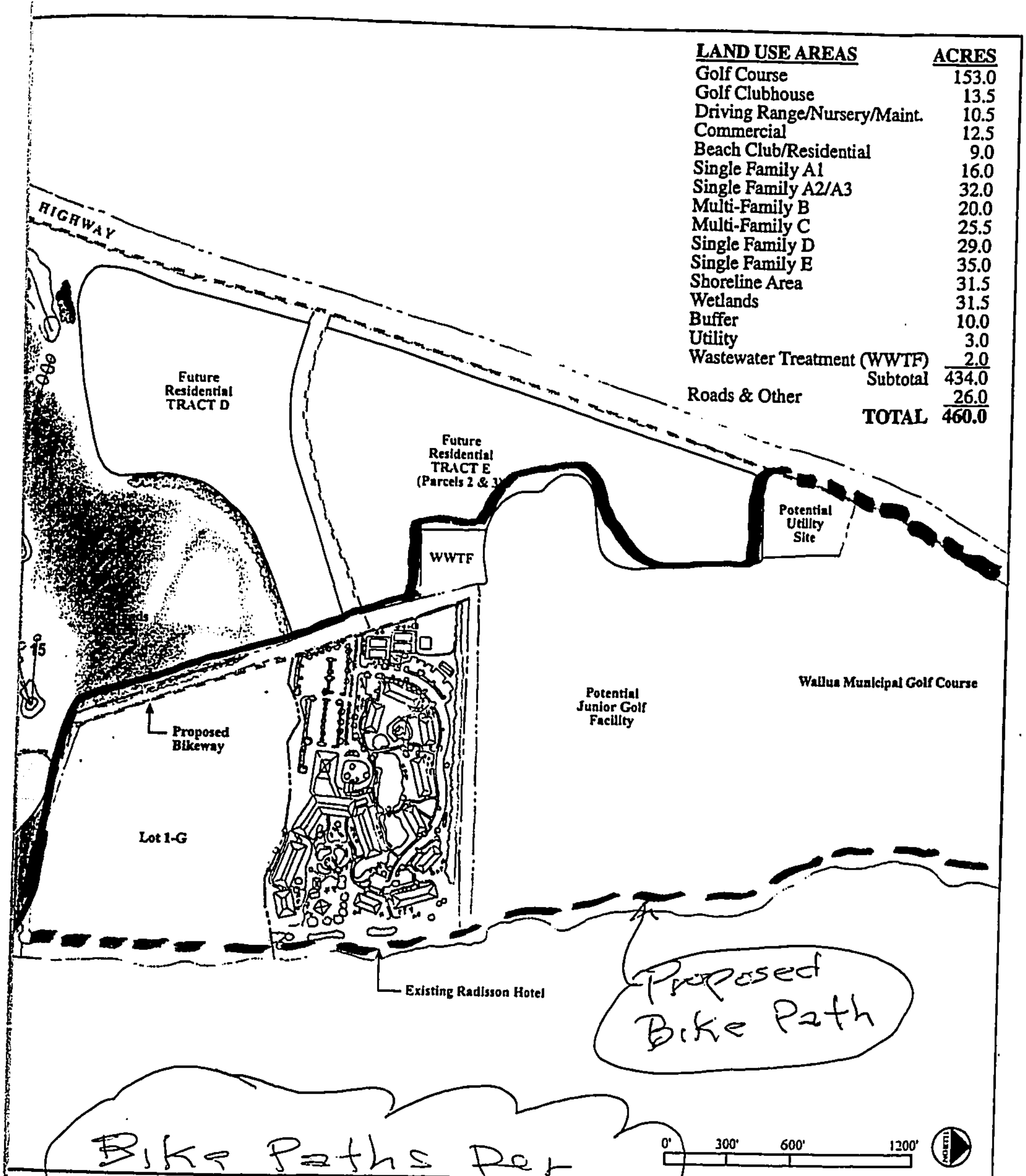
Irrigation water will be provided through two on-site wells. Non-potable water will be withdrawn from these wells, and stored in a series of irrigation ponds. Irrigation demand is projected at between 500,000 to 1.0 million gpd, depending upon the seasonal rainfall conditions.

EXH. A15



Overall Master Plan

Ocean Bay Plantation
at Hanamā'ulu



Bike Paths Per Bike Plan Hawaii

GROUP 70 INTERNATIONAL

March 2002

EXH. A2

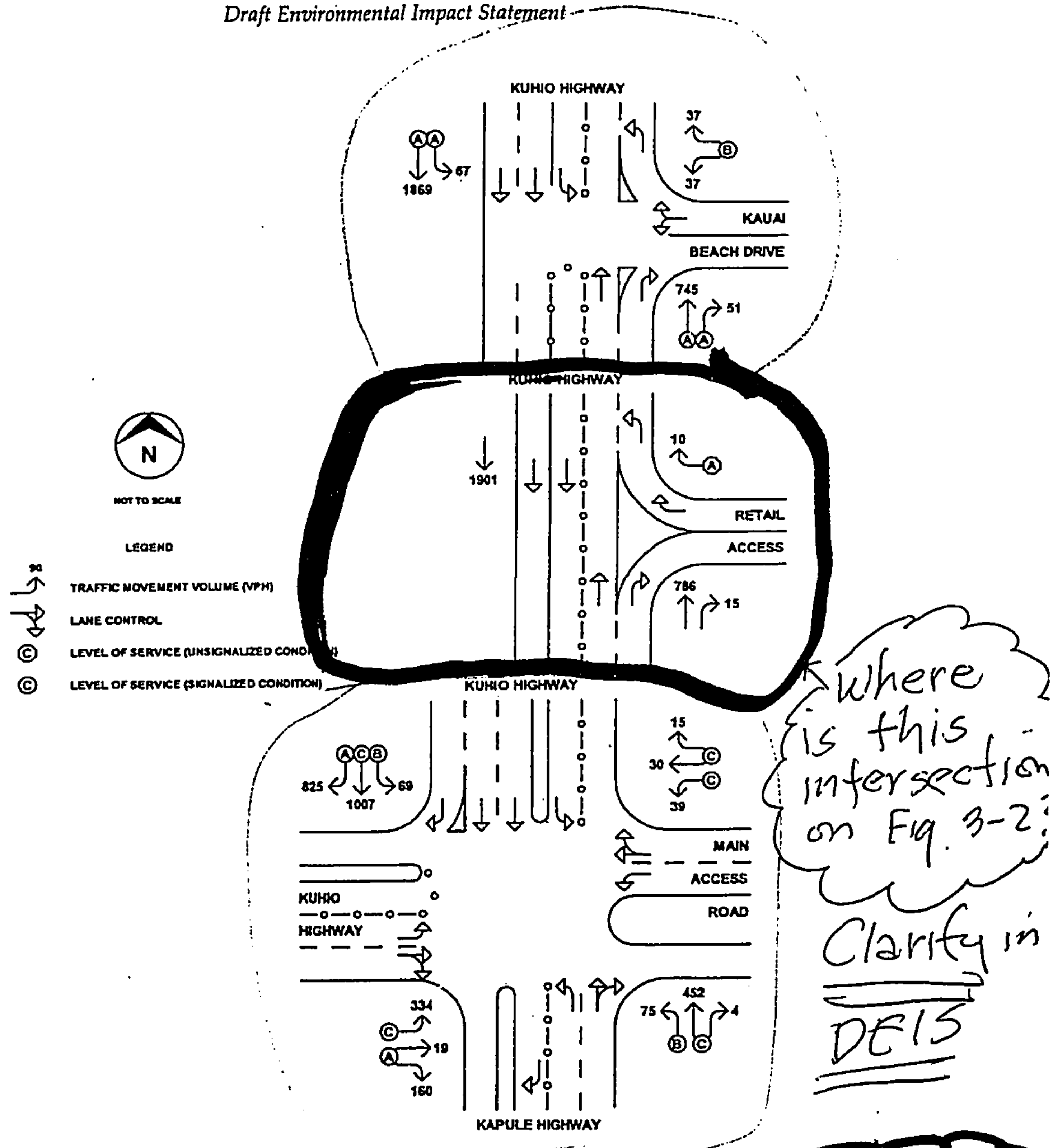
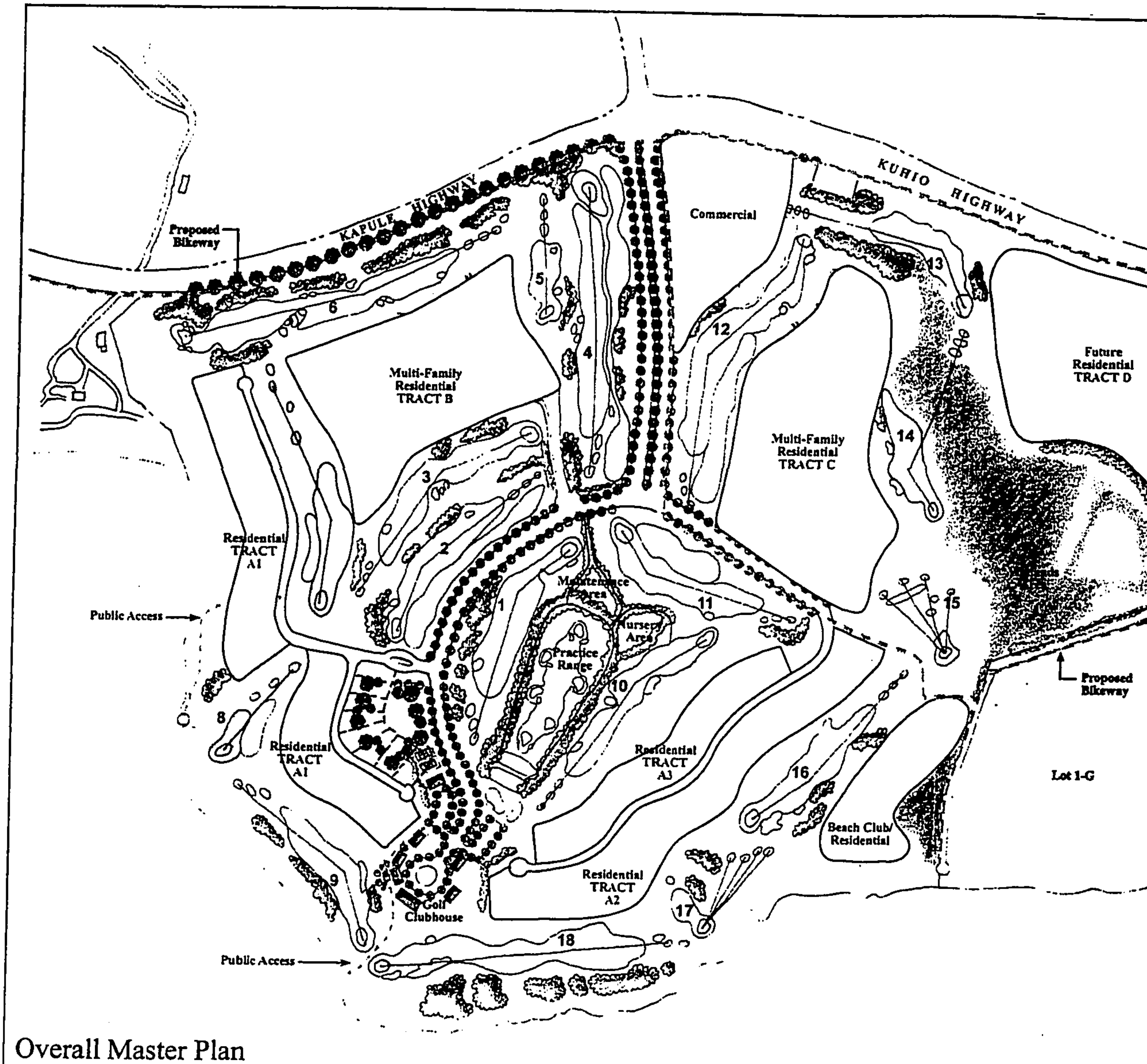


FIGURE 5-2 2010 AM PEAK HOUR TRAFFIC WITH PROJECT

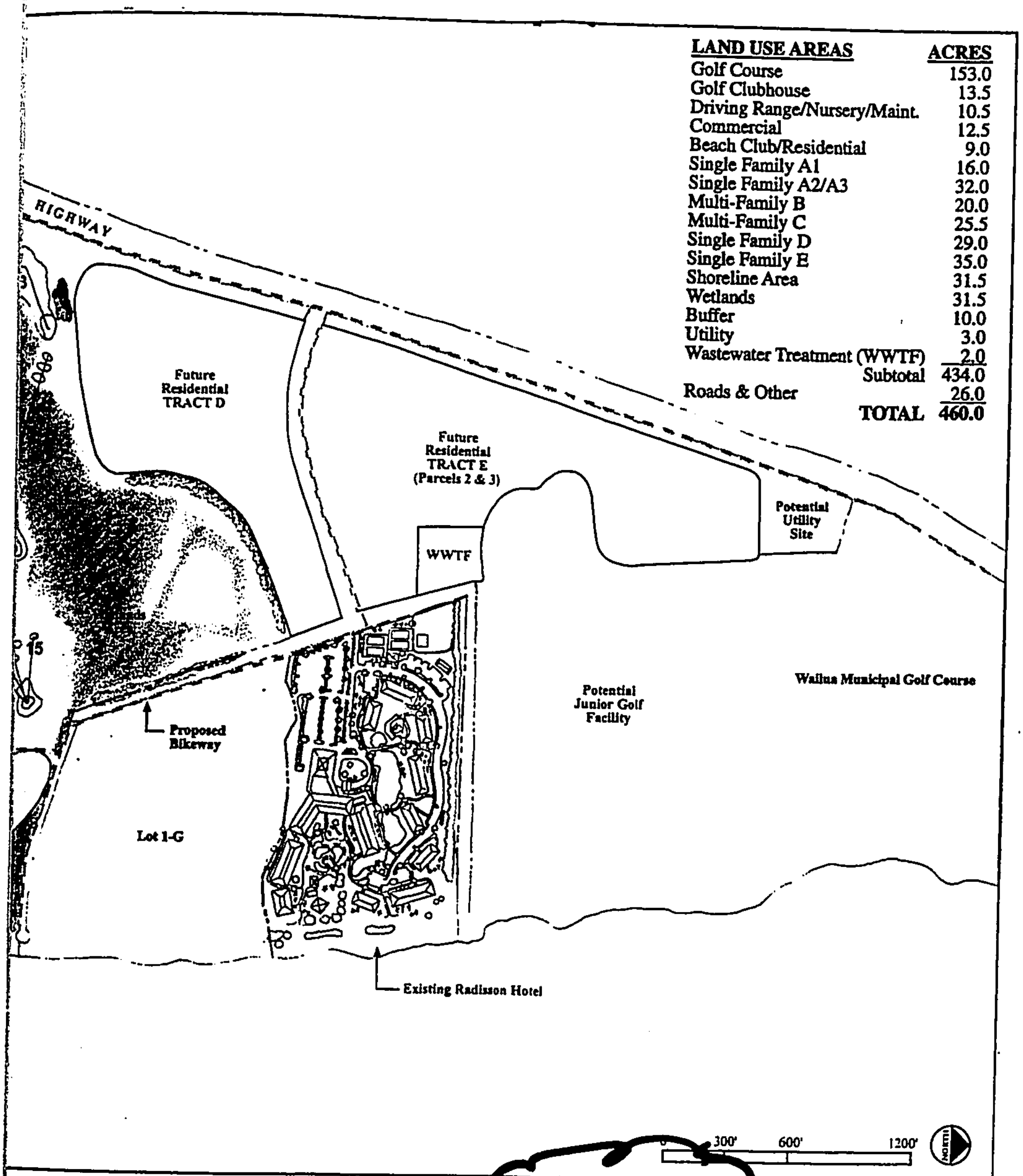
(CONTRA-FLOW OPERATION)

EXH. B1



Overall Master Plan

Ocean Bay Plantation
at Hanamā'ulu



LAND USE AREAS	ACRES
Golf Course	153.0
Golf Clubhouse	13.5
Driving Range/Nursery/Maint.	10.5
Commercial	12.5
Beach Club/Residential	9.0
Single Family A1	16.0
Single Family A2/A3	32.0
Multi-Family B	20.0
Multi-Family C	25.5
Single Family D	29.0
Single Family E	35.0
Shoreline Area	31.5
Wetlands	31.5
Buffer	10.0
Utility	3.0
Wastewater Treatment (WWTF)	2.0
Subtotal	434.0
Roads & Other	26.0
TOTAL	460.0

ExH. B2

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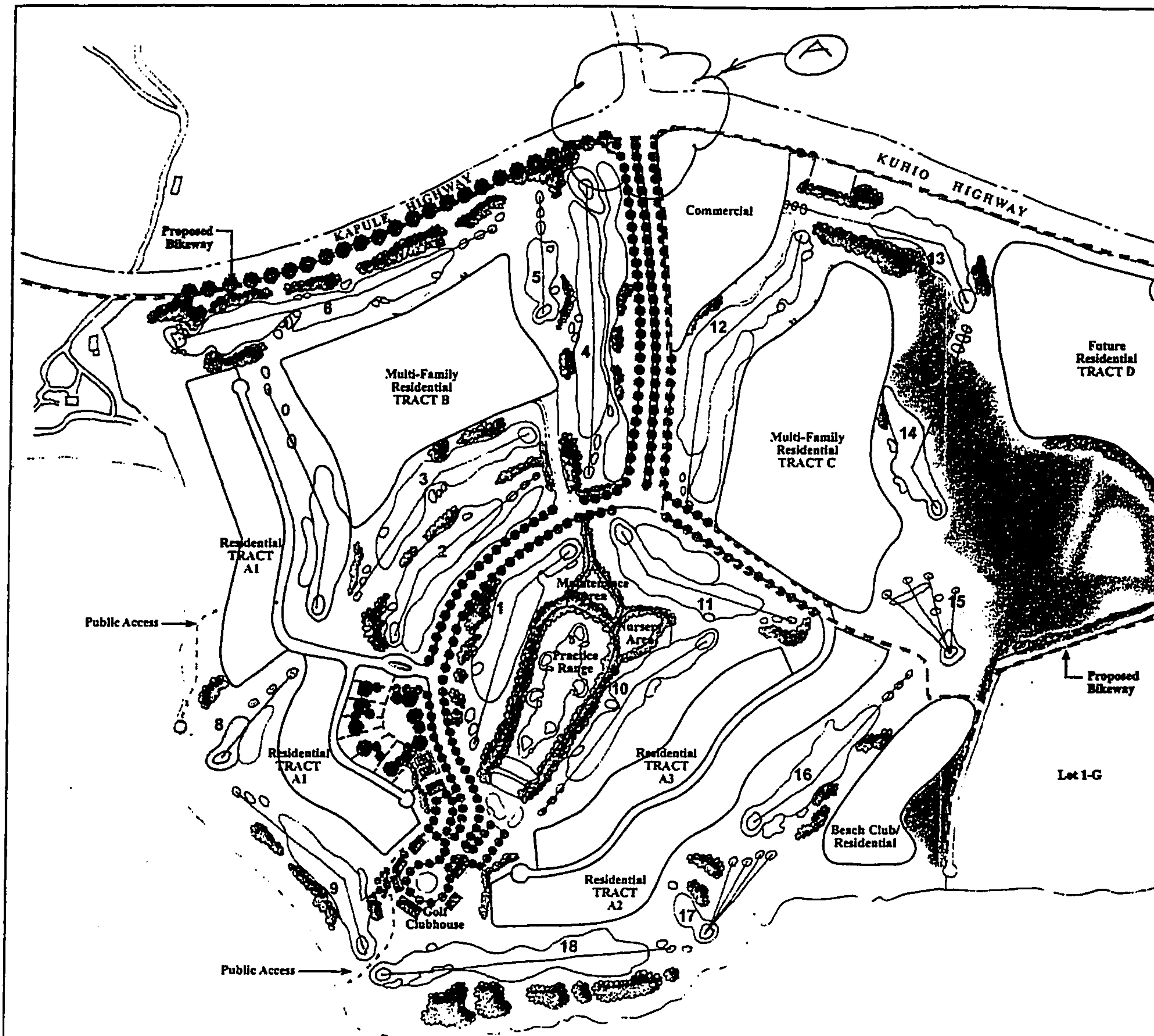
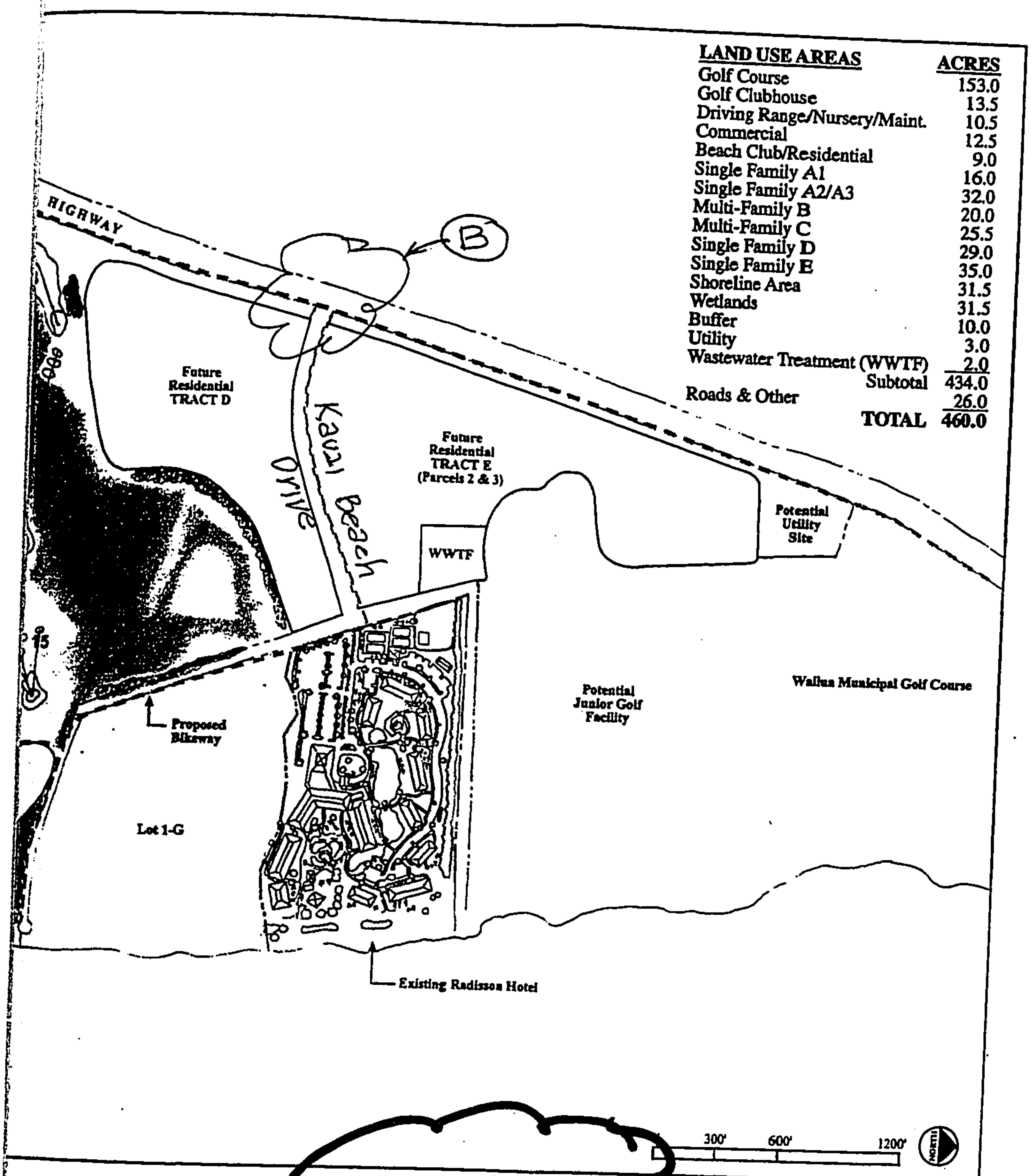
INTERNATIONAL
March 2002



Overall Master Plan

Ocean Bay Plantation
at Hanamā'ulu



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Roads & Other	26.0
TOTAL	460.0

EXH. C1

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INTERNATIONAL
March 2002

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June 3, 2002

Mr. Steven M. Kyono, P.E., District Engineer
State of Hawai'i
Department of Transportation, Highways Division
Kaua'i District
3060 'Eiwa Street, Room 205
Līhu'e, HI 96766

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Kyono:

Thank you for your letter of April 15, 2002 and the enclosed materials regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. The following is offered in response to your comments.

1. Bike Path. As presented in 1994 Bike Plan Hawai'i: A State of Hawai'i Master Plan (BPH), which is currently being updated, the proposed route is only a conceptual plan. At present, the owner is proposing a bike plan that will preserve the environmental quality of the property's coastal features while allowing the public to enjoy the project amenities, wetlands, and the coastline. We are coordinating with both the State and County to discuss the bike path options for the site. The owner's proposal includes a bike path to be sited along the entire length of the property fronting Kapule and Kūhiō Highways while providing an additional bike path/lane through the project property. The route would traverse the interior section of the project from the main entrance, crossing the wetland area on the north-central portion of the property, and connecting with Kaua'i Beach Drive that leads back to Kūhiō Highway. Vehicular and bicycle routes within the project will provide access to pedestrian accesses that lead to the property's shoreline areas.

2. Retail Access. Figure 3-1 and Section 3.5 of the DEIS will be revised to illustrate and discuss the accessway that leads to and from the proposed Gateway Village Commercial Center.

3. Project Site Access. The two major roadways that will provide access to the project site are located at the intersection of Kūhiō Highway and Kapule Highway and at Kaua'i Beach Drive. The retail access illustrated in the revised Figure 3-1 of the FEIS is designed and intended to service the Gateway Village Commercial Center.

4. Detailed Listing of Improvements. The owner recognizes the list of requested improvements in Section 3(A & B) of your letter, and will coordinate with DOT to address these requirements during the entitlement review process. As the project evolves to a more detailed phase, continued coordination with the Department of Transportation (DOT) and its divisions will be sought in determining the phasing and scheduling of the highway and roadway improvements.

Your letter and this response will be included in the Final Environmental Impact Statement. We will forward your office a copy of the Final EIS upon its completion.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENT QUALITY CONTROL
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HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

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GROUP

May 7, 2002

Mr. Dee Crowell, Director
Planning Department, County of Kaua'i
4444 Rice Street, Suite 473
Lihue, Hawaii 96766

Dear Mr. Crowell:

Subject: Draft EIS for the Ocean Bay Plantation at Hanama'ulu, Kaua'i

Thank you for the opportunity to review the subject document. We have the following comments.

1. Storm runoff during construction may significantly impact the nearby ocean water quality. Please provide specific details of the mitigation measures to minimize construction related runoff.

2. The state Department of Transportation is planning to improve Kuhio Highway between Hanama'ulu and Kapaa. Please coordinate with SDOT to ensure that the Ocean Bay project is compatible the highway improvements.

3. Please disclose whether the project will use any public lands or funds.

4. Please review the attached guidelines for water well development and include relevant information relating the new irrigation wells in the Final EIS.

5. Please consult with the Department of Health Clean Water Branch to determine the need for long-term monitoring of the nearby ocean water quality.

6. Please consult with the state Water Commission concerning the appropriateness of using surface water supply from the mauka lands, reservoirs and ditch systems. Describe the impacts of using this surface water supply.

7. Please identify all firms or persons who prepared the EIS.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson

Genevieve Salmonson
Director

GUIDELINES FOR ASSESSING WATER WELL DEVELOPMENT PROJECTS

Prepared by the Office of Environmental Quality Control, May 1998

I. INTRODUCTION

Water is recognized as one of Hawaii's most important resources. Its quality and availability for a wide variety of purposes is essential to both humans and the natural environment. Hawaii's water supply, development and distribution is a critical environmental issue today and is likely to become even more sensitive in the future. The establishment of guidance protocols such as this will encourage understanding and careful planning of this important resource.

These guidelines are not new rules or law. The purpose of the guidelines is to provide preparers and reviewers a general standard of completeness to apply for any EA or EIS relating to well development. The objectives of this guidance document are to integrate the review of environmental concerns with existing planning and regulatory processes and to alert decision makers of the environmental effects of the well project. The approving agency or accepting authority remains responsible for the contents of the EA or EIS.

Pursuant to HAR §11-200-8(a)(5), basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource may be exempt from preparing an environmental assessment. Accordingly, drilling of monitor wells as defined by the CWRM (provided the well shall not be capable of being used or intended to be used to withdraw groundwater for the purposes of exploring or developing ground water) may be exempt.

Environmental assessments for exploratory wells should not need to comply with all the information requirements below because some of the information will not be available until the well is tested. Should the exploratory well yield positive results and demonstrate production capability, a second environmental assessment for the production well should be prepared to comply with all the information requirements.

II. IMPACT ASSESSMENT CONTENT

In addition to the content requirements for environmental assessments and impact statements, which are set out in the EIS rules, any well development project should include the following information.

1. Orientation Maps

Maps with the appropriate scale and coverage to analyze the aquifer or hydrologic unit that show the following:

a) General information: location of proposed well, TMK or land ownership maps, location

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of existing and future wells in the affected aquifer or hydrologic unit, and general references such as roads, schools, etc.

b) Hydrologic information: aquifer or hydrologic unit boundary, nearby streams and wetlands, known or assumed groundwater flowpaths, known or assumed water level contours.

c) Contamination information: Points or regions of known contamination, points of potential contamination (landfills, individual wastewater disposal systems (cesspools, septic tanks, aeration units), hazardous waste sites, dry wells and injection wells), known or assumed chloride levels at specified depths in relation to nearest or adjacent wells, likely wellhead protection area for the proposed well.

NOTE: New injection wells and dry wells are typically prohibited from within 1/4 mile of a drinking water well. Other restrictions could apply. New water wells should not be situated in areas that have a significant need for injection wells, drywells or on-site individual wastewater disposal systems.

2. Aquifer or Hydrologic Unit Status

A description of the aquifer or hydrologic unit status including the following:

* Sustainable yields or other measures of water availability
* Authorized water use by the Commission on Water Resource Management (for Water Management Areas only)
* Data table presenting the following information as appropriate
    - Current water use totals, including subtotals for individual users
    - Current installed capacity including subtotals for individual wells and/or groups of wells.
    - Pending installed capacity and/or use for the proposed well and subtotals for individual wells and/or groups of wells within the aquifer

NOTE: Format suggestions and sample data tables for aquifer status data are contained in appendix #1.

3. Contamination Analysis and Vulnerability Assessment

A record of contamination problems in the aquifer or hydrologic unit including but not limited to saltwater intrusion, turbidity, heavy metals, inorganic and organic chemicals, microbiological agents, water quality parameters (such as pH, alkalinity, calcium, conductivity and temperature), and radioactivity. If contamination exists, the sources and duration of the contamination should be listed. Water quality data from nearby wells should be presented as well as any anticipated need for treatment or filtering systems. Discuss past and existing land uses within the likely wellhead protection area and the potential for future contamination from those uses.

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The potential for contamination should be assessed based on geologic and hydrologic considerations. Although sources of contamination might be presently absent, vulnerability to contamination might be great, if contamination sources occur in the future, due to factors such as high rates of infiltration or thin, protective soil horizons.

Any hazardous materials used and/or produced during drilling and treatment should be described. The method of handling these hazardous materials should also be disclosed.

4. **Hydrologic Impact Analysis**

A description of the associated watershed and recharge area and a discussion of the potential effects the well development may have on affiliated groundwater and surface water (e.g., streams and wetlands). Relevant hydrologic, physical, chemical, and biological data for potentially affected waters should be included. If potential impacts exist, a monitoring program for the surface waters should be included.

NOTE: See appendix #2 for sample description.

The EA should include pump test data on water level, extraction rates, and water quality. Similar data from nearby wells should also be included. The precise criteria used to determine if the well should be converted to production should be described. Any provisions for future use and monitoring of wells not placed into production should also be described.

5. **Biological Assessment**

A floral and faunal survey for sites in biologically sensitive areas.

6. **Archaeological and Cultural Impact Assessment**

A description of the archaeological and cultural significance of the region, including an on-site survey as well as consultations with Native Hawaiian groups such as DHHL, OHA and local community associations. (If applicable, the Environmental Council's Guidelines for Assessing Cultural Impacts could be used for this purpose.)

7. **Financial and Institutional Arrangements**

In some instances, a well is developed by private financing, the transfer of public lands to government or private developers, or in return for a water allocation credit to supply an urban development. The EA should include a full discussion of any institutional, financial or land use arrangements or commitments related to developing the well and delivering water to end users.

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These arrangements may include the formation of public utility companies and subsequent rate-setting, the establishment of county water commitments, the co-funding of state or county water system development, an executive order or other set-aside of state lands, and purchase of land or easements by public entities.

Any or all of these arrangements and all permits or governmental approvals required to fulfill these commitments should be listed.

8. **Watershed and Land Use Analysis**

A discussion of how waters from the well will be used, and an analysis of how the proposed well development may affect land and water uses on the island and in the region. The analysis should include a discussion of the following (published materials may be referenced):

* Hawaii State Water Plan and its component parts
* County General, Development, and/or Community Plans
* Plans for future water development within the aquifer
* Any related water, wastewater, drainage or erosion control plans
* Historical water supply and demand figures for the region
* How the well may affect existing water sources
* Any secondary or cumulative impacts caused by promoting land uses that alter the hydrology of the source and/or end-use area
* An assessment of the well's impact on the land owners, water users including farmers and kuleana residents in the region and a declaration if ceded lands are involved.

9. **Alternative Analysis**

A list of alternatives to new groundwater development and discussion of their related costs and benefits. The list should include but not be limited to alternative locations, wastewater reuse, rainfall catchment, existing potable and non-potable water supplies, water conservation and Demand Side Management or Integrated Resources Planning. Show why developing a new source is more cost efficient than water conservation programs (slow-flow and low-flush retrofits, leak detection, etc.). In the case of back-up wells, there should be a discussion of the feasibility of providing a back-up pump only, rather than drilling a second well.

10. **Impacts of Accessory Facilities**

A description of impacts associated with the well's permanent production facilities including pumps, distribution pipelines, control devises, storage facilities, access roads and accessory structures.

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The inclusion of this information will help make environmental assessments and environmental impact statements complete. If you have any questions, please call OEQC at 586-4185.

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Appendix #1

FORMAT SUGGESTIONS AND SAMPLE TABLES AND CHARTS TO DISPLAY SUSTAINABLE YIELD DATA.

Sustainable Yield

Sustainable yield policies for basal aquifers involve trade-offs between groundwater extraction rates and aquifer water levels. The selected extraction rate implies acceptance of the affiliated equilibrium head (h_e), the water level at which the aquifer stabilizes under pumping at sustainable yield levels.

Equilibrium head is usually less than pre-development water levels or initial head (h_i). For comparative purposes, it is helpful to attach values of h_e and h_i to sustainable yield figures. Groundwater extraction can then be discussed in terms of its relationships with sustainable yields and water levels.

Data Subtotals and Grouping

To assure the clarity of information presented in the EA, tables for the following categories of data should be grouped by user/operator and landowner.

Categories for Data Tables in the EA

* Current water use totals
* Current installed capacity
* Pending installed capacity
* Authorized water use

To assist in spatial analysis, subtotals should also be grouped for aquifer sub areas and/or water quality regimes (such as zones of varying recharge of extraction intensity or chloride concentration).

A sample table for the display of this data is presented in the next page.

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<u>Aquifer or Hydrologic Unit Status Data</u>
Sustainable Yield = 40 mgd
Initial head = 20 feet
Equilibrium head = 18 feet
Authorized Water Use (for water management areas only) = 36 mgd

Table 1: Overall Aquifer or Hydrologic Unit Status Data in million gallons per day

Land Owner	Authorized Water Use (Permitted by CWRM)	Existing (E)		Planned/Pending (P)		Potential Future (E + P)	
		Pump Capacity*	Average Use **	Pump Capacity	Proposed Use	Pump Capacity	Proposed Use
A	4	5	4	+5	+4	10	8
B	7	10	7	+3	+2	13	9
C	25	25	15	-10	-5	15	10
Total	36	40	26	-2	+1	38	27

Table 2: Aquifer or Hydrologic Unit Status Data for Landowner C in million gallons per day

Well Site	Authorized Water Use (Permitted by CWRM)	Existing (E)		Planned/Pending (P)		Potential Future (E + P)	
		Pump Capacity	Average Use	Pump Capacity	Proposed Use	Pump Capacity	Proposed Use
Mauka	10	10	8	0	0	10	8
Makai	5	5	0	-5	0	0	0
Central	10	10	7	-5	-5	5	2
Total	25	25	15	-10	-5	15	10

<u>*Notes:*</u>
** Total amount of water a well pump is capable of removing from the ground under ideal conditions in a 24-hour period. This number should be the same as the "rated pump capacity or installed pump capacity" as reported by the well owner to the CWRM.*
*** Average water use based upon water meter readings as reported by the well owner to the CWRM. The average should be based on the appropriate number of years of data.*

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Appendix #2

SAMPLE DESCRIPTION LIST FOR THE AFFECTED SECTOR WITHIN A WATERSHED AND GROUNDWATER RECHARGE AREA

Below you will find a list of characteristics that should be discussed in the description of affected sector within a watershed and groundwater recharge area.

Watershed:

1. Drainage area boundaries
2. Drainage networks and patterns
3. Groundwater discharges as sources of surface water flows
4. Surface water flow and habitat characteristics
   a. timing, magnitude, duration, frequency of groundwater-source baseflows
   b. relationships between baseflows and aquatic and riparian habitats and communities,
   c. water quality
   d. water uses (e.g., ditch or`auwai systems)

Recharge Area:

1. Boundaries
2. Geologic structure
3. Groundwater flow patterns
4. Overlying land and water uses, and runoff patterns.
5. Relationships between recharge rates and patterns, and climatic variations
6. Relationships between proposed groundwater extraction and associated activities, and aquifer water levels
7. Storage volumes, other wells, discharges to surface and coastal waters, and water quality parameters

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Appendix #3

SOURCES OF INFORMATION

1) Hydrologic information may be obtained from the Commission on Water Resources Management. These include:

- a) location of existing wells;
- b) CWRM aquifer boundary;
- c) information on nearby streams;
- d) sustainable yield for aquifer;
- e) authorized water use by CWRM (for water management areas only);
- f) current water use within aquifer;
- g) current installed capacity within aquifer;
- h) pending installed capacity and water use within aquifer;
- I) Hawaii State Water Plan and its component parts;
- j) water levels of nearby wells; and
- k) salinity levels of nearby wells.

2) Contamination information may be obtained from the Department of Health. These include:

Safe Drinking Water Branch

- a) results of water quality tests of nearby wells;
- b) records of contamination problems in the aquifer; and
- c) locations of drywells and injection wells.

Wastewater Branch

- a) locations of individual wastewater systems.

Solid and Hazardous Waste Branch

- a) location of hazardous waste sites; and
- b) location of landfills.

3) Preliminary information about the well head protection area may be obtained from the Safe Drinking Water Branch, Department of Health.

4) Information about wetlands may be obtained from the U.S. Army Corps of Engineers.

5) County general, development and community plans may be obtained from the respective planning departments.

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June 3, 2002

Ms. Genevieve Salmonson, Director
State of Hawai'i, Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

**Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter**

Dear Ms. Salmonson:

Thank you for your letter of May 7, 2002 to the County of Kaua'i Department of Planning regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project and the provision of the enclosed materials. The following are offered in response to your comments.

1. Storm Runoff During Construction. Due to the project's proximity to coastal waters, the owner will undertake extensive measures to protect both coastal and wetland water quality. Section 5.1.1 of the Final EIS (FEIS) has been expanded to include further discussion on the mitigative measures that will be used to minimize construction related runoff.

2. Highway Improvements. As the project progresses to a more detailed design phase, coordination with the State Department of Transportation will be on-going regarding transportation facilities. Specific issues of concern to the State DOT are addressed in the response to its correspondence, and enclosed in this Final EIS.

3. Use of Public Lands or Funds. The Ocean Bay Plantation at Hanamā'ulu project is a private development initiative that does not intend to use public funding or lands. The project will provide resources or make specific improvements to public infrastructure, such as roadways and water supply, to satisfy the increased demand resulting from the project.

4. Guidelines for Water Well Development. The enclosed copy of the Guidelines will be considered during the detailed design phases of the project. Further, the project will also apply the relevant Hawaii Well Construction and Pump Installation Standards. The information provided in the EIS meets the requirements set forth in the Guidelines.

5. Long-term Monitoring of Ocean Water Quality. The Department of Health, Clean Water Branch will be consulted to determine the extent and level of long-term monitoring of ocean water quality that will be required. This agency is also being provided with a copy of this letter.

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6. Use of Surface Water Supply. The County Department of Water Master Plan, which has been adopted by the State Water Commission, has determined that the existing water storage supply within the 214 service zone, from which the Ocean Bay Plantation project will be serviced, has 590,000 gallons more capacity than the estimated volume required by year 2020. The calculations provided in Appendix K indicate that the project would require 310,000 gallons of storage volume, which is within the limits of the existing system storage capacity.

7. Preparation of the EIS. A new section has been included in Section 9.0 of the FEIS that identifies those firms and individuals that were involved in the preparation of the EIS document.

Your comments and this response letter will be included in the FEIS. We will also forward you a copy of the FEIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

Attachments

cc: State of Hawaii, Department of Health, Clean Water Branch

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MAY 24 2002
GROUP 70

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FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD02-291

May 1, 2002

Keith Nitta
County of Kauai
Department of Planning
4444 Rice Street, Suite 473
Lihue, HI 96766

Subject: Ocean Bay Plantation at Hanama'ulu
Draft Environmental Impact Statement
Hanamaulu, Kauai

Dear Mr. Nitta:

OHA is in receipt of your request for comments on the above-referenced document. We ask that the draft EIS be amended to address our concerns about burials, access for traditional and customary practices, and marine resources.

Burials

OHA strongly recommends that the applicant formally consult with the Kauai Island Burial Council to further evaluate the potential for encountering iwi. The draft EIS concludes that inadvertent discoveries of burials are not anticipated due to past agricultural use. However, this conclusion is incompatible with the archeological survey's disclosure that remains have been found in the surrounding area and the cultural impact assessment's finding that eight informants identified burial grounds in the project area. Further, this conclusion rests upon the mistaken assumption that previous cultivation would have removed all human remains—iwi have been discovered in lands that were in sugar cultivation or urbanized. For these reasons, the applicant should reconsider their conclusion regarding the potential impacts to Hawaiian burials in consultation with the Kauai Island Burial Council.

To mitigate for potential harms to Hawaiian burials, the applicant should develop a contingency burial treatment plan in consultation with the Burial Council, the State Historic Preservation Division, and the Office of Hawaiian Affairs.

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Finally, the afore-mentioned findings of the applicant's own archeological and cultural impact studies suggest that a cultural monitor should be present during ground-disturbing activities. The draft EIS makes some mention of the appropriateness of using a cultural monitor but the final EIS must make specific provisions for a cultural monitor. OHA requests that the applicant prepare a cultural monitoring plan. The plan should be made available for Kauai Island Burial Council and OHA review. OHA recommends that the plan include protocol for evaluation of cultural and archeological findings, notification, and site management, as well as quality control measures and guidelines for work stoppage.

Access, Traditional and Customary Practices
The document indicates that two public access routes are provided. However, the applicant must consult with the Hawaiian community regarding whether these public access routes are appropriately placed or if more access routes are required. The results of this consultation should be included in the final EIS.

Ocean Quality and Marine Communities
As cultural practices depend upon the quality of the coastal waters and the marine resources, the applicant should plan for even more protective mitigative measures than currently listed in the draft EIS. OHA requests that the applicant develop and implement an erosion control plan to include monitoring of near-shore waters. There is precedent for monitoring ocean water quality in the 1250 Oceanside Partners, LLC, Hokulia development where work proceeds under Department of Health supervision. The plan should also restrict the acreage exposed to the elements at any given time to less than 20 acres.

Thank you for the opportunity to comment on the above referenced project If you have questions, please contact Sharla Manley, policy analyst at 594-1944 or email her at sharlam@oha.org.

Sincerely,

Jalna S. Keala
Acting Director, Hawaiian Rights Division

CK: sam

cc: Board of Trustees
Clyde W. Namu'o, Administrator
Kauai CAC
✓Jeff Overton, Group 70 International, Inc.

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June 3, 2002

Ms. Jalna S. Keala, Acting Director
State of Hawai'i
Office of Hawaiian Affairs
Hawaiian Rights Division
711 Kapi'olani Boulevard, Suite 500
Honolulu, HI 96813

**Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter**

Dear Ms. Keala:

Thank you for your letter of May 1, 2002 to the County of Kaua'i Planning Department regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. The following is offered in response to your comments.

Traditional Burials and Historic Resources. We concur with your statements that pre-existing land use patterns are not completely indicative of the potential presence of cultural resources or burial sites in any given area. However, the extensive use of the lands within the project area for agricultural production and operation over the last century has severely altered the area's natural landscape However, as presented in Section 5.1.5 of the DEIS, the applicant is committed to treating any discoveries of burials or cultural resources with the highest level of sensitivity and appropriateness. Further, the implementation of the approved coastal renaturalization plan illustrates the applicant's commitment to enhancing, maintaining, and preserving the area's natural landscape.

As discussed in Appendix N to the DEIS, the sandy areas and soil areas seaward of former sugarcane cultivation limits of the project area have been identified by selected cultural informants as potential cultural landscapes that could contain burial sites. These cultural informants included current and former members of the Kaua'i/Ni'ihau Burial Council (K/NBC). In the course of consulting with these current and former K/NBC members (including the current Chair), there was no request made on behalf of these members to engage in "formal consultation" at this time, since no known traditional burial sites were identified within the project area.

As presented in the DEIS, mitigative measures have been recommended for the ten identified significant historic sites (9 of which are on-site) situated within or near the vicinity of the project area. Two of the identified sites (Site 1838 and 1839) have been classified as prehistoric, and both are outside development areas. A revised archaeological inventory survey was submitted and approved

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by the State Department of Land and Natural Resources, State Historic Preservation Division.

Of the nine significant historic sites, data recovery has been completed for one site (Site 2068) with no further protection required. As necessary, an appropriate plan for the remaining eight sites will be prepared and submitted for SHPD's review and approval. It is also recommended that in the event of an encounter with significant unidentified surface or subsurface cultural remains, further archaeological consultation with the appropriate agencies and organizations will be sought. As appropriate, the applicable processes outlined in existing State regulations, specifically those pertaining to the inadvertent discovery of burials (HAR, Title 13, Chapter 300, Section 40) and the development of a burial treatment plan (HAR, Title 13, Chapter 300, Section 33) will also be employed.

Access, Traditional and Customary Practices. As discussed in a revision of Section 3.7 and the Master Plan (Figure 3-1 of the DEIS), four designated public access routes within the project area will provide shoreline access. The provision of these access routes satisfies the requirement to comply with existing State regulations and the recently adopted Bill 1968 by the Kaua'i Council, which is an ordinance that amends Chapter 9 of the Kaua'i County Code. Access to the shoreline has been and will continue to be provided, thus no mitigative measures are necessary.

Ocean Quality and Marine Communities. As presented in section 5.2.10.1 of the, and Appendix H to the DEIS, the inshore waters of the project area's shoreline continues to serve as an area for gathering marine resources. Due to the project's proximity to coastal waters, the owner will undertake extensive measures to protect both coastal and wetland water quality during the development and implementation of its erosion control plan. It is the intent of the applicant to conduct ocean water quality monitoring during the construction and operational phases of the project.

Your letter and this response will be included in the Final Environmental Impact Statement. We will forward your office a copy of the Final EIS upon its completion.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

DOCUMENT CAPTURED AS RECEIVED

University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
Krauss Annex 19 · 2500 Dole Street · Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 · Facsimile: (808) 956-3980

May 7, 2002
RE: 0725

Mr. Keith Nitta
Department of Planning
County of Kaua'i
4444 Rice Street, Suite 473
Lihue, HI 96766

Dear Mr. Nitta:

Ocean Bay Plantation
Draft Environmental Impact Statement
Hanama'ulu, Kaua'i

EWM Kaua'i, LLC proposes to develop 460-acres of former sugarcane property to provide a mixed-use residential and golf course community in Hanama'ulu, Kaua'i. The proposed components of the project master plan include residential lots for single and multi-family homes, an 18-hole golf course and golf clubhouse, a beach club, and a small-scale retail commercial center. The master plan also includes maintaining and enhancing particular areas, including an open space corridor along the coastline, wetlands, and highway buffer areas.

The phased implementation of the Master Plan is anticipated to occur over a period of 10-15 years. Under the present schedule, site clearing, grading and infrastructure construction would begin in 2003. The golf course and clubhouse would be built in the first two years, along with the first phases of the residential component, including approximately 73 single-family house lots. The remaining single-family and multi-family residential units would be developed in increments over the following 5 to 10 years. The proposed improvements to the vacant property are to be implemented in phases upon obtaining necessary permits and approvals.

The Environmental Center has reviewed this document with the assistance of Marshall Mock, Kaua'i Community College, and Kevin Polloi, Environmental Center.

General Comments

Our review has identified several general concerns. First, we note that the proposed project entails construction of at least two wells to augment the County's existing water system in response to needs of the proposed project. What is the present condition of the affected aquifer, and what are the cumulative effects of this project's water demands compounded with current water usage. A previous letter from Colin Kippen, Deputy Director for the Office of Hawaiian Affairs (section 9.0), also stated this concern.

In terms of highway improvements, who will pay for upgrades and highway construction made necessary by this project? In a previous letter, State Director of Transportation, Brian Minaai stated that the applicant is responsible for the design and construction of highway improvements (section 9.0). The document did not address this concern.

Finally, the sands of Nukoli'i near the project area previously have yielded ancient burials. The document did not address potential effects of the project to this area.

Specific Comments

3.5 Shoreline Areas and Beach Access

Although the document states that access to the shoreline will be available, what guarantees are provided in the Master Plan to ensure adequate beach access? Are there assurances that the public parking lot will be free of charge? Will there be any temporal or spatial restrictions to public shoreline access, and if so, what will be the exact nature of those restrictions?

3.16.1 Clearing, Grubbing, Grading and Excavation

According to the document, the quantity of earthwork related to project implementation is not known. In the event that the volume of soil excavation exceeds onsite fill needs, where will the excavated dirt be disposed?

5.2.5 Groundwater Resources

Figure 4-5 does not indicate the locations of the three wells (Nos. 0320-01, 0320-03 and 0321-01).

5.2.9 Fauna

The construction of ponds for the golf course will attract native and migratory water birds, in addition to the three endangered species identified in the document. The draft EIS should examine the potential effects of the project on native and migratory waterfowl.

Thank you for the opportunity to review this draft Environmental Impact Statement.

Sincerely,

John T. Harrison, Ph.D.
Environmental Coordinator

Cc: OEQC
Jeff Overton, Group 70 International, Inc.
James Moncur
Marshall Mock
Kevin Polloi

GROUP 70

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June 3, 2002

Mr. John T. Harrison, Ph.D.
Environmental Review Coordinator
University of Hawai'i at Mānoa
Environmental Center
Krauss Annex 19, 2500 Dole Street
Honolulu, HI 96822

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Harrison:

Thank you for your letter of May 8, 2002 to the County of Kaua'i Planning Department regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. The following is offered in response to your comments.

General Comments

Water Demands. As discussed in Section 4.15.2 of the, and Appendix K to the DEIS, the County Department of Water Master Plan has determined that the existing water storage supply within the 214 service zone, from which the Ocean Bay Plantation project will be serviced, has 590,000 gallons more capacity than the estimated volume required by year 2020. The calculations provided in Appendix K indicate that the project would require 310,000 gallons of storage volume, which is within the limits of the existing system storage capacity.

Highway Improvements. As the project progresses to a more detailed design phase, coordination with the State Department of Transportation will be on-going in determining what specific improvements and the associated costs will be needed and become the responsibility of the property owner.

Burials. Section 5.1.5 provides a discussion on the probable impacts and proposed mitigative measures related to cultural, historic, and archaeological resources, with a specific focus on traditional burials. The owner is committed to treating any discoveries of burials or other cultural resources with the highest level of sensitivity and appropriateness.

Specific Comments

Shoreline Areas and Beach Access. As discussed in a revision of Section 3.7 and the Master Plan (Figure 3-1 of the DEIS), four designated public access routes within the project area will provide shoreline access. In addition, two additional

Group 70 International, Inc. • Architecture • Planning • Interior Design • Building Diagnostics • Asset Management • Environmental Services
[illegible]

accesses to the shoreline are readily available from public lands or right of ways at both ends of the project site. The provision of these access routes satisfies the requirement to comply with existing State regulations and the recently adopted Bill 1968 by the Kaua'i Council, which is an ordinance that amends Chapter 9 of the Kaua'i County Code.

Clearing, Grubbing, Grading, and Excavation. As stated in Section 5.1.1 and 5.1.2, a Grading Permit must be obtained from the County of Kaua'i to begin construction. The grading work will be in compliance with the requirements of the County of Kaua'i Grading Ordinance.

Given the size and location of the project area, the grading work will also require a National Pollutant Discharge Elimination System (NPDES) permit, as authorized by the Clean Water Act. The NPDES program regulates point sources such as man-made ditches that have the potential to discharge runoff that may contain pollutants. The grading work for the Ocean Bay Plantation project will be performed in accordance with the requirements of the NPDES permit.

Groundwater Resources. Figure 4-5 of the DEIS illustrates the existing drainage areas within the project area. Figure 4-4 presents the well locations within the project area (Well 0020-01, Well 0020-02, Well 0020-03) and those off-site (Wells 0120-01 & 02, Well 0021-01, Well 5921-01).

Fauna. Section 5.2.9 adequately presents the probable impacts the project may have to avifauna and discusses the appropriate mitigative measures.

Your letter and this response will be included in the Final Environmental Impact Statement. We will forward your office a copy of the Final EIS upon its completion.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

MARYANNE W. KUSAKA
MAYOR

DEE M. CROWELL
PLANNING DIRECTOR
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PLANNING DEPARTMENT

RECEIVED
MAY 29 2002

May 7, 2002

Jeff Overton
Group 70 International, Inc.
925 Bethel Street, 3rd Floor
Honolulu, Hawaii 96813-4307

SUBJECT: Draft Environmental Impact Statement (DEIS)
Ocean Bay Plantation at Hanamaulu, Kauai, Hawaii

Thank you for allowing us this opportunity to comment on the project's DEIS. At this point, we would like to offer the following comments regarding the DEIS:

1. The project involves many phases from obtaining entitlements to securing permits. The DEIS is helpful in understanding the project throughout its entire process. However, we would like the applicant along with all concerned parties to be mindful of the following:

   - Our comments should not be misconstrued to mean that we support the applications for entitlements. Instead, our comments are intended to discuss concerns relating to the proposed project that should be disclosed to all interested parties to ensure that the applicable planning issues are covered in the EIS.

   - Elements of the project may change over time in consideration of unforeseen events or circumstances. Should changes occur, our Department may require that the EIS be updated to cover those changes. At this point, we would like to clarify that only major changes would trigger amendments to the EIS.

2. Internal traffic circulation is an important concern. We feel that there must be a roadway connection to the adjoining Radisson Hotel to the north in order to allow traffic to circulate between both projects without having to enter the highway. Such a connection would also provide access options for both projects, and allow for one signalized intersection. A loop system would also allow both projects to share utilities, access, and resources. Although the traffic generated by the Radisson Hotel is not the responsibility of this project, the issue of connecting the roadways for both projects will arise during the course of obtaining entitlements.

3. This property is in a very visible location near the intersection and bridge. As a result, it is important that the character of the current landscaping along the highway be continued along the property's highway frontage. Also, we are concerned that the buildings near the highway should not create a "strip" type development.

4. The Commercial zoning being contemplated raises concerns about its need and location due to the proximity of other Commercial zoning in the nearby Hanamaulu and Lihue. The need for a "spot" of Commercial zoning in the area will have to be addressed during the application for entitlements.

5. The County has been contemplating the development of a bike/pedestrian trail along the eastern coastline starting from Nawiliwili to Anahola. This property provides an important link to the trail. We note that there is a trail proposal in the DEIS, however, we are not certain at this point whether the proposed alignment is acceptable or not. This matter will be covered during permitting, subdivision, and/or the course of obtaining entitlements.

6. The Hanamaulu Beach Park abuts the subject property to the south. There is a possibility that additional lands will have to be acquired to expand the park for expanded use by the general public.

7. It is important to note that the public access requirements within our laws have recently been revised to now require mandatory public access for projects applying for permits and/or subdivision. Consequently, we will need more details on the provision of public access to the bay and ocean during the upcoming applications.

8. The lack of water sources and the inability of the Lihue area to yield to the development adequate water sources have restricted growth in Lihue. In the process of developing a water source for this project, the applicant should discuss with the Water and Planning Departments the matter of sharing water with the Lihue area.

9. Lihue's growth has also been restricted by the lack of sewer capacity. As indicated in the DEIS, this project will have a private sewage treatment plant (STP). If this is the case, the County would like to discuss the possibility of the private STP handling sewage from outside of the project, or the provision of lands within the project site (for sale or credits) for a regional STP.

10. We are not certain about the land uses being proposed near the north of the Kauai Beach Drive. Because this part of the project abuts public lands and is separated from the rest of the project by Kauai Beach Drive, we are not clear how this element will integrate with the balance of the project. Further information on the development of this part of the project should be resolved prior to submitting State Land Use District Boundary Amendment and/or General Plan Amendment application(s).

11. In the General Plan, the pattern of growth is an important concern for the Lihue area. Accordingly, the priority for growth in the Lihue area is the development of the "infill" area around the airport, stadium and hospital. It is important that growth in Lihue be focussed on developing the "infill" as a priority before urbanizing outside of Lihue. This concern must be clearly addressed in the request for General Plan amendment.

12. The General Plan is a vision-oriented document, written in a thematic format. Therefore, the applicant should address the applicable vision and policy sections of the General Plan during the filing for an amendment.

Please feel free to contact Keith Nitta of my staff if you have any questions or comments on this matter at 241-6677.

DEE M. CROWELL
Planning Director

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June 3, 2002

Mr. Dee M. Crowell, Planning Director
County of Kaua'i
Department of Planning
4444 Rice Street, Suite 473
Līhu'e, HI 96766

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Crowell:

Thank you for your letter of May 7, 2002 regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. The following is provided as a response to your comments.

1. We acknowledge the Department's position that the comments presented in your letter are intended to encompass a wide range of concerns that should be disclosed to all interested parties. We further recognize that any substantial modification or alteration of existing project plans may require the EIS to be updated, as appropriate.

2. The applicant will coordinate with the State Department of Transportation to determine specific highway improvements. The option of providing an access road for circulation in-between the subject parcel and the Radisson Hotel is not being considered due to the presence of wetlands and the lack of need for an internal traffic connection.

3. The landscaping theme of the highway buffer zone will be representative of the overall landscaping plan for the entire project, which includes the reintroduction of appropriate native species of plants. The design and construction of residential units, the commercial center, and the golf facilities will be sited and built to a scale that is reflective of the rural character of the surrounding area.

4. The proposed Gateway Village Commercial Center is designed to provide a convenient shopping location for the residents of the Ocean Bay Plantation, as well as the visitors utilizing the Līhu'e-Kapa'a traffic corridor. Section 2.3 will be expanded to further the discussion on commercial demand within the local vicinity and the greater island community.

   As presented in Section 2.3 of the, and Appendix N to the DEIS, the proposed Gateway Village Commercial Center is similar is size to some of the smaller shopping centers on the island of Kaua'i, such as the Po'ipū

Village and the Ching Young Village in Hanalei. The planned uses of the center include general retail, restaurant, and other uses, which is expected to capture approximately 15% of passing visitor traffic, and 2% of residential traffic not associated to the Ocean Bay Plantation. The analysis suggests that the commercial supply provided by the Center will be sustained with the neighboring and visiting demand.

5. As mentioned in your letter, EWM Kaua'i, LLC is proposing a bike plan that is intended to preserve the environmental quality of the property's coastal features while allowing the public to enjoy the project amenities, wetlands, and the coastline. We recognize that the finalization of proposed alignment will require the approval of both State and County agencies.

6. It is the intent of the property owner to create a community whose resources are to be enjoyed both residents and visitors alike. There is currently no plan to convert a portion of the site to expand beach park use at Hanamā'ulu Beach Park.

7. As discussed in a revision of Section 3.7 and the Master Plan (Figure 3-1 of the DEIS), four designated public access routes within the project area will provide shoreline access. The provision of these access routes satisfies the requirement to comply with existing State regulations and the recently adopted Bill 1968 by the Kaua'i Council, which is an ordinance that amends Chapter 9 of the Kaua'i County Code. As required, additional details of these accesses will be provided during the appropriate stages of the application process.

8. The County Department of Water Master Plan 2020, which has been adopted by the State Water Commission, has determined that the existing water storage supply within the 214 service zone, from which the Ocean Bay Plantation project will be serviced, has 590,000 gallons more capacity than the estimated volume required by year 2020. The calculations provided in Appendix K indicate that the project would require 310,000 gallons of storage volume, which is within the limits of the existing system storage capacity. Further discussions will be held with the County Department of Water to address the project requirements for water service.

9. The project will provide resources or make specific improvements to public infrastructure, such as roadways and water supply, to satisfy the increased demand resulting from the project. As such, further discussion related to the possibility of reserving a portion of land on the project area to be used in the long-term planning of a Regional Wastewater Treatment Facility will be required.

10. It is the intent of the property owner to develop this 35-acre area for single-family homes (Tract E), as described in the Section 3.0 of the DEIS.

11. A Petition for General Plan Amendment was submitted before the County of Kaua'i on May 21, 2002 and is currently under review. The request addresses the intent of the project to support the future infill development priority.

12. The property owner, as the Applicant to the Petition for General Plan Amendment, has proposed specific language changes to the text of the GP in addition to changes in the document's maps.

Your comments and this response letter will be included in the Final EIS (FEIS). We will also forward you a copy of the FEIS upon its completion. We appreciate the time, effort, and attention of you and your staff in the discussions and meetings held to discuss the subject property.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
ADMINISTRATIVE ASSISTANT

CESAR C. PORTUGAL
COUNTY ENGINEER
TELEPHONE 241-6600

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DEPUTY COUNTY ENGINEER
TELEPHONE 241-6640

AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
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LIHU'E, KAUA'I, HAWAI'I 96766

April 30, 2002

RECEIVED
MAY 10 2002
GROUP 70

Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813

Attention: Mr. Jeff Overton

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR OCEAN BAY PLANTATION AT HANAMA'ULU
TMK: 3-7-3-1 & 3-9-5: 5 PW3.229

We reviewed the subject draft environmental impact statement and offer the following comments:

A. PRELIMINARY ENGINEERING REPORT FOR STORM DRAINAGE SEPTEMBER 28, 2001

1. The subject draft environmental impact statement report refers to a Preliminary Engineering Report for storm drainage dated September 28, 2001 prepared by Kodani and Associates, Inc. The Preliminary Engineering Report for storm drainage is not considered complete or acceptable. Although it may not be necessary to submit, review, and accept the Preliminary Engineering Report at this time, we certainly hope the completed flood studies with hydrologic and hydraulic maps, data, and calculations are submitted and accepted prior to developing any plans for grading, grubbing and building structures and facilities, especially next to the wetland area.

2. Our Storm Water Runoff Drainage Manual which has been adopted by the County Council on November 28, 2001, requires storm runoff rates be kept to predevelopment levels for projects that exceed 2 acres. Mitigating drainage measures such as detention basins need to be incorporated with the development to keep storm runoff rates to predevelopment levels. Although the Preliminary Engineering Report states that the predevelopment storm runoff levels will be less than the existing conditions, the drainage report is incomplete and needs to be reviewed and approved by the Department of Public Works.

Group 70 International, Inc.
April 30, 2002
Page (2)

3. As stated in the Preliminary Engineering Report, the findings contained are general and preliminary. The Preliminary Engineering Report needs to be submitted for our review and approval.

Thank you for this opportunity to provide our comments. Should you have any questions, please feel free to contact Wallace Kudo of my staff at (808) 241-6620.

Very truly yours,

CESAR C. PORTUGAL
County Engineer

wk

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June 3, 2002

Mr. Cesar C. Portugal, County Engineer
Department of Public Works
County of Kauai
4444 Rice Street
Lihue, Kauai, HI 96766

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Portugal:

Thank you for your letter of April 30, 2002 regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. We have provided the following response to your comments.

1. Your concern regarding the Preliminary Engineering Report for Storm Drainage has been noted. As the proposed project progresses to a more detailed design phase, an updated Engineering Report for Storm Drainage will be prepared and submitted for your review.
2. As applicable, modifications to the conceptual drainage system layout will be in accordance to the County of Kaua'i's Storm Drainage Standards that were adopted after the submittal of the Preliminary Engineering Report for Storm Drainage. The revised report will include a review and recommendation of mitigative drainage measures that upon implementation will maintain storm runoff rates to better than predevelopment levels.
3. Please refer to Point (1).

Your comments and this response letter will be included in the Final EIS (FEIS). We will also forward you a copy of the FEIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
ADMINISTRATIVE ASSISTANT

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RECEIVED
APR 26 2002
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AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
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LIHU'E, KAUA'I, HAWAI'I 96766

April 24, 2002

Jeffrey H. Overton, Chief Environmental Planner
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu Hawaii 96813-4307

RE: Draft Environmental Impact Statement, Ocean Bay Plantation at Hanamaulu

Thank you for the opportunity to review the subject DEIS. As the County of Kauai Bicycle Coordinator my key concern is that the proposed plan does not provide provisions for the Coastal Bike Path identified in the 1994 Bike Plan Hawaii, A State of Hawaii Master Plan (see attachment). A major feature of the path is its "location adjacent to the scenic Kapaa/Lihue coastline". The proposed bikeway is not located adjacent to the scenic coastline and is therefor inconsistent with the master plan.

The Coast Bike Path is more than just a bikeway; it is to be a bike and pedestrian path. The County of Kauai standards of the path are set in the attached Lydgate Park Recreational Path Design & Maintenance Guidelines. The bike/pedestrian path for this project should connect to the existing sugar train bridge on to the South of the property and along the shoreline to the North of the property. Within the property the path should be adjacent to the scenic coastline.

Please call me at 241-6650 if you have any questions.

Sincerely,

Douglas Haigh
Chief, Building Division
County of Kauai Bicycle Coordinator

DH
cc: DCE
Parks & Recreation
Planning

Bike Plan Hawaii

A State of Hawaii Master Plan

(Summary)

April 1994

Highways Division
Department of Transportation
State of Hawaii

Kauai has approximately 3.8 miles of existing bikeways. The Master Plan proposes the development of 173 bikeway miles distributed along both the general circumference of the island as well as in the more urbanized sections of Lihue, Kapaa and in the general thoroughfare along Maluhia Road, Poipu Road, and Lawai Road which leads to Koloa.

Of the 173 future proposed bikeway miles (see Table 2), approximately 103.3 miles would be under the jurisdiction of the State at a cost of $22.5 million, and 63.1 miles would be under the jurisdiction of the County of Kauai at a cost of $15.2 million. Approximately 6.6 future proposed bikeway miles would have to be defined as to the jurisdiction responsible for development and would cost $1.6 million. The total cost of this system would be $39.3 million. The distribution of bikeways include 136.4 miles of bicycle routes, 8.2 miles of bicycle lanes, and 28.4 miles of bicycle paths.

KAPAA

The Kapaa area along the proposed Kuhio Highway bicycle route is heavily developed especially within the town limits. Bicyclists have little or no riding space. In order for future bikeways development, major portions of the roadway would have to be widened along with acquisition of sufficient right-of-way.

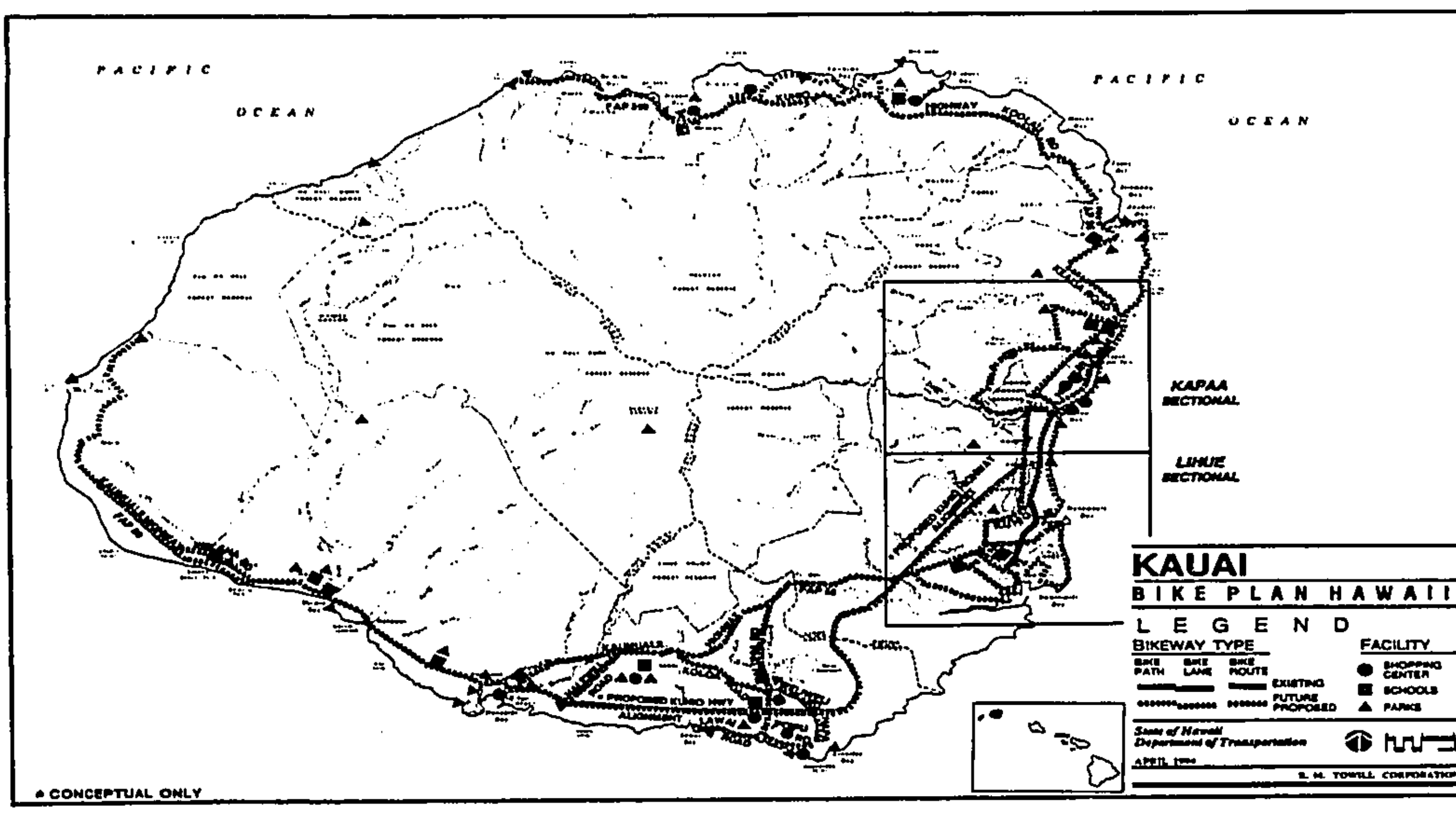
Adjoining the Kapaa to Lihue region there is potential for a coastal bike path which would span approximately 16 miles from Anahola (to the north of Kapaa) to Nawiliwili (adjacent, and to the south of Lihue) along the coastline. Major features of this bike path will be both its length and its location adjacent to the scenic Kapaa/Lihue coastline. This coastal bike path could provide an excellent alternative for bicyclists commuting between Kapaa and Lihue, bypassing many congested and narrow roadway sections.

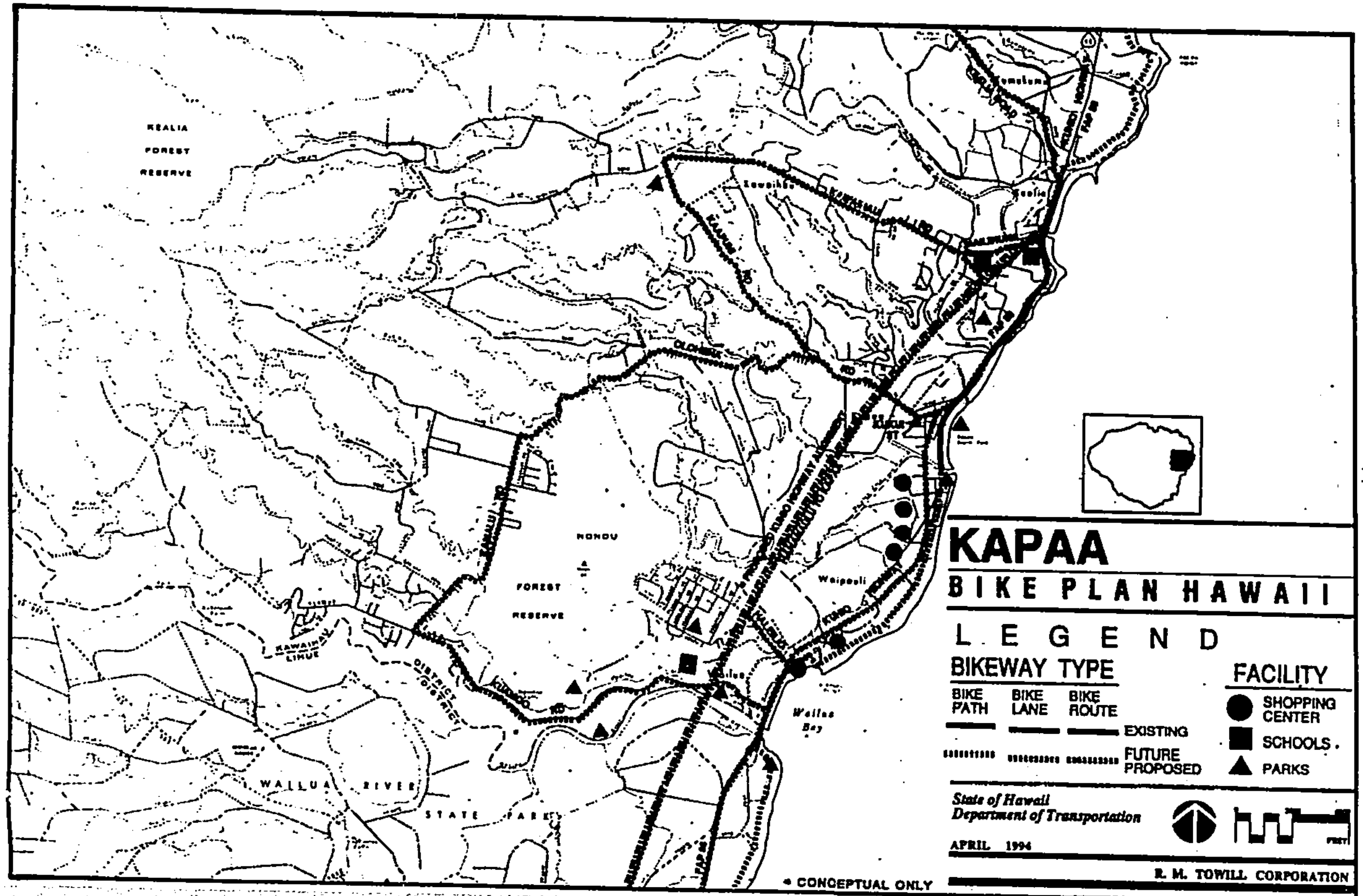
MALUHIA ROAD/POIPU ROAD/LAWAI ROAD

Roadways along the Koloa section of the island are relatively narrow past Maluhia Road on the way towards the Poipu Road/Lawai Road juncture. Major road right-of-way acquisition and possible realignment will be required to provide for sufficient bikeways development.

PRINCEVILLE TO HANALEI BAY, TO HAENA

Access will require special consideration given narrow rights-of-way. This is especially so at Hanalei Valley with its numerous one-lane bridges and narrow roads. The reward of a fully developed bicycling facility in this area, however, will include scenic and rustic views combined with an island ambiance that is unique to Hanalei.





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BIKE ROUTE
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State of Hawaii
Department of Transportation
APRIL 1994
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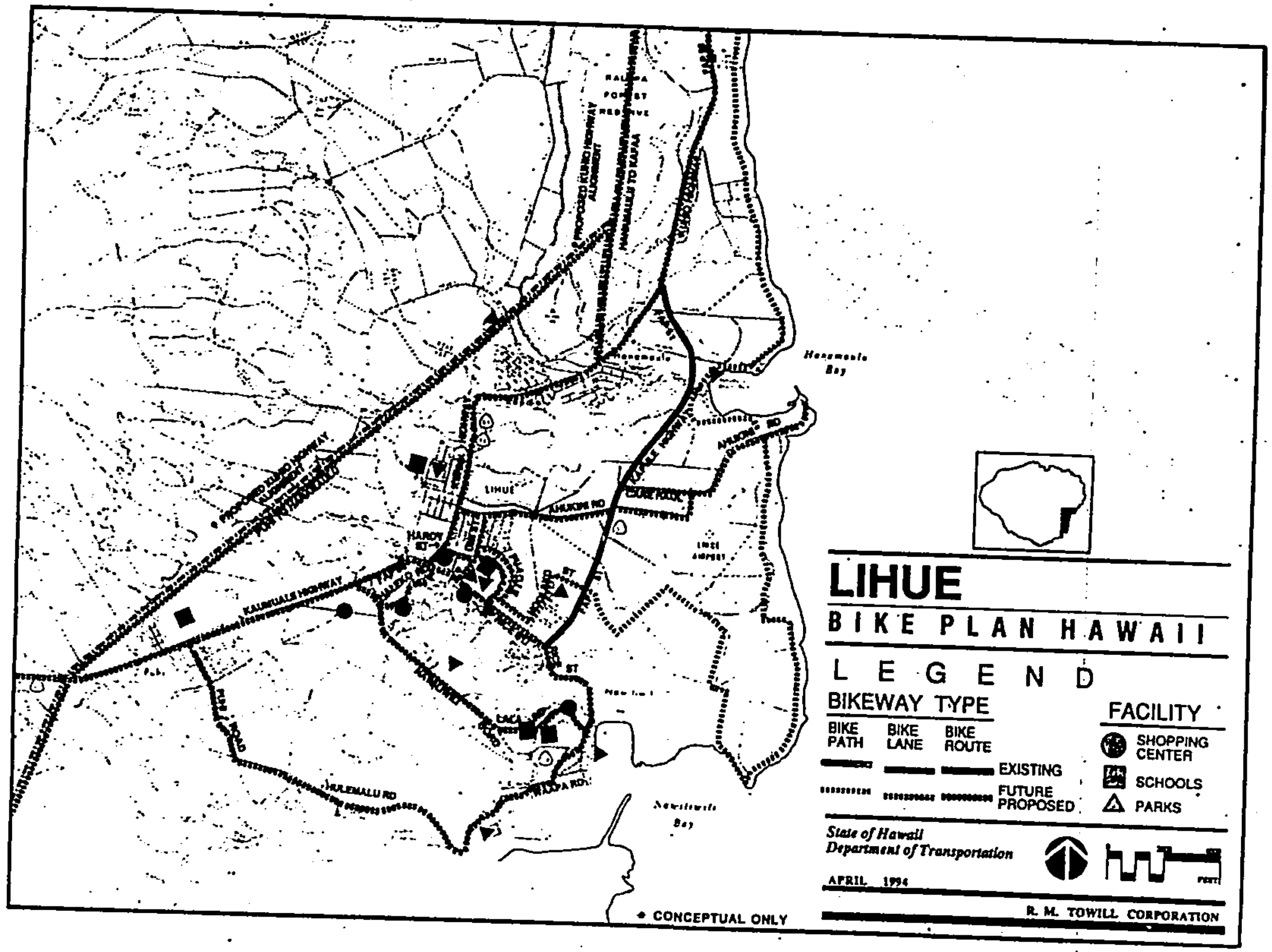
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KAUMUALII HIGHWAY
HULEMALU RD
AHUKINI RD
HARDY ST
LIHUE

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June 3, 2002

Mr. Douglas Haigh, Chief
Building Division
Department of Public Works
County of Kaua'i Bicycle Coordinator
4444 Rice Street
Lihue, Kauai, HI 96766

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Haigh:

Thank you for your letter of April 24, 2002 regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. We have provided the following response to your comments.

As presented in 1994 Bike Plan Hawai'i: A State of Hawai'i Master Plan (BPH), which is currently being updated, the proposed route is only a conceptual plan. However, it is within the jurisdiction of the County of Kaua'i to determine the ultimate route. The route proposed in the BPH considered the use of the existing cane haul roads along the coastline during a time when the property was in the ownership and use of the Līhu'e Plantation Company, Ltd. However, since the closure of the plantation in 2000, the cane haul roads are no longer available for use.

At present, the current owner, EWM Kaua'i, LLC, is proposing a bike plan that will preserve the environmental quality of the property's coastal features while allowing the public to enjoy the project amenities, wetlands, and the coastline. The owner's proposal includes a bike path to be sited along the entire length of the property fronting Kapule and Kūhiō Highways while providing an additional bike path/lane through the project property. The route would traverse the interior section of the project from the main entrance, crossing the wetland area on the north-central portion of the property, and connecting with Kaua'i Beach Drive that leads back to Kūhiō Highway. Vehicular and bicycle routes within the project will provide access to pedestrian accesses that lead to the property's shoreline areas. This viable alternative is currently being reviewed by the State Department of Transportation, Highways Division.

Your comments and this response letter will be included in the Final EIS (FEIS). We will also forward you a copy of the FEIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

DEPARTMENT OF WATER

County of Kauai

"Water has no Substitute – Conserve It!"

April 10, 2002

RECEIVED
APR 15 2002
GROUP 70

Mr. Keith Nitta
Planning Department, County of Kauai
4444 Rice Street, Suite 473
Lihue, HI 96766

Dear Mr. Nitta:

Subject: Draft Environmental Impact Statement (DEIS) Ocean Bay Plantation at Hanamaulu, TMK: 3-7-03:001; 3-9-05:005, Hanamaulu, Kauai.

This is regarding Jeffrey H. Overton's letter of March 19, 2002, transmitting the subject DEIS. The Department of Water has concerns regarding the "Project Description 3.12 Potable Water Supply System" and "Appendix K – Ocean Bay Plantation at Hanamaulu Preliminary Engineering Report for Water" portions of DEIS.

The proposed project is outside of the Department's service area as defined in the Department's General Plan for Domestic Water. The developer will be required to submit a detailed water master plan for the proposed project, for our review and approval.

The Department will require the developer to provide the necessary infrastructure to accommodate the full growth water demands for the proposed development. This shall include but not be limited to additional source and storage facilities along with necessary transmission facilities as approved in the water master plan.

If you have any questions, please contact Mr. Edward Doi of my staff at 245-5417.

Sincerely,

for Ernest Y.W. Lau
Manager and Chief Engineer

cc: Jeff Overton, Group 70 International

ED/
[illegible]

— 4398 Pua Loke Street, Lihue, Kauai, Hawaii or P. O. Box 1706, Lihue, HI 96766-5706 —
Phone No. (808) 245-5400 – Administration FAX No. (808) 246-8628 – Engineering/Fiscal/Shop FAX No. (808) 245-5813

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June 3, 2002

Mr. Ernest Y.W. Lau, Manager and Chief Engineer
County of Kaua'i
Department of Water
P.O. Box 1706
Līhu'e, HI 96766-5706

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Mr. Lau:

Thank you for your letter of April 10, 2002 to the County of Kaua'i Department of Planning regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project. We have provided the following response to your comments.

We again acknowledge your comment that the site of the proposed project is located outside of the Department's current General Plan for Domestic Water Use. As required, the applicant will complete a Water Master Plan for the project and submit this to the Department for review and approval. The Water Master Plan will address the requirements for water source, storage, and transmission facilities as well as any determined infrastructure that is necessary to accommodate the project's water demands.

Your comments and this response letter will be included in the Final EIS (FEIS). We will also forward you a copy of the FEIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton

Jeffrey H. Overton, AICP
Chief Environmental Planner

SIERRA CLUB
Kaua'i Group of the Hawai'i Chapter
Post Office Box 3412
Lihu'e, Kaua'i, Hawai'i 96766

May 6, 2002

RECEIVED
MAY - 8 2002
GROUP 70

Group 70 International, Inc.
925 Bethel Sgtreet, 5th Floor
Honolulu, HI 96813-4307

Draft Environmental Impact Statement Comments
Ocean Bay Plantation Hanama`ulu
TMK: 4-3-7-3:1;4-3-9-5:5 Kaua`i, Hawaii

The Kaua`i General Plan does not provide for development in this area which is designated as Resource and Agriculture. There are no compelling reasons to change the Kaua`i General Plan that was recently approved which involved broad public input during a long deliberated process.

The proposed project does not comply with the Kaua`i General Plan in the following sections:

Section 5- PRESERVING KAUAI'S RURAL CHARACTER

Wide expanses of open lands- natural areas and lands in active cultivation – that provide separation between the towns and communities.

5.1 The Policy Framework for Land Use and Development of the Kaua`i General Plan states:

b. Promote compact urban settlements in order to limit public service costs and to preserve open space.

c. Define and conserve Scenic Roadway Corridors along the roadways that connect Towns, Resort areas, and Residential Communities. These corridors are intended to conserve the open space between towns and to prevent sprawl and commercial strip development.

5.1.2 Policy for Future Growth

e. Expansion contiguous to an existing town or residential community is preferred over a new residential community.

5.2 Agricultural Lands

5.2.1 Policy

a) Lands included within the Agriculture designation shall be predominantly used for or held in reserve to be used in the future for agricultural activities.

b) The primary intent of the Agriculture designation is to conserve land and water resources in order to:

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5.2 Agricultural Lands
5.2.1 Policy

a) Lands included within the Agriculture designation shall be predominantly used for or held in reserve to be used in the future for agricultural activities.
b) The primary intent of the Agriculture designation is to conserve land and water resources in order to:
    1. Insure an excellent resource base for existing and potential agricultural uses;
    2. Promote and preserve open agricultural lands as a key element of Kauai's rural character and lifestyle, essential to its image as "The Garden Island" and to the continued viability and development of Kauai's visitor industry.
c) In administering zoning and subdivision regulations, the County shall seek to preserve important agricultural lands. Important agricultural lands include those designated "A" or "B" by the Land Study Bureau evaluation or "Prime" or "Unique by the Agricultural Lands of Importance Sate of Hawaii evaluation.

f) The primary intent of the Agriculture designation shall take precedence over the secondary intent.

Soil in the proposed area of development is designated at the highest rating of A *prime.*

Rationale for Policy
The policy statement on the Agriculture designation continues Kauai's longstanding policy of preserving agricultural lands as a valuable resource base. ...The primary intent highlights the importance of open agricultural lands in maintaining Kauai's rural character and its economic viability as visitor designation.

5.3 Open Lands
5.3.2.1 Land Use Map
Coastal Areas. Strips of shoreline land around the island are designated Open. Some also lie within the State Conservation District. The intent is to preserve coastal bluffs, sandy beach and other natural features. Typically, these strips range from 150 feet to 300 feet wide, but some are substantially wider where warranted by the topography or natural features of the site.

Section 4 - 4.6.2 Industrial Development.
4.6.3 Policy

a. The County promotes commercial and industrial development on appropriately zoned lands by providing the necessary infrastructure and service

c) Concentrate commercial and industrial development, particularly new shopping centers which attract a large amount of vehicular traffic, in Kauai's major towns and job centers in order to minimize highway traffic and avoid urban sprawl and strip development.

d) Concentrate commercial development in Lihue, other urban centers, and in town centers.

4.2.3.3 Planned Projects and Land Supply
Given the existing supply of Resort-designated land, there is no cause to make major redesignations through the General Plan Update.

Section 6 Enhancing Town & Communities and Providing for Growth
6.3 Lihue
With the previous UMU designations and zoning for two large, masterminded planned projects -the Lihue-Hanamaulu Infill project and Puakea – the County essentially adopted a strategy of focusing Kauai's growth around its main urban center.

6.3.1 Preliminary Planning District Vision
Directing development to the Hanama`ulu-Lihue-Puhi core, the County has maintained open space and important highway views between Puhi and the Knudsen Gap and in the Kalepa Ridge corridor.

We ask that the following concerns and questions regarding the proposed project be addressed in the Final Environmental Impact Statement:

LAND USE – The proposed project would involve an inappropriate use of the land since it is designated Resource and Agriculture. The development would result in the loss of prime agricultural land with Class "A" soil. Upzoning is in major conflict with the Kaua`i General Plan as outlined above.

SPRAWL

The definition of sprawl is approving projects of significant size in areas that do not have existing water supply, waste water treatment facilities, adequate transportation infrastructure or any verifiable need. This is entirely inconsistent with the Kaua`i General Plan.

WATER SUPPLY

General growth in the Lihue/Hanamaulu area is constrained by lack of readily available water resources. The General Plan Update 7.4.2 states, "Water supply in Lihue is constrained by a lack of new groundwater sources. For geological reasons, the Lihue area is not favorable for development of water wells, which typically have been low yielding."

How much water has already been approved for development in other areas of the Lihue district that would draw from the water system? Lihue area which has areas which are designated for residential and resort expansion in the General Plan has also looked to the same area to supply its water. How much growth has been approved of in the Wailua and Kapa`a districts which are depending on the same water system? Existing sources that supply that Wailua Kapa`a area are already overtaxed. This DEIS does not make it clear that these needs exist and could be conflicting with water demands wince this project has not been included in the count's forecast figures.

Is there sufficient water to handle this degree of development for the nearly 500 units and golf course of 590,000 gallons?
How will the 31.4 acres of wetlands be affected?
Is the plan for using effluent for golf course realistic? What is the back up plan? How will it be supervised?

If plans for using effluent or non potable water from onsite wells prove impractical, where would the additional half million gallons of water needed come from? At the driest periods a maximum of 1.1 million gallons of water would be needed.

It appears that the project will be relying heavily on pumping from on site wells which could have an impact on other available water sources. Puhi, Lihue, and Hanamaulu water source availability is rated at capacity according to the County Dept of Water 1998. Wailua Homesteads and Wailua are near capacity.

Developing unregulated water sources such as these proposed irrigation wells pumping at significant levels would not seem to be consistent with protection and wise management of public water resources.

WASTE WATER TREATMENT: Since there is no waste water treatment currently available what are the specific plans for a waste water plan? Who would bear the cost of the construction, and on going maintenance of the system? What kind of wastewater treatment facility will be built? Will an actual wastewater facility be built for all sewage? If so, to what extent will the sewage be treated – primary, secondary, tertiary? Where will it be discharged? If the applicant proposed to discharge it through underground injection well, please disclose how long it takes such effluent to reach the costal waters and the level of contamination.

DRAINAGE AND SLUDGE: Further substantial analysis must be performed to determine the proposed drainage capabilities. Will it meet the standards of a 100-year storm event? Where will sludge be deposited or disposed of?

\

TRANSPORTATION: The proposed project is inconsistent with transportation infrastructure. Major roadway construction that would service the Lihue/Hanama`ulu area is projected to be 20 years in the future. All plans currently on the books to improve the Kuhio and Kapule highways address current needs only, therefore the proposed development over the next 10 years-15 years will negatively impact upon an already overburdened traffic flow.

PUBLIC ACCESS: Mandated legislation for pubic access to the shoreline is not adequately addressed. It does not appear that pubic parking would be conveniently located and public access could only be accomplished by walking over the proposed golf course.

ENDANGERED HAWAIIAN WATER BIRDS: Existing wetlands provide habitat for three endangered water birds Hawaiian. Developer claims in their plans that this area will be enhanced and yet they also propose utilization for several holes of the golf course within the same area. This would not seem to be an appropriate way to allow endangered water birds to feel safe in using the place for nesting and habitat.

WETLANDS: Plans to divert drainage and change surface water flow patterns to accommodate development could impact wetlands quality and are not addressed. Run off of pesticides/ herbicides and fertilizers from proposed golf course would pollute wetlands, which provide critical habitat for endangered waterfowl.

REEF & REEF FISH: Golf Course is proposed along the shoreline and nitrates from fertilizers and pesticide/herbicide residue would endanger the reef as well as reef fish.

GOLF COURSE: Golf Course is proposed to use twice as much water as the over 400 dwelling units. There is already a golf course adjacent to the property, the Wailua Municipal Golf Course, and has plans for future expansion.

PEDESTRIAN/BIKE PATH: The General Plan and the State DOT transportation plans for Kauai designate location of Pedestrian /Bike path to be along the coastline of the island. The proposal does not meet the criteria of specifications of these plans as the developer has the pedestrian/bike path running through the housing development.

Comments submitted by:
Kaua`i Group of the Hawaii Chapter of the Sierra Club Conservation Committee

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June 3, 2002

The Kaua'i Group of the Hawai'i Chapter of the Sierra Club Conservation Committee
Sierra Club, Kaua'i Group of the Hawai'i Chapter
P.O. Box 3412
Līhu'e, HI 96766

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Conservation Committee Members:

Thank you for your letter of May 6, 2002 to the County of Kaua'i Department of Planning regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project.

The County of Kaua'i General Plan (GP), adopted in November 2000, provides the visionary framework that guides the course of planning for specific geographical areas. We believe the various elements that define the proposed Ocean Bay Plantation at Hanamā'ulu project help to achieve the County's vision for the Līhu'e region and the greater island community. As such, we have provided the following responses to your specific comments that address the project's role within the context of the GP.

1. Land Use. The decline of the plantation-operated sugar and pineapple industries has resulted with an extensive supply of available farmlands for diversified agriculture and other land uses. As discussed in Section 5.2.16 of the, and Appendix A to the DEIS, this supply of available agricultural land outweighs the land demand for continuing and expanding island operations in diversified agriculture.

   An amendment to the GP is being requested to redesignate the project area from Agriculture/Open to Residential Community. The project area is contiguous to the Residential Community designated area immediately across Kapule Highway from the project area. Therefore, the redesignation of this property would be consistent with the County's strategy of focusing the growth of the island to occur around its main urban center.

   Plans for the project area include the implementation of a coastal renaturalization plan. This plan will reintroduce appropriate native species of plants to the coastal area, which is currently comprised of a salt-spray buffer of ironwood trees that were planted during the plantation era. The integration of the project's landscape from the coastline to the highway's edge will maintain the visual quality of, and accessibility to the area's natural resources.

2. Sprawl. It is our position that the project is an extension of an existing residential community adjacent to the project area. The project will provide resources or make specific improvements to public infrastructure, such as roadways and water supply, to satisfy the increased demand resulting from the project.

3. Water Supply. The County Department of Water Master Plan 2020, which has been adopted by the State Water Commission, has determined that the existing water storage supply within the 214 service zone, from which the Ocean Bay Plantation project will be serviced, has 590,000 gallons more capacity than the estimated volume required by year 2020. The calculations provided in Appendix K indicate that the project would require 310,000 gallons of storage volume, which is within the limits of the existing system storage capacity.

   Preliminary consultation with the State Department of Health, Safe Drinking Water Branch has confirmed the proposed siting of the injection wells are acceptable subject to installation and performance testing.

4. Wastewater Treatment. Section 5.2.17 (Wastewater Disposal) discusses the proposed wastewater treatment system, which is composed of three main components: a gravity sewer system, a pump station and a force main system, and the wastewater treatment facility. A portion of land on the project area will be set aside for the long-term planning of a Regional Wastewater Treatment Facility.

   During the detailed phase of the project design, further determinations will be made as to the specifications of the wastewater system, which will required review and approval by the State Department of Heath and the County Department of Public Works.

5. Drainage and Sludge. As applicable, modifications to the conceptual drainage system layout will be in accordance to the County of Kaua'i's Storm Drainage Standards that were adopted after the submittal of the Preliminary Engineering Report for Storm Drainage. This revised report will include a review and recommendation of mitigative drainage measures that upon implementation will maintain storm runoff rates to better than predevelopment levels. This revision of the Preliminary Engineering Report will be submitted to the County Department of Public Works for their review and approval.

6. Transportation. As the project progresses to a more detailed design phase, coordination with the State Department of Transportation will be on-going in determining what specific highway improvements and the associated costs will be needed and become the responsibility of the property owner, EWM Kaua'i, LLC.

7. Public Access. As discussed in a revision of Section 3.7 and the Master Plan (Figure 3-1 of the DEIS), four designated public access routes within the project area will provide shoreline access. The provision of these access routes satisfies the requirement to comply with existing State regulations and the recently adopted Bill 1968 by the Kaua'i Council, which is an ordinance that amends Chapter 9 of the Kaua'i County Code.

8. Endangered Hawaiian Water Birds. Further discussion of minimizing impacts to wildlife habitat will be provided in Section 5.2.9 of the FEIS. As presented in Appendix E of the DEIS, any modification to construct golf greens within the delineated wetland will require further consultation with the United States Fish and Wildlife Service under the aegis of the Endangered Species Act of 1973, as amended.

9. Wetlands. Enhancing and maintaining the natural features of the wetland habitat including the area's water quality is an integral part of the overall landscaping plan for the project. As discussed in Section 5.2.5 of the, and Appendices C and O to the DEIS indicate that through the implementation of best management practices and turf uses, the only nutrient in applied fertilizers that has any potential to pass through the thick soil mantle of the project area is nitrogen. It is anticipated that approximately 5.75 pounds per day would be carried downward into the underlying shallow groundwater.

   Given the shallow groundwater flow rate and local rainfall discharge, approximately 0.47 million gallons per day (mgd) of nitrogen-enriched shallow groundwater would end up in the wetlands, where it would be absorbed by existing grasses and other vegetation.

10. Reef and Reef Fish. As discussed in Point (9), nitrogen is the only nutrient that has the potential to pass through the soil mantle of the project area. Approximately 0.16 mgd of nitrogen-enriched shallow groundwater would discharge into the marine environment along the east and south shores of the project site (5,500 feet of shoreline). Given the small nutrient concentration in the large volume of discharged shallow groundwater, no negative effects to the nearby reef ecosystem are anticipated.

11. Golf Course. The owner has expressed an interest to work with the County of Kaua'i in any expansion of the Wailua Golf Course or the

development of a junior golf academy on the abutting property. Treated effluent from the individual wastewater treatment plant will be used to irrigate the golf course, reducing the need for irrigation water.

12. Pedestrian/Bike Path. As presented in 1994 Bike Plan Hawai'i: A State of Hawai'i Master Plan (BPH), which is currently being updated, the proposed route is only a conceptual plan. At present EWM Kaua'i, LLC is proposing a bike plan that will preserve the environmental quality of the property's coastal features while allowing the public to enjoy the project amenities, wetlands, and the coastline.

Your comments and this response letter will be included in the Final EIS (FEIS). We will also forward you a copy of the FEIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

MARYANNE W. KUSAKA
MAYOR

VIRGINIA M. KAPALI
DIRECTOR

COUNTY OF KAUAI
OFFICE OF ECONOMIC DEVELOPMENT
4444 Rice Street, Suite 200, Lihue, HI 96766
Tel: 808-241-6390 Fax: 808-241-6399

COUNTY OF KAUAI
'02 MAY 15 A8:31
PLANNING DEPT.

May 7, 2002

Mr. Dee Crowell, Planning Director
County of Kauai Planning Department
4444 Rice Street
Lihue, HI 96766

ATTN: Keith Nitta, Planner

RE: Draft Environmental Impact Statement
Ocean Bay Plantation at Hanamaulu

Thank you for the opportunity to comment on the Draft EIS for the Ocean Bay Plantation at Hanamaulu.

In review of the Draft EIS, the developer addressed the short and long term impact of job creation in both construction and operations. Their research shows an infusion of 123.4 million in construction spending over a period of 12 years. They further calculated a creation of about 300 new jobs with an annual payroll of over 7.5 million. If the buildout is as such, Ocean Bay Plantation would be a welcomed economic stimulus as a new source of jobs, revenue and expenditures on Kauai.

The new revenue source in terms of direct visitor expenditures, creation of business enterprises, increased property valuation, and increased personal income for our local residents will provide an economy of scale in a rural area. Just as important, the applicant has committed that Ocean Bay Plantations will preserve the historic and cultural value of the property and allow public access with a bikeway and a nature hiking trail.

The Hawaii State Department of Labor and Industrial Relations reported that the County of Kauai's unemployment rate was 5.7 percent in March 2002, a decrease of 0.8 percentage point compared with the February rate of 6.5 percent. Despite this fact, Kauai holds the highest unemployment rate across the State.

With this in mind, we continue to strive and seek solutions to stimulate our island economy and promote job opportunities for Kauai's residents.

Should you have any further questions, please call our office for assistance.

Sincerely,

Virginia M. Kapali

Virginia M. Kapali, Director
Office of Economic Development

GROUP 70

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June 3, 2002

Ms. Virginia M. Kapali, Director
County of Kaua'i
Office of Economic Development
4444 Rice Street, Suite 200
Līhu'e, HI 96766

Subject: Ocean Bay Plantation at Hanamā'ulu
Draft Environmental Impact Statement (EIS) Comment Letter

Dear Ms. Kapali:

Thank you for your letter of May 7, 2002 to the County of Kaua'i Department of Planning regarding your review of the Draft Environmental Impact Statement (DEIS) for the Ocean Bay Plantation at Hanamā'ulu project.

We appreciate the shared sentiment that the Ocean Bay Plantation project represents an opportunity of positive economic growth that recognizes the value of its natural and cultural resources. We believe this project can be an impetus of potential revenue in the creation and establishment of new businesses that provide jobs for the local community and stimulates both local and visitor expenditures.

We acknowledge that a committed effort by both private and public sectors is necessary to find the viable solutions that address the prevalent issues of unemployment and which will nurture the economic vitality for the County of Kaua'i.

Your comments and this response letter will be included in the Final EIS (FEIS). We will also forward you a copy of the FEIS upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP
Chief Environmental Planner

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Section 10.0
REFERENCES

10.0 REFERENCES

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APPENDIX A

Ocean Bay Plantation at Hanamā'ulu: Impact on Agriculture

Decision Analysts Hawai'i

October 2001

Ocean Bay Plantation at Hanama'ulu: Impact on Agriculture

PREPARED FOR:

Group 70 International, Inc.

PREPARED BY:

Decision Analysts Hawai'i, Inc.

October 2001

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Executive Summary

Project Proposal

EWM Kaua'i, LLC (EWM Kaua'i) intends to develop Ocean Bay Plantation at Hanama'ulu, referred to in this report as "the project." This project, which will be located on 465 acres of coastal land to the north of Hanama'ulu Bay, will be a master-planned, mixed-use residential and golf-course community with a small retail commercial center.

About 326 acres (70%) of the project site is fallowed sugarcane land that was formerly cultivated by Lihu'e Plantation which closed in 2000. The remainder of the site contains undeveloped land.

Development of the project will require that the portion of the project site that is in the State Agriculture Districts be changed to the Urban District.

Agricultural Conditions

About 340 acres (73%) of the project site have good farm land. This evaluation is based on the favorable soil conditions and soil ratings, the gently sloping terrain, the mild sunny climate, and available irrigation water. Also, the fields have good access. However, strong on-shore winds and salt spray limit the choice of crops.

Locational Advantages and Disadvantages

In terms of location, farmers in the Hanama'ulu area are competitive when supplying the small Kaua'i market. And compared to other farmers in Hawai'i, they are competitive supplying mainland markets, as long as their products have long shelf-lives and so can be shipped by surface vessel.

However, compared to farmers on O'ahu, they are at a disadvantage supplying the Honolulu market. Furthermore, they are at a disadvantage supplying mainland markets when their products have short shelf-lives and so must be shipped by air.

Impact on Existing Farming Activities

The project will not adversely affect any existing farm operation since none exists on the property.

Impact on the Growth of Diversified Agriculture

The Project commits about 340 acres of good agricultural land to a non-agricultural use. However, this commitment of land is not expected to adversely affect the growth of diversified agriculture in view of the vast amount of former plantation agriculture land that is now available on Kaua'i and Statewide.

Nuisance Issues

For new tenants in the project, future diversified agricultural operations that may locate mauka of Kapule and Kuhio Highways are not likely to cause significant nuisance problems because the project will be (1) upwind from farm operations and (2) homes will be buffered by the golf course. Consequently, no additional measures are needed to mitigate potential nuisance problems.

Offsetting Benefits

While the project will result in the development of some good agricultural land, this loss to agriculture will be offset by the following benefits:

— up to 470 new homes

— over 300 new jobs and over \$7.5 million per year in payroll

— public recreational amenities, including a golf course, a bikeway, and a nature hiking trail.

Consistency with State and County Plans

State and County plans call directly or implicitly for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture. To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured.

With regard to plantation agriculture, development of the project will have no impact on sugarcane or pineapple farms since none exist on the property. Furthermore, Lihue Plantation closed for reasons unrelated to the project.

With regard to diversified agriculture, the project will reduce the availability of agricultural land by a very small amount. However, because of the vast amount of land that has been released from plantation agriculture, ample agricultural land is available on Kaua'i and other islands to accommodate the growth of diversified agriculture.

Regarding policies "...to preserve and protect agricultural lands," discussions in the "Agriculture" portion of the *State Functional Plan* recognize that redesignation of lands from Agriculture to Urban should be allowed "... upon a demonstrated change in economic or social conditions, and where the requested redesignation will provide greater benefits to the general public than its retention in ..." agriculture; that is, when an "overriding public interest exists." The enormous contraction in plantation agriculture—resulting in the supply of agricultural land far exceeding demand—constitutes a major change in economic and social conditions. Furthermore, the proposed project will provide significant housing, employment and recreational benefits.

At the County level, the project is consistent with *The Kaua'i 2020 Vision Statement*, which envisions "... an extension of Lihue town to the ... north, filing in around ... Hanama'ulu."

Thus, the project will not conflict with the major thrust of the plantation-agriculture portions or the diversified-agriculture portions of State plans or County Plans.

OCEAN BAY PLANTATION AT HANAMA'ULU: IMPACT ON AGRICULTURE

INTRODUCTION[1]

EWM Kaua'i, LLC (EWM Kaua'i) intends to develop Ocean Bay Plantation at Hanama'ulu, referred to in this report as "the project." Addressed below are the impacts of the project on agriculture, covering:

- project location and description
- current and nearby land uses
- State and County land classifications
- agricultural conditions of the site
- locational advantages and disadvantages for agriculture
- historic and potential agricultural uses of the land
- the impact of the project on existing farm activities
- the impact of the project on the growth of diversified agriculture
- a discussion of nuisance issues related to agriculture
- benefits of the project that will offset adverse agricultural impacts
- consistency of the project with the agricultural portion of State and County land-use plans.

The Appendix provides additional information on Hawai'i's agricultural land market.

PROJECT LOCATION AND DESCRIPTION[1]

The project site, which covers about 465 acres, lies along the eastern coast of Kaua'i in the Lihu'e District in the *ahupua'a* of Hanama'ulu. The site abuts and lies to the north of Hanama'ulu Bay, and is bounded on its *mauka* side by Kuhio and Kapule Highways, on its north end by Wailua County Golf Course, and its *makai* side by the Radisson Kaua'i Beach Resort and the Pacific Ocean.

Built over a period of 10 to 15 years, the project will be a master-planned community having the following components:

- 18-hole golf course, golf clubhouse, and beach club
- up to 170 single-family house lots, most of which would be 0.5-acre in size but some 0.75 acre
- up to 300 multi-family condominium homes (8 units/acre) built in two areas
- an open-space corridor along the coastline, wetlands and highway buffer
- a bikeway and nature hiking trail
- a small-scale retail commercial center on approximately 8 acres

CURRENT AND NEARBY LAND USES

About 326 acres (70%) of the project site is fallowed sugarcane land that was cultivated by Lihu'e Plantation before it ceased operations in 2000. The remainder of the site contains undeveloped shoreline and drainage areas, and other areas that were not farmed because of poor soils.

Nearby land uses include Hanama'ulu Beach Park and Ahukini Landing (south of the project site), former sugarcane land that is now available for diversified agriculture (on the *mauka* side of Kuhio and Kapule Highways), the Waialua County Golf Course (north of the project site), and Radisson Kaua'i Beach Resort (on the *makai* side of the project site).

LAND CLASSIFICATIONS[1]

Currently, portions of the project site are in three State Land Use Districts: Agriculture (about 382 acres, or 82%), Urban (about 50 acres, or 11%) and Conservation (about 33 acres, or 7%). Development of the project will require that the portion of the site which is in the State Agriculture District be changed to the Urban District. Also, land within the Conservation District will require appropriate sub-zone designation and a Conservation District Use Permit for landscaping.

At the County level, most of the site is zoned as Agriculture and some is zoned as Open Space. Implementation of the project will require an amendment to the *Kaua'i General Plan*, appropriate re-zoning or Project District approvals, and appropriate County permits.

AGRICULTURAL CONDITIONS

Soil Types[2]

The land within the project area consists of fourteen soil types, categorized as follows between higher-quality and lower-quality soils based on SCS Ratings (see below):

		Acres	SCS Rating
Higher-Quality Soils			
LhB	Lihu'e silty clay, 0 to 8% slopes	272	IIe
LIB	Lihu'e gravelly silty clay, 0 to 8% slopes	60	IIe
HnA	Hanalei silty clay, 0 to 2% slopes	10	IIw
Moderate-Quality Soils			
Mta	Mokuleia clay loam, poorly drained variant	26	IIIw
LIC	Lihu'e gravelly silty clay, 8 to 15% slopes	23	IIIe
LhC	Lihu'e silty clay, 8 to 15% slopes	8	IIIe
Mr	Mokuleia fine sandy loam	4	IIIs
KvC	Koloa stony silty clay, 8 to 15% slopes	3	IIIe
KvD	Koloa stony silty clay, 15 to 25% slopes	19	IVe
Lower-Quality Soils			
LhE2	Lihu'e silty clay, 25 to 40% slopes	15	VIe
BS	Beaches	9	VIIIw
rRR	Rough broken land	8	VIIIe
rRO	Rock outcrop	3	VIIIs
Fd	Fill land	7	None

Soil Ratings

Three classification systems are commonly used to rate soils in Hawai'i: (1) Land Capability Grouping, (2) Agricultural Lands of Importance to the State of Hawai'i, and (3) Overall Productivity Rating.

Land Capability Grouping (SCS Rating)[2]

The 1972 Land Capability Grouping by the United States Department of Agriculture Soil Conservation Service (SCS), rates soils according to eight levels, ranging from the highest classification level I to the lowest level VIII.

Assuming that all the land is irrigated, approximately 332 acres (71%) are rated IIe (LhB and LIB) and 10 acres (2%) are IIw (HnA). Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices. The subclassification "e" indicates that the limitation is due to the risk of erosion, while the subclassification "w" indicates limitations due to excess water.

Approximately 34 acres (7%) are rated IIIe (KvC, LhC and LIC), 26 acres (6%) are IIIw (MtA), and 4 acres (1%) are rated IIIs (Mr). Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both. The subclassification "s" indicates severe limitations because of stoniness, unfavorable texture, shallowness, or low water-holding capacity.

Approximately 19 acres (4%) are rated IVe (KvD). Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Approximately 15 acres (3%) are rated VIe (LIB). Class VI soils have very severe limitations that make them unsuitable for cultivation and restrict their agricultural use largely to pasture or range.

Approximately 8 acres (2%) are rated VIIe (rRR). Class VII soils have very severe limitations that make them unsuitable for cultivation and restrict their agricultural use largely to pasture or range.

Approximately 9 acres (2%) are rated VIIIw (BS) and 3 acres (1%) are rated VIIIs (rRO). Class VIII soils and landforms have limitations that preclude their use for commercial plant production, pasture or range.

Finally, about 7 acres (1%) are unrated fill land (Fd).

Agricultural Lands of Importance in the State of Hawai'i (ALISH)[3]

The ALISH ratings were developed in 1977 by the SCS, University of Hawai'i (UH) College of Tropical Agriculture and Human Resources, and the State of Hawai'i, Department of Agriculture. This system classifies land into three categories: (1) Prime agricultural land which is land that is best suited for the production of crops because of its ability to sustain high yields with relatively little input and with the least damage to the environment; (2) Unique agricultural land which is non-Prime agricultural land currently being used for the production of

specific high-value crops; and (3) Other agricultural land which is non-Prime and non-Unique agricultural land that is of importance to the production of crops.

Approximately 343 acres (74%) of the soils in the project site are rated Prime, 62 acres (13%) are rated Other, and about 61 acres(13%) are not rated by ALISH.

Overall Productivity Rating (LSB Rating)[4]

In 1972, the UH Land Study Bureau (LSB) developed the Overall Productivity Rating, which classifies soils according to five levels, with A representing the class of highest productivity and E the lowest.

Approximately 326 acres (70%) of the soils in the project site are rated B by the LSB; 56 acres (12%) are rated C, 28 acres (6%) are rated D, and 55 acres (12%) are rated E.

Summary Evaluation of Soil Quality

These three soil-rating systems indicate that about 340 acres (73%) of the project site has soils that are good for cultivating crops (II or better under the SCS rating, Prime under the ALISH rating, and B or better under the LSB rating).

Soil Characteristics

Consistent with the above soil ratings, the better agricultural lands exhibit a number of favorable characteristics: they are well-suited for tillability, slopes are gentle to moderate (see below), and the soils are moderately fine in texture, not stony, and well-drained.[4] Also, the soils are strongly acid in the surface layer and neutral in the subsoil.[2]

Slopes

As indicated by the soil types discussed above, the better soils have slopes of less than 8%.[2]

Elevation

The project site is at an elevation that ranges from 0 feet to about 80 feet above sea level. At this elevation, the land is suitable for certain low-elevation crops, but it is unsuitable for "high-elevation crops" such as those being grown in Kula (about 2,000) on Maui or Waimea (about 3,00 feet) on the Big Island.

Climatic Conditions

Like other farm areas in Hawai'i, Hanama'ulu has a mild *semi*tropical climate, which is due primarily to three factors: (1) Hawai'i's mid-Pacific location near the Tropic of Cancer, (2) the influence of surrounding warm ocean waters that vary little in temperature between the winter and summer seasons, and (3) the prevailing northeasterly tradewinds which bring air having temperatures that are close to those of the surrounding waters.

Solar Radiation[5]

The area receives moderate sunshine, with an average daily insolation of 450 calories per square centimeter.

Temperatures[6]

Temperatures at Hanama'ulu generally range from 74°F to 85°F in the summer months, and from 65°F to 78°F in the winter months.

Rainfall[6,7]

Average annual rainfall in the area is less than 50 inches per year. Rainfall in the summer averages less than 2 inches per month, and in the winter, it averages over 5 inches per month. Unlike most tropical areas winter, rather than summer, is the rainy season in Hawai'i.

Winds and Salt Spray[7]

The project area is exposed to (1) onshore trade winds averaging about 18 knots and (2) salt spray carried by the wind. The strong winds and salt spay limit the choice of crops.

Irrigation Water

Sugarcane fields within the project site were irrigated with water from Hanama'ulu Ditch.

Road Access

The project site is reached via Kuhio and Kapule Highways.

Summary

About 340 acres (73%) of the project site have good farm land. This evaluation is based on the favorable soil conditions and soil ratings, the gently sloping terrain, the mild sunny climate, and available irrigation water. Also, the fields have good access. However, strong on-shore winds and salt spray limit the choice of crops.

Locational Advantages and Disadvantages

Kaua'i Market

Farmers in the Hanama'ulu area are well-located for servicing the Kaua'i Island market because of the short trucking distance to Lihu'e (less than 3 miles), which is the island's commercial, industrial, distribution and transportation center.

However, the Kaua'i Island market is comparatively small: in 2000, Kaua'i had about 58,463 residents and about 7,159 rooms to house visitors.[8,9]

Honolulu Market

All farmers on Kaua'i are at a disadvantage competing against farmers on O'ahu in supplying the Honolulu market due to the interisland shipping costs, delays and extra handling. Comparing barge and air-cargo service, shipping by barge is less expensive and larger loads can be shipped, but the shipments are slow and infrequent. Air service is faster and frequent, but it is far more expensive, and cargo-hold capacities are limited.

However, the Honolulu market is comparatively large: in 2000, O'ahu had about 876,200 residents and about 36,300 rooms to house visitors.[8,9]

Mainland Market

Compared to Hawai'i, the mainland market is enormous: in 2000, the U.S. had a total population of 281.4 million people.[8] In supplying this market with products that can be carried by container ship because they have long shelf-lives (e.g., canned fruit), farmers on Kaua'i are competitive with farmers on O'ahu and other islands. Even though freight from Kaua'i must first be barged to Honolulu then transferred onto a container ship, Matson's overseas shipping service includes interisland barge service at no additional fee: except for some minor port charges, Matson charges a common fare for all islands.[10]

In the case of fresh products that must be shipped by air to the mainland because of their short shelf-lives, farmers on Kaua'i are at a disadvantage compared to farmers on O'ahu because most mainland air cargo is shipped via Honolulu International Airport. Compared to farmers on O'ahu, Kaua'i farmers encounter additional costs, delays and handling for interisland air-cargo service and for transferring the fresh products from small interisland aircraft to large overseas aircraft.

Summary

In terms of location, farmers in Hanama'ulu are competitive when supplying the small Kaua'i island market. And compared to other farmers in Hawai'i, they are competitive supplying mainland markets, as long as their products have long shelf-lives and so can be shipped by surface vessel.

However, compared to farmers on O'ahu, they are at a disadvantage supplying the Honolulu market. Furthermore, they are at a disadvantage supplying mainland markets when their products have short shelf-lives and so must be shipped by air.

HISTORIC AND POTENTIAL AGRICULTURAL USES

Since before 1890 until 2000, about 326 acres (70%) of the land in the project area were used for growing sugarcane, but the fields are now follow. Aside from sugarcane, other crops that can be grown at the site include a variety of tropical fruits, vegetables, herbs, and foliage and nursery products.

IMPACT ON EXISTING FARM ACTIVITIES

The project will not adversely affect any existing farm operation since none exists on the property.

IMPACT ON THE GROWTH OF DIVERSIFIED AGRICULTURE

The project will commit about 340 acres of good agricultural land to a non-agricultural use (see "Agricultural Conditions" above). However, this commitment will not adversely affect the growth of diversified agriculture. This conclusion is based on the following findings from Appendix A:

— Ample land is available for diversified agriculture

A vast amount of land has been released from plantation agriculture (about 236,200 acres since 1968), and this release of land has far outpaced the demand for land for diversified crops (an increase of about 38,500 acres over this same period). While some of the released land has been converted or is scheduled to be converted to non-agricultural uses, most of it remains available for diversified crops. Thus, ample land is available on Kaua'i, O'ahu, and other islands to accommodate the growth of diversified agriculture.

— Land is not the limiting factor to the growth of diversified agriculture

Consistent with the above, the limiting factor to the growth of diversified agriculture is *not* the *land supply*, but rather the *size of the market* for crops that can be grown *profitably* in Hawai'i.

These findings also apply to Kaua'i. Since 1971, the contraction and eventual closure of Kilauea Sugar Co., McBryde Sugar Co., Ltd., Kekaha Sugar Co., Ltd., and The Lihue Plantation released about 46,100 acres.[11]

With regard to the project, it will involve the loss of far too little good agricultural land to adversely affect the availability of land to farmers on Kaua'i or in other parts of the State, or to adversely affect the growth of diversified agriculture in Hawai'i.

NUISANCE ISSUES

Nuisances arising from farm operations can become an issue for residents and store operators as well as for farm operators. Some residents and store operators who are close to and downwind from farming operations may complain about occasional noise, dust, chemical spraying, odors, etc. In turn, farmers may have to change their operations in order to address these complaints.

However, for new tenants in the project, future diversified agricultural operations that may locate mauka of Kapule and Kuhio Highways are not likely to cause significant nuisance problems because the project will be (1) upwind from farm operations and (2) homes will be buffered by the golf course.

In view of the above, no additional measures are needed to mitigate potential nuisance problems.

OFFSETTING BENEFITS

While the project will result in the development of some good agricultural land, this loss to agriculture will be offset by the following benefits:

— up to 470 new homes;

— over 300 new jobs and over $7.5 million per year in payroll (based on retail space estimated at 25% of gross area, 2.5 jobs per 1,000 square feet of retail space, 50 jobs at the golf course, 50 jobs to service homes and maintain grounds, and an average of $25,000 per job); and

— public recreational amenities, including a golf course, a bikeway, and a nature hiking trail.

This compares with sugar operations that supported about 11 jobs when the area was under cultivation.

CONSISTENCY WITH STATE AND COUNTY PLANS

The *Hawai'i State Constitution*, the *Hawai'i State Plan*, the *State Agriculture Functional Plan*, and *The Kaua'i 2020 Vision Statement* call directly or implicitly for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture.[12-15] To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured.

With regard to plantation agriculture, development of the project will have no impact on sugarcane or pineapple farms since none exist on the property. Furthermore, Lihue Plantation closed for reasons unrelated to the project.

With regard to diversified agriculture, the project will reduce the availability of agricultural land by a small amount. However, because of the vast amount of land that has been released from plantation agriculture since the late 1960s, ample agricultural land is available on Kaua'i and other islands to accommodate the growth of diversified agriculture.

Regarding policies "...to preserve and protect agricultural lands," discussions in the "Agriculture" portion of the *State Functional Plan* recognize that redesignation of lands from Agriculture to Urban should be allowed "... upon a demonstrated change in economic or social conditions, and where the requested redesignation will provide greater benefits to the general public than its retention in ..." agriculture; that is, when an "overriding public interest exists."[14] The enormous contraction in plantation agriculture—resulting in the supply of agricultural land far exceeding demand—constitutes a major change in economic and social conditions. Furthermore, the proposed project will provide significant housing, employment and recreational benefits (see above).

At the County level, the project is consistent with *The Kaua'i 2020 Vision Statement*, which envisions "... an extension of Lihue town to the ... north, filling in around ... Hanama'ulu."

In summary, the project will not conflict with the major thrust of the plantation-agriculture portions or the diversified-agriculture portions of State plans or County Plans.

REFERENCES

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Appendix A
Hawai'i's Agricultural Land Market

Introduction

Presented below is an overview of the agricultural land market in Hawai'i. The discussion includes the release of land from plantation agriculture (i.e., sugarcane and pineapple), the growth in land requirements for diversified crops (i.e., all crops other than sugarcane and pineapple), and the availability of land for diversified crops.

Release of Land from Plantation Agriculture

Because Hawai'i's sugar and pineapple industries have contracted substantially over the past three decades, an enormous and growing supply of farm land is available for diversified agriculture and other land uses. Since 1968, land in plantation agriculture has declined from about 305,900 acres to about 69,700 acres in 2000, for a 32-year decrease of about 236,200 acres (an average decrease of about 7,400 acres per year).[1,2]

On Kaua'i, the contraction and eventual closure of Kilauea Sugar Co., McBryde Sugar Co., Ltd., Kekaha Sugar Co., Ltd., and The Lihue Plantation released about 46,100 acres since 1971.[3]

Growth in Land Requirements for Diversified Crops

Land requirements to accommodate the growth of diversified crops are modest compared to the available supply. As plantation agriculture was contracting, Statewide land requirements for diversified crops grew from 21,600 acres in 1968 to 60,100 acres in 2000, for a 32-year increase of 38,500 acres (an average increase of 1,200 acres per year).[1,2]

Although a great many crops can be grown in Hawai'i's year-round subtropical climate, the modest growth in land requirements for diversified crops reflects the fact that few of them can be grown profitably on a large scale. The primary reasons for this are given below.[4]

- Hawai'i's subtropical climate is not well-suited to the commercial production of major crops that grow better in the temperate mainland climates.
- For certain crops, special hybrids adapted to Hawai'i's subtropical climate are yet to be developed.
- Crop pests are more prevalent and more expensive to control in Hawai'i than they are on the mainland where the cold winters kill many pests.
- Fruit-fly infestations prevent exports of many crops, or require expensive treatment.
- Most soils in Hawai'i have low nutrient levels and therefore require high expenditures for fertilizer.
- Hawai'i suffers from high farm-labor costs, largely because the agriculture industry must compete against the visitor industry and related industries for its labor.
- High overseas transportation costs increase the cost of importing agricultural supplies and equipment and, for export crops, shipping produce to market.
- For a number of crops, consumption volumes in Hawai'i are too small to support large, efficient farms.
- Hawai'i farmers must compete against highly efficient mainland and foreign farms which, in a number of cases, can deliver produce to Hawai'i more cheaply than can be done locally because these farms incur lower costs for land, labor, supplies, fertilizer, pest control, equipment, etc. Furthermore, many of them benefit from large volumes and economies of scale.

In short, the limiting factor to the growth of diversified agriculture is *not* the *land supply*, but rather the *size of the market* for those crops which can be grown *profitably* in Hawai'i.

AVAILABILITY OF LAND FOR DIVERSIFIED AGRICULTURE

As indicated above, a vast amount of land has been released from plantation agriculture, and this release of land has far outpaced the demand for land for diversified crops. As a result, the amount of land in crops has declined from about 327,500 acres in 1968 to an estimated 129,800 acres in 2000, for a net release of about 197,700 acres (an average decrease of about 6,200 acres per year).[1,2]

Some of this land has been or is scheduled to be converted to urban, forestry or other uses. But, the majority of the 197,700 acres remains available for diversified crops. Much of this land is fallow, is used for grazing, or is in some other low-value land-holding operation. A major issue Statewide is how to use productively the vast amount of high-quality agricultural land that has become available.

On Kaua'i, most of the 46,100 acres that were released from sugar cultivation remain available for diversified agriculture.

Similarly, agricultural lands remain available on O'ahu, Maui, Moloka'i, Lana'i and the Big Island. On O'ahu, most of the 22,500 acres released from sugar production during the 1990s remain available. Fields in Kunia and 'Ewa are regarded as among the best farm land in the State, based on the high solar radiation, high-quality soils, and the short trucking distance to the large Honolulu market and, for export markets, to the Honolulu International Airport and Honolulu Harbor.[5] These lands have been leased, but markets for crops grown on the land are still being developed.[6] On the North Shore, various crops are being explored, but most of the former sugarcane land remains fallow.[7,8]

SUMMARY

In summary, ample land is available on all islands to accommodate the growth of diversified agriculture. Furthermore, the limiting factor to the growth of diversified agriculture is *not* the *land supply*, but rather the *size of the market* for crops that can be grown *profitably* in Hawai'i.

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APPENDIX B

Ocean Bay Plantation at Hanamā'ulu Preliminary Engineering Report for Storm Drainage

Kodani and Associates, Inc.

September 2001

OCEAN BAY PLANTATION
AT HANAMA'ULU
PRELIMINARY ENGINEERING REPORT
FOR STORM DRAINAGE
September 28, 2001

Kodani and Associates, Inc.
3145 Akahi Street
Lihue, HI 96766

OCEAN BAY PLANTATION
AT HANAMA'ULU
PRELIMINARY ENGINEERING REPORT
FOR STORM DRAINAGE
September 28, 2001

STANFORD M. IWAMOTO
LICENSED PROFESSIONAL ENGINEER
No.5738-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Signature

Kodani and Associates, Inc.
3145 Akahi Street
Lihue, HI 96766

INTRODUCTION

This engineering report was prepared in conjunction with EWM Kauai, LLC's preparation and processing of an Environmental Impact for the 460-acre Ocean Bay Plantation at Hanama'ulu on the Island of Kauai. The location of the project site is shown on Figure No. 1.

EWM Kauai, LLC intends to develop the subject property to provide a mixed-use residential and golf course community on their 460-acre coastal parcel in Hanamā'ulu, Kaua'i. The project will include a small retail commercial center at its access to Kuhio Highway. Ocean Bay Plantation at Hanama'ulu will be master-planned community serving the U.S. mainland, international, and local Kaua'i and Hawai'i markets for single-family custom homes and quality multi-family housing.

A critical requirement that should be addressed for any planned community is to assess and mitigate, if necessary, any adverse drainage impacts to neighboring and downstream properties caused by the development of the planned community. This report will determine and then compare the existing and future storm runoff flows and drainage patterns at the project site. This report will then evaluate the impacts of any additional runoff from the site generated during major storms on downstream properties and waterways. A preliminary layout of the on-site drainage system for capturing and routing runoff from minor storms will also be developed. Finally, this report will analyze the potential for soil erosion and sediment loss during the various development stages of the Master Planned Community.

The analysis and findings contained herein are at a general concept level and reflect the preliminary nature of EWM Kauai. LLC's proposals at this early stage of the planning process.

PROJECT DESCRIPTION

The proposed components of the Master Plan for Ocean Bay Plantation at Hanama'ulu include:

- 18-hole golf course and golf clubhouse.
- 49 lots for single-family homes (0.75 acre lots).
- 16 lots for single-family homes (0.5-acre lots).
- Up to 300 multi-family condominium homes (8 units/acre) built in two areas
- Up to 100 single-family house lots on 55 acres (0.5-acre lots)
- An open space corridor along the coastline, wetlands and highway buffer.
- A small-scale retail commercial center on approximately 8 acres

The Ocean Bay Plantation at Hanama'ulu Master Plan is included as Figure No. 2.

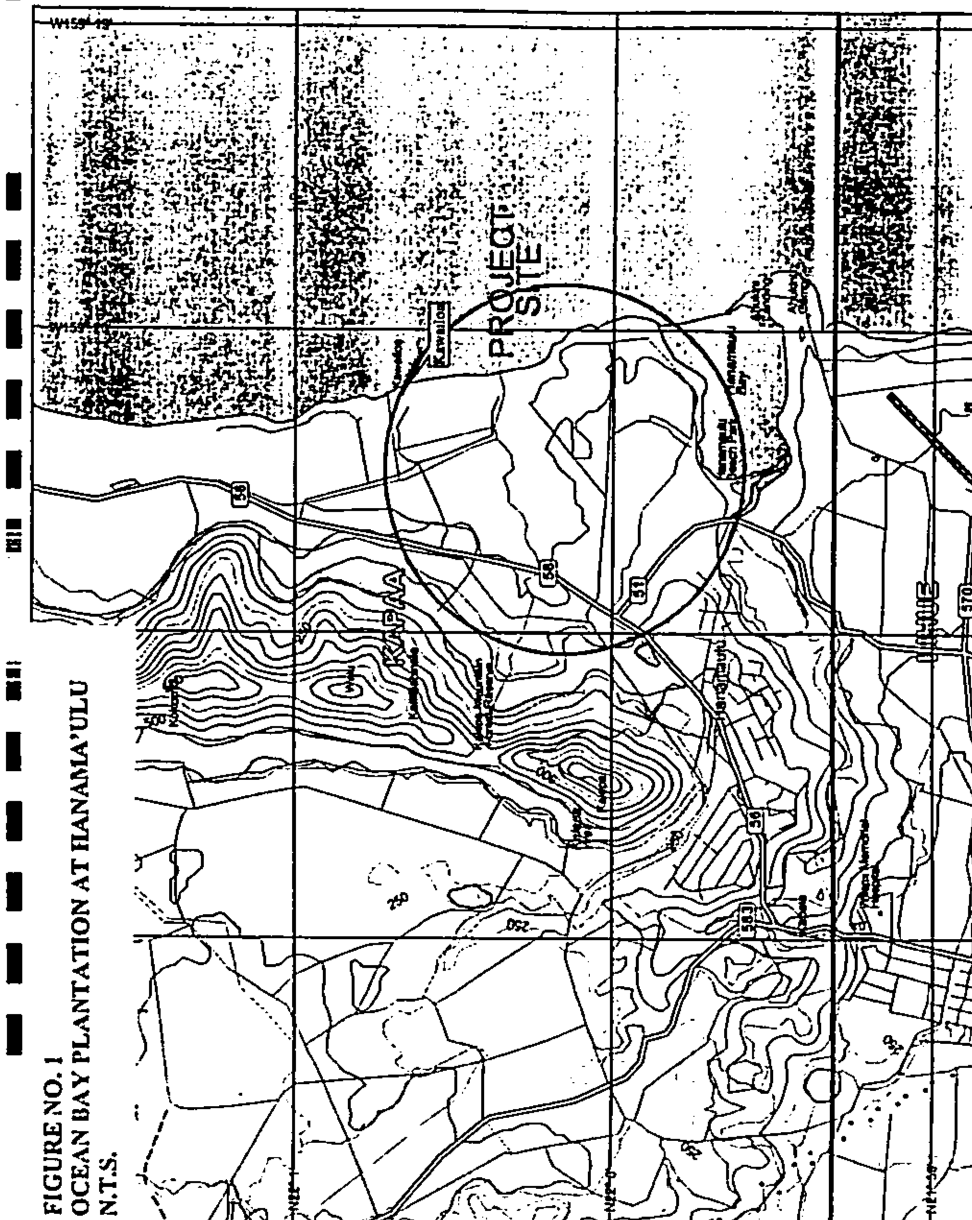

FIGURE NO. 1
OCEAN BAY PLANTATION AT HANAMA'ULU
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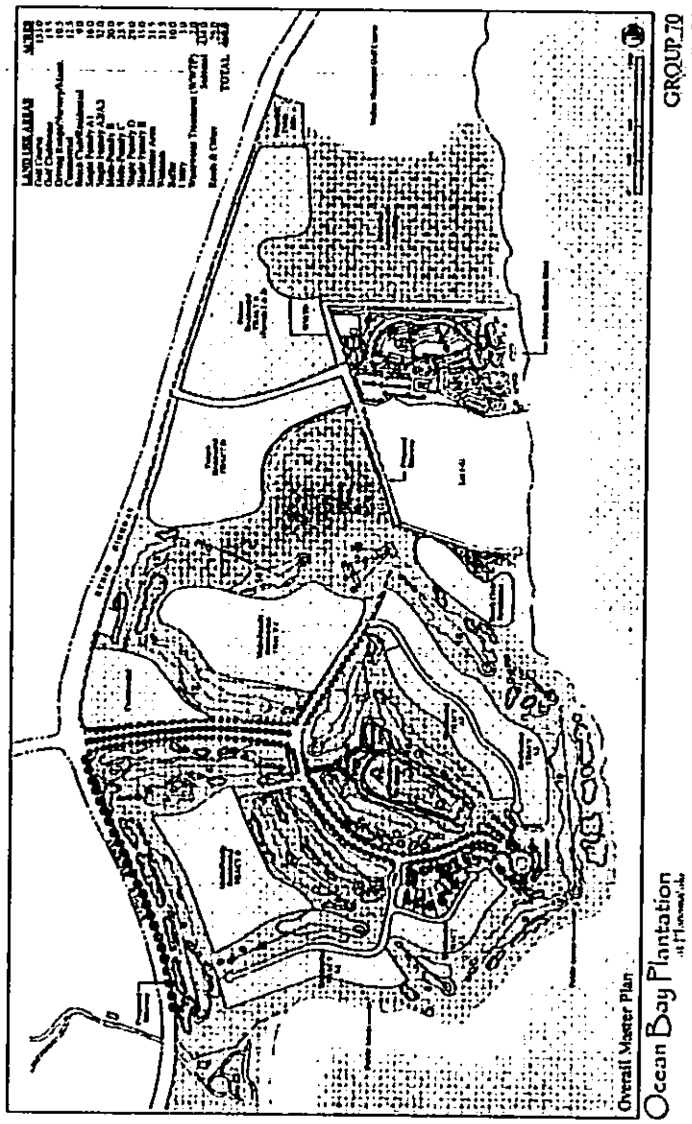

FIGURE NO. 2
OCEAN BAY PLANTATION AT HANAMA'ULU
MASTER PLAN

METHODOLOGY

Hydrology calculations were performed by using the Soil Conservation Services, SCS, TR-55 Method (Urban Hydrology for Small Watersheds). For the 100-year 24-hour storm, a rainfall intensity of 17.5 inches was used. The soil within the Ocean Bay Plantation at Hanama'ulu is Lihue Soil, a type "B" soil classification. The following Runoff Coefficients were used in the calculations of peak discharge flows:

Sugar Cane (Straight Row) Ratoon = 78
Brush (Good) = 55
Brush (Poor) = 66
Flood Plain = 58
Golf Course = 61
Single Family (0.5 acre lots) = 68
Single Family (0.75 acre lots) = 69
Multi-Family = 85
Commercial = 92
Roads and Shoulders = 85

The value for the Ratoon Sugar Cane Fields, Cn = 78, was used for the abandoned sugar cane fields. The fields had been untended for almost a year and provided less than 50% ground cover.

STORM RUNOFF

With the development of the Ocean Bay Plantation at Hanama'ulu, the abandoned sugar cane fields will be transformed into a golf course and clubhouse, homes, stores, and roads. This transformation will have a mixed result on storm runoff from the project site. While an increase in impermeable areas may result in the generation of additional runoff, the replacement of many acres of abandoned sugar cane fields with a well maintained golf course will result in a decrease of storm runoff. This report will calculate the quantities of runoff generated under existing and proposed conditions and determine the impact that any additional flows may have on downstream areas.

EXISTING DRAINAGE CONDITIONS. The land used to build the proposed Ocean Bay Plantation at Hanama'ulu is presently covered with abandoned sugar cane fields resulting from the the closing of Amfac Kauai's sugar operations in 2000 The cane fields are no longer irrigated and vegetation on the fields is sparse providing little or no ground cover. Running through the center of the project site is a wetlands area which receives runoff from mauka of the highway. The drainage areas which make up the Ocean Bay Plantation at Hanama'ulu are shown on Figure Nos. 3 and 4, Drainage Area Maps, Present Condition and are briefly described below.

Drainage Area A consists of the area mauka of Kuhio Highway extending to the ridge line of Kalepa Ridge and the wetlands area makai of the highway. Kuhio Highway provides an effective barrier that stops runoff from entering other drainage areas directly makai of the highway. Runoff is routed along the highway to a low point in the road where twin 108" culverts route the runoff to the wetland area below. Drainage Area A consists of Kuhio Highway, abandoned sugar cane fields mauka of the highway, areas of brush on Kalepa Ridge, the wetlands area, and hillside areas adjacent to the wetland.

Drainage Area B is located just south of the wetlands and consists of abandoned sugar cane fields. Runoff from this drainage area is to the wetlands area.

Drainage Area C is located south of Drainage Area B in the middle of the plateau. Runoff from this area is to a small cove on the east side of the project site. This area also consists of abandoned sugar cane fields.

Drainage Areas D, E, and F are located on the perimeter of the southern plateau. All of these areas contain abandoned sugar fields and runoff sheet flowing directly to the ocean

Drainage Areas G and H are located north of the wetlands between Kuhio Highway and the Radisson Kauai Resort hotel. These areas also contain abandoned sugar cane fields with runoff flowing either to the wetlands area or to a drainage canal just mauka of the hotel property.

Peak discharge rates shown are for the 100-year 24-hour storm and were calculated using the SCS's TR-55 with calculations included for review in Appendix A.

FUTURE DRAINAGE CONDITIONS The development of EWM Kauai's Ocean Bay Plantation at Hanama'ulu Master Planned Community will result in a change in the basic characteristics of land within the project site. Impermeable area will be added with the construction of buildings and roads and much of the abandoned sugar cane fields will become part of a new golf course. Existing drainage patterns will basically remain the same with only minor changes in the areas of each drainage basin. Changes in each of the drainage areas are discussed below.

Drainage Area A will not be impacted by the development. The areas mauka of the highway are not part of this project and wetland areas makai of the highway will not be developed.

Drainage Area B will include portions of the golf course, multi-family housing, commercial buildings, and roadway areas. Runoff will still flow to the wetlands area.

Drainage Area C will include portions of the golf course, a golf clubhouse and driving range, both single family and multi family units, and roadway areas. Runoff will continue to be routed to the cove.

Drainage Area D, E, and F will include consist primarily of golf course areas with small pockets of single-family residences.

Drainage Area G and H will consist of single-family residences.

A more detailed breakdown of the land use characteristics for each drainage area can be found in Appendix B in the calculations for the composite Runoff Curve Numbers for each drainage area.

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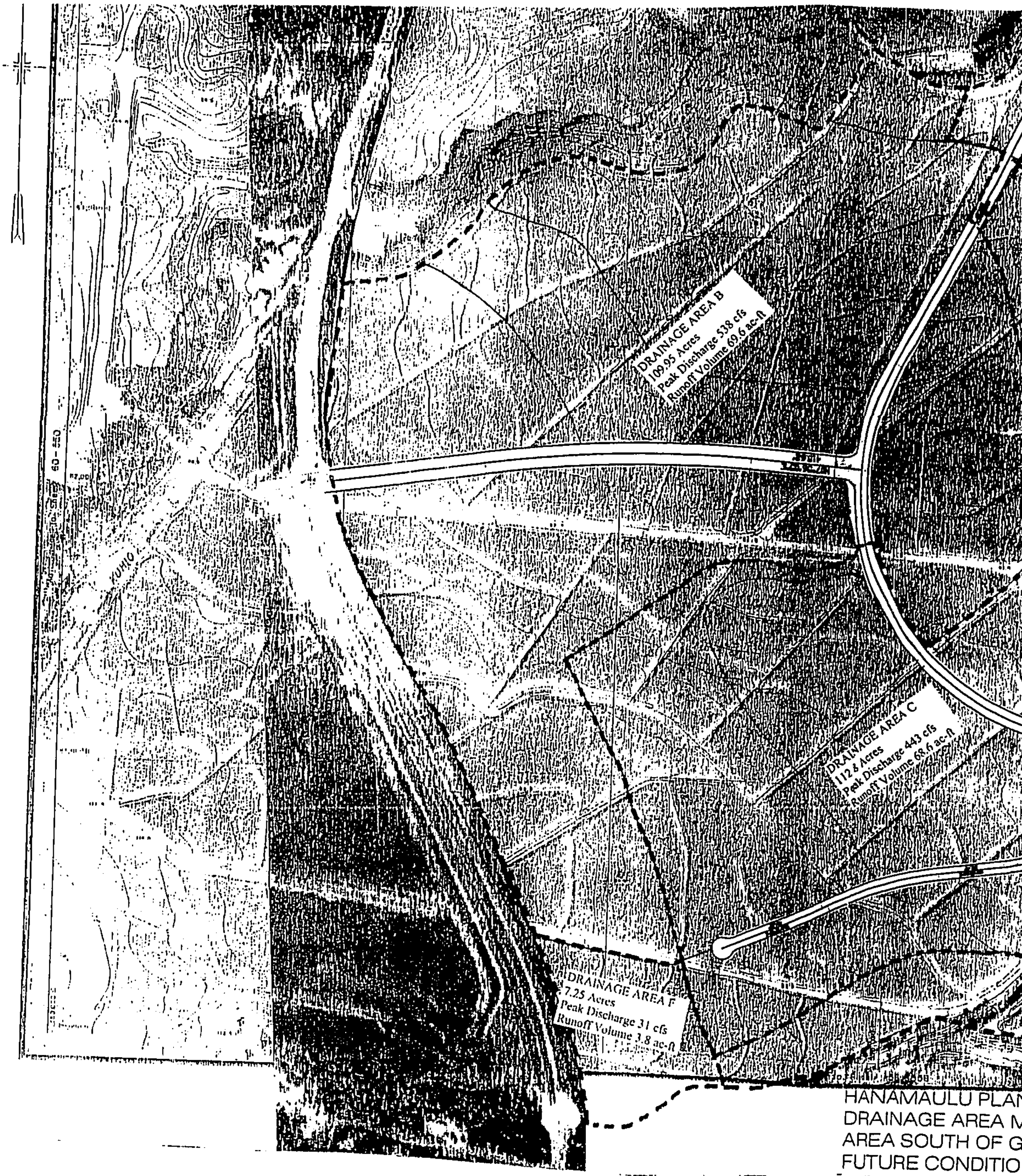

HANAMAULU PLAN
DRAINAGE AREA M
AREA SOUTH OF G
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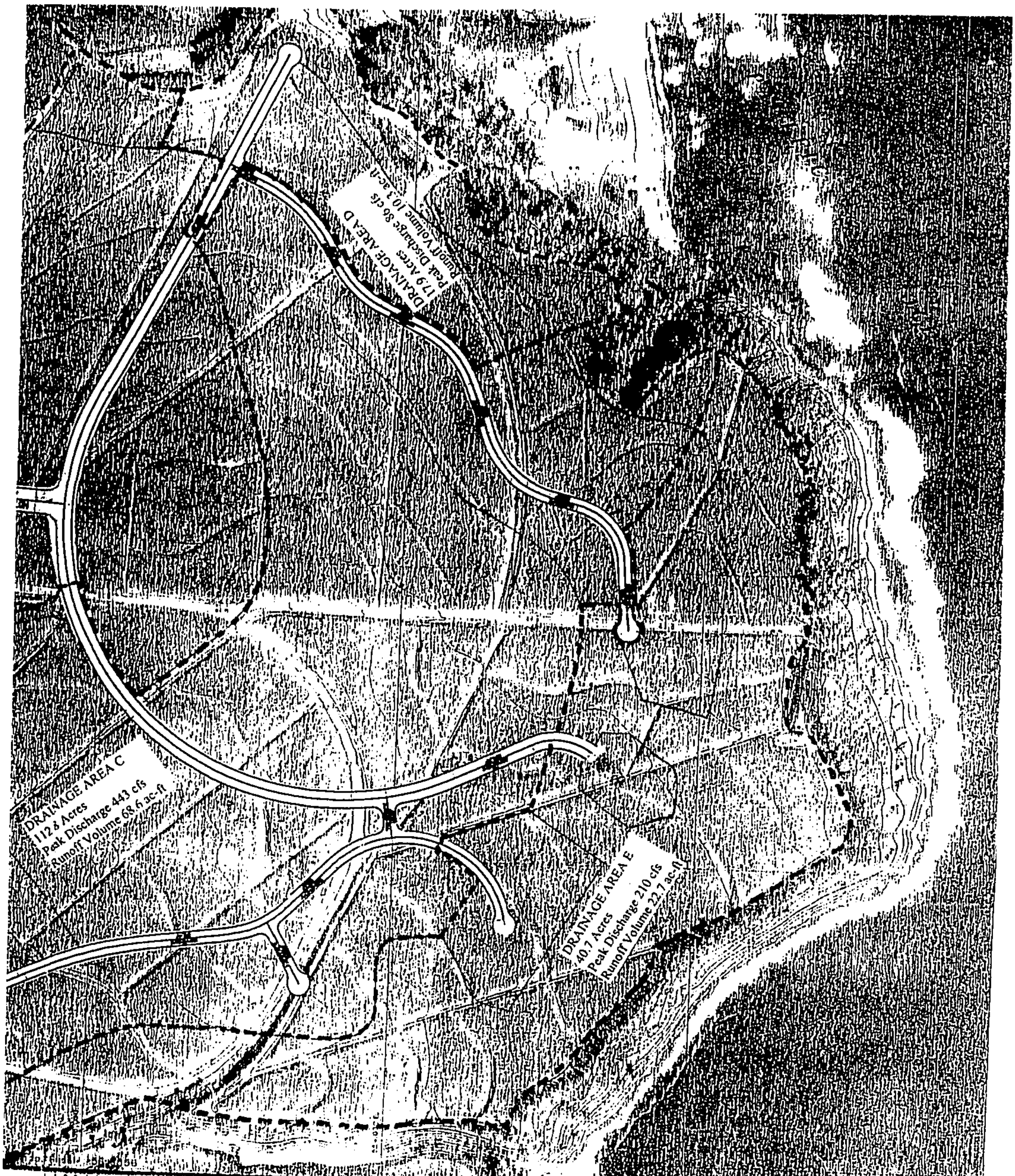

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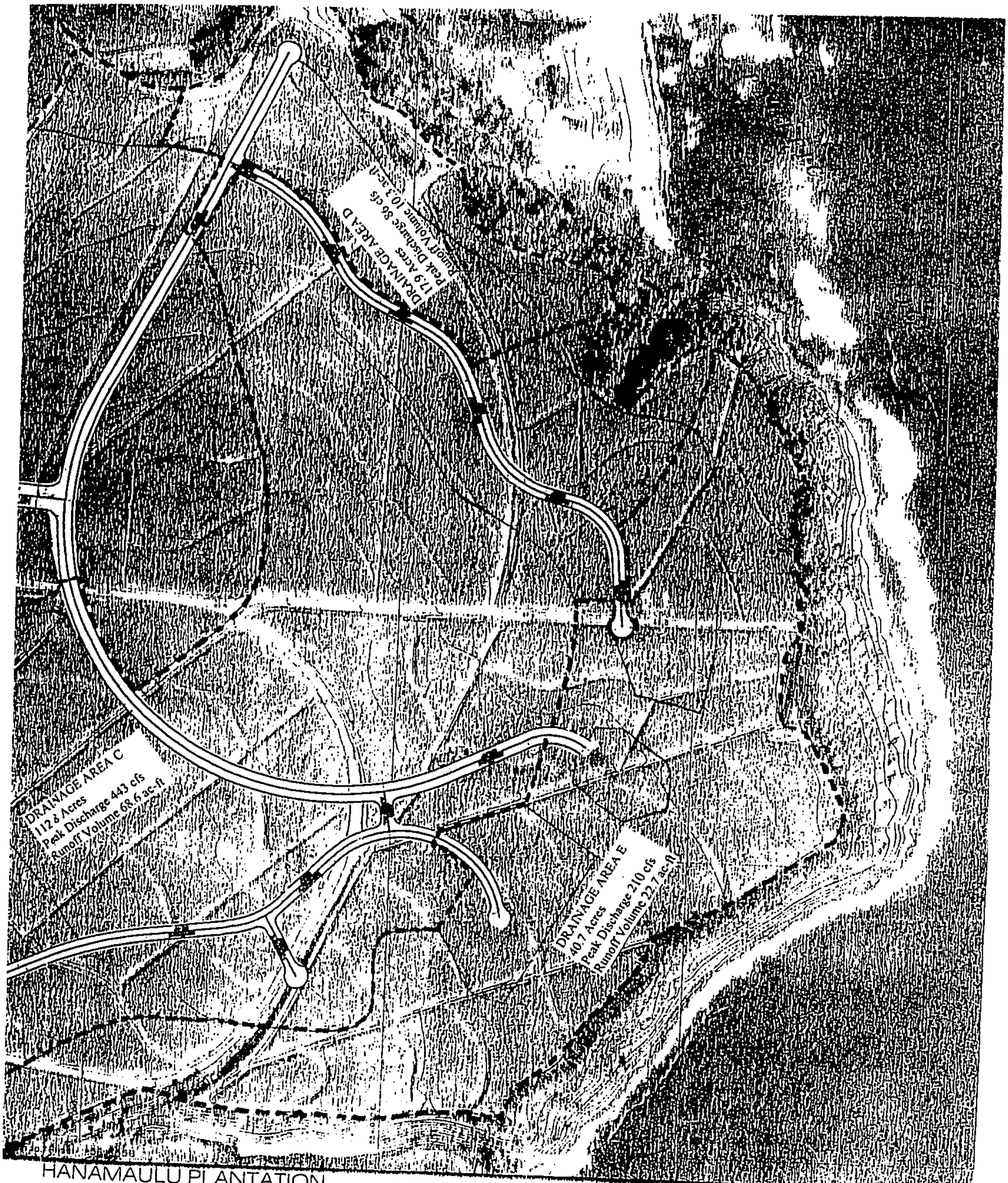

HANAMAULU PLANTATION
DRAINAGE AREA MAP
AREA SOUTH OF GULLY
FUTURE CONDITION

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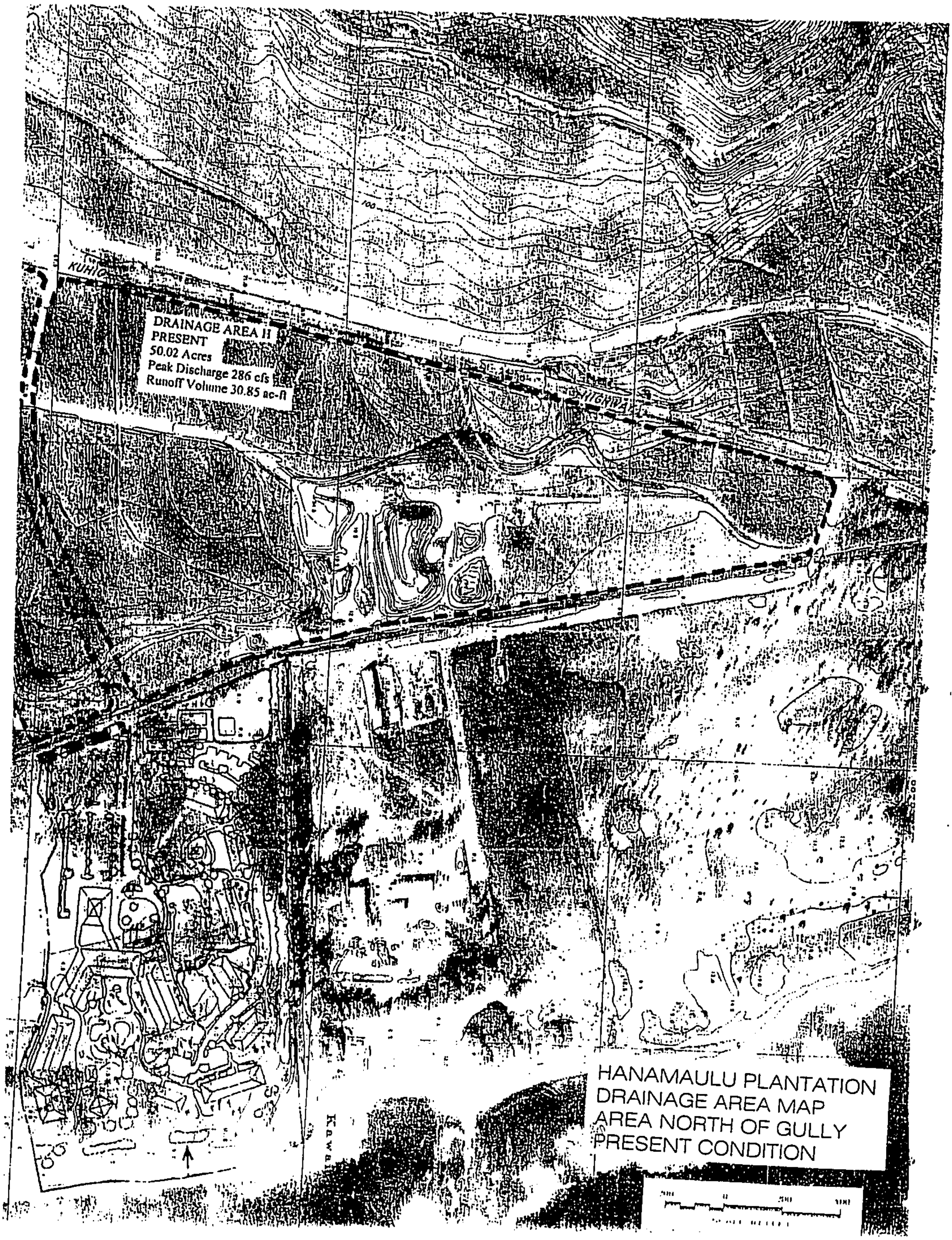

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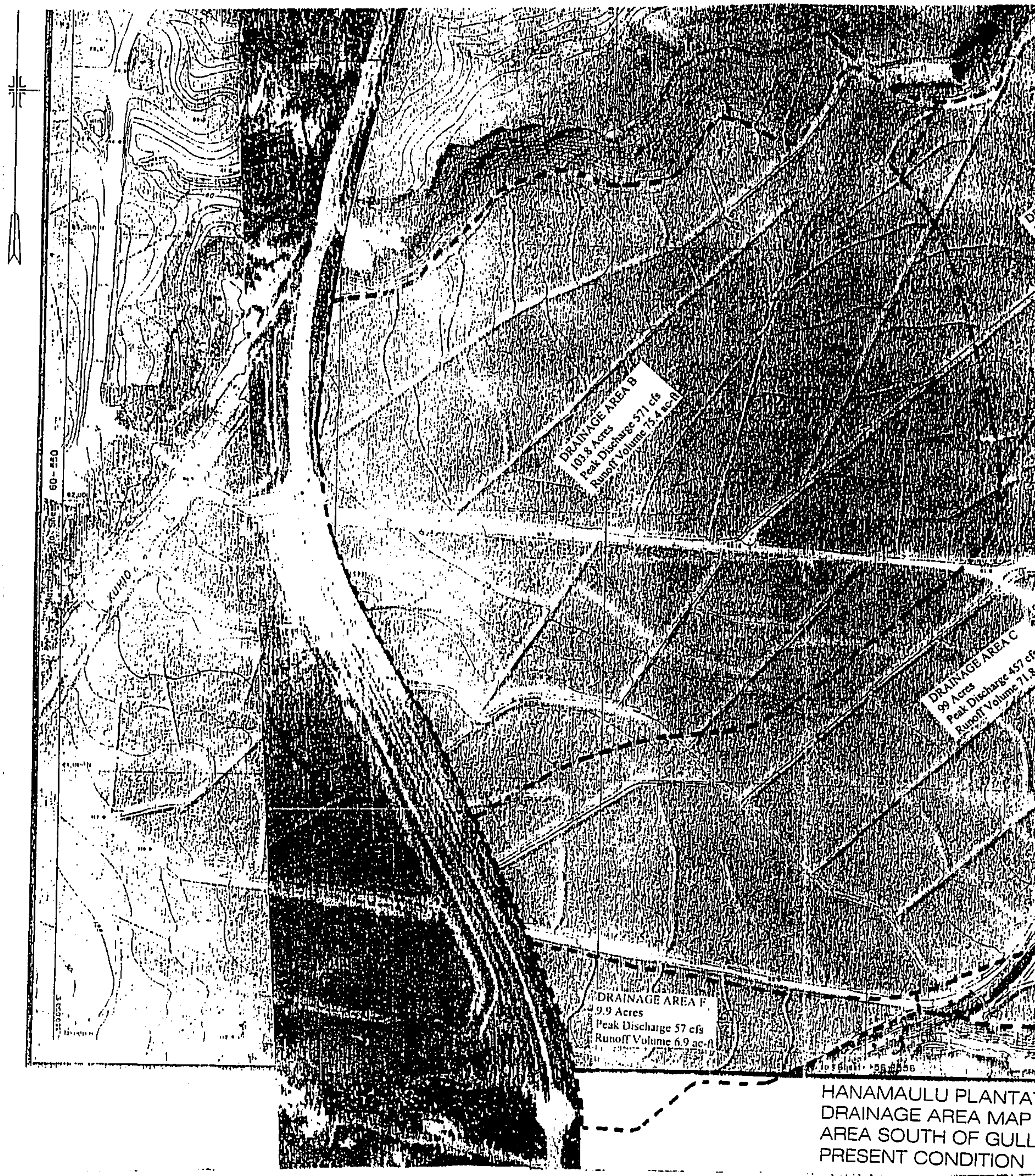

HANAMAULU PLANTAT
DRAINAGE AREA MAP
AREA SOUTH OF GULL
PRESENT CONDITION

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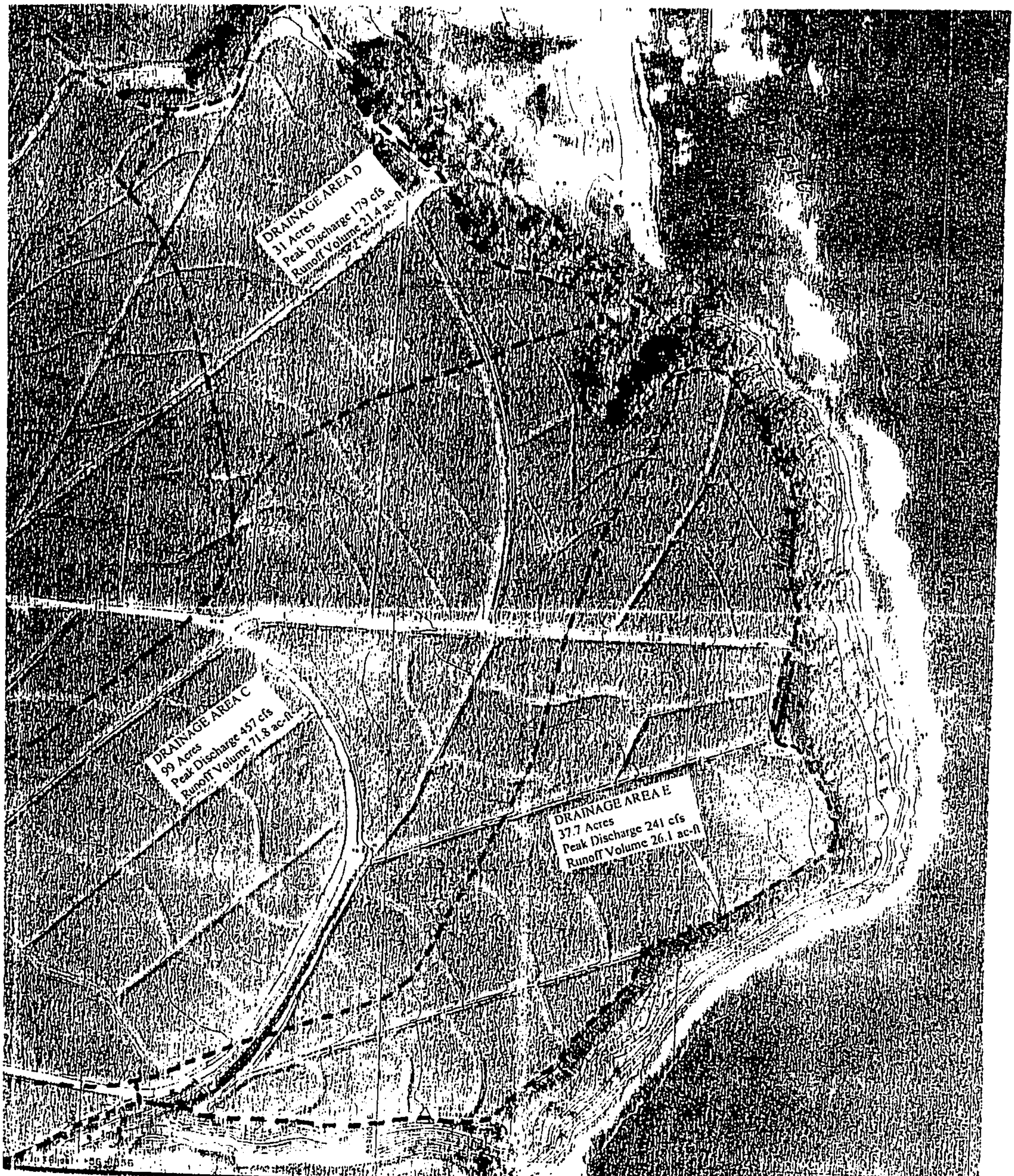

HANAMAULU PLANTATION
DRAINAGE AREA MAP
AREA SOUTH OF GULLY
PRESENT CONDITION

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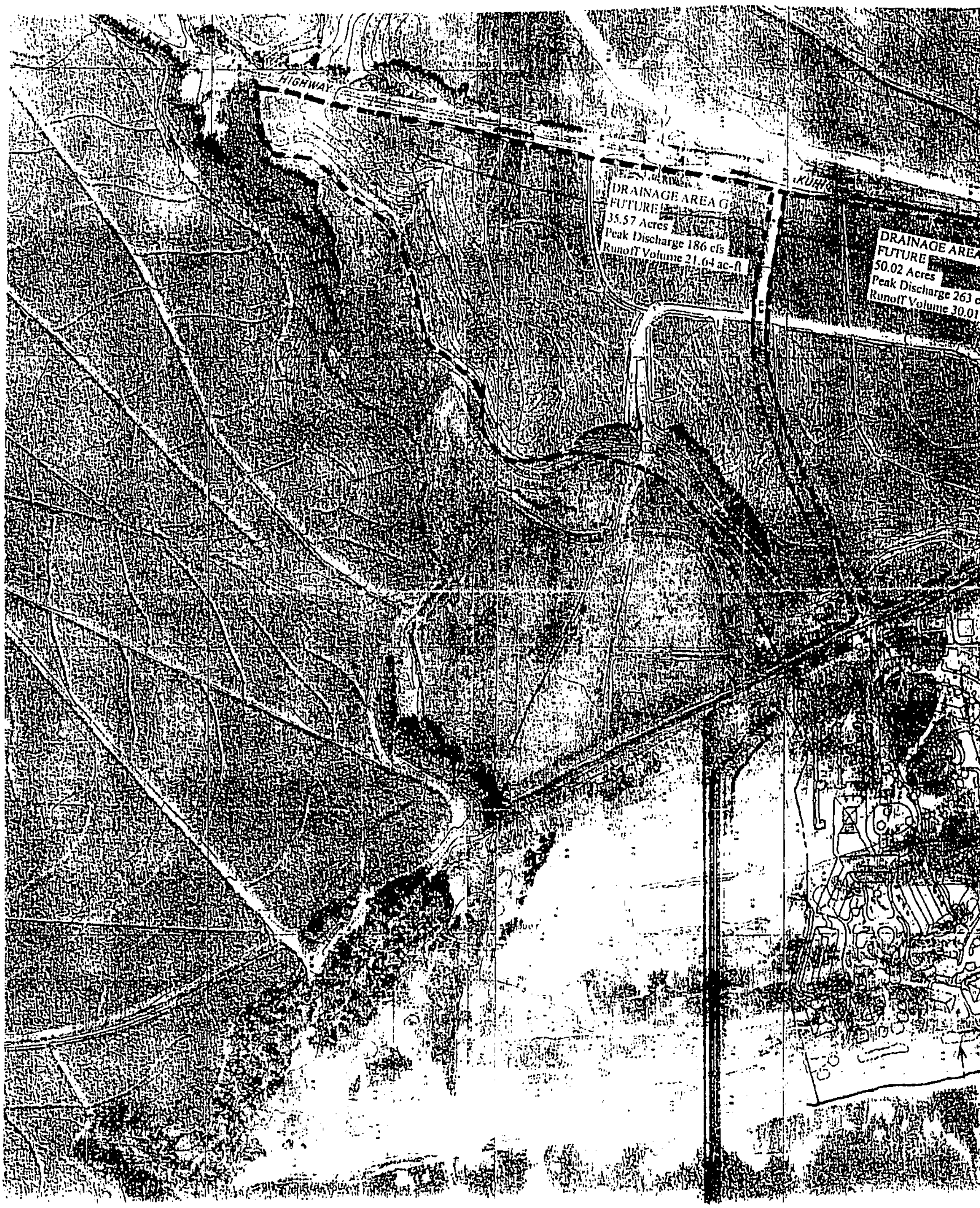

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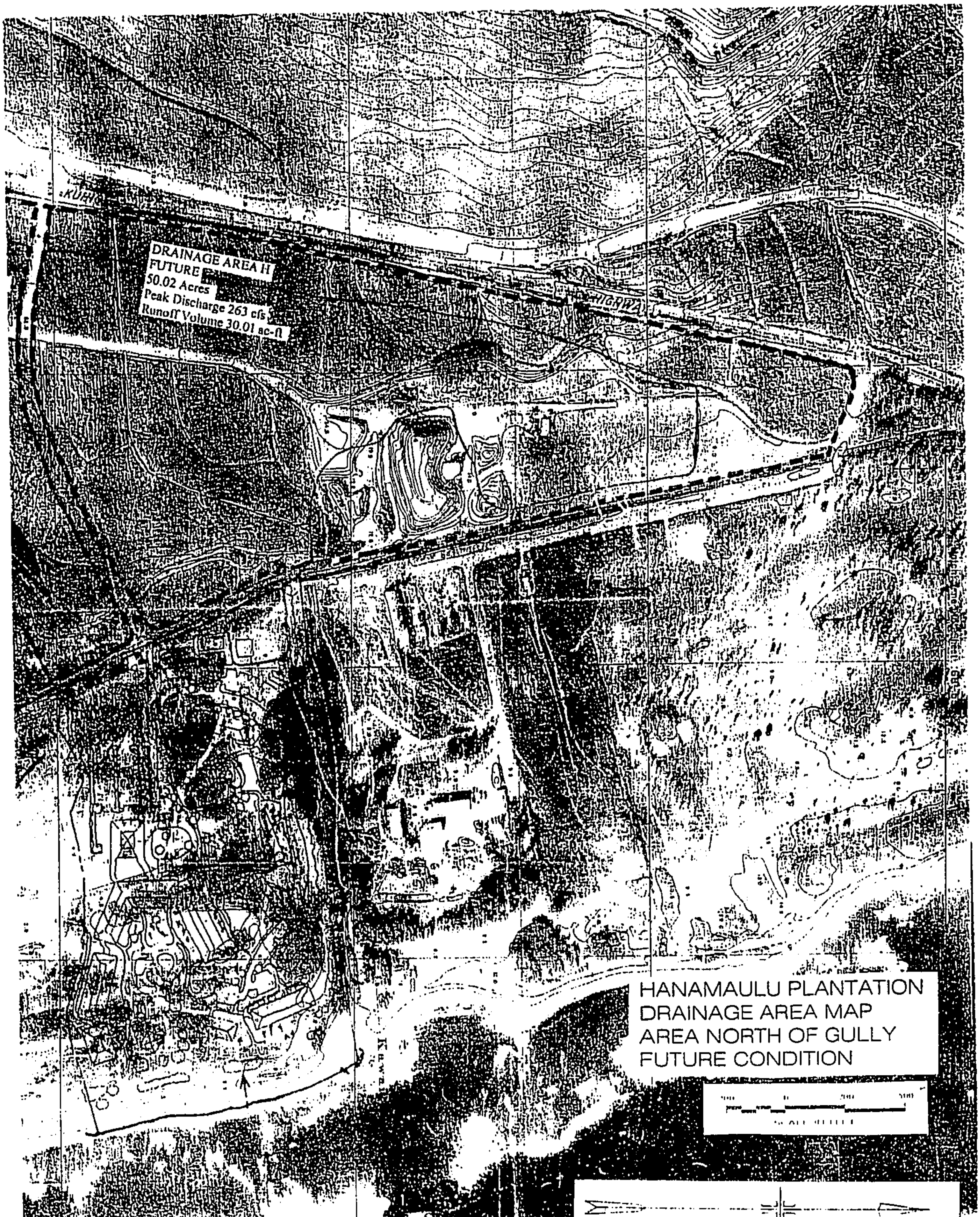


Figure Nos. 5 and 6 shows the future drainage areas along with the estimated peak flows. Peak flow calculations for the future condition can also be found in Appendix B.

TABLE NO. 1
PEAK DISCHARGE RATES

DRAINAGE AREA	EXISTING CONDITIONS		FUTURE CONDITIONS		PERCENT CHANGE IN PEAK DISCHARGE
	Peak Discharge (cfs)	Runoff Volume (acre-feet)	Peak Discharge (cfs)	Runoff Volume (acre-feet)	
A	946		946		No Change
B	723	126	713	121	-1.4%
C	596	120	613	121	2.8%
D	201	36	102	18	-49.2%
E	281	44	263	41	-6.4%
F	65	12	39	7	-40.0%
G	255	42	234	38	-8.3%
H	366	54	351	53	-4.1 %
Total	3433	434	3261	399	-5.0%

As shown in the Table above, there is a reduction in the total peak discharge of about 5%. The only drainage area which generates more runoff is Drainage Area C. The increase in runoff is due to an increase in the area of Drainage Area C. Since Drainage Area C discharges just above a small cove on the shoreline there are no properties downstream that would be adversely impacted by this increase in the peak discharge rate. For the remainder of the drainage areas, since the peak discharge rate is being reduced, downstream properties should not be adversely affected.

It should be noted that the calculations above do not take into account the effect that any ponds constructed on the golf course will have on reducing the discharge peak rate. It is expected that the ponds will retain water from minor storms for use in irrigation and detain part of the runoff from larger storms and thereby attenuate the peak discharge rate. Since the exact dimensions and sections of the ponds are not available at this point in the planning process, any attempt to calculate the effect the ponds may have on reducing the peak flow rate would only be premature.

DRAINAGE SYSTEM.

Plans to effectively manage storm runoffs from minor storm events (two-year one-hour storm) should be a part of any planned community. EWC Kauai, LLC's Ocean Bay Plantation at Hanama'ulu will utilize a drainage system consisting of drain inlets, manholes, drain pipes and outlet structures built along the roadways to control runoff from minor storm events.

The calculation of storm runoff quantities is based on the Storm Drainage Standards of the Department of Public Works, County of Kauai, dated 2001. As specified in the Storm Drainage Standards, the rational method for computing flow rates was used with the following factors:

Rainfall Intensity (2-year) = 2.4
Time of Concentration = 8 min
Intensity Correction Factor = 2.5
Runoff Coefficient (Residential) = 0.58
Runoff Coefficient (Roadways) = 0.83

Using the drainage system design criteria by the County of Kauai's Storm Drainage Standards, a conceptual drainage system layout along the major roadways for the Ocean Bay Plantation at Hanama'ulu was developed (see Figure 7). There are two drainage systems serving the plateau area south of the wetland area. These drainage systems are used primarily to drain the roadway areas and any lots that drain to the roadways. In other areas not served by underground drainage systems, runoff would either sheet flow directly to the golf course to ponds used both for flood and water quality control or flow directly to the ocean. Drainage System B is located in the multi-family area of Drainage Area B and discharges runoff to the wetlands area. There are three drainage systems within Drainage Area C. Drainage Area C-1 serves a single-family residential area and discharges runoff into the cove at the east side of the project site. Drainage Area C-2 serves the single-family residential area on the south side of the development and outlets to a pond on the golf course. Drainage Area C-3 serves a multi-family residential area on the west side of the project site and also outlets to a pond.

The residential areas that will be developed in Drainage Areas G and H will also require storm drainage systems. However, conceptual layouts for these two areas were not attempted since the development of these areas will take place in later phases of this project and roadway layouts for these areas have not yet been developed. Any storm drainage systems constructed for these areas would discharge directly to the drainage canal mauka of the Radisson Kauai Beach Hotel property.

ORDER OF MAGNITUDE COSTS

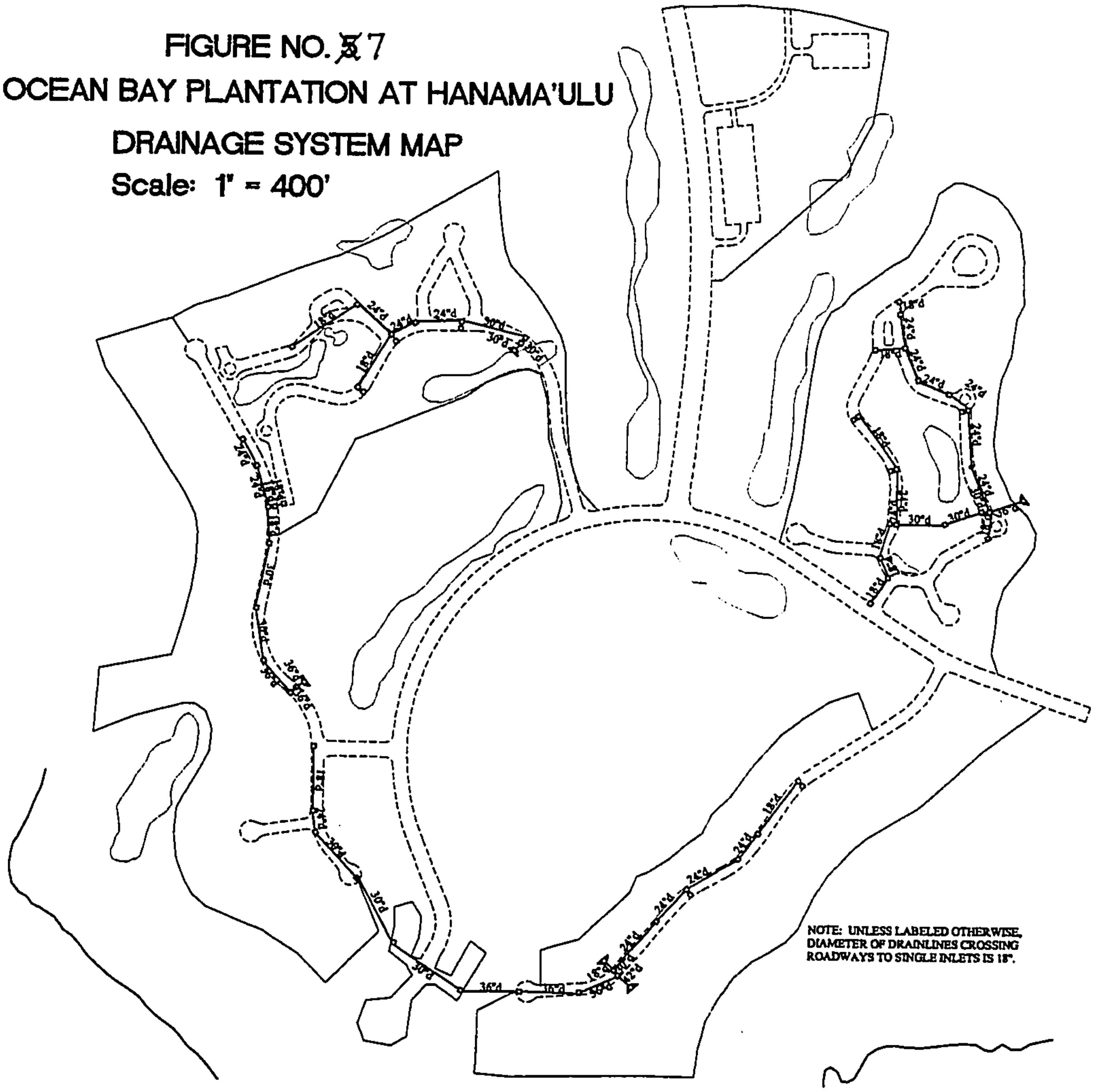
The drainage systems will consist of drain inlets, manholes, concrete inlet and outlet structures, and drainage pipe ranging in size from 18" to 54". The estimated cost for the drainage system is $2,100,000.

FIGURE NO. ~~5~~ 7

OCEAN BAY PLANTATION AT HANAMA'ULU

DRAINAGE SYSTEM MAP

Scale: 1" = 400'



EROSION AND SEDIMENT CONTROL.

The proposed project site is currently covered with abandoned sugar cane fields that provide poor ground cover for the soil. This makes the land extremely susceptible to erosion and sediment loss due to runoff from storms.

The Universal Soil Loss Equation (USLE) as outlined in the U.S. Soil Conservation Services (SCS) Erosion and Sediment Control Guide for Hawaii is used to estimate soil loss due to erosion at the perimeter of the abandoned cane fields. Soil loss was estimated for both existing and developed conditions. The soil loss equation is defined as followed:

A = Soil Loss (tons/acre/year) = (R)(K)(L)(S)(C)(P) where:

R = Rainfall Factor
K = Soil Erodibility Factor
L = Slope Length Factor
S = Slope Gradient Factor
C = Cover and Management Factor
P = Erosion Control Practice Factor

Existing Conditions. The project site is mainly covered by abandoned sugar cane fields. The sparse ground cover in these fields make them susceptible significant erosion and sediment losses during periods of rain. To minimize the transportation of sediment to downstream areas, sediment ditches and basins that were constructed by Amfac Sugar Kauai for use during their sugar operations are still in place and functioning.

To determine the soil loss for the existing condition of the project area, six unknowns must be established. The rainfall factor (R) and the soil erodibility factor (K) is set at 400 and 0.17 (Lihue Silty Clay), respectively. Based on a slope length of 200 feet and an average slope of 2.8%, the (L)(S) factor calculates to be 0.33. Since there is no ongoing maintenance of the fields, an erosion control factor of 1.0 was selected. A cover and management factor (C) of 0.13 is used for the abandoned cane fields. . Using this data, the soil loss (A) calculates to be:

A = (400)(.17)(.33)(.13)(1.0) = 2.91 tons/acre/year

For the 460 acre Master Planned Community site, the soil loss will be about 1342 tons per year.

Developed Conditions. The Ocean Bay Plantation at Hanama'ulu will include residential housing, commercial, and recreational land uses. Soil loss for the developed condition can be expected to decrease due to the increase in impermeable areas and greater maintenance of vegetated areas (primarily golf course area).

The rainfall factor (400) and the soil erodibility factor (0.17) were previously determined and will not change for the developed condition. Based on a slope length of 300 feet and an average slope of 2.8% the (L)(S) factor calculates to be 0.37. An erosion control factor of 1.0 assuming that no specific erosion control methods are in place was selected. Based on an established grass cover, the cover and management factor (C) is set at 0.01. Using this data, the soil loss (A) for the developed condition calculates to be:

A = (400)(.17)(.37)(.01)(1.0) = 0.25 tons/acre/year

The total soil loss over 460 acres for a year is 115 tons per year. Therefore there is a significant drop in the amount of soil loss from existing conditions.

Soil Loss During Construction. The potential for erosion and sediment loss is greatest during the construction period for the Ocean Bay Plantation at Hanama'ulu. Soil loss would be the especially high during the grading process.

To estimate the amount of soil loss, it was assumed that the project site would be graded over a one-year period with no more than 25 acres being graded at any one time. It was also assumed that each 25 acres would take a month to grade and that it would take another month before temporary or permanent grassing would become established on the just graded area. A composite cover and management factor was calculated to be 0.20 based on those assumptions

The rainfall factor (400), the soil erodibility factor (0.17) and (L)(S) factor (0.37) were previously determined and will not change for soil loss during construction. An erosion control factor of 1.0 was chosen based on the assumption that erosion would be controlled during construction primarily through the establishment of temporary and permanent ground covers. Since the cover and management factor already takes into account the establishment of ground cover and no other erosion control methods would be utilized, a factor of 1.0 was chosen. Using these assumptions, the soil loss (A) during construction calculates to be:

A = (400)(.17)(.37)(0.20)(1.0) = 5.03 tons/acre/year

The soil losses for Lihue-Hanamaulu Master Planned Community during a one year period of grading would be 2313 tons. While this is a significant increase over the present soil losses, the soil losses occur at this higher rate for only as long as the grading is ongoing. Once grassing is in place, soil losses drop to levels much lower than present conditions. Over a two year period, the grading period and the first year after grading, soil loss would total 2,428 tons, which is less than the two-year total for existing conditions, 2,684 tons.

It should also be noted that the total represents soil losses from the ground surface and do not represent the amount of sediment that might be transported offsite to the wetlands or to the ocean. During the construction period, Best management practices such as sediments basins, filter fences, diversion swales and biofiltration swales will all be used to minimize the amount of soil transported off-site.

APPENDIX A
EXISTING CONDITION
PEAK DISCHARGE RATE
100-YEAR 24-HOUR STORM

MAUKA DRAINAGE AREAS EXISTING

AREA		SOIL TYPE	LAND USE	COEFFICIENT	AREAXCOEF	Tc	Q	DEPTH	VOLUME
MAUKA BRUSH	49.5	B	BRUSH - GOOD	55	2722.5				
MAUKA CANE FIELDS	167.5	B	RATOON	75	12562.5				
KUHIO HIGHWAY	28.6	B	50%PAVED 50% POORGRASS/DIRT	85	2431				
TRIANGLE	60.4	B	RATOON	75	4530				
MAUKA FOREST	199.7	B (172.7)	TREES, BRUSH-GOOD	55	9498.5				
		C(27.0)	TREES, BRUSH-POOR	66	1782				
A	75.1	B	RATOON(24.9)	75	1867.5				
			BRUSH(15.8)GOOD	55	869				
			FLOOD PLAIN(34.4)-GOOD	58	1995.2				
TOTAL	580.8				38258.2				
				COEFFICIENT	65.87				
B	103.8	B	RATOON	75		0.96	946		
C	99	B	RATOON	75		0.41	723	14.51	125.51
D	31	B	RATOON	75		0.57	596	14.51	119.71
E	37.7	B	RATOON	75		0.45	201	14.05	36.30
F	9.9	B	RATOON	75		0.32	281	14.05	44.14
	35.57	B	RATOON	75		0.44	65	14.05	11.59
	50.02	B	RATOON	75		0.35	255	14.05	41.65
						0.28	366	13.06	54.44

```
ÿÿÿType.... Graphical Peak
ÿÿÿName.... HANAMAULU B                                        ÿPage 1.01

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu Plantation Drainage Area B

          >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

  Drainage Area           =    103.800 acres  ---> .162188 sq.mi.
  Runoff Curve Number     =     78
  Time of Concentration   =   .4100 hrs
  Pond and Swamp Areas    =     .00 %   ---> .000 acres

                                  ------------------------------
                                  RAINFALL DISTRIBUTION = TYPE I
                                  Storm #1     Storm #2
                                  ------------------------------
 Frequency (years)                    100          50
 Rainfall, P, 24-hr (in)          17.5000     15.5000

 Initial Abstraction, Ia (in)       .5641       .5641
 Ia/p Ratio                         .0322       .0364
 Unit Discharge, * qu (csm/in)        307         307
 Runoff, Q (in)                   14.5181     12.5634
 Pond & Swamp Adjustment, Fp         1.00        1.00

 PEAK DISCHARGE, qp (cfs)             723         625
 -------------------------------------------------------

 Summary of Computations for qu
 ------------------------------
      Ia/p     #1                  .10000      .10000
      C0       #1                 2.30550     2.30550
      C1       #1                 -.51429     -.51429
      C2       #1                 -.11750     -.11750
      qu       #1 (csm/in)       306.9190    306.9190

      Ia/p     #2                  .10000      .10000
      C0       #2                 2.30550     2.30550
      C1       #2                 -.51429     -.51429
      C2       #2                 -.11750     -.11750
      qu       #2 (csm/in)       306.9190    306.9190

    * qu (csm/in)                     307         307

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
  If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

  log(qu)   = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc))**2 ) Where: Tc=hours

  qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

ÿÿÿS/N: HOMOL0862777   Kodani and Associates, Inc.
ÿÿÿPond Pack Ver: 10-9-97 :055 ÿÿÿCompute Time: 13:02:49 ÿÿÿDate: 09-17-2001
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ÿÿÿType.... Graphical Peak
ÿÿÿName.... HANAMAULU C                                        ÿPage 1.01

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu C Existing

          >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

  Drainage Area           =     99.000 acres  ---> .154687 sq.mi.
  Runoff Curve Number     =     78
  Time of Concentration   =   .5700 hrs
  Pond and Swamp Areas    =     .00 %   ---> .000 acres

                                  ------------------------------
                                  RAINFALL DISTRIBUTION = TYPE I
                                  Storm #1     Storm #2
                                  ------------------------------
 Frequency (years)                    100          50
 Rainfall, P, 24-hr (in)          17.5000     15.5000

 Initial Abstraction, Ia (in)       .5641       .5641
 Ia/p Ratio                         .0322       .0364
 Unit Discharge, * qu (csm/in)        265         265
 Runoff, Q (in)                   14.5181     12.5634
 Pond & Swamp Adjustment, Fp         1.00        1.00

 PEAK DISCHARGE, qp (cfs)             596         516
 -------------------------------------------------------

 Summary of Computations for qu
 ------------------------------
      Ia/p     #1                  .10000      .10000
      C0       #1                 2.30550     2.30550
      C1       #1                 -.51429     -.51429
      C2       #1                 -.11750     -.11750
      qu       #1 (csm/in)       265.4901    265.4901

      Ia/p     #2                  .10000      .10000
      C0       #2                 2.30550     2.30550
      C1       #2                 -.51429     -.51429
      C2       #2                 -.11750     -.11750
      qu       #2 (csm/in)       265.4901    265.4901

    * qu (csm/in)                     265         265

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
  If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

  log(qu)   = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc))**2 ) Where: Tc=hours

  qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿType.... Graphical Peak                                    ÿPage 1.01
ÿÿÿName.... HANAMAULUD

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu Plantation F

              >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

    Drainage Area           =      31.000 acres  ---> .048437 sq.mi.
    Runoff Curve Number     =      75
    Time of Concentration =     .4500 hrs
    Pond and Swamp Areas    =       .00 %   ---> .000 acres

                                  -------------------------------
                                  RAINFALL DISTRIBUTION = TYPE I
                                  Storm #1    Storm #2
                                  -------------------------------
    Frequency (years)                  100          50
    Rainfall, P, 24-hr (in)        17.5000     15.5000


    Initial Abstraction, Ia (in)     .6667       .6667
    Ia/p Ratio                       .0381       .0430
    Unit Discharge, * qu (csm/in)      295         295
    Runoff, Q (in)                 14.0510     12.1116
    Pond & Swamp Adjustment, Fp       1.00        1.00

    PEAK DISCHARGE, qp (cfs)           201         173
    --------------------------------------------------------------

    Summary of Computations for qu
    ----------------------------
             Ia/p    #1                .10000      .10000
             C0      #1               2.30550     2.30550
             C1      #1               -.51429     -.51429
             C2      #1               -.11750     -.11750
             qu      #1 (csm/in)     294.9298    294.9298

             Ia/p    #2                .10000      .10000
             C0      #2               2.30550     2.30550
             C1      #2               -.51429     -.51429
             C2      #2               -.11750     -.11750
             qu      #2 (csm/in)     294.9298    294.9298

        * qu (csm/in)                     295         295

    * Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
      If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

      log(qu)  = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc))**2 ) Where: Tc=hours

      qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿPond Pack Ver: 10-9-97 :055 ÿÿÿCompute Time: 13:07:17 ÿÿÿDate: 09-17-2001
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ÿÿÿType.... Graphical Peak                                    ÿPage 1.01
ÿÿÿName.... HANAMAULUE

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu Plantation E

              >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

    Drainage Area           =      37.700 acres  ---> .058906 sq.mi.
    Runoff Curve Number     =      75
    Time of Concentration =     .3200 hrs
    Pond and Swamp Areas    =       .00 %   ---> .000 acres

                                  -------------------------------
                                  RAINFALL DISTRIBUTION = TYPE I
                                  Storm #1    Storm #2
                                  -------------------------------
    Frequency (years)                  100          50
    Rainfall, P, 24-hr (in)        17.5000     15.5000


    Initial Abstraction, Ia (in)     .6667       .6667
    Ia/p Ratio                       .0381       .0430
    Unit Discharge, * qu (csm/in)      340         340
    Runoff, Q (in)                 14.0510     12.1116
    Pond & Swamp Adjustment, Fp       1.00        1.00

    PEAK DISCHARGE, qp (cfs)           281         242
    --------------------------------------------------------------

    Summary of Computations for qu
    ----------------------------
             Ia/p    #1                .10000      .10000
             C0      #1               2.30550     2.30550
             C1      #1               -.51429     -.51429
             C2      #1               -.11750     -.11750
             qu      #1 (csm/in)     339.8001    339.8001

             Ia/p    #2                .10000      .10000
             C0      #2               2.30550     2.30550
             C1      #2               -.51429     -.51429
             C2      #2               -.11750     -.11750
             qu      #2 (csm/in)     339.8001    339.8001

        * qu (csm/in)                     340         340

    * Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
      If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

      log(qu)  = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc))**2 ) Where: Tc=hours

      qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿType.... Graphical Peak
ÿÿÿName.... HP_GPRESENT

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hp_G Present Condition

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

Drainage Area = 35.570 acres ---> .055578 sq.mi.
Runoff Curve Number = 75
Time of Concentration = .3520 hrs
Pond and Swamp Areas = .00 % ---> .000 acres

	RAINFALL DISTRIBUTION = TYPE I	
	Storm #1	Storm #2
Frequency (years)	100	50
Rainfall, P, 24-hr (in)	17.5000	15.5000
Initial Abstraction, Ia (in)	.6667	.6667
Ia/p Ratio	.0381	.0430
Unit Discharge, * qu (csm/in)	327	327
Runoff, Q (in)	14.0510	12.1116
Pond & Swamp Adjustment, Fp	1.00	1.00
PEAK DISCHARGE, qp (cfs)	255	220

Summary of Computations for qu

Ia/p	#1	.10000	.10000
C0	#1	2.30550	2.30550
C1	#1	-.51429	-.51429
C2	#1	-.11750	-.11750
qu	#1 (csm/in)	327.0001	327.0001
Ia/p	#2	.10000	.10000
C0	#2	2.30550	2.30550
C1	#2	-.51429	-.51429
C2	#2	-.11750	-.11750
qu	#2 (csm/in)	327.0001	327.0001
* qu (csm/in)		327	327

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

log(qu) = C0 + (C1 * log(Tc)) + (C2 * (log(Tc))**2) Where: Tc=hours

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿType.... Graphical Peak
ÿÿÿName.... HP_H

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... HP_H Present

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

Drainage Area = 50.020 acres ---> .078156 sq.mi.
Runoff Curve Number = 69
Time of Concentration = .2800 hrs
Pond and Swamp Areas = .00 % ---> .000 acres

	RAINFALL DISTRIBUTION = TYPE I	
	Storm #1	Storm #2
Frequency (years)	100	50
Rainfall, P, 24-hr (in)	17.5000	15.5000
Initial Abstraction, Ia (in)	.8986	.8986
Ia/p Ratio	.0513	.0580
Unit Discharge, * qu (csm/in)	358	358
Runoff, Q (in)	13.0656	11.1658
Pond & Swamp Adjustment, Fp	1.00	1.00
PEAK DISCHARGE, qp (cfs)	366	312

Summary of Computations for qu

Ia/p	#1	.10000	.10000
C0	#1	2.30550	2.30550
C1	#1	-.51429	-.51429
C2	#1	-.11750	-.11750
qu	#1 (csm/in)	358.0215	358.0215
Ia/p	#2	.10000	.10000
C0	#2	2.30550	2.30550
C1	#2	-.51429	-.51429
C2	#2	-.11750	-.11750
qu	#2 (csm/in)	358.0215	358.0215
* qu (csm/in)		358	358

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

log(qu) = C0 + (C1 * log(Tc)) + (C2 * (log(Tc))**2) Where: Tc=hours

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿPond Pack Ver: 10-9-97 :055 ÿÿÿCompute Time: 13:15:21 ÿÿÿDate: 09-17-2001
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§§§Type.... Graphical Peak
§§§Name.... HANAMAULUP                                              §Page 1.01

§§§File.... .\sample\HP_AL.PPK
§§§Title... Hanamaulu Plantation P

              >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

   Drainage Area           =      9.900 acres  ---> .015469 sq.mi.
   Runoff Curve Number     =     75
   Time of Concentration   =   .4400 hrs
   Pond and Swamp Areas    =     .00 %   ---> .000 acres

                                    ---------------------------------
                                    RAINFALL DISTRIBUTION = TYPE I
                                    Storm #1      Storm #2
                                    ---------------------------------
   Frequency (years)                     100           50
   Rainfall, P, 24-hr (in)           17.5000      15.5000

   Initial Abstraction, Ia (in)        .6667        .6667
   Ia/p Ratio                          .0381        .0430
   Unit Discharge, * qu (csm/in)         298          298
   Runoff, Q (in)                    14.0510      12.1116
   Pond & Swamp Adjustment, Fp          1.00         1.00

   PEAK DISCHARGE, qp (cfs)               65           56
   ------------------------------------------------------------------

   Summary of Computations for qu
   ------------------------------
        Ia/p    #1                    .10000       .10000
        C0      #1                   2.30550      2.30550
        C1      #1                   -.51429      -.51429
        C2      #1                   -.11750      -.11750
        qu      #1 (csm/in)         297.8047     297.8047

        Ia/p    #2                    .10000       .10000
        C0      #2                   2.30550      2.30550
        C1      #2                   -.51429      -.51429
        C2      #2                   -.11750      -.11750
        qu      #2 (csm/in)         297.8047     297.8047

      * qu (csm/in)                      298          298

 * Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
   If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

   log(qu)  = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc))**2 ) Where: Tc=hours

   qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

§§§S/N: HOMOL0862777   Kodani and Associates, Inc.
§§§Pond Pack Ver: 10-9-97 :055 §§§Compute Time: 13:26:47 §§§Date: 09-17-2001
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§§§Type.... Tc§Calcs
§§§Name.... HP_B_FUT                                                §Page 1.01

§§§File.... .\sample\HP_AL.PPK
§§§Title... Hanamaulu Plantation - Future

  ::::::::::::::::::::::::::::::::::::::::::::::: =========================
  TIME OF CONCENTRATION CALCULATOR                  Total Tc:     .3941 hrs
  ::::::::::::::::::::::::::::::::::::::::::::::: =========================

  Hanamaulu Plantation - Future
  ---------------------------------------------------------------------------

  Segment #1:  Tc: TR-55 Sheet
  Description: Hanamaulu Plantation B Sheet

  Mannings n             .1500
  Hydraulic Length     300.00 ft
  2yr, 24hr P          6.5000 in
  Slope               .025000 ft/ft

  Avg.Velocity            .33 ft/sec

                                             Segment #1 Time:     .2524 hrs
  ---------------------------------------------------------------------------

  Segment #2:  Tc: TR-55 Shallow
  Description: Hanamaulu Plantation B Future

  Hydraulic Length   1300.00 ft
  Slope              .039000 ft/ft
  Unpaved

  Avg.Velocity          3.19 ft/sec

                                             Segment #2 Time:     .1133 hrs
  ---------------------------------------------------------------------------

  Segment #3:  Tc: TR-55 Channel
  Description: Hanamaulu Plantation B

  Flow Area           27.5300 sq.ft
  Wetted Perimeter      33.35 ft
  Hydraulic Radius        .83 ft
  Slope               .050000 ft/ft
  Mannings n            .0240
  Hydraulic Length    1250.00 ft

  Avg.Velocity          12.22 ft/sec

                                             Segment #3 Time:     .0284 hrs
  ---------------------------------------------------------------------------

§§§S/N: HOMOL0862777   Kodani and Associates, Inc.
§§§Pond Pack Ver: 10-9-97 :055 §§§Compute Time: 12:44:02 §§§Date: 09-17-2001
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ÿÿÿType.... TcÿCalcs                                          ÿPage 1.01
ÿÿÿName.... HP_C_FUT

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu Plantation C Future

    ::::::::::::::::::::::::::::::::::::::::::::: =======================
    TIME OF CONCENTRATION CALCULATOR               Total Tc:     .5470 hrs
    ::::::::::::::::::::::::::::::::::::::::::::: =======================

    Hanamaulu Plantation C Future
    --------------------------------------------------------------------


    Segment #1:  Tc: TR-55 Sheet
    Description: HP_C Future Sheet

    Mannings n           .1500
    Hydraulic Length   300.00 ft
    2yr, 24hr P        6.5000 in
    Slope             .017000 ft/ft

    Avg.Velocity           .28 ft/sec

                                          Segment #1 Time:     .2945 hrs
    --------------------------------------------------------------------

    Segment #2:  Tc: TR-55 Channel
    Description: HP_C Future Channel

    Flow Area          29.7000 sq.ft
    Wetted Perimeter     27.07 ft
    Hydraulic Radius      1.10 ft
    Slope              .040000 ft/ft
    Mannings n           .0240
    Hydraulic Length   1300.00 ft

    Avg.Velocity         13.21 ft/sec

                                          Segment #2 Time:     .0273 hrs
    --------------------------------------------------------------------

    Segment #3:  Tc: TR-55 Shallow
    Description: HP_C Future Shallow

    Hydraulic Length  1850.00 ft
    Slope              .020000 ft/ft
    Unpaved

    Avg.Velocity          2.28 ft/sec

                                          Segment #3 Time:     .2252 hrs
    --------------------------------------------------------------------

ÿÿÿS/N: HOMOL0862777   Kodani and Associates, Inc.
ÿÿÿPond Pack Ver: 10-9-97 :055 ÿÿÿCompute Time: 12:46:00 ÿÿÿDate: 09-17-2001
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ÿÿÿType.... TcÿCalcs                                          ÿPage 1.01
ÿÿÿName.... HP_GFUT

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... HP_G Present

    ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
    TIME OF CONCENTRATION CALCULATOR
    ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

    HP_G Present
    --------------------------------------------------------------------


    Segment #1:  Tc: TR-55 Sheet
    Description: HP_G Present Sheet

    Mannings n           .1500
    Hydraulic Length   200.00 ft
    2yr, 24hr P        6.5000 in
    Slope             .025000 ft/ft

    Avg.Velocity           .30 ft/sec

                                          Segment #1 Time:     .1825 hrs
    --------------------------------------------------------------------

    Segment #2:  Tc: TR-55 Shallow
    Description: HP_G Present

    Hydraulic Length  1050.00 ft
    Slope              .033000 ft/ft
    Unpaved

    Avg.Velocity          2.93 ft/sec

                                          Segment #2 Time:     .0995 hrs
    --------------------------------------------------------------------

                                                ========================
                                                 Total Tc:     .2820 hrs
                                                ========================

ÿÿÿS/N: HOMOL0862777   Kodani and Associates, Inc.
ÿÿÿPond Pack Ver: 10-9-97 :055 ÿÿÿCompute Time: 12:50:43 ÿÿÿDate: 09-17-2001
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APPENDIX B
FUTURE CONDITION
PEAK DISCHARGE RATE
100-YEAR 24-HOUR STORM

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ÿÿÿType.... TcÿCalcs                                      ÿPage 1.01
ÿÿÿName.... HP_HFUT

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... HP_G Present

    ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
    TIME OF CONCENTRATION CALCULATOR
    ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

    HP_G Present
    ----------------------------------------------------------------------


    Segment #1:  Tc: TR-55 Sheet
    Description: HP_H Future Sheet

    Mannings n          .1500
    Hydraulic Length   200.00 ft
    2yr, 24hr P        6.5000 in
    Slope             .050000 ft/ft

    Avg.Velocity          .40 ft/sec

                                         Segment #1 Time:     .1383 hrs
    ----------------------------------------------------------------------

    Segment #2:  Tc: TR-55 Shallow
    Description: HP_G Future

    Hydraulic Length  1300.00 ft
    Slope             .050000 ft/ft
    Unpaved

    Avg.Velocity         3.61 ft/sec

                                         Segment #2 Time:     .1001 hrs
    ----------------------------------------------------------------------

                                          ========================
                                           Total Tc:      .2384 hrs
                                          ========================
ÿÿÿS/N: H0M0L0862777   Kodani and Associates, Inc.
ÿÿÿPond Pack Ver: 10-9-97 :055 ÿÿÿCompute Time: 12:52:44 ÿÿÿDate: 09-17-2001
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HANAMAULU PLANTATION
MAKAI DRAINAGE
FUTUTURE CONDITION

				Area	Cn	Comp Cn	Comp Cn	Tc	Q	DEPTH	VOLUME
DRAINAGE AREA B											
Multi Family				25	85	2125.00					
Commercial				8	92	736.00					
Golf Course				11.85	61	722.85					
Golf Course	67.95	0.907	40000	23.59	61	1439.22					
Golf Course	44.1	0.907	40000	36.73	61	2240.51					
Road	1900	80		3.49	88	307.07					
Road	1000	56		1.29	88	113.13					
		Total		109.95		7683.79	69.89	0.39	713	13.23	121.22
DRAINAGE AREA C											
Multi-Family				12	85	1020.00					
Golf Course				9.07	61	553.27					
Golf Course	47.75	0.907	40000	27.77	61	1693.95					
Golf Course	34.44	0.907	40000	28.68	61	1749.74					
Single Family				8	70	560.00					
Single Family				3.75	69	258.75					
Single Family				15.75	69	1086.75					
Road	4900	44		4.95	88	435.56					
Road	2200	56		2.83	88	248.69					
		Total		112.80		7606.90	67.44	0.55	613	12.89	121.17
DRAINAGE AREA D											
Golf Course	11.15	0.907	40000	9.29	61	566.48					
Single Family	9.68	0.907	40000	8.06	69	558.29					
Road	400	56		0.51	88	45.25					
		total		17.88		1168.03	65.39	0.45	102	12.36	18.40
DRAINAGE AREA E											
Golf Course				2.6	61	158.60					
Golf Course	33.92	0.907	40000	28.25	61	1723.32					
Single Family				3.75	69	258.75					
Single Family				4.5	69	310.50					
Golf Clubhouse				1.6	92	147.20					
		Total		40.70		2596.37	63.84	0.32	263	12.18	41.31
DRAINAGE AREA F											
Golf Course	8.7	0.907	40000	7.25	61	442.01	61.00	0.44	39	11.63	7.02
Total Area B to F	288.56										
DRAINAGE AREA G				35.57			68	0.35	234	12.89	38.21
DRAINAGE AREA H				50.02			67	0.238	378	12.72	53.02

ÿÿÿType.... Graphical Peak
ÿÿÿName.... HANAMAULU B FUT

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu Plantation Drainage Area B

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

```
Drainage Area           =     109.950 acres  ---> .171797 sq.mi.
Runoff Curve Number     =      70
Time of Concentration   =    .3900 hrs
Pond and Swamp Areas    =     .00 %   ---> .000 acres

                                   ------------------------------
                                   RAINFALL DISTRIBUTION = TYPE I
                                    Storm #1     Storm #2
                                   ------------------------------
Frequency (years)                     100          50
Rainfall, P, 24-hr (in)            17.5000      15.5000

Initial Abstraction, Ia (in)          .8571        .8571
Ia/p Ratio                            .0490        .0553
Unit Discharge, * qu (csm/in)         313          313
Runoff, Q (in)                     13.2348      11.3275
Pond & Swamp Adjustment, Fp           1.00         1.00

PEAK DISCHARGE, qp (cfs)              713          610
--------------------------------------------------------------

Summary of Computations for qu
------------------------------
      Ia/p    #1                   .10000       .10000
      C0      #1                  2.30550      2.30550
      C1      #1                  -.51429      -.51429
      C2      #1                  -.11750      -.11750
      qu      #1 (csm/in)        313.4456     313.4456

      Ia/p    #2                   .10000       .10000
      C0      #2                  2.30550      2.30550
      C1      #2                  -.51429      -.51429
      C2      #2                  -.11750      -.11750
      qu      #2 (csm/in)        313.4456     313.4456

    * qu (csm/in)                    313          313
```

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

log(qu) = C0 + (C1 * log(Tc)) + (C2 * (log(Tc))**2) Where: Tc=hours

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿType.... Graphical Peak
ÿÿÿName.... HANAMAULU C FUT                                  ÿPage 1.01

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu C Existing

              >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

    Drainage Area            =     112.800 acres  ---> .176250 sq.mi.
    Runoff Curve Number      =      68
    Time of Concentration    =    .5500 hrs
    Pond and Swamp Areas     =      .00 %    ---> .000 acres

                                  --------------------------------
                                  RAINFALL DISTRIBUTION = TYPE I
                                  Storm #1     Storm #2
                                  --------------------------------
    Frequency (years)                  100          50
    Rainfall, P, 24-hr (in)        17.5000     15.5000

    Initial Abstraction, Ia (in)     .9412       .9412
    Ia/p Ratio                       .0538       .0607
    Unit Discharge, * qu (csm/in)      270         270
    Runoff, Q (in)                 12.8944     11.0025
    Pond & Swamp Adjustment, Fp       1.00        1.00

    PEAK DISCHARGE, qp (cfs)           613         523
    -----------------------------------------------------------

    Summary of Computations for qu
    ------------------------------
            Ia/p   #1                 .10000      .10000
            C0     #1                2.30550     2.30550
            C1     #1                -.51429     -.51429
            C2     #1                -.11750     -.11750
            qu     #1 (csm/in)      269.8410    269.8410

            Ia/p   #2                 .10000      .10000
            C0     #2                2.30550     2.30550
            C1     #2                -.51429     -.51429
            C2     #2                -.11750     -.11750
            qu     #2 (csm/in)      269.8410    269.8410

          * qu (csm/in)                  270         270

  * Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
    If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

    log(qu)   = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc))**2 ) Where: Tc=hours

    qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿType.... Graphical Peak
ÿÿÿName.... HANAMAULUDFUT                                    ÿPage 1.01

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu Plantation F

              >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

    Drainage Area            =      17.900 acres  ---> .027969 sq.mi.
    Runoff Curve Number      =      65
    Time of Concentration    =    .4500 hrs
    Pond and Swamp Areas     =      .00 %    ---> .000 acres

                                  --------------------------------
                                  RAINFALL DISTRIBUTION = TYPE I
                                  Storm #1     Storm #2
                                  --------------------------------
    Frequency (years)                  100          50
    Rainfall, P, 24-hr (in)        17.5000     15.5000

    Initial Abstraction, Ia (in)    1.0769      1.0769
    Ia/p Ratio                       .0615       .0695
    Unit Discharge, * qu (csm/in)      295         295
    Runoff, Q (in)                 12.3680     10.5022
    Pond & Swamp Adjustment, Fp       1.00        1.00

    PEAK DISCHARGE, qp (cfs)           102          87
    -----------------------------------------------------------

    Summary of Computations for qu
    ------------------------------
            Ia/p   #1                 .10000      .10000
            C0     #1                2.30550     2.30550
            C1     #1                -.51429     -.51429
            C2     #1                -.11750     -.11750
            qu     #1 (csm/in)      294.9298    294.9298

            Ia/p   #2                 .10000      .10000
            C0     #2                2.30550     2.30550
            C1     #2                -.51429     -.51429
            C2     #2                -.11750     -.11750
            qu     #2 (csm/in)      294.9298    294.9298

          * qu (csm/in)                  295         295

  * Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
    If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

    log(qu)   = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc))**2 ) Where: Tc=hours

    qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿType.... Graphical Peak
ÿÿÿName.... HANAMAULUEFUT

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu Plantation E

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

Drainage Area = 40.700 acres ---> .063594 sq.mi.
Runoff Curve Number = 64
Time of Concentration = .3200 hrs
Pond and Swamp Areas = .00 % ---> .000 acres

	RAINFALL DISTRIBUTION = TYPE I Storm #1	Storm #2
Frequency (years)	100	50
Rainfall, P, 24-hr (in)	17.5000	15.5000
Initial Abstraction, Ia (in)	1.1250	1.1250
Ia/p Ratio	.0643	.0726
Unit Discharge, * qu (csm/in)	340	340
Runoff, Q (in)	12.1882	10.3320
Pond & Swamp Adjustment, Fp	1.00	1.00
PEAK DISCHARGE, qp (cfs)	263	223

Summary of Computations for qu

Ia/p	#1	.10000	.10000
C0	#1	2.30550	2.30550
C1	#1	-.51429	-.51429
C2	#1	-.11750	-.11750
qu	#1 (csm/in)	339.8001	339.8001
Ia/p	#2	.10000	.10000
C0	#2	2.30550	2.30550
C1	#2	-.51429	-.51429
C2	#2	-.11750	-.11750
qu	#2 (csm/in)	339.8001	339.8001
* qu (csm/in)		340	340

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

log(qu) = C0 + (C1 * log(Tc)) + (C2 * (log(Tc))**2) Where: Tc=hours

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿType.... Graphical Peak
ÿÿÿName.... HANAMAULUFFUT

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hanamaulu Plantation F

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

Drainage Area = 7.250 acres ---> .011328 sq.mi.
Runoff Curve Number = 61
Time of Concentration = .4400 hrs
Pond and Swamp Areas = .00 % ---> .000 acres

	RAINFALL DISTRIBUTION = TYPE I Storm #1	Storm #2
Frequency (years)	100	50
Rainfall, P, 24-hr (in)	17.5000	15.5000
Initial Abstraction, Ia (in)	1.2787	1.2787
Ia/p Ratio	.0731	.0825
Unit Discharge, * qu (csm/in)	298	298
Runoff, Q (in)	11.6354	9.8107
Pond & Swamp Adjustment, Fp	1.00	1.00
PEAK DISCHARGE, qp (cfs)	39	33

Summary of Computations for qu

Ia/p	#1	.10000	.10000
C0	#1	2.30550	2.30550
C1	#1	-.51429	-.51429
C2	#1	-.11750	-.11750
qu	#1 (csm/in)	297.8047	297.8047
Ia/p	#2	.10000	.10000
C0	#2	2.30550	2.30550
C1	#2	-.51429	-.51429
C2	#2	-.11750	-.11750
qu	#2 (csm/in)	297.8047	297.8047
* qu (csm/in)		298	298

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

log(qu) = C0 + (C1 * log(Tc)) + (C2 * (log(Tc))**2) Where: Tc=hours

qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿType.... Graphical Peak
ÿÿÿName.... HP_GFUTURE                                   ÿPage 1.01

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... Hp_G Future Condition

            >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

   Drainage Area            =     35.570 acres ---> .055578 sq.mi.
   Runoff Curve Number      =     68
   Time of Concentration    =   .3520 hrs
   Pond and Swamp Areas     =     .00 %   ---> .000 acres

                                   ------------------------------
                                   RAINFALL DISTRIBUTION = TYPE I
                                   Storm #1     Storm #2
                                   ------------------------------
   Frequency (years)                   100          50
   Rainfall, P, 24-hr (in)          17.5000      15.5000

   Initial Abstraction, Ia (in)       .9412        .9412
   Ia/p Ratio                         .0538        .0607
   Unit Discharge, * qu (csm/in)        327          327
   Runoff, Q (in)                   12.8944      11.0025
   Pond & Swamp Adjustment, Fp         1.00         1.00

   PEAK DISCHARGE, qp (cfs)             234          200
   ---------------------------------------------------------

   Summary of Computations for qu
   ------------------------------
        Ia/p     #1                 .10000       .10000
        C0       #1                2.30550      2.30550
        C1       #1                -.51429      -.51429
        C2       #1                -.11750      -.11750
        qu       #1 (csm/in)      327.0001     327.0001

        Ia/p     #2                 .10000       .10000
        C0       #2                2.30550      2.30550
        C1       #2                -.51429      -.51429
        C2       #2                -.11750      -.11750
        qu       #2 (csm/in)      327.0001     327.0001

      * qu (csm/in)                    327          327

  * Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
    If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

   log(qu)  = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc))**2 ) Where: Tc=hours

   qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿPond Pack Ver: 10-9-97 :055 ÿÿÿCompute Time: 13:14:09 ÿÿÿDate: 09-17-2001
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ÿÿÿType.... Graphical Peak
ÿÿÿName.... HP_HFUTURE                                   ÿPage 1.01

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... HP_H Future

            >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

   Drainage Area            =     50.020 acres ---> .078156 sq.mi.
   Runoff Curve Number      =     67
   Time of Concentration    =   .2914 hrs
   Pond and Swamp Areas     =     .00 %   ---> .000 acres

                                   ------------------------------
                                   RAINFALL DISTRIBUTION = TYPE I
                                   Storm #1     Storm #2
                                   ------------------------------
   Frequency (years)                   100          50
   Rainfall, P, 24-hr (in)          17.5000      15.5000

   Initial Abstraction, Ia (in)       .9851        .9851
   Ia/p Ratio                         .0563        .0636
   Unit Discharge, * qu (csm/in)        353          353
   Runoff, Q (in)                   12.7210      10.8374
   Pond & Swamp Adjustment, Fp         1.00         1.00

   PEAK DISCHARGE, qp (cfs)             351          299
   ---------------------------------------------------------

   Summary of Computations for qu
   ------------------------------
        Ia/p     #1                 .10000       .10000
        C0       #1                2.30550      2.30550
        C1       #1                -.51429      -.51429
        C2       #1                -.11750      -.11750
        qu       #1 (csm/in)      352.5430     352.5430

        Ia/p     #2                 .10000       .10000
        C0       #2                2.30550      2.30550
        C1       #2                -.51429      -.51429
        C2       #2                -.11750      -.11750
        qu       #2 (csm/in)      352.5430     352.5430

      * qu (csm/in)                    353          353

  * Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
    If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

   log(qu)  = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc))**2 ) Where: Tc=hours

   qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in) * (Fp)

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ÿÿÿPond Pack Ver: 10-9-97 :055 ÿÿÿCompute Time: 09:30:08 ÿÿÿDate: 09-27-2001
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APPENDIX C
STORM DRAINAGE SYSTEM CALCULATIONS

```
ÿÿÿType.... TcÿCalcs
ÿÿÿName.... HP_HFUT                                          ÿPage 1.01

ÿÿÿFile.... .\sample\HP_AL.PPK
ÿÿÿTitle... HP_G Present

    ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
    TIME OF CONCENTRATION CALCULATOR
    ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

    HP_G Present
    --------------------------------------------------------------------

    Segment #1:  Tc: TR-55 Sheet
    Description: HP_H Future Sheet

    Mannings n           .1500
    Hydraulic Length   300.00 ft
    2yr, 24hr P        6.5000 in
    Slope             .050000 ft/ft

    Avg.Velocity          .44 ft/sec

                                         Segment #1 Time:     .1913 hrs
    --------------------------------------------------------------------
    Segment #2:  Tc: TR-55 Shallow
    Description: HP_G Future

    Hydraulic Length  1300.00 ft
    Slope             .050000 ft/ft
    Unpaved

    Avg.Velocity         3.61 ft/sec

                                         Segment #2 Time:     .1001 hrs
    --------------------------------------------------------------------

                                            ========================
                                             Total Tc:     .2914 hrs
                                            ========================
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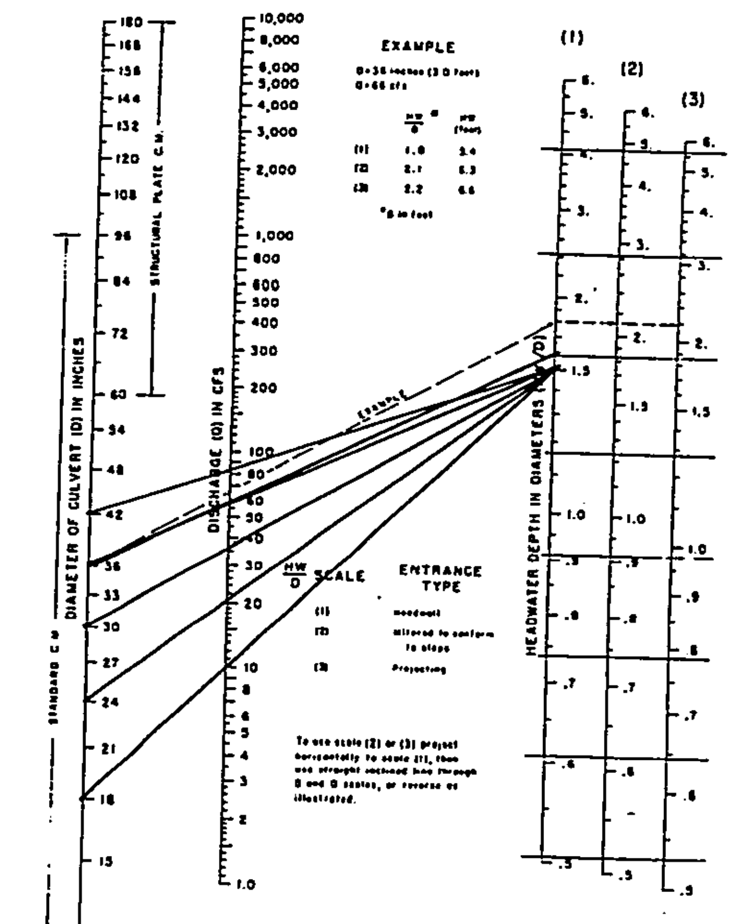
OCEAN BAY PLANTATION AT HANAMA'ULU
DRAINAGE SYSTEM CALCULATIONS

Drainage Area	Area	C	I x Corr	Q	Comm. Q
C-1p	0.17	0.83	6	0.85	
C-1o	1.82	0.58	6	5.84	6.48
C-1n	1.09	0.58	6	3.79	10.28
C-1m	0.49	0.58	6	1.71	11.98
C-1l	0.3	0.83	6	1.49	
C-1k	0.78	0.58	6	2.71	18.19
C-1j	0.66	0.58	6	2.30	18.49
C-1b	1.97	0.58	6	6.86	25.34
C-1i	1.39	0.58	6	4.84	
C-1h	2.67	0.58	6	9.29	14.13
C-1g	1.85	0.58	6	6.44	20.57
C-1f	1.95	0.58	6	6.79	27.35
C-1e	0.44	0.83	6	2.19	29.54
C-1d	1.66	0.83	6	8.27	37.81
C-1c	0.14	0.83	6	0.70	38.51
C-1a	0.29	0.83	6	1.44	65.30
C-2j	0.87	0.83	6	4.33	
C-2i	0.38	0.83	6	1.89	6.23
C-2h	3.11	0.58	6	10.82	
C-2g	1.44	0.58	6	5.01	22.06
C-2f	0.96	0.58	6	3.34	25.40
C-2e	0.88	0.58	6	3.06	28.46
C-2d	1.31	0.58	6	4.56	33.02
C-2c	1.87	0.58	6	6.51	33.53
C-2b	1.25	0.58	6	4.35	43.88
C-2a	0.38	0.83	6	1.89	45.77
			6		
C-3j	2.03	0.58	6	7.06	
C-3i	1.61	0.58	6	5.60	12.67
C-3h	0.16	0.83	6	0.80	
C-3g	0.33	0.58	6	1.15	1.95
C-3f	0.12	0.83	6	0.60	
C-3e	0.67	0.58	6	2.33	17.54
C-3d	0.12	0.83	6	0.60	
C-3c	0.94	0.58	6	3.27	20.81
C-3b	0.82	0.58	6	2.85	23.67
C-3a	0.12	0.83	6	0.60	24.26
B-1i	0.27	0.83	6	1.34	
B-1h	0.28	0.83	6	1.39	2.74
B-1g	0.83	0.58	6	2.89	5.63
B-1o	2.4	0.58	6	8.35	
B-1n	1.16	0.58	6	4.04	12.39
B-1m	1.16	0.58	6	4.04	
B-1l	1.21	0.58	6	4.21	20.84
B-1k	0.13	0.83	6	0.65	
B-1j	1.32	0.58	6	4.59	25.88
B-1f	2.51	0.58	6	8.73	40.24
B-1e	0.21	0.83	6	1.05	41.29
B-1d	0.11	0.83	6	0.55	
B-1c	0.4	0.83	6	1.99	2.54
B-1u	0.54	0.58	6	1.88	
B-1t	0.21	0.83	6	1.05	2.93
B-1s	0.07	0.83	6	0.35	
B-1r	0.07	0.83	6	0.35	3.62
B-1q	0.21	0.83	6	1.05	4.67
B-1b	0.46	0.58	6	1.60	6.27
B-1a	0.31	0.58	6	1.08	51.17

Plate 21



HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

OCEAN BAY PLANTATION AT HANMA'ULU
DRAINAGE SYSTEM CALCULATIONS

Drainage Area	Area	C	I x Corr	Q	Flow	Diameter	Length
C-2j	0.87	0.92	5.4	4.32			
C-2i	0.38	0.92	5.4	1.89	4.32	18	33
C-2f					6.21	18	32
C-2h	3.11	0.65	5.4	10.92			
C-2g	1.44	0.65	5.4	5.05	10.92	24	215
C-2f	0.96	0.65	5.4	3.37	15.97	24	137
C-2e	0.88	0.65	5.4	3.09	25.55	30	140
C-2d	1.31	0.65	5.4	4.60	28.64	30	250
C-2c	1.87	0.65	5.4	6.56	33.24	30	206
C-2b	1.25	0.65	5.4	4.39	39.80	36	160
C-2a	0.38	0.92	5.4	1.89	44.19	36	32
Outlet					46.08	36	50

Pipe Lengths	
18"	65
24"	352
30"	596
36"	242
Structures	10
Outlets	1

OCEAN BAY PLANTATION AT HANMA'ULU
DRAINAGE SYSTEM CALCULATIONS

Drainage Area	Area	C	I x Corr	Q	Flow	Diameter	Length
B-1i	0.27	0.92	5.4	1.34			
B-1h	0.28	0.92	5.4	1.39	1.34	18	114
B-1g	0.92	0.65	5.4	3.23	2.73	18	87
B-1f	2.51	0.65	5.4	8.81	5.96	18	137
B-1e					14.77	24	32
B-1j	1.32	0.65	5.4	4.63			
B-1k					4.63	18	32
B-1l	1.21	0.65	5.4	4.25			
B-1m	1.16	0.65	5.4	4.07	4.25	18	32
B-1k	0.13	0.92	5.4	0.65	8.32	18	250
B-1e	0.21	0.92	5.4	1.04	13.80	24	216
B-1b1					29.41	30	175
B-1b	0.46	0.65	5.4	1.61	29.41	30	145
B-1a					31.03	30	32
B-1c	0.51	0.92	5.4	2.53			
B-1e					2.53	18	107
B-1n	1.16	0.65	5.4	4.07			
B-1t					4.07	18	116
B-1o	2.4	0.65	5.4	8.42			
B-1u	0.54	0.65	5.4	1.90	8.42	18	52
B-1t	0.21	0.92	5.4	1.04	10.32	24	129
B-1s	0.07	0.92	5.4	0.35	11.36	24	131
B-1r	0.07	0.92	5.4	0.35	11.71	24	128
B-1p	0.1	0.92	5.4	0.50	12.06	24	102
B-1pmh					13.80	24	211
B-1a	0.31	0.65	5.4	1.09	13.60	24	184
Outlet					46.25	36	120
B-1q	0.21	0.92	5.4	1.04			
B-1p					1.04	18	32

Drainage Pipe Lengths	
18"	850
24"	1133
30"	352
36"	120
Structures	21
Outlet	1

OCEAN BAY PLANTATION AT HANMA'ULU
DRAINAGE SYSTEM CALCULATIONS

Drainage Area	Area	C	I x Corr	Q	Flow	Diameter	Length
C-1p	0.17	0.92	5.4	0.84			
C-1o	1.62	0.65	5.4	5.69	0.84	18	32
C-1n	1.09	0.65	5.4	3.83	6.53	18	250
C-1m	0.49	0.65	5.4	1.72	10.36	24	128
C-1k	0.78	0.65	5.4	2.74	12.08	24	224
C-1j	0.66	0.65	5.4	2.32	16.30	24	169
C-1b	1.97	0.65	5.4	6.91	18.62	24	248
C-1a					25.54	30	32
C-1l	0.3	0.92	5.4	1.49			
C-1k					1.49	18	32
c-1l	1.39	0.65	5.4	4.88			
C-1h	2.67	0.65	5.4	9.37	4.88	18	241
C-1g	1.85	0.65	5.4	6.49	14.25	24	82
C-1f	1.95	0.65	5.4	6.84	20.74	30	240
C-1fmh					27.59	30	203
C-1e	0.44	0.92	5.4	2.19	27.59	30	150
C-1d	1.66	0.92	5.4	8.25	29.77	30	238
C-1c	0.14	0.92	5.4	0.70	38.02	36	212
C-1a	0.29	0.92	5.4	1.44	38.72	36	232
Outlet					65.69	42	100

Total Pipe Length	C-1	C-2	C-3	B-1	total	Unit Price	Price
18"	555	65	104	959	1683	100	168300
24"	651	352	72	1133	2408	125	301000
30"	863	596	90	352	1901	150	285150
36"	444	242		120	806	175	141050
42"	100				100	225	22500
Structures	17	10	11	21.00	59	8000	472000
Inlet/Outlets	2	1	1	1.00	5	20000	100000
						Total	1490000

OCEAN BAY PLANTATION AT HANMA'ULU
DRAINAGE SYSTEM CALCULATIONS

Drainage Area	Area	C	I x Corr	Q	Flow	Diameter	Length
C-3j	2.03	0.65	5.4	7.13			
C-3i	1.61	0.65	5.4	5.65	7.13	18	250
C-3e					12.78	24	166
C-3h	0.16	0.92	5.4	0.79			
C-3g	0.33	0.65	5.4	1.16	0.79	18	32
C-3e	0.67	0.65	5.4	2.35	1.95	18	240
C-3mh					17.68	24	102
C-3c	0.94	0.65	5.4	3.30	17.68	24	177
C-3b	0.82	0.65	5.4	2.88	21.57	30	247
C-3a	0.12	0.92	5.4	0.60	24.45	30	38
Outlet					25.05	30	50
C-3f	0.12	0.92	5.4	0.60			
C-3e					0.60	18	32
C-3d	0.12	0.92	5.4	0.60			
C-3c					0.60	18	32
Pipe Lengths							
18"	104						
24"	72						
30"	90						
Structures	11						
Outlets	1						

OCEAN BAY PLANTATION AT HANMAULU
DRAINAGE SYSTEM CALCULATIONS

Drainage Area	Area	C	I x Corr	Q	Flow	Diameter	Length
C-1p	0.17	0.92	5.4	0.84			
					0.84	18	32
C-1o	1.62	0.65	5.4	5.69			
					6.53	18	250
C-1n	1.09	0.65	5.4	3.83			
					10.36	24	128
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					12.08	24	224
C-1k	0.78	0.65	5.4	2.74			
					16.30	24	169
C-1j	0.66	0.65	5.4	2.32			
					18.62	24	248
C-1b	1.97	0.65	5.4	6.91			
					25.54	30	32
C-1s							
C-1l	0.3	0.92	5.4	1.49			
					1.49	18	32
C-1k							
c-1l	1.39	0.65	5.4	4.88			
					4.88	18	241
C-1h	2.67	0.65	5.4	9.37			
					14.25	24	82
C-1g	1.85	0.65	5.4	6.49			
					20.74	30	240
C-1f	1.95	0.65	5.4	6.84			
					27.59	30	203
C-1fmh							
					27.59	30	150
C-1e	0.44	0.92	5.4	2.19			
					29.77	30	238
C-1d	1.66	0.92	5.4	8.25			
					38.02	36	212
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					38.72	36	232
C-1a	0.29	0.92	5.4	1.44			
					65.69	42	100
Outlet							

Total Pipe Length	C-1	C-2	C-3	B-1	total	Unit Price	Price
18"	555	65	104	959	1683	100	168300
24"	851	352	72	1133	2408	125	301000
30"	863	596	90	352	1901	150	285150
36"	444	242		120	806	175	141050
42"	100				100	225	22500
Structures	17	10	11	21.00	59	8000	472000
Inlet/Outlets	2	1	1	1.00	5	20000	100000
						Total	1490000

Ocean Bay Plantation at Hanamau
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\hanamaul.fm2
Worksheet	minor street flow
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope 0.020000 ft/ft
Water Surface Elevation 0.50 ft
Elevation range: 0.00 ft to 0.60 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-6.00	0.60	-6.00	6.00	0.025
0.00	0.00	6.00	16.00	0.013
6.00	0.30			
16.00	0.50			

Results		
Wtd. Mannings Coefficient	0.020	
Discharge	16.20	cfs
Flow Area	4.35	ft²
Wetted Perimeter	21.03	ft
Top Width	21.00	ft
Height	0.50	ft
Critical Depth	0.56	ft
Critical Slope	0.009017	ft/ft
Velocity	3.72	ft/s
Velocity Head	0.22	ft
Specific Energy	0.72	ft
Froude Number	1.44	
Flow is supercritical.		

APPENDIX C

Assessment of the Potential Effects on Surface and Groundwater of the Ocean Bay Plantation at Hanamā'ulu

Tom Nance Water Resource Engineering

December 2001

Assessment of the Potential Effects on Surface and Groundwater of the Ocean Bay Plantation at Hanamaulu

Prepared for:

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March 2002

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Introduction

This report provides an assessment of the potential effects on surface and groundwater resources due to the development and operation of the proposed Ocean Bay Plantation at Hanamaulu. The 460-acre project site is located on the peninsula on the north side of Hanamaulu Bay. The land was formerly used for sugarcane cultivation by Lihue Plantation Company (LPCO). The master plan for the development, dated March 2002, is illustrated on Figure 1. The land uses and their respective areas are also summarized below.

Land Uses for the Ocean Bay Plantation at Hanamaulu

Land Use		Area (Acres)
Golf Course		153.0
Golf Clubhouse		13.5
Driving Range, Nursery, and Maintenance		10.5
Gateway Village (Commercial)		12.5
Beach Club		9.0
Single Family Residential	: A1 (31 Lots)	16.0
	: A2 & A3 (42 Lots)	32.0
	: C	25.5
	: D	29.0
	: E	35.0
Multi-Family Residential	: B	20.0
	: C	25.5
Shoreline Area		31.5
Wetlands		31.5
Landscaped Buffer		10.0
Utility		3.0
Wastewater Treatment Plant		2.0
Roads and Other		26.0
Total Project Area		460.0

Water Resource-Related Infrastructure for the Project

Potable Supply. The project's potable supply would be provided from the Wailua-Kapaa system of the Kauai Department of Water (DOW). This system is supplied by three wells in Nonou Ridge (State Nos. 0320-01, 0320-03, and 0321-01) and has a 2.0-million gallon (MG) storage tank located just inland of the Wailua Houselots. Supply to the project site would be provided by the 16-inch transmission/distribution pipeline which runs along Kuhio Highway. The October 2001 "Ocean Bay Plantation at Hanamaulu, Preliminary Engineering Report for Water" prepared by Kodani and

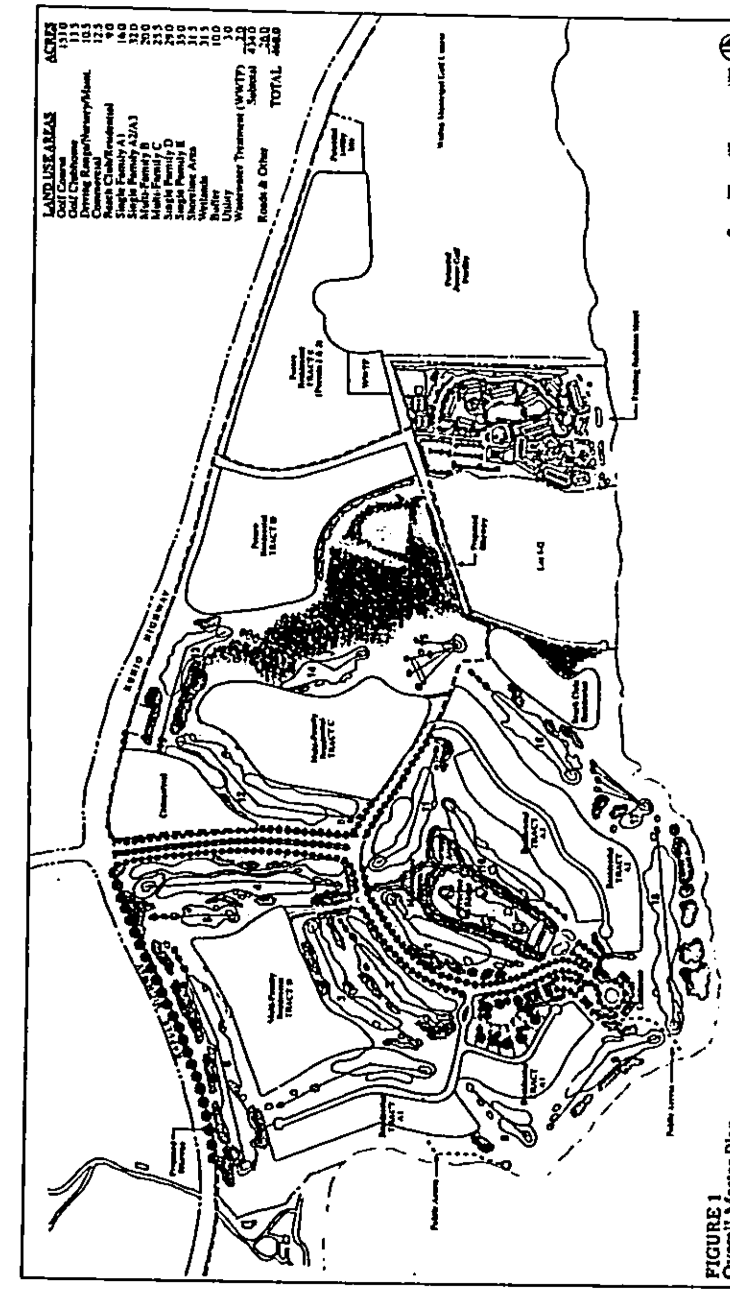


FIGURE 1
Overall Master Plan
Ocean Bay Plantation at Hanamaulu
GROUP 70

Associates, Inc. describes the infrastructure necessary to connect to the DOW system. The improvements would include a 12-inch line from DOW's 16-inch Kuhio Highway main into the project and 8- and 6-inch lines within the project itself. Supply requirements are projected in the Kodani report using DOW's design standards. Applying these standards to the February 2002 land use master plan, the required average supply at full build-out would be approximately 0.21 million gallons per day (MGD):

Projected Potable Supply Requirement

Land Use	No. of Units	Use Rate GPD/Unit	Average Supply (MGD)
Single Family Residences	170	500	0.0850
Multi-Family Residences	250	350	0.0875
Commercial	8 Acres	3000/Ac.	0.0240
Golf Course Clubhouse	--	--	0.0050
Beach Club	200 Users	25 GPD/User	0.0050
Wastewater Treatment Plant			0.0050
Project Total			0.2115

Wastewater Treatment and Disposal. The project will construct and operate its own wastewater treatment facility (WWTF) which would produce R-1 (tertiary) quality effluent. It is intended to pump this effluent to the golf course for irrigation reuse. The November 2001 "Ocean Bay Plantation at Hanamaulu, Conceptual Engineering Report for Wastewater Treatment and Effluent Disposal" by Gray Hong Bills Nojima & Associates, Inc. describes the treatment processes envisioned. According to this report, the WWTF would be designed for an average wastewater flow of 0.26 MGD, an amount which is actually higher than the projected potable water use. For purposes of calculating the amount of effluent available for irrigation reuse in this report, 60 percent of potable water use or 0.12 MGD at full build-out has been assumed.

Irrigation Supply. Non-potable water from wells developed on-site and from the R-1 effluent produced by the WWTF will be used for irrigation. The areas irrigated with non-potable water will include the golf course, entry feature, Gateway Village, the landscaped buffer along the Kapule Highway frontage, the Beach Club, the main roads within the project itself, and a portion of the shoreline area. The total area to be irrigated will be approximately 145 acres:

Project Areas to be Irrigated by Non-Potable Supply

Land Use	Area (Acres)
Golf Course	96
Entry Feature and Gateway Village	8
Kapule Highway Landscaped Buffer	10
Beach Club	7
Roadways	4
Shoreline Area	20
Total	145

The required non-potable irrigation supply has been approximated with the following series of assumptions:

- Station 1020.1 at the Lihue Airport provides rainfall data which are reasonably representative of the project site.
- Station 1020.1 also provides pan evaporation data representative of the project site.
- Irrigation applications will be at 80 percent of the pan evaporation rate less the effective rainfall. An additional 15 percent will be needed to offset application inefficiencies and losses.
- Effective rainfall is defined as 75 percent of the total rainfall.

Using these assumptions and the 145 acres to be irrigated, non-potable supply requirements as a long-term average and during a dry year such as 1998 are compiled on Tables 1 and 2. The year-round long term average is estimated at 0.55 MGD. During a dry year such as 1998, the year-round average would be on the order of 0.8 MGD and reach a maximum of about 1.1 MGD in the most critical months. This maximum is equivalent to pumping at about 770 gallons per minute (GPM) over 24 hours.

Initially, the supply of R-1 effluent from the WWTF would be essentially negligible, so all of the irrigation requirement would have to be provided from onsite wells. The first of these wells (State No. 0020-03) has been completed and results of pump testing are available (Figure 2). The water produced is fresh (chlorides are about 50 MG/L) and installation of a permanent pump of 350 to 400 GPM would be appropriate. If the second well has similar quality and capacity, then two wells would provide sufficient supply for the maximum use in dry years. Otherwise, a third well would be needed.

Table 1

Estimate of Long-Term Average Irrigation Supply Requirements

Month	Pan Evaporation (Inches)	Rainfall (Inches)	Irrigation Over 145 Acres (Inches)	Irrigation Over 145 Acres (Average MGD)
January	5.69	6.46	0.00	0.000
February	6.08	3.94	2.18	0.308
March	7.42	4.84	2.88	0.338
April	8.10	3.18	4.70	0.617
May	9.08	3.18	5.84	0.718
June	8.88	1.87	7.88	0.961
July	10.30	2.13	7.84	0.870
August	10.10	2.05	7.52	0.856
September	9.22	2.24	6.58	0.860
October	8.04	4.25	3.73	0.473
November	8.38	4.68	1.81	0.238
December	5.84	5.35	0.57	0.073
Annual	95.80	44.02	4.22	0.545

Notes: 1. Rainfall is the long-term adjusted mean for Station 1020.1 in Giambelluca, Nullet, & Schroeder, 1986.
2. Pan evaporation is the 28-year average for Station 1020.1 in Ekern and Chang, 1985.

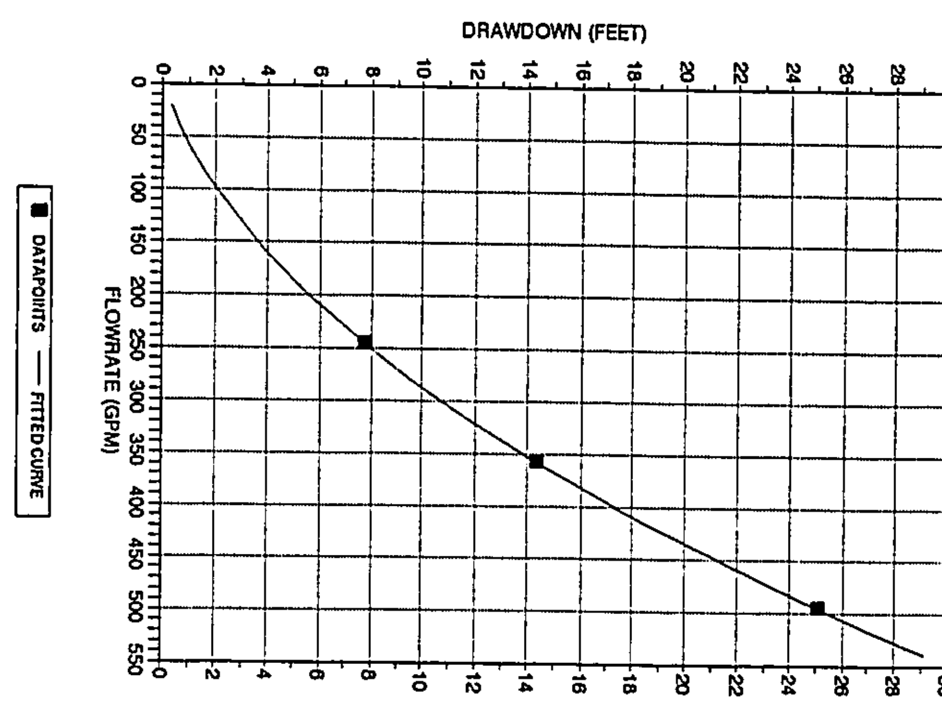
Table 2

Estimate of Dry Year Irrigation Requirements
Using Data From Year 1998

Month	Pan Evaporation (Inches)	Rainfall (Inches)	Irrigation Over 145 Acres (Inches)	Irrigation Over 145 Acres (Average MGD)
January	6.33	5.56	1.03	0.131
February	6.88	0.64	5.64	0.821
March	8.11	1.50	6.17	0.783
April	8.85	1.93	7.41	0.872
May	10.82	1.42	8.55	1.086
June	9.23	1.90	8.85	0.970
July	9.88	1.47	7.82	0.993
August	8.83	5.88	4.14	0.525
September	10.43	1.31	8.47	1.111
October	9.82	0.88	8.19	1.039
November	7.94	1.82	5.65	0.741
December	6.44	2.15	4.07	0.517
Annual	108.44	28.47	6.19	0.798

Note: Pan evaporation and rainfall are the data for Station 1020.1 at Lihue Airport for 1998 as published in "Climatological Data" by the National Oceanic and Atmospheric Administration.

FIGURE 2. HYDRAULIC PERFORMANCE of WELL 0020-03 ON DECEMBER 20, 2001



Drainage. Approximately 410 acres on the mauka side of Kuhio and Kapule Highways drain into the unnamed gulch which crosses the project site (refer to Figure 3). Another 875 acres, also mauka of Kuhio Highway, drain into the man-made ditch which runs along the northeast boundary of the site. No improvements within the project site are necessary to accommodate stormwater runoff from these two offsite areas. As a result, the drainage improvements that are contemplated would be designed to handle onsite runoff exclusively. These are described in the September 2001 "Ocean Bay Plantation at Hanamaulu, Preliminary Engineering Report for Storm Drainage" by Kodani and Associates, Inc. Improvements would include a closed conduit system within the project roadways with discharge points to water features in the golf course, to the wetlands associated with the unnamed gulch, to the ditch along the northeast boundary of the site, and into the small natural cove just south of the County beach park. No discharges along the steep east and south shorelines of the site would occur.

Overview of Existing Water Resources

Groundwater. Table 3 lists available information on wells in the near vicinity. The locations of these wells are shown on Figure 3. Knowledge of the occurrence of groundwater beneath and in the near vicinity of the site is based on information from these wells and from recent water quality testing done for this assessment.

There are three geologic formations which control the occurrence and movement of groundwater in the near vicinity: the older Waimea series lavas; the younger Koloa series lavas; and the alluvial deposits which form the coastal plain north and east of the project site. Kalepa Ridge is an outcrop of the older Waimea lavas which also exist beneath the site at an unknown depth. Typically, the flow lavas of the Waimea series are highly permeable. In Kalepa Ridge, however, numerous intruded dikes locally compartmentalize groundwater and reduce the overall permeability of the formation. The two wells in the ridge directly inland of the project (Nos. 0021-01 and 5921-01), which have only moderate yields with relatively large drawdowns, are examples of this dike-influenced reduced permeability. Further to the north and at a lower elevation on the flank of the ridge, Well 0120-01 has significantly better hydraulic performance, apparently because it is not as significantly influenced by intruded dikes.

Drilling of the first well onsite (No. 0020-03) started and ended in Koloa series lavas. Strata penetrated included soil and saprolite for the first 100 feet, another 140 feet of weathered rock with essentially no effective permeability, and then relatively unweathered rock of moderate permeability for the last 50 feet of the boring (from 170 to 220 feet below sea level). Water was first encountered about 30 feet above sea level in the soil and saprolite. It remained at that level (with essentially no

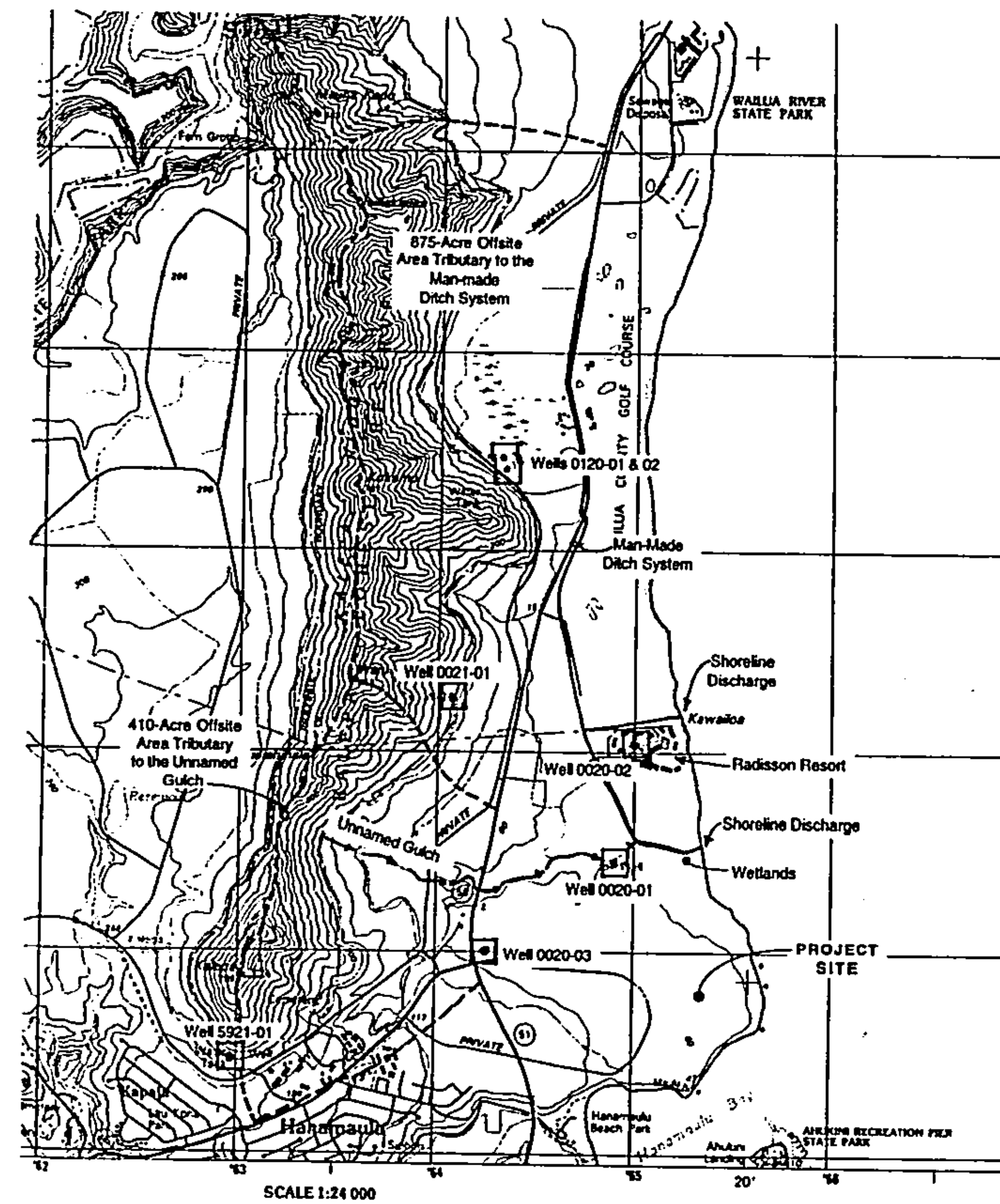


Figure 3

Offsite Drainage Areas and Well Locations

Table 3

Data on Wells Within the Project Site and In the Near Vicinity

Well		Year Drilled	Casing Diameter (Inches)	Ground Elevation (Ft MSL)	Total Depth (Feet)	Elevation at Bottom (Ft MSL)	Formation Tapped	Static Water Level		Representative Hydraulic Performance Drawdown (Ft) @ Flowrate (GPM)	Present Use or Status
State No.	Name / Owner							Ft MSL	Date		
0020-01	Shaft 2	--	Horiz. Shaft	10e	12	-2	Koloa	3e	Not Known	Not Available	Unused
0020-02	Radisson Lagoon	1981	8	10e	200	-190	Waimea	12	August 1981	Not Available	Free Flows into Radisson Lagoon
0020-03	EWM No. 1	2001	12	70	290	-220	Koloa	7.85	October 2001	14 Feet @ 350 GPM	Under Construction; Project Irrigation
0021-01	DLNR Kalepa Ridge	1967	8	166	276	-110	Waimea	15	1967	20 Feet @ 50 GPM	Unused
0120-01	Wailua Golf Course	1899(?)	12	12	240	-228	Waimea	10	1960	14 Feet @ 750 GPM	Golf Course Irrigation
0120-02	State	1899(?)	10	12	312	-300	Waimea	10	1960	Not Available	Buried and Lost in Year 2000
5921-01	Kauai DOW	1954	14	302	540	-238	Waimea	16	1976	25 Feet @ 120 GPM	Supply for DOW's Hanamaulu System

yield) until the drilling reached a depth of 240 feet (170 feet below sea level). At that depth, the water level abruptly dropped to between 7 and 8 feet above sea level and the borehole began to produce water via airlift pumping during drilling. Groundwater in these moderately permeable strata of the Koloa lavas at depth has a significant tidal response. As shown on Figure 4, the tidal amplitude in the well is about 20 percent of the ocean's amplitude and the highs and lows occur about 0.55 hours later than the ocean tide in Hanamaulu Bay.

Although the results of the onsite borehole are not completely conclusive, there does not appear to be a significant hydraulic connection between the shallow groundwater in the soil and saprolite and the deeper groundwater in the more permeable strata encountered in the last 50 feet of the borehole. The best indications of the hydraulic separation between the shallow and deeper groundwater are the abrupt rather than progressive drop in water level during drilling and the lack of cascading water in the open borehole. As will be shown in the section following on surface water, it appears that most of the shallow groundwater moves laterally and discharges into the unnamed gulch, into man-made perimeter ditch on the project's northeast boundary, or into the wetlands.

Finally, based on the results of the well at the Radisson Resort (No. 0020-02) which was drilled through the marine deposits of the coastal formation, there is a change from gray marine silt and sand to the relatively unweathered Waimea series lavas at about 140 feet below sea level at this location. A weathered surface of the Waimea lavas was not encountered. It is also important to note that Koloa lavas were not found between the alluvium and Waimea lavas.

Several other aspects of groundwater occurrence in this area should be noted. First, it is not known whether a hydraulic connection between groundwater in the Waimea lavas of Kalepa Ridge and the permeable Koloa lavas at depth beneath the project site exists. The relative water levels (15 to 16 feet in Waimea Wells 5921-01 and 0021-01 versus 7 to 8 feet in the onsite Koloa formation Well 0020-03) suggest that discharge from the Waimea formation into the Koloa lavas is possible. However, the water quality results, specifically the lower salinity and silica in the downgradient Koloa formation well (Table 4), suggest that this may not be the case. Second, it is worth noting that Koloa lavas, in flowing around the south end of Kalepa Ridge to form the peninsula which comprises the project site, appear to have stopped at that point. Well 0020-02 at the Radisson Resort clearly taps directly into Waimea lavas below the coastal alluvium without encountering intervening Koloa lavas. Also the Waimea lavas at this location are at a shallower depth than the depth of Koloa lavas within the project site as established by Well 0020-03. This suggests that the later-stage Koloa lavas banked against the pre-existing Waimea lavas on the north side of the peninsula.

FIGURE 4. TIDAL VARIATIONS IN HANAMAULU
WELL 0020-03

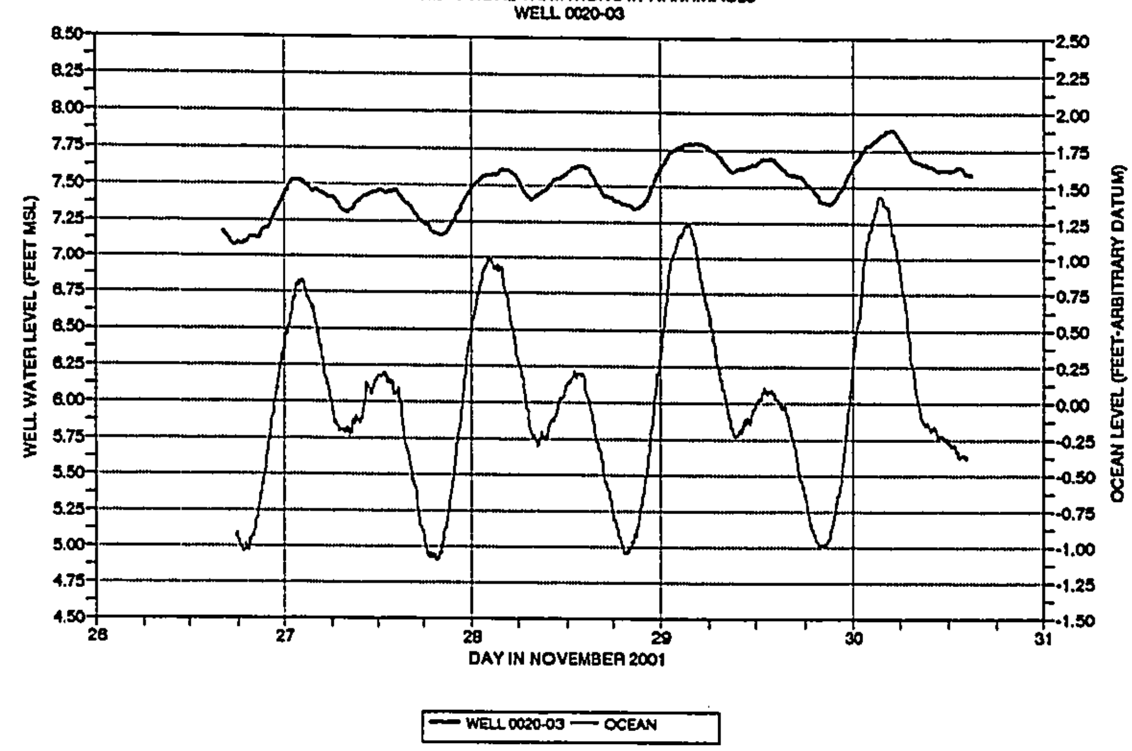


Table 4

Water Quality Analyses of Selected Groundwater Samples

Well No.	Forms of Nitrogen (μM)				Forms of Phosphorus (μM)			Silica (μM)	Salinity (PPT)
	NO_3	NH_4	TON	TN	PO_4	TOP	TP		
0020-03	151.35	0.20	42.90	194.45	13.35	0.05	13.40	1032	0.299
0020-02	625.25	2.85	25.25	653.35	15.05	0.10	15.15	1182	0.438
5921-01	119.95	0.90	11.65	132.50	5.00	0.55	5.55	1191	0.331

Notes: 1. Samples collected by Tom Nance Water Resource Engineering on November 20, 2001.
2. All laboratory analyses by Marine Analytical Specialists.

Surface Water. There are three surface water features of significance within and around the project site. One is the unnamed gulch which originates on the flank of Kalepa Ridge, crosses the project site, and then discharges into the man-made ditch just above the wetlands. Above Kuhio Highway, the gulch is dry except during and immediately following substantial rainfalls. Below the highway, the gulch typically contains pools of water sustained by slow seepage of shallow groundwater from the thick soil mantle across the project site.

The second surface water feature of note is the man-made channel which originates on the mauka side of Kuhio Highway north of the project site, runs along the northeast boundary of the site, and loses topographic definition in the wetlands. There are two ocean outlets to this ditch system. One runs along the north side of the Radisson Resort and the other is downstream of the wetlands at the northeast corner of the project site. Both outlets are normally closed off from direct exchange with the ocean by wave-built beach berms. Direct exchange with the ocean only occurs if the berms are overtopped by storm surf or eroded during a substantial stormwater runoff event.

One such beach berm eroding storm event fortuitously occurred during the collection of field data for this report. Based on measurements at Station 1020.1 at Lihue Airport, 3.74 inches of rain fell between 6:00 p.m. and midnight on November 26th and another 1.71 inches fell between midnight and noon on November 27th. The beach berm at the makai end of the outlet ditch on the north side of the Radisson Resort was eroded to enable direct ocean discharge (Figure 5), whereas the 1.75-foot water level rise in the ditch system did not come close to overtopping the beach berm at the shoreline discharge point downstream of the wetlands. When the water level recorder was retrieved from the ditch on the north side of the Radisson Resort three days after the storm rainfall, the eroded beach berm had not yet been rebuilt by waves. Direct ocean discharge of runoff stored in the ditch system was still occurring.

The third surface water feature of note is the wetlands which exist in the low-lying areas around and downgradient of the unnamed gulch and man-made ditch. Standing water in a portion of this area is sustained by shallow groundwater seepage and by surface runoff during and following rainstorms.

The series of salinity and temperature measurements made throughout the surface water features (Table 5 and Figure 6), as well as the more extensive quality analyses of selected samples compiled on Table 6, provide insight on the contribution of groundwater to the surface water features and the changes that occur during and following significant stormwater runoff events. The following are of particular note:

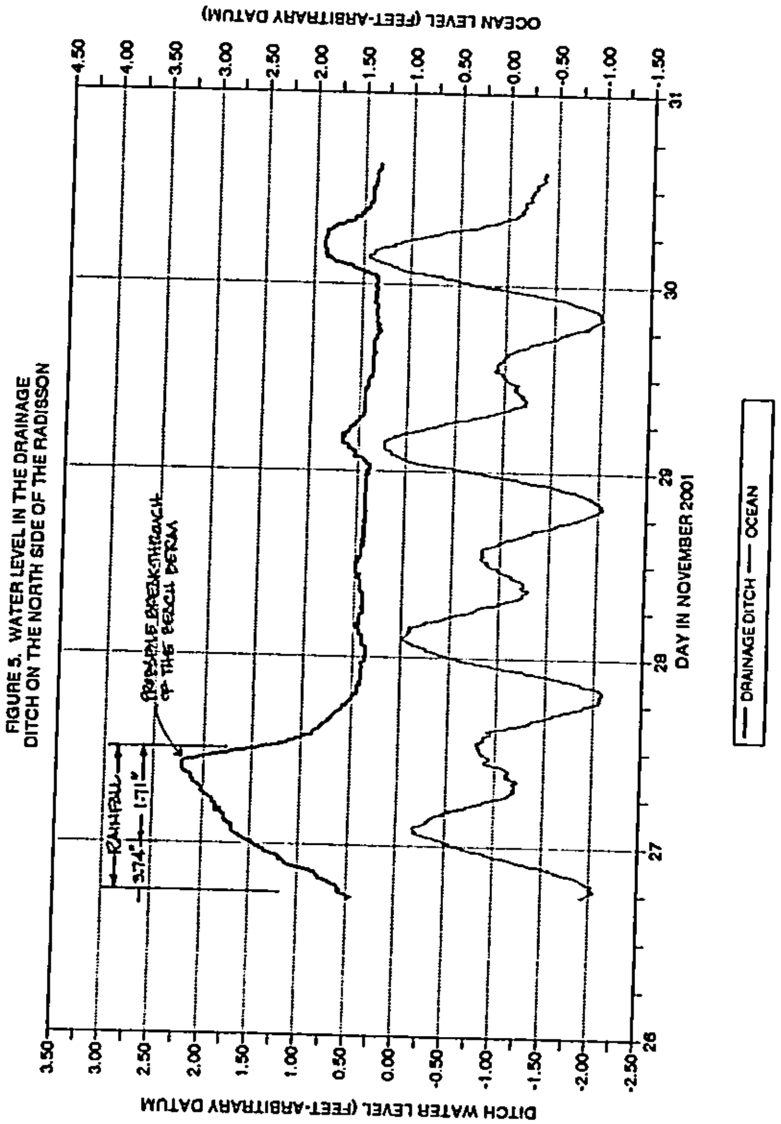


FIGURE 5. WATER LEVEL IN THE DRAINAGE DITCH ON THE NORTH SIDE OF THE RADISSON

Table 5

Field Measurements of Conductivity, Salinity, and Temperature at Various Locations in the Man-Made Ditch System

Site No.	Dry Weather Measurements						Wet Weather Measurement on November 27, 2001		
	November 7, 2001			November 26, 2001					
	Conductivity (µS/cm @ 25° C.)	Salinity (PPT)	Temperature (° F.)	Conductivity (µS/cm @ 25° C.)	Salinity (PPT)	Temperature (° F.)	Conductivity (µS/cm @ 25° C.)	Salinity (PPT)	Temperature (° F.)
1	49,100	31.38	78.8	40,700	24.60	81.6	5,650	3.19	73.4
2	813	0.42	73.2	787	0.39	75.7	2,790	1.51	73.2
3	568	0.28	76.4	640	0.31	77.9	1,290	0.68	72.3
4	595	0.29	75.2	605	0.30	75.0	1,318	0.70	72.3
5	1,485	0.75	76.0	1,465	0.74	76.1	1,455	0.76	73.0
6	1,545	0.77	77.5	1,548	0.77	77.5	1,496	0.79	73.2
7	797	0.40	75.7	970	0.47	78.0	749	0.39	72.6
8	993	0.50	74.6	1,098	0.53	79.1	1,620	0.86	72.3
9	255	0.13	72.8	258	0.13	73.0	51	0.03	72.1
10	52,400	34.29	77.5	52,400	34.37	77.3	52,600	34.35	77.7

Notes: 1. Refer to Figure 6 for the location of the measurements.
2. All data taken on the afternoon of November 26, 2001 with a HACH Sension 5 Meter.

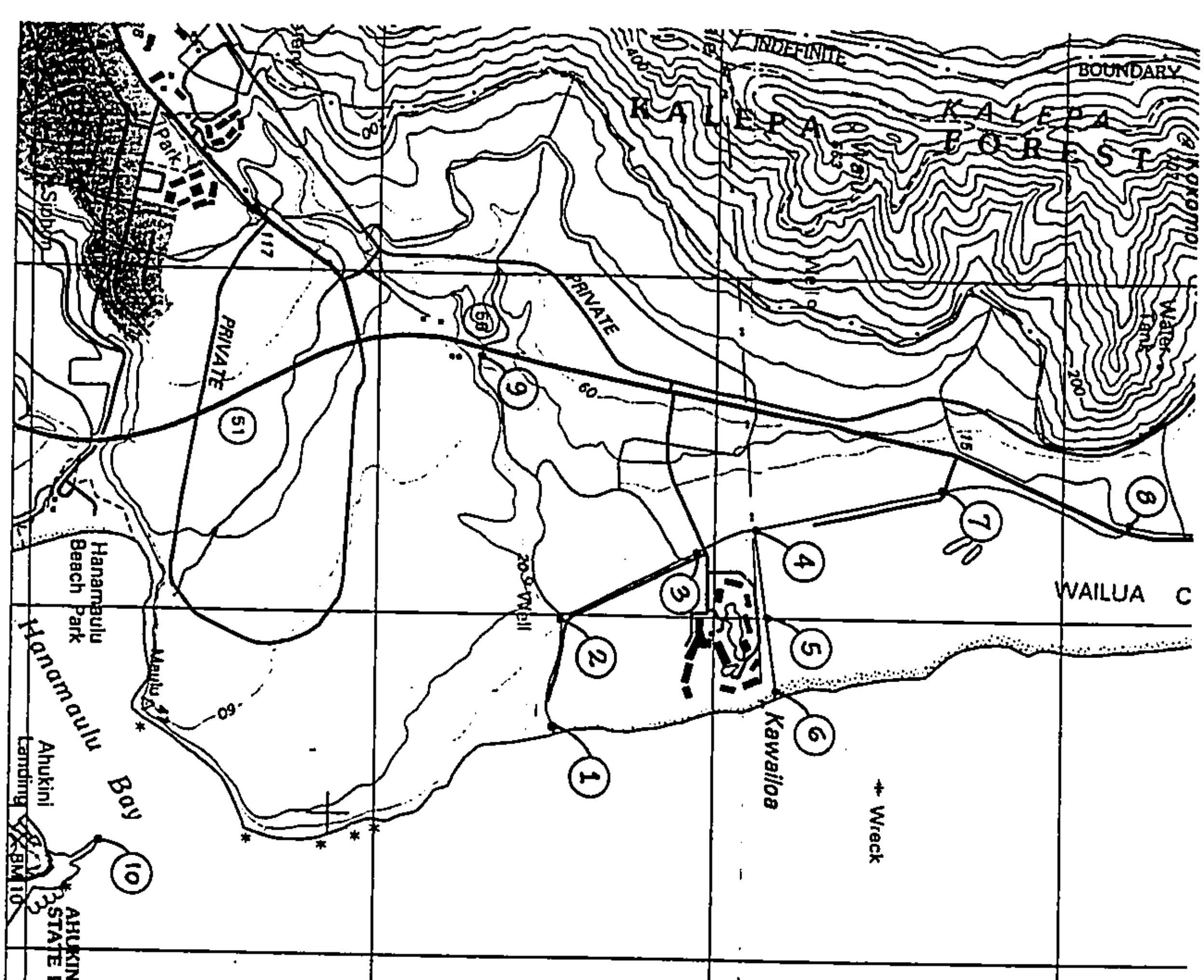


Figure 6
Locations of Surface Water Measurements
(Refer to Table 5 for Results)

Table 6

Water Quality Analyses of Selected Surface Water Samples

Samples Collected During Dry Weather on November 16, 2001

Site No.	Forms of Nitrogen (μM)				Forms of Phosphorus (μM)			Silica (μM)	Salinity (PPT)
	NO_3	NH_4	TON	TN	PO_4	TOP	TP		
1	4.30	37.10	252.00	293.40	9.10	7.50	16.60	180	22.732
2	0.65	2.25	12.60	15.50	1.85	0.05	1.90	987	0.371
6	4.85	4.10	35.90	44.85	0.80	0.95	1.75	756	1.330
7	1.05	7.40	43.90	52.35	1.00	1.50	2.50	817	0.560
9	1.80	146.00	100.20	248.00	3.10	2.30	5.40	122	0.207

Samples Collected During Wet Weather on November 27, 2001

Site No.	Forms of Nitrogen (μM)				Forms of Phosphorus (μM)			Silica (μM)	Salinity (PPT)
	NO_3	NH_4	TON	TN	PO_4	TOP	TP		
2	68.66	255.76	189.72	514.14	0.94	8.30	9.24	584	1.748
6	32.30	88.62	25.52	146.44	1.40	1.30	2.70	430	0.942
7	1.38	11.10	31.04	43.52	1.02	0.50	1.52	471	0.466
9	4.08	1.86	12.92	18.84	1.50	0.02	1.52	20	0.088

Notes: 1. November 16th samples collected by Marine Research Consultants and November 27th samples collected by Tom Nance Water Resource Engineering.
2. All laboratory analyses by Marine Analytical Specialists.

- Silica concentrations demonstrate that in dry periods, most of the water in the surface water features originated as groundwater.

- There are two exceptions to the predominance of groundwater in the surface water features during dry weather:

  - Water in the unnamed gulch at the top of the project site (Site No. 9) is ponded surface water from above the project site.
  - Water in the open pool between the wetlands and beach berm (Site No. 1) two-thirds to three-quarters seawater.

- The wet weather measurements and samples compiled on Tables 5 and 6 were taken on November 27, 2001 immediately following the 18-hour storm rainfall of November 26 to 27. As indicated previously, the beach berm north of the Radisson Resort had been eroded, allowing direct ocean discharge, whereas the berm downstream of the wetlands had not been eroded or overtopped. Some of the contrasts between the wet and dry weather measurements are:

  - The salinity of water in the pool between the wetlands and shoreline beach berm was considerably reduced by the input of surface runoff, an expectable result.
  - As shown by the differences between sampling Sites 9 and 2, runoff from the project site into the unnamed gulch had relatively high salinity, high silica, and high nitrogen. This is likely to be the result of the washing of residual salts on the ground surface.

Potential Effects of the Project on Surface and Groundwater Resources

Four aspects of the project have the potential to affect surface and groundwater resources. These four are: the use of groundwater from the DOW wells in Nonou Ridge for potable supply; the use of onsite wells for irrigation supply; potential infiltration of fertilizer nutrients from landscaped areas to the underlying groundwater; and stormwater discharge into the unnamed gulch and man-made ditch system. Each of these aspects is assessed below.

Potable Supply From DOW's Wells in Nonou Ridge. As indicated previously, the use of potable water from DOW's system is expected to be about 0.21 MGD. According to Kodani and Associates, Inc. water report cited previously, there is sufficient available capacity in DOW's three wells in Nonou Ridge (Nos. 0320-01, 0320-03, and 0321-01). Supplying this project would be an essentially perpetual commitment of 0.21 MGD of the resource. It would also diminish the discharge of groundwater into the marine environment in the Wailua area by a similar amount. However, this latter effect would not be significant because the discharge is likely to be diffuse and occur offshore at significant depth. The adjacent discharge of the Wailua River, which averages more than 120 MGD, is the dominant fresh water input into the marine environment in the region.

Use of Onsite Wells for Irrigation. Initially, the use of onsite groundwater for irrigation would average about 0.55 MGD (refer back to Table 1). In dry years, however, the average could be on the order of 0.8 MGD and it would be as high as 1.1 MGD in the most critical periods (refer to Table 2). The availability of R-1 quality treated wastewater will initially be negligible but will gradually increase to about 0.12 MGD at the project's full build-out. Use of onsite groundwater would be diminished accordingly, ultimately declining to a long-term average of about 0.43 MGD.

There are three active offsite wells in the general vicinity of the project: DOW's Well 5921-01 which supplies a portion of the potable supply to Hanamaulu; the County's Well 0120-01 which provides irrigation supply to the Wailua golf course; and Well 0020-02 which provides circulation water to the Radisson Resort's lagoon. Use of onsite wells for irrigation is not expected to affect any of the three actively used wells for the following reasons:

- All three of the actively used wells draw from the Waimea series lavas whereas the onsite irrigation wells will draw from the Koloa lavas;
- Locations of the onsite irrigation wells are downgradient (from Well 5921-01) or far across gradient (from Wells 0020-02 and 0120-01) from the actively used wells; and
- The 7 to 8 ft (MSL) water levels in the Koloa lavas tapped by the onsite wells is lower than the 10 to 15 ft (MSL) levels in the actively used wells which tap the Waimea series lavas.

Infiltration of Fertilizer Nutrients to Underlying Groundwater

The November 2001 "Condensed Integrated Golf Course Management Plan for the Proposed Ocean Bay Plantation at Hanamaulu Golf Course" prepared by Wm. Kent Alkire II discusses application rates of fertilizers. Of the nutrients in these fertilizers, only nitrogen has any potential to pass through the site's thick soil mantle and reach the shallow groundwater in significant quantities. As such, the assessment herein will focus on nitrogen.

If we assume fertilizer application rates for landscaping in general are similar to the golf course fertilization rates, then the application rates in the Alkire report can be used to approximate project-wide nitrogen applications. As compiled in the table below, the total nitrogen applied throughout the project site at full build-out could be on the order of 42,600 pounds per year. It is reasonable to expect that about five percent of this or about 2100 pounds per year will be carried downward into the underlying shallow groundwater.

Estimated Fertilizer Nitrogen Applied Throughout the Project

Land Use	Area (Acres)	Application Rate (Lbs/1000 ft²/Year)	Amount (Lbs/Year)
Golf Course : Tees and Greens	6	9	2,350
: Fairways	45	7	13,700
: Surrounding Turf	45	5	9,800
Entry, Buffer, and Roads	29	5	6,300
Single Family Residential	34	5	7,400
Multi-Family Residential	14	5	3,050
Totals	173	--	42,600

Notes: 1. Fertilizer nitrogen application taken from Alkire (2001).
2. 30 percent of single and multi-family residential areas assumed to be landscaped.

The potential impact of this nitrogen addition can be approximated as follows. Percolation of nitrogen-enriched irrigation water will reach the shallow groundwater and then move laterally. The shallow groundwater flowrate is primarily a function of local rainfall recharge. Approximating this recharge as one-third of the rainfall across the 460-acre site amounts to 230 million gallons a year or an average of about 0.63 MGD. The addition of 2100 pounds of nitrogen a year to this flowrate would increase the concentration in groundwater by 1.1 milligrams per liter.

Over about 340 acres of the 460-acre site, the shallow groundwater discharges into the man-made ditch, unnamed gully, or directly into the wetlands. In other words, about 0.47 MGD of the nitrogen-enriched shallow groundwater would ultimately end up in the wetlands. Most of the nitrogen would be utilized by the grasses and other vegetation in the wetlands rather than be discharged into the marine environment.

The remaining 0.16 MGD of nitrogen-enriched shallow groundwater would discharge into the marine environment along the east and south shores of the project site. The quantity of discharge is relatively small and would be spread out along a 5500-foot long shoreline.

Stormwater Runoff Into the Gulch, Ditch System, and Wetlands

To assess the likely quality of runoff from the developed project site, samples were collected from the Radisson Resort and Kauai Lagoons golf courses at the end of the 18-hour storm rainfall of November 26-27, 2001. These results are presented in Table 7. The most significant aspects of these results are:

- Nitrogen concentrations from landscaped and parking areas of the Radisson Resort and from both Kauai Lagoons golf courses were less than nitrogen levels in runoff from the presently unused site (Sample 2 on Table 6). These nitrogen levels were also less than nitrogen in the runoff discharged to the ocean north of the Radisson Resort (Sample 6 on Table 6).

- Phosphorus levels in the Radisson Resort and Kauai Lagoons golf courses were higher than in runoff from the present site or discharged to the ocean.

Owning to the design of the project's drainage system and the stormwater retention capacity of the man-made ditch system and wetlands, most stormwater runoff would be retained onsite within golf course lakes or in the downgradient wetlands. Nutrients in retained runoff would either be recycled on the golf course or utilized in the wetlands. Only during severe storms, such as the 5-year event on November 26 to 27, 2001, will direct discharge to the ocean occur. When such infrequent discharges occur, the contribution to the marine environment from the developed project site will not be significant in comparison to the nutrient input by the Wailua River and Hanamaulu Stream north and south of the project site.

Table 7

Water Quality Analyses of Offsite Stormwater Runoff Samples

Sample Location	Forms of Nitrogen (uM)				Forms of Phosphorus (uM)			Silica (uM)	Salinity PPT
	NO_3	NH_4	TON	TN	PO_4	TOP	TP		
Kauai Lagoons Resort									
• Mokihana Golf Course	51.70	17.74	52.30	121.74	28.70	1.38	30.08	118	0.114
• Kiele Golf Course	27.68	11.66	46.06	85.40	23.82	0.96	24.78	92	0.091
Radisson Resort									
• Mauka Landscaped Area	1.84	3.70	47.14	52.68	23.56	2.98	26.56	98	0.095
• Makai Landscaped Area	0.66	4.74	83.06	88.46	50.60	2.42	53.02	448	0.599
• Hotel Parking Lot	0.02	0.94	25.82	26.78	10.58	0.22	10.80	83	0.116

Notes: 1. All samples collected on November 27th at the end of the storm rainfall by Tom Nance Water Resource Engineering.
2. All laboratory analyses by Marine Analytical Specialists.

APPENDIX D

An Assessment of Potential Effects to the Marine Environment in the Vicinity of the Proposed Ocean Bay Plantation at Hanamā'ulu Līhu'e, Kaua'i, Hawai'i

Marine Research Consultants

December 2001

**AN ASSESSMENT OF POTENTIAL EFFECTS
TO THE MARINE ENVIRONMENT
IN THE VICINITY OF THE PROPOSED
OCEAN BAY PLANTATION AT HANAMAULU
LIHUE, KAUAI, HAWAII**

DRAFT

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December 2001

1.0 PURPOSE

Planning is currently underway for the development and operation of the Ocean Bay Plantation at Hanamaulu on a 460-acre site located adjacent to the north side of Hanamaulu Bay, on the eastern coastline of the Island of Kauai. The land was formerly planted in sugarcane by Lihue Plantation Company. The master plan for the proposed development includes an 18-hole golf course, single family and multi-family residential lots, a beach club, and various utilities including a wastewater treatment facility.

While all planning and construction activities will place a high priority on maintaining the existing nature of the marine environment, it is nevertheless important to address any potential impacts that may be associated with the planned project. None of the proposed land uses includes any direct alteration of the coastal areas or nearshore waters. The potential exists, however, for the project to affect the composition and volume of groundwater that flows beneath the project site, as well as surface water that flows across the site. As all groundwater and surface water that could be affected by the project subsequently reaches the ocean, it is recognized that there is potential for the project to affect the marine environment.

In order to evaluate the potential for impacts, a baseline survey of the marine environment in the vicinity of the project has been conducted. The rationale of this assessment is to determine the contribution of groundwater and surface water to the marine environments in the vicinity of the Ocean Bay Plantation at Hanamaulu site, and to evaluate the effects that this input has on water quality and marine community structure at the present time before the commencement of any new construction activities. Combining this information with estimates of changes in groundwater flow rates and chemical composition that could result from the project, will provide a basis to evaluate the potential effects to the marine environments. Predicted changes in groundwater and surface water flow rates and groundwater chemistry have been supplied by Tom Nance Water Resource Engineering (TNWRE) in a report under separate cover entitled "Assessment of the Potential Effects on

Surface and Groundwater of the Ocean Bay Plantation at Hanamaulu" dated December 2001. Results of the combined evaluation will indicate if, and to what degree, there is the potential for negative effects to the aquatic environments from the proposed project.

2.0. METHODS

2.1. WATER CHEMISTRY

2.11. Sampling Sites

The site for the Ocean Bay Plantation at Hanamaulu is located adjacent to the northern shoreline of Hanamaulu Bay, and extends to the north, bounded on the west by Kuhio Highway, and on the east by the open coastal shoreline (Figure 1). Water samples were collected along four transects extending from the most shoreward points of Hanamulu Bay and the open coastline to approximately 500 meters (m) offshore. Transects locations were selected based on proximity to points where surface and groundwater drainage enters the ocean. Transect 1 was located off a drainage ditch just north of the Radisson Hotel; Transect 2 was located off a wetland that is the culmination of another drainage ditch located adjacent to the County Beach Park, and near the location of the proposed Beach Club; Transect 3 was located off a small natural inlet that occurs at the juncture of the sand beach and the rocky shoreline between planned golf course holes 16 and 17 (samples were also collected within the inlet behind the shoreline). Transect 4 originated at the innermost part of Hanamaulu Bay at the juncture of the sandy beach and the rocky headland that in a boundary of the project. Transect 4 traversed the length of Hanamaulu Bay and extended out into the open ocean. In addition, samples were collected at five locations within and adjacent to the project site where surface water occurred (see Figure 1 for all sampling locations).

2.12. Sampling Protocol

All field work was conducted on November 16, 2001. Samples were collected from a small boat, and by swimmers working from shore. All samples were collected in the

morning between the hours of 7:00 and 11:00, which encompassed a period of falling tides (+2 feet to +0.5 feet). Environmental conditions during all sample collection consisted of calm winds and seas, with surf of 1-3 feet breaking on the shoreline. It is important to note that such conditions of calm winds and seas in the project area are not the norm. During tradewind weather, which occurs predominantly throughout the year, the project site is exposed to strong winds and tradewind generated swells. In addition, owing to the essentially round shape of Kauai, long period swells emanating from both the north and the south produce breaking waves on the reef fronting the project site. Hence, the fortuitous conditions of little wind, and calm sea and swell that occurred during the sampling window allowed sample collection within the surf zone that would not have been possible during normal tradewind weather.

At each of the three transect sites that originated on the open coastline, water samples were collected on transects perpendicular to shore, extending from points at the shoreline where streamflow or runoff enters the ocean for a distance offshore deemed to be beyond the influence of runoff or groundwater input. The sampling scheme consisted of sampling stations at distances of 0.1, 2, 10, 25, 50, 75, 100, 150, 300 and 500 m from the shoreline. On the transect that bisected Hanamaulu Bay, samples were collected along a transect extending from the inner northwest corner of the Bay along the northern perimeter, and out the entrance of the Bay into the open ocean.

Water samples were collected at two depths at all locations except those within 5 meters from shore; a surface sample was collected within approximately 20 centimeters (cm) of the ocean surface, and a bottom sample was collected within approximately 20 cm of the sea floor. Surface water samples were collected by opening acid-washed, triple-rinsed 1-liter polyethylene bottles at the desired depth. Bottom Water samples were collected using 1.8-liter Niskin-type oceanographic sampling bottles. These bottles were lowered to the desired depth in an open position where spring-loaded endcaps were triggered to close by a messenger released from the surface. Upon retrieval of the sampling bottle, water was transferred to a 1-liter polyethylene bottle. At stations within 5 meters from shore, and within the small cove at the origin of Transect 3, only one sample was collected at the midpoint of the water column. Following field sampling, samples were immediately placed on ice, and shipped to Honolulu.

Such sampling is designed to span the greatest range of salinity with respect to freshwater efflux at the shoreline. As the key interest in the investigation deals with inputs from groundwater and stream water, sampling was most concentrated in the shallow nearshore areas where these inputs would be most noticeable. Such a sampling scheme, which allows scaling of water chemistry parameters to salinity, is applicable to a hydrographic mixing model that has been established as an effective method of determining changes in chemical make-up of groundwater and surface water discharge. In addition, the method allows identification of chemical sources on land that are contributing to material input to the marine environment (Dollar and Atkinson 1992, Smith and Atkinson 1990, Dollar and Smith 1988). This methodology also eliminates the necessity of repetitive sampling at the same tidal state in order to compare temporal variability. In addition, the sampling scheme allows for determination of spatial variability of chemical constituents within the horizontal range of the survey (across the reef), and with respect to vertical stratification.

2.13 Monitoring Constituents

Water quality parameters evaluated included the 10 specific criteria designated for open coastal waters in Chapter 11-54, Section 06 (Open Coastal waters) of the Water Quality Standards, Department of Health, State of Hawaii. These criteria include: total nitrogen (TN) which is defined as inorganic nitrogen plus organic nitrogen, nitrate + nitrite nitrogen (NO_3^- + NO_2^-, hereafter referred to as NO_3^-), ammonium (NH_4^+), total phosphorus (TP) which is defined as inorganic phosphorus plus organic phosphorus, chlorophyll a (Chl *a*), turbidity, dissolved oxygen, temperature, pH and salinity. In addition, orthophosphate phosphorus (PO_4^{-3}) and silica (Si) were reported because these constituents are sensitive indicators of biological activity and the degree of groundwater mixing, respectively.

2.14. Analytical Methodology

Analyses for NH_4^+, PO_4^{3-}, and NO_3^- + NO_2^- (hereafter termed NO_3^-) were performed

using a Technicon autoanalyzer according to standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TN and TP were analyzed in a similar fashion following digestion. Total organic nitrogen (TON) and total organic phosphorus (TOP) were calculated as the difference between total nitrogen (TN) and dissolved inorganic nitrogen (DIN), and total phosphorus (TP) and dissolved inorganic phosphorus (DIP), respectively. The level of detection for the dissolved nutrients is 0.2 µM for TN and Si, 0.02 µM for TP, NO_3^- and NH_4^+, and 0.01 µM for PO_4^{3-}.

Turbidity was measured on a Monitek Model 21 90-degree nephelometer, and reported in nephelometric turbidity units (ntu, level of detection 0.01 ntu). Chl *a* was measured by filtering 300 ml of water through glass fiber filters; pigments on filters were extracted in 90% acetone in the dark at -5° C for 12-24 hours, and the fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer (level of detection 0.01 µg/L). Salinity was determined using an AGE Model 2100 laboratory salinometer with a precision of 0.0003‰. pH and temperature were measured in the field using an Accumet meter with temperature compensated combination electrode and a precision of 0.01 pH units and 0.01°C. Percent saturation of dissolved oxygen was measured using a Royce Model 900 field meter with precision to 1%.

All lab analyses were conducted in the laboratory of Marine Analytical Specialists in Honolulu,HI (Laboratory Certification NO: HI-0009).

2.2 ASSESSMENT OF MARINE BIOLOGICAL COMMUNITY STRUCTURE

Biotic and physiographic structure of the marine environment in the vicinity of the Ocean Bay Plantation at Hanamaulu was evaluated by establishing a descriptive and quantitative baseline of benthic reef communities. Key components of reef communities include hermatypic and soft corals, benthic algae, motile macroinvertebrates, reef fish, and protected and endangered species such as sea turtles and marine mammals.

All monitoring surveys were conducted on December 14, 2001by divers using SCUBA equipment, and working out of a 19-foot boat. Evaluation of the marine biological community was conducted by qualitative reconnaissance surveys along the length of the area fronting the project site along the shoreline out to the 20 meter (60 foot) depth contour. Information gathered during the surveys included abundance estimates of the dominant flora and fauna, as well as observations on the factors that affect these biotic assemblages. Quantitative surveys of the offshore area were not possible as the entire region off the pond was subjected to breaking surf which makes deployment of sampling gear impossible.

3.0 RESULTS

3.1 Physical Structure

The geological structure of the coastal area off the project site between the northern edge of Hanamaulu Bay and the northern boundary off of the existing Radisson Hotel is composed of sandy beaches grading into a shallow, gently sloping nearshore limestone reef platform. An exposed, weathered beachrock ledge forms the intertidal area between the sand beach and a subtidal limestone platform. Numerous sand-filled channels or grooves that are oriented primarily perpendicular to the shoreline bisect the beachrock ledge and limestone platform. Owing to the orientation of the shoreline (facing east-northeast) the area is directly impacted by northeasterly tradewind seas. In addition, refracting long period swells from the south and north also generate breaking surf on the nearshore reef platform. As a result, the nearshore area is under near constant impact from wave stress, which is an important factor in regulating the composition of the benthic communities.

Moving seaward, bottom topography consists of a relatively flat limestone pavement covered with a layer of fine sandy sediment. Vertical relief in this area consists of some undercut ledges and caves, as well as numerous shallow depressions filled with coarse sand composed primarily of the remains of calcareous algae. Sandy sediment on the limestone pavement is in a constant state of resuspension by wave and current forces. This continual scouring prevents the development of extensive coral communities, and the major colonizer of the pavement is various species of algae. The flat pavement extends offshore to the limits of investigation, which corresponds to a water depth of approximately 60 ft.

The shoreline of Hanamaulu Bay fronting the property consists of relatively steep cliffs lined with boulders at the water line. Within Hanamaulu Bay, bottom structure consists primarily of red sandy mud. Large colonies of the plating coral *Montipora* spp. provide the dominant biotic component of the inner bay floor. Such large flat colonies were specific to the inner bay, and did not occur in the regions beyond the bay mouth. Such assemblages of corals are common in wave-sheltered, mud bottom habitats in Hawaii.

3.2 WATER CHEMISTRY

Tables 1 and 2 show results of water chemistry analyses for all marine waters, and for five surface water samples collected on, or in the vicinity of the project site. Table 1 shows nutrient concentrations in units of micrograms per liter (µg/L) while Table 2 shows nutrient concentrations in micromolar units (µM). Concentrations of ten chemical constituents in surface and bottom water samples are plotted as functions of distance from the shorelines in Figures 2-5. Note in Tables 1-2 and Figures 2-5 that the open coastline off the project site is considered the "zero" distance from shore; samples collected seaward of the coastline are positive distances from shore; samples collected in Hanamaulu Bay landward of the bay mouth and in the small cove at Transect 3 are negative distances from shore.

Examination of Tables 1and 2 and Figures 2-5 show several major patterns of horizontal stratification of water chemistry constituents in the ocean and Hanamaulu Bay. Probably the most obvious characteristic of the data set is the steep vertical gradients separating the three samples collected within the small cove at the origin of Transect 3 from the remainder of the sample set. Within the cove, salinity is substantially reduced to a low of 21‰, compared to ~35‰ at all of the ocean sampling points. Conversely, the concentrations of silica (Si), nitrate (NO_3^-) and total nitrogen (TN) are substantially elevated in the inlet compared to all of the other ocean sampling locations (Figure2, and 3). Phosphate (PO_4^{3-}) also displays a elevated concentration at the back of the inlet, but at a far lower increase than observed for Si and NO_3^- (Figure 4). These gradients represent the infiltration of nutrient rich groundwater into the landward extension of the cove, which mixes rapidly with ocean water (see TNWRE 2001 for nutrient concentrations in groundwater). Within 10 m of the shoreline there is no evidence of reduced salinity or increased concentrations of NO_3^-.

Throughout the length of the sampling transects at Sites 1 and 2, and seaward of the shoreline at Site 3, there are no distinct horizontal gradients in salinity, Si, or NO_3^-. The lack of any gradients indicates that the input of groundwater at the shoreline, which is evident in the cove, is completely mixed to background ocean concentrations at the shoreline. Such complete mixing is likely a result of physical processes, primarily from wave-generated turbulence, and low input of groundwater at the shoreline. It is also important to note that the water sampling was conducted on a day when oceanic mixing processes were at a minimum. The normal conditions of physical processes (wave energy) are substantially higher and would serve to mix groundwater inputs to background oceanic levels even more than measured.

Plots of water chemistry constituents that do not occur in high concentrations in groundwater relative to ocean water do not display the same horizontal and vertical profiles as observed for Si and NO_3^-. the constituents that are found in groundwater. Plots of TON and TOP do not exhibit any gradients with higher concentration within the inlet relative to the ocean samples (Figures 3 and 4). NH_4^+, which is generally not found in groundwater does, however, exhibit a peak within the inlet relative to ocean waters (Figure 3). Similarly Chl *a* in the cove is elevated (Figure 5). It is likely that these constituents indicate an increase in biotic activity, particularly algal growth in the inlet relative to open coastal waters.

The other major pattern that is evident in the data is the single anomalous data point sampled 100 m inland from the mouth of Hanamaulu Bay. It is apparent in the data that there is no groundwater emanating from the shoreline in the inner portion of Hanamaulu Bay (no decrease in salinity or increase in Si). At the sampling point 100 m from the mouth of the Bay salinity in the surface samples is decreased to about 26‰ and Si increases to about 81 μM (Tables 1-2, Figure 2). It is likely that this anomaly is a result of sampling within the plume of water discharging at the shoreline from Hanamaulu Stream. The lack of a similar spike in the concentration of NO_3^- to correspond with Si substantiates that the decreased salinity is not a result of groundwater, as groundwater typically contains elevated NO_3^-.

The general pattern of water chemistry within Hanamaulu Bay reveals no distinct vertical gradients (with the exception of the single point described above). The only nutrients that reveal distinct horizontal gradients are the components of phosphorus (PO_4^{3-}, TOP and TP) which peak at the most inshore part of the Bay and decrease with distance seaward (Figure 4). All forms of nitrogen (NO_3^-, NH_4^+ , TON and TN) exhibit relatively constant concentrations throughout the Bay, which are only slightly higher than in the open ocean (Figures 2 and 3).Turbidity and Chl a exhibit a general pattern of peak values in the landward portion of the Bay and decrease with proximity to the open ocean (Figure 5).

Examination of the chemical composition of surface water collected around the development property reveals a wide range of values (Tables 1-2). TNWRE (2001) provides a detailed explanation of surface water composition and origin. In short, he finds that during dry weather, most of the surface water on or near the site originates as groundwater. Two exceptions are that water in the unnamed gulch at the top of the project site (SW-5) is ponded surface water from above the project site. Water in the open pool between the wetlands and the berm near the county park (SW-3) is primarily seawater. During wet weather, the salinity in the pool (SW-3) became substantially fresher.

In summary, several major points are apparent from the evaluation of gradients of water chemistry constituents: 1) there is a small input of groundwater mixing with ocean water into the small cove at Transect 3 that results in distinct decreases in salinity and increases in groundwater nutrients; 2) mixing of groundwater in the ocean at all sites is thorough, even during the calmest weather, resulting in virtually no zone of mixing within the nearshore area; and 3) water within Hanamaulu Bay contains little groundwater, but does have a component of surface runoff from discharge from Hanamaulu Stream.

3.3 BIOLOGICAL COMMUNITY ASSESSMENT

3.3.1 Benthic Community Structure

Marine community structure as represented in this report can be defined as the abundance, diversity, and distribution of benthos (bottom dwelling organisms), including stony and soft corals, marine plants (algae), motile benthos such as echinoderms, pelagic species such as reef fish, and federally protected species. When considering environmental changes caused by changes in land use or changes in non-point input of water of altered composition, benthic communities are probably the most useful biological assemblages for direct evaluation of environmental impacts to the offshore marine environment. Because benthos are generally long-lived, immobile, and can be significantly 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.

The benthic (bottom dwelling) community zonation pattern off the project site is formed in response to physical structure of the habitat and natural environmental stress over the different regions of the environment. Owing to the shallow depth and proximity to the shoreline, this region receives most of the force of breaking waves and surge. Northeast tradewind that occur over approximately 80% of the time in summer, and 50% of the time in winter generate waves that impinge directly on the subject site. In addition, owing to the relatively round shape of the Island of Kauai, long-period swells generated from storms in both the north and south Pacific reach the eastern Kauai coastline as breaking waves. Because of frequent episodes of high energy breaking waves, few species of benthic reef organisms are capable of settling on in the nearshore boulder zone. Considering reef-building corals, the most abundant species is *Pocillopora meandrina*, a sturdy hemispherical branching species. *Pocillopora meandrina* is classified as a "pioneering species" because it rapidly colonizes newly cleared surfaces, and 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 sea cliff and boulders near the shoreline.

Other frequently occurring corals in the shallow zone are *Porites lobata* and *Montipora patula*. These species occur as flat encrusting colonies on the upper surfaces of boulders. This growth form is advantageous in areas of extreme water motion because there are no protruding surfaces that can suffer breakage. Macroalgae were essentially absent from the nearshore zone presumably as a result

of the vigorous wave forces. With distance seaward coral cover increases gradually; total coral cover in the deeper reef zone from a depth of 20-60 feet was estimated at 15-25% of bottom cover.

Besides corals, the major biotic assemblages in the pavement zone consisted of benthic algae. Most of the limestone surfaces were covered with a short turf of unidentifiable algae. Larger plants that were observed ubiquitously over the pavement included the green algae *Caulerpa* spp.,*Codium* spp., and *Enteromorpha* sp. Especially abundant were clumps of *Halimeda* spp., and large areas of sand were composed of dead and weathered Halimeda segments. Brown algae observed included *Dictyota* spp., *Padina* spp., *Sargassum* spp., *Sphaecelaria* sp. and *Turbinaria ornata*. Red seaweeds included *Acanthophora spicifera*, *Amansia glomerata*, *Asparagopsis taxiformis*, *Corallina* sp., *Galaxaura* spp., *Gibbsmithia hawaiiensis*, *Liagora* spp., *Neogoniolithon* sp., *Porolithon* spp, *Hydrolithon* spp. and *Trichogloea* sp. While there were numerous species of benthic algae observed,none of the species assemblages represented any unusual aggregation of plants, but rather comprised a typical high energy Hawaiian flat-bottom cover.

The major taxa of motile benthic organisms occurring within the survey area were sea urchins (Echinoidea) and sea cucumbers (Holothuroidea). While several individuals of these taxa were observed, they were conspicuously rare compared to other Hawaiian reef sites. Motile organisms were observed very infrequently in the boulder zone, probably as a result of intense water motion. The most abundant urchins in the pavement zone were the two species that bore into limestone surfaces, *Echinometra matheai* and *Echinostrephus aciculatus*. Several individuals of larger species of urchins, *Tripneustes gratilla*, *Echinothrix diadema*, and *Heterocentrotus mammillatus* were also observed, are considered rare in occurrence. Most common of the sea cucumbers are the species *Holothuria atra* and *H. mauritiana*, which occurred mainly on the limestone pavement.

The benthic community structure within Hanamaulu Bay was distinctly different than on the outer exposed reefs. The predominant benthos within the bay were large flat encrustations of two species of the genera Montipora (*M. patula* and *M. verrucosa*) that covered up to 50% of the bottom. Flat plating growth forms of Montipora are typical of high sediment environments in Hawaii, such as in Hilo Bay.

3.3.2 Reef Fish Community Structure

The abundance and diversity of the fish community off the Ocean Bay Plantation at Hanamaulu is typical of wave-swept exposed coastlines in Hawaii. Most of the fishes observed on the reef flat were located near small crevices and holes which afforded some shelter. The damselfish species *Chromis vanderbilti*, *C. hanui* and *C. ovalis*; the hawkfish *Parracirrhites arcatus*; and the wrasses *Coris gaimard* and *Thalassoma duperrey* were all observed clustered near small crevices or coral heads. The triggerfish *Sufflamen fraenatus* was seen in areas of open bottom, but quickly retreated to its shelter upon the approach of a diver. The wrasse *Coris ballieui* was also seen ranging across areas of open bottom. In general however, the deeper sites were characterized by a remarkable scarcity of reef fish. The combination of a few individuals representing only a few species results in very low species diversity for this habitat. It may be that this area is frequented by schooling midwater species such as the akule (*Trachiurops crumenophthalmus*) and 'opelu (*Decapterus pinnulatus*), but these species are transients as opposed to the site-attached nature of most reef fishes.

3.3.3 Endangered and Protected Species

Several 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 coastlines of Kauai, and is known to feed on selected species of macroalgae. The endangered hawksbill turtle (*Eretmochelys imbricata*) is known infrequently from waters off of Kauai. Hawaiian monk seals (*Monachus schlauslandi*) are also sited occasionally around the island of Kauai. The shoreline area fronting the Ocean Bay Plantation at Hanamaulu site consists primarily of sandy beaches, making the area accessible for turtle and seal haul-outs. While turtles and seals undoubtedly occur in the offshore areas and on the beaches, none were observed during the fieldwork for the present assessment.

Populations of the endangered humpback whale (*Megaptera novaeangliae*) are known to winter in the Hawaiian Islands from December to April. The present survey was conducted in November, when whales are present in Hawaiian waters. However, none were seen during the surveys.

4.0 DISCUSSION and CONCLUSIONS

4.1 Effects to Marine Water Chemistry and Biota

The purpose of this baseline survey is to provide the information to make valid estimates of the potential for impact to the marine environments from development of the proposed Ocean Bay Plantation at Hanamaulu . The information collected for this study provides the basis to understand the processes that are operating in the groundwater-surface water-ocean system, and to specifically address the concerns raised in the planning process.

The proposed Ocean Bay Plantation at Hanamaulu does not include any plans for any direct alteration of the shoreline or offshore areas. Therefore, potential impacts to the marine environment can only be considered from activities on land that may result in delivery of materials (fresh water, sediment, nutrients, and potentially toxic materials) to the ocean through infiltration to groundwater and surface runoff. As discussed in TNWRE (2001), three aspects of the project have the potential to affect surface and groundwater resources: 1) the use of groundwater from the DOW (Dept. Of Water) wells for potable water supply; 2) potential infiltration of fertilizer nutrients from landscaped areas to the underlying groundwater; and 3) stormwater discharge into the unnamed gulch and man-made ditch system.

TNWRE (2001) has estimated the change in groundwater flow rates, salinity, and nutrient concentrations from each of these factors. Presented below are considerations of potential changes to the marine environment based on data collected for the assessment along with the estimates of changes to groundwater parameters as calculated by Nance.

4.1.1 Potable Water

TNWRE estimates that there is sufficient capacity to supply the project from existing wells. Such supply would diminish the discharge of groundwater into the marine environment in the Wailua area by approximately the same volume as is removed for potable use (~0.21 million gallons per day [mgd]). However, as shown by the data collected on the ocean transects for the present study, such a change in groundwater discharge is inconsequential because oceanic mixing processes effectively eliminate the groundwater input at the shoreline.

4.1.2 Infiltration of Fertilizer Nutrients to Underlying Groundwater

The "Condensed Integrated Golf Course Management Plan for the Proposed Ocean Bay Plantation at Hanamaulu Golf Course" (Alkire 2001) discusses application rates of fertilizers on the proposed course. Of the nutrients in these fertilizers, only nitrogen has the potential to pass through the thick soil mantle and reach the shallow groundwater in significant quantities. As shown in TNWRE (2001) the total nitrogen applied throughout the project site for the golf course and landscaping throughout the project site at full build-out is estimated at 42,600 pounds per year. Typical golf courses have a loss rate of about 5-10% of fertilizer nitrogen that moves through the soil mantle to underlying groundwater (Dollar and Atkinson 1992). If it is assumed 5% of the applied fertilizer enters groundwater, and that adding this amount of infiltrate to recharge on site by local rainfall results in an increase in the concentration of groundwater nitrogen by about 1.1 milligrams per liter (78 µM).

TNWRE estimates that about 75% of the shallow groundwater on the site discharges into the on-site ditches and gullies which discharge into the wetlands. Wetlands are adapted to receive high nutrient water from surface or groundwater flow, and most of the nitrogen is taken up by plants and recycled within the wetland. In fact, in many locales, constructed wetlands have become a method of choice for "polishing" treated sewage effluent that is subsequently re-used as irrigation water. The remaining ~25% of the fertilizer nutrients would be discharged to the marine environment along the 5,500-foot long shoreline fronting the project.

Effects to the marine environment from the discharge of fertilizer nutrients will be insignificant for several reasons. Dollar and Atkinson (1992) showed that at Keauhou Bay on the Kona Coast of the Island of Hawaii, nutrients from two golf courses that ringed the bay increased the nitrogen concentration of groundwater entering the ocean by about 80 µM, which is essentially the same amount as the 78 µM predicted for the Ocean Bay Plantation at Hanamaulu golf course (see above). However, while this subsidy doubles the concentration of nitrogen entering the Bay, there were no effects to biotic structure or water clarity. Within the wave-sheltered Bay low salinity groundwater formed a distinct surface layer that flowed out the mouth of the Bay with no contact with the benthic communities on the floor of the Bay. Thus, the residence time of surface water containing the elevated nutrient concentrations was so short that phytoplankton could not establish within the Bay.

Similar dynamics have been described for Honokohau Harbor on the West Coast of Hawaii by Bienfang (1980), who states that..."the potential eutrophying effects of the groundwater nutrients are avoided as a result of the rapid harbor flushing." Thus, it is clear, based on published literature, that in semi-enclosed bodies of marine waters that receive input of nutrient subsidized groundwater, the potential for impacts to biotic communities is negligible. For the present case, where physical mixing processes are substantial in the entire nearshore area, the subsidies of nutrients in groundwater would be mixed to background oceanic levels essentially instantaneously. From the data collected for this study, Hanamaulu Bay does not appear to receive input of groundwater from the project site. As a result, there would be no effect to the Bay from nutrient subsidies resulting from fertilization on the project site.

4.1.3 Storm Water Runoff

TNWRE (2001) reports that sampling immediately following a major storm event that occurred on November 16, 2001, showed that nitrogen concentrations from landscaped and parking areas of the existing Radisson Resort and from the existing Kauai Lagoons Golf Courses were less than nitrogen levels in runoff from the presently unused site. Presumably the elevated nitrogen levels in runoff from the existing site were elevated resulting from leaching from flow across vacant land that was previously planted in sugarcane. Phosphorus concentrations, however, were slightly higher in the runoff from the existing hotel and golf course than from the undeveloped site.

Owing to the design of the drainage system for the Ocean Bay Plantation at Hanamaulu, and the stormwater retention capacity of the man-made ditch system and wetlands, most stormwater runoff would be retained onsite within lakes and water features on the golf course, or in wetlands downgradient from the project site. Nutrients in retained runoff would either be recycled on the golf course or utilized in the wetlands. Only during severe storms such as the 5-year event on November 26-27 will direct discharge to the ocean occur. During such events, however, several factors will negate the potential for impacts to the marine environment. First, during storm events, wind and waves are generally even more intense than the normally high rates of mixing that occurs in the nearshore marine environment during typical conditions of tradewind weather. Second, during storm events the discharge of surface water from the project site is insignificant in comparison to discharge by the Wailua River to the north of the project site and Hanamaulu Stream to the south of the site.

4.1.5 Sediment

Another factor associated with storm water runoff that should be considered is the potential input of sediment to the marine environment. During the construction phase of the project, it is possible that exposed soil may erode during storms. With the completed project when all of the golf course is grown in, and landscaping and construction is complete, the potential for sediment input is lower not only than at present, but during past decades when the area was planted in sugarcane.

Should sediment from the project enter the marine environment, the potential for impacts are minimal or nonexistent. Within the marine environment, the nearshore area contains locally high regions of cover of calcareous sands of marine origin. 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. Because of the existence of natural sands, and the normal conditions of coastal ocean turbulence which continually resuspend natural sediment, biotic 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 resuspension within the study area, any additional input from land resulting from construction activity would probably not have the potential to accumulate to the point were organisms could be buried.

4.2 POTENTIAL EFFECTS TO ENDANGERED AND PROTECTED MARINE SPECIES

As mentioned in the results there are several protected marine species that may inhabit the environment offshore of the Ocean Bay Plantation at Hanamaulu site. Because there is no plan for any work in the nearshore region, there is no potential for blasting or excavation that might affect behavior of whales, monk seals and other marine mammals. Similarly, as described above, there is little potential for changes in water quality resulting from the project that differs qualitatively from the existing situation. It is also not likely that the proposed project will result in decreased access to the shoreline. Thus, there is little potential for any negative factors associated with the project that may affect turtles, seals or other federally protected species.

5.0 SUMMARY

A concern in the planning process for the Ocean Bay Plantation at Hanamaulu is the potential for impacts to marine and wetland environments downgradient from the project site. As there will be no alterations of any of the marine habitats by the project, potential impacts are restricted to alteration of groundwater that flows under the project site to the ocean and surface runoff that could run across the site.

Perhaps the most important aspect of evaluating prospective changes to the marine environment is the characterization of existing natural conditions. Results from the present survey, as well as other surveys conducted of neighboring marine areas fronting the Kauai Lagoons golf course, indicate that there is little detectable input of groundwater to the ocean even under the calmest of conditions. The lack of detectable input of groundwater at the shoreline, or anywhere else in the marine environment (with the exception of a small inlet in the central part of the property) indicates that groundwater is not a factor affecting the nearshore water chemistry. Under the "normal" regime of tradewind conditions where physical processes create substantial turbulence in the nearshore area, groundwater is mixed to background oceanic levels even more completely.

Estimates of changes to groundwater composition and flow from the project (primarily the golf course and landscaping) indicate a potential increase of groundwater recharge and the concentration of nitrogen. However, because of virtually undetectable input of groundwater near the shoreline, and the substantial physical mixing, these increases are likely to not cause any changes to water chemistry and hence to community structure. Similar situations that have been documented in other locations in Hawaii substantiate that the magnitude of nutrient subsidy to groundwater that may occur from the proposed project does not result in negative impacts to the marine environment.

Stormwater also does not present a potential problem as stormwater draining from existing resort developments and golf courses in the area contain less nitrogen, than the undeveloped property. Hence, if anything, the proposed project may improve water quality with respect to storm water discharge.

Thus, the potential for impact to marine water quality and biotic communities as a result of development of the project appears to be minimal. Similarly, there is little potential for the project to have any effect on endangered or protected species.

In summary, based on the results of the present study, as well as past work on the marine environments off the eastern shoreline of Kauai, it can be concluded that as

long as reasonable steps are taken in construction practices and operational procedures that prevent unanticipated changes in material delivery to the nearshore ocean, there should be no adverse impacts to the marine environment from the Ocean Bay Plantation at Hanamaulu.

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TABLE 1. Results of water chemistry analyses on samples collected November 18, 2001 on four ocean transects off the site of the proposed Ocean Bay Plantation at Hanamaulu, Kauai Hawaii. Nutrient concentrations are in micrograms per liter (µg/L). "DFS" indicates distance from shore (or the most landward portion of Hanamaulu Bay, "S" indicates surface sample, "B" indicates bottom sample. Also shown are data for five surface water samples. For location of sampling sites, see Figure 1.

TRANSECT	DFS (meters)	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (ntu)	SALT (o/oo)	pH (ref)	Chl-a (µg/l)	Temp (deg C)	O2 % sat.
1	0	2.79	31.64	0.98	343.66	9.92	139.58	12.71	172.20	0.34	34.206	8.138	0.126	24.4	94
NORTH OF	2	1.86	8.54	0.14	101.16	9.30	109.08	11.16	117.74	0.30	34.962	8.191	0.132	25.1	95
RADISSON	10	1.86	1.96	0.56	56.20	8.99	95.20	10.85	97.72	0.26	35.084	8.214	0.162	24.5	95
	25	2.17	1.40	0.70	51.99	9.61	94.08	11.78	96.18	0.24	35.128	8.212	0.180	24.4	94
	50	1.86	1.68	0.42	81.54	10.54	84.00	12.40	86.10	0.17	35.108	8.201	0.246	24.5	96
	75	1.86	1.68	0.56	84.83	9.92	82.32	11.78	84.56	0.14	35.100	8.208	0.120	24.3	94
	100s	2.48	2.94	5.88	88.80	9.30	77.84	11.78	86.68	0.21	35.148	8.189	0.108	23.8	105
	100b	2.79	3.22	3.08	56.76	9.30	82.60	12.09	88.90	0.17	35.145	8.170	0.174	24.0	108
	150s	4.03	1.40	1.40	84.58	8.37	93.38	12.40	96.18	0.18	35.182	8.187	0.102	24.4	98
	150b	6.20	8.02	5.04	81.49	7.75	88.06	13.95	99.12	0.17	35.129	8.158	0.126	24.3	94
	300s	2.48	2.24	2.52	51.42	9.61	88.48	12.09	93.24	0.18	35.178	8.187	0.126	24.4	102
	300b	2.79	1.98	2.94	50.02	8.99	79.24	11.78	84.14	0.14	35.169	8.188	0.132	24.9	108
	500s	3.41	1.96	7.84	83.79	8.06	85.40	11.47	95.20	0.16	35.129	8.193	0.150	24.4	95
	500b	3.41	2.24	3.36	68.56	8.68	86.80	12.09	97.40	0.16	35.145	8.189	0.174	24.8	94
2	-5	5.89	3.22	5.60	89.92	7.75	112.42	13.64	121.24	0.22	35.148	8.249	0.258	26.1	99
COUNTY	0	2.79	3.78	6.44	55.08	9.30	90.86	12.09	101.08	0.16	35.120	8.238	0.234	25.7	99
PARK	10	1.55	2.52	2.38	53.39	9.30	86.10	10.85	91.00	0.26	35.137	8.228	0.162	24.4	100
	25	1.86	2.38	3.08	57.32	8.06	78.82	9.92	84.28	0.17	35.113	8.212	0.132	24.5	102
	50	1.86	2.80	3.64	58.73	7.75	82.04	9.61	88.48	0.10	35.102	8.207	0.182	24.3	99
	75	2.48	2.80	5.46	86.88	5.89	78.02	8.37	84.28	0.10	35.047	8.212	0.138	24.5	98
	100s	3.10	4.78	5.32	84.58	6.82	78.72	9.92	86.80	0.20	35.144	8.142	0.204	23.4	97
	100b	4.96	4.48	4.06	40.75	5.27	80.38	10.23	88.90	0.13	35.117	8.121	0.240	23.8	100
	150s	2.79	3.36	3.64	61.54	6.20	89.48	8.99	98.46	0.11	35.092	8.172	0.216	24.1	94
	150b	4.65	3.36	5.46	75.31	3.72	81.34	8.37	90.18	0.12	35.095	8.149	0.126	24.3	95
	300s	1.55	2.52	3.84	75.87	6.20	83.72	7.75	89.88	0.11	35.031	8.187	0.138	24.3	101
	300b	2.17	2.38	4.06	60.70	6.51	81.34	6.68	87.78	0.11	35.073	8.189	0.132	24.4	99
	500s	2.17	2.52	4.20	83.18	6.82	79.10	8.99	85.82	0.11	34.959	8.203	0.126	24.4	100
	500b	1.86	3.78	3.92	49.74	7.75	98.00	9.61	105.70	0.11	35.121	8.165	0.246	24.3	99
3	-10	7.75	1008.84	21.28	5122.07	10.85	113.12	18.60	1143.24	0.33	21.306	7.534	1.451	26.0	92
INLET	-2	4.03	386.80	18.32	1799.81	6.82	120.68	10.85	506.80	0.39	30.539	7.834	0.847	25.3	93
	0	2.48	231.42	16.10	1326.29	8.06	90.86	10.54	338.38	0.25	32.022	7.954	0.276	25.0	93
	10	1.86	13.44	5.46	58.17	9.30	110.18	11.16	129.08	0.12	35.103	8.185	0.204	25.9	95
	25	4.65	7.14	4.78	95.54	8.06	109.20	12.71	121.10	0.10	35.074	8.196	0.150	25.3	95
	50	1.55	5.18	6.02	60.70	8.68	103.60	10.23	114.80	0.12	35.081	8.198	0.162	25.4	94
	100s	5.27	3.64	7.70	98.38	7.75	100.38	13.02	111.72	0.12	35.022	8.201	0.234	23.8	103
	100b	4.03	6.02	5.60	55.38	8.37	98.14	12.40	109.76	0.10	35.149	8.158	0.216	23.9	102
	150s	1.55	4.48	8.40	68.85	9.30	98.18	10.85	109.08	0.11	35.035	8.200	0.108	23.8	99
	150b	1.55	6.02	8.72	46.37	8.99	102.20	10.54	114.94	0.09	35.137	8.178	0.144	23.8	100
	300s	0.93	3.92	6.58	61.28	8.37	102.76	9.30	113.26	0.09	35.094	8.203	0.114	23.8	103
	300b	4.96	4.34	7.14	68.65	16.12	100.80	21.08	112.28	0.09	35.129	8.182	0.120	24.0	102
	500s	3.41	2.24	5.74	87.95	12.40	92.62	15.81	100.80	0.11	35.016	8.205	0.126	23.3	102
	500b	1.55	3.92	5.18	49.46	10.54	90.44	12.09	99.54	0.12	35.128	8.198	0.138	23.7	100
4	-500	8.06	10.36	13.30	801.97	17.36	118.16	25.42	141.82	0.72	34.422	8.126	1.714	24.1	100
HANAMAULU	-450	7.75	10.50	14.98	687.61	16.43	115.64	24.18	141.12	0.70	34.482	8.110	1.930	24.4	100
BAY	-350s	7.13	5.04	21.42	458.34	12.09	107.38	19.22	133.84	0.37	34.853	8.142	1.522	23.9	100
	-350b	6.20	4.90	14.42	298.98	11.78	109.48	17.98	128.80	0.50	34.869	8.158	2.577	24.0	100
	-250s	7.13	5.60	18.88	233.23	8.06	98.84	15.18	124.32	0.35	34.954	8.168	0.969	23.4	105
	-250b	7.75	6.02	29.54	209.35	8.06	104.30	15.81	139.86	0.30	34.977	8.172	0.851	23.9	102
	-100s	2.48	18.90	22.54	2297.18	13.02	146.86	15.50	188.30	0.49	24.731	8.098	0.402	23.8	98
	-100b	2.48	7.42	10.08	133.48	12.71	122.08	15.19	139.58	0.15	34.907	8.156	0.420	23.8	101
	0s	3.72	8.96	15.96	265.83	8.99	117.18	12.71	142.10	0.16	34.297	8.147	0.390	23.6	103
	0b	2.79	7.00	12.88	44.96	9.30	92.26	12.09	112.14	0.11	35.181	8.172	0.438	24.1	102
	150s	2.17	5.74	10.22	43.56	8.06	98.28	10.23	114.24	0.11	35.202	8.193	0.144	23.4	104
	150b	2.17	5.18	4.48	41.31	8.37	96.04	10.54	105.70	0.09	35.193	8.198	0.150	24.2	102
	-500s	1.86	4.20	6.16	69.87	9.30	103.18	11.16	113.54	0.11	35.057	8.212	0.126	24.2	103
	-500b	2.17	5.32	10.22	49.18	8.68	99.26	10.85	114.80	0.08	35.163	8.200	0.150	24.4	102
SURFACE WATER	SW-1	57.35	9.10	31.5	27729	1.55	178	58.9	217.0	0.82	0.371	7.440	1.265	24.5	32
	SW-2	24.80	67.90	57.4	21239	29.45	503	54.3	627.9	0.78	1.330	8.142	2.026	24.1	78
	SW-3	782.10	60.20	519.4	5047	232.50	3528	514.8	4107.8	3.50	22.732	7.804	48.071	27.8	83
	SW-4	31.00	14.70	103.6	22958	46.50	815	77.5	732.9	0.62	0.560	7.820	6.545	26.9	45
	SW-5	96.10	25.20	2044.0	3437	71.30	1403	167.4	3472.0	8.00	0.207	7.410	8.923	27.3	38

TABLE 2. Results of water chemistry analyses on samples collected November 16, 2001 on four ocean transects off the site of the proposed Ocean Bay Plantation at Hanamaulu, Kauai Hawaii. Nutrient concentrations are in micromoles(µM). "DFS" indicates distance from shore (or the most landward part of Hanamaulu Bay); "S" indicates surface sample; "B" indicates bottom sample. Also shown are data for five surface water samples. For location of sampling sites, see Figure 1.

TRANSECT	DFS (meters)	PO4 (µM)	NO3 (µM)	NH4 (µM)	Si (µM)	TOP (µM)	TON (µM)	TP (µM)	TN (µM)	TURB (ntu)	SALT (o/oo)	pH (std)	Chl-a (µg/l)	Temp (deg. C°)	O2 % sat.
1 NORTH OF RADISSON	0	0.08	2.28	0.07	12.23	0.32	9.87	0.41	12.30	0.34	34.206	8.138	0.126	24.4	94
	2	0.08	0.81	0.01	3.60	0.30	7.79	0.36	8.41	0.30	34.982	8.181	0.132	25.1	95
	10	0.08	0.14	0.04	2.00	0.29	6.80	0.35	6.98	0.26	35.084	8.214	0.162	24.5	95
	25	0.07	0.10	0.05	1.85	0.31	6.72	0.38	6.87	0.24	35.128	8.212	0.180	24.4	94
	50	0.06	0.12	0.03	2.19	0.34	8.00	0.40	8.15	0.17	35.108	8.201	0.246	24.5	96
	75	0.06	0.12	0.04	2.30	0.32	5.88	0.36	6.04	0.14	35.100	8.208	0.120	24.3	94
	100s	0.08	0.21	0.42	3.16	0.30	5.56	0.38	6.19	0.21	35.148	8.188	0.108	23.8	105
	100b	0.09	0.23	0.22	2.02	0.30	5.90	0.39	6.35	0.17	35.145	8.170	0.174	24.0	108
	150s	0.13	0.10	0.10	3.01	0.27	6.67	0.40	6.87	0.18	35.192	8.187	0.102	24.4	98
	150b	0.20	0.43	0.36	2.90	0.25	6.29	0.45	7.08	0.17	35.129	8.158	0.126	24.3	94
	300s	0.08	0.16	0.18	1.83	0.31	6.32	0.39	6.66	0.18	35.178	8.187	0.126	24.4	102
	300b	0.09	0.14	0.21	1.78	0.29	5.66	0.38	6.01	0.14	35.169	8.186	0.132	24.9	108
	500s	0.11	0.14	0.56	2.27	0.28	6.10	0.37	6.80	0.18	35.129	8.193	0.150	24.4	95
	500b	0.11	0.18	0.24	2.44	0.28	6.20	0.39	6.80	0.16	35.145	8.189	0.174	24.6	94
2 COUNTY PARK	-5	0.19	0.23	0.40	3.20	0.25	8.03	0.44	8.66	0.22	35.148	8.249	0.258	26.1	99
	0	0.09	0.27	0.48	1.98	0.30	6.49	0.39	7.22	0.16	35.120	8.238	0.234	25.7	99
	10	0.05	0.18	0.17	1.90	0.30	6.15	0.35	6.50	0.26	35.137	8.228	0.162	24.4	100
	25	0.06	0.17	0.22	2.04	0.28	5.83	0.32	6.02	0.17	35.113	8.212	0.132	24.5	102
	50	0.06	0.20	0.26	2.08	0.25	5.86	0.31	6.32	0.10	35.102	8.207	0.192	24.3	99
	75	0.08	0.20	0.38	2.38	0.19	5.43	0.27	6.02	0.10	35.047	8.212	0.138	24.5	98
	100s	0.10	0.34	0.38	3.01	0.22	5.48	0.32	6.20	0.20	35.144	8.142	0.204	23.4	97
	100b	0.16	0.32	0.29	1.45	0.17	5.74	0.33	6.35	0.13	35.117	8.121	0.240	23.8	100
	150s	0.09	0.24	0.26	2.18	0.20	6.39	0.29	6.89	0.11	35.092	8.172	0.218	24.1	94
	150b	0.15	0.24	0.39	2.68	0.12	5.81	0.27	6.44	0.12	35.095	8.149	0.126	24.3	95
	300s	0.05	0.16	0.26	2.70	0.20	5.98	0.25	6.42	0.11	35.031	8.187	0.138	24.3	101
	300b	0.07	0.17	0.29	2.16	0.21	5.81	0.28	6.27	0.11	35.073	8.189	0.132	24.4	99
	500s	0.07	0.18	0.30	2.98	0.22	5.65	0.29	6.13	0.11	34.959	8.203	0.126	24.4	100
	500b	0.06	0.27	0.28	1.77	0.25	7.00	0.31	7.55	0.11	35.121	8.165	0.246	24.3	99
3 INLET	-10	0.25	72.08	1.52	182.28	0.35	8.08	0.80	81.68	0.33	21.306	7.534	1.451	26.0	92
	-2	0.13	28.20	1.38	64.05	0.22	8.62	0.35	38.20	0.38	30.539	7.834	0.647	25.3	93
	0	0.08	16.53	1.15	47.27	0.26	6.48	0.34	24.17	0.25	32.022	7.954	0.278	25.0	83
	10	0.08	0.98	0.38	2.07	0.30	7.67	0.38	9.22	0.12	35.103	8.185	0.204	25.9	95
	25	0.15	0.51	0.34	3.40	0.28	7.80	0.41	8.65	0.10	35.074	8.196	0.150	25.3	95
	50	0.05	0.37	0.43	2.18	0.28	7.40	0.23	8.20	0.12	35.081	8.198	0.182	25.4	94
	100s	0.17	0.28	0.55	3.43	0.25	7.17	0.42	7.98	0.12	35.022	8.201	0.234	23.8	103
	100b	0.13	0.43	0.40	1.97	0.27	7.01	0.40	7.84	0.10	35.149	8.158	0.216	23.9	102
	150s	0.05	0.32	0.60	2.45	0.30	6.87	0.35	7.79	0.11	35.035	8.200	0.108	23.8	99
	150b	0.05	0.43	0.48	1.65	0.29	7.30	0.34	8.21	0.08	35.137	8.179	0.144	23.8	100
	300s	0.03	0.28	0.47	2.18	0.27	7.34	0.30	8.09	0.08	35.004	8.203	0.114	23.6	103
	300b	0.16	0.31	0.51	2.45	0.52	7.20	0.88	8.02	0.09	35.129	8.182	0.120	24.0	102
	500s	0.11	0.18	0.41	3.13	0.40	6.63	0.51	7.20	0.11	35.018	8.205	0.126	23.3	102
	500b	0.06	0.28	0.37	1.78	0.34	6.48	0.38	7.11	0.12	35.128	8.198	0.138	23.7	100
4 HANAMAULU BAY	-500	0.26	0.74	0.86	28.54	0.56	8.44	0.82	10.13	0.72	34.422	8.126	1.714	24.1	100
	-450	0.25	0.75	1.07	24.47	0.53	8.28	0.78	10.08	0.70	34.482	8.110	1.930	24.4	100
	-350s	0.23	0.38	1.53	18.24	0.39	7.67	0.62	9.56	0.37	34.853	8.142	1.522	23.9	100
	-350b	0.20	0.35	1.03	10.64	0.38	7.82	0.58	9.20	0.50	34.809	8.158	2.577	24.0	100
	-250s	0.23	0.40	1.42	8.30	0.28	7.06	0.49	8.88	0.35	34.854	8.168	0.989	23.4	105
	-250b	0.25	0.43	2.11	7.45	0.28	7.45	0.61	9.98	0.30	34.877	8.172	0.851	23.9	102
	-100s	0.08	1.35	1.61	81.75	0.42	10.49	0.50	13.45	0.49	24.731	8.098	0.402	23.8	96
	-100b	0.08	0.63	0.72	4.76	0.41	8.72	0.48	9.97	0.15	34.907	8.156	0.420	23.8	101
	0s	0.12	0.84	1.14	9.48	0.29	8.37	0.41	10.15	0.18	34.297	8.147	0.390	23.8	103
	0b	0.09	0.50	0.92	1.80	0.30	6.59	0.39	8.01	0.11	35.191	8.172	0.438	24.1	102
	150s	0.07	0.41	0.73	1.55	0.26	7.02	0.33	8.18	0.11	35.202	8.193	0.144	23.4	104
	150b	0.07	0.37	0.32	1.47	0.27	6.86	0.34	7.55	0.08	35.193	8.198	0.150	24.2	102
	-500s	0.06	0.30	0.44	2.49	0.30	7.37	0.36	8.11	0.11	35.057	8.212	0.129	24.2	103
	-500b	0.07	0.38	0.73	1.75	0.29	7.00	0.35	8.20	0.08	35.183	8.200	0.150	24.4	102
SURFACE WATER	SW-1	1.85	0.65	2.25	986.80	0.06	12.80	1.90	15.50	0.82	0.371	7.440	1.265	24.5	32
	SW-2	0.80	4.85	4.10	755.85	0.95	35.90	1.75	44.85	0.78	1.330	8.142	2.026	24.1	76
	SW-3	8.10	4.30	37.10	179.80	7.50	252.00	16.60	293.40	3.50	22.732	7.604	48.071	27.8	63
	SW-4	1.00	1.05	7.40	817.00	1.50	43.90	2.50	82.35	0.62	0.560	7.820	8.545	26.9	45
	SW-5	3.10	1.80	146.00	122.30	2.30	100.20	8.40	248.00	8.00	0.207	7.410	8.823	27.3	39

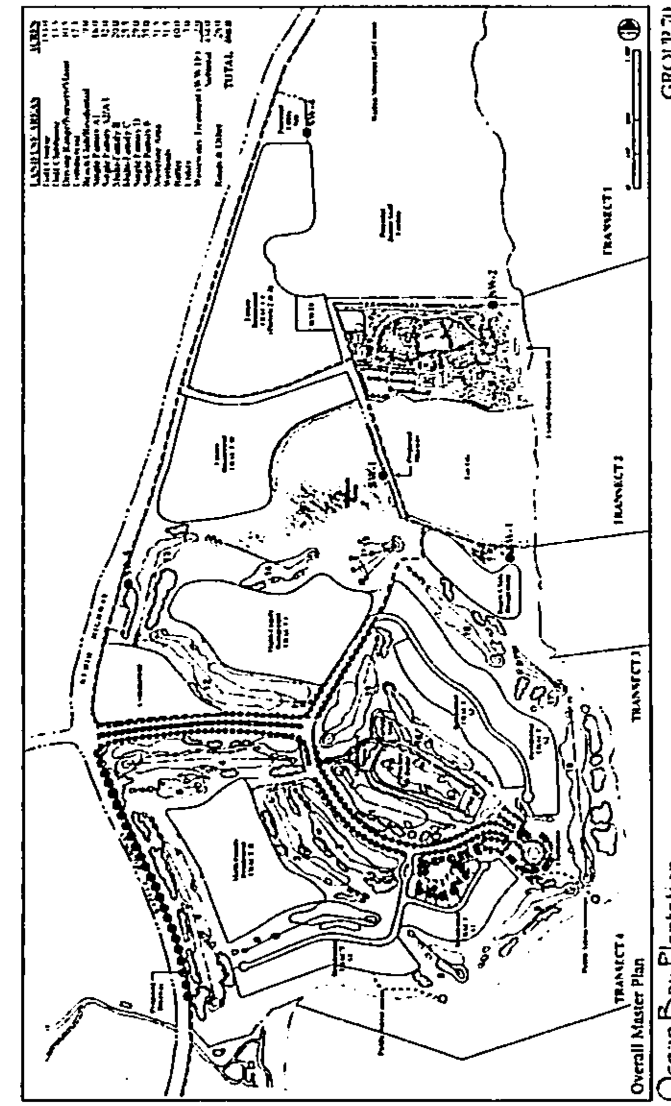

FIGURE 1. Rendering showing location and master plan concept of Ocean Bay Plantation at Hanamaulu. Also shown are locations of four water sampling transects in the ocean, and locations of water surface sample collection (SW).

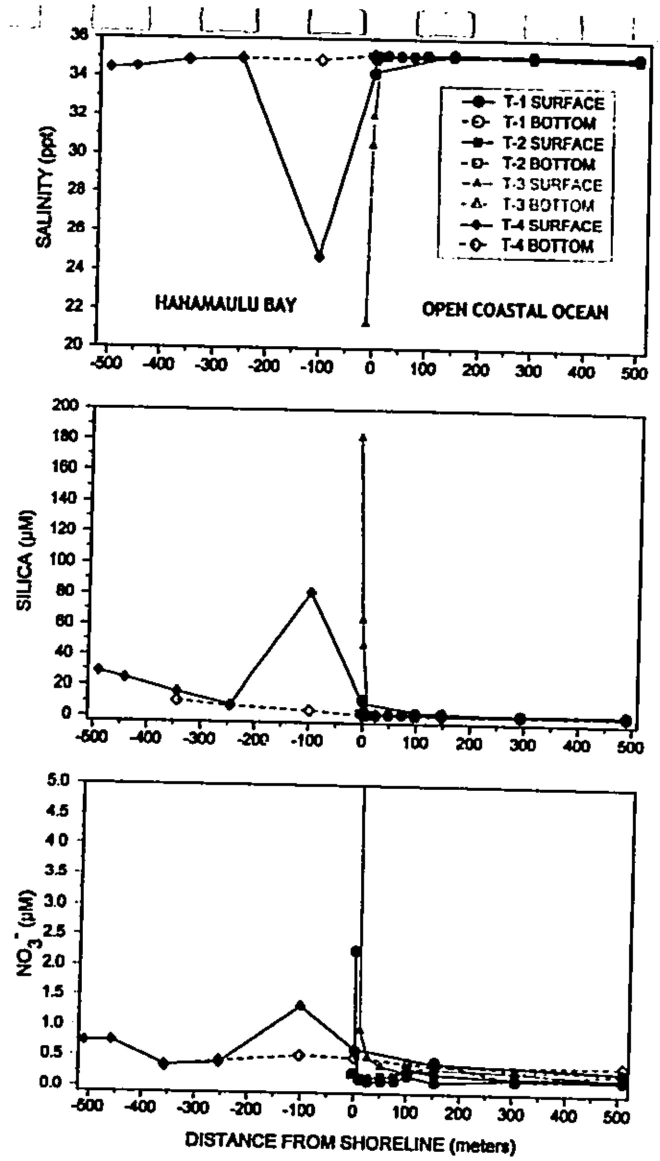

FIGURE 2. Plots of water chemistry constituents as functions of distance from shore in surface and bottom samples collected offshre of the proposed Ocean Bay Plantation at Hanamaulu Development on the east coast of Kauai on November 16, 2001. Negative values indicate distance inland from the seaward boundary of Hanamaulu Bay. Positive values indicate distance seaward from the open coastal shoreline. For transect locations, see Figure 1.

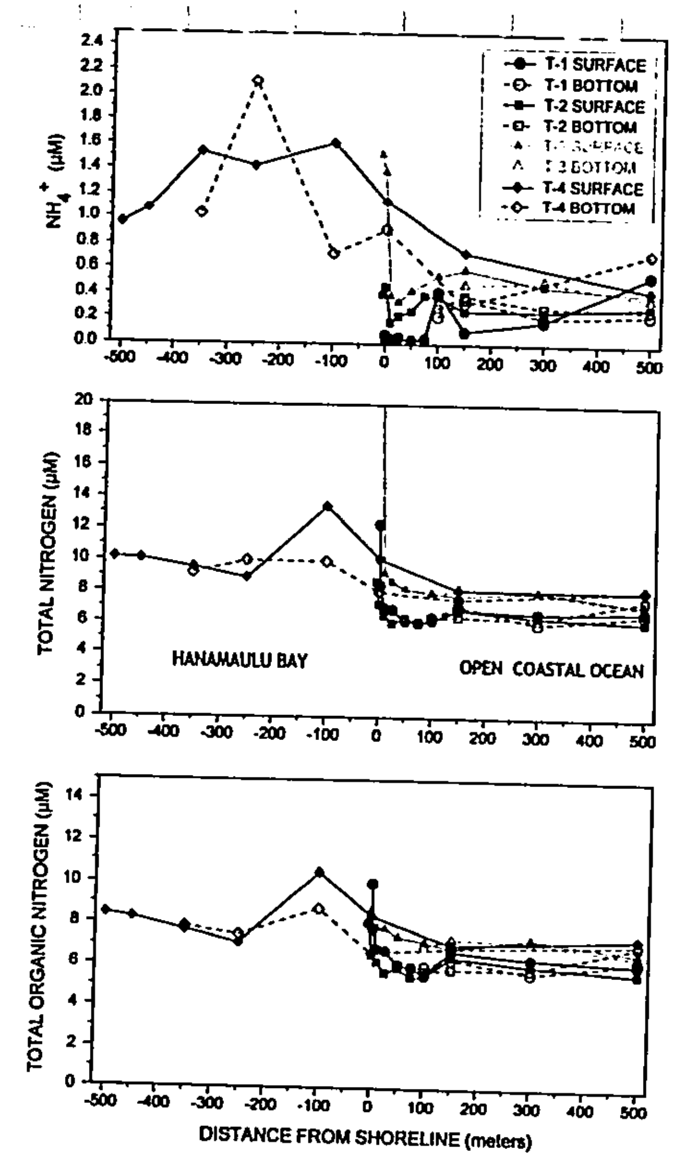

FIGURE 3. Plots of water chemistry constituents as functions of distance from shore in surface and bottom samples collected offshre of the proposed Ocean Bay Plantation at Hanamaulu Development on the east coast of Kauai on November 16, 2001. Negative values indicate distance inland from the most seaward point of Hanamaulu Bay; positive values indicative distance seaward from open coastal shoreline. For transect locations, see Figure 1.

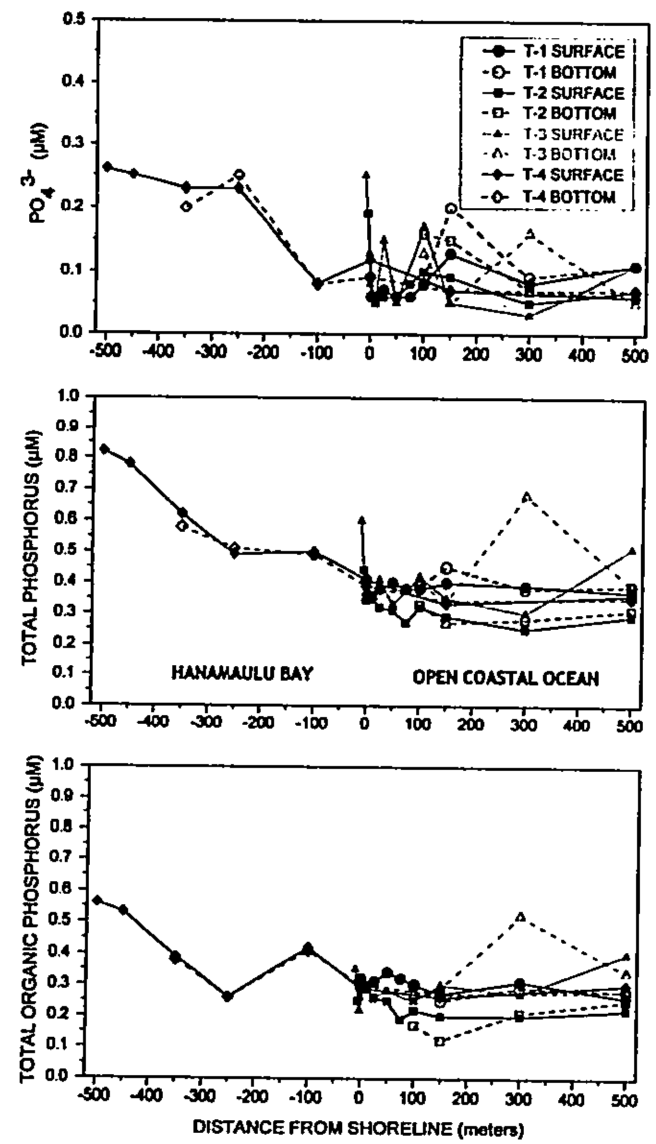

FIGURE 4. Plots of water chemistry constituents as functions of distance from shore in surface and bottom samples collected offshre of the proposed Ocean Bay Plantation at Hanamaulu Development on the east coast of Kauai on November 16, 2001. Negative values indicate distance inland from the outer boundary of Hanamaulu Bay. Positive values indicate distance extending seaward from the coastal shoreline. For transect locations, see Figure 1.

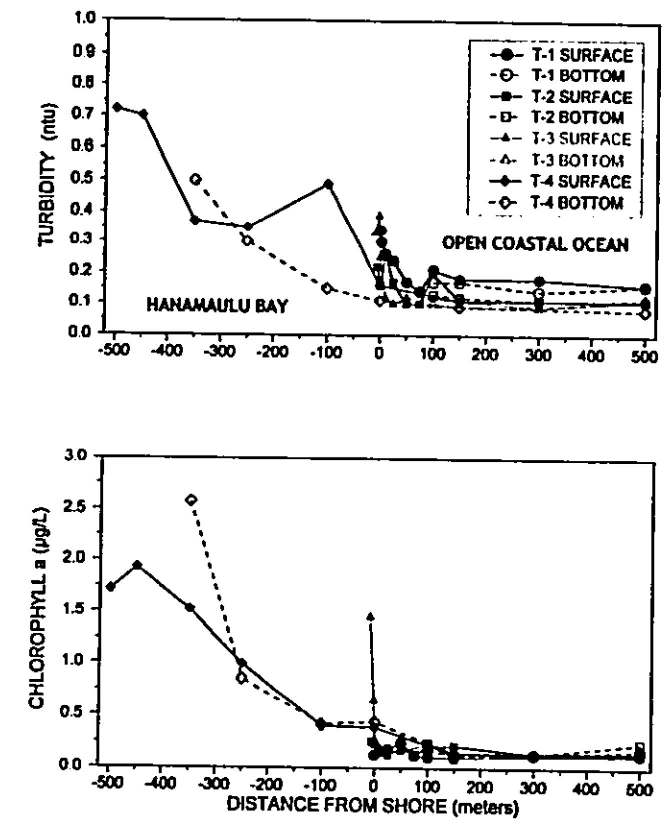

FIGURE 5. Plots of water chemistry constituents as functions of distance from shore in surface and bottom samples collected offshre of the proposed Ocean Bay Plantation at Hanamaulu Development on the east coast of Kauai on November 16, 2001. Negative values indicate distance inland from the seaward boundary of Hanamaulu Bay; positive values indicate distance seaward from the open coastal shoreline. For transect locations, see Figure 1.

APPENDIX E

Botanical Survey, Hanamā'ulu Plantation, Līhu'e District, Kaua'i

Char & Associates

September 2001

BOTANICAL SURVEY
HANAMA'ULU PLANTATION
LIHU'E DISTRICT, KAUA'I

by

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Prepared for: GROUP 70 INTERNATIONAL

September 2001

BOTANICAL SURVEY
HANAMA'ULU PLANTATION
LIHU'E DISTRICT, KAUA'I

INTRODUCTION

The project site consists of approximately 460 acres located in Hanama'ulu, Kaua'i. The ±460-acre parcel is bounded by the Wailua Municipal Golf Course and an existing hotel complex to the north, Kuhio Highway to the west, Hanama'ulu Bay and a county park to the south, and the Pacific Ocean to the east.

Most of the property, until recently, has been under sugar cane cultivation. The uncultivated areas support California grass wetland/pasture, coastal vegetation, and koa haole thicket.

A mixed use residential and golf course community are proposed for the site. The proposed components of the Master Plan for the project includes residential lots for single and multi-family homes, an 18-hole golf course and golf clubhouse, and a small scale retail commercial center. The Master Plan also includes an open space corridor along the coastline, wetlands, and highway buffer areas.

Field studies to assess the botanical resources on the project site were conducted on 16 and 17 August 2001 by a team of three botanists. The primary objectives of the field study were to:

1) provide a general description of the vegetation on the site;
2) inventory the flora;
3) search for threatened and endangered species as well as species of concern; and
4) identify areas of potential environmental problems or concerns and propose appropriate mitigation measures.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. Topographic maps as well as a very recent, colored aerial photograph were examined to determine vegetation cover patterns, terrain characteristics, access, boundaries, and reference points. All parts of the site were easily accessed from the network of cane haul roads which criss-cross the property.

A walk-through survey method was used. Notes were made on plant associations and distribution, disturbances, substrate types, drainage, exposure, topography, etc. The less disturbed areas with coastal vegetation were more intensively surveyed as these areas were more likely to support native plant communities and, perhaps, rare plants.

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

DESCRIPTION OF THE VEGETATION

The vegetation on the majority of the site consists of sugar cane fields, now abandoned, on more or less level to gently sloping lands. A shallow, broad gulch supports California grass dominated wetlands and pasture on the northern half of the property; a stream runs along the bottom of the gulch, but is not well-defined. Coastal vegetation forms a band along the seaward facing slopes of the property. A dense thicket composed primarily of tall koa haole shrubs is found on the northern tip,

near the municipal golf course.

An inventory of all the plants observed on the property during our field studies is presented in the checklist at the end of this report.

Abandoned Sugar Cane Fields

Former sugar cane fields support scattered clumps of sugar cane (*Saccharum officinarum*), 3 to 4 ft. tall. In most places, Guinea grass (*Panicum maximum*), native to Africa, has invaded the fields from the surrounding uncultivated areas. On some fields, Guinea grass may form a dense cover, 2 to 4 ft. tall, with few, if any, remnant, live plants of sugar cane.

A number of other weedy species have also established themselves on these formerly cultivated areas. These include mostly annual to short-lived species such as *Macroptilium atropurpureum*, swollen fingergrass (*Chloris barbata*), fuzzy rattlepod (*Crotalaria incana*), lion's ear (*Leonotis nepetifolia*), hairy horseweed (*Conyza canadensis*), false mallow (*Malvastrum coromandelianum*), etc. Along the edges of the fields, especially where they adjoin irrigation ditches, California grass (*Brachiaria mutica*), mauna-loa vine (*Canavalia cathartica*), and koa haole shrubs are locally common to abundant.

A few woody components are occasionally observed lightly scattered throughout this grassy and weedy cover. These include young trees of Java plum (*Syzygium cumini*) and ironwood (*Casuarina equisetifolia*), and shrubs of sourbush (*Pluchea carolinensis*), Christmas berry (*Schinus terebinthifolius*), and koa haole.

California Grass Wetland/Pasture

This vegetation type is characterized by thick mats of California grass, 2 to 3 ft. tall. It is found within the shallow, broad gulch which crosses the property; parts of the California grass wetland/pasture are used for grazing cattle.

An informal wetland delineation study was conducted earlier by Char & Associates and Group 70 International, Inc. (Char 2001). Wetland areas are dominated by obligate wetland, facultative wetland, and facultative indicator species (Reed 1997). The wetland areas are characterized by scattered clumps or sometimes extensive patches of umbrella sedge (*Cyperus involucratus*) and mats of California grass. Primrose willow (*Ludwigia octovalvis*) is almost always associated with the wetland areas. Also found here are smaller numbers of honohono (*Commelina diffusa*) and false daisy (*Eclipta prostrata*).

Open water areas, such as ditches, support clumps of bulrush (*Schoenoplectus lacustris*, *S. californicus*), and cattail (*Typha latifolia*). The ditch running along the east boundary supports floating mats of water lettuce (*Pistia stratiotes*), duckweed (*Lemna aequinoctialis*), and hihiawai (*Ceratopteris thalictroides*)--a water fern.

Where the wetland narrows, closer to the ocean, the vegetation consists of dense mats of California grass with patches of honohono locally abundant in areas with standing water. Where the stream meets the sandy beach, water hyssop (*Bacopa monnieri*) is abundant, forming low mats.

Pasture or non-wetland areas occur on the slopes bordering the wetland areas and on the northeast portion of the gulch. Large

thickets of hau (*Hibiscus tiliaceus*) are found on some slopes. In other places, low mats of California grass with scattered clumps of Guinea grass and trees and shrubs of Java plum, koa haole, ironwood, Christmas berry, and sourbush are found.

Coastal Vegetation

The coastal vegetation forms a band along the seaward facing portions of the project site. Three variants of the coastal vegetation are recognized based on differences in substrate type and exposure.

A sandy beach is found where the stream from the wetland empties into the ocean; this is near the beach road and a small, County-owned beach pavilion. The sandy substrate supports solid stands of naupaka (*Scaevola sericea*), 3 to 4 ft. tall, with scattered, taller tree heliotrope (*Tournefortia argentea*), 12 to 15 ft. tall. 'Aki'aki or beach dropseed grass (*Sporobolus virginicus*) and pohuehue or beach morning glory (*Ipomoea pes-caprae*) form low mats, especially on the seaward facing portions of the naupaka shrubs. Other species associated with this coastal vegetation on sandy substrate include nanea (*Vigna marina*), Bermuda grass (*Cynodon dactylon*), *Chamaesyce serpens*, hau, wedelia (*Sphagneticola triloba*), and hala (*Pandanus tectorius*).

The coastal vegetation from the 17th tee and around to the 8th green is composed of large stands of ironwood trees. The topography in this area is rugged with coastal cliffs and rocky outcroppings. Along the upper cliff faces, adjacent to the abandoned sugar cane fields, the ironwood trees are 30 to 50 ft. tall. Along the steeper, more exposed, seaward facing slopes, the ironwood trees are low and windsheared, 10 to 12 ft. tall. The ironwood trees were originally planted by the sugar plantation as a windbreak and have since naturalized; ironwood is salt spray-tolerant (Neal 1965; Wagner et al. 1990). A few native species are found associated with this coastal vegetation subtype, usually on the more open and exposed seaward facing areas. These include nauapaka, 'ilima papa (Sida fallax), pa'u-ohi'iaka (Jacquemontia ovalifolia ssp. sandwicensis), 'aki'aki grass, and 'akulikuli (Sesuvium portulacastrum).

On the more protected slopes facing Hanama'ulu Bay, the coastal vegetation consists of more or less dense koa haole shrubs, 12 to 15 ft. tall. Kolomona (Senna surattensis), a shrubby member of the pea family with yellow flowers, is common. Scattered here and there are small to large stands of Java plum trees, 20 to 25 ft. tall. A few small stands of ironwood are also found here. Guinea grass is the most abundant ground cover, forming robust clumps 2 to 3 ft. tall. A large hau thicket is found on the slopes near the Hanama'ulu beach park boundary.

Koa Haole Thicket

A dense thicket of koa haole shrubs, 15 to 18 ft. tall, is found on the northern tip of the project site, near the Wailua Municipal Golf Course. Scattered through the thicket are trees of Java plum, Macaranga tanarius, tropical almond (Terminalia catappa), coconut (Cocos nucifera), and Chinese banyan (Ficus microcarpa), 20 to 35 ft. tall. Hau forms a much-branched tangle near the abandoned sugar cane fields.

Guinea grass, California grass, Neonotonia wightii, and Macroptilium atropurpureum are locally abundant along the perimeter of the thicket and on the dirt road which cuts through the thicket. Under the koa haole shrubs, there is not much ground cover due to the heavily shaded conditions.

A fairly open, grassy area lined by koa haole shrubs also occurs on this part of the project site. At the time of our survey, there was a small corral and a few horses on this area.

DISCUSSION AND RECOMMENDATIONS

Abandoned sugar cane fields now overgrown by Guinea grass and a number of weedy species occupies the majority of the project site; this vegetation type is found on the more or less level to gently sloping portions of the property. The shallow, broad gulch on the property supports California grass dominated wetlands and pasture. Coastal vegetation consisting of stands of naupaka shrubs is found on sandy subtrate. Areas with coastal cliffs and rock outcroppings support ironwood forest on the more exposed coastline, and koa haole scrub with Java plum trees along the more protected Hanama'ulu Bay side. Dense koa haole thicket occupies only a small area on the northern tip of the project site.

The vegetation on the ±460-acre project site is dominated by introduced or alien species. This is not surprising given the long use of the site by Lihu'e Plantation for sugar cane cultivation.

A total of 135 plant species were inventoried on the site. Of these, 113 species (84%) are introduced. Four species (3%) are originally of Polynesian introduction, and 18 species (13%) are native. Of the natives, 17 are indigenous, that is, they are native to the Hawaiian Islands and elsewhere. One species, the pa'uohi'iaka (Jacquemontia ovalifolia ssp. sandwicensis) is endemic, that is, it is native only to the Hawaiian Islands. None of the plants found during our field studies is a threatened and endangered species or a species of concern (U.S. Fish and Wildlife Service 1999; Wagner et al. 1999).

The proposed development of the site is not expected to have a significant negative impact on the botanical resources of the site or the general region. All of the plants can be found in similar environmental habitats throughout the main Hawaiian Islands. The majority of the native plants occur within the coastal vegetation and the wetland areas. An open space corridor is planned for these areas. The Master Plan proposed for the project will serve to protect the natural coastline, its scenic vistas, and wetland resources.

However, it is recommended that areas cleared of vegetation be revegetated as soon as possible. This would prevent soil loss and discharge of sediments into the ocean and wetland areas.

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PLANT SPECIES LIST -- Hanama'ulu Plantation, Kaua'i

The following checklist is an inventory of all the plants observed on the project site. The plant names are arranged alphabetically by families within each of three groups: Ferns, Dicots, and Monocots. The taxonomy and nomenclature of the Ferns follow Lamoureux (1988), while the flowering plants, Dicots and Monocots, are in accordance with Wagner et al. (1990), and Wagner and Herbst (1999). The few recent name changes follow those reported in the Hawaii Biological Survey series (Evenhuis and Eldredge 1999-2000).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:
   - E = endemic = native only to the Hawaiian Islands.
   - I = indigenous = native to the Hawaiian Islands and elsewhere.
   - I? = questionably indigenous = data not clear if dispersal to the islands by natural or human-related mechanisms, but weight of evidence suggests probably natural.
   - P = Polynesian introduction = plants originally of Polynesian introduction prior to Western contact, that is, Cook's arrival in the islands in 1778.
   - P? = questionably a Polynesian introduction = may have been introduced by the Polynesians prior to Western contact, or possibly soon after Western contact.
   - X = introduced or alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact (1778).
   - X? = questionably introduced = date of introduction unclear or very soon after Western contact; may possibly be indigenous or of Polynesian introduction.

4. Presence (+) or absence (-) of a particular species within each of four vegetation types recognized on the project site (see text for discussion):
a = Abandoned Sugar Cane Fields
g = California Grass Wetland/Pasture
c = Coastal Vegetation
k = Koa Haole Thicket

Scientific name	Common name	Status	a	g	c	k
FERNS						
NEPHROLEPIDACEAE (Swordfern family)						
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	hairy swordfern, 'okupukupu	X	-	+	-	-
PARKERIACEAE (Waterfern family)						
Ceratopteris thalictroides (L.) Brongn.	hihiawai, palai kahawai	P	-	+	-	-
FLOWERING PLANTS						
DICOTS						
ACANTHACEAE (Acanthus family)						
Asystasia gangetica (L.) T. Anderson	Chinese violet, coromandel	X	+	+	+	-
Thunbergia fragrans Roxb.	white thunbergia	X	-	-	+	-
AIZOACEAE (Fir-marigold family)						
Sesuvium portulacastrum (L.) L.	'akulikuli	I	-	-	+	-
Tetragonia tetragonioides (Pall.) Kuntze	New Zealand spinach	X	+	-	+	-
AMARANTHACEAE (Amaranth family)						
Achyranthes aspera L.		X	-	-	-	+
Amaranthus spinosus L.	spiny amaranth, pakai kuku	X	-	+	+	-
Amaranthus viridis L.	slender amaranth, pakai	X	-	+	-	-
ANACARDIACEAE (Mango family)						
Schinus terebinthifolius Raddi	Christmas berry	X	+	+	+	+
APOCYNACEAE (Dogbane family)						
Thevetia peruviana (Pers.) K. Schum.	be-still tree	X	+	-	-	-
ASTERACEAE (Daisy family)						
Bidens pilosa L.	Spanish needle, ki, ki nehe	X	-	-	-	+
Conyza bonariensis (L.) Cronq.	hairy horseweed, ilioha	X	+	-	-	-
Eclipta prostrata (L.) L.	false daisy	X	-	+	-	-

Scientific name	Common name	Status	Vegetation type a	g	c	k
Emilia fosbergii Nicolson	flora's paintbrush, pualele	X	+	-	-	-
Emilia sonchifolia (L.) DC	purple pualele	X	+	-	-	-
Parthenium hysterophorus L.	false ragweed, Santa maria	X	+	+	-	+
Pluchea carolinensis (Jacq.) G. Don	sourbush, pluchea	X	+	+	+	+
Pluchea indica (L.) Less.	Indian pluchea	X	-	+	-	-
Sonchus oleraceus L.	sowthistle, pualele	X	+	-	-	-
Spagneticola trilobata (L.) Pruski	wedelia	X	+	+	+	-
Synedrella nodiflora (L.) Gaertn.	nodeweed	X	-	-	-	+
Tridax procumbens L.	coat buttons	X	+	-	-	-
Verbesina enceliolides (Cav.) Benth. & Hook.	golden crown-beard	X	+	-	-	-
Xanthium strumarium var. canadense (Mill.) Torr. & A. Gray	cocklebur, kikania	X	-	+	-	-
BORAGINACEAE (Borage family)						
Heliotropium procumbens var. depressum (Cham.) Fosb.		X	+	+	-	-
Tournefortia argentea L.f.	tree heliotrope	X	-	-	+	-
CACTACEAE (Cactus family)						
Hylocereus undatus (Haw.) Britton & Rose	night-blooming cereus	X	-	-	+	-
CASUARINACEAE (She-oak family)						
Casuarina equisetifolia L.	ironwood, paina	X	+	+	+	-
CHENOPODIACEAE (Goosefoot family)						
Chenopodium murale L.	'aheahea	X	-	+	-	-
COMBRETACEAE (Indian almond family)						
Terminalia catappa L.	tropical almond, false kamani	X	-	-	+	+
CONVOLVULACEAE (Morning glory family)						
Ipomoea aquatica Forssk.	ung-choi, swamp cabbage	X	-	+	-	-
Ipomoea indica (J. Burm.) Merr.	koali 'awa, koali 'awahia	I	+	+	+	+
Ipomoea obscura (L.) Ker-Gawl.	field bindweed	X	+	-	-	+
Ipomoea pes-caprae ssp. brasiliensis (L.) Ooststr.	pohuehue, beach morning glory	I	-	-	+	-

Scientific name	Common name	Status	Vegetation type a	g	c	k
Ipomoea triloba L.	little bell, pink bindweed	X	+	-	-	-
Jacquemontia ovalifolia ssp. sandwicensis (A. Gray) K. Robertson	pa'uohi'iaka	E	+	-	+	-
Merremia tuberosa (L.) Rendle	woodrose, pilikai	X	-	+	-	-
CUCURBITACEAE (Gourd family)						
Momordica charantia L.	wild bittermelon	X	+	+	-	-
EUPHORBIACEAE (Spurge family)						
Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge	X	-	+	-	-
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X	+	-	-	+
Chamaesyce prostrata (Aiton) Small	prostrate spurge	X	+	-	-	-
Chamaesyce serpens (Kunth) Small		X	-	-	+	-
Macaranga tanarius (L.) Mull. Arg.		X	+	-	-	+
Phyllanthus debilis Klein ex Willd.	niruri	X	+	-	-	-
Ricinus communis L.	castor bean, koli	X	+	-	-	+
FABACEAE (Pea family)						
Canavalia cathartica Thouars	maunaloa	X	+	+	+	+
Chamaecrista nictitans (L.) Moench	partridge pea, lauki	X	+	-	+	+
Crotalaria incana L.	fuzzy rattlepod, kukaehoki	X	+	-	+	-
Crotalaria pallida Aiton	smooth rattlepod, pikakani	X	+	-	-	-
Desmanthus pernambucanus (L.) Thellung	slender mimosa	X	+	+	+	-
Dolichos lablab L.	hyacinth bean, papapa	X	+	-	-	+
Indigofera hendecaphylla Jacq.	creeping indigo	X	+	-	-	-
Indigofera suffruticosa Mill	indigo, 'iniko	X	+	-	+	-
Leucaena leucocephala (Lam.) de Wit	koa haole	X	+	+	+	+
Macroptilium atropurpureum (DC) Urb.		X	+	-	-	+
Macroptilium latyroides (L.) Urb.	wild bean, cow pea	X	+	-	-	-
Mimosa pudica var. unijuga L.	sensitive plant, sleeping grass, pua hilahila	X	+	+	-	+
Neonotonia wightii (Wight & Arn.) Lackey		X	-	-	-	+
Phaseolus limensis Macf.	lima beans	X	+	-	-	-
Senna occidentalis (L.) Link	coffee senna, 'auko'i	X	+	-	-	-
Senna surattensis (N.L. Burm.) H. Irwin & Barneby	kolomona, kalamona	X	+	-	+	+
Vigna marina (J. Burm.) Merr.	nanea, pohilihil	I	-	+	+	-

APPENDIX F

A Survey of Avian and Mammalian Species Conducted for the Ocean Bay Plantation at Hanamā'ulu Master Plan, Līhu'e District, Kaua'i

Rana Productions, Ltd.

September 2001

A Survey of Avian and Terrestrial Mammalian Species Conducted for the Ocean Bay Plantation at Hanama'ulu Master Plan Lihu'e District, Kaua'i.

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Introduction:

This report summarizes the findings of a two day ornithological and mammalian survey of the proposed Ocean Bay Plantation at Hanama'ulu development site. The 460 acre parcel is located on the north side of Hanama'ulu Bay, in the Lihu'e District, on the island of Kaua'i, Hawai'i (Figures 1). Fieldwork was conducted from August 20th through the 22nd, 2001.

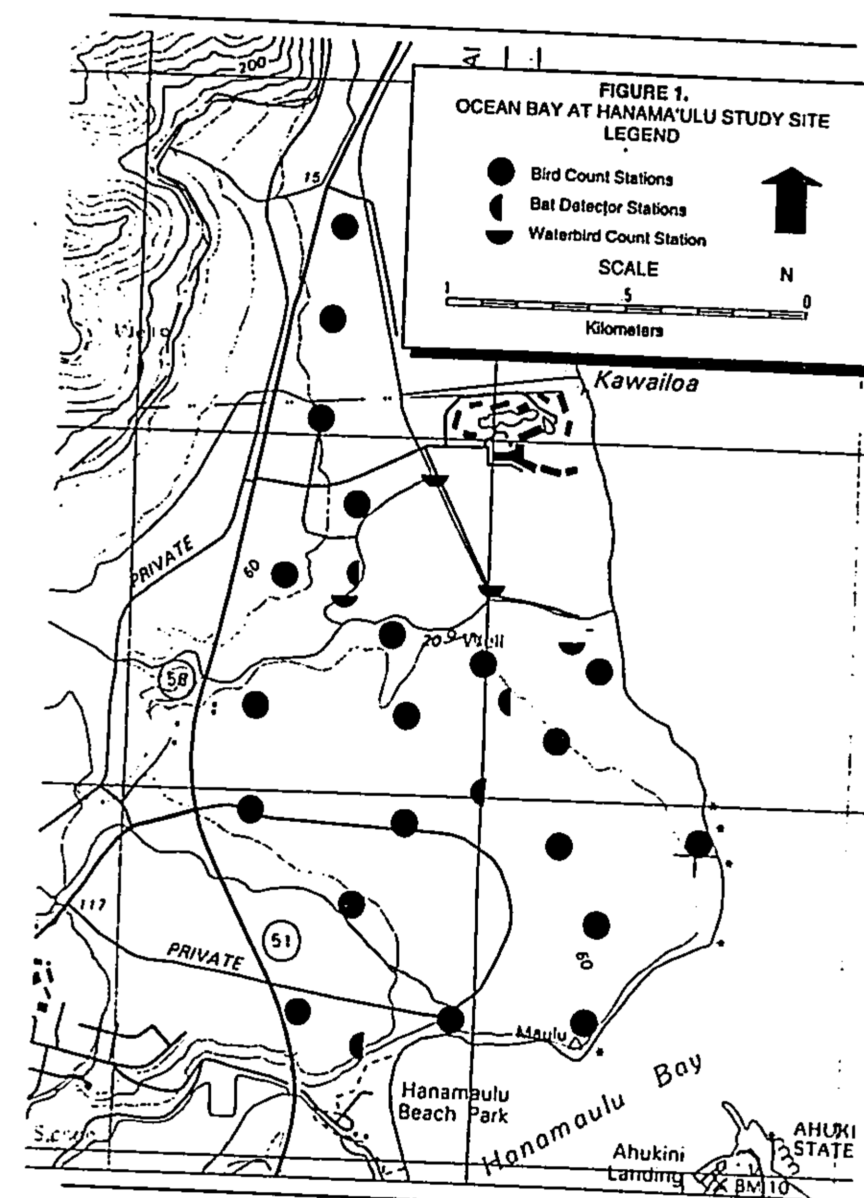
The primary purpose of the survey was to determine if there were any federally listed endangered, threatened, proposed, or candidate avian or mammalian species on, or in the immediate vicinity of the proposed project site. In addition, we were asked to assess the probability of any usage of the site by listed avian and mammalian species given the habitat the site currently provides. Federal and State of Hawai'i listed species status follows (DLNR, 1998; Federal Register, 1999a, 1999b, 2001)

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

General Site Description:

The project site encompasses approximately 460 acres located on the north side of Hanama'ulu Bay, in the Lihu'e District, on the island of Kaua'i, Hawai'i. The site is bound to the west by Kuhio Highway and the Hanama'ulu-Ahukini cut-off road. To the north by the Wailua Municipal Golf Course, the east by the Pacific Ocean and to the south, by Hanama'ulu Bay (Figure 1). The areas surveyed slope gently from west to east, from an elevation of approximately 80 feet above mean sea level, down to sea level (USGS 1996).

The vast majority of the project site consists of fallow sugar cane (*Saccharum officinarum*) fields. There is a 32.5 ± acre wetland which bisects the parcel. The wetland runs from Kuhio Highway, through the parcel and eventually drains into the ocean south of the existing Radisson Hotel (Figure 1). The wetland is bordered on the north and south sides by dense stands of *hau* (*Hibiscus tilsceus*), the bulk of the wetland is almost totally overgrown with California grass (*Brachiara mutica*), and other alien species. Within the sugar cane fields there are numerous dirt roads, along which there is wide mix of predominately alien (introduced to Hawai'i by humans) grass and weedy species typical of ruderal areas within sugar cane fields in Hawai'i. Additionally, there are numerous abandoned irrigation canals running through the former sugar cane fields. The vegetation within the fallow fields was extremely dry, and quite sparse. The area fronting Hanama'ulu



Bay has a band of ironwood (*Casuarina equisetifolia*) trees separating the cane fields from the shoreline. There is a small in-holding at the northern end of the property that is predominately vegetated with *koa haole* (*Leucaena leucoccephala*), and other alien species. There are several horse corrals and horses within this part of the property.

Mammalian Survey Methods:

In an effort to detect the presence of endangered Hawaiian hoary bats (*Lasiurus cinereus semotus*), or *'ope'ape'a*, as it is known in Hawaiian, two stationary, remote bat-census stations were deployed on each of two nights (Figure 1). Broadband AnaBat II ultrasonic bat detectors coupled to voice activated cassette recorders and remote timing devices were used to detect bat vocalizations. Following techniques developed by Krusic et al. (1996), the units were calibrated using a pet ultrasonic flea collar. In addition, visual scans were made for bats on two evenings, during crepuscular periods.

All other observations of mammalian species were of an incidental nature. With the exception of the Hawaiian hoary bat, all terrestrial mammals found on the island of Kaua'i are alien species. Most are ubiquitous; no trapping program was proposed or undertaken to quantify the use of the study site by alien mammalian species. The survey of mammals other than bats was limited to visual and auditory detection, coupled with observation of scat, tracks, and other animal sign. A running tally was kept of all vertebrate species observed and heard within the project sites.

Avian Survey Methods:

Twenty count stations were established within the project site (Figure 1). Six-minute variable circular plot counts were made at each station (Reynolds et al., 1980). Counts were conducted once at each station. Field observations were made with the aid of Leitz 10 X 42 binoculars and by listening for vocalizations. Counts were concentrated between 06:30 a.m. and 10:00 a.m., the peak of daily bird activity. Four, time-dependant, waterbird counts were made from locations adjacent to the wetland and two of the drainage canals (Figure 1). An additional two hours were spent on site during the evenings of the 20th and 21st and the mornings of the 21st and 22nd of August, 2001, in an attempt to detect nocturnally flying seabirds and owls over-flying the area. Time not spent counting was used to search the sites and the surrounding area for species and habitats not detected during count sessions.

Mammalian Survey Results

Endangered Hawaiian hoary bats were seen on both nights, and a total of nine were observed during the survey. None of the bats was detected by the ultrasonic bat detectors; all were, rather, recorded visually. At least five separate animals were seen

foraging along the coast line on the night of the 20th. On the 21st, at least four bats were observed foraging over Hanama'ulu Bay, and the southern corner of the project site. During daylight hours, the only mammalian species seen within the project area were; cat (*Felis catus*), horse (*Equus caballus*), and domestic cattle (*Bos taurus*). We recorded sign and scat of two other mammalian species; domestic dog (*Canis f. familiaris*), and pig (*Sus scrofa*). All of these introduced mammalian species are deleterious to avian populations.

The carapace of a threatened green sea-turtle (*Chelonia mydas*) was found beside the main entrance road, just west of the ironwood grove, close to the rocky beach located north of Hanama'ulu Bay.

Avian Survey Results

Twenty-one avian species, representing 15 separate families, were recorded during station counts (Table 1). Of the 21 species detected, one, the Hawaiian Coot (*Fulica alai*), or *'alae ke'oke'o* as it is known in Hawaiian, is an endemic species (native and unique to Hawai'i), and is listed as an endangered species under Endangered Species Act of 1973, as amended (ESA), and by the State of Hawai'i under it's endangered species program (Federal Register 1999a, DLNR 1998). Two species, White-tailed Tropicbird (*Phaethon lepturus dorothea*), or *koa'e kea*, and Black-crowned Night-Heron (*Nycticorax nyticorax hoactli.*), or *'auku'u*, are indigenous (native to Hawai'i but also found elsewhere naturally). Two species; Pacific Golden-Plover (*Pluvialis fulva.*), or *kolea*, and Wandering Tattler (*Heterosceles incanus*), or *'ulili*, are regularly occurring indigenous migrants, and the remaining 16 species are alien to the Hawaiian islands. One additional alien species, Common Waxbill (*Estrilda a. astrild*) was recorded as an incidental observation while within the project area, but not during station counts (Table 1).

An additional two endangered endemic sub-species; Common Moorhen (*Gallinula chloropus sandvicensis*), or *'alea'ula* and Hawaiian Stilt (*Himantopus mexicanus knudseni*), or *ae'o*, were detected during the time-dependant waterbird counts. Both species were also encountered incidentally, when driving along the drainage canals adjacent to the Wailua Municipal Golf Course, and along the unnamed road which provides access to the beach park located to the south of the Radisson Hotel (Figure 1).

During the course of crepuscular and nocturnal visits to the project site, three additional seabird species were recorded flying over the site. These were the endangered endemic Hawaiian subspecies of the Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*), or *'ua'u*, the threatened endemic sub-species of the Newell's Shearwater (*Puffinus auricularis newelli*), or *'a'o*, and Wedge-tailed Shearwaters (*Puffinus pacificus*), or *'ua'u kani*.

Avian diversity and densities were relatively low. Two species, Japanese White-eye (*Zosterops japonicus*), and Zebra Dove (*Geopelia striata*) accounted for 32% of the total

Table 1.

Avian Species Detected on the Ocean Bay Plantation at Hanama'ulu Site

Common Name	*Scientific Name*	*ST*	*RA*
PETRELS & SHEARWATERS - Procellariidae			
Dark-rumped Petrel (Hawaiian)	*Pterodroma phaeopygia sandwichensis*	EE	IN
Wedge-tailed Shearwater	*Puffinus pacificus*	I	IN
Newell's Shearwater	*Puffinus auricularis newelli*	TE	IN
TROPICBIRDS - Phaethonidae			
White-tailed Tropicbird	*Phaethon lepturus dorothea*	I	0.15
HERONS - Ardeidae.			
Cattle Egret	*Bubulcus ibis.*	A	1.10
Black-crowned Night-Heron.	*Nycticorax nyticorax hoactli.*	I	0.05
PHEASANTS & ALLIES – *Phasianidae*			
Red Junglefowl	*Gallus gallus.*	A	2.25
Ring-necked Pheasant	*Phasianus colchicus.*	A	0.15
RAILS & ALLIES - Rallidae			
Common Moorhen (Hawaiian)	*Gallinula chloropus sandvicensis*	EE	IN
Hawaiian Coot.	*Fulica alai.*	EE	0.05
STILTS & AVOCETS - Recurvirostridae			
Black-necked Stilt (Hawaiian)	*Himantopus mexicanus knudseni*	EE	IN
PLOVERS & LAPWINGS - Charadriidae			
Pacific Golden-Plover.	*Pluvialis fulva.*	IM	0.60
SANDPIPERS & ALLIES - Scolopacidae			
Wandering Tattler	*Heteroscelus incanus*	IM	0.10
PIGEONS & DOVES - Columbidae			
Spotted Dove.	*Streptopelia chinensis.*	A	1.75
Zebra Dove.	*Geopelia striata.*	A	2.55
OLD WORLD WARBLERS - Sylviidae			
Japanese Bush-Warbler	*Cettia diphone*	A	0.10
THRUSHES - Turdidae			
White-rumped Shama.	*Copsychus malabaricus indicus*	A	0.10
BABBLERS - Timaliidae			
Hwamei	*Garrulax canorus*	A	0.05
SILVEREYES - Zosteropidae			
Japanese White-Eye.	*Zosterops japonicus*	A	4.25
STARLINGS - Sturnidae			
Common Myna.	*Acridotheres tristis.*	A	0.80
SALTATORS & ALLIES - Cardinalidae			
Red-crested Cardinal.	*Paroaria coronata.*	A	1.15
Northern Cardinal.	*Cardinalis cardinalis.*	A	1.40
CARDULINE FINCHES & ALLIES - Fringillidae			
House Finch.	*Carpodacus mexicanus frontalis*	A	2.20
WAXBILLS & ALLIES - Estrildidae			
Common Waxbill.	*Estrilda a. astrild*	A	IN
Nutmeg Manikin	*Lonchura punctulata topela*	A	0.10
Chestnut Munia	*Lonchura atricapilla*	A	1.80
Java Sparrow.	*Padda oryzivora*	A	0.60

Key to Table 1.

- **ST** Status
- **I** Indigenous, resident species
- **A** Alien species
- **EE** Endangered, endemic specis
- **TE** Threatened, endemic species
- **IM** Indigenous, migratory species
- **RA** Relative Abundance: Number of birds detected divided by the number of count stations (20)
- **IN** Incidental observation / not counted during station counts, but seen on the site

of all birds recorded during station counts. The most common avian species detected was the Japanese White-eye, which accounted for 20% of the total individual birds recorded. An average of 21 birds was recorded per station count.

Discussion:

A one-time survey cannot provide a total picture of the wildlife using any given area. Certain species will not be detected for one reason or another. Seasonal variations in populations, coupled with seasonal availability and use of resources, will cause different use patterns throughout a year and, in fact, over a number of years. Coupling the results of a one time survey with the results of previous surveys conducted in similar habitats and locations, greatly expands the value of the information gathered.

The findings of the mammalian survey are consistent with the results of other recent surveys conducted within the lowland areas of Kaua'i (David, 1995, 1998, 1999a, 1999b, 2000, 2001). The detection of the endangered Hawaiian hoary bat within the development site was not unexpected. This species is regularly seen in and around Lihue, as well as most of the lowland areas on the Island of Kaua'i (Tomich, 1986; David, 1995, 1999b, 2001; R. David, pers. obs. 1980-2001). Unlike nocturnally flying seabirds, which often collide with man-made structures, bats are uniquely adapted to avoid collision with obstacles, man-made and natural. They navigate and locate their prey using ultrasonic echolocation, which is sensitive enough to allow them to locate and capture small volant insects at night.

Although no live rodents were detected during the course of this survey, it is likely that roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use various resources found within the project site. Without conducting a trapping program, it is difficult to assess the population densities of these often hard-to-see mammals. All of these introduced rodents are deleterious to native avian and floral species.

The findings of the avian survey are consistent with the findings of other recent surveys conducted within the lowland areas of Kaua'i (David, 1995, 1998, 1999a, 1999b 2000, 2001; Day and Cooper, 1999, 2001; Day et al., 2000, 2001). The detection of listed seabird species over flying the project site was not unexpected. Both the endangered Dark-rumped Petrel, and the threatened Newell's Shearwater cross the northern, eastern and southern coastline of Kaua'i across a broad front and in relatively large numbers during the breeding season (Cooper and Day, 1995, 1998; Day and Cooper, 1997; Day et al., 2000, 2001a). The author recently completed a radar and night vision survey of both species in conjunction with the construction of the Lihu'e Energy Service Center and attendant utility structures and lines located approximately 1.5 miles west-south-west of the Hanamau'ulu Road entrance to the subject property. During the course of that five day survey we averaged 171 listed seabirds per night passing within a 1 mile radius of our radar unit, which in turn was picking up targets as close as 1 mile from the proposed development site (Day et. al., 2001). Thus, it is reasonable to project that similar numbers of both species also fly-over the proposed development site during the breeding season.

Both species of seabirds, especially fledging birds, can become disoriented by exterior lighting on their way to sea in the Fall. When disoriented, seabirds often collide with manmade structures and, if not killed outright, the dazed or injured birds become easy targets of opportunity for feral mammals. Collision with utility structures is considered to be the second most significant cause of mortality of these two seabird species in Hawai'i (Telfer et al., 1987; Ainley et al., 1995, 1997, 1998, 2001; Cooper and Day, 1995, 1998; Day and Cooper, 1995). The primary cause of mortality in both species is thought to be predation by alien mammalian species at the nesting colonies (Ainley et al., 2001; Day and Cooper, 1998; Cooper and Day, 1995). There are no known nesting colonies, nor appropriate nesting habitat for either listed seabird species within or close to the project site.

Any man-made structure or naturally occurring physical feature that extends higher than the surrounding mean vegetation height on the island of Kaua'i may pose a threat to either or both listed seabird species. The principal potential impact that development of the project site poses to Dark-rumped Petrel and Newell's Shearwater is the increased threat that individual birds will be downed after becoming disoriented by new exterior lighting that will be required in conjunction with the proposed development.

Three endangered waterbird species; Common Moorhen, Hawaiian Coot, and Hawaiian Stilt were seen within the wetland area located in the center of the site, and in the adjacent drainage canals. One species, the Common Moorhen, was seen with three very small chicks, indicating that at least this species breeds within the larger wetland. Currently the wetland habitat does not favor Hawaiian Coots, which prefer more open water than is currently present on site. The dense California grass areas within the wetlands and canals represents very desirable habitat for Common Moorhen. Hawaiian Stilts were only

encountered in the small pond located just behind the beach and south of the wetland out-fall. The pond currently has a lot of trash in it, and smells quite nasty.

The future management of the wetlands and possibly the design of the golf course may result in impacts to one or more of the endangered waterbirds which currently use resources within the wetlands in the project area. The removal of cattle from the main wetland, may result in the wetlands and drainage canals being overgrown by California grass or other alien species, this would remove habitat currently being used by the three species under discussion. Any modification required to construct golf greens within the delineated wetland, will in all probability require further consultation with the USFWS under the aegis of the Endangered Species Act of 1973, as amended.

Recommendations

To reduce the possibility that the nocturnally flying Dark-rumped Petrels and Newell's Shearwaters may be disoriented by external lights and collide with man-made structures, it is recommended that any external lighting planned within the proposed improvements be shielded (Reed et al., 1985; Telfer et al., 1987). This mitigation would minimize the threat of disorientation and downing of Dark-rumped Petrels, and Newell's Shearwaters.

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Scientific name	Common name	Status	Vegetation type a	g	c	k
MONOCOTS						
AGAVACEAE (Agave family)						
Sansevieria trifasciata Prain	snake plant, mother-in-law's tongue	X	-	-	+	-
ARACEAE (Aroid family)						
Epipremnum pinnatum (L.) Engl.	taro vine, golden pothos	X	-	+	+	-
Pistia stratiotes L.	water lettuce	X	-	+	-	-
ARECACEAE (Palm family)						
Cocos nucifera L.	coconut, niu	P	-	-	+	+
CANNACEAE (Canna family)						
Canna indica L.	Indian shot, ali'ipoe poloka	X	-	-	+	-
COMMELINACEAE (Spiderwort family)						
Commelina diffusa N.L. Burm.	honohono	X	-	+	-	-
CYPERACEAE (Sedge family)						
Bolboschoenus maritimus ssp. paludosus (A. Nels.) T. Koyama	kaluha	I	-	+	-	-
Cyperus involucratus Rottb.	umbrella sedge, 'ahua'awa haole	X	-	+	-	-
Cyperus polystachyos Rottb.		I	-	+	-	-
Cyperus rotundus L.	nutgrass, nut sedge	X	+	+	-	-
Eleocharis geniculata (L.) Roem. & Schult.	spikerush	X	-	+	-	-
Schoenoplectus californicus (C.A. Mey.) Palla	bulrush, kaluha	X?	-	+	-	-
Schoenoplectus lacustris (L.) Palla	great bulrush, 'aka 'akai	I	-	+	-	-
LEMNACEAE (Duckweed family)						
Lemna aequinoctialis Welw.	duckweed	X	-	+	-	-

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Scientific name	Common name	Status	Vegetation type a	g	c	k
LILIACEAE (Lily family)						
Crinum asiaticum L.	spider lily	X	-	-	+	-
MUSACEAE (Banana family)						
Musa X paradisiaca L.	banana, mai'a	X	-	+	-	-
PANDANACEAE (Hala family)						
Pandanus tectorius S. Parkinson ex Z	hala, pu hala, pandanus	I	-	-	+	-
POACEAE (Grass family)						
Brachiaria mutica (Forssk.) Stapf	California grass	X	+	+	+	+
Brachiaria subquadripara (Trinc.) Hitchc.						
Cenchrus echinatus L.	common sandbur, 'ume'alu	X	+	+	-	-
Chloris barbata (L.) Sw.	swollen fingergrass, mau'ulei	X	+	-	-	-
Chloris divaricata R. Br.	stargrass	X	+	+	+	+
Chloris radiata (L.) Sw.	radiate fingergrass, plushgrass	X	-	+	-	-
Coix lachryma-jobi L.	Job's tears	X	-	+	-	-
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X	-	+	-	-
Digitaria ciliaris (Retz.) Koeler	kukaepua'a	X	+	+	+	+
Digitaria insularis (L.) Mez ex Ekman	sourgrass	X	-	+	-	-
Digitaria violescens Link	smooth crabgrass, kukaepua'a uka	X	-	-	+	-
Echinochloa colona (L.) Link	jungle rice	X	+	-	-	-
Eleusine indica (L.) Gaertn.	wiregrass, manienie ali'i	X	-	+	-	-
Eragrostis amabilis (L.) Wight & Arnott	lovegrass	X	-	+	+	+
Melinis repens (Willd.) Zizka	Natal redtop, Natal grass	X	-	+	-	-
Panicum maximum Jacq.	Guinea grass	X	+	-	-	-
Paspalum conjugatum Bergius	Hilo grass, mau'u Hilo	X	+	+	+	+
Paspalum fimbriatum Kunth	Panama paspalum	X	-	+	-	-
Paspalum scrobiculatum L.	ricegrass, mau'u laiki	X	-	+	-	-
Paspalum urvillei Steud.	Vasey grass	I?	-	+	-	-
Paspalum vaginatum Sw.	seashore paspalum	X	-	+	-	-
Saccharum officinarum L.	sugar cane, ko	X	-	+	-	-
Sporobolus virginicus (L.) Kunth	'aki'aki, beach dropseed	X	+	-	-	-
		I	-	-	+	-
TYPHACEAE (Cattail family)						
Typha latifolia L.	cattail	X	-	+	-	-

Scientific name	Common name	Status	Vegetation type a	g	c	k
GOODENIACEAE (Goodenia family)						
Scaevola sericea Vahl	naupaka, naupaka kahakai, beach naupaka	I	-	+	+	-
LAMIACEAE (Mint family)						
Leonotis nepetifolia (L.) R. Br.	lion's ear	X	+	-	-	-
MALVACEAE (Mallow family)						
Abutilon grandifolium (Willd.) Sweet	hairy abutilon, ma'o	X	+	+	+	-
Abutilon incanum (Link) Sweet	ma'o, hoary abutilon	I?	+	-	-	-
Hibiscus rosa-sinensis L.	red hibiscus	X	+	-	-	-
Hibiscus tiliaceus L.	hau	I?	+	+	+	+
Malachra alceifolia Jacq.		X	-	+	-	-
Malvastrum coromandelianum (L.) Garcke	flase mallow, hauuoi	X	+	+	-	-
Sida fallax Walp.	'ilima	I	-	-	+	-
Sida rhombifolia L.	Cuba jute	X	+	+	-	+
Sida spinosa L.	prickly sida	X	-	-	-	+
Thespesia populnea (L.) Sol. ex Correa	milo	I?	-	-	+	-
MORACEAE (Mulberry family)						
Ficus microcarpa L.f.	Chinese banyan	X	+	-	-	+
MYRTACEAE (Myrtle family)						
Psidium guajava L.	guava, kuawa	X	+	-	-	+
Syzygium cumini (L.) Skeels	Java plum	X	+	+	+	+
NYCTAGINACEAE (Four-o'clock family)						
Boerhavia coccinea Mill.		X	-	+	-	-
Mirabilis jalapa L.	four-o'clock, marvel of Peru, nani ahiahi	X	+	-	+	-
ONAGRACEAE (Evening primrose family)						
Ludwigia octovalvis (Jacq.) Raven	primrose willow, kamole	P?	-	+	-	-

Scientific name	Common name	Status	Vegetation type a	g	c	k
PAPAVERACEAE (Poppy family)						
Argemone mexicana L.	Mexican poppy	X	+	-	-	-
PASSIFLORACEAE (Passion flower family)						
Passiflora edulis f. flavicarpa Degener	lilikoʻi	X	-	-	+	+
Passiflora laurifolia L.	yellow granadilla	X	-	-	+	-
PHYTOLACCACEAE (Pokeweed family)						
Rivina humilis L.	coral berry	X	-	-	+	-
PORTULACACEAE (Purslane family)						
Portulaca oleracea L.	common pigweed, 'ihi	X	-	-	+	-
Portulaca pilosa L.		X	-	-	+	-
RHIZOPHORACEAE (Mangrove family)						
Rhizophora mangle L.	American mangrove	X	-	-	+	-
RUBIACEAE (Coffee family)						
Morinda citrifolia L.	noni	P	+	-	+	-
SCROPHULARIACEAE (Figwort family)						
Bacopa monnieri (L.) Wettst.	water hyssop	I	-	+	-	-
STERCULIACEAE (Cacao family)						
Waltheria indica L.	'uhaloa, hi'aloa, kanakaloa	I?	+	-	+	+
VERBENACEAE (Verbena family)						
Lantana camara L.	lantana, lakana	X	+	-	+	-
Verbena litoralis Kunth	weed verbena	X	-	+	-	-
ZYGOPHYLLACEAE (Creosote bush family)						
Tribulus terrestris L.	puncture vine, goat head	X	+	-	-	-

APPENDIX G

<u>Archaeological Inventory Survey, Ocean Bay Plantation at Hanamā'ulu Project, Land of Hanamā'ulu, Līhu'e District, Island of Kaua'i</u>

PHRI, Inc.

March 2002

Report 2182-030602

Archaeological Inventory Survey
Ocean Bay Plantation at Hanamā'ulu

Land of Hanamā'ulu, Lihu'e District
Island of Kaua'i

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

Report 2182-030602

Archaeological Inventory Survey
Ocean Bay Plantation at Hanamā'ulu

Land of Hanamā'ulu, Lihu'e District
Island of Kaua'i (TMK:4-3-7-3:1;4-3-9-5:5)

BY

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WITH

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SUMMARY

Paul H. Rosendahl, Ph.D., Inc. (PHRI) recently completed an archaeological inventory survey of the approximately 460-acre Ocean Bay Plantation at Hanamā'ulu site, located in the Land of Hanamā'ulu, Līhu'e District, Island of Kaua'i (TMK:4-3-7-3:1; 4-3-9-5:5). The work was done at the request of Mr. Jeff Overton of Group 70 International, representing EWM Kauai, LLC. The basic objective of the project was to provide information sufficient for (a) preparation of an Environmental Impact Statement (EIS) for the proposed development of the project site, and (b) compliance with the historic preservation regulatory review requirements of the Hawai'i State Historic Preservation Division (SHPD) and the County of Kaua'i.

The current report is an upgraded version of an earlier PHRI report (Walker et al. 1991). The current project area had been previously surveyed in 1990 by PHRI for an Environmental Impact Statement that was to be prepared in connection with AMFAC/JMB Hawaii, Inc.'s Lihu'e/Puhi/Hanamā'ulu Master Plan Project. That inventory survey included virtually the entire current project site. The Walker et al. (1991) report was completed but was never submitted to SHPD for formal review. PHRI consulted with Dr. Ross Cordy, SHPD Archaeology Branch Chief, regarding the prior field survey and report, and in consultation with Dr. Cordy formulated the specific tasks needed to upgrade the prior report and survey. PHRI then proceeded with the required fieldwork and upgraded the report to its current state.

Four site complexes and six single-feature sites were identified in or in the vicinity of the project area. The sites and complexes were composed of a variety of formal feature types. The most common feature types are bridges (2), cultural deposits (2), and cemeteries (1 and possibly 2). Other feature types in the area include concrete foundations, a retaining wall, and a terrace. Transportation constituted over one-quarter of the functional site types. This function is almost certainly connected to the sugar cane production and distribution that took place in the area. Temporary and possible permanent habitation constituted one-third of the functional types. These relate to the prehistoric use of the project area for habitation at the coast, doubtless for the procurement of marine resources.

Two test excavations, totaling 0.75 sq m in surface area, were dug within the project area at Sites 1839 (Feature B) and 1840. In addition to the test units, two bulk soil radiocarbon samples were collected from Site 1838, and a sample of mammal bone and diagnostic historic artifacts was collected from the surface of Site 1843.

The ten sites identified (Sites 1838, 1839, 1840, 1841, 1843, 1845, 1846, 2066, 2067, and 2068) are all assessed as significant under Criterion D (information content). Site 1845 is additionally assessed as significant for Criterion A (important for historical contribution to significant events and/or broad patterns of history) and Criterion C (excellent example of a site type). Site 1846 is additionally assessed as significant for Criterion A. Sites 2066 and 2067 are additionally assessed as significant for Criterion E (cultural value). Site 2068 requires further data collection. Following this, the site need not be preserved. The remaining nine sites (1838, 1839, 1840, 1841, 1843, 1845, 1846, 2066, and 2067) require preservation "as is."

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INTRODUCTION

BACKGROUND

Paul H. Rosendahl, Ph.D., Inc. (PHRI) recently completed an archaeological inventory survey of the approximately 460-acre Ocean Bay Plantation at Hanamā'ulu site, located in the Land of Hanamā'ulu, Lihu'e District, Island of Kaua'i (TMK:4-3-7-3:1; 4-3-9-5:5)(*Figure 1*). The work was done at the request of Mr. Jeff Overton of Group 70 International, representing EWM Kauai, LLC. The basic objective of the project was to provide information sufficient for (a) preparation of an Environmental Impact Statement (EIS) for the proposed development of the project site, and (b) compliance with the historic preservation regulatory review requirements of the Hawai'i State Historic Preservation Division (SHPD) and the County of Kaua'i.

SCOPE OF WORK

The level of archaeological investigation generally conducted in conjunction with the preparation of an EIS is referred to as an *Inventory survey*. The basic purpose of an *inventory survey* is to identify all sites and features of potential archaeological significance present within a specified project area. An inventory survey generally comprises the initial level of archaeological investigation, and is conducted to determine the presence or absence of archaeological resources. It indicates the general nature and variety of archaeological remains present, and the general distribution and density of such remains. Finally, it permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for any subsequent mitigation work (such as preservation, data recovery excavations, or construction monitoring) that might be necessary or appropriate.

The current project area had been previously surveyed in 1990 by PHRI for an Environmental Impact Statement that was to be prepared in connection with AMFAC/JMB Hawaii, Inc.'s Lihu'e/Puhi/Hanamā'ulu Master Plan Project. That inventory survey included virtually the entire current project site. The report for the earlier survey (Walker et al. 1991) was completed but was never submitted to SHPD for formal review. Prior to the fieldwork for the current project PHRI consulted with Dr. Ross Cordy, SHPD Archaeology Branch Chief, regarding our prior field survey and report, and the specific tasks and level-of-effort needed to upgrade the prior survey to current SHPD review standards.

The specific objectives of the 1990 survey were fourfold: (a) to identify all potentially significant archaeological remains present within the parcel; (b) to collect information sufficient to evaluate and document the potential significance of all identified remains; (c) to evaluate the potential impacts of any proposed development upon any identified significant remains; and (d) to recommend appropriate measures that would mitigate any adverse impacts upon identified significant remains.

The following are the specific tasks for the current work. They were formulated based on consultation with Dr. Cordy, a review of prior archaeological survey work done in the general area, information derived from the 1990 inventory survey, and our familiarity with both the general project area and the current regulatory review requirements of the SHPD.

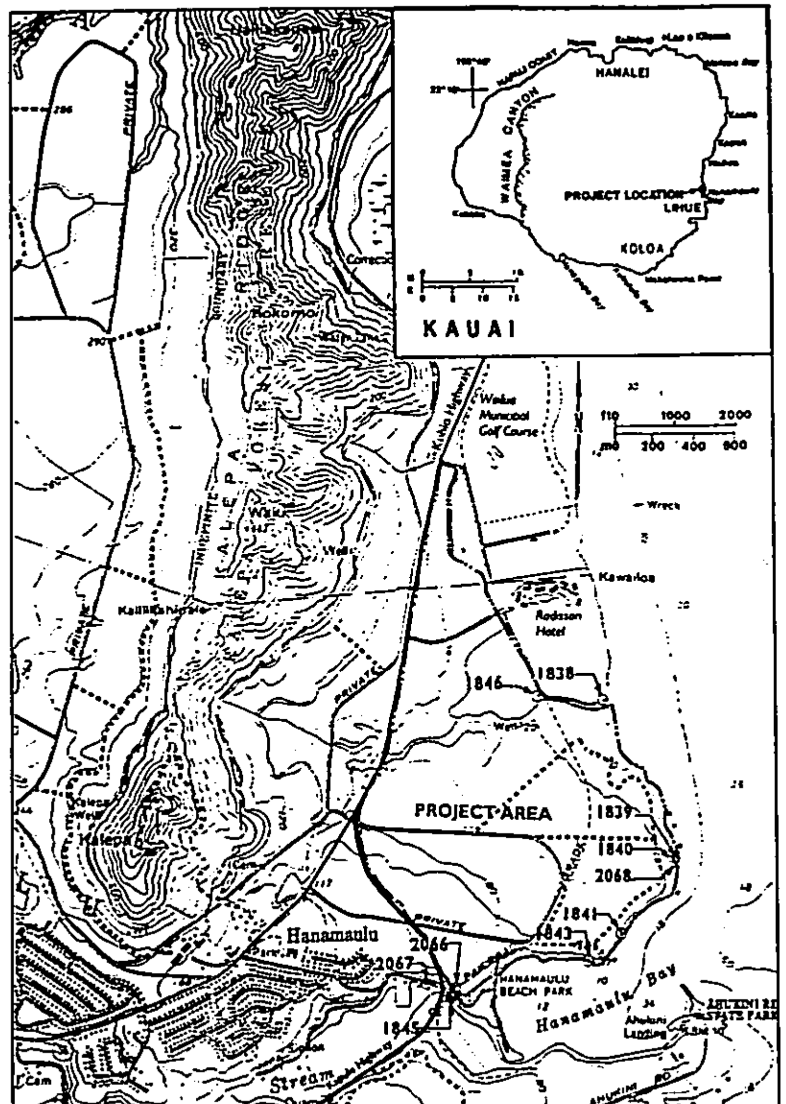


Figure 1. Project Area and Site Locations

1. Appropriate background review and research, including upgrading background section of the earlier PHRI 1990 survey report;
2. Mobilization – including fieldwork preparations, field crew travel, and demobilization;
3. Fieldwork – relocation and updated assessment of condition and significance of all previously identified sites, and detailed recording of any newly identified sites;
4. Post-field analyzes of fieldwork and other research data;
5. Prepare draft and final report; and
6. Coordinate and consult with client, client representatives, agency staff, etc. as appropriate and/or required.

Both the prior inventory and the current survey were carried out in accordance with the appropriate standards of the County of Kaua'i and the SHPD, as contained in the draft SHPD Administrative Rules, Title 13, Subtitle 13, Chapter 276 (DLNR 2001). The significance of archaeological remains identified within the project area was assessed in terms of Rules Governing Procedures for Historic Preservation Review (Chapter 284, Hawai'i Administrative Rules; DLNR 2001). DLNR-SHPD uses these criteria to evaluate eligibility for both the Hawai'i State and National Register of Historic Places. Significance criteria are discussed further in the *Conclusion* section.

PROJECT AREA DESCRIPTION

The project area consists of c. 460 acres and is located in the Land of Hanamā'ulu (*Figure 1*). It is bounded on the south by Hanamā'ulu Bay; on the east by the Pacific Ocean; on the west by the Hanamā'ulu-Ahukini cut-off road and Kuhio Highway; and on the north by Kaua'i Beach Road. The project area has, in the past, been subjected to sugar cane cultivation, but is abandoned at the present time. EWM Kauai, LLC intends to develop the property as a mixed-use residential and golf course community. This low-density master-planned community will include large open-space areas (to preserve the coastline strand), open space and wetland resources, and will maintain the open space character and sense of place of the surrounding area.

The terrain within most of the project area is generally level and consists of four classifications of soil: Lihu'e silty clay (0-8% slopes), Lihu'e silty clay (8-15% slopes), Lihu'e gravelly silty clay (0-8% slopes), and Koloa stony silty clay (15-25%) (Foote et al. 1972). The Koloa series soils are present immediately inland of the coastline. They developed in material weathered from basic igneous rock and overlie hard rock (Foote et al. 1972).

Vegetation in the immediate coastline and the coastal flats at the northeast corner of the project area, adjacent to the beach access road, consists predominately of ironwood (*Casuarina equisetifolia* L.), *naupaka-kahakai* (*Scaevola sericea* Vahl), grasses, and tree heliotrope (*Heliotropium anomalum* H. & A. var. *argenteum* Gray). There are three classifications of soil present within the immediate coastline: Rough broken land, Rock outcrop, and Beaches (Foote et al. 1972). The Rock outcrop land consists of exposed basalt and andesite bedrock, which covers more than 90% of the surface (Foote et al. 1972). Within the southern half of the project area, the lands classified as Beaches are composed solely of basalt cobble and boulder areas that are constantly awash with waves. Present within the coastal flats at the northeast corner of the project area are three classifications of soil: Mokuleia fine sandy loam, Koloa stony silty clay (8-15% slopes), and Beaches (Foote et al. 1972). Within the coastal flats, the land classified as Beaches is composed of light-colored sands derived from coral and seashells.

Because the section of land inland of the Radisson Kauai Beach Resort Hotel is a low-lying drainage, sometimes containing standing water, vegetation in this area includes various reeds, sedges, grasses, and *hau*. Present within this area are three classifications of soil: Mokuleia clay loam (poorly drained variant), Lihu'e silty clay (25-40% slopes, eroded), and Hanalei silty clay (0-2% slopes) (Foote et al. 1972). According to Foote et al., Hanalei series soils are used for taro, pasture, sugarcane, and vegetable crops. Hanalei silty clay (0-2% slopes) specifically "...occurs on stream bottoms and flood plains" (Foote et al. 1972:38).

The area inland of the county parkland appears to have been modified sometime in the past, as evidenced by the presence of secondary growth species such as *koa-haole* and Indian Pluchea (*Pluchea indica* [L.] Less.). Present within this area are four classifications of soil: Mokuleia clay loam (poorly drained variant), Lihu'e silty clay (25-40% slopes, eroded), Lihu'e gravelly silty clay (8-15% slopes), and Fill Land (Foote et al. 1972). According to Foote et al., Fill Land "...consists of areas filled with material from dredging, excavation from adjacent uplands, garbage, and bagasse and slurry from sugar mills. . .Generally, these materials are dumped and spread over marshes, low-lying areas along the coastal flats, coral sand, coral limestone, or areas shallow to bedrock".

Rainfall in the general vicinity of the project area ranges between 40-50 inches per year, and the mean annual temperature in the project area vicinity ranges from 70-75 degrees F (Armstrong 1983:63).

PREVIOUS ARCHAEOLOGICAL RESEARCH

In order to obtain the information necessary to compile this section on previous archaeological work in the project area, PHRI searched for relevant records and reports at the SHPD. According to SHPD records, the following two reports were supposed to be present in the SHPD Library, but these could not be found despite assistance from the SHPD staff. This section was therefore written without the information from these reports:

Hammatt, H.
2001 Archaeological Assessment of the Proposed Sandwich Isles Communication Fiberoptic Cable Project within an Approximately 51 Mile Road Corridor Between Kekaha and Moloaa.

Kawachi, C.T.
1995 Archaeological Monitoring of the Kuhio Highway Widening Project, Wailua, Kawaihau, Kauai.

Archaeological work conducted within or immediately adjacent to the present project area includes investigations by Thrum (1907), Dickey (1916), Bennett (1931), Cox (1977), Kikuchi (1984), (Henry et al. 1993), Walker and Rosendahl (1990), Rosendahl (1990), Kawachi (1993), Folk and Hammatt (1994), Fager and Spear (2000), Creed et al. (2001), and Perzinski and Hammatt (2001). *Figure 2* shows the locations of many of these previous studies; for locations of studies north of the project area refer to the individual listed TMKs.

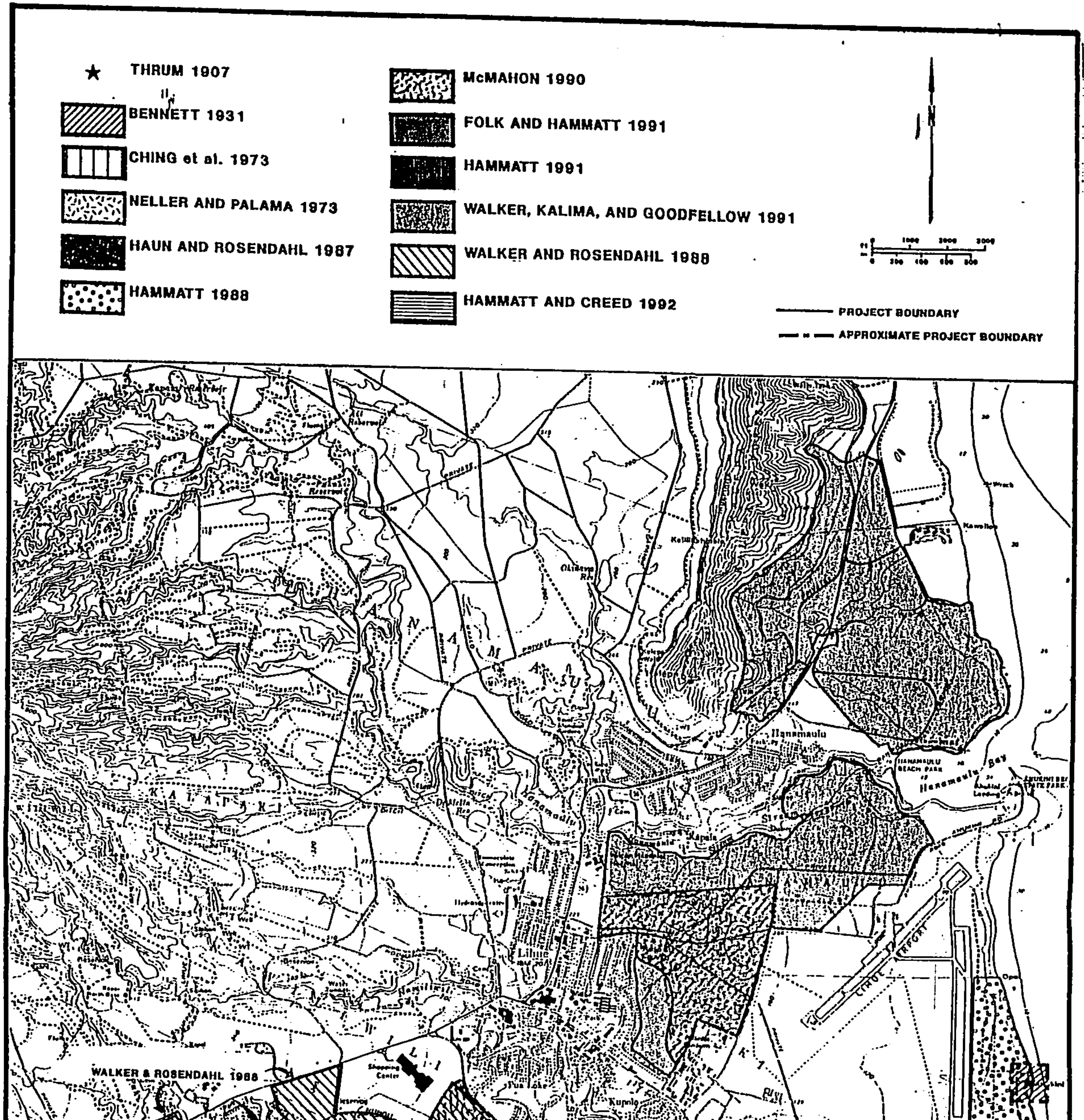
In 1906 T.G. Thrum compiled a list of *heiau* for the Island of Kaua'i (Thrum 1907). Of the numerous *heiau* Thrum recorded, two (Ahukini and Kalauokamanu) are in the general vicinity of the present project area. Thrum, however, did not mark the location of the heiau on a map and his descriptions are brief. Thrum described Ahukini Heiau as "[a] medium sized heiau; all destroyed" and Kalauokamanu Heiau as "[a] large walled heiau that stood above the present mill; destroyed about 1855. Of pookanaka class" (1907:40).

In 1928-1929, while surveying sites on Kaua'i for B.P. Bishop Museum, Bennett described Ahuhini (Ahukini) and Kalauokamanu *heiau* and assigned them site numbers 101 and 102, respectively (Bennett 1931). In addition to repeating Thrum's site descriptions, Bennett indicates that Ahuhini Heiau was once located "...near Ahukini Point on the bluff overlooking the sea" (Bennett 1931:125). Because Bennett (1931) indicates both *heiau* had been destroyed, it appears the sites may not have been relocated. During his survey, Bennett (1931) recorded one other site (Site 103, dune burials) in the immediate vicinity of the present project area. Bennett describes Site 103: "[i]n the sand dunes that run along the shore half way between Hanamaulu and Wailua River are many burials" (125).

In 1949 Mrs. Rebecca Banks recorded 36 petroglyph figures on boulders stretching across the mouth of the Wailua River (in TMK:4-1-04:01) (Dickey 1916:16). These boulders became a National Historic Landmark in 1962. In 1973, Dr. Kikuchi and the Anthropology Club of Kaua'i Community College surveyed the same area and relocated the petroglyphs, some of which had bulldozer marks on them (Kikuchi 1984:8). In 1991, the Division of Water Resource Management, Design Section contacted the SHPD to do surveys of the mouths of Wailua and other Kaua'i rivers in order to determine the presence or absence of historic sites. During these surveys, none of the petroglyphs previously recorded were relocated; however, a boulder with petroglyph figures and a superimposed grinding facet, was identified and recorded (Kawachi 1993:30; TMK:4-1-04:01).

In 1972, F.K.W. Ching of Archaeological Research Center Hawaii, conducted a survey near Nawiliwili Bay for the Kanoa Estate (Ching et al. 1973, Neller and Palama 1973). This survey resulted in the examination of nine archaeological features, including three fishponds (Sites 98 [501], 3027 and 3028), two irrigation ditches (Sites 3029 and 3030), and the remains of four taro fields (all are now components of the North Niumalu Complex – HRHP Site 50-30-11-3168).

In 1977, Archaeological Research Center Hawaii, Inc. (ARCH), provided consultant services and conducted salvage fieldwork during construction of a force main and effluent ponding basin north of the clubhouse of the Wailua Golf Course (TMK:3-9-02)(Cox 1977). During the fieldwork, scattered human remains representing 13 burials were identified, most of which were on the western (*mauka*) side of sand dunes. Three of the burials were in an extended position, with the crania facing east or northeast, suggesting possible ceremonial significance. Following the investigation, the burial remains were left either *in situ* or were reinterred as near as possible to their original locations. Included in the report is osteological analysis of the remains and general comments regarding distribution. With the exception of historic railroad items, no other cultural remains (artifacts or deposits) were identified.


THRUM 1907
BENNETT 1931
CHING et al. 1973
NELLER AND PALAMA 1973
HAUN AND ROSENDAHL 1987
HAMMATT 1988
McMAHON 1990
FOLK AND HAMMATT 1991
HAMMATT 1991
WALKER, KALIMA, AND GOODFELLOW 1991
WALKER AND ROSENDAHL 1988
HAMMATT AND CREED 1992
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HANAMAULU BEACH PARK
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WALKER & ROSENDAHL 1988

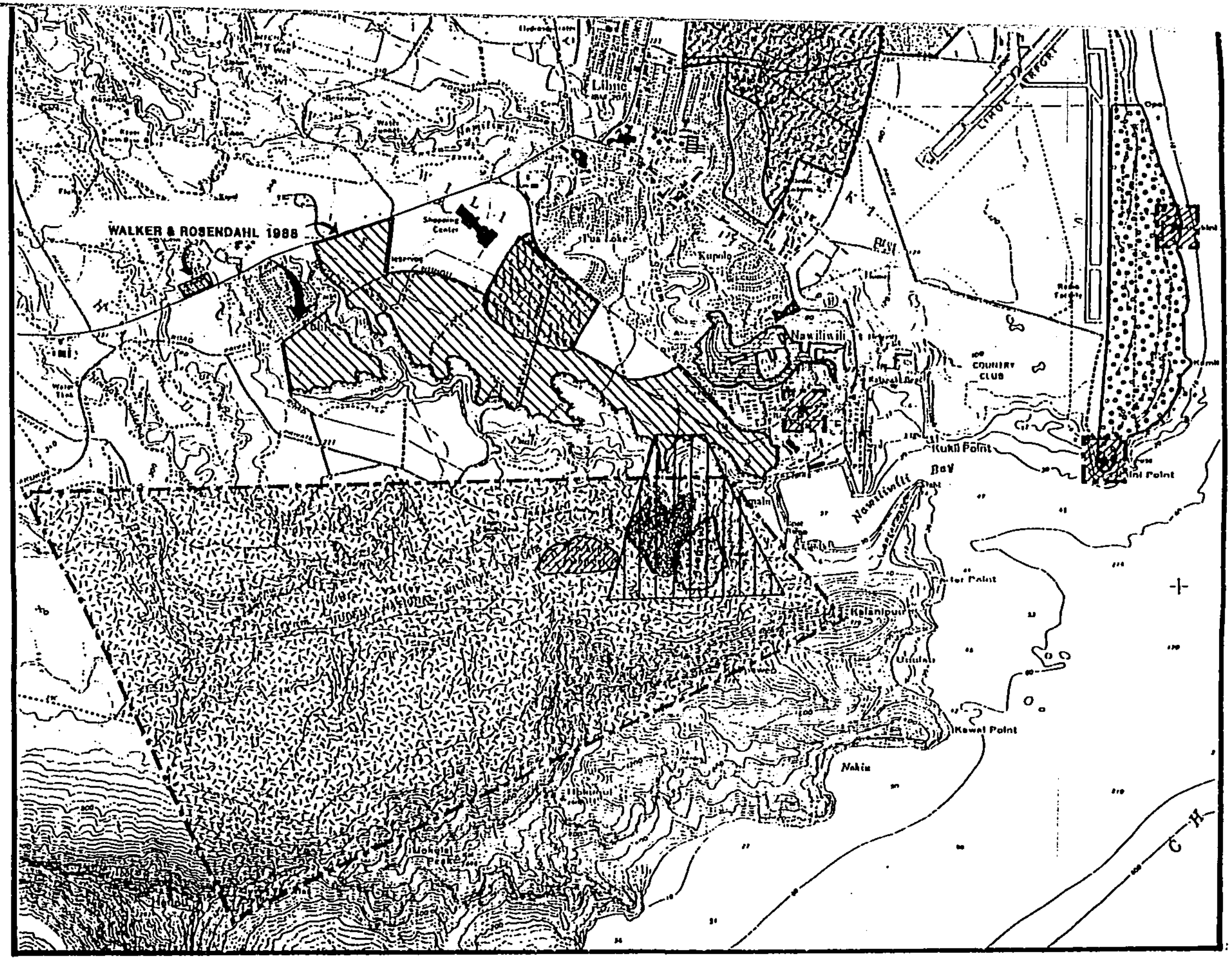


Figure 2. Previous Archaeological Investigations

According to local informants, burial remains previously identified north of the golf course clubhouse were usually of sparsely distributed single individuals. But burial remains previously identified south of the clubhouse (toward Hanamā'ulu and the present project area) were often in groups or multiple individuals (Cox 1977:27). The burials of this type identified within the Wailua Golf Course area are probably those referred to by Bennett (1931).

In 1993, Erkelens and Welch (1993) encountered a burial during investigations of a sewer line trench extending from Kaua'i Correctional Facility to Wailua Golf Course (TMK:3-9-02). Informants stated that "hundreds of bones" were found during construction of the golf driving range in the early 1960s (cf. Fager and Spear 2000:8).

In 1994 Cultural Surveys Hawaii was contracted to monitor backhoe trenching in order to install a fiber optic cable from the edge of the sea to Kuhio Highway, through the Wailua Golf Course at Wailua, Kaua'i (TMK:3-9-02). During the excavations and subsequent reroutings, several burials and disarticulated human remains were discovered. These consisted of (1) a single, discrete articulated adult; (2) several disarticulated adult bones; and (3) disturbed and disarticulated bones screened from the sand castings from the first original trench. These disturbed bones represented at least six individuals (three adults and three subadults)(Folk and Hammatt 1994:i).

Numerous burials were recovered during renovation of the golf course irrigation system in 2000. Scientific Consultant Services encountered 44 pre-contact burials with an additional 42 isolated finds of isolated bones from previously disturbed burials. In addition, pre-contact artifacts, including two adzes, a sinker stone, and a hammerstone were recovered, and historic artifacts such as glass and porcelain-ware were also found (Fager and Spear 2000)(TMK:3-9-02).

Given the archaeological findings and cultural significance of the areas discussed above, Cultural Surveys of Hawaii in 2001 recommended mitigation in the form of a monitoring program in conjunction with construction of a proposed trail/bike path through Lydgate State Park (TMK:3-0-06)(Creed et al. 2001).

Cultural Surveys of Hawaii in 2001 monitored construction activities associated with the expansion of Waikaea Bridge. However, after four monitoring days it was evident that the original widening of the channel and subsequent construction of the bridge in 1948 had removed any cultural materials that may have once existed there (TMK:4-3-06,08)(Perzinski and Hammatt 2001).

PHRI Archaeological Investigations

Between November 1988 and April 1989 PHRI conducted an archaeological inventory survey of the Grove Farm Lihue/Puhi project area, located in the Lands of Nawiliwili, Niumalu, and Ha'iku, Lihue District. The survey resulted in identifying two sites (a historic cemetery [Site 503], and a historic residence [Site 9390]). Subsurface testing revealed no subsurface cultural deposits. An additional inventory in eight small areas of the project area also revealed no archaeological sites (Henry et al. 1993).

In late 1989 PHRI conducted an archaeological inventory survey of the approximately 66-acre proposed Hanamaulu Affordable Housing project area (Walker and Rosendahl 1990). The parcel is centrally located between Hanamaulu Stream gulch, Kuhio Highway, and Hanamā'ulu-

Ahukini cut-off road. The basic objective of the survey was to provide information sufficient for the preparation of an Environmental Assessment (EA). The survey included variable-coverage surface and limited subsurface archaeological inventory survey. During the surface survey, the only cultural remains identified were isolated coral fragments. No structural features or cultural deposits were encountered. The subsurface survey entailed excavation of nine backhoe trenches. The trenches yielded no cultural matrices, buried pondfields, subsurface horizontal features, portable cultural remains, or datable materials of any kind. As a result of these negative findings, no further archaeological work was recommended (Walker and Rosendahl 1990).

In late 1990, PHRI conducted an archaeological field inspection and limited subsurface testing of the Kalepa Radio Station and Kalepa Road Improvement project area located on Kalepa Ridge in the Land of Hanamā'ulu (Rosendahl 1990). During construction at the Radio Station site, previously unidentified human burial remains had been uncovered in a boulder mound, and the remains had been designated as Site 1827. DLNR-HPP/SHPO had been contacted and recovered portions of the burials.

The principal objectives of the field inspection were to identify all sites present within the project area and to assess the potential significance of all identified archaeological remains, and to define the scope of any subsequent archaeological work. The specific purpose of the field inspection for the Road Improvement project area was to identify any archaeological remains on or alongside a 500-ft-long section of an existing roadbed. During the inspection of the roadbed, no archaeological remains of any kind were identified, either within or immediately adjacent to the roadbed (Rosendahl 1990).

The field inspection of the Radio Station project area consisted of inspecting Site 1827 and the areas of disinterred burials and *in situ* burial remains previously identified by DLNR-HPP/SHPO. The purpose of the inspection was to determine if additional human burials were present and to make appropriate recommendations for further archaeological work. Because intact human burial remains had been found, and because there were still undisturbed areas within the project area suitable for burials, it was felt that there were probably additional burials in the area. It was also discovered that Site 1827 had originally functioned as a quarry or flake reduction area (Rosendahl 1990). Based on the findings of the field inspection, it was recommended that an alternative site be selected for the Radio Station project. Three alternative sites were later selected, and PHRI inspected these sites and conducted backhoe testing at two of the sites. Because one of the alternative sites (Alternate Site 1) was located atop a portion of Site 1827, it was not tested. No portable remains or human burials were present within the trenches. Based on the fieldwork findings, PHRI recommended that the radio station be constructed at either Alternate Site 2 or 3 (Rosendahl 1990). No further archaeological work was recommended within the 500-ft section of existing gravel road (Road Improvement project area) (Rosendahl 1990).

SETTLEMENT PATTERNS

Prehistoric Settlement

The Colonization Period

Kirch (1985:298-3 08) has proposed a chronology for evolution of native Hawaiian culture. This chronology consists of four periods, beginning with initial settlement and ending with the period in which contact with Europeans began to affect development of the indigenous culture.

The Colonization Period (AD 300-600) is the period in which the first Polynesians migrated to the Hawaiian Archipelago and settled the islands. Although a Colonization Period component has been documented on Kaua'i, very little information concerning this earliest phase of Hawaiian prehistory exists. To date, only a few sites in the archipelago have yielded dates prior to AD 600. Kirch comments on two such sites, Layer III at the Bellows Dune Site (018) on O'ahu, and Layer III at the Pu'u Mu Dune Site at South Point on Hawai'i (Kirch 1985). In addition, PHRI investigations at the Hyatt Regency Kaua'i Hotel project area resulted in the recovery of a radiocarbon sample that dated to AD 220-690 (Lay.II, Blk.1)(Walker, Rosendahl, and Goodfellow 1992).

Based on the limited amount of data, it appears that the early settlers focused their activities on areas with easy access to plentiful marine resources and/or the fertile soils of coastal river valleys. The sites were isolated and small and were occupied by limited populations. No sites dating to the Colonization Period have been documented in the immediate vicinity of the project area. The nearby coastal area and the Huleia River Valley have the characteristics typical of these areas and may yield such dates. It is doubtful, however, that Colonization Period sites are present within the coastal plateaus of the current project area (Kirch 1985:298-302).

The Developmental Period

During the Developmental Period (AD 600-1100), permanent settlements were established throughout the islands, mostly in the fertile windward valleys or along coastal areas with plentiful marine resources. Occupation and utilization of the coastal region of Kaua'i is currently poorly documented. This is no doubt due in part to the relatively small populations that frequented the region during early times. Although Kirch notes a probable population increase during the Developmental Period, he also states that it is unlikely that there were more than 20,000 people in the entire Hawaiian chain by AD 1100 (Kirch 1985:302). The occupants of the small settlements focused their subsistence activities on the readily accessible, coastal marine environment, making occasional forays to the interior for resource procurement. The absence of accumulated midden and structural features from this period is probably due to the small population and the nature of their subsistence activities.

It may be that the lack of evidence for occupation of the current project area and vicinity during the Developmental Period is due to the significant amount of historic disturbance that has occurred. Historic land use and its impact on the area are discussed in detail below. Future archaeological investigations in the general region, nonetheless, may yield dates from the Developmental Period.

The Expansion Period

The Expansion Period (AD 1100-1650) was characterized by numerous developments, including a rapid increase in population and intensified agriculture (large-scale irrigation, dryland agriculture, and aquaculture), which required new social, political and religious forms (Kirch 1985:303-306). The development of the *ahupua 'a* system, a system of land division and related social organization unique to Hawai'i, led to more complex social and political integration (Hommon 1976, Green 1980).

The traditional Hawaiian land division, or *ahupua'a*, in ideal form, extends from the coastline to the mountains, and often corresponds with a valley drainage. The ranking chief, or land manager *(konohiki)* of an *ahupua 'a* collected rents or tributes from the commoners *(maka-'āinana)* who lived and worked on the land. The ranking chief was a member of a non-localized ruling elite *(ali'i)* and as a result, earlier kinship-based relationships between ranking chief and his local community no longer existed.

During the Expansion Period agricultural and aquacultural networks were developed, for example, the four *lo'i*, or taro fields located in the flats of the Niumalu area; the primary and secondary *'auwai* or irrigation ditches which were used to transport water from the Huleia River inland to the taro fields; the 'Alekoko or Menehune *loko kuapā* (walled fishpond), an excellent example of an aquacultural structure; and the two *loko wai* (freshwater ponds) located to the east.

The Proto-Historic Period

The Proto-Historic Period (AD 1650-1795) was a time of elaboration of the material culture and social order present at the end of the Expansion Period. More agricultural fields and aquacultural systems were constructed, accompanied by the expansion of permanent habitation into portions of the upland areas. This period ends with the consolidation of the Hawaiian Islands, from Hawai'i to Ni'ihau, under the rule of Kamehameha I in 1810.

Western contact in 1778 introduced new materials and concepts to Hawaiian culture, and western diseases greatly affected the indigenous population. During the later Proto-Historic Period and early Historic Period, Hawaiian cultural evolution saw significant changes in the traditional Hawaiian lifestyle.

Prehistoric settlement, more relative to the current project area, within coastal areas of this general southeastern area of Kaua'i, the Lands of Hanamā'ulu, Kalapaki, Nawiliwili, Niumalu, and Wailua, appears to have been concentrated at Huleia Valley-Nawiliwili Bay and Wailua River Valley-Wailua Bay. According to Joesting (1984), the Wailua area was a highly desirable place of residence and was the principal residence of Kaua'i's high chiefs. The chiefly importance of the Wailua area is further evidenced by the number of *heiau* concentrated within that general area (Malae, Poliahu, Holoholoku, and Hikinaakala are among the many *heiau* named) (Thrum 1907). Because the Wailua river valley provides a permanent fresh water source and contains large tracts of fertile alluvial and colluvial soils, it is ideally suited for the cultivation of native crops to sustain a large population. Such a population would provide the labor force such as a complex chiefdom would need in order to function.

In much the same way as Wailua operated, the Huleia Valley probably also supported a substantial prehistoric population. This is evidenced by an extensive agricultural system of taro terraces and a large fishpond (Alekoko Fishpond) in Huleia Valley (Handy 1940, Neller and Palama 1973, Ching et al. 1973). Important nearby ceremonial sites include, but are not limited to, Kuhiau Heiau, Ninini Heiau, and Ahukini Heiau (Thrum 1907, Bennett 1931, Stauder 1973). Kuhiau Heiau, in Nawiliwili, has been described as the largest and most famous on Kaua'i in its day (Stauder 1973) (Thrum 1907).

During the historic period, the disturbance caused by the historic sugar cane industry probably destroyed the archaeological remains that may once have existed in the upper coastal plateaus surrounding the coastline. Handy and Handy suggest that in prehistoric times these areas may have been used for dryland agriculture, which included crops such as breadfruit and sweet potato (1972). Rosendahl's work at Site 1827 resulted in the identification of a quarry or flake reduction activity area that was subsequently reused as a burial site (1990). These findings suggest that surrounding upland areas were periodically exploited for raw materials to supply the main settlements located on the coast. The lack of readily accessible food and water may have resulted in only a temporary utilization of these areas.

Historic Settlement and Historical Documentary Research

Accounts of legends and traditional references are presented in *Appendix B*.

Historic Period sites in the coastal region of Kaua'i are typically utilitarian features associated with the production of sugar cane. Evidence of this industry is present on both the strand and on the raised coastal plateaus. The coastal has been found to contain sites associated with the transportation of the cane from the fields, to the coastal mills and waiting ships (roads, bridges, wharves, etc.). The upland plateaus, which were mostly in cane, often contains the remains of habitation structures (e.g., camps and manager's houses) and cane hauling roads. Cemeteries, features associated with long-term historic occupation, have also been documented in the area.

Early Historical Accounts

William Bennett, an archaeologist who studied many areas of Hawai'i in the early part of this century, noted that it was hard to link archaeological finds on the island to individual chiefs and political events due to the incompleteness of the genealogical record:

> Two factors separate the archaeological history of Kauai from the political history: the scarcity and inaccuracy of the genealogies, and the lack of accurate legendary knowledge about the ruins and artifacts. Some of the heiaus are said to have been built by such and such a chief, but it has been possible to place few of these chiefs in chronological sequence (Bennett 1931).

Bennett also noted Kauai's political independence:

> As to actual history the most significant point is that Kauai remained politically independent up to 1824. The island was never conquered, though in 1810 Kaumuali'i ceded the island to Kamehameha I to prevent an invasion. With the death of Kaumuali'i in 1824 the independence of Kauai ceased (Bennett 1931:7-8).

At this point, it might be of interest to relate in greater detail the events surrounding and following the cession of Kauai. According to Kamakau:

> By the mid-1700s, Kaumuali'i had become Ruling Chief of Kaua'i, and the lands of the entire island were his. In 1810 Kaumuali'i sailed to Honolulu to acknowledge the sovereignty of the King of Hawai'i. It appears that no change took place in the established land tenure as Kaumuali'i returned to Kaua'i still in charge of his lands. There was a promise on his part, however, that the island would be left eventually to the Kamehameha line (Kamakau 1992).

On the death of Kamehameha I, Liholiho came to Kaua'i to check on the loyalty of Kaumuali'i. Kaumuali'i proposed in a formal manner to surrender himself, his island, and all that he had to Liholiho. Bingham (1822:244) recorded the colorful scene:

> Kaumuali'i: ...Do with them as you please. Place what chief you please as governor here.
>
> Liholiho: ...I did not come to take away your island. I do not wish to place anyone over it. Keep your island and take care of it just as you have done, and do what you please with your vessels.

Kaumuali'i was married to Ka'ahumanu, one of the strongest political forces in the kingdom. To strengthen the political tie with Kaua'i, Ka'ahumanu also wed Keali'iahonui, son of Kaumuali'i. Kaumuali'i died in May 1824, leaving his Kaua'i lands to the Kamehameha heir. Apparently though, lands in the hands of Kaua'i chiefs were to be administered by them. On September 13, 1824, Hoapili wrote from Waimea to Kamehameha II in London: "...Your servant Kaumuali'i is dead. He left word that Pa'alua (also known as Kalanimoku, who with Ka'ahumanu were the two strongest political forces) was to take care of your land..." This indicates Kaumuali'i fulfilled the land agreement of 1810. The lands were to be held in trust by Ka'ahumanu and Kalanimoku for Kamehameha II and that those chiefs who had lands would keep them, those who were landless would remain so. This disposition of land brought about the Insurrection of 1824 when landless chiefs attempted to overthrow the forces of Kamehameha II. The revolt brought disaster for all Kaua'i chiefs as they lost their holding to the relatives and retainers of the Kamehameha line, who took over the lands of Kaua'i (Kamakau 1961:269).

Landless Kauai chiefs induced Kaumuali'i's son Humehume, to join them in revolt, but reinforcements from the other islands under Kalanimoku defeated the insurgents "...and the loafers and hangers-on (*palaualeo*) of Oahu and Maui obtained the rich lands of Kauai" (ibid.).

Little information can be found to help determine which chiefs obtained land after the uprising. It appears that the Crown and near relatives received the bulk of the lands. The government on Kauai was placed in the hands of Kaikioewa, whose loyalty to the Kamehameha line was unquestioned. Emilia, his wife, became governess after Kaikiowea's death in 1839 and held the post until 1842.

Several early western visitors recorded their impressions of the *ahupua'a* in the vicinity of the project area. These journals and accounts of their visits have proven to be valuable sources of information on the early historic period of Hawai'i. In 1793 Captain George Vancouver landed on Kauai and noted three rivers emptying out into the sea, two at Wailua and one at Kapa'a. He wrote that this was "the most fertile and pleasant district of the island" and the "principal residence of the king" (Joesting 1984:50).

Vancouver also estimated the birth of Kaumuali'i to be in about the year 1780. Tradition tells us that he was born at the birthstones of Wailua Valley (ibid:59).

Wailua is also noted as the ancient capital, although it did not possess an anchorage or landing. It was also known as the residence of Deborah Kapule, a queen, whose home served as a stopping point for travelers on their way to or from Hanalei between 1830 and 1850. This is where the Coco Palms Hotel is presently located (ibid:141).

In 1972, Handy and Handy (1972) published an account of native Hawaiian agricultural practices. Handy and Handy speculate that because Hanamā'ulu Stream gulch, near the current project area, offers a suitable environment for prehistoric agriculture, it may contain numerous terraced flats. Handy and Handy also surmise that the stream gulch was covered with *lo'i* for wetland taro cultivation and extended approximately two and a half miles inland (1972:425-426). Handy also describes traditional agricultural land use in the area:

> Coconut planted near sea level throughout; in valley bottoms in Hanamā'ulu ...Wauke planted in inner valley slopes, especially Koolau, *Puna* [emphasis Handy]. Kona. Olona; wet median forests from 1,000-2,000' elevation; Koolau and Puna (1940:59).

Farming in the Hanamā'ulu area included the raising of taro, sweet potatoes, breadfruit, and coconuts. Hanamā'ulu Stream flows through a broad gulch extensively terraced in olden times. Before the advent of sugar cane, the stream delta was very likely an important area for wet taro cultivation. Upland slopes would have been ideal for planting sweet potato (Handy and Handy 1972).

Heiau Sites

Bennett briefly describes two *heiau* sites in the Hanamā'ulu area:

> Site 102. Kalauokamanu heiau, in Hanamā'ulu above the present mill. Described by Thrum as "A large walled heiau that stood above the present mill; destroyed about 1855. Of pookanaka class.
>
> Site 103. Dune burials. In the sand dunes that run along the shore half way between Hanamā'ulu and Wailua River are many burials (Bennett 1931:125).

Thrum (1907) lists 124 *heiau* for the island of Kauai, several in the Wailua area:

> Malae - Central Wailua - A walled and paved heiau 273 x 324 feet in size of traditional Menehune construction. The place of its altar is pointed out near the center toward the west wall, and around on all sides ran a ledge about six feet wide whereon the people are said to have sat during its ceremonies. The outer walls are yet standing, in good order, from 7 to 10 feet or more in height, its corners buttressed with 13 foot walls. Kapule (Queen Deborah) changed this heiau about 1830, and erected division walls for cattle and calf pens with its inner structures and stone pavements. A portion is now planted in cane.

> Poliahu - Upper Wailua - This heiau of medium size is situated within sight of Malae, and was connected with it in its working. In fair condition.
>
> Holoholoku - Wailua - Of Pookanaka class, site not identified. Tradition credits this heiau as being the repository, until comparatively modern times, of the first kaeke, or drum, introduced into these islands.
>
> Hikinaakala - Wailua Kai - The ruins of this heiau stand along the shore near the south side of the stream, 395 feet long, 56 feet at rear and 80 feet on the front. It shows three distinct divisions paved; the inner section still in fair condition 120 feet in depth. End and S.E. corner walls are 6 feet high and 11 feet thick, of heavy stones. Two large boulders stand near the middle near the division wall of this section. The outer or front section of 80 feet includes a width that runs back beyond the division wall.

In 1934 the *Garden Island Press* newspaper published an article mentioning various *heiau* in the general vicinity of the project area:

> Replete with folklore and legend, the fertile, well-watered lowlands of Wailua-kai were used naturally as the king's seat even into historical times. Remaining monuments of stone, heiaus now largely in ruins, are numerous and of unusual significance throughout this Wailua region.
>
> Passing toward the mountains directly through this grove of swaying cocoanut palms, the traveler comes upon a low hill, Puu-ki, the river-side ridge of which was known to ancient Hawaiians as Ka Lae o ka Manu, the crest of the bird, or Bird Ridge. At the foot of this hill lies the side and the original wall and sacrificial stone of what is quite properly believed to be the oldest heiau on the island of Kauai. Here, it is said, the first human sacrifice ever made on this island was performed, and to this temple was brought the first drum, kaeke, fashioned from the hollowed stump of a cocoanut tree with shark-skin stretched taut over its head.
>
> Also associated with these *heiau* are the Birthstones (Pohaku Hoohanau) adjacent to Holoholoku, the Bellstone near Poliahu, the *puuhonua*, or refuge spot (Hauola) adjacent to Hikinaakala, and the petroglyphs along the southern bank of the river near Hikinaakala.
>
> Another *heiau* located in Hanamā'ulu is Kalauokamanu. This was situated just west of the Lihu'e Plantation Yard and adjacent to a cane haul road. It is said to be of the *pookanaka* class and was destroyed in 1855.

Land Tenure

In 1848, during the reign of Kamehameha III, the traditional Hawaiian land ownership system was replaced with a more Western-style system. This radical restructuring was called The Great Mahele (division). The Great Mahele separated and defined the undivided land interests of the King and the high-ranking chiefs, and the *konohiki*, who were originally those in charge of tracts of land on behalf of the king or a chief (Chinen 1958:vii and Chinen 1961:13). More than 240 of the highest-ranking chiefs and *konohiki* in the kingdom joined Kamehameha III in this division.

The first Mahele was signed on Jan. 27, 1848 by Kamehameha III and Princess Victoria Kamamalu, and by her guardians Mataio Kekuanaoa and Ione Ii. The last Mahele was signed by the King and E. Enoka on March 7, 1848 (Chinen 1958:16).

The Mahele did not convey title to any land. The chiefs and *konohiki* were required to present their claims to The Land Commission to receive awards for lands quit-claimed to them by Kamehameha III. They were also required to pay commutations to the government in order to receive royal patents on their awards. Until an award was issued, title remained with the government. The lands awarded to the chiefs and *konohiki* became known as Konohiki Lands. Because there were few surveyors in Hawai'i at the time of the Mahele, the lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This expedited the work of the Land Commission and speeded the transfers (Chinen 1961:13).

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

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

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

The *ahupua'a* of Wailua has 48 listees in the Indices of Awards (Board of Commissioners 1929) and was declared to be Crown Land, "To be the private lands of his majesty Kamehameha III, to have and to hold to himself, his heirs, and successors, forever...1848." These crown lands reverted to the Territory of Hawai'i with the enactment of the Organic Act of 1900, and have since been called Government lands. The present owner of Wailua is the County of Kaua'i.

The Indices to Land Commission Awards, contains the following awards for Hanamā'ulu:

LCA	Awardee	Acreage
3648	Kala	1.25 Acs 30 rods
3650	Kaluhiwaha	3 roods, 35 rods
3649	Kamalo	1.75 Acs 20 rods
7713	V. Kamamalu	9177 Acs (Ap 2) ahp

3644	Kaualupa	1.25 Acs 23 rods
3558	Keke	3 roods 1 rod
3600	Keolanui	1.75 Acs 30 rods
3653	Kolu	1 Ac 37 rods
5089	Kuhaimoana	3 roods 17 rods
3640	Kumakahaohao	1 Ac 1 rood 12 rods
3271	Lalahilimoku, Leimoku	1 Ac 1 rood 21 rods
3657	Niho	1 Ac 1 rood 13 rods
3423	Paka	1.50 Acs 33 rods
3426	Pelekane	1 Ac 17 rods
3371	Naehu	1.25 Ac 19 rods (Kapaia)
3647	Kapuohi	4 Acs 32 rods (Moala)
3647	Kapuohi	38 rods (Papuaa)

The fourth name on the list, V. Kamamalu, is Victoria, sister of Alexander Liholiho (King Kamehameha IV), Lot Kamehameha (King Kamehameha V), Moses Kekuaiwa, and half sister of Ruth Keelikolani (Board of Commissioners 1929:3). She was awarded Hanamā'ulu Ahupua'a, of which the present project area is a part, extending to the ocean (LCA 7713:2, Part 7; R.P. 4481 [*Figure 3*]), in 1862. Prior to this, the land belonged to the crown. Whenever *ali'i* procured an entire *ahupua'a*, they were bound to respect the rights of the existing tenants. These tenants, if they filed a claim with the Board of Commissioners to Quiet Land Titles, could continue to cultivate and live on their parcels. The following are excerpts from testimonies for awards to individuals in Hanamā'ulu *ahupua'a* (the awards are shown in *Figure 3*):

> LCA 3558 to Keke, Foreign Testimony vol. 13:160
> Kaualapa sworn, he has seen...consists of three lois in the ili of Waiaoao and then it also a small kula adjoining. Claimant has also a house lot at Hoeua...Claimant had his land from his friend Pekue in 1846. His house lot he had from Keo. Claimant held a house lot at Opai which was disputed by Keo the Konohiki. Claimant agreed to give him the lot above described at Hoeua.

> LCA 3600 to Keolanui, Foreign Testimony vol. 13:153
> ...in the ili of Palaka and consists of [not listed or illegible] lois and house lot, all family but one piece bounded thus...Claimant had his land from Daniela Oleloa, in the days of good old Kaihiaena & has occupied it ever since without opposition...

> LCA 3653 to Kolu, Foreign Testimony vol. 13:151
> ...it consists of four lois in the ahupuaa of Hanamā'ulu and consists of four loi in the ili of Maulele, with small kula adjoining the kula is not cultivated being exhausted to the depredations of cattle. Claimant has also a house lot in the village of Kamakahanahana which is surrounded by a fence. No. 1 is bounded...Koloa - auwai of Keoki. No. 2 is kula of Kamakahanahana...Claimant had his land from Keo, konohiki, in the days of Kaikioewa had peaceable possession ever since his claim has never been disputed. Keo says I am a luna under Kanoa and know the land and gave the land to Claimant according to the testimony of Keolauui which all true.

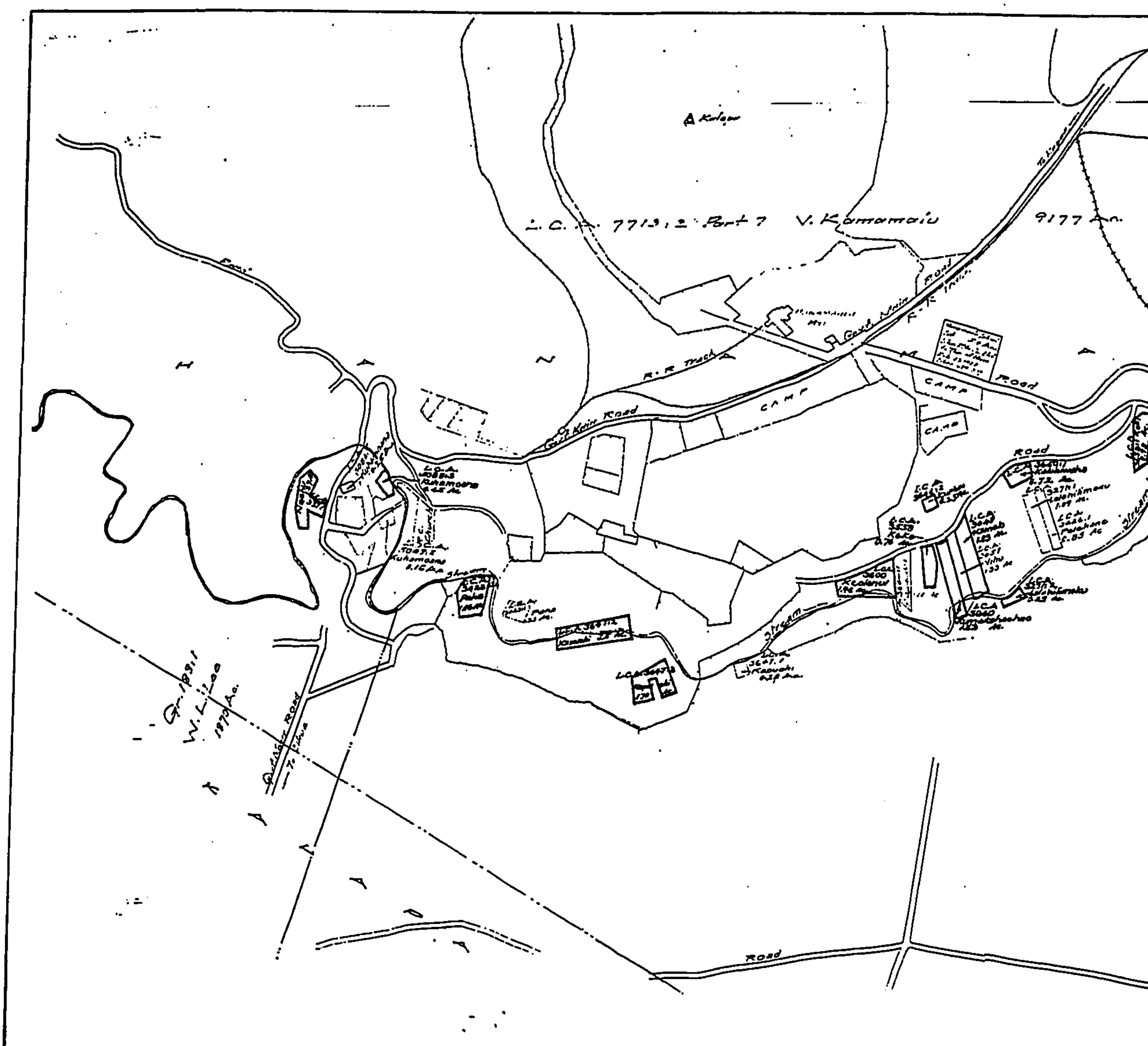
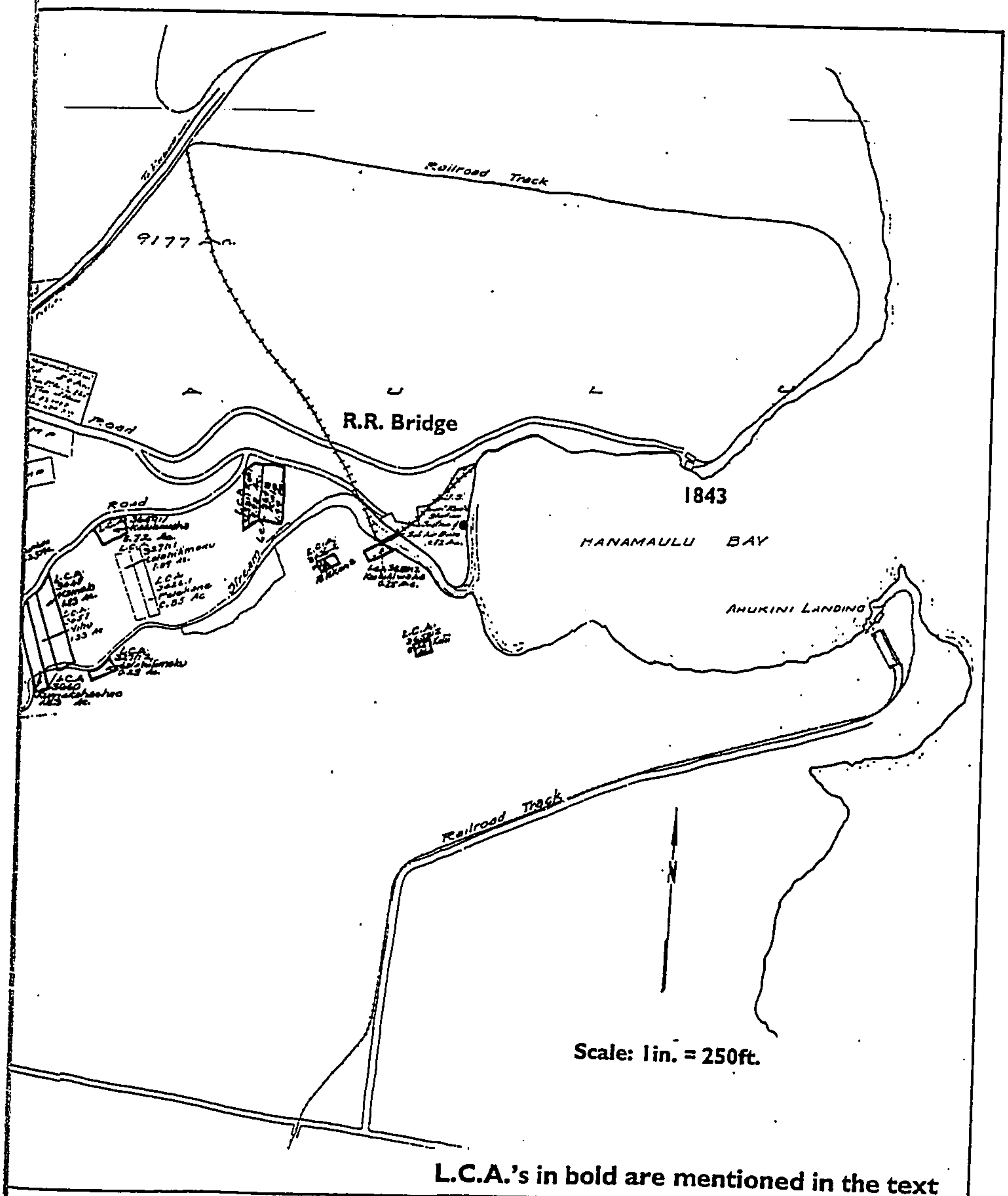


Figure 3. Project Area Showing Land Commission Awards (LCA)



L.C.A.'s in bold are mentioned in the text

LCA 3426 to Pelekane, Foreign Testimony vol. 13:156
....consists of 4 loi and in the ili of Kapuhala. Claimant has also a house lot near the sea shore at a place called Kaho....Lot 2 (bounded by)...North - fish pond...land from his konohiki Pau soon after Kanoa came to Kauai and occupied it in peace till Keo and became konohiki again in 1849 who took away from Claimant two lois and gave them to Aumoana Keke sworn declares the testimony of Lalahilimoku to be all true. Keo sworn says it is true that Pelekane held and occupied said from lois...

LCA 3371 to Naehu and heirs, Foreign Testimony vol. 13:155
...consists of 10 lois and small kula adjoining on which Claimants house in the ili of Kapaia. Claimamt had his land from his son-in-law Kailihania soon after Kanoa came to Kauai and he occupied it in peace till his death which occurred in 1849. He gave land to his daughter Kaipu.

LCA 3647 to Kapuohi, Foreign Testimony vol. 13:151
...consists of 8 lois and 23 loi not now cultivated. These lois lie in two pieces, being divided koeles [small land unit farmed by a tenant for the chief]. No. 1 contains one loi called Moala in the ili of Waiea. No. 2 contains all the other lois. No. 3 house lot in the ku of Papuaa....Claimant had his land from Pau, the konohiki about 5 years ago. That part of the Claimant's land lying south of the Hanamā'ulu stream had never been disputed to this day. But the land laying on the Wailua side is disputed by the konohiki. Witness say there never was any dispute about until within the last few days. He says Claimant gave the land to his friend Luakini who held it several years till his death about a year or [missing or illegible] ago when he returned the land to Kapuohi the present Claimant. Papawaa, sworn says, I am a Kamaaina of Hanamā'ulu and know the land of Claimant and never heard of any dispute about the claim till Tuesday last when I heard that Keo disputed it and I believe the testimony of Kupule is all true.

LCA 3271 to Lalahilimoku, Foreign Testimony vol. 13:161
...consists of six lois in the ili of Kuka. Claimants house lot is in the village of Puako...had his land from Daniela Aleloa in the days of Kaikioewa and has occupied it ever since in peace...

LCA 3423 to Paka, Foreign Testimony vol. 13:155
...consists of 8 loi in the ili of Peaiki and small kula adjoing. Claimant also has a house in Peaiki...land from Keo his konohiki in the days of Kaikioewa...

Also found in the Land File of the State Archives were various references to Hanamā'ulu:

Interior Dept., Aug. 19, 1862 - In letter from M. Kekuanaoa to W. Webster, informing that the above land which is claimed as belonging to the King has been surveyed and awarded by the Land Commissioner and a Royal Patent issued to V. Kamamalu, &c.

Interior Dept., Aug. 4, 1863 - In letter from H. A. Widemann to Webster, that he had seen his name on a lease to the Lihu'e Plantation for the above lands, which leads him to think he has something to do with Victoria's lands.

Interior Dept., July 20, 1870 - In letter from Paul Isenburg [sic] to J. O. Dominis enclosing a draft for $7250 being the purchase price for the above ahupua'a &c.

Interior Dept., Oct. 4, 1870 - In letter from Duncan McBryde to C.C. Harris, that Mr. Isenburg [sic] has inquired of him if he knew the mauka Boundary of the Crown Land of Wailua that part which adjoins the above ahupua'a lately sold to Lihu'e Plantation. Desiring to know whether the said ahupua'a was held by the late Princess Victoria by Royal Patent according to survey by Pease, or by the Ancient Boundary, &c.

Interior Dept., July 20, 1871 - In letter from E. Krull to the Commissioner of Crown Lands stating that he is holding the Wailua Estate under two leases from the Hawaiian Govt. first from J. Young to Thos. Brown for 99 years & second from Kamehamahea IV, to Hoffschlaeger for 50 years but since a royal patent had been granted to the Lihu'e Plantation for the above ahupua'a containing about 800 acres which is included in his 2 leases & which hampers the pasturage of his cattle, he desires to have said leases cancelled & asking that he be allowed to enter into a new Indenture of lease for the same lands with the exception of the lands granted to said plantation for a term of 25 years at a yearly rate of not more than $300.

Interior Dept., Bk 15 p. 109 - In list of Konohiki lands, showing that V. Kamamalu is owner of the above land & that it has a sea coast frontage of 3.55 miles.

Public Instruction, Jan 24, 1891 - J. K. Burkett to Min of Public Instruction - Have talked with Mr. Wilcox & Mr. Isenberg in regard to a lot for a school house at the above place, &c.

Public Instruction, Feb. 11, 1893 - A. S. Wilcox to Min of Pub Instr Think it best to send a copy of the former survey of the above school lot, as the corner stones have all disappeared & will be difficult to find the exact spot without it &c.

Public Instruction, April 3, 1907 - Registar of Conveyances to Supt. of Publ Inst. Submitting Abstract of Title in re a portion of R.P. 4481, Land Claim Award No. 7718, Ap. 2, Part 7, of land situate at the above tract, Kauai, claimed to be owned by the Lihu'e Plantation Co. Ltd. &c. Notes of Survey of School lot in said tract, attached.

Public Instruction, Aug 25, 1909 - Supt of Pub Instr to J.K. Farley To assist the Dept in suggesting valuation of 2.03 acres of school lot at the above tract, valued at $300 per acre &c. Doc's relating thereto attached.

Executive Pinkham, Aug 4, 1915 - Commissioner of Public Lands to Governor Pinkham Informing that the Lihu'e Plantation Co., delivers to the Koloa Sugar Co., waters rising & flowing on the above lands, paying a little over $10,000 a year &c.

In general, these *lo'i* (taro fields) were located adjacent to and to the west of the current project area, inland from the ocean in upland areas. Here dryland taro cultivation was probably practiced, while coconut, sweet potatoes, and breadfruit could have also been grown. Where *lo'i* were adjacent to, or touching Hanamā'ulu Stream, based on the above historical documentation, wetland taro was probably grown. Coconut, sweet potatoes, and breadfruit could have also been grown. LCAs referenced in five of the above testimonies were located adjacent to, or touching Hanamā'ulu Stream; the remainder of the LCAs are situated in upland areas away from the ocean and the stream. The current project area, being a tableland, was probably prehistorically and historically (before the advent of sugar), planted in dryland taro.

Briefly summarized, the Mahele records tell of native tenants living in the valleys, along rivers, and by the shore below the project area. The records mention house sites, taro pond fields, irrigation systems, dryland agricultural parcels, fishponds, pastures, and other features of the landscape. The records also indicate that it is likely that prior to clearing the land for plantation use, native tenants harvested various natural resources from the *kula* (plains lands), perhaps did some *kula* planting, and pastured animals above their *kuleana* (homestead lands). Because of the intensive nature of plantation land use, it is unlikely that evidence of these uses remains.

Current Project Area Land Use History

During the Great Mahele, the *ahupua'a* of Hanamā'ulu, including the current project area, became crown lands. Later, in 1862, a royal patent was issued to Princess Kamamalu by the Land Commission. Then, in 1863, Paul Isenberg, manager of Lihue Sugar Plantation, leased the *ahupua'a* of Hanamā'ulu from the Princess. The Lihue Sugar Plantation had been started by H. A. Pierce, W. L. Lee, and C. R. Bishop, and the first crop had been planted in 1850 (Joesting 1984:172-173). After the death of Princess Kamamalu, Isenberg, in 1870, bought 17,000 acres of the *ahupua'a*, including the current project area (Joesting 1984:221).

Towards the end of the 19th century and into the 20th century, due to the association with the Isenberg brothers, Paul and Hans, Hackfield and Company began to take over the Lihue Sugar Plantation (Cooper and Daws: 208-209). Later, Hackfield and Company evolved into AMFAC, the current property owner. A brief history of Lihue Plantation Company is presented in *Appendix B*.

The current project area, besides being planted in sugar cane, was also used, in portions, as a historic trash dump. Site 2068 of the current project is a historic dump on a small bluff overlooking the ocean. The glass, ceramics, and other materials at the dump appear to date from the 1880s to the 1910s. Site 1843, the historic wharf and cane road, also contained a small collection of glassware and ceramics appearing to date from the late 19th and early 20th centuries. The cane road appears to follow near, but not on, the shoreline, heading west and joining the old government road; from there it is a short distance to the Hanamā'ulu Mill (*Figure 2*).

Summary of Project Area Settlement Patterns

Settlement patterns in the current project area were probably similar to that of other previously studied areas of the archipelago. In prehistoric times, as today, sheltered coastal bays and river valleys were desirable places to live, as they provided easy access to marine resources and the resources of river valleys. During the Expansion Period, the native agriculturalists and aquaculturalists were forced to supply a steadily increasing population, so they lived in areas

suitable for extensive resource procurement. Areas such as flat, easily irrigated alluvial plains and terraced gulches suitable for wetland taro cultivation would be expected to yield remnants of the agricultural and aquacultural complexes (*lo'i, 'auwai, loko kuapā,* and *loko wai*). The degree of historic disturbance of the current project area makes the recovery of significant prehistoric cultural remains unlikely. Although several prehistoric sites have been recorded in the lower coastal plateaus (Rosendahl 1990), most of the sites in the project area would likely be historic.

FIELD METHODS AND PROCEDURES

The survey fieldwork for the project area was conducted October 3-11, 1990 under the supervision of Supervisory Archaeologist Alan T. Walker, assisted by Assistant Supervisory Archaeologist Jenny O'Claray and Field Archaeologists Mike Fager, John Murray, and Jack Harris. While planning the survey strategies, considerations included: (a) past land alteration patterns (sugar cane cultivation), and (b) prehistoric site distribution patterns (as shown in previous archaeological work). Because areas altered by sugar cane cultivation were unlikely to contain archaeological features, such areas (including portions of the current project area) were not surveyed fully, but were sampled. One hundred percent ground survey was conducted in all portions of the project area not cultivated in sugar cane. This included all coastal areas, unaltered stream gulches, and drainages within sugar cane fields, and the edges of all unaltered areas bordering sugar cane fields. Because previous archaeological work indicated that the immediate shoreline area of the Hanamā'ulu project area unit, and the coastal flats at the northeast corner of the Hanamā'ulu project area unit (adjacent to the beach access road) were likely to contain archaeological sites, they were covered 100%.

The surface survey was conducted in a series of pedestrian transects. Intervals between sweeping crewmembers were 15.0-20.0 m, depending on vegetation and terrain. To aid in relocating sweep areas and sites, sweeps were numbered sequentially. To ensure complete coverage, the edges of sweep areas were flagged with red- or blue-striped flagging tape. As sites were identified, they were flagged with pink-and-blue flagging tape and were assigned sequential PHRI temporary numbers prefixed by "T-," beginning with T-1. Subsequently, all identified sites were assigned permanent State Inventory of Historic Places (SIHP) site numbers. All sites were plotted on a blueline topographic map (1"=600' scale) provided by Helber, Hastert & Kimura (now Helber, Hastert & Fee) and were listed by sweep designations in a field notebook. Site plotting was aided by 1"=1000' scale, black-and-white, aerial photos (R.M. Towill Corp. Photo Nos. 1165-1 through -3, dated November 26, 1989 and Photo No. 8437-43 dated February 27, 1986).

Sites were then recorded on standard PHRI site record forms and were sketch-mapped, with orientation and site dimensions determined using metric tape and compass. At least one 35 mm black-and-white photograph was taken of each site (PHRI Roll Nos. 1566 and 1567). Sites were tagged with an aluminum strip bearing the site number, PHRI project number (90-894), the letters PHRI, and the date. This information was also written on pieces of flagging tape, which were then wrapped around stones and placed in protected areas on the site.

Two test units, totaling 0.75 sq m surface area, were excavated within the project area. Test Units were numbered sequentially within sites and were excavated using hand trowel, whisk broom, and dust pan. Test units were terminated on bedrock or on large bedrock boulders, below cultural matrices. Surface collection was done at two sites. Two bulk radiocarbon soil samples were collected from Site 1838 – one from a cultural deposit exposed in an eroding cut bank (Layer II) and one from an exposed surface deposit (Layer I). Diagnostic historic artifacts and a sample of mammal bone were collected from Site 1843.

To facilitate recovery of portable remains, all material excavated from the test units was processed through 1/4- and 1/8-in mesh. Because the test units contained no midden material, only midden recovered from the two bulk radiocarbon soil samples from Site 1838 underwent laboratory analysis. Soil samples were described in detail using standard procedures and terminology as set forth in the *Soil Survey Manual* (Soil Survey Staff 1962).

The fieldwork for the current project was conducted on August 10, 2001 by PHRI Supervisory Archaeologist Alan B. Corbin, M.A., and PHRI Field Technician Bruce M. Gothar. As previously mentioned, the purpose of the current project was to relocate and update the condition and significance of all sites previously identified during the 1990 survey, and to record any newly identified sites. During the process of relocating sites, three sites (2066, 2067, 2068) were newly identified. These were plotted on a USGS map and aerial photograph provided by the client. The sites were recorded on standard PHRI site record forms and at least one color photograph was taken of each site, generally from the same vantage point as the original site photograph taken during the 1990 survey. Newly identified sites were given a temporary site number (T-) and later were assigned permanent SIHP numbers (*Table 1*).

Table 1. Correlation of SIHP Site Numbers with PHRI Temporary Field Numbers

*SIHP	PHRI
2066	T-11
2067	T-12
2068	T-13

State Inventory of Historic Places numbers: four-digit numbers prefixed by 50-30-08 or 11 (50=State of Hawaii; 30=Island of Kaua'i; 08 or 11=USGS 7.5' series quad map "Kapaa" or "Lihu'e, Hawaii").

FINDINGS

RELOCATION OF SITES

During the present and previous survey a total of ten sites containing 14 features were identified within or immediately adjacent to the project area. *Figure 1* shows the locations of all of the identified sites. *Table 2* provides a summary of sites and their component features in terms of formal type, functional type, and completed fieldwork tasks. *Appendix A* provides detailed information for each site, including:

1. Site number — SIHP numbers and PHRI temporary site numbers. SIHP numbers are four-digit numbers prefixed by 50-30-08 or 11 (50=State of Hawaii; 30=Island of Kaua'i; 08 or 11=USGS 7.5" series quad map ["Kapaa" or "Lihu'e, Kaua'i". PHRI temporary numbers are one- and two-digit numbers prefixed by "T";
2. A site type designation - provides formal feature type for sites consisting of a single feature, or designates the site as a complex if site comprises more than one feature. Also lists total number of features present;
3. A description of site topography - a brief description of the terrain in the area of the site;
4. A listing of site vegetation - lists principal components of the vegetation within and in the vicinity of the site;
5. A statement of site condition - overall state of preservation of the site (poor, fair, good, or excellent);
6. An assessment of site integrity - degree of post-abandonment modification by human agencies (unaltered, partially altered, and completely altered) and nature of modifications, if any, with a determination of possession of integrity or non-possession of integrity of the site.
7. A probable age - indicates probable/possible age of the site (i.e., historic or prehistoric);
8. A functional interpretation - probable or possible functions for each site; or, if function cannot be determined, assigns indeterminate function. For sites with multiple functions, functions are separated by a hyphen;
9. A site description - a brief overall description of the site, listing types of constituent features, portable remains, if any, and other site data; and
10. Feature dimensions - maximum length, width, and height or depth. Dimensions immediately followed by a description of feature construction, associated portable remains, and other information.

Table 2. Summary of Identified Sites and Features

SIHP Site No.	Formal Site/Feature Type	Tentative Functional Interpretation	Chronology	Fieldwork Tasks Completed DR	SC	EX
1838	Complex (2)	Habitation		+	-	+
A	Cultural deposit		Prehistoric; poss. AD 1170-1400			
B	Cultural deposit		Recent			
1839	Complex (2)	Temporary habitation	Prehistoric; exact age unknown	+	-	-
	Wall		Prehistoric; exact age unknown			
	Terrace		Prehistoric; exact age unknown			
1840	Retaining wall	Transportation	Historic	+	-	+
1841	Poss. auto road/trail	Transportation	Historic	+	-	-
1843	Complex (3)	Transportation/ agriculture	Historic	+	-	-
A	Concrete foundation		Historic			
B	Cane road		Historic			
C	Concrete wall		Historic			
1845	Railroad bridge	Transportation	Historic	+	-	-
1846	Concrete railroad bridge	Transportation	Historic	+	-	-
2066	Complex (3)	Multiple	Historic/poss. hist.	+	-	-
A	Upright	Possible burial	Poss. historic			
B	Cane road	Transportation	Historic			
C	Foundation	Possible habitation	Poss. historic			
2067	Cemetery	Burial	Historic	+	-	-
2068	Trash dump	Trash dump	Historic	+	-	-

DR=detailed recording (scaled drawings, photographs, and written descriptions)
SC=surface collections
EX=limited excavations

Four site complexes and six single-feature sites were identified in or in the vicinity of the project area. The sites and complexes were composed of a variety of formal feature types. The most common feature types in the project area are bridges (2), cultural deposits (2), and cemeteries (1 and possibly 2). Other feature types in the area include concrete foundations, a retaining wall, and a terrace (*Table 3*).

Table 3. Frequencies of Formal Feature Types

Formal Type	Number	Percent
Bridge	2	15
Cultural deposit	2	15
Road	2	15
Retaining Wall	1	7.7
Cemetery	1?	7.7
Upright	1	7.7
Concrete wall	1	7.7
Concrete foundation	1	7.7
Terrace	1	7.7
Dump	1	7.7
Total	13	98.9

Transportation constituted over one-quarter of the functional feature types (*Table 4*). This function is almost certainly connected to the sugar cane production and distribution that took place in the area. Temporary and possible permanent habitation constituted one-third of the functional types. These relate to the prehistoric use of the project are for habitation at the coast, doubtless for the procurement of marine resources.

Table 4. Frequencies of Functional Feature Types

Function Type	Number	Percent
Transportation	4	28.5
Transportation/ agriculture	3	21.4
Habitation	2	14.2
Temporary habitation	1	7.1
Indeterminate	1	7.1
Religious/cere-monial	1	7.1
Cemetery	1	7.1
Refuse disposal	1	7.1
Total	14	99.6

SUBSURFACE TESTING AND SURFACE COLLECTION

During the initial survey in 1990, two test excavations, totaling 0.75 sq m in surface area, were dug within the project area. The purpose of the excavations was to determine the presence or absence of cultural remains and to attempt recovery of datable material. Excavations were placed at Sites 1839 (Feature B) and 1840. In addition to the test units, two bulk soil radiocarbon samples were collected from Site 1838, and a sample of mammal bone and diagnostic historic artifacts was collected from the surface of Site 1843. Both dating samples were submitted for age determination analysis.

Site 1838 - Complex

PHRI Radiocarbon Sample No. RC-891 was collected from a possible cultural deposit (Layer II) exposed in a cut sand bank. The possible cultural deposit (designated Feature A of Site 1838) was composed of charcoal-stained sand and contained sparse marine shell midden. The profile exposed in the cut sand bank displayed the following stratigraphy (measurements taken from center of unit)(*Figure 4*):

Layer	Description
I	0-5 cmbs; yellowish-brown (10YR 5/4 dry); sand; weak, very fine to fine, single grain structure; loose when dry, loose when moist, nonsticky and nonplastic when wet; lower boundary is abrupt and smooth in profile;
II	5-18 cmbs; grayish-brown (10YR 5/2 dry); coarse sand; weak, very fine to fine, single grain structure; loose when dry, loose when moist, nonsticky and nonplastic when wet; lower boundary is abrupt and smooth in profile; layer contains charcoal flecks and shell fragments;

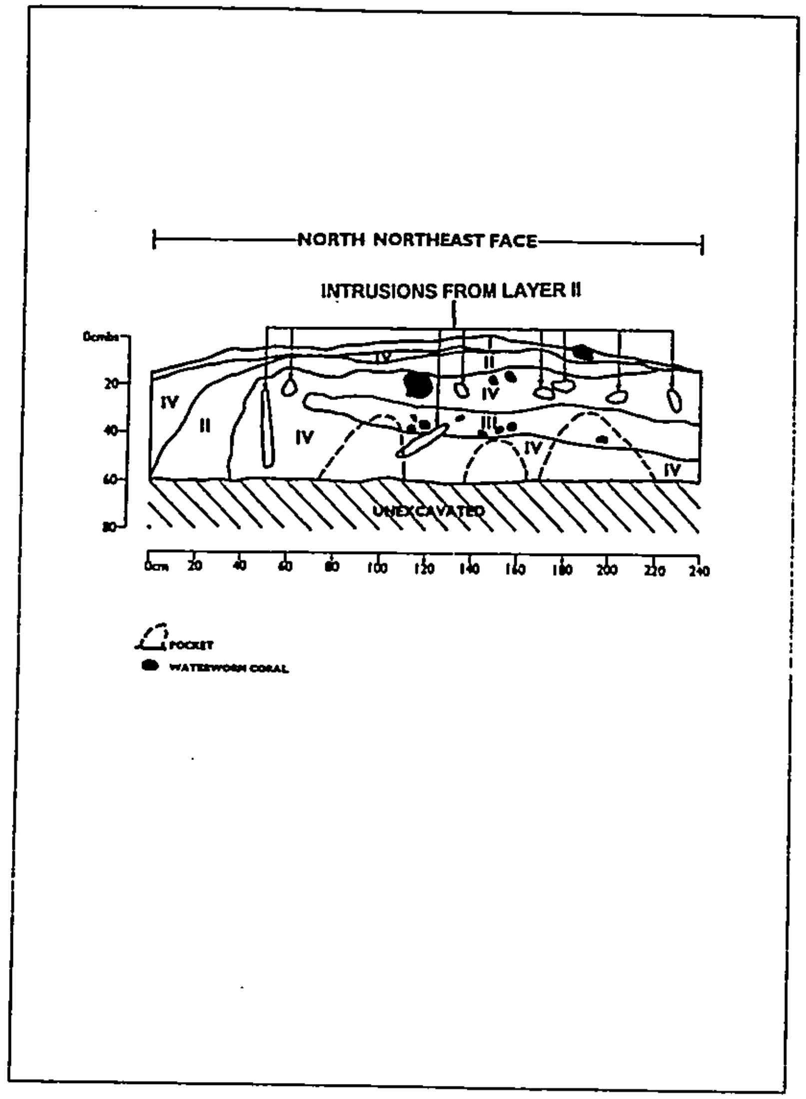


Figure 4. Site 1838, Feature A, Profile

III 32-40+ cmbs; pink (7.5YR 8/4 dry); coarse sand; loose when dry, loose when moist, nonsticky and nonplastic when wet; layer continues below base of exposed profile

IV 18-60+ cmbs; pale yellow (2.5Y 8/2 dry); coarse sand; loose when dry, loose when moist, nonsticky and nonplastic when wet; layer continues below base of exposed profile

A radiocarbon sample (PHRI No. RC-890) was collected from a possible cultural deposit (Layer I) exposed on the surface of a sand dune. The possible cultural deposit (designated Feature B of Site 1838) was composed of charcoal-stained sand and contained sparse marine shell. The soil layer is described as follows:

Layer	Description
I	0-7+ cmbs; dark grayish-brown (10YR 4/2 dry); sand to coarse sand texture; weak, very fine to fine, single grain structure; loose when dry, loose when moist, nonsticky and nonplastic when wet; layer continues below base of exposed deposit

Site 1839 - Complex

Test Unit 1 (TU-1) measured 0.5 by 0.5 m and was placed within Feature B, a terrace (*Figures 5; A-3, Appendix A*). The test unit was placed on the flat interior soil surface of the terrace, although no portable remains or stonework were visible. TU-1 displayed the following stratigraphy:

Layer	Description
I	0-5 cmbs; dark reddish-brown (5YR 2.5/2 dry); clay loam; structureless; many micro to coarse tubular roots; loose when dry, very friable when moist, slightly sticky and slightly plastic when wet; lower boundary is abrupt and smooth in profile;
II	5-30+ cmbs; dark reddish-brown (2.5YR 3/4 dry); loamy clay; weak to medium, very fine, subangular blocky structure; few micro tubular roots; loose when dry, very friable when moist, slightly sticky and slightly plastic when wet; layer continues below base of unit.

No shell midden or cultural material was encountered in the test unit. Excavation was terminated in Layer II at depth of 30 cmbs. Layer I appears to constitute a decaying organic horizon, and Layer II appears to be sterile subsoil.

Site 1840 - Retaining Wall

Test Unit 1 (TU-1) was 1.0 by 0.5 m and was placed against the base of the retaining wall (*Figure A-7; Appendix A*). Below a thin layer of decaying organic material, TU-1 displayed the following stratigraphy:

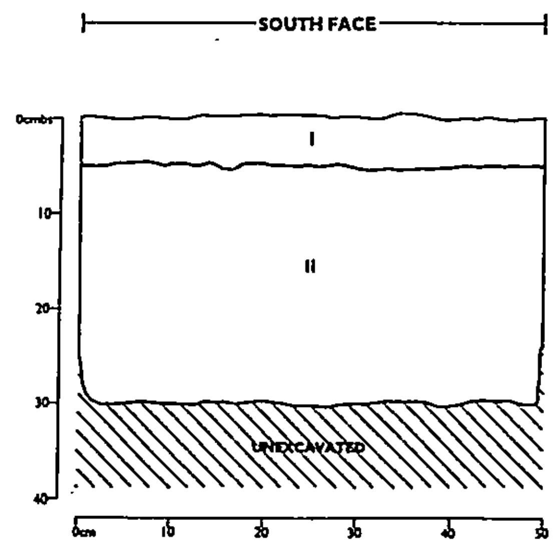


Figure 5. Site 1839, Feature B, TU-1, Profile

Layer	Description
I	0-30 cmbs (overlain by stone retaining wall); dark reddish-brown (2.5YR 3/4 dry); clay; weak, very fine, crumb structure; few fine to medium vesicular roots; few pores; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; layer continues below base of unit.

With the exception of recent historic glass fragments, no cultural material (including shell midden) was encountered in the test unit. Upon examination of the west face profile of the test unit, it was determined that the retaining wall was built on the surface of Layer I. Excavation was terminated in Layer I at depth of 30 cmbs. Layer I appears to be sterile subsoil. It is thought to be a retaining wall primarily due to the fact that the soil in back of the wall is built up much higher than the road on the other side of the wall. It is thought to be an historic retaining wall that may be connected to military activity since several foxholes were found in this area.

AGE DETERMINATIONS

Objectives and Methods

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

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

Results

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

Both of the samples yielded definitive age ranges. Sample RC-891 yielded an age range of AD 1170 to 1400, indicating that occupation of Feature A of Site 1838 occurred during prehistoric times, and may have occurred as early as c. AD 1170. Sample RC-890, which was derived from Feature B at Site 1838, yielded an essentially modern age range.

Table 5. Summary of Radiocarbon Age Determinations

PHRI Lab.No. RC-	Lab. No. BETA-	Provenience	C-14 Age Yrs. BP (one sigma)	C-13/ C-12 Ratio	C-13 Adjusted C-14 Age Yrs. BP	*Calendric Range Yrs. AD
890	40267	Site 1838, Fea. B, Layer I 0-7 cmbs	101.1±0.7% modern	-16.8	40±60	—
891	40268	Site 1838, Fea. A, Layer II 5-24 cmbs	620±80	-19.5	710±80	1170-1400

*Calibrated according to Stuiver and Pearson (1986). Range at two sigma.

PORTABLE ARTIFACTS

Non-Indigenous Artifacts

A total of 42 non-indigenous artifacts of recent historic age were collected from the project area. The assemblage derives entirely from Site 1843, and consists of ceramics and glassware. A detailed tabulation of artifacts by deposit area is presented in *Table 6*. No indigenous artifacts were recovered during the project. The results of the artifactual analysis are discussed below.

Table 6. Detailed Distribution of Portable Artifacts, Site 1843, Surface

Artifact Type	Subtype	Quantity
Ceramics		
	Porcelain sherd	22
	Ceramic sherd	5
	Subtotal:	27
Glass ware		
	Bottle	1
	Bottle fragments	13
	Vase fragments	1
	Subtotal:	15
	Total:	42

Ceramics

Twenty-seven ceramic and porcelain artifacts were recovered from the surface of Site 1843. Ceramic artifacts are classified based on a range of attributes, including paste color, texture, vessel form and diameter, and surface finish. Porcelain artifacts, which form a highly specialized class of ceramic artifacts, are manufactured using an extremely fine-grained white clay, and are

characterized by a glassy surface finish and extreme hardness after firing (Shepard 1968). Judging by appearance, and by the fact that they were found in association with the bottle fragments, one of which was dated to c. AD 1900-1918, the ceramics probably date from the latter part of the 18th century to the early part of the 19th century.

Twenty-two of the ceramic artifacts are classified as porcelain. The specimens include ten rim sherds, one composite rim/base/body sherd, four base sherds, six body sherds, and one support. With the exception of one vase rim sherd and the six body sherds, all of the sherds derive from small or shallow bowls with non-restricted mouths. Bowl diameters, as measured from the rim sherds, range from 8-38 cm, while vessel wall thicknesses range from 2.0 to 8.0 mm. All but one of the bases are footed, each with a single-piece circular foot, and are convex in cross-section. The interior surface of all bowls is white with a glossy surface; one exhibits fine drying cracks. Exterior surfaces are more varied. Four of the bowls have exteriors that are white with a glossy surface. Eight of the bowls are decorated with fine blue floral or nature motifs that have been transferred onto a glossy white background; a ninth bowl has a blue floral design supplemented by green. The remaining bowl is hand-painted with an orange floral design.

The vase rim sherd derives from a narrow-mouthed vase with a non-restricted opening. The vase has a diameter of 8.5 cm and a vessel wall thickness that ranges from 3.0 mm at the rim to 6.0 mm below the rim. The vase is hand-painted with a band of daffodils against a green background encircling the rim, and has a second, thin band of gold paint encircling the vessel body parallel to the rim. The exterior of the vase below the gold band is white and glossy, and is fluted (*Figure 6*). The interior surface is uniformly white and glossy.

The support is hollow and attaches to a fragment of a base. It is hand-painted with an orange floral design similar to that noted on one of the bowl rim sherds, and may be a fragment of the same vessel. The support is 16.0 mm in diameter. The body sherds range in vessel wall thickness from 4.0 to 8.0 mm. Like the bowl fragments, all of the body sherds have interior surfaces that are white with a glossy finish. Three of the body sherds have exterior surfaces that are decorated with blue floral designs similar to those noted above, while a fourth exhibits a green transfer design rather than blue. The exteriors of the remaining two body sherds are a pale bluish-green with a glossy finish, and are ribbed in a manner similar to Fiesta Ware.

The five remaining ceramic artifacts (one rim sherd, two base sherds, and two body sherds) are manufactured from coarser textured clays. The rim sherd is manufactured from a very fine, buff to light orange silty-textured clay. Based on the orientation of the rim and the curvature of the sherd, the specimen most likely derives from a large, shallow, non-restricted bowl approximately 38.0 cm in diameter. Vessel wall thickness ranges from 8.0 mm at the rim, to 6.0 mm further away from the rim. The interior surface is decorated with a white glaze that exhibits abundant, fine drying cracks. The glaze is overlain by a thin black band of paint parallel to the rim, and a yellow painted flower. The exterior of the sherd is decorated with a white glaze and exhibits drying cracks.

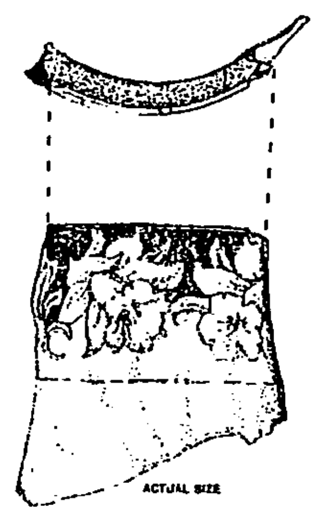


Figure 6. Vase Rim Sherd

One of the base sherds is manufactured from a fine, buff-colored paste that is silty in texture. The base is footed with a single-piece, flanged circular foot. Vessel wall thickness ranges from 5.0 mm for the foot, to 7.0 mm for the base. The interior surface is decorated with white glaze, and exhibits drying cracks and various fading stains. The exterior surface is decorated in an identical manner, including the drying cracks, and features two parallel ridges, one on the foot and the other at the juncture of the foot and vessel wall. The second base sherd is manufactured from a very fine, buff to light-orange colored, silty textured paste, similar to the rim sherd described above. The base is convex in cross-section, and is not footed. Both the interior and exterior surfaces are decorated with white glaze and exhibit drying cracks.

Both of the body sherds are manufactured from a fine, buff-to-white, silt-textured paste. One of the sherds is curved in a convex-concave pattern, suggesting the form of a plate or shallow bowl. It has a vessel wall thickness of 5.0 mm, and is decorated with a white, cracked glaze on both the interior and exterior surface. The other body sherd has a convex shape, and may derive from a bowl. Vessel wall thickness ranges from 3.0 to 5.0 mm. The interior surface of the sherd is decorated with a cracked, cream-colored glaze and is painted with several parallel blue bands. The exterior surface is painted with blue geometric and floral designs over the white glaze, and strongly resembles Pfaltzgraf Ware.

Glassware

Fifteen glass artifacts were encountered on the surface of Site 1843. The inventory includes one complete bottle, 13 bottle fragments, and a body fragment from a glass vessel of unknown form. Bottles are classified based on a range of attributes, including glass color, form, size, and manufacturing technique. Identifications of bottles and bottle fragments were augmented by comparisons with historic period bottles illustrated in Wilson and Wilson (1968), Putnam (1968), Fike (1987), Elliot (1971), and Garland (Appendix A *in* Walker 1985).

The complete bottle, which measures 9.5 cm by 4.5 cm by 2.5 cm, is a Japanese medicine bottle manufactured from dark amber glass (c. AD 1900-1918). The body of the bottle is mold-made, indicated by a fine seam along each side, while the mouth and neck are hand tooled. There are oval recessed panels on both the front and back of the bottle; the front panel is embossed with four Japanese characters. A series of embossed parallel lines runs from the shoulder to the base of the bottle between the recessed panels (*Figure 7*).

The bottle fragments include six mouth/neck/shoulder fragments, six base fragments, and one body fragment. The fragments are manufactured from clear glass (3), clear irridized glass (1), pale green glass (3), dark brown glass (3), dark green glass (1), pale yellow glass (1), and lavender glass (1). The mouth/neck/shoulder fragments range in diameter from 1.4 to 3.8 cm, and exhibit the following range of neck finishes: one reinforced extract with a double ring, one flat or patent neck, one bead finish, one crown finish, one ring or oil finish, and one composite crown and double ring (Fike 1987:8). The fragment with the reinforced extract and double ring neck finish is embossed with the statement "5 FLUID OZ."

Five of the base fragments are round in profile, while the sixth is classified as an "elixir" or "handy base" profile (Fike 1987:10). The round bases are uniformly 8.0 cm in diameter, and are generally convex in cross section. Three of the base fragments have embossed lettering. The letters "& S" appear on a dark brown base fragment, "P.C.C.W." appears on a pale green fragment, and "-AM'S POUND" appears on one wall of the elixir base fragment. The single body fragment is manufactured from clear glass, and represents portions of two sides of a rectangular bottle. The front of the fragment is embossed with the words "BOSTON, U.S.A."

ACTUAL SIZE

Figure 7. Japanese Medicine Bottle

The remaining glass artifact is a body fragment from a glass vessel of unknown form. It is manufactured from opaque white glass, and has a wall thickness of 2.0 to 5.0 mm. The exterior surface of the fragment is fluted, or impressed, with a series of parallel rectangular panels, in an alternating pattern of small and large panels. Above the panels, the fragment has a flat surface, which is painted with a floral motif of faded yellow flowers and green leaves. The interior surface of the fragment is undecorated

Summary

In general, the assemblage of non-indigenous artifacts recovered during the current investigation suggests that areas surrounding Site 1843 served as a periodic refuse area during the late 19th and early 20th centuries. The artifacts are generally fragmentary, indicating that they have been disturbed since being discarded and deposited at the site. No artifactual remains were encountered in the deposits from Sites 1838 and 1839.

MIDDEN

Objectives and Methods

The variety and content of food remains within midden deposits provide useful information concerning prehistoric diet and resource utilization. The analysis of midden remains for the current project has two primary objectives:

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

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

All midden recovered from the bulk soil radiocarbon samples and surface collection underwent detailed analysis. No midden was present in the test units. Detailed analysis involved splitting the sample into two size classes by passing each sample through 1/4-inch and 1/8-inch mesh. One hundred percent of the material retained in the 1/4-inch screen was completely sorted to the lowest taxonomic level possible, while the material retained in the 1/8-inch screen was inspected both for artifactual material and for taxa not encountered in the larger portion of the sample. Marine shell identifications were verified and augmented using Kay (1979).

The sampling design outlined above is adapted from Kirch (1979), based on a series of experiments measuring the relative distribution of molluscan and bone material retained on each screen. Kirch concluded that use of the screening process increased the speed of the sorting process without decreasing either the accuracy or statistical validity of the overall analysis. The taxonomic distribution and weight of material retained on the 1/4-inch screen should thus be considered representative of the variety and relative percentages of each taxon present in the sample.

Results

The range of taxa present in the midden sample from each deposit is summarized in *Table 7.* Total weights for each taxon (in grams) are tabulated by site and feature, with subtotals indicating the combined weight per feature for each larger material class (e.g., gastropods). The total weight of each taxon in the project area is provided in the final column of the table, while the grand total represents the combined weight of all the midden materials for the project area.

Table 7. Qualitative Distribution of Ecofactual Remains

Material	Site 1838 Feature A	Site 1838 Feature B		Site 1843	
	Level II	Level I	Site Total	Surface	GrandTotal
MOLLUSCA					
GASTROPODA					
TURBINIDAE					
Turbo sanwicensis	-	3.40	3.40	-	3.40
NERITIDAE					
Nerita picea	-	1.84	1.84	-	1.84
STROMIDAE					
Strombus maculatus	0.03	-	0.03	-	0.03
HIPPONICIDAE	0.19	0.42	0.61	-	0.61
CYPRAEIDAE	-	1.84	1.84	-	1.84
THAIDIDAE	-	4.43	4.43	-	4.43
CONIDAE	-	0.96	0.96	-	0.96
PLEUROBRANCHIDAE					
Operculatum aurantium	-	0.29	0.29	-	0.29
SUBTOTAL GASTROPODA	**0.22**	**13.18**	**13.40**	**0.0**	**13.40**
OTHER INVERTEBRATES					
ECHINOIDEA	0.35	1.5	1.85	-	1.85
TOTAL INVERTEBRATES	**0.57**	**14.68**	**15.25**	**0.0**	**15.25**
VERTEBRATE					
BONE	-	-	0.0	7.66	7.66
TOTAL	**0.57**	**14.68**	**15.25**	**7.66**	**22.91**

In general, the taxa represented by the midden samples taken from the project area are common inhabitants of the shorelines, shallow-water areas, solution benches and fringing reefs of the windward islands of the Hawaiian chain. By weight, 58.5% of the 22.91 grams of midden material recovered from the project area is contributed by marine gastropods, 8.1% is contributed by echinoids, and 33.4% by mammal bone. No vegetal remains were encountered in the deposits. The range and relative weight percentages of taxa at each site show somewhat different patterns than those noted for the project area as a whole. The deposits associated with Site 1838 are composed entirely of marine gastropods and echinoids, while the deposits encountered on the surface of Site 1843 are composed entirely of mammal bones.

The results of the midden analysis indicate that subsistence patterns at Site 1838 included limited collection and consumption of marine resources, ranging from several taxa of marine gastropods to echinoids. All of the marine taxa represented in the midden deposits, both at the site and feature level, were readily obtainable in the shallow-water areas immediately off shore, from tidal pools, or from the solution benches and fringing reefs located near the shoreline. The mammal bones on the surface of Site 1843 may indicate a subsistence pattern that included exploitation of terrestrial resources, but were more likely deposited as refuse, similar to the glass and ceramic artifacts described above. However, due to the lack of artifacts and/or structural remains, and the probable damage to the site from previous military maneuvers, it is not possible to determine whether Site 1838 represents a temporary or permanent habitation

CONCLUSION

SUMMARY AND DISCUSSION

The archaeological inventory survey of the current Hanamā'ulu project area was executed in two phases. The first phase was an inventory survey done in 1990, and the second phase comprised the recent field inspection, site relocation, and updating of data for the previously identified sites. The 1990 survey included a 100% ground survey of all areas not planted in sugar cane, limited survey and inspection of areas planted in sugar cane, and limited subsurface testing. Only limited surface survey was done in areas of sugar cane fields because surface archaeological features are not likely to have survived in areas that have undergone the substantial surface and subsurface modification involved in sugar cane cultivation.

Previous archaeological work conducted in the vicinity of the present project by Walker and Rosendahl (1990) has demonstrated the absence of archaeological features in sugar cane fields. During the Walker and Rosendahl (1990) work a sample area (c. 33%) of an area from which sugar cane had been recently harvested was examined and tested using a backhoe. The ground visibility was excellent. No surface sites were identified, and the backhoe test excavations revealed only several small, isolated coral pebbles (Walker and Rosendahl 1990). Therefore, it is likely that no archaeological features are present within the present project area within areas of sugar cane cultivation.

As mentioned in the background section, prior to sugarcane cultivation it is likely that, in adjacent lands south of the current project area, dryland taro (*lo'i*) farming was undertaken where upland areas were not located adjacent to streams (primarily Hanamā'ulu Stream); where *lo'i* were located adjacent to Hanamā'ulu Stream, irrigated taro fields may have been planted. The project area is a tableland/plateau located above Hanamā'ulu Stream and the ocean. It is therefore unlikely that irrigated taro patches existed; rather, non-irrigated *lo'i* probably existed.

Given the extensive sugar cane cultivation that occurred within the present project area, it is not surprising that the present survey confirmed that only a limited number of archaeological sites are present. The sites include four complexes and six single-feature sites, and comprise the following functional feature types: habitation (cultural deposit, wall, and terrace), transportation (retaining wall, road, concrete foundation, concrete wall, and concrete bridge), burial (one historic cemetery and one upright [possible burial]), and refuse disposal. A few prehistoric sites were identified, but generally the sites are historic. The overall physical condition and integrity of the sites varies from poor to good.

The possibility of subsurface habitations and burials existed in the project area, in areas of coastal sand dunes. On the coast at Wailua, or the beach area in Hanamā'ulu Bay, burial (in sand dunes) and habitation activities probably took place (Bennett 1931, Cox 1977). In the project area, sand dunes extend along northern portion of the project area, along the coast in a narrow band, for a distance of about 243.9 m (800 ft). This sandy area was 100% surveyed, and two midden deposits were located (Features A and B of Site 1838). Feature A was excavated, and charcoal recovered returned a date of AD 1170-1400 (see *Findings* section). Feature B was surface-scraped to a depth of 0.70 cm, and recovered charcoal returned a modern date. Due to the extensive recent modifications to this area due to modern camping, there is scattered recent charcoal from campfires and recent hearths in the area. Recent surface marine ecofacts also are present. It is likely that Feature B reflects this scenario.

Two general patterns exist in the overall distribution of the formal and functional types within the project area, and it appears the patterns are directly influenced by historic period activity. First, of the ten sites identified, all are in areas minimally modified or unmodified by historic period land alteration. Second, all the historic period sites (Sites 1840, 1841, 1843, 1845, 1846) are located along or near the coast. These historic sites were all probably connected by a historic road or trail (see *Figure 1*) that followed the coastline and which may be associated with Ahukini Landing on the south side of Hanamā'ulu Bay (Site 1843, however, predates Ahukini Landing, according to an informant). The historic period artifacts recovered from Site 1843 may reflect habitation associated with the small wharf area, or with inhabitants of a small support community in the immediate area. The historic dump (Site 2068) may or may not be associated with the transportation route. The people who created the dump may have been involved in the cane or transportation business, but the artistic and apparently expensive glass represented by the fragments encountered at the site may indicate the dump creators were of a relatively higher-status. In general, the age of the glass and other materials appears to be from the 1880s to the 1910s (see *Appendix A*, Site 2068).

In the process of relocating the sites of the 1990 survey, three additional sites were newly identified. One of the sites, a historic period cemetery (Site 2067), is located adjacent to Hehi Road, and is just outside the present project area. It is currently still semi-maintained and visited. The second site, containing an upright, and an historic cane road and possible house foundation (Site 2066), is also just outside the project area, on a bluff at the edge of the sugar cane field abutting the Hanamā'ulu-Ahukini Cutoff Road. This area, south of the cane road, will not be impacted by the planned construction of the housing community/golf course. The third site, 2068, is a historic trash dump on a small bluff overlooking the ocean.

The sites in the project area associated with sugar cane cultivation are associated, specifically, with Lihu'e Plantation. These sites are Sites 1843, 1845, and possibly Sites 1841, 1846, and 2066.

Site 1843 is a complex of a cane road and wharf, and represents the remnants of a shipping wharf, cane road, and an unidentified structure (*Figure 2*), built before the construction of Ahukini Landing and used by Lihue Plantation for shipping sugar.

Site 1845 is a railroad bridge used for sugar transport by Lihue Plantation Co until 1960. Due to its distinctive architecture, and the fact other bridges of this architectural style are absent or rare on Kaua'i, and the fact that the railroad industry had a significant historical influence on Kaua'i, it was given a significance criteria of "A" (significant for broad patterns of history).

Site 1841 is a retaining wall, either built by the military during training exercises or historically to maintain a cane road.

Site 2066 is, in part, a bermed road leading to a bluff overlooking Hanamā'ulu Bay, and may be related to cane production and transportation down to Hanamā'ulu Bay.

Site 1846 consists of two concrete bridges which may be associated with the railroad and cane production, since the old railroad grade (*Figure 1*) passes through this area.

Lihue Plantation developed the sugar cane industry in this part of Kaua'i during the early historic period. Its history is described in more detail in the historical documentary research portion of this report (*Appendix B*) and the settlement pattern section of this report. Cultivation of sugar cane within most of the current project area has continued through recent times.

Two sites within the project area (Sites 1838 and 1839) are prehistoric. Both are located on the coast and are assigned habitation functions. Based on an age determination result from a single radiocarbon sample collected from Site 1838, it appears that occupation of the coastal zone within the project area may have occurred as early as AD 1170-1400. The date recovered from the project area correlates with one of the later prehistoric periods (the Expansion Period, AD 1100-1650) proposed by Kirch (1985). The Expansion Period (AD 1100-1650) is characterized by numerous developments, including a rapid increase in population and intensified agricultural practices (large-scale irrigation, dryland cultivation, and aquaculture). These resulted in the creation of new social, political, and religious forms (Kirch 1985:303-306). Development of the *ahupua'a* system, a system of land division and related social organization unique to Hawaii, led to a more complex level of social and political integration (Hommon 1976, Green 1980).

Because of the extensive historic modifications in the current project area, and the resulting loss of prehistoric sites, we must rely on historical documentary research and previous archaeological work in surrounding areas to gain an understanding of the prehistoric settlement pattern for this area of Kaua'i. Based on such information, prehistoric settlement in the immediate vicinity of the present project area seems to have taken place primarily in Hanamā'ulu Stream gulch and along the coast (Bennett 1931, Handy and Handy 1972). Hanamā'ulu Stream gulch appears suitable for wetland taro cultivation and probably contained an extensive agricultural system comprising *lo'i* and terraces (Handy and Handy 1972). On the coast at Wailua, or the beach area in Hanamā'ulu Bay, burial (in sand dunes) and habitation activities probably took place (Bennett 1931, Cox 1977). Because the coast between Hanamā'ulu Bay and Wailua Golf Course consists predominately of a rocky shoreline, activities along the coast of the present project area were probably restricted to marine resource exploitation and temporary habitation.

The higher lands surrounding the coastline (currently in sugar cane), and Hanamā'ulu Stream gulch were probably used for dryland agriculture (probably including crops such as sweet potato and breadfruit [Handy and Handy 1972]). Known functional activities occurring in the Kalepa Ridge area, located near the current project area, included burial, quarry or flake reduction, and ceremonial activities. The location of a now destroyed *heiau* (Kalauokamanu) was noted by Bennett (1931) and a quarry or flake reduction activity area subsequently reused as a burial site (Site 1827) has been noted by Rosendahl (1990).

In general, the *lo'i* (taro fields) known from historical documentation were located adjacent to and to the west of the current project area, inland from the ocean in upland areas. Here dryland taro cultivation was probably practiced, while coconut, sweet potatoes, and breadfruit could have also been grown. Where *lo'i* were adjacent to, or touching Hanamā'ulu Stream, based on the above historic documentation, wetland taro was probably grown. Coconut, sweet potatoes, and breadfruit could also have been grown. LCAs of five of the above testimonies were located adjacent to, or touching Hanamā'ulu Stream; the remainder are situated in upland areas away from the ocean or the stream. The current project area, being a tableland, was probably prehistorically, and historically (before the advent of sugar) planted in dryland taro.

Prehistoric settlement within coastal areas of this general southeastern area of Kaua'i, the Lands of Hanamā'ulu, Kalapaki, Nawiliwili, Niumalu, and Wailua, appears to have been concentrated at Huleia Valley–Nawiliwili Bay and Wailua River Valley–Wailua Bay. According to Joesting (1984), the Wailua area was a highly desirable place of residence and was the principal residence of Kaua'i high chiefs. The chiefly importance of the Wailua area is further evidenced by the number of *heiau* concentrated within that general area (Malae, Poliahu, Holoholoku, and Hikinaakala are among the many *heiau* named) (Thrum 1907). Because the

Wailua river valley provides a permanent fresh water source and contains large tracts of fertile alluvial and colluvial soils, it is ideally suited for the cultivation of native crops to sustain a large population. Such a population would provide the labor force such as a complex chiefdom would need in order to function.

Like Wailua, the Huleia Valley probably also supported a substantial prehistoric population. This is evidenced by an extensive agricultural system of taro terraces and a large fishpond (Alekoko Fishpond) in Huleia Valley (Handy 1940, Neller and Palama 1973, Ching et al. 1973). Important nearby ceremonial sites include, but are not limited to, Kuhiau Heiau, Ninini Heiau, and Ahukini Heiau (Thrum 1907, Bennett 1931, Stauder 1973). Kuhiau Heiau, in Nawiliwili, has been described as the largest and most famous on Kaua'i in its day (Stauder 1973) (Thrum 1907).

GENERAL RESEARCH TOPICS

With regard to the scientific research value of sites and features within the Hanamā'ulu project site, the general goal of future research should be to obtain information on the culture history and lifeways of the Hawaiian population that occupied the project area. Future archaeological research should include the following:

1. Definition of the nature (temporary, semi-permanent, or permanent) and sequence (single or recurrent) of occupation within the project area to determine if the inhabitants were local residents, or were simply transiting through the area to places such as Wailua Bay or Nawiliwili Bay;

2. Definition of the marine resources and the methods, techniques, and technologies of marine resource exploitation;

3. Detailed historical documentary research aimed at expanding current knowledge regarding the nature of the identified Historic Period sites and their relationship to Lihu'e Plantation or sugar cane cultivation; and

4. Examination and analyses of archaeological data with traditional and historic references.

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

Significance assessments and recommended general treatments for all identified sites are summarized in *Table 8*. Significance categories used in the site evaluation process are based on Rules Governing Procedures for Historic Preservation Review (Chapter 284, Hawai'i Administrative Rules; DLNR 2001). The DLNR-SHPD uses these criteria for evaluating cultural resources. Sites determined to be potentially significant for information content fall under Criterion D, which defines significant resources as ones that "...have yielded, or may be likely to yield, information important in prehistory or history." 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."

Table 8. Summary of General Significance Assessments and Recommended General Treatments

Site No.*	Integrity	Significance Evaluations A	B	C	D	E	General Recommendations FDC	NFW	PID	PAI
1838	-	+	-	-	+	-	-	-	-	+
1839	+	-	-	-	+	-	-	-	-	+
1840	+	-	-	-	+	-	-	-	-	+
1841	-	-	-	-	+	-	-	-	-	+
1843	-	-	-	-	+	-	-	-	-	+
1845	+	+	-	+	+	-	-	-	-	+
1846	+	+	-	-	+	-	-	-	-	+
2066	-	-	-	-	+	+	-	-	-	+
2067	+	-	-	-	+	+	-	-	-	+
2068	-	-	-	-	+	-	+	-	-	-

General Significance Categories:

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

Recommended General Treatments:

FDC = Further data collection necessary (detailed recording, surface collections, and limited excavations, and possibly subsequent data recovery/mitigation excavations)
NFW = No further work of any kind necessary, sufficient data collected, archaeological clearance recommended, no preservation potential
PID = Preservation with some level of interpretive development recommended (including appropriate related data recovery work)
PAI = Preservation "as is", with no further work (and possible inclusion into landscaping), or possibly minimal further data collection necessary

State Inventory of Historic Places numbers: four-digit numbers prefixed by 50-30-08 or 11 (50=State of Hawaii; 30=Island of Kaua'i; 08 or 11=USGS 7.5' series quad map "Kapaa" or "Lihu'e, Hawaii")

Sites with potential cultural significance and value (Criterion E) 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 a historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth." 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."

All of the project sites were evaluated using the criteria mentioned above. Also, all sites were evaluated on the basis of major ongoing research issues revolving around general questions of chronology, settlement and exploitative patterns, site and assemblage variability, material culture and technology, diet and economy, and socio-religious values.

The ten sites identified (Sites 1838, 1839, 1840, 1841, 1843, 1845, 1846, 2066, 2067, and 2068) are all assessed as significant under Criterion D (information content). Site 1845 is additionally assessed as significant for Criterion A (important for historical contribution to significant events and/or broad patterns of history) and Criterion C (excellent example of a site

type). Site 1846 is additionally assessed as significant for Criterion A. Sites 2066 and 2067 are additionally assessed as significant for Criterion E (cultural value). Site 2068 requires further data collection to attempt to provide a chronology for the site based on recovered artifacts. Following this, the site need not be preserved. The remaining nine sites (1838, 1839, 1840, 1841, 1843, 1845, 1846, 2066, and 2067) require preservation "as is."

No further work is recommended for Site 1838 since it has been previously tested and is now eroded to such a degree that further research would not be feasible. The developer has stated that the site will not be impacted by project development.

The newly identified historical refuse dump (Site 2068) has been measured, described, photographed, and plotted; however, further work is recommended in the form of surface collection since it might contain important information on the early 1900s use of this area.

Sites 1839 and 1840 have been tested, and data collected from these sites during the prior survey is considered sufficient. The developer has stated that the site will not be impacted by project development.

Site 1841 has been photographed and plotted. The developer has stated that the site will not be impacted by project development.

Site 1843 has been photographed, plotted, and surface collected. The information from the site has been adequately collected and it is unlikely the site would produce further information. The site developer has stated that the site will not be impacted by project development.

Site 1845, a historic bridge distinctive due to its multiple-arched style of construction, is assessed as significant under Criteria A, C, and D (A-important for historical contribution to significant events and/or broad patterns of history; C-excellent example of a site type; D-important for information content). This bridge is outside the project area and will not be impacted by project construction.

Site 1846, another concrete bridge, is assessed as significant under Criterion A. The developer has stated that the site will not be impacted by project development.

Site 2066, which may contain the possible cemetery, will not be impacted by project development.

The historic cemetery (Site 2067) is recommended for preservation "as is." It is located outside the current project area.

The evaluations and recommendations presented within this final report have been based on a variable-coverage surface and limited subsurface inventory survey of the project area. Due to the limitations of such surveys, there is always the possibility, however remote, that potentially significant, unidentified surface or subsurface cultural remains will be encountered during the course of future investigations in the area. In such situations, archaeological consultation should be sought immediately.

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APPENDIX A: SITE DESCRIPTIONS

The following site descriptions are from two sources: the descriptions for Sites 1838, 1839, 1840, 1841, 1843, 1845, and 1847 are from the 1990 survey fieldwork, and the descriptions for newly identified Sites 2066, 2067, and 2068 are from the current field work. All previously identified sites were relocated and inspected during the recent fieldwork. If necessary, updated information on the sites is presented here so that both the site's condition in 1990 and its current condition in 2001 are clearly defined. Photographs taken during the 2001 survey are not presented when they are virtually identical to those taken during the 1990 survey; they are, however, on file at the PHRI Hilo office.

SITE NO.: State: 1838 **PHRI:** T-1
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Undulating terrain of sand mounds and ponds southwest of site.
VEGETATION: Grass, ironwood trees, ground vines.
CONDITION: Fair-good
INTEGRITY: Altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Possible cultural layers.
DESCRIPTION: The site consists of two culture deposits (Features A and B). The overall total area dimensions are c.70.0 m by 10.0 m. Feature B is approximately 65.00 m from Feature A.

FEATURE A: Cultural deposit
FUNCTION: Habitation
DIMENSIONS: 2.40 m by 0.60 m
DESCRIPTION: The cultural deposit is a mound that may have been pushed by a bulldozer. A local informant (name not given) has stated that military maneuvers have occurred here and that bones of an unspecified nature were also found during this time. The north-northeast face of the mound is exposed by natural erosion, revealing a stratigraphy of four layers. The cultural deposit is a dark, gray/black, charcoal-flecked layer with scattered waterworn shells and coral fragments. The deposit (Layer III) contained a high concentration of marine midden and coral fragments. East of the exposed area of the deposit are deep pockets that may have been caused by erosion.

FEATURE B : Cultural deposit
FUNCTION: Habitation
DIMENSIONS: 1.70 m by 1.70 m
DESCRIPTION: This is a dark grayish-black sandy surface layer with dense of coral and shell fragments scattered on the surface.

Feature B is on a fairly level area on top of a south-southwest slope. The southwest side of the feature is a natural swamp or pond; *naupaka* and beach heliotrope are present around the feature. A road is immediately north-northeast of Feature B. Vehicle tracks were observed on the feature.

Updated Information: Feature A has been has been further eroded and spread out since the 1990 survey and is now approximately 9.00 m by 7.00 m by 0.40 m. A cultural layer is still slightly visible, but the overall condition is now poor. Feature B was not found. The general area is heavily used for picnicking, with scattered modern trash. Compare photographs *Figure A-1* (1990) and *A-2* (2001) taken from the same vantage point. Due to the lack of artifacts and/or structural remains, and the probable damage to the site from previous military maneuvers, it is not possible to determine whether Site 1838 represents a temporary or permanent habitation.

SITE NO.: State: 1839 **PHRI:** T-2
SITE TYPE: Complex(2 Features)
TOPOGRAPHY: Generally flat with a slight slope toward the ocean; basalt boulders scattered throughout.
VEGETATION: Ironwood (ground is covered with ironwood needles)
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: The site consists of a wall (Feature A), and a terrace (Feature B) (*Figures A-3, A-4, A-5*). The overall dimensions of the site are c. 20.0 m at 220° by 10.0 m.

FEATURE A: Wall
FUNCTION: Temporary habitation
DIMENSIONS: 8.40 m by 1.70 m by 0.75 m
DESCRIPTION: The feature is constructed with basalt boulders and small basalt cobbles and is stacked two courses high. It is oriented c. 45.0 m southeast of Site 1840, heading south at 220° from the feature. This feature is on generally flat terrain, sloping slightly toward the ocean. Ironwood trees are present in the vicinity.

FEATURE B : Terrace
FUNCTION: Indeterminate
DIMENSIONS: 7.50 m by 7.50 m by 0.47 m
DESCRIPTION: This terrace is connected to an earth berm. It is located c. 15.0 m north at 40° of Feature A, and 16.0 m north of the ocean. It is on a generally flat area, sloping slightly toward the ocean, about 16.0 m north.

Updated Information: Features A and B are virtually unchanged since the previous survey. A newly identified site, Site 2068, was recorded approximately 28 m to the northeast.

SITE NO.: State: 1840 **PHRI:** T-3
SITE TYPE: Retaining wall
TOPOGRAPHY : Top edge of N-S running coastal bluff sloping slightly to the east. Red clay with scattered boulders.
VEGETATION: False ironwood, grasses, and *'ilima*.
CONDITION: Good
INTEGRITY: Altered
PROBABLE AGE: Historic

Figure A-1. Site1838, Feature A, View to NNE (1990)

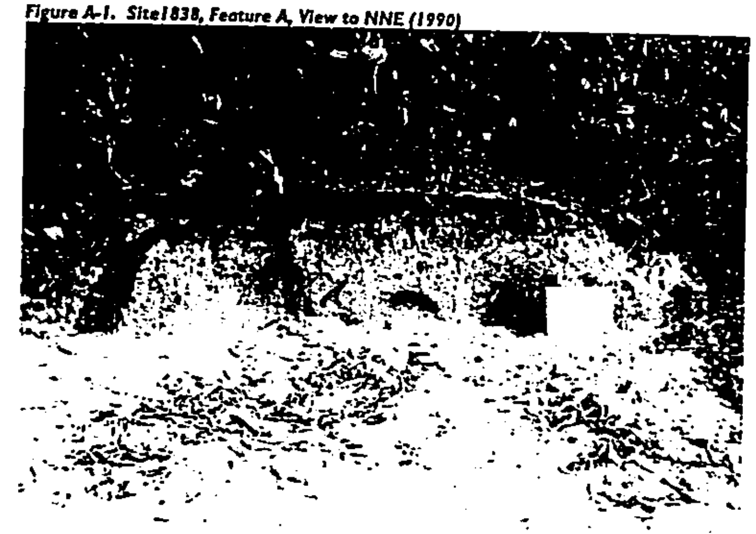


Figure A-2. Site 1838, Feature A, View to NNE (2001)

Figure A-3. Site 1839, View to WSW (1990)

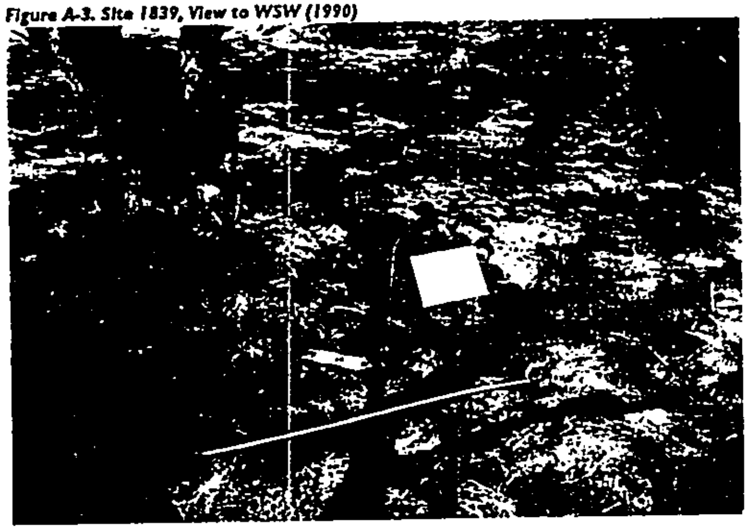


Figure A-4. Site 1839, Feature A, View to SW

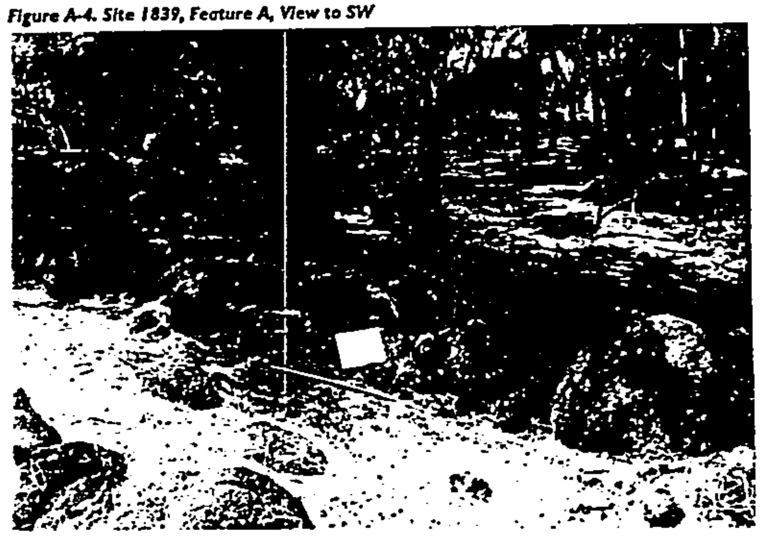
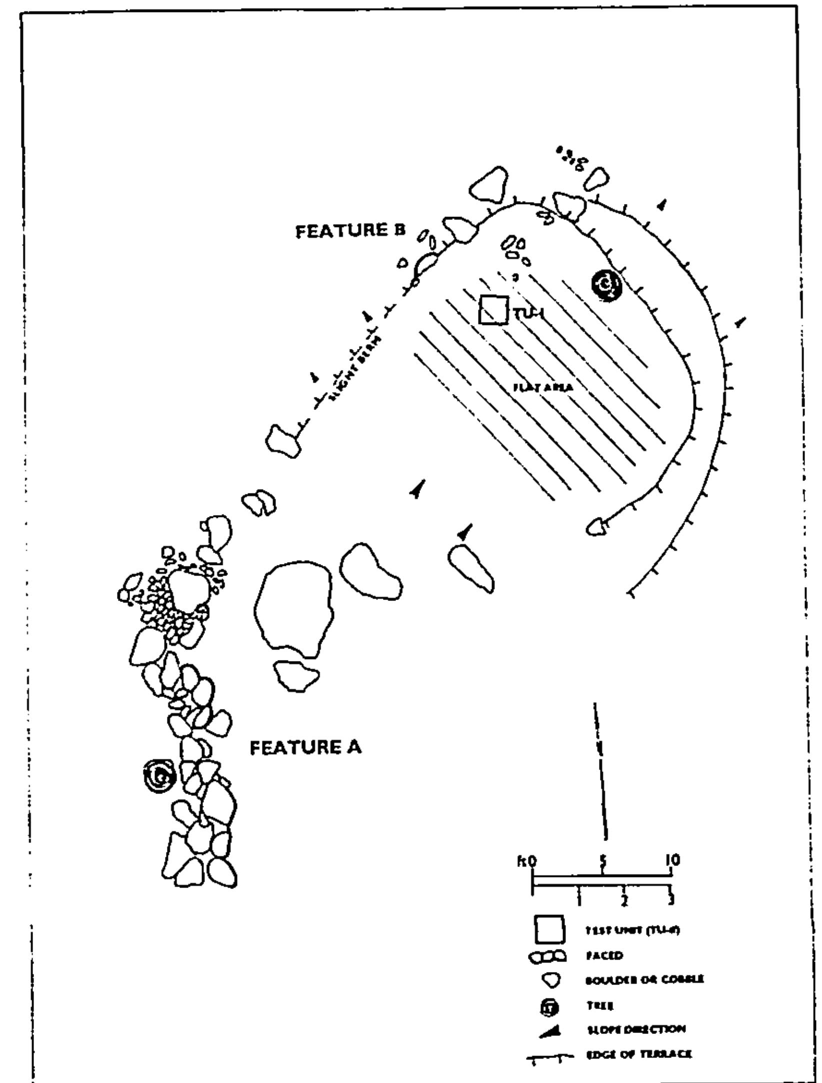


Figure A-5. Site 1839

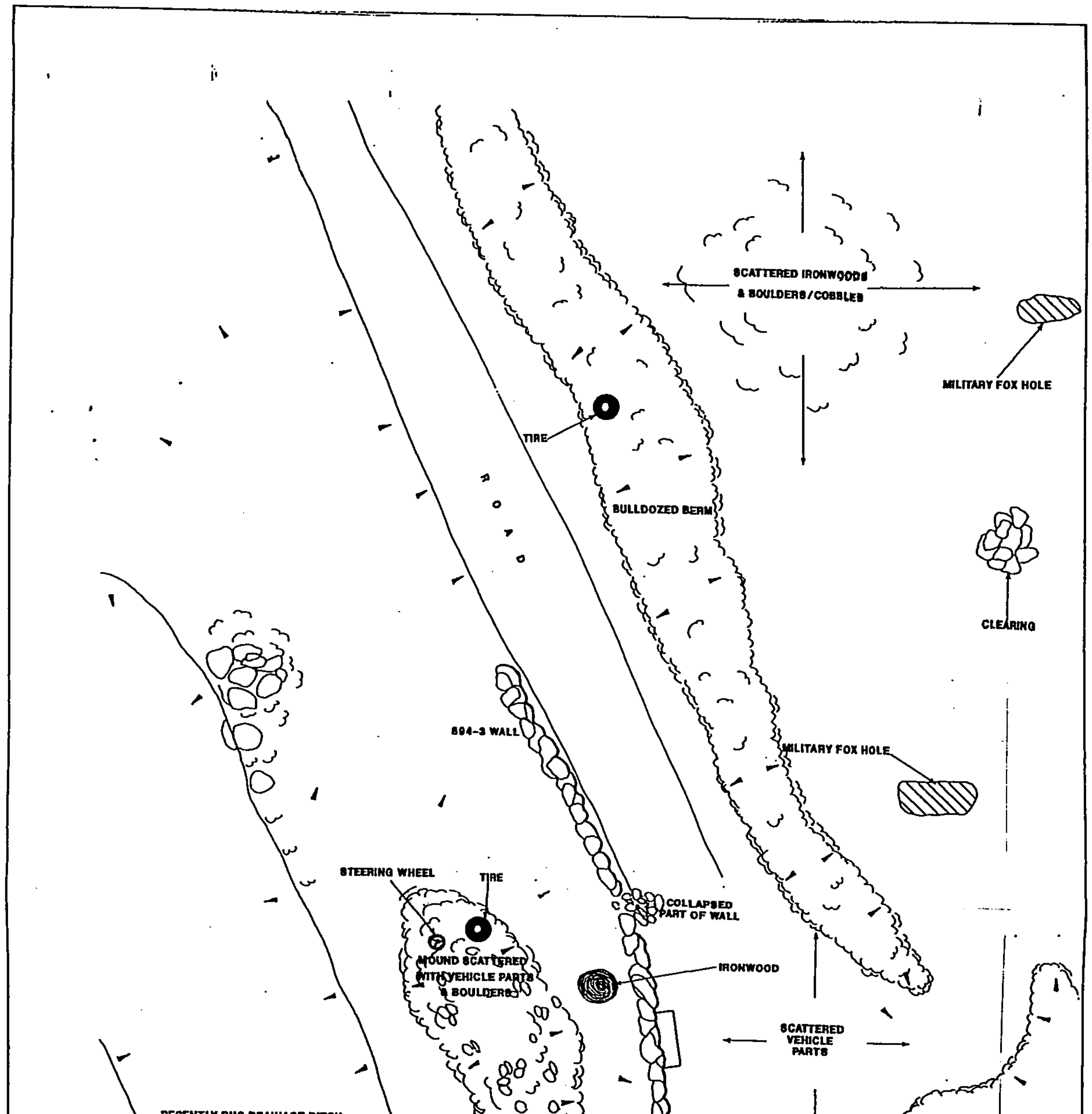


FUNCTIONAL INTERPRETATION: Transportation
DIMENSIONS: 15.50 m by 11.00 m by 0.60 m
DESCRIPTION: This structure is composed of stacked small to medium basalt boulders. The boulders are stacked two-four courses c. 0.75 m to 1.10 m high (*Figures A-6, A-7, A-8*). The wall is vertically faced on the east-northeast side, facing a dirt roadcut. Behind the wall to the west-southwest, is a pile of red clay mixed with recent rubbish (mostly car parts); this pile averages c. 6.0 m in width and ends abruptly at a north-south running ditch that is presumed to be for sugar cane field drainage. The maximum height of this mound is c. 2.5 m above the north-to-south roadcut, and about 1.4 m above the high point of the wall. The wall runs at 342° to 162°, with a slight westerly jog of c. 3.0 m at the north end. The high point is c. 5.0 m from the south end. There is also a crude clearing mound c. 12.0 m east of the north end of the wall, at 83°. This mound is oval (c. 1.9 m northwest to southeast by 1.4 m by 0.6 m) and constructed with small to medium basalt boulders. The wall is thought to be a retaining wall primarily due to the fact that the soil in back of the wall is built up much higher than the road on the other side of the wall (see photo). The wall may be a historic retaining wall that may be connected to military activities or sugar cane transportation.

Updated Information: This wall is virtually unchanged from the 1990 survey.

SITE NO.: State: 1841 **PHRI:** T-4
SITE TYPE: Road
TOPOGRAPHY: Rocky and sloping, above steep southeast rocky cliff
VEGETATION: False ironwood, *naupaka*, succulent ground cover
CONDITION: Fair
INTEGRITY: Intact
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Transportation
DIMENSIONS: 250.0 m by 6.0 m by 3.0 m
DESCRIPTION: This is a semi-collapsed section running north-northeast to south-southwest; present along the coast edge from the north point of Hanamā'ulu Bay (*Figures A-9 and A-10*). There is a ledge that slopes gradually up, running north-northeast from the point, which has been mostly cleared of medium and large boulders to create a roughly level surface. The boulders have been stacked along the seaward edge to create a retaining wall/breakwater; this breakwater is from two to eight courses and averages c. 0.50 m to 2.75 m high. Some sections are faced on the ocean side, and a few short sections extend above the ledge and are faced on the inside also. The wall sections vary from c. 0.50 m to 0.80 m in height by 0.60 m to 1.25 m in width. The surfaces of the cleared areas are irregular but roughly level. There are no machinery scars visible on the structure. The "pathway" is very obscure near the point. A few short sections inland appear paved with angular cobbles. At the north-northeast end, the stone trail/road turns into a bulldozed dirt road. The site tag is located on top of a faced retaining wall eight courses high and about 0.50 m southwest of the northeast end. The road cut rises c. 3° to 4°.

Updated Information: This site is unchanged from its 1990 condition.


SCATTERED IRONWOODS
& BOULDERS/COBBLES
MILITARY FOX HOLE
TIRE
ROAD
BULLDOZED BERM
CLEARING
594-3 WALL
MILITARY FOX HOLE
STEERING WHEEL
TIRE
COLLAPSED
PART OF WALL
MOUND SCATTERED
WITH VEHICLE PARTS
& BOULDERS
IRONWOOD
SCATTERED
VEHICLE
PARTS

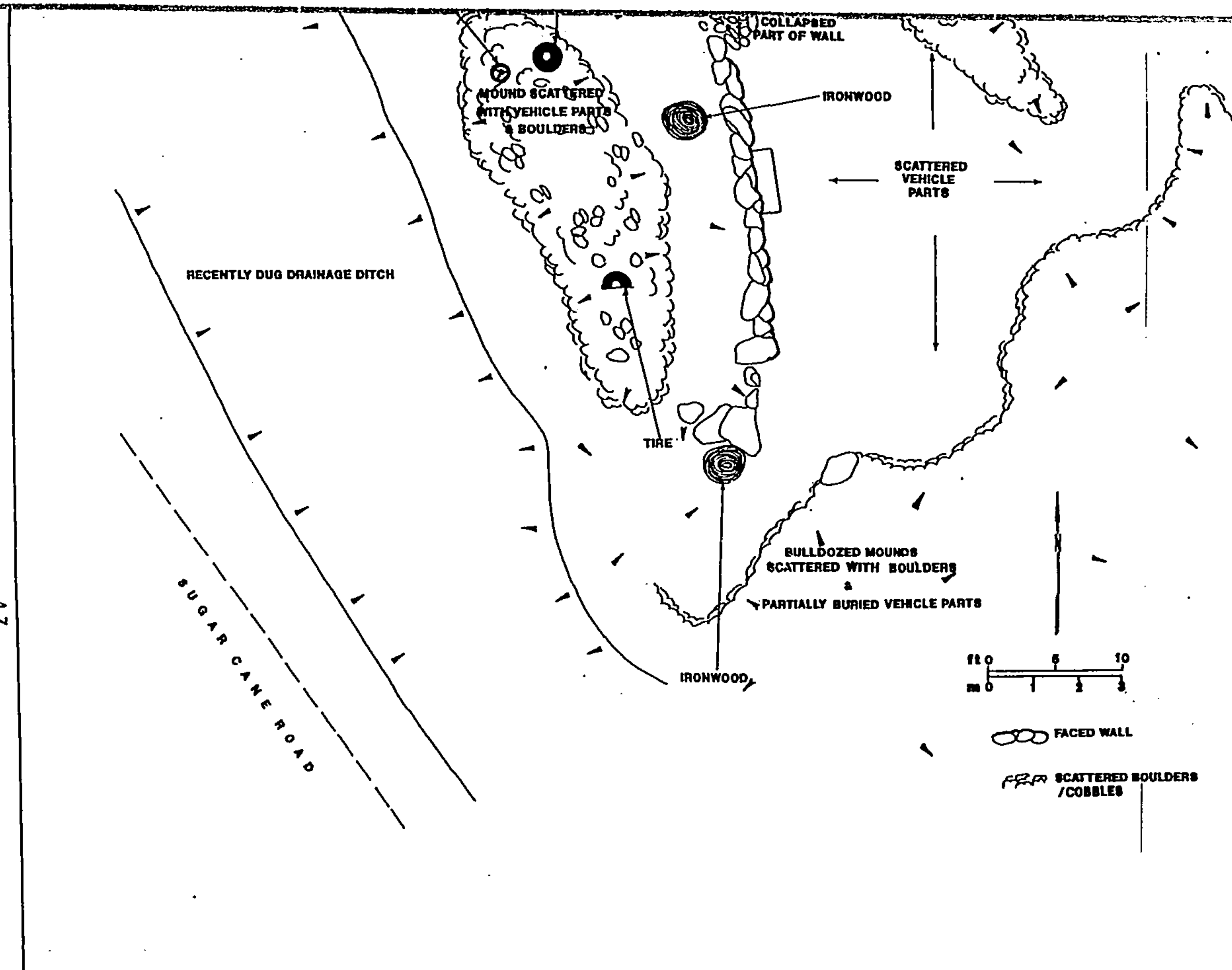


Figure A-6. Site 1840

Figure A-7. Site 1840, View to W

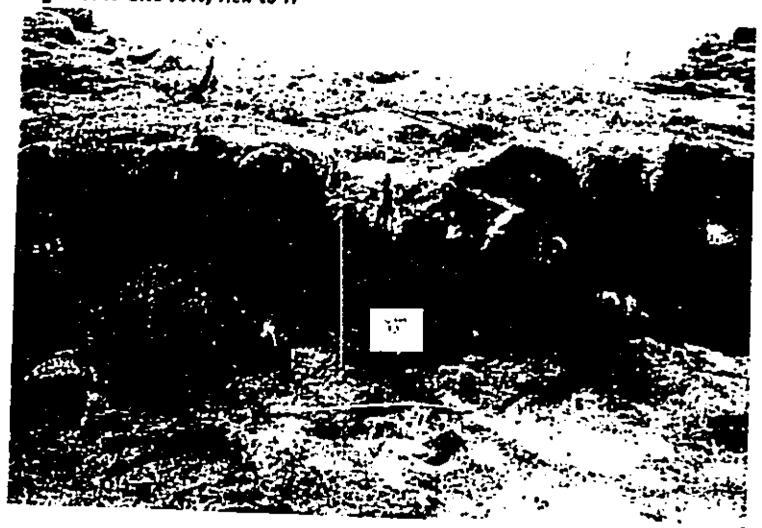


Figure A-8. Site 1840, Test Unit 1, View to W

Figure A-9. Site 1841, View to S

Figure A-10. Site 1841, View to NW

SITE NO.: State: 1843 **PHRI:** T-6
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: On a shelf of land that fronts a steep slope, that rounds the north point of Hanamā'ulu Bay.
VEGETATION: Ironwood, Java plum, *noni* (*Morinda citrifolia*), *koa-haole*, grasses, and vines.
CONDITION: Poor-Fair
INTEGRITY: Altered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: The site consists of a concrete wharf (Feature A), a road (Feature B), and a concrete wall (Feature C). The overall dimensions are c. 32.0 m by 17.0 m.

FEATURE A: Concrete wharf
FUNCTION: Transportation
DIMENSIONS: 17.00 m by 5.20 m by 1.80 m
DESCRIPTION: The concrete wharf is rectangular. It is reinforced with basalt cobbles and large steel beams that run perpendicular to its length at the water line. Feature A is probably associated with a paved road rounding the point, and served as docking facilities for agriculture (loading sugar cane). This feature probably continued farther into the bay at one time. The pilings extend farther into the bay (for ships). This feature extends into the water near the north point of Hanamā'ulu Bay. A separate wall section runs parallel to the east and abuts a large cobble/small boulder basalt paved road (designated Feature B).

FEATURE B: Road
FUNCTION: Transportation
DIMENSIONS: 19.00 m by 15.00 m by 1.30 m
DESCRIPTION: This is a beach road partially paved with cobbles and small basalt boulders. It apparently begins at the concrete wharf (Feature A) and runs east then makes a turn around the north point of Hanamā'ulu Bay and runs roughly north-northeast. Feature B is present in many forms of varying condition: discrete walls to broken alignments, bare rock to muddy areas to paved areas with waterworn basalt boulders cobbles.

FEATURE C: Concrete wall
FUNCTION: Transportation/agriculture
DIMENSIONS: 15.80 m by 2.70 m by 0.40 m
DESCRIPTION: This feature is a foundation-like wall with a lower similar concrete wall running parallel (c. 70.0 m) along the length of the south side. The main wall is composed of concrete mortared, dressed basalt, one course, very large and brick-like. The lower wall seems to be made primarily of concrete. This feature is near the foot of the steep slope and is partially buried by talus and covered with dense vegetation. The feature's main wall contains corners at both ends that turns 90° north toward the slope. The walls are obliterated by debris from the slope and by vegetation. A solid area of concrete at the east end may have been an interior slab (room, platform, etc.). A partial wall section is observed at the west end of this feature's main wall, also forming a corner, but it is also densely covered.

Updated Information: Feature A is largely intact, and appears much the same as in 1990 (*Figures A-11 and A-12*); however, the tree is no longer present and several large boulders are now present. The southwest corner of the slab has also been further impacted by storm action, possibly by Hurricane Iniki (*Figures A-13 and A-14*). Less paving is now visible on Feature B, probably due to storm action. The entire Feature C appears to have been affected by storm action; the westernmost concrete section has been displaced c. 5 m farther west (*Figure A-15 [1990], Figure A-16 [2001]*).

SITE NO.: State: 1845 **PHRI:** T-8
SITE TYPE: Railroad Bridge
TOPOGRAPHY: Near a stream or a lowland marsh, where it enters the ocean.
VEGETATION: Java plum, *koa-haole*, *hau*, grass, and vines.
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Transportation
DIMENSIONS: 57.80 m by 3.08 m by 7.50 m
DESCRIPTION: The bridge is constructed of steel reinforced concrete, supported on three points (*Figure A-17*). Two arches meet at the bottom of a middle support pillar. This bridge spans a marsh and is supported by two hillocks, one at each end. The bridge spans a modern road on the northeast half and a swampy lowland stream on the other half.

Updated Information: This site has remained unchanged since the 1990 survey.

SITE NO.: State: 1846 **PHRI:** T-9
SITE TYPE: Concrete bridge
TOPOGRAPHY: Between two drainage ditches and south of a previously identified sand dune
VEGETATION: *Hau*, sword grass, and *koa-haole*; *hau* and sword grass are predominant.
CONDITION: Fair-good
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Transportation
DIMENSIONS: 9.40 m by 5.00 m by 5.60 m (approximately)
DESCRIPTION: This site consists of two concrete bridges, probably associated with a railroad and built over and between what seems to be two drainage ditches (*Figure A-18*). The bridges are oriented north-northwest to south-southeast and are constructed of steel-reinforced concrete. The bridge span is a rectangular concrete structure that is supported by a triangular base at each end. Both bridges are heavily covered in vegetation.

One bridge is c. 9.4 m long north-northwest to south-southeast by 2.45 m wide by 3.5 m above the drainage channel. The other bridge is c. 6.0 m long north-northwest to south-southeast by 5.0 m wide and 5.6 m above drainage floor. The bridges are c. 10.0 m to 15.0 m apart.

Figure A-11. Site 1843, Feature A, View to SW (1990)

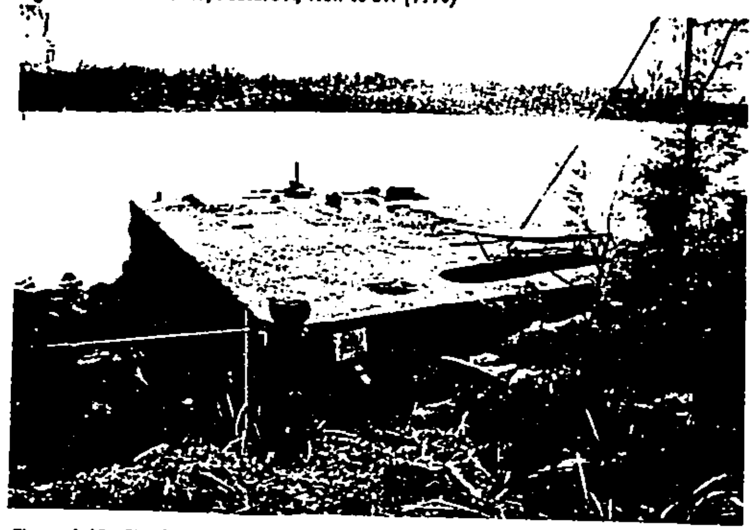


Figure A-12. Site 1843, Feature A, View to W (2001)

Figure A-13. Site 1843, Feature A, View to ESE (1990)

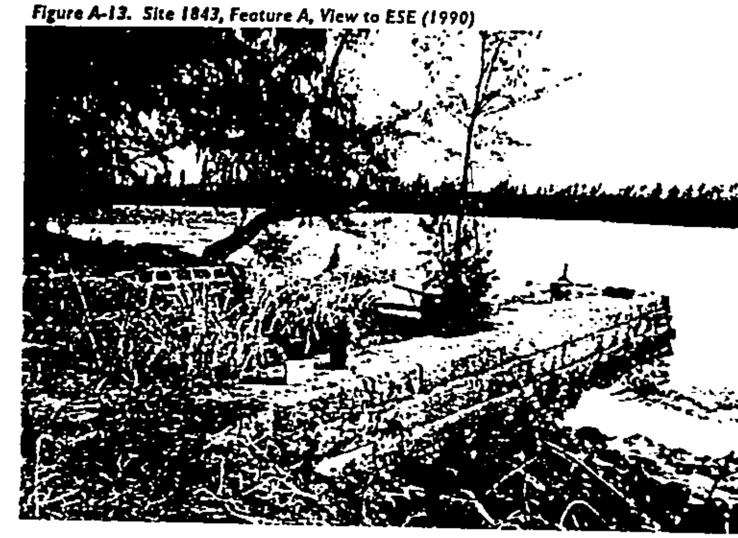


Figure A-14. Site 1843, Feature A, View to W (2001)

Figure A-15. Site 1843, Features B and C, View to E (1990)

Figure A-16. Site 1843, Features B and C, View to E (2001)

Figure A-17. Site 1845, View to WSW (1990)

Figure A-18. Site 1846, View to W (1990)

Updated Information: Although the bridges remain intact, they are overgrown with dense *hau*, which has replaced the previous vegetation. Compare *Figure A-18 (1990) to Figure A-19 (2001).*

SITE NO.: State: 2066 PHRI: T-11
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: On a slight slope
VEGETATION: *Koa-haole*, grass, Java plum, and various grasses
CONDITION: Poor
INTEGRITY: Absent
PROBABLE AGE: Pre-historic to Historic
FUNCTIONAL INTERPRETATION: Indeterminate
DIMENSIONS: Approximately 25.00 by 20.00 m
DESCRIPTION: The site consists of an upright (Feature A) (*Figure A-20*), a road (Feature B), and a possible historic house foundation (Feature C). The overall dimensions are c. 28.00 by 15.00 m.

FEATURE A: Upright
DESCRIPTION: This is an upright stone 0.75 m long and 0.45 m wide surrounded by scattered pieces of coral. About one dozen coral pieces immediately surround the upright, while another 6+ pieces are scattered up to 15.00 m to the north. The upright and coral may be a component of a historic cemetery known to have existed in this area: a Lihu'e informant stated that he knew of the cemetery in this area as a child, and that members of the Lester Rego family were interred there (personal communication, Dirge Kane 2001). However, no other graves or gravestones were identified in the area.

FEATURE B: Road
FUNCTION: Transportation
DIMENSIONS: C. 29.00 m by 3.20 m
DESCRIPTION: This is an old dirt road with side earthen berms leading down from the cane road south to the bluff. It is approximately 29 m long and 3.2 m wide and is heavily overgrown. The road may be associated with cane production and transportation down to Hanamā'ulu Bay, since this area was in active cane production until recently. It may also be associated with Feature C.

FEATURE C: Possible Historic House Foundation
DESCRIPTION: A possible historic house foundation about 20.0 m north of Feature A and adjacent to Feature B. It is possible that the northern foundation stones are simply road push from construction of the bordering cane road, and the southern foundation stones are remnants of a terrace. Features A, B, and C may be associated, or they may be temporally distinct (*Figure A-21*). All three features are outside of the area to be developed.

Figure A-19. Site 1846, View to W (2001)

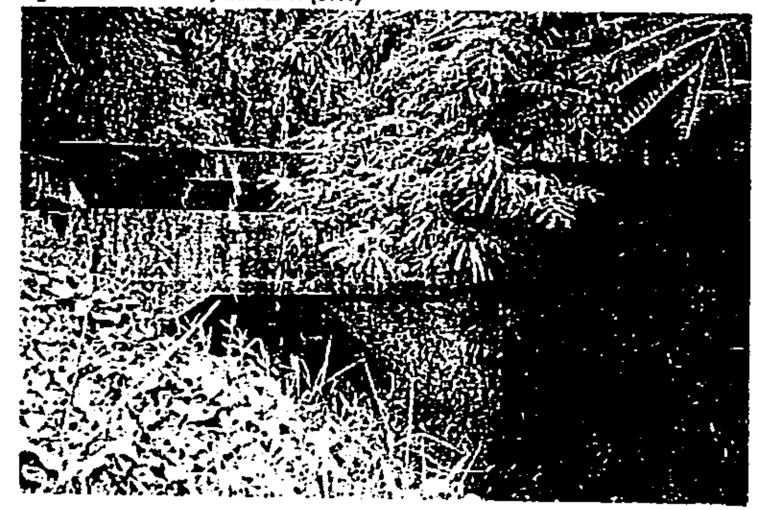


Figure A-20. Site 2066, Feature A Upright, View to S

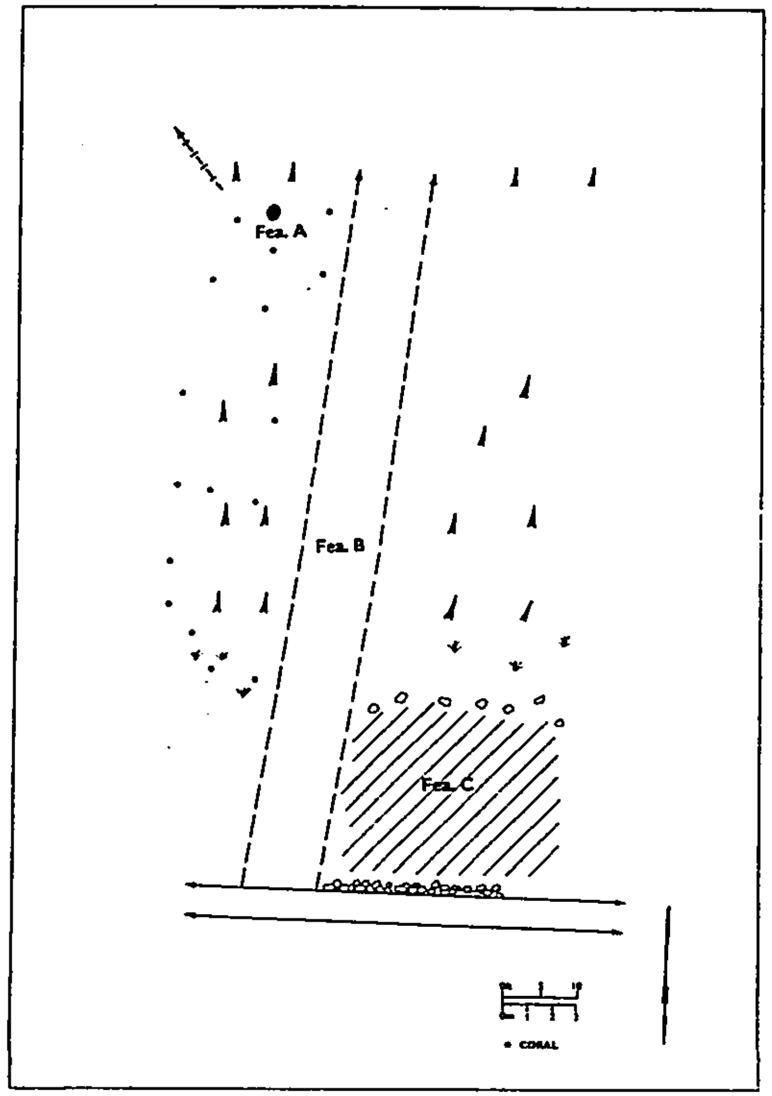


Figure A-21. Site 2066

SITE NO.: State: 2067 **PHRI:** T-12
SITE TYPE: Historic Cemetery
TOPOGRAPHY: On a fairly steep slope
VEGETATION: *Java Plum*, various grasses, vines, breadfruit trees
Condition: Fair
INTEGRITY: Intact
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Burial
DIMENSIONS: Approximately 60.0 m by 60.0 m
DESCRIPTION: This is a semi-maintained cemetery with recent offerings (flowers and plastic flowers) and an associated probable house foundation (*Figures A-22 and A-23*). There are approximately nine to eleven graves. The oldest visible grave with a headstone appears to date from the late 1880s, while the most recent visible grave with a headstone indicates 1952 as the year of death. This site is not within the current project area.

SITE NO.: State: 2068 **PHRI:** T-13
SITE TYPE: Historic Trash Dump
TOPOGRAPHY: On a small bluff overlooking the ocean
VEGETATION: *Naupaka*, various grasses, ironwood trees
CONDITION: Poor-Fair
INTEGRITY: Altered
PROBABLE AGE: Historic (1880s to 1910s)
FUNCTIONAL INTERPRETATION: Refuse disposal
DIMENSIONS: 12.00 m N-S by 7.00 E-W
DESCRIPTION: This is a historic dump on a small bluff overlooking the ocean, approximately 28.00 m and 32 degrees from Site 1839 (*Figure A-24*). It appears that pothunters have visited the site looking for bottles; there is a 1.0 m by 1.0 m hole placed approximately in the site center; no whole bottles exist, they probably have been collected. The refuse materials were doubtless dumped from the bluff above. Materials include: approximately 300 pieces of ceramic of various glazes; several oriental rice bowl fragments; about 1,000 medium bottle fragments, several of which are purple, and about 1,000 smaller fragments; about 30 medicine bottle fragments; several cup and beer mug fragments; several artistic glass fragments; several pieces of crockery and *majolica* pottery fragments; several fairly large rusted machinery parts; and several unidentified faunal bone fragments. The age of the materials appears to be from the 1880s to the 1910s.

Figure A-22. Site 2067, Two Gravestones

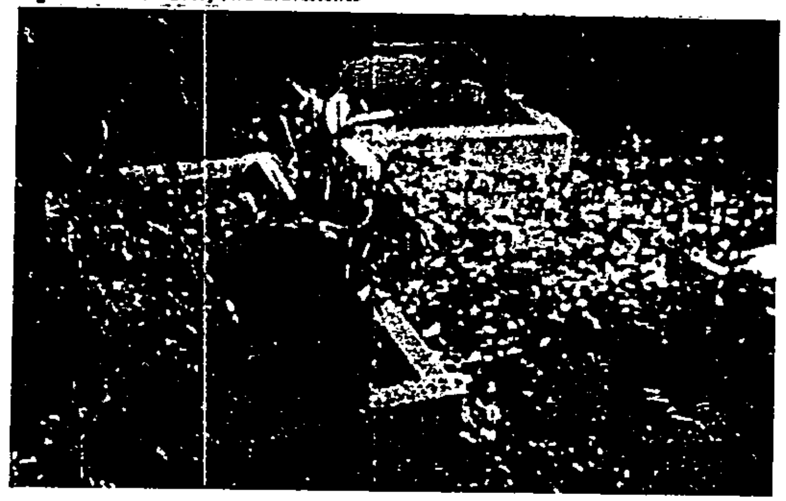


Figure A-23. Site 2067, Probable House Foundation

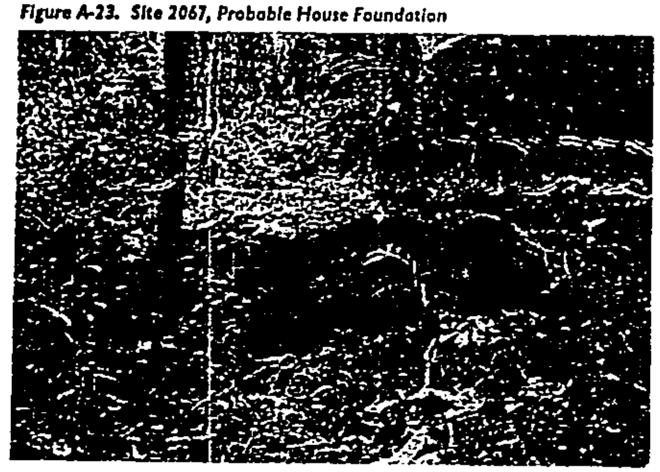
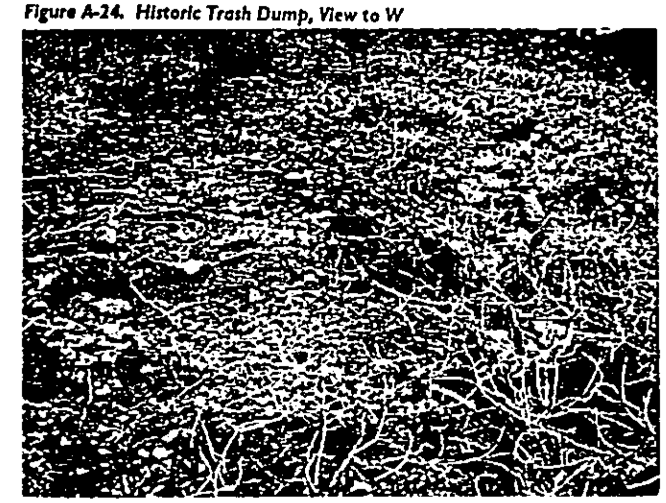


Figure A-24. Historic Trash Dump, View to W



APPENDIX B:

HISTORICAL DOCUMENTARY RESEARCH

Ocean Bay Plantation at Hanamā'ulu
Land of Hanamā'ulu, Līhu'e District, Island of Kaua'i (TMK:4-3-7-3:1;4-3-9-5:5)

by Lehua Kalima and Helen Wong Smith

Kaua'i has always been unique among the Hawaiian Islands as a somewhat separate kingdom due to its distance from the rest of the islands. In *Archaeology of Kauai*, William Bennett writes:

> It seems...that there was much more communication between all parts of Kauai than between Kauai and the other islands. In other words Kauai may be considered as a cultural unity (Bennett 1929:54).

The District of Lihu'e has been the setting of numerous stories. In the book, *Kauai: The Separate Kingdom*, Ernest Joesting writes, "There is no explanation for the choice of the name Lihu'e...The name can be interpreted as meaning "cold chill," although it might well have had another meaning in ancient times..." (Joesting 1984:154).

It should be noted that old maps and documents at the time of the Great Mahele (c. 1848) refer to the district as Puna, not Lihu'e. This is the name often given to the southeastern portion of an island, such as the well-known Puna District on the Island of Hawai'i.

Hanamā'ulu translates literally as "tired (as from walking) bay," and it is said to be the birthplace of the hero Kawelo (Puku'i et al. 1974). Few sources refer specifically to Hanamā'ulu, and the information contained in them is general in nature; this document therefore also includes information from the nearby *ahupua'a* of Niumalu and Wailua relevant to the project area. Niumalu translates literally as shade [of] coconut trees" (Puku'i et al. 1974). Wailua means "two waters" (Puku'i et al. 1974).

Hanamā'ulu is mentioned in *Olelo No'eau*, a book of Hawaiian sayings and epithets:

> *No Hanama'ulu ka ipu puehu.*
> (The quickly emptied container belongs to Hanama'ulu.)
>
> Said of the stingy people of Hanama'ulu, Kaua'i - no hospitality there. At one time, food containers would be hidden away and the people of Hanama'ulu would apologize for having so little to offer their guests (Puku'i 1983: No. 2230).

Another traditional saying mentions Wailua as a land of large streams (Puku'i 1983:1648):

> *Ka wai halau o Wailua.*
> (The expansive waters of Wailua)

TRADITIONAL REFERENCES

According to Abraham Fornander, who has written extensively about the legends and mythical origins of Kaua'i:

> The legendary history of Kauai is very unsatisfactory in any effort to restore historical form and sequence. The legends are disconnected and the genealogies are few...That the ruling families of Kauai were the highest tapu chiefs in the group is

> evident from the avidity with which chiefs and chiefesses of the other islands sought alliance with them. They were always considered as the purest of the "blue blood" of the Hawaiian aristocracy...But of the exploits and transactions of most of the chiefs who ruled over Kauai during this period, there is little preserved to tell (Fornander 1917:271-2).

The Wailua area figures in numerous legends, while the other *ahupua'a* are rarely mentioned. Donald Matsumori, in a report on the history of Wailua and Kapaa, states "...all the kings of Kaua'i from ancient times to Kaumualii were born at Wailua. The legend of the Naha Stone names Wailua as the place of its origin" (1973:1).

The Naha stone is a famous stone that was lifted by Kamehameha as a boy, a testament to his strength at such a young age. It was prophesied that whoever lifted the stone would become the ruler of Hawai'i.

Joesting (1984) adds that:

> The lower portion of the Wailua River, that portion where the waters flow into the Pacific Ocean, was one of the most desirable places to live in ancient Hawaii. It had been chosen as the capital by kings and was the home of the high chiefs of Kauai. Together with Waialua, on Oahu, it was considered to be one of the two most sacred areas in all the Islands . . . Wailua Nui Hoano, or Great Sacred Wailua, was the name given to the ocean-bordered portion of this expansive valley. The sacred section extended inland for some two miles on the southern side and three miles on the north . . . The ancient significance of Wailua is shown through the legends of men who sailed there and back again to Tahiti before the thirteenth century. Other legends talk of the frequent journeys of people from the other islands to Wailua .

According to Judge Lyle Dicke (1916) of the Hawaiian Historical Society:

> When, in a Hawaiian story, the hero is made to visit Kauai, the Wailua beach at the mouth of the river is usually where the landing takes place. Here all the prehistoric voyagers from Kahiki who came to Kauai landed and here the prophet Naula-Maihea was thrown alive by a whale, which had swallowed him near Oahu. There of the Naha Stone of Hawaii names Wailua, Kauai, as the place from which the stone came. In the story of Laieikawai it was Poloula, chief of Wailua, who gave the prophet Hulumaniani a canoe and rowers to seek the cause of a mysterious rainbow on Oahu. There are at least three Hawaiian cat's cradles or hei which have reference to Wailua (1916:14).

Dicke also tells a tale of the brothers of Maui, the demigod, who was responsible for many super-human feats in the Hawaiian Islands:

> Maui wished to bring the Hawaiian Islands together and for that purpose to catch the powerful fish Luehu, which, if hooked, would cause all the islands to draw together...As soon as Luehu was caught, the Hawaiian Islands began to draw together. As Kauai and Oahu came near great crowds gathered on the shore of Oahu and cheered. This did not disturb the brothers of Maui at first (who were pulling the islands together), who paddled steadily but when the cheerers exclaimed at the beauty of the woman behind Maui, all the brothers turned at once to look (this they weren't supposed to do at risk of losing the fish). Immediately the great fish became loose from the hook and the islands slid apart as they had been. Only two islands had actually touched each other. The point near Nawiliwili lighthouse had touched

> Kaena Point on Oahu and as they drew apart a piece of Oahu was caught on Kauai and a piece of Kauai on Oahu. This rock off Kaena point is still called "Pohaku o Kauai," Rock of Kauai. Because of their turning back, Maui's brothers, on their return to Wailua, turned to stones which are set across the mouth of the Wailua River (ibid:18).

Another tale deals with Puniakaia and the people of Wailua:

> Puniakaia of Kaneohe, Oahu, had a pet fish that he had raised from its childhood, named Uhumakaikai. When fishing at Wailua, Puniakaia bet his bones against four pieces of land that inside 15 days he would catch more fish than the people of Wailua and all their pigs and dogs could carry away and eat, and sent word to the fish Uhumakaikai to help him win his bet. On the 14th day, when he had caught no fish, the Wailua people made preparations to kill him and prepared an *imu*, wood and stones, to bake him, but at daylight the next day fish were seen coming to Wailua both from north and south. The fish covered the sand at Wailua and extended deep into the sea. The fish Uhumakaikai came, too, and Puniakaia picked it up and kissed it and for love of it returned to his Oahu home, giving the whole of Kauai to the owner of the canoe that had brought him to Wailua (ibid:19).

In a report by Cox (1977) on Wailua *ahupua'a* the author emphasized that Wailua was a place of central importance on the island and the primary residence and major religious center for the *ali'i nui* of the island. In the legends of the first *ali'i* to reach Hawai'i, Mo'ikeha is said to have picked Wailua as his home (Cox 1977:4).

Besides tales of the marvelous feats associated with an area, tales are also told of bizarre or scary things. Wailua is mentioned in this story by Skinner:

> Hawaii has its "haunts" and "spooks," just as do some countries that do not believe in such things. One of the spectres troubles a steep slope near Lihu'e, Kauai. An obese and lazy chief ordered one of his retainers to carry him to the top of the slope on his shoulders. It was a toilsome climb, the day was hot, hence it is no wonder that just before he gained the summit the man staggered, fell, and sent his dignified and indignant lord sprawling on the rocks. This was a fatal misstep, for the chief ran the poor fellow through with his spear. The ghost possibly laments because it did not lose its burden sooner and with more emphasis.

Another place that the natives avoid is the Sugar Loaf on Wailua River, Kauai. Hungry robbers broke a taboo and ate some bananas that had been consecrated to a local god, Kamalau. Missing the fruit, the deity turned himself into the rock known as the Sugar Loaf, which is sixty feet high, that he might watch his plantation without being identified. The thieves noticed the rock; they, however, could not recall that it had been there on the day before, and suspecting something kept away. The sister of the god, believing him to be lost, leaped into the river and became a stone herself. And so, having rid themselves of the flesh, these two are free to wander in the spirit (Skinner 1900:224).

EARLY HISTORICAL ACCOUNTS

William Bennett, an archaeologist who studied many areas of Hawai'i in the early part of this century, noted that it was hard to link archaeological finds on the island to individual chiefs and political events due to the incompleteness of the genealogical record:

> Two factors separate the archaeological history of Kauai from the political history: the scarcity and inaccuracy of the genealogies, and the lack of accurate legendary

> knowledge about the ruins and artifacts. Some of the heiaus are said to have been built by such and such a chief, but it has been possible to place few of these chiefs in chronological sequence.

Bennett also noted Kauai's political independence:

> As to actual history the most significant point is that Kauai remained politically independent up to 1824. The island was never conquered, though in 1810 Kaumualii ceded the island to Kamehameha I to prevent an invasion. With the death of Kaumualii in 1824 the independence of Kauai ceased (Bennett 1931:7-8).

At this point, it might be of interest to relate in greater detail the events surrounding and following the cession of Kauai. According to Kamakau:

> By the mid-1700s, Kaumualii had become Ruling Chief of Kaua'i, and the lands of the entire island were his. In 1810 Kaumualii sailed to Honolulu to acknowledge the sovereignty of the King of Hawai'i. It appears that no change took place in the established land tenure as Kaumualii returned to Kaua'i still in charge of his lands. There was a promise on his part, however, that the island would be left eventually to the Kamehameha line.
>
> On the death of Kamehameha I, Liholiho came to Kaua'i to check on the loyalty of Kaumualii. Kaumualii proposed in a formal manner to surrender himself, his island, and all that he had to Liholiho. Bingham (1822:244) recorded the colorful scene: "...Do with them as you please. Place what chief you please as governor here." Liholiho: "...I did not come to take away your island. I do not wish to place anyone over it. Keep your island and take care of it just as you have done, and do what you please with your vessels."
>
> Kaumualii was married to Kaahumanu, one of the strongest political forces in the kingdom. To strengthen the political tie with Kaua'i, she also wed Kealiiahonui, son of Kaumualii. Kaumualii died in May 1824, leaving his Kaua'i lands to the Kamehameha heir. Apparently though, lands in the hands of Kaua'i chiefs were to be administered by them. Sept. 13, 1824, Hoapili wrote from Waimea to Kamehameha II in London: "...Your servant Kaumualii is dead. He left word that Paalua (also known as Kalanimoku, who with Kaahumanu were the two strongest political forces) was to take care of your land..." This indicates Kaumualii fulfilled the land agreement of 1810. The lands were to be held in trust by Kaahumanu and Kalanimoku for Kamehameha II and that those chiefs who had lands would keep them, those who were landless would remain so. This disposition of land brought about the Insurrection of 1824 when landless chiefs attempted to overthrow the forces of Kamehameha II. The revolt brought disaster for all Kaua'i chiefs as they lost their holding to the relatives & retainers of the Kamehameha line, who took over the lands of Kaua'i (Kamakau 1961:269)
>
> Landless Kauai chiefs induced Kaumualii's son Humehume, to join them in revolt; but reinforcements from the other islands under Kalanimoku defeated the insurgents. "...and the loafers and hangers-on (*palaualeo*) of Oahu and Maui obtained the rich lands of Kauai" (ibid.).

Little information can be found to help determine which chiefs obtained land after the uprising. It appears that the Crown and near relatives received the bulk of the lands. The government on Kauai was placed in the hands of Kaikioewa, whose loyalty to the Kamehameha line was unquestioned. Emilia, his wife, became governess after Kaikiowea's death in 1839 and held the post until 1842.

Several early western visitors recorded their impressions of the *ahupua'a* in the vicinity of the project area. These journals and accounts of their visits have proven to be valuable sources of information on the early historical period of Hawai'i. In 1793 Captain George Vancouver landed on Kauai and noted three rivers emptying out into the sea, two at Wailua and one at Kapaa. He wrote that this was "the most fertile and pleasant district of the island" and the "principal residence of the king" (Joesting 1984:50).

Vancouver also estimated the birth of Kaumualii to be in about the year 1780. Tradition tells us that he was born at the birthstones of Wailua Valley (ibid:59).

Wailua is also noted as the ancient capital, although it did not possess an anchorage or landing. It was also known as the residence of Deborah Kapule, a queen, whose home served as a stopping point for travelers on their way to or from Hanalei between 1830 and 1850. This is where the Coco Palms Hotel is presently located (ibid:141).

Handy (1940) describes traditional agricultural land use in the area:

> Coconut planted near sea level throughout; in valley bottoms in Hanamā'ulu ...Wauke planted in inner valley slopes, especially Koolau, *Puna* [emphasis Handy], Kona. Olona; wet median forests from 1,000-2,000' elevation; Koolau and Puna [emphasis Handy] (1940:59).

Farming in the Hanamā'ulu area included the raising of taro, sweet potatoes, breadfruit and coconuts. The Hanamā'ulu stream flows through a broad gulch extensively terraced in olden times. Before the advent of sugar cane, the stream delta was very likely an important area for wet taro cultivation. Upland slopes would have been ideal for planting sweet potato (Handy and Handy 1972).

HEIAU SITES

Bennett briefly describes two *heiau* sites in the Hanamā'ulu area:

> Site 102. Kalauokamanu heiau, in Hanamā'ulu above the present mill. Described by Thrum as "A large walled heiau that stood above the present mill; destroyed about 1855. Of pookanaka class.
>
> Site 103. Dune burials. In the sand dunes that run along the shore half way between Hanamā'ulu and Wailua River are many burials (Bennett 1931:125).

Thrum (1907) lists 124 *heiau* for the island of Kauai, several in the Wailua area:

> **Malae** - Central Wailua - A walled and paved heiau 273 x 324 feet in size of traditional Menehune construction. The place of its altar is pointed out near the center toward the west wall, and around on all sides ran a ledge about six feet wide whereon the people are said to have sat during its ceremonies. The outer walls are yet standing, in good order, from 7 to 10 feet or more in height, its corners buttressed with 13 foot walls. Kapule (Queen Deborah) changed this heiau about 1830, and erected division walls for cattle and calf pens with its inner structures and stone pavements. A portion is now planted in cane.

> **Poliahu** - Upper Wailua - This heiau of medium size is situated within sight of Malae, and was connected with it in its working. In fair condition.
>
> **Holoholoku** - Wailua - Of Pookanaka class, site not identified. Tradition credits this heiau as being the repository, until comparatively modern times, of the first kaeke, or drum, introduced into these islands.
>
> **Hikinaakala** - Wailua Kai - The ruins of this heiau stand along the shore near the south side of the stream, 395 feet long, 56 feet at rear and 80 feet on the front. It shows three distinct divisions paved; the inner section still in fair condition 120 feet in depth. End and S.E. corner walls are 6 feet high and 11 feet thick, of heavy stones. Two large boulders stand near the middle near the division wall of this section. The outer or front section of 80 feet includes a width that runs back beyond the division wall.

In 1934 the *Garden Island Press* newspaper published an article mentioning various *heiau* in the general vicinity of the project area:

> Replete with folklore and legend, the fertile, well-watered lowlands of Wailua-kai were used naturally as the king's seat even into historical times. Remaining monuments of stone, heiaus now largely in ruins, are numerous and of unusual significance throughout this Wailua region.
>
> Passing toward the mountains directly through this grove of swaying cocoanut palms, the traveler comes upon a low hill, Puu-ki, the river-side ridge of which was known to ancient Hawaiians as Ka Lae o ka Manu, the crest of the bird, or Bird Ridge. At the foot of this hill lies the side and the original wall and sacrificial stone of what is quite properly believed to be the oldest heiau on the island of Kauai. Here, it is said, the first human sacrifice ever made on this island was performed, and to this temple was brought the first drum, kaeke, fashioned from the hollowed stump of a cocoanut tree with shark-skin stretched taut over its head.
>
> Also associated with these *heiau* are the Birthstones (Pohaku Hoohanau) adjacent to Holoholoku, the Bellstone near Poliahu, the *puuhonua*, or refuge spot (Hauola) adjacent to Hikinaakala, and the petroglyphs along the southern bank of the river near Hikinaakala.
>
> Another *heiau* located in Hanamā'ulu is Kalauokamanu. This was situated just west of the Lihu'e Plantation Yard and adjacent to a cane haul road. It is said to be of the *pookanaka* class and was destroyed in 1855.

LAND TENURE

In 1848, during the reign of Kamehameha III, the traditional Hawaiian land ownership system was replaced with a more Western-style system. This radical restructuring was called The Great Mahele (division). The Great Mahele separated and defined the undivided land interests of the King and the high-ranking chiefs, and the *konohiki*, who were originally those in charge of tracts of land on behalf of the king or a chief (Chinen 1958:vii and Chinen 1961:13). More than 240 of the highest-ranking chiefs and *konohiki* in the kingdom joined Kamehameha III in this division. The first Mahele was signed on Jan. 27, 1848 by Kamehameha III and Princess Victoria Kamamalu, and by her guardians Mataio Kekuanaoa and Ione Ii. The last Mahele was signed by the King and E. Encka on March 7, 1848 (Chinen 1958:16).

The Mahele did not convey title to any land. The chiefs and *konohiki* were required to present their claims to The Land Commission to receive awards for lands quitclaimed to them by Kamehameha III. They were also required to pay commutations to the government in order to receive royal patents on their awards. Until an award was issued, title remained with the government. The lands awarded to the chiefs and *konohiki* became known as Konohiki Lands. Because there were few surveyors in Hawai'i at the time of the Mahele, the lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This expedited the work of the Land Commission and speeded the transfers (Chinen 1961:13).

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

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

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

The *ahupua'a* of Wailua has 48 listees in the Indices of Awards (Board of Commissioners 1929) and was declared to be Crown Land, "To be the private lands of his majesty Kamehameha III, to have and to hold to himself, his heirs, and successors, forever...1848." These crown lands reverted to the Territory of Hawai'i with the enactment of the Organic Act of 1900, and have since been called Government lands. The present owner is the County of Kaua'i.

The Indices to Land Commission Awards, contains the following awards for Hanamā'ulu:

LCA	Awardee	Acreage
3648	Kala	1.25 Acs 30 rods
3650	Kaluhiwaha	3 roods, 35 rods
3649	Kamalo	1.75 Acs 20 rods
7713	V. Kamamalu	9177 Acs (Ap 2) ahp
3644	Kaualupa	1.25 Acs 23 rods
3558	Keke	3 roods 1 rod
3600	Keolanui	1.75 Acs 30 rods
3653	Kolu	1 Ac 37 rods
5089	Kuhaimoana	3 roods 17 rods
3640	Kumakahaohao	1 Ac 1 rood 12 rods
3271	Lalahilimoku, Leimoku	1 Ac 1 rood 21 rods
3657	Niho	1 Ac 1 rood 13 rods
3423	Paka	1.50 Acs 33 rods
3426	Pelekane	1 Ac 17 rods
3371	Naehu	1.25 Ac 19 rods (Kapaia)
3647	Kapuohi	4 Acs 32 rods (Moala)
3647	Kapuohi	38 rods (Papuaa)

The fourth name on the list, V. Kamamalu, is Victoria, sister of Alexander Liholiho (King Kamehameha IV), Lot Kamehameha (King Kamehameha V), Moses Kekuaiwa, and half sister of Ruth Keelikolani (Board of Commissioners 1929:3). She was awarded Hanamā'ulu Ahupua'a. Whenever *ali'i* procured an entire *ahupua'a*, they were bound to respect the rights of the existing tenants. These tenants, if they filed a claim the Board of Commissioners to Quiet Land Titles, could continue to cultivate and live on their parcels. The following are excerpts from testimonies for awards to individuals in Hanamā'ulu:

LCA 3558 to Keke, Foreign Testimony vol. 13:160
Kaualapa sworn, he has seen...consists of three lois in the ili of Waiaoao and then it also a small kula adjoining. Claimant has also a house lot at Hoeua...Claimant had his land from his friend Pekue in 1846. His house lot he had from Keo. Claimant held a house lot at Opai which was disputed by Keo the Konohiki. Claimant agreed to give him the lot above described at Hoeua.

LCA 3600 to Keolanui, Foreign Testimony vol. 13:153
...in the ili of Palaka and consists of [not listed or illegible] lois and house lot, all family but one piece bounded thus...Claimant had his land from Daniela Oleloa, in the days of good old Kaihiaena & has occupied it ever since without opposition...

LCA 3653 to Kolu, Foreign Testimony vol. 13:151
...it consists of four lois in the ahupuaa of Hanamā'ulu and consists of four loi in the ili of Maulele, with small kula adjoining the kula is not cultivated being exhausted to the depredations of cattle. Claimant has also a house lot in the village of Kamakahanahana which is surrounded by a fence. No. 1 is bounded...Koloa - auwai of Keoki. No. 2 is kula of Kamakahanahana...Claimant had his land from Keo, konohiki, in the days of Kaikioewa had peaceable possession ever since his claim has never been disputed. Keo says I am a luna under Kanoa and know the land and gave the land to Claimant according to the testimony of Keolauui which all true.

LCA 3426 to Pelekane, Foreign Testimony vol. 13:156
....consists of 4 loi and in the ili of Kapuhala. Claimant has also a house lot near the sea shore at a place called Kaho ....Lot 2 (bounded by)...North - fish pond...land from his konohiki Pau soon after Kanoa came to Kauai and occupied it in peace till Keo and became konohiki again in 1849 who took away from Claimant two lois and gave them to Aumoana Keke sworn declares the testimony of Lalahilimoku to be all true. Keo sworn says it is true that Pelekane held and occupied said from lois...

LCA 3371 to Naehu and heirs, Foreign Testimony vol. 13:155
...consists of 10 lois and small kula adjoining on which Claimants house in the ili of Kapaia. Claimamt had his land from his son-in-law Kailihania soon after Kanoa came to Kauai and he occupied it in peace till his death which occurred in 1849. He gave land to his daughter Kaipu.

LCA 3647 to Kapuohi, Foreign Testimony vol. 13:151
...consists of 8 lois and 23 loi not now cultivated. These lois lie in two pieces, being divided koeles [small land unit farmed by a tenant for the chief]. No. 1 contains one loi called Moala in the ili of Waiea. No. 2 contains all the other lois. No. 3 house lot in the ku of Papuaa....Claimant had his land from Pau, the konohiki about 5 years ago. That part of the Claimant's land lying south of the Hanamā'ulu stream had never been disputed to this day. But the land laying on the Wailua side is disputed

by the konohiki. Witness say there never was any dispute about until within the last few days. He says Claimant gave the land to his friend Luakini who held it several years till his death about a year or [missing or illegible] ago when he returned the land to Kapuohi the present Claimant. Papawaa, sworn says, I am a Kamaaina of Hanamā'ulu and know the land of Claimant and never heard of any dispute about the claim till Tuesday last when I heard that Keo disputed it and I believe the testimony of Kupule is all true.

LCA 3271 to Lalahilimoku, Foreign Testimony vol. 13:161
...consists of six lois in the ili of Kuka. Claimants house lot is in the village of Puako...had his land from Daniela Aleloa in the days of Kaikioewa and has occupied it ever since in peace...

LCA 3423 to Paka, Foreign Testimony vol. 13:155
...consists of 8 loi in the ili of Peaiki and small kula adjoing. Claimant also has a house in Peaiki...land from Keo his konohiki in the days of Kaikioewa...

Found in the Land File of the State Archives were various references to Hanamā'ulu:

Interior Dept., Aug. 19, 1862 - In letter from M. Kekuanaoa to W. Webster, informing that the above land which is claimed as belonging to the King has been surveyed and awarded by the Land Commissioner and a Royal Patent issued to V. Kamamalu, &c.

Interior Dept., Aug. 4, 1863 - In letter from H. A. Widemann to Webster, that he had seen his name on a lease to the Lihu'e Plantation for the above lands, which leads him to think he has something to do with Victoria's lands.

Interior Dept., July 20, 1870 - In letter from Paul Isenburg [sic] to J. O. Dominis enclosing a draft for $7250 being the purchase price for the above ahupua'a &c.

Interior Dept., Oct. 4, 1870 - In letter from Duncan McBryde to C.C. Harris, that Mr. Isenburg [sic] has inquired of him if he knew the mauka Boundary of the Crown Land of Wailua that part which adjoins the above ahupua'a lately sold to Lihu'e Plantation. Desiring to know whether the said ahupua'a was held by the late Princess Victoria by Royal Patent according to survey by Pease, or by the Ancient Boundary, &c.

Interior Dept., July 20, 1871 - In letter from E. Krull to the Commissioner of Crown Lands stating that he is holding the Wailua Estate under two leases from the Hawaiian Govt. first from J. Young to Thos. Brown for 99 years & second from Kamehamahea IV, to Hoffschlaeger for 50 years but since a royal patent had been granted to the Lihu'e Plantation for the above ahupua'a containing about 800 acres which is included in his 2 leases & which hampers the pasturage of his cattle, he desires to have said leases cancelled & asking that he be allowed to enter into a new Indenture of lease for the same lands with the exception of the lands granted to said plantation for a term of 25 years at a yearly rate of not more than $300.

Interior Dept., Bk 15 p. 109 - In list of Konohiki lands, showing that V. Kamamalu is owner of the above land & that it has a sea coast frontage of 3.55 miles.

Public Instruction, Jan 24, 1891 - J. K. Burkett to Min of Public Instruction - Have talked with Mr. Wilcox & Mr. Isenberg in regard to a lot for a school house at the above place, &c.

Public Instruction, Feb. 11, 1893 - A. S. Wilcox to Min of Pub Instr Think it best to send a copy of the former survey of the above school lot, as the corner stones have all disappeared & will be difficult to find the exact spot without it &c.

Public Instruction, April 3, 1907 - Registar of Conveyances to Supt. of Publ Inst. Submitting Abstract of Title in re a portion of R.P. 4481, Land Claim Award No. 7718, Ap. 2, Part 7, of land situate at the above tract, Kauai, claimed to be owned by the Lihu'e Plantation Co. Ltd &c. Notes of Survey of School lot in said tract, attached.

Public Instruction, Aug 25, 1909 - Supt of Pub Instr to J.K. Farley To assist the Dept in suggesting valuation of 2.03 acres of school lot at the above tract, valued at $300 per acre &c. Doc's relating therto attached.

Executive Pinkham, Aug 4, 1915 - Commissioner of Public Lands to Governor Pinkham Informing that the Lihu'e Plantation Co, delivers to the Koloa Sugar Co., waters rising & flowing on the above lands, paying a little over $10,000 a year &c.

THE SUGAR PLANTATION

Koloa, Kaua'i was home to the first Sugar Plantation in the islands. A brief history of Lihu'e Plantation Company is presented here, taken from the *Pacific Commercial Advertiser* 50th Anniversary Edition, July 2, 1906:

> Lihu'e sugar plantation is interesting because of its phenomenal success and the many obstacles which have been encountered and overcome all through its progress, and especially during the early years when the sugar industry in Hawai'i was in its experimental stages.
>
> The early records of the plantation show that in 1854 Messrs. Henry Peirce [sic], Wm. L. Lee, Wm. C. Parke, Edwin O. Hall, C. R. Bishop, C. W. Austin, W. H. Bates formed a co-partnership under the name of Henry A. Peirce & Co. whose business should be to plant sugar cane, manufacturing sugar, and all other branches of business theretofore carried on by the proprietors of the said plantation, which indicates that the plantation had been in operation prior to that date. Mr. Rice was the manager. The mill which stood on the present site, was run by water power; the crop amounted to 120 tons of sugar. The plantation store stood near the site of the present manager's residence on the road to Koloa, and was conducted by Mr. Samuel T. Alexander. In front of the store was a large open space surrounded by a grove of koa and kukui trees where natives from all parts of the island congregated on Saturday afternoons, bringing products of all kinds for sale. Wailua produced hau rope; Kapaa was noted for its rush hats and mats, while bullock cart loads of melons were brought from Anahola and Kealia. The taro and sugar cane from Wahiawa was regarded by the natives as especially fine in quality and was in demand for the use of the chiefs not only in Kauai, but in Honolulu as well. The salt produced in the ponds of Makaweli took the color of the soil blown from the land and was regarded as a luxury because of its red tinge. Opihi's from the mountains were then, as today, regarded by Hawaiian epicures as particularly toothsome, and all these staple supplies, foods and delicacies found their way to Lihu'e market.

> It was Mr. Rice who first introduced irrigation on the cane fields in Hawai'i. The average yield of sugar per acre was, at that time, one and one-half tons and was insufficient to make the industry a profitable one, and he conceived the idea of bringing the waters of the Kilohana stream on to the plantation for irrigation, and he built a ditch for that propose. Even with irrigation the outlook for he place was evidently dark, for in 1861 a proposition was considered to abandon the planting of sugar cane. Mr. Paul Isenberg was an employee of the plantation at the time and it was due to his advice and efforts that the proposition to abandon was given up, and planting was continued.
>
> In the year 1862 Mr. Rice died and Mr. Isenberg succeeded to the management of the estate. Mr. Isenberg was a man of strong character, clear foresight and indomitable will and energy, who, by his perseverance and example, not only pulled Lihu'e plantation through difficulties of extraordinary success, but he inspired his neighbors with pluck to plod along to a successful issue against conditions, at times, most discouraging. So great was his faith in the future of the sugar industry in Hawai'i that, when later he had acquired an interest in the plantation, and his proposal to purchase the *Hanamā'ulu* (emphasis the *Advertiser*) lands was opposed by his partners, he entered into an agreement with them whereby any loss which might be incurred in the planting of these lands was to be borne by him individually, whereas any profit arising from the same was to go in as a general realization to the several partners. The tract in question contains 17,000 acres and was bought for $8,500, which price was regarded by some members of the firm as too high.
>
> Men of Mr. Isenberg's discernment rarely err in such matters. It was this purchase which gave to Lihu'e plantation its present water supply, and added thousands of acres of fine cane land....

The Hanamā'ulu lands referred to above were purchased during the sixties. In 1877 Mr. A. S. Wilcox was given a contract to plant the tract on shares; the mill was erected by Lihu'e plantation....and in 1899 Mr. A. S. Wilcox, giving up Hanamā'ulu, the cultivation of that place was taken up by Lihu'e plantation, since which time the two places have been run in conjunction, although the cane of the respective places have been ground at its own mill....Mr. Wolters (manager) succeeded in increasing the crop of the combined places, Lihu'e and Hanamā'ulu, to 18,000 tons (Pacific Commercial Advertiser 1906:60-61).

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APPENDIX H

Cultural Impact Assessment Study Ocean Bay Plantation at Hanamā'ulu, Land of Hanamā'ulu, Līhu'e District, Island of Kaua'i

PHRI, Inc.

October 2001

Report 2182-091501

Cultural Impact Assessment Study
Ocean Bay Plantation at Hanamā'ulu

Land of Hanamā'ulu, Līhu'e District
Island of Kaua'i

Technical Report for Environmental Impact Statement

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

Report 2182-091501

Cultural Impact Assessment Study
Ocean Bay Plantation at Hanamā'ulu

Land of Hanamā'ulu, Līhu'e District
Island of Kaua'i (TMK:4-3-7-3:1;4-3-9-5:5)

Technical Report for Environmental Impact Statement

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Appendix A. Outline of General Informant Interview Content • A-1

EXECUTIVE SUMMARY

This cultural impact assessment study as a technical report for an Environmental Impact Statement (EIS) to be submitted in support of development applications for the proposed Ocean Bay Plantation at Hanamā'ulu golf course and residential development, located on approximately 460-acres in the Land of Hanamā'ulu, Līhu'e District, Island of Kaua'i (TMK:4-3-7-3:1; 4-3-9-5:5). The general purpose is to comply with the requirements of *Chapter 343 (Haw.Rev.Stat.)*, as amended by H.B. No.2895, H.D.1 of the Hawai'i State Legislature (2000) and approved by the Governor as *Act 50* on April 26, 2000, and which among other things requires that environmental assessments (EA) and impact statements (EIS) identify and assess the potential effects of any proposed project upon the "...cultural practices of the community and State...."; more specifically, they should address the issue of potential project impacts upon traditional native Hawaiian cultural uses and practices, in accordance with the OEQC "Guidelines for Assessing Cultural Impacts" adopted in November 1997.

The specific purpose of the present study is to assess the potential impacts of the proposed project upon the cultural resources–the practices, features and/or beliefs–of native Hawaiians or any other ethnic group, that are currently associated with the Hanamā'ulu project area. To accomplish this purpose, several specific objectives were established: (a) identify any native Hawaiian or other ethnic group cultural practices currently being conducted by individual cultural practitioners or groups; (b) collect sufficient information so as to define the general nature, location, and authenticity of any identified cultural practices; (c) assess the potential impacts of the proposed project upon identified cultural practices; and (d) recommend appropriate mitigation measures for any potentially adverse impacts upon identified cultural practices.

The basic study methodology involved contacting and consulting with as many as possible potentially knowledgeable individuals and group representatives. A final revised "List of Potential Informants" included some 56 potential information sources. Of the 56 individuals, some 41 individuals, representing many different groups and organizations, were contacted and consulted. The extent of this effort indicates it likely that the full range of traditional native Hawaiian cultural practices currently associated with the Hanamā'ulu project area has been identified.

Cultural practices identified as currently occurring within and immediately adjacent to the project area appear to be entirely associated with the immediate shoreline area and inshore waters. These practices primarily involve a variety of marine resource exploitation activities and recreational activities. This general finding was not unexpected, given the almost total modification and alteration of the inland portion of the project area by over a century of historic period sugarcane cultivation.

The traditional native Hawaiian cultural practices identified appear to represent only one of two general types of behaviors; i.e., practices with active behaviors involving both observable activities with material results and their implicit inherent values or beliefs. None of the informants contacted explicitly identified any specific examples of the other type of behaviors; i.e., those practices with more passive behaviors which seek to produce nonmaterial results. No potential traditional cultural properties of any kind were identified by any of the contacted informants. The only cultural practice that would seem to be a contemporary practice rather than a traditional and customary cultural practice was the funerary practice of scattering of cremated remains into shoreline waters. A single informant noted this practice.

Based on an evaluation of the traditional native Hawaiian cultural practices identified as currently associated with the Ocean Bay Plantation project area at Hanamā'ulu, and an assessment of the potential impacts of the proposed project upon those identified practices, the present identification study has concluded that the proposed golf course and residential development project–in which the planned development would be done almost entirely within the existing limits of the inland portion of the project area that was previously altered and greatly modified by historic period sugarcane, should have no significant or adverse effect on the existing cultural practices identified as currently associated with the shoreline area and immediately adjacent inshore waters. Given the nature and development limits of the proposed project, and with the specific exception of possible short-term construction period restrictions, the continued exercise of all traditional and customary native Hawaiian rights for access and gathering practices would not in any way be constrained, restricted, prohibited, or eliminated. This conclusion is made with the qualification that public shoreline access for the continuation of the identified cultural practices will remain intact.

PREFACE

The present study, which is the result of work done by PHRI over a four month period beginning in early August 2001, is based largely on contacts and consultations made with potentially knowledgeable individuals and group representatives, with additional information obtained from other readily available documentary sources and previously prepared reports. The general purpose of the study is to comply with the requirements of *Chapter 343 (Haw.Rev.Stat.)*, as amended by H.B. No.2895, H.D.1 of the Hawai'i State Legislature (2000) and approved by the Governor as *Act 50* on April 26, 2000, and which among other things requires that environmental assessments (EA) and impact statements (EIS) identify and assess the potential effects of any proposed project upon the "...cultural practices of the community and State...." More specifically, the purpose of the study is to address the issue of potential project impacts upon current native Hawaiian cultural uses and practices within the Hanamā'ulu project area in accordance with the OEQC "Guidelines for Assessing Cultural Impacts" adopted in November 1997.

The overall rationale that has guided the present study was that the level of study effort should be commensurate with the potential of the proposed project for making any adverse impacts upon any native Hawaiian cultural practices currently conducted by cultural practitioners within the Hanamā'ulu project area. Thus the present identification study is believed to comprise a reasonable approach for the assessment of potential cultural impacts within this specific project area. The potential for the project to result in significant or adverse effects upon any current native Hawaiian cultural practices, beliefs, or features would likely to be minimal or indeterminate; that is, given (a) over a century of historic period sugarcane cultivation of the inland portion of the project area, and (b) mandatory preservation of public shoreline access for purposes of recreation and marine resource exploitation, it was thought very unlikely that the continuation of any current practices would be in any way constrained, restricted, prohibited, or eliminated.

I would like to acknowledge the efforts made by those who have helped achieve the successful completion of the present study within the specific constraints of time and scope. First, I would like to thank the many individuals and group representatives who were contacted by and consulted with our study project team – especially those *kama'āina* and cultural practitioners who shared aspects of their specific knowledge of the Hanamā'ulu project area. Second, I would like to acknowledge the efforts of the other member of our study project team. As a native Hawaiian and a graduate of the Kamehameha Schools, PHRI Cultural Specialist Wanda Pua-Kaipo has taken positive advantage of this opportunity to bring together her two of her many interests – native Hawaiian culture and the management of traditional Hawaiian archaeological resources – and explore how the two elements interact and operate in the everyday world; I believe she has accomplished much in that direction, and I am pleased to find that she has exceeded my expectations with her efforts. I anticipate working together on future projects.

Paul H. Rosendahl
Hilo, Hawai'i

INTRODUCTION

STUDY IDENTIFICATION

At the request of Mr. Jeff Overton of Group 70 International and on behalf of their client, EWM Kaua'i, LLC, Paul H. Rosendahl, Ph.D., Inc. (PHRI) has prepared this cultural impact assessment study as a technical report for an Environmental Impact Statement (EIS) to be submitted in support of development applications to State and County regulatory agencies for the proposed Ocean Bay Plantation at Hanamā'ulu golf course and residential development, located on approximately 460-acres in the Land of Hanamā'ulu, Līhu'e District, Island of Kaua'i (TMK:4-3-7-3:1; 4-3-9-5:5).

STUDY PURPOSE

General Purpose

The general purpose of this cultural impact assessment is to assess the potential impacts of the proposed Ocean Bay Plantation at Hanamā'ulu project on any identified cultural resources in compliance with the requirements of *Chapter 343 (Haw.Rev.Stat.)*, as amended by H.B. No.2895, H.D.1 of the Hawai'i State Legislature (2000) and approved by the Governor as *Act 50* on April 26, 2000. *Chapter 343 (Haw.Rev.Stat.)* was amended by the State legislature because of the perceived need to assure that the environmental review process explicitly addressed the potential effects of any proposed project–i.e., "cultural impacts"–upon the cultural resources of the different groups comprising the multi-ethnic community of Hawaii.

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

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

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

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

There are at least two significant differences that distinguish traditional cultural properties as a subset within the larger sphere of cultural resources. First, while cultural resources such as practices and beliefs may be spatially associated with general types of geographical areas, such as the coastal shoreline and inshore area at Hanamā'ulu, a traditional cultural property is a specific physical entity or feature with a definable boundary, such as a specific location on a point on the Hanamā'ulu shoreline. Second, while cultural resources such as practices and beliefs can include general cultural behaviors such as the gathering of various plants for general subsistence or ceremonial uses, a traditional cultural property is a specific

place or feature directly associated with specific behaviors the continuity of which over time, in either actual practice or remembrance, can be demonstrated.

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

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

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

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

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

Specific Purpose and Objectives

The specific purpose of the present cultural impact assessment study is to assess the potential impacts of the proposed Ocean Bay Plantation at Hanamā'ulu project upon the cultural resources–the practices, features and/or beliefs–of native Hawaiians or any other ethnic group, that are associated with the 460-acre Ocean Bay Plantation at Hanamā'ulu project area. To accomplish this purpose, several specific objectives were established:

1. Identify any native Hawaiian or other ethnic group cultural practices currently being conducted by individual cultural practitioners or groups;
2. Collect sufficient information so as to define the general nature, location, and authenticity of any identified cultural practices;
3. Assess the potential impacts of the proposed project upon identified cultural practices; and
4. Recommend appropriate mitigation measures for any potentially adverse impacts upon identified cultural practices.

Thus, the overall goal or objective of the present cultural impact assessment study is to identify any native Hawaiian or other cultural practices currently being conducted within the 460-acre Ocean Bay Plantation at Hanamā'ulu project area that might potentially be in some manner constrained, restricted, prohibited, or eliminated if the proposed project were to be constructed. The types of practices to be identified would be inclusive; that is, claims for all three types of practices–traditional cultural property, traditional and customary cultural practices, and contemporary cultural practices–would be identified and considered.

CULTURAL IMPACT ASSESSMENT AND OEQC GUIDELINES

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

Background

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

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

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

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

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

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

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

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

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

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

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

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

Discussion

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

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

1. How would project-specific determinations be made as to whether or not a cultural impact assessment study might even be necessary or appropriate–given the specific nature and location of a proposed project;
2. If a cultural impact assessment study is to be conducted, how does one determine what constitutes an appropriate project-specific level of effort – that is, the general scope of work or objectives for the study, and the specific tasks or activities required to accomplish successfully the scope of work or objectives;
3. What criteria are to be used for determining the credibility and reliability of potential cultural information sources (generally referred to as "informants" or "knowledgeable individuals");
4. If specific cultural practices, beliefs, or features are definitely identified as being associated with a project area, what criteria are to be applied for evaluating (a) the descriptive adequacy and (b) the cultural authenticity of the identified practices, beliefs, or features;
5. If specific culturally authentic practices, beliefs, or features are definitely identified as being associated with a project area, what criteria are to be used for assessing the nature and extent of potential impacts of a proposed project on the identified practices, beliefs, or features–that is, "no effect," "no adverse effect," or "adverse effect;"
6. If a project is determined to have potentially adverse impacts upon specific identified culturally authentic practices, beliefs, or features, what criteria are to be used for evaluating the adequacy and appropriateness of alternative potential mitigation actions;
7. Within the purview of what regulatory office or agency would the review and acceptance or rejection of a completed cultural impact assessment study legitimately fall; and

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

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

PRESENT STUDY SCOPE

Level of Study Effort and Rationale for Study Approach

The scope of work and methodology for the present cultural impact assessment are based on the general assumption that the level of study effort appropriate in any project-specific context should involve the consideration of several factors, the most relevant of which are the following: (a) the probable number and significance of known or suspected cultural properties, features, exploitable natural resources, practices, or beliefs within or associated with the specific project area; (b) the potential number of individuals (potential informants) with cultural knowledge of the specific project area; (c) the availability of historical and cultural information for the specific project area or immediately adjacent lands; (d) the physical size, configuration, and natural and human modification history of the specific project area; (e) the present or recent modern land use of the specific project area; and (f) the potential effects of the project on known or expected cultural properties, features, practices, exploitable natural resources, or beliefs within or related to the specific project area.

Consideration of these factors within the specific nature and context of the proposed 460-acre Ocean Bay Plantation at Hanamā'ulu project, as well as consultation with professional staff in the State Historic Preservation Division-History and Culture Branch, indicated that the appropriate level of study for an adequate assessment of potential cultural impacts would be a relatively lesser level of study effort that could be characterized as an identification study. The distinctive characteristics of an identification study are that it would be limited to (a) the identification of native Hawaiian or other ethnic group cultural practices, beliefs, properties, features, or exploitable natural resources associated with and/or present within or related to the specific project area that are currently being conducted by and/or known to individual cultural practitioners or groups, and (b) the collection of information reasonably sufficient so as to define the general nature, location, and likely authenticity of identified cultural claims.

An identification study would not involve the considerably greater level of study effort–both calendar months and hours of labor–needed to carry out what could be characterized as a full documentation study. The distinctive characteristics of the latter, which would commonly be referred to as a full ethnographic or oral history study, would be (a) the collection of detailed information regarding identified native Hawaiian or other ethnic group cultural practices by means of formal oral history interviews which are usually tape recorded and transcribed, and (b) the analysis and synthesis of all collected data – from interviews, as well as relevant historical documentary and archival research–within the general cultural-historical context of traditional native Hawaiian or other ethnic group culture and the defined specific geographical area of a specific project.

The overall rationale guiding the present identification study has been that the level of study effort should be commensurate with the potential of the proposed project for making any adverse impacts upon any native Hawaiian or other ethnic group cultural practices currently conducted by cultural practitioners within the project area. The identification study presented here is believed to comprise a reasonable approach for the assessment of potential cultural impacts within this specific project area. The potential for the project to result in adverse impacts upon any current native Hawaiian or other ethnic group cultural practices, beliefs, or features would seem likely to be minimal or indeterminate; that is, given the past land use history of the project area and the general nature of the proposed project, it is very unlikely that the continued exercise of any current practices would be in any way constrained, restricted, prohibited, or eliminated.

Because the project is believed unlikely to have any determinable adverse impacts on any current native Hawaiian or other ethnic group cultural practices associated with Ocean Bay Plantation at Hanamā'ulu project area, the level of study effort comprising the present identification study is believed sufficient.

Adequate evaluation and documentation of such practices for the present study do not require intensive ethnographic studies that would document the specific details of each identified cultural practice. Neither are exhaustive efforts needed to evaluate the authenticity of identified cultural practices, or to determine whether such practices represent traditional and customary cultural practices or more recently established contemporary cultural practices. Whatever the nature of any current native Hawaiian or other ethnic group cultural practices associated with the Ocean Bay Plantation at Hanamā'ulu project area, the proposed project, as currently conceived, should not be likely to significantly affect the continuation of such practices.

Study Scope and Tasks

An action plan was initially prepared for providing overall direction to the conduct of the cultural impact assessment identification study. This action plan included the following tasks:

1. Project team members assemble preliminary working lists of potential contacts, informants, and information sources (groups and individuals);
2. Compare preliminary lists and assemble prioritized final list of potential contacts, informants, and information sources;
3. Review final list with client and client representatives;
4. Conduct limited background review of readily available historical and cultural documents and reports;
5. Make initial contacts with potentially knowledgeable informants;
6. Conduct initial communications, meetings, and/or informal interviews with potentially knowledgeable informants;
7. Review and evaluate initial findings, and develop revised list of principal knowledgeable informants and cultural practice associations;
8. Select principal knowledgeable informants with whom subsequent formal oral history interviews would be appropriate for documentation purposes;
9. Develop outline of general informant oral history interview topic areas for subsequent formal oral history interviews; and
10. Prepare cultural impact assessment identification study report.

Project Personnel and Roles

The identification study project team consisted of two individuals: PHRI Cultural Specialist Wanda Hoke Pua-Kaipo, and PHRI Principal Paul H. Rosendahl. Initial potential contact lists were formulated, compared, and finalized, and project team members were assigned primary responsibility for attempting to contact specified potential informants. The list was continually revised and expanded, as potential informants were contacted, information was obtained, and the contacted individual in turn suggested additional referrals to be contacted. The list eventually stabilized as contact referrals became largely repeated and new names became rare. The majority of the contacts were made, and information obtained, by Mrs. Pua-Kaipo. While repeated attempts were made to contact all individuals placed on the revised list of potential informants, a few did not respond to repeated attempts or could not be contacted at all.

The present identification study report was prepared by Dr. Rosendahl, with the assistance of Mrs. Pua-Kaipo. Mrs. Pua-Kaipo was primarily responsible for preparing the sections dealing with (a) study methodology--particularly that portion dealing with potential informants contacted, (b) identification of native Hawaiian practices associated with the Hanamā'ulu project area, and (c) the broader issues and concerns of the local Hawaiian community, while Dr. Rosendahl assumed primary responsibility for preparation of most of the other sections of the report, including (a) the introduction, background, and study approach and rationale, and (b) the conclusions. The sections that summarize the background and nature of the proposed project overall, and the historical background for the project area were largely adapted from existing sources.

STUDY METHODOLOGY

Guidance Documents

Several references were utilized as basic guidance documents for the conduct of the present cultural impact assessment identification study. The principal sources were the following:

1. The OEQC *Guidelines for Assessing Cultural Impacts* (OEQC 1997);
2. The *Native Hawaiian Rights Handbook* (MacKenzie 1991), and more specifically the discussions of traditional and customary rights contained in the two chapters on access rights (Lucas 1991a) and gathering rights (Lucas 1991b);
3. The *Report on Native Hawaiian Traditional and Customary Practices Following the Opinion of the Supreme Court of the State of Hawai'i in Public Access Shoreline Hawaii v. Hawai'i County Planning Commission* prepared by the PASH/Kohanaiki Study Group (1998);
4. The text of several relevant decisions of the Hawai'i Supreme Court, including the decision commonly referred to as the "PASH decision" (1995), and the decisions in State of Hawai'i v. Alapa'i Hanapi (1998) and Ka Pa'akai o Ka 'Aina et al. v. Land Use Commission, State of Hawai'i et al. (2000);
5. The federal regulations of the Advisory Council on Historic Preservation for the *National Register of Historic Places* (CFR 1981) and the *Protection of Historic Properties* (CFR 1986);
6. National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1990); and
7. Recent versions of the State Historic Preservation Division (SHPD) draft administrative rules, including Chapter 275: *Rules Governing Procedures for Historic Preservation Review for Governmental Projects Covered Under Sections 6E-7 and 6E-8, HRS* (DLNR 2001a), Chapter 284: *Rules Governing Procedures for Historic Preservation Review to Comment on Chapter 6E-42, HRS, Projects* (2001b), and Chapter 284--*Rules Governing Procedures for Ethnographic Inventory Surveys, Treatment of Traditional Cultural Properties, and Historical Data Recovery* (DLNR n.d.).

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

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

In the absence of any formally adopted administrative rules, SHPD can also be said to basically follow the federal regulations of the Advisory Council on Historic Preservation for guidance in the evaluation of significance--as contained in Section 60.4 ("Criteria for evaluation") of the "National Register of Historic Places" (CFR 1981), and for guidance in the assessment of potential effects--as contained in Section 800 9 ("Criteria of effect and adverse effect") of the "Protection of Historic Properties" (CFR 1986).

Information Sources

The principal sources of information utilized for this study were various individuals identified in the List of Potential Informants (*Table 1*). An effort was made to identify and contact individuals potentially knowledgeable of the project area with regard to traditional cultural properties, traditional and customary cultural practices, and/or contemporary ("neo-traditional") cultural practices. Potentially knowledgeable individuals were evaluated by means of an initial contact and preliminary interview to determine which–if any–individuals had site-specific knowledge and might be candidates for formal ethnographic interviews.

The Project Team formulated an initial list of potential informants. An attempt was made to identify as many potential informants as possible. This list was comprised of individuals associated with State agencies, associations, community groups, Hawaiian Civic Clubs, *hālau hula* (*hula* schools), as well as individuals from a wide number of backgrounds and expertise. Individuals contacted were asked to provide referrals and, based on this networking; the initial contact list was expanded to include 55 individuals. Given the limited time frame, a conscious effort was made to contact as many people as possible within the Hawaiian community on Kaua'i. A special effort was made to contact *kūpuna* (elders), other knowledgeable individuals, and cultural practitioners, such as *kumu hula* (*hula* teachers), cultural specialists, teachers, and crafts people.

Additional sources of information consulted were prior archaeological reports and maps of the general Hanamā'ulu, Līhu'e, and Wailua areas. No new or additional historical documentary work was done

Summary of Potential Informants Contacted

A final List of Potential Informants contacted for the present study is contained in *Table 1*. Numerous attempts were made to contact everyone on the Potential Informant List. Repeated attempts were made either by phone or through intermediaries. Attempts were made to follow up on all leads that were given. Those people not successfully contacted are indicated as such and these names remain on the list to show the broad spectrum of people for whom contacts were attempted. All informant interviews were done informally by telephone, and written notes were kept. A previously prepared outline of general informant interview topics was utilized for general interview guidance (see *Appendix A*, at end). For the present study, all informants were contacted by phone; no formal taped interviews were done for this identification study.

The informants represented diverse backgrounds and community groups, and included various ethnicities in addition to native Hawaiians. Their expertise included, but was not limited to, cultural resource specialists, historians, researchers, *kumu hula*, and *kūpuna*. Any potential informant who might have had an interest in the area, use the area or have site-specific knowledge of the project area was also included in the study. Of the 56 informants included in the final revised "List of Potential Informants," a total of 41 informants were contacted and 15 were unsuccessfully contacted. Virtually every one of the 41 contacted individuals was able to provide one or more referrals. Of the 41 individuals contacted, four were unable to provide any useful information; 26 provided limited general and cultural information; and 11 provided useful information specific to the project area and have potential for follow-up and/or possible interviews. None of the informants contacted were able to provide more detailed information regarding usage, folklore, and cultural practices within or immediately adjacent to the project area. Several of these last 11 informants have good interview potential, and consideration for interviews and further follow-up is recommended. Also, Of the 15 potential informants that not successfully contacted, three were reported by other informants as being knowledgeable; i.e., having good interview potential, and are recommended for follow-up.

Following are brief profiles of informants identified and evaluated as knowledgeable individuals and who are recommended as potential candidates for more detailed formal oral history interviews that would record the cultural practices and beliefs associated with project. These individuals were selected because of their site-specific knowledge of the Hanamā'ulu project area, knowledge of local place names and folklore, family ties to the area and/or their use of project area for cultural purposes.

Stanley Kaluahine – Retired from a career in the Marines and as General Manager for Princeville, Stanley currently resides in Kapa'a. He grew up living at Hanamā'ulu Beach with his dad and family. Stanley and his *'ohana* fished from Hanamā'ulu Bay to Ha'ena throughout his early years, and still occasionally fish Hanamā'ulu Bay.

Table 1. List of Potential Informants

	Name	Contact: None	Contact: WPK	Contact: PHR	Expertise	Potential	Affiliation	Additional Comments
1	Ako, Val	-	◆	-	NH,C/P	2/R	LR	Brother of Kino Kanahenui (Kona, Hawaii Island)
2	Bekaert, Dolly	-	◆	-	PE	0	ALC	Amfac Land Manager
3	Blake, Hartwell	◆	-	-	LGL	0	CK	Kauai County Council Attorney
4	Burgess, Stella	-	◆	-	NH	0/R	LR	Cultural Director, Hyatt Poipu Hotel
5	Durant, John	◆	-	-	NH	0	LR	Nephew to Leopold Durant
6	Durant, Leopold "Butch"	-	◆	-	NH	2	LR	
7	Durant, Roland	◆	-	-	NH	0	LR	Son to Leopold Durant
8	Furukawa, Mike	-	◆	-	PE	1/R	GFP	Grove Farms; former Amfac Property Manager
9	Gomes, Stephen	-	◆	-	PE	1/R	LR, ALC	Retired Amfac Irrigation Superintendent
10	Hashimoto, Annie	◆	-	-	NH	0	KHCC	Hawaiian Civic Club
11	Hong, Walton D.Y., Esq	-	-	◆	LGL	R	LR	Project attorney for EWM Kauai, LLC
12	Ishimoto, Hisao	-	◆	-	PE	1/R	LR	Retired Amfac Land Division employee
13	Kahelekomo, Janet	-	◆	-	NH	1/R	LR	Lionel Kachi's sister
14	Kalilikea, Sarah	◆	-	-	NH	3	LR	Nawiliwili resident
15	Kaliloa, Annie	-	◆	-	-	0	LR	
16	Kaluahine, Stanley	-	◆	-	NH	3/R	LR	Retired General Manager, Princeville
17	Kane, Dirge	-	◆	◆	NH	2	LR	Possible burials information
18	Kane, Pomai	-	-	◆	NH	2	LR	Wife of D Kane
19	Kachi, Lionel	-	◆	-	NH	1/R	KHCC,LR	Kaumualii Hawaiian Civic Club
20	Kachi, Lydia	-	◆	-	NH	1/R	KHCC,LR	Wife of Lionel Kachi
21	Kapeka-Arboles, LaFrance	-	◆	◆	NH	3/R	LR, OHA, KAHBC	OHA Kauai Office Coordinator
22	Kauka, Sabra	-	◆	-	NH,CRS	1/R	HHHI, HKP, HK	
23	Kelekoma, Alika	-	◆	-	NH,PE	3/R	LR	
24	Kelekoma, Clay	-	◆	-	NH	0/R	LR	
25	Kilau, Charlie	◆	-	-	NH	3	LR	No phone
26	Kilau, Lily Pia	◆	-	-	NH	3	LR	No phone
27	Kilau, Walter	-	◆	-	NH	1/R	LR	
28	Kikuchi, Bill	-	◆	-	HPS	0	KCC	Anthropology/Archaeology Professor
29	Leite, Shirley Matsushima	-	◆	-	NH	3/R	past LR	Mother is Rego family; sister to Lester and Joyce Matsushima
30	Lovell-Obatake, Cheryl	-	◆	-	NH, C/P, CRS	3/R	KAHBC, LR, HPL, HHC, CAC	Former KAHBC member
31	Madrid, Angel	◆	-	-	PE	0	LR	Former Amfac Land Division employee
32	Maly, Kepa	-	◆	-	CRS, HDR	O/R	KPA	Cultural Specialist, former Kauai resident; local family ties thru wife
33	Matsushima, Lester	-	◆	-	NH	3	LR	Burials information, Rego family
34	McEldowney, Holly	-	-	◆	CRS, EHST, HDR HPS	0/R	SHPD	Cult./Hist. Staff
35	McKeague, Kawika	-	◆	◆	NH, PLN	1/R	G70	G70 employee; nephew of Nani Rogers
36	McMahon, Nancy	-	-	◆	HPS	0/R	LR,SHPD	Kauai staff archaeologist
37	Moniz, Elodie	-	◆	-	PE	0/R	LR	Amfac employee (38 years)
38	Morikawa, Cindy Kilau	◆	-	-	NH	3	LR	Husband Yasu is fisherman, Kilau family fished area
39	Morikawa, Wendy	◆	-	-	NH	0	LR	Sister to Yasu Morikawa
40	Morikawa, Yasu	◆	-	-	NH	3	LR	Local shoreline fisherman
41	Nagao, Alan	-	◆	-	C/P	2/R	LR	Fisherman; Hanama'ulu resident
42	Nalone-Salvador, Lurline	-	◆	-	NH,CRS	0/R	KS	
43	Oana, Stanley	-	◆	-	NH	2/R	LR, HBC, MOH	Hanama'ulu resident
44	Panui, Margaret	◆	-	-	NH	0	LR	
45	Pia, John	-	◆	-	NH	3/R	LR, AACE	Brother to Lily Pia Kilau
46	Pratt, David	◆	-	-	PE	0	GFP	Grove Farms
47	Rayno, Peter	-	◆	-	PE	3/R	LR	Retired Amfac employee
48	Rego, Bobby	-	◆	-	NH	2/R	LR	Uncle to Lester and Joyce Matsushima
49	Rego, John	◆	-	-	NH	0	LR	245-2240 (h7)
50	Rogers, Nani	◆	-	-	NH	0	LR	Aunt to Kawika McKeague
51	Santa, Eddie	-	◆	-	PE	3/R	LR	Hanamaulu Valley resident, retired Amfac employee
52	Sasaki, Joyce Matsushima	-	◆	-	NH	3/R	LR	Mother is Rego family, sister to Lester Matsushima and Shirley Leite
53	Wann, Presley	-	◆	-	NH	1	LR,KAHBC	Wailua area
54	Youn, Avery	-	◆	-	NH,PLN	1/R	LR	Architect, extensive work at Nukolii, past County Planning Director
55	Youn, Healani	-	◆	-	NH, KH	1/R	LR	Past Ms. Aloha Hula; sister to Avery Youn, kumu hula
56	Yoshida, Laurie	-	◆	◆	CR	R	LR,SP-LY	Community relations advisor to EWM Kauai, LLC

Table 1. (Cont.)

KEYS

Expertise:	C/P	Cultural Practitioner
	CRS	Community Relations
	CRS	Cultural Resources Specialist
	HDR	Historical Documentary Researcher
	HPS	Historic Preservation/Cultural Resources Management Specialist
	LGL	Legal (Attorney)
	NH	Native Hawaiian
	PLN	Planner
	PE	Plantation Employee
Potential:	0	None
	1	Limited information; possible follow-up contact
	2	Useful information; probable follow-up contact
	3	Good information; definite follow-up; potential formal interview informant
	R	Provided referral(s) to other potential informants and/or information sources
Affiliation:	AACE	Anahola Ancient Cultural Exchange
	ALC	Amfac Land Company, Limited
	CAC	Citizen Advisory Committee
	CK	County of Kauai
	DLNR	Department of Land and Natural Resources
	G70	Group 70 International
	GFP	Grove Farm Properties
	HBC	Hanama'ulu Beautification Committee
	HK	Hale Kupono
	HOP	Hooulu Ka Ola Na Pua
	HNH	Hui Naauao o Hawaii Nei
	HPL	Hawaii Patriotic League
	HRP	Hyatt Regency Poipu Hotel
	KHCC	Kaumualii Hawaiian Civic Club
	KCC	Kauai Community College
	K/NIBC	Kaua'i/Ni'ihau Islands Burial Council
	KPA	Kumu Pono Associates (Hilo)
	KS	Kamehameha Schools
	LR	Local Resident
	MoH	Malama-o-Hoopii
	NWC	Nawiliwili Watershed Council
	OHA	Office of Hawaiian Affairs
	OK	Onipaa Kaelia
	PLN	Planner
	SHPD	State Historic Preservation Division (DLNR)
	SP-LY	Successful Planning-Laurie Yoshida
Other:	PHR	Paul H. Rosendahl (PHRI)
	PHRI	Paul H. Rosendahl, Ph.D., Inc
	WPK	Wanda Pua-Kaipo

LaFrance Kapaka-Arboles – Kaua'i Office Coordinator for the Office of Hawaiian Affairs, LaFrance was raised by her grandmother, Helen Kapaka, in Hulē'a Valley. *Tutu* Kapaka was a practitioner of *ho'oponopono*. Through this practice, LaFrance became acquainted with many of the old time families of the Hanamā'ulu area.

Cheryl Lovell-Obatake – Raised in Nāwiliwili, Cheryl manages kuleana land in Nāwiliwili, Kalapaki and Niumalu. She is former Chair of the Kaua'i/Ni'ihau Island Burial Council, and current Chair of the Nāwiliwili Watershed Council. Cheryl was also a member of the Citizen Advisory Committee and participated in many meetings involving the Kaua'i General Plan, particularly Chapter 3, which deals with caring for land, water and culture. Both Cheryl and her 'ohana fish the shoreline along the project area.

Lester Matsushima – Lester was born and raised in Hanamā'ulu, as were his parents. He worked for the plantation and pineapple canneries before leaving Kaua'i to join the Air Force. He returned to Kaua'i after retiring from the military, and worked for Federal Civil Service Air Defense at Kōke'e, from which he is currently retired. Lester's great grandfather, Wahinealohakeo, was the last konohiki from the Hanamā'ulu Bay area.

John Pia – Born and raised in Hanamā'ulu, John retired as a construction heavy equipment operator and supervisor for E.F. Nielson & Aina Site. John and his wife, Suzanne, currently operate the non-profit Anahola Ancient Cultural Exchange summer program for Hawaiian kids utilizing *kūpuna*. John's sister Lily, who is in her 60s, still currently gathers 'opihi from the project area shoreline, and Lily's family also actively fishes the area.

Eddie Sarita – A member of the Hanamā'ulu Beautification Committee, Eddie grew up in Hanamā'ulu in the 1950s and 1960s. He worked for 25 years with Amfac, and is currently the Manager of Kaua'i Convention Center. Eddie remembers the Hanamā'ulu area in great detail, and particularly fishing practices from his younger years.

OCEAN BAY PLANTATION AT HANAMĀ'ULU PROJECT

PROJECT SETTING AND BACKGROUND

The Ocean Bay Plantation project area consists of c. 460 acres of former sugarcane lands located in the Land of Hanamā'ulu in the District of Līhu'e on the Island of Kaua'i (*Figure 1*). It is bound on the south by Hanamā'ulu Bay; on the east by the Pacific Ocean; on the west by the Hanamā'ulu-Ahukini Cut-off Road and Kuhio Highway, and on the north by Kaua'i Beach Road. Virtually all of the project area was under sugarcane cultivation for more than a century, but has stood abandoned and overgrown since sugarcane cultivation was discontinued approximately fifteen to twenty years ago.

The terrain within most of the project area is generally level. Koloa series soils (Foote et al. 1972) are present immediately inland of the coastline; these soils developed in material weathered from basic igneous rock, and overlie hard rock. Four general types of the Koloa series soils are present: Lihu'e silty clay (0-8% slopes), Lihu'e silty clay (8-15% slopes), Lihu'e gravelly silty clay (0-8% slopes), and Koloa stony silty clay (15-25%).

There are three general types of soil present within the immediate coastline: area: Rough Broken Land, Rock Outcrop, and Beaches (Foote et al. 1972). The Rock outcrop land consists of exposed basalt and andesite bedrock, which covers more than 90% of the surface (Foote et al. 1972). Within the southern half of the project area, the lands classified as Beaches are composed solely of basalt cobble and boulder areas that are constantly awash with waves. Present within the coastal flats at the northeast corner of the project area are three general types of soil: Mokulē'ia fine sandy loam, Koloa stony silty clay (8-15% slopes), and Beaches. Within the coastal flats, the land classified as Beaches is composed of light-colored sands derived from coral and seashells.

Rainfall in the general vicinity of the project area ranges between 40-50 inches per year, and the mean annual temperature in the project area vicinity ranges from 70-75 degrees F (Armstrong 1983:63). Vegetation in the immediate coastline and the coastal flats at the northeast corner of the project area, adjacent to the existing beach access road, consists mainly of ironwood (*Casuarina equisetifolia* L.), *naupaka-kahakai* (*Scaevoloa sericea* Vahl), introduced grasses, and tree heliotrope (*Heliotropium anomalum* H. & A. var. *argenteum* Gray). Because the section of land inland of the Radisson Kauai Beach Resort Hotel is a low-lying drainage, or intermittent wetland sometimes containing standing water, vegetation in this area includes various reeds, sedges, grasses, and *hau* (*Hibiscus tiliaceus* L.). Present within this area are three general types of soils: Mokuleia clay loam (poorly drained variant), Lihu'e silty clay (25-40% slopes, eroded), and Hanalei silty clay (0-2% slopes) (Foote et al. 1972). Hanalei series soils are generally suitable for taro, pasture, sugarcane, and vegetable crops, and Hanalei silty clay (0-2% slopes) specifically "...occurs on stream bottoms and flood plains" (Foote et al. 1972:38). Lihu'e series soils are generally suitable for irrigated sugarcane, pineapple, pasture, and orchards (Foote et al. 1972:82).

The area inland of the county parkland appears to have been modified sometime in the past, as evidenced by the presence of secondary growth species such as *koa-haole* (*Leucaena glauca* (L.) Benth.) and Indian Pluchea (*Pluchea indica* [L.] Less.). Present within this area are general types of soil: Mokuleia clay loam (poorly drained variant), Lihu'e silty clay (25-40% slopes, eroded), Lihu'e gravelly silty clay (8-15% slopes), and Fill Land (Foote et al. 1972). Fill Land "...consists of areas filled with material from dredging, excavation from adjacent uplands, garbage, and bagasse and slurry from sugar mills. Generally, these materials are dumped and spread over marshes, low-lying areas along the coastal flats, coral sand, coral limestone, or areas shallow to bedrock" (Foote et al. 1972: 31).

Paul H. Rosendahl, Ph.D., Inc. (PHRI) recently completed an archaeological inventory survey for the Ocean Bay Plantation at Hanamā'ulu project (Corbin et al. 2001). The basic objective of the survey was to provide information sufficient for (a) preparation of an Environmental Impact Statement for the proposed development of the project site, and (b) compliance with the regulatory review requirements of the Hawai'i State Historic Preservation Division (SHPD) and the County of Kaua'i. The current survey report (Corbin et al. 2001) is a revised and upgraded version of an earlier PHRI report (Walker et al. 1991). The present Hanamā'ulu project area had been previously surveyed in 1990 by PHRI for an EIS that was to have been prepared in connection with AMFAC/JMB Hawaii, Inc.'s Lihu'e/Puhi/Hanamā'ulu Master Plan Project.

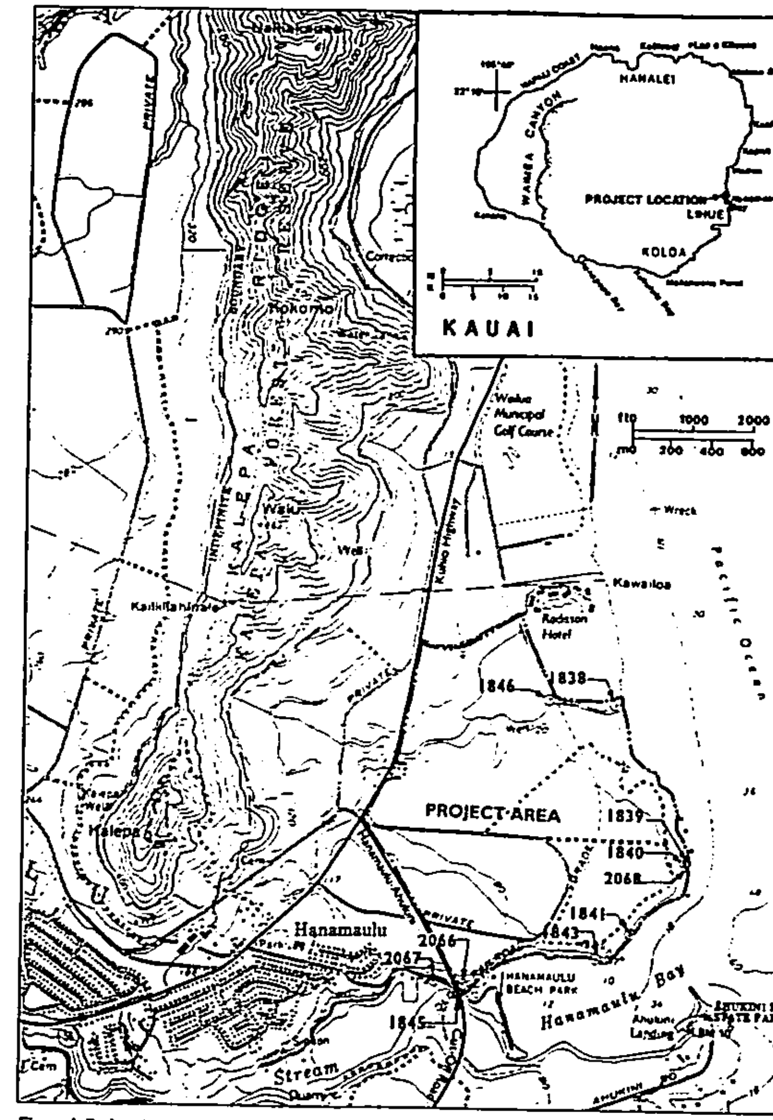

Figure 1. Project Area and Site Location Map.

The 1990 inventory survey included virtually the entire current project site. The 1990 inventory survey report (Walker et al. 1991) was completed but was never submitted to SHPD for formal review. In June 2001, PHRI consulted with Dr. Ross Cordy, SHPD Archaeology Branch Chief, regarding the prior 1990 field survey and report, and formulated the specific tasks needed to upgrade the prior survey and report as appropriate for the Ocean Bay Plantation at Hanamā'ulu project. PHRI then proceeded with the appropriate supplemental fieldwork in August 2001, and subsequently revised and upgraded the earlier report to the current version (Corbin et al. 2001).

Four site complexes and six single-feature sites were identified within or in the immediate vicinity of the Ocean Bay Plantation at Hanamā'ulu project area. (See *Figure 1* for location of sites.) The sites and complexes were composed of a variety of formal feature types. The most common feature types were bridges (two), cultural deposits (two), and cemeteries (one, possibly two). Other feature types in the area included concrete foundations, a retaining wall, and a terrace. Transportation constituted one-quarter of the functional site types. This function was almost certainly connected to the sugarcane production and distribution that took place in the area. Temporary and possible permanent habitation constituted one-half of the functional types. These related to the prehistoric use of the project area for habitation at the coast, doubtless for the procurement of marine resources.

Of the ten sites identified within or immediately adjacent to the Ocean Bay Plantation at Hanamā'ulu project area, six were assessed as significant for information content, and no further work or preservation was recommended (Sites 1838, 1839, 1840, 1841, 1843, 2068). One site (Site 1845), a historic concrete railroad bridge, was assessed as significant under multiple criteria, and further data collection followed by preservation with some level of interpretive development was recommended. Another concrete bridge site (Site 1846) was also assessed as significant under multiple criteria, and further data recovery in the form of limited historical research without subsequent preservation was recommended. Site 2066, a complex with a distinctive upright basalt boulder, was recommended for further data recovery in the form of limited historical research and possible preservation. Site 2067, a historic cemetery located just outside the current project area, was recommended for preservation "as is" and would be avoided and protected during project development.

PROJECT DESCRIPTION

[Note: The following summary has been adapted from the Environmental Impact Statement Preparation Notice (EISPN) published in the September 8, 2001 issue of the OEQC bulletin, *The Environmental Notice*.]

The applicant, EWM Kaua'i, LLC, proposes to develop the 460-acre property as a mixed-use residential and golf course community. The low-density master-planned community would maintain the open space character and sense of place of the surrounding area, and would include large open-space buffer areas along the coastline, the existing wetland, and the existing highway. Proposed for the project area single and multi-family residential lots, an 18-hole golf course and associated clubhouse facility, and a small-scale commercial center. Project implementation is anticipated to be phased over a 10-15 year period, with initial site clearing, grading, and infrastructure tentatively scheduled to begin in 2003. The golf course and clubhouse, and a portion of the single family residential lots would be developed during the first two years, while the remaining single and multi-family lots would be incrementally developed over the following 5-10 years.

SUMMARY OF HISTORICAL DOCUMENTARY RESEARCH

[Note: The following summary has been adapted from Kalima and Smith 2001.]

Hanamā'ulu is mentioned in *Olelo No'eau*, a book of Hawaiian sayings and epithets:

> *No Hanama'ulu ka ipu puehu.*
>
> (The quickly emptied container belongs to Hanamā'ulu.)
>
> Said of the stingy people of Hanamā'ulu, Kaua'i - no hospitality there. At one time, food containers would be hidden away and the people of Hanamā'ulu would apologize for having so little to offer their guests (Puku'i 1983: No. 2230).

Hanamā'ulu translates literally as "tired (as from walking) bay," and it is said to be the birthplace of the hero Kawelo (Puku'i et al. 1974). Few legendary sources refer specifically to Hanamā'ulu; what legendary information exists is indirect and primarily concerns the nearby *ahupua'a* of Wailua. In a report by Cox (1977) on Wailua, the author emphasized that Wailua was a place of central importance on the island and the major religious center for the *ali'i nui* of the island (Cox 1977:4).

Handy (1940) describes traditional agriculture in the Hanamā'ulu area:

> Coconut planted near sea level throughout; in valley bottoms in Hanamā'ulu... *Wauke* planted in inner valley slopes, especially Koolau, Puna (1940:59).

Farming in the Hanamā'ulu area included raising taro, sweet potato, breadfruit and coconuts. Hanamā'ulu Stream flows through a broad gulch extensively terraced in olden times. Before the advent of sugar cane, the stream delta was very likely an important area for wet taro cultivation. Upland slopes would have been ideal for planting sweet potato (Handy and Handy 1972).

Archaeologist W.C. Bennett briefly describes two *heiau* in the Hanamā'ulu area:

> Site 102. Kalauokamanu heiau, in Hanamā'ulu above the present mill. Described by Thrum as "A large walled heiau that stood above the present mill; destroyed about 1855. Of *po'okanaka* class.
>
> Site 103. Dune burials. In the sand dunes that run along the shore half way between Hanamā'ulu and Wailua River are many burials (Bennett 1931:125).

Bennett, an archaeologist who studied many areas of Hawai'i in the early part of this century, noted that it was hard to link archaeological finds on Kaua'i to individual chiefs and political events due to the incompleteness of the genealogical record and Kauai's independence from the other islands, which have relatively better-documented political records. There is also little information to help determine early land ownership (Bennett 1929).

In 1848, during the reign of Kamehameha III, the traditional Hawaiian land ownership system was replaced with a more Western-style system referred to as the Great Mahele. During the Mahele all land was designated as Crown Lands, Government Lands, or Konohiki Lands. These lands were all "subject to the rights of native tenants" (Laws of Hawai'i 1848:22), the common Hawaiian people who lived on and worked the land. Eventually, fee simple title was awarded to all native tenants who occupied and improved any portion of Crown, Government, or Konohiki lands; the Land Commission issued thousands of awards to the native tenants. The Indices to Land Commission Awards(Board of Commissioners 1929) contain the following awards for Hanamā'ulu; the fourth name on the list, V. Kamamalu, is Victoria, sister of Alexander Liholiho (King Kamehameha IV), Lot Kamehameha (King Kamehameha V), Moses Kekuaiwa, and half sister of Ruth Keelikolani, and she was awarded Hanamā'ulu Ahupua'a:

LCA	Awardee	Acreage
3648	Kala	1.25 Acs 30 rods
3650	Kaluhiwaha	3 roods, 35 rods
3649	Kamalo	1.75 Acs 20 rods
7713	V. Kamamalu	9177 Acs (Ap 2) ahp
3644	Kaualupa	1.25 Acs 23 rods
3558	Keke	3 roods 1 rod
3600	Keolanui	1.75 Acs 30 rods
3653	Kolu	1 Ac 37 rods
5089	Kuhaimoana	3 roods 17 rods
3640	Kumakahaohao	1 Ac 1 rood 12 rods
3271	Lalahilimoku, Leimoku	1 Ac 1 rood 21 rods
3657	Niho	1 Ac 1 rood 13 rods
3423	Paka	1.50 Acs 33 rods
3426	Pelekane	1 Ac 17 rods
3371	Naehu	1.25 Ac 19 rods (Kapaia)
3647	Kapuohi	4 Acs 32 rods (Moala)
3647	Kapuohi	38 rods (Papuaa)

The following are excerpts from testimonies for awards to individuals in Hanamā'ulu:

LCA 3558 to Keke, Foreign Testimony vol. 13:160 - Kaualapa sworn, he has seen...consists of three lois in the ili of Waiaoao and then it also a small kula adjoining. Claimant has also a house lot at Hoeua.... Claimant had his land from his friend Pekue in 1846. His house lot he had from Keo. Claimant held a house lot at Opai which was disputed by Keo the Konohiki. Claimant agreed to give him the lot above described at Hoeua.

LCA 3600 to Keolanui, Foreign Testimony vol. 13:153 - In the ili of Palaka and consists of [not listed or illegible] lois and house lot, all family but one piece bounded thus...Claimant had his land from Daniela Oleloa, in the days of good old Kaihiaena & has occupied it ever since without opposition...

LCA 3653 to Kola, Foreign Testimony vol. 13:151 – It consists of four lois in the ahupuaa of Hanamā'ulu and consists of four loi in the ili of Maulele, with small kula adjoining the kula is not cultivated being exhausted to the depredations of cattle. Claimant has also a house lot in the village of Kamakahanahana which is surrounded by a fence. No. 1 is bounded...Koloa - auwai of Keoki. No. 2 is kula of Kamakahanahana...Claimant had his land from Keo, konohiki, in the days of Kaikioewa had peaceable possession ever since his claim has never been disputed. Keo says I am a luna under Kanoa and know the land and gave the land to Claimant according to the testimony of Keolauui which all true.

LCA 3426 to Pelekane, Foreign Testimony vol. 13:156 - ....consists of 4 loi and in the ili of Kapuhala. Claimant has also a house lot near the sea shore at a place called Kaho ....Lot 2 (bounded by)...North - fish pond...land from his konohiki Pau soon after Kanoa came to Kauai and occupied it in peace till Keo and became konohiki again in 1849 who took away from Claimant two lois and gave them to Aumoana Keke sworn declares the testimony of Lalahilimoku to be all true. Keo sworn says it is true that Pelekane held and occupied said from lois...

LCA 3371 to Naehu and heirs, Foreign Testimony vol. 13:155 - ...consists of 10 lois and small kula adjoining on which Claimants house in the ili of Kapaia. Claimant had his land from his son-in-law Kailihania soon after Kanoa came to Kauai and he occupied it in peace till his death, which occurred in 1849. He gave land to his daughter Kaipu.

LCA 3647 to Kapuohi, Foreign Testimony vol. 13:151 - ...consists of 8 lois and 23 loi not now cultivated. These lois lie in two pieces, being divided koeles [small land unit farmed by a tenant fer the chief]. No. 1 contains one loi called Moala in the ili of Waiea. No. 2 contains all the other lois. No. 3 house lot in the ku of Papuaa....Claimant had his

land from Pau, the konohiki about 5 years ago. That part of the Claimant's land lying south of the Hanamā'ulu stream had never been disputed to this day. But the land laying on the Wailua side is disputed by the konohiki. Witness say there never was any dispute about until within the last few days. He says Claimant gave the land to his friend Luakini who held it several years till his death about a year or [missing or illegible] ago when he returned the land to Kapuohi the present Claimant. Papawaa, sworn says, I am a Kamaaina of Hanamā'ulu and know the land of Claimant and never heard of any dispute about the claim till Tuesday last when I heard that Keo disputed it and I believe the testimony of Kupule is all true.

LCA 3271 to Lalahilimok, Foreign Testimony vol. 13:161 - ...consists of six lois in the ili of Kuka. Claimants house lot is in the village of Puako...had his land from Daniela Aleloa in the days of Kaikioewa and has occupied it ever since in peace...

LCA 3423 to Paka, Foreign Testimony vol. 13:155 - ...consists of 8 loi in the ili of Peaiki and small kula adjoining. Claimant also has a house in Peaiki...land from Keo his konohiki in the days of Kaikioewa....

Found in the Land File of the State Archives were various references to Hanamā'ulu:

Interior Dept., Aug. 19, 1862 - In letter from M. Kekuanaoa to W. Webster, informing that the above land which is claimed as belonging to the King has been surveyed and awarded by the Land Commissioner and a Royal Patent issued to V. Kamamalu, &c.

Interior Dept., Aug. 4, 1863 - In letter from H. A. Widemann to Webster, that he had seen his name on a lease to the Lihue Plantation for the above lands, which leads him to think he has something to do with Victoria's lands.

Interior Dept., July 20, 1870 - In letter from Paul Isenburg [sic] to J. O. Dominis enclosing a draft for $7250 being the purchase price for the above ahupua'a &c.

Interior Dept., Oct. 4, 1870 - In letter from Duncan McBryde to C.C. Harris, that Mr. Isenburg [sic] has inquired of him if he knew the mauka Boundary of the Crown Land of Wailua that part which adjoins the above ahupua'a lately sold to Lihue Plantation. Desiring to know whether the said ahupua'a was held by the late Princess Victoria by Royal Patent according to survey by Pease, or by the Ancient Boundary, &c.

Interior Dept., July 20, 1871 - In letter from E. Krull to the Commissioner of Crown Lands stating that he is holding the Wailua Estate under two leases from the Hawaiian Govt. first from J. Young to Thos. Brown for 99 years & second from Kamehamahea IV, to Hoffschlaeger for 50 years but since a royal patent had been granted to the Lihue Plantation for the above ahupua'a containing about 800 acres which is included in his 2 leases & which hampers the pasturage of his cattle, he desires to have said leases cancelled & asking that he be allowed to enter into a new Indenture of lease for the same lands with the exception of the lands granted to said plantation for a term of 25 years at a yearly rate of not more than $300.

Interior Dept., Bk 15 p. 109 - In list of Konohiki lands, showing that V. Kamamalu is owner of the above land & that it has a sea coast frontage of 3.55 miles.

Public Instruction, Jan 24, 1891 - J. K. Burkett to Min of Public Instruction - Have talked with Mr. Wilcox & Mr. Isenberg in regard to a lot for a school house at the above place, &c.

Public Instruction, Feb. 11, 1893 - A. S. Wilcox to Min of Pub Instr. Think it best to send a copy of the former survey of the above school lot, as the corner stones have all disappeared & will be difficult to find the exact spot without it &c.

Public Instruction, April 3, 1907 - Registar of Conveyances to Supt. of Pub Inst. Submitting Abstract of Title in re a portion of R.P. 4481, Land Claim Award No. 7718, Ap. 2, Part 7, of land situate at the above tract, Kauai, claimed to be owned by the Lihue Plantation Co. Ltd. &c. Notes of Survey of School lot in said tract, attached.

Public Instruction, Aug 25, 1909 - Supt of Pub Instr to J.K. Farley To assist the Dept in suggesting valuation of 2.03 acres of school lot at the above tract, valued at $300 per acre &c. Doc's relating thereto attached

Executive Pinkham, Aug 4, 1915 - Commissioner of Public Lands to Governor Pinkham Informing that the Lihue Plantation Co., delivers to the Koloa Sugar Co., waters rising & flowing on the above lands, paying a little over $10,000 a year &c.

Kaua'i was home to the first sugar plantation in the islands. A brief history of Lihue Plantation Company, which included Hanamā'ulu lands, is presented here:

> The early records of the plantation show that in 1854 Messrs. Henry Peirce [sic], Wm. L. Lee, Wm. C. Parke, Edwin O. Hall, C. R. Bishop, C. W. Austin, W. H. Bates formed a co-partnership under the name of Henry A. Peirce & Co. whose business should be to plant sugar cane, manufacturing sugar...which indicates that the plantation had been in operation prior to that date. Mr. Rice was the manager. The mill... was run by waterpower; the crop amounted to 120 tons of sugar...It was Mr. Rice who first introduced irrigation of the cane fields in Hawai'i.... The average yield of sugar per acre was, at that time, one and one-half tons and was insufficient to make the industry a profitable one...Even with irrigation the outlook for the place was evidently dark, for in 1861 a proposition was considered to abandon the planting of sugar cane. Mr. Paul Isenberg was an employee of the plantation at the time and it was due to his advice and efforts that the proposition to abandon was given up, and planting was continued. In the year 1862 Mr. Rice died and Mr. Isenberg succeeded to the management of the estate...his perseverance and example, not only pulled Lihue plantation through difficulties of extraordinary success, but he inspired his neighbors with pluck to plod along to a successful issue against conditions, at times, most discouraging. So great was his faith in the future of the sugar industry in Hawai'i that, when later be had acquired an interest in the plantation, and his proposal to purchase the Hanamā'ulu lands was opposed by his partners, he entered into an agreement with them whereby any loss which might be incurred in the planting of these lands was to be borne by him individually, whereas any profit arising from the same was to go in as a general realization to the several partners. The tract in question contains 17,000 acres and was bought for $8,500, which price was regarded by some members of the firm as too high (*Pacific Commercial Advertiser* 50th Anniversary Edition, July 2, 1906.)

In 1877 Mr. A.S. Wilcox was given a contract to plant the Hanamā'ulu lands; the mill was erected by Lihue Plantation. In 1899, Hanamā'ulu cultivation was taken up by Lihue Plantation (*Pacific Commercial Advertiser* 1906:60-61). The Lihue Plantation eventually merged with the Kekaha Plantation almost 100 years later in 1995 and continued in business as Amfac Sugar Kaua'i, under the ownership of Lihue Plantation Company, Ltd., the parent company of which, in turn, was Amfac Land Company, Ltd. The Hanamā'ulu lands were finally taken out of sugarcane cultivation by late 1998.

FINDINGS

TRADITIONAL AND CUSTOMARY CULTURAL PRACTICES AND BELIEFS

A number of cultural practices that most likely would be considered to be representative of traditional and customary native Hawaiian cultural practices were identified as currently occurring within the Hanamā'ulu project area. Identified practices and specific informant references are summarized in *Table 2*. While multiple informant references were encountered for about half of the practices reported, others were reported by only a single informant reference. *Table 1* should be consulted for informant reference names and information.

Table 2. Summary of Informant References to Cultural Practices

Practice	Informant Reference*
Collection of Shoreline Marine Resources	
Gathering *hā'uke'uke* (edible sea urchins)	41
Gathering *limu* (edible seaweeds) in general	16, 17
Gathering *limu kohu*	5, 33, 41
Gathering *limu wāwae'iole*	51
Gathering *'opihi* (limpets)	5, 16, 17, 33, 43, 47
Fishing (various forms)	
Fishing in general	5, 8, 16, 17, 21, 30, 33, 43, 47, 53, 55
Bottom fishing	30
Catching *akule, halalū, 'ōpelu, akule, moi, 'ama'ama*	16, 43
Catching lobster and *he'e*	23
Catching *'o'opu* from stream	29, 41
Crabbing (*kūhonu*, Samoan crab, etc.)	29, 41
Diving/spearfishing	51
Kilo, or spotting, for *akule* in Hanamā'ulu Bay	5, 30, 41, 45
Reef fishing (*āholehole, manini, hīnālea*, etc.)	5, 51
Throw net fishing	5
Collection of Other Shoreline Resources	
Gathering *pili* grass	41
Gathering wild spinach	29
Other Shoreline Practices	
Burial ground	5, 23, 29, 30, 33, 45, 48, 53
Funerary deposition, scattering cremated remains	21

*See Table 1 for informant names and information.

Cultural practices identified as currently occurring within and immediately adjacent to the Ocean Bay Plantation at Hanamā'ulu project area appear to be entirely associated with the immediate shoreline area and inshore waters. These practices primarily involve a variety of marine resource exploitation activities and recreational activities. This general finding was not unexpected, given the almost total modification and alteration of the inland portion of the project area by over a century of historic period sugarcane cultivation. Public access to the shoreline area is gained generally by means of walking from Hanamā'ulu Beach Park. Existing dirt roads leading from the public highway to the shoreline area pass through private land, and direct access along these roads has generally been closely controlled by means of locked gates or chains and exclusionary signage.

Several related general types of marine resource exploitation activities were identified by local informants, including (a) collection of shoreline resources such as *hā'uke'uke* (edible sea urchins), *limu* (edible seaweeds), and *'opihi* (limpets), (b) different forms of fishing for a variety of species, and

(c) collection of shoreline, or strand, resources such as *pili* grass and wild spinach (species uncertain). Another cultural practice identified by informants as associated with the shoreline area was the use of sandy areas and soil areas seaward of former sugarcane cultivation limits for human burials. None of the informants identified any specific traditional native Hawaiian beliefs associated with the project area.

IDENTIFICATION OF TRADITIONAL CULTURAL PROPERTIES

While attempting to identify cultural practices and beliefs associated with the Hanamā'ulu project area, effort was also expended toward the identification of any traditional cultural properties that might be present. No potential traditional cultural properties of any kind were identified by any of the informants contacted in the course of the assessment study. Hanamā'ulu project area

CONTEMPORARY CULTURAL PRACTICES AND BELIEFS

The only cultural practice that would seem to be a contemporary practice rather than a traditional and customary cultural practice was the funerary practice of scattering of cremated remains into shoreline waters. A single informant noted this practice.

CURRENT CULTURAL CONCERNS

In addition to the various cultural practices and activities identified in the course of the informant contacts and informal interviews, a number of issues and concerns related to the proposed Ocean Bay Plantation at Hanamā'ulu golf course and residential development project. Several informants expressed their opposition to "development" in general, including the presently proposed project.

A number of informants also mentioned more project-specific concerns. These included (a) provision for continued public shoreline access for a variety of activities; (b) land use practices related to the development and maintenance of the proposed golf course that were perceived to have potential adverse impacts to the quality of the shoreline and inshore waters, and the exploitable marine resources present (e.g., fertilizer and pesticide runoff; (c) adequate and appropriate shoreline setbacks for development elements; and (d) possible construction of a pathway along the shoreline for biking and hiking.

CONCLUSION

The basic purpose of this concluding section is to assess the findings of the present cultural impact assessment study to determine if any of the native Hawaiian cultural practices, beliefs, or features identified as being associated with the proposed Ocean Bay Plantation at Hanamā'ulu project area represent traditional and customary practices which might be affected by the proposed golf course and residential development. The specific objectives of this conclusion include the following:

1. Summarize the nature and variety of identified traditional native Hawaiian cultural practices;
2. Evaluate the significance of the identified traditional native Hawaiian cultural practices;
3. Assess the potential effects of the proposed golf course and residential development upon the identified traditional native Hawaiian cultural practices; and
4. Make recommendations for further work that might (a) mitigate any potentially adverse effects of the proposed development upon the identified traditional native Hawaiian cultural practices, beliefs, or properties, and/or (b) be otherwise appropriate.

IDENTIFICATION OF CULTURAL PRACTICES, BELIEFS, AND PROPERTIES

The number and variety of individuals and groups contacted and consulted during the present identification study, as evidenced by the individuals named in the "List of Potential Informants" *(Table 1)*, demonstrate an adequate, appropriate, and reasonable good-faith effort to identify the full range of traditional native Hawaiian cultural practices currently associated with proposed Ocean Bay Plantation at Hanamā'ulu project area. Of the 55 individuals that were included in the final revised "List of Potential Informants," some 40 individuals, representing many different groups and organizations, were contacted and consulted. This documented effort indicates it likely that the full range of current traditional native Hawaiian cultural practices associated with the project area has been identified, even though only the general nature of these practices has been determined but not documented in any detail. In the course of the identification study, informants representing diverse backgrounds and community groups were contacted and consulted, including individuals of ethnicities other than native Hawaiian. With the single exception of an apparently contemporary cultural practice (i.e., the funerary practice of scattering cremated remains into the inshore waters), traditional native Hawaiian cultural practices, features, and beliefs were the only ones identified by informants; no specific cultural practices, features, and beliefs of any other, non-native Hawaiian, cultural or ethnic groups were specifically mentioned by any of the informants as being associated with the Hanamā'ulu project area.

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

The traditional native Hawaiian cultural practices identified as currently associated with the Hanamā'ulu project area appear to represent only one of these two general types of behaviors; i.e., practices with active behaviors involving both observable activities with material results and their implicit inherent values or beliefs. None of the informants contacted and informally interviewed explicitly identified any specific example of the latter type of behaviors; i.e., those practices with more passive behaviors which seek to produce nonmaterial results.

While attempting to identify cultural practices and beliefs associated with the Hanamā'ulu project area, effort was also expended toward the identification of any traditional cultural properties that might be present. No potential traditional cultural properties of any kind were identified by any of the informants contacted in the course of the assessment study.

EVALUATION OF IDENTIFIED CULTURAL PRACTICES, BELIEFS, AND PROPERTIES

The specific purpose of the present cultural impact assessment study is to assess the potential impacts of the proposed Ocean Bay Plantation at Hanamā'ulu project upon the cultural resources–the practices, features and/or beliefs–of native Hawaiians, or any other ethnic group, that are associated with the 460-acre Ocean Bay Plantation at Hanamā'ulu project area

For purposes of evaluating the significance of the native Hawaiian cultural practices identified in association with Hanamā'ulu project area, it would be useful to consider them in terms of the three types of informant claims that were defined earlier (see page 2). With the single exception of an apparently contemporary cultural practice (i.e., the funerary practice of scattering cremated remains into the inshore waters), traditional native Hawaiian cultural practices, features, and beliefs were the only ones identified by informants. No information was obtained to suggest that any of the other practices might, or should, be regarded as contemporary, or neo-traditional claims. Furthermore, no specific cultural practices, features, and beliefs of any other, non-native Hawaiian, cultural or ethnic groups were specifically mentioned by any of the informants as being associated with the Hanamā'ulu project area.

The cultural practices identified by any informants as being associated with the Hanamā'ulu project area would constitute claims which would lie within the purview of Article XII, Section 7, of the Hawai'i State Constitution ("Traditional and Customary Rights"), particularly as reaffirmed in 1995 by the Hawai'i State Supreme Court in the decision commonly referred to as the "PASH decision," and as further clarified more recently in its 1998 decision in State of Hawai'i v. Alapa'i Hanapi and its 2000 decision in Ka Pa'akai o Ka 'Aina et al. v. Land Use Commission, State of Hawai'i et al. These would be claims of traditional and customary native Hawaiian access and use-rights that would include a broad range of cultural practices and beliefs associated with a general geographical area or region rather than a clearly definable property or site

A general familiarity with the content of traditional Hawaiian culture–both in its tangible material aspects and, perhaps to a somewhat lesser degree, its immaterial and behavioral aspects, indicated nothing unusual among the identified practices. None of the identified cultural practices were particularly unique to the Hanamā'ulu project area; similar practices traditionally took place in similar shoreline settings throughout the islands, and those identified at the Hanamā'ulu project area were apparently engaged in there by local residents primarily because the area is situated in close proximity to local communities and, until more recently closed off, was readily accessible by means of several existing dirt roads through old sugarcane lands.

Based on an evaluation of the findings of the present cultural impact assessment identification study made in reference to (a) the known content of traditional Hawaiian culture, and (b) the National Register Criteria as clarified by National Register Bulletin No. 38, it is believed that all of the traditional native Hawaiian cultural practices and implicit beliefs identified as being currently associated with the Hanamā'ulu project area can be considered to be culturally and historically significant. All would seem to qualify as traditional and customary cultural practices within the meaning of the Hawai'i State Constitution. No potential traditional cultural properties of any kind were identified by any of the informants contacted in the course of the assessment study. Finally, with the single exception of an apparently contemporary cultural practice (i.e., the funerary practice of scattering cremated remains into the inshore waters), none of the identified practices and implicit beliefs would seem to represent contemporary, or neo-traditional, cultural practices or beliefs.

ASSESSMENT OF POTENTIAL PROJECT EFFECTS

Discussion

The assessment of potential project effects upon the traditional native Hawaiian cultural practices identified as associated with proposed Ocean Bay Plantation at Hanamā'ulu project area has been done in general accordance with the guidance documents cited in the earlier "Study Methodology" section of this report. Of particular relevance were Part 800.9 ("Criteria of effect and adverse effect") of the federal regulations of the Advisory Council on Historic Preservation for the "Protection of Historic Properties" (CFR 1986), and Chapter 284: *Rules Governing Procedures for Historic Preservation Review to Comment on Chapter 6E-42, HRS, Projects* of the State Historic Preservation Division (2001b).

In order to assess the potential effects of the proposed golf course and residential development at Hanamā'ulu upon the traditional native Hawaiian cultural practices that have been identified in association with the project area, it is useful to review the scope and nature of the proposed development. The Ocean Bay Plantation project area consists of c. 460 acres of former sugarcane lands. Virtually all of the project area was under sugarcane cultivation for more than a century, but has stood abandoned and overgrown since sugarcane cultivation was discontinued approximately fifteen to twenty years ago. The background to the proposed project and the details of planned construction have been presented in an earlier section of the present report; of relevance here is the basic observation that the planned development would be done almost entirely within the existing limits of the inland portion of the project area that was previously altered and greatly modified by historic period sugarcane cultivation. With the possible exception of minor improvements such as appropriate landscaping, and pedestrian footpaths and/or bicycle paths, the shoreline portion of the project area would not be altered or developed, and public access to the shoreline would continue. While there may be temporary, or short-term, inconveniences associated with golf course and residential construction activities (for example, temporary restrictions upon access to specific parts of the shoreline area or along specific routes leading to the shoreline area), proposed construction would not result in any direct physical impacts causing any significant or long-term effects upon the existing physical environment of the shoreline portion of the project area

With regard to potential effects upon identified cultural practices having active behaviors involving both observable activities with material results and their inherent values or beliefs – that is, the gathering and collecting of marine resources and plant materials within the shoreline area and immediately adjacent inshore waters for various purposes, it is possible to determine that at least for the active behavior and material results, the proposed development project would have no significant effect at all. Given the specific nature and physical development limits of the proposed project, and with the specific exception of possible short-term construction period restrictions, the continued public shoreline access and the exercise of all traditional and customary native Hawaiian rights for access and gathering practices – and any other as yet unidentified practices – would not be in any way constrained, restricted, prohibited, or eliminated.

With regard to any potential effects upon cultural practices with more passive behaviors which involve experiential activities with nonmaterial results ("communing with nature"), as well as potential effects upon the inherent values or beliefs associated with active behaviors involving observable activities, assessment of potential effects is more difficult. This is because of the subjective nature of any adverse effects that might be perceived upon the practices, beliefs, and values involved. It simply is not possible to assess or quantify in any objective manner the significant or adverse effects upon such practices that informant's claim they might experience as a result of the proposed development. However, it should be noted that none of the informants contacted and informally interviewed explicitly identified any specific example of the latter type of behaviors; i.e., those practices with more passive behaviors which seek to produce nonmaterial results; therefore, the issue of potential effects upon cultural practices with more passive behaviors which involve experiential activities with nonmaterial results may well be a moot issue.

Concluding Assessment

Based on an evaluation of the traditional native Hawaiian cultural practices and implicit beliefs identified as currently associated with the Ocean Bay Plantation project area at Hanamā'ulu, and an assessment of the potential impacts of the proposed project upon those identified practices, the present identification study has concluded that the proposed golf course and residential development project-in which the planned development would be done almost entirely within the existing limits of the inland portion of the project area that was previously altered and greatly modified by historic period sugarcane, should have no significant or adverse effect on the existing cultural practices identified as currently associated with the shoreline area and immediately adjacent inshore waters. Given the nature and development limits of the proposed project, and with the specific exception of possible short-term construction period restrictions, the continued exercise of all traditional and customary native Hawaiian rights for access and gathering practices would not in any way be constrained, restricted, prohibited, or eliminated. This conclusion is made with the qualification that public shoreline access for the continuation of the identified cultural practices will remain intact.

RECOMMENDATIONS

The present report concludes the cultural impact assessment for the proposed project. The assessment has determined that the proposed project should not have any significant effect, much less any adverse effect, on the traditional native Hawaiian cultural practices identified as currently associated with the shoreline area and immediately adjacent inshore waters of the Ocean Bay Plantation project area at Hanamā'ulu. Therefore, it is neither necessary nor appropriate to recommend any further actions that would usually be referred to as mitigation measures. However, in response to the opportunity offered by the identification of several individuals with site-specific knowledge of the Hanamā'ulu project area, knowledge of local place names and folklore, family ties to the area and/or their use of project area for cultural purposes, certain further work is recommended. The scope of this work goes beyond the level of study effort recommended in the OEQC guidelines for the assessment of potential cultural impacts by the proposed Ocean Bay Plantation project at Hanamā'ulu. The recommended work would focus on the formal recordation of the native Hawaiian cultural practices and potential traditional cultural property that have been identified as associated with the Hanamā'ulu project area. A work plan to guide the conduct of this recommended further work, and a proposed content outline for an appropriate report, can be prepared by PHRI and would be submitted to the State Historic Preservation Division for review and comment.

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APPENDIX A

OUTLINE OF GENERAL INFORMANT INTERVIEW CONTENT

Cultural Impact Assessment Study
Ocean Bay Plantation at Hanamā'ulu
Land of Hanamā'ulu, Līhu'e District
Island of Kaua'i
(TMK: 4-3-7-3:1; 4-3-9-5:5)

General Information

- Full name
- Telephone number
- Current residence and address
- Interview date, time, location
- Other participants

Biographical Information

- Age, birthdate, birthplace
- Immediate family composition
- Education
- Occupation
- Family background: parents, grandparents, residential ties
- Previous residences: childhood to present
- Any additional family background pertinent to informant knowledge

General Sources of Informant Knowledge

Knowledge of Specific Historic/Cultural Properties, Practices, and/or Beliefs

- Name(s) of property/place or area
- Description of property/place or area
    - Present physical characteristics, setting, location, uses
    - Original/prior physical characteristics, setting, location, uses
- Practices or beliefs associated with property/place or area
- Specific sources of informant knowledge
- Individuals, families, and/or groups associated with property/place or area
    - Specific nature of association
    - Time frame/depth and intensity of association

Perceived Impact(s) of Proposed Uses on Any Properties/Places/Areas, Practices, and/or Beliefs

Possible Mitigation Measures

Any Additional Information to Provide

Any Additional Thoughts or Concerns

APPENDIX I

Traffic Impact Analysis Report for the Proposed Ocean Bay Plantation at Hanamā'ulu

Randy Okaneku
The Traffic Management Consultant

June 2002 rev.

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED

OCEAN BAY PLANTATION AT HANAMA`ULU

TAX MAP KEYS (4) 3-7-3:1 & (4) 3-9-5:5

PREPARED FOR

GROUP 70 INTERNATIONAL, INC.

June 5, 2002

PREPARED BY

TMC THE TRAFFIC MANAGEMENT CONSULTANT
RANDALL S. OKANEKU, P.E., P.T.O.E., PRINCIPAL • 1188 BISHOP STREET, SUITE 1907 • HONOLULU, HI

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TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED
OCEAN BAY PLANTATION AT HANAMA'ULU
TAX MAP KEYS (4) 3-7-3:1 & (4) 3-9-5:5

I. Introduction

A. Project Description

EWM Investments, LLC proposes to develop Ocean Bay Plantation at Hanama'ulu, a mixed-use residential and golf course community, on their 460-acre coastal parcel in Hanama'ulu, Kauai, Hawaii. The property is identified as Tax Map Keys (4) 3-7-3:1 and (4) 3-9-5:5. Figure 1 depicts the vicinity map.

Ocean Bay Plantation at Hanama'ulu is proposed as a new master-planned community comprised of single-family (SF) homes and multi-family (MF) housing. This low-density master-planned community would include a small retail-commercial center near its main access to Kuhio Highway. The proposed project would be developed in phases over a period of 10-15 years. With construction beginning in 2004, the project would be build-out and fully occupied by the Year 2018. The Year 2020 is used as the study's planning horizon for the purpose of the traffic impact analysis.

The proposed components of the Master Plan for the Ocean Bay Plantation at Hanama'ulu include:

- A 177± acre 18-hole golf course, a driving range, a golf clubhouse, and tennis courts.
- One hundred seventy-three (173) lots for single-family homes (one dwelling unit per 0.34 to 0.5 acre lot).
- Up to 250 multi-family condominium homes (8 units/acre), which will be built in three areas.
- A 40,000 square foot of gross floor area (SFGFA) retail-commercial center on approximately 12.5 acres.
- A beach club.

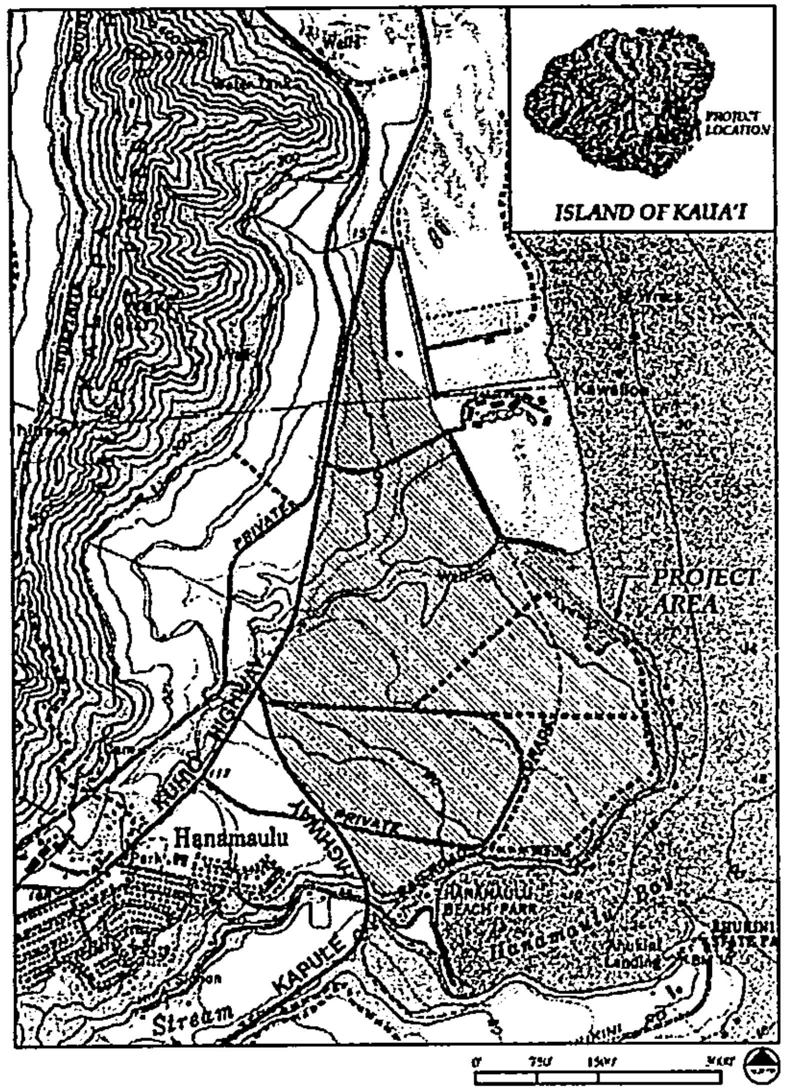


Figure 1. Vicinity Map

For the purpose of this traffic impact analysis, an "interim phase" was analyzed. The Interim Phase is expected to be completed by the Year 2010 and would include the 177-acre golf course, clubhouse and tennis courts; 73 single-family dwelling units; and the 40,000 SFGFA retail-commercial center. Full build-out of the proposed master plan also would include 250 multi-family dwelling units and an additional 100 single-family dwelling units.

Access is proposed on the makai (east) leg of the intersection of Kapule Highway and Kuhio Highway. A secondary access to the commercial-retail center is proposed on Kuhio Highway, north of its intersection with Kapule Highway. Finally, access to about 100 single-family homes, planned in the latter phases of development, is proposed on Kauai Beach Drive. The site plans for the overall Master Plan are depicted on Figure 2.

B. Purpose and Scope of the Study

The purpose of this study is to analyze the traffic impacts of the proposed Ocean Bay Plantation at Hanama'ulu. This report presents the findings and recommendations of the study. The scope of this study includes:

1. Description of the proposed project.
2. Evaluation of existing roadways and traffic conditions.
3. Development of trip generation characteristics of the proposed project.
4. Analysis of the Years 2010 and 2020 traffic conditions without the proposed project.
5. Identification and analysis of traffic impacts resulting from the development of the interim phase and full build-out of the proposed project.
6. Recommendations of improvements, as necessary, that would mitigate the traffic impacts identified in this study.

C. Methodologies

1. Capacity Analysis Methodology

The highway capacity analysis, performed for this study, is based upon procedures presented in the Highway Capacity Manual (HCM), published by the Transportation Research Board, 2000. HCM defines Level of Service (LOS) as "a quality measure describing operational conditions within a traffic stream". Several factors are included in determining LOS such as: speed, travel time, freedom to maneuver, traffic interruptions, driver comfort, and convenience. LOS "A", "B", and "C" are considered satisfactory levels of service. LOS "D" is generally considered a "desirable minimum" operating level of service. LOS "E" is an undesirable condition, and LOS "F" is an unacceptable condition. Intersection LOS is primarily based upon delay.

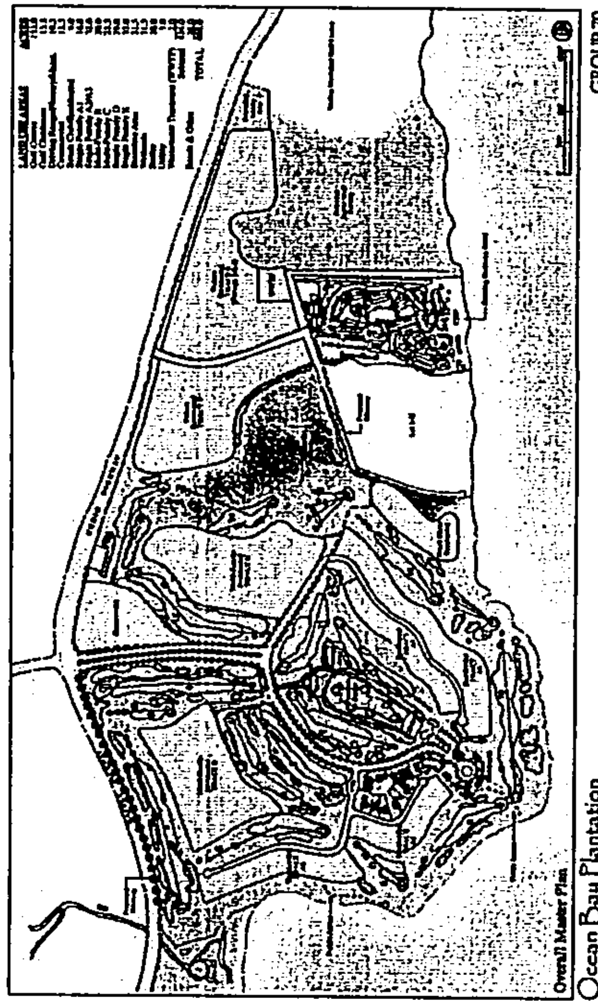


Figure 2. Proposed Master Plan

Table 1 summarizes the LOS criteria.

Table 1. Level of Service Criteria (HCM)

LOS	Signalized Intersections Control Delay (sec/veh)	Unsignalized Intersections Control Delay (sec/veh)
A	≤ 10	≤ 10
B	> 10 – 20	> 10 – 15
C	> 20 – 35	> 15 – 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	> 80	> 50

"Volume-to-capacity" (v/c) ratio is a measure indicating the relative traffic demand to the roadway's capacity. HCM defines capacity as "the maximum number of vehicles that can pass a given point during a specified period under prevailing roadway, traffic flow, and traffic control conditions." A v/c ratio of 0.50 indicates that the traffic demand is utilizing 50 percent of the roadway's capacity.

Worksheets for the capacity analysis, performed throughout this report, are compiled in the Appendix B.

2. **Trip Generation Methodology**

The trip generation methodology is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in Trip Generation, 6th Edition. ITE trip rates are developed by correlating the total vehicle trip generation data with various activity/land use characteristics, such as the vehicle trips per hour (vph) per dwelling unit (DU).

The total trips generated by a shopping center can be defined as driveway trips, i.e., traffic entering and exiting the project site. A percentage of the PM peak hour trips, generated by a shopping center, are considered to be "pass-by" trips, i.e., traffic already on the road stopping at a "secondary" destination. The "new" or primary trips generated by the project are trips, whose primary destination would be the proposed shopping center.

The percentages of pass-by trips were correlated with the gross leasable floor areas of the shopping centers that were taken from studies that were compiled by ITE.

The results of the analysis were published in the Trip Generation Handbook, October 1998. Based upon the regression equation in Figure 5.5 of the Trip Generation Handbook, the pass-by trips are expected to comprise about 51 percent of the total PM peak hour trips generated by the proposed 40,000 SFGFA retail-commercial center. Given the location of the proposed retail center at a major highway junction, the percentage rate of pass-by trips seems to be reasonable.

The trip generation characteristics for the proposed project are based upon ITE trip rates for the respective land uses envisioned for the proposed master-planned community. Where trip rates for certain types of land uses were not developed by ITE, trips rates for similar uses were used. The trip rates used in this analysis were developed from the regression equations when available. Where the regression analyses were not performed due to the limited data, average trip rates were used.

II. Existing Conditions

A. Roadways

Kapule Highway is a two-way, two-lane arterial highway between Hanama'ulu and Lihue. To the north, Kapule Highway continues and becomes Kuhio Highway. Kapule Highway bypasses Hanama'ulu and Lihue to the east. Kapule Highway is signalized at its intersection with Kuhio Highway. Exclusive left-turn and right-turn lanes are provided on northbound Kapule Highway and southbound Kuhio Highway, respectively.

Kuhio Highway is a two-way arterial highway, which extends from Lihue to East Kauai. North of Kapule Highway, Kuhio Highway is a two-way, three-lane highway – two lanes in the northbound direction and one lane in the southbound direction. During the AM peak period, Kuhio Highway is coned to provide a southbound contra-flow lane, resulting in two lanes in the southbound direction and one lane in the northbound direction. Kuhio Highway (north and west legs) intersects Kapule Highway (south leg) in Hanama'ulu.

Kauai Beach Drive is a two-lane local roadway, located to the north of the project site. Kauai Beach Drive provides access to the Radisson Kauai Beach Resort. Kauai Beach Drive is stop-controlled at its Tee-intersection with Kuhio Highway. An exclusive left-turn storage lane and a median left-turn shelter lane are provided on southbound Kuhio Highway at Kauai Beach Drive. A right-turn deceleration lane is provided on northbound Kuhio Highway at Kauai Beach Drive.

B. Existing Peak Hour Traffic Volumes and Operating Conditions

1. Field Investigation and Data Collection

Manual traffic count surveys were conducted at the Kuhio Highway intersections with Kapule Highway and with Kauai Beach Drive in September 18-19, 2001, during the peak periods of traffic – from 6:30 AM to 8:30 AM and from 3:30 PM to 5:30 PM. The peak period data are presented in Appendix A.

The peak hour data, collected at the intersection of Kuhio Highway and Kapule Highway, were compared with the most recent available traffic data, obtained from State Department of Transportation (DOT).

2. Existing AM Peak Hour Traffic

The AM peak hour of traffic occurred from 7:00 AM to 8:00 AM. The total traffic entering the intersection of Kuhio Highway and Kapule Highway, during the AM peak hour was 2,504 vehicles per hour (vph). Year 1999 DOT AM peak hour data indicated that 2,526 vph entered the intersection, which was about one percent higher than the peak hour data collected during the field study. The AM peak hour direction of traffic was southbound – 71 percent southbound and 29 percent northbound.

The left-turn movement from eastbound Kuhio Highway to northbound Kuhio Highway operated at LOS "D". The other intersections in the study area operated at satisfactory Levels of Service, i.e., LOS "C" or better, during the existing AM peak hour. Figure 3 depicts the existing AM peak hour traffic volumes, and the results of the capacity analysis.

3. Existing PM Peak Hour Traffic

The PM peak hour of traffic occurred between 4:15 PM and 5:15 PM. The total traffic entering the intersection of Kuhio Highway and Kapule Highway, during the PM peak hour was 2,480 vph. Year 1999 DOT PM peak hour data indicated that 2,442 vph entered the intersection, which was about one and one half percent lower than the peak hour data collected during the field study. The PM peak hour direction of traffic was northbound – 63 percent northbound and 37 percent southbound.

The left-turn movement from eastbound Kuhio Highway to northbound Kuhio Highway continued to operate at LOS "D", during the PM peak hour of traffic. Kauai Beach Drive operated at LOS "E" at Kuhio Highway. The existing PM peak hour traffic volumes, and the results of the capacity analysis are depicted on Figure 4.

III. Future Traffic Conditions

B. External Traffic

1. Kauai Long Range Land Transportation Plan

This traffic impact analysis was prepared within the context of the Kauai Long Range Land Transportation Plan, (KLRLTP), prepared for the State of Hawaii Department of Transportation in cooperation with the County of Kauai Department of Public Works and Planning Department, by Austin, Tsutsumi & Associates, Inc., dated May 1997. The future external peak hour traffic forecasts were based upon the Hanama'ulu screenline (Kuhio Highway and Kapule Highway) volumes with the committed improvements, as presented in the KLRLTP.

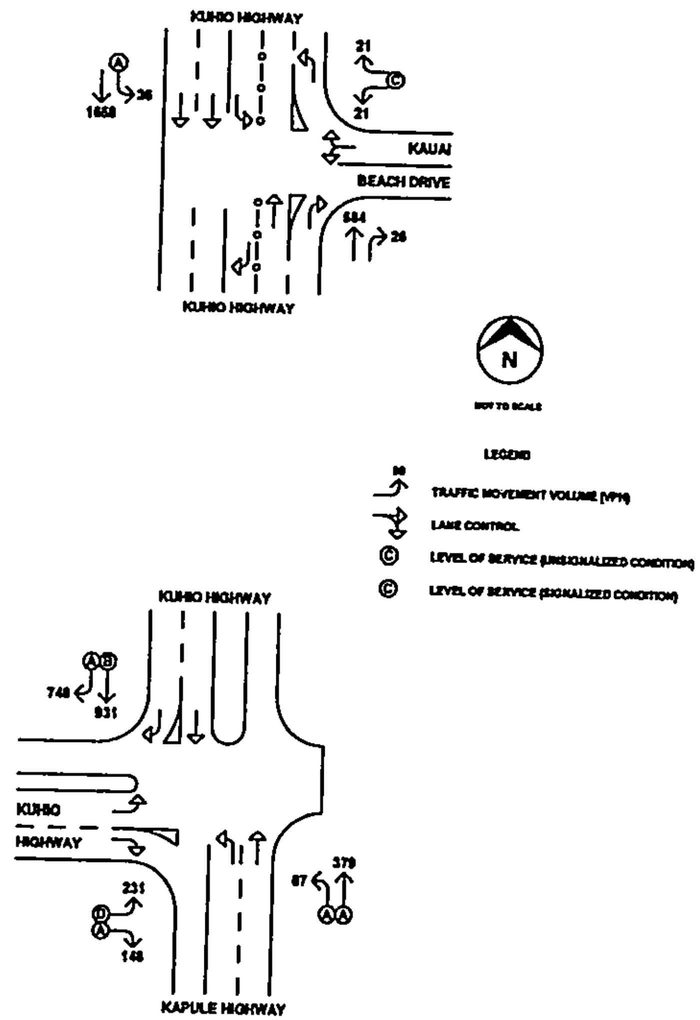


Figure 3. Existing AM Peak Hour Traffic

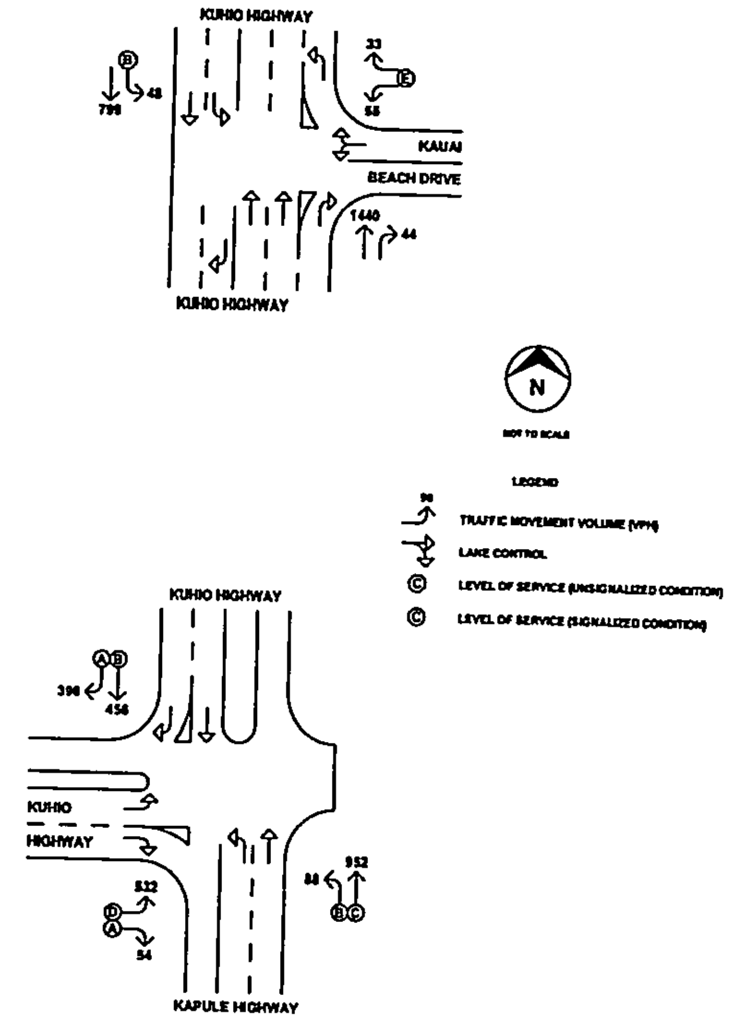


Figure 4. Existing PM Peak Hour Traffic

According to the DOT forecasts, 24-hour traffic demands, north of the intersection of Kuhio Highway and Kapule Highway, are expected to increase by an average of 4.4 percent per year. To the south of the intersection of Kuhio Highway and Kapule Highway, 24-hour traffic demands are expected to increase by an average of 3.75 percent per year. In order to conform to the KLRLTP, the planning horizon for this traffic impact analysis was extended from the Year 2018 – the expected project completion date – to the Year 2020. The Year 2010 peak hour traffic forecasts were developed by interpolation between the Year 2020 traffic forecast and the existing traffic (Year 2001) conditions.

2. Future Time-Share Resort on Kauai Beach Drive

A future 250-room time-share resort development was assumed to be developed on Kauai Beach Drive. The trip generation characteristics for the future time-share resort on Kauai Beach Drive were based upon ITE trip rates for an all-suites hotel because of its physical similarities with a timeshare resort. ITE describes an all-suites hotel as a lodging with large suites, a restaurant, a lounge, and small meeting rooms. Convention activities are generally excluded. The ITE trip generation rates of an all-suites hotel are up to 30 percent less than a typical hotel.

The travel behavior may be less active for a visitor staying at a timeshare resort than at a hotel. Timeshare resorts generally cater to return visitors and families staying for longer periods of time than the average visitor, resulting in lower turnover rates. Longer stays provide opportunities for day or overnight trips to the other islands. The returning guests/residents are expected to spend more leisurely vacations than the first time visitors, who stay for shorter periods of time.

At this writing, the County of Kauai has not approved plans for the proposed resort. However, the resort trips generated by the future project were added to the DOT forecasts for the Years 2010 and 2020, in anticipation of its approval. Table 2 summarizes the trip generation characteristics for the future 250-room time-share resort development.

Table 2. Future Time-Share Resort Trip Generation Characteristics

Land Use (ITE Code)	Units	AM Peak Hour (vph)			PM Peak Hour (vph)		
		Enter	Exit	Total	Enter	Exit	Total
All Suites Hotel (311)	250 Rooms	48	24	72	35	48	83

The traffic assignment of trips generated by the future time-share resort was based upon the distribution of peak hour traffic observed during the field investigation.

C. Year 2010 Peak Hour Traffic Analysis Without Project

1. Year 2010 AM Peak Hour Traffic Analysis Without Project

The intersection of Kuhio Highway and Kapule Highway is expected to operate at near capacity conditions (v/c = 0.97), during the Year 2010 AM peak hour of traffic under existing roadway conditions. The left-turn movement from eastbound Kuhio Highway to northbound Kuhio Highway is expected to operate at LOS "E". The southbound through movement on Kuhio Highway is expected to operate at LOS "D". Figure 5 depicts the Year 2010 AM peak hour traffic without the proposed project, and the results of the capacity analysis.

2. Year 2010 PM Peak Hour Traffic Analysis Without Project

The Year 2010 PM peak hour traffic demand is expected to exceed the capacity of the intersection of Kuhio Highway and Kapule Highway (v/c = 1.09), during the Year 2010 PM peak hour of traffic under existing roadway conditions. The left-turn movement from eastbound Kuhio Highway to northbound Kuhio Highway is expected to operate at LOS "E". The northbound through movement on Kapule Highway and the southbound through movement on Kuhio Highway also are expected to operate at LOS "E", during the PM peak hour of traffic without the proposed project.

Kauai Beach Drive is expected to operate at LOS "F" at Kuhio Highway under unsignalized conditions, during the PM peak hour of traffic without the proposed project. The intersection of Kuhio Highway and Kauai Beach Drive is expected to meet the warrant for the installation of traffic signals, according to the <u>Manual on Uniform Traffic Control Devices Millennium Edition</u> (MUTCD), published by the U.S. Department of Transportation, Federal Highways Administration. The Year 2010 PM peak hour traffic demand on Kauai Beach Drive is expected to exceed the lower threshold volume for the minor street approach as defined under the MUTCD Warrant 3 Peak Hour. The Year 2010 PM peak hour traffic without the proposed project, and the results of the capacity analysis are depicted on Figure 6.

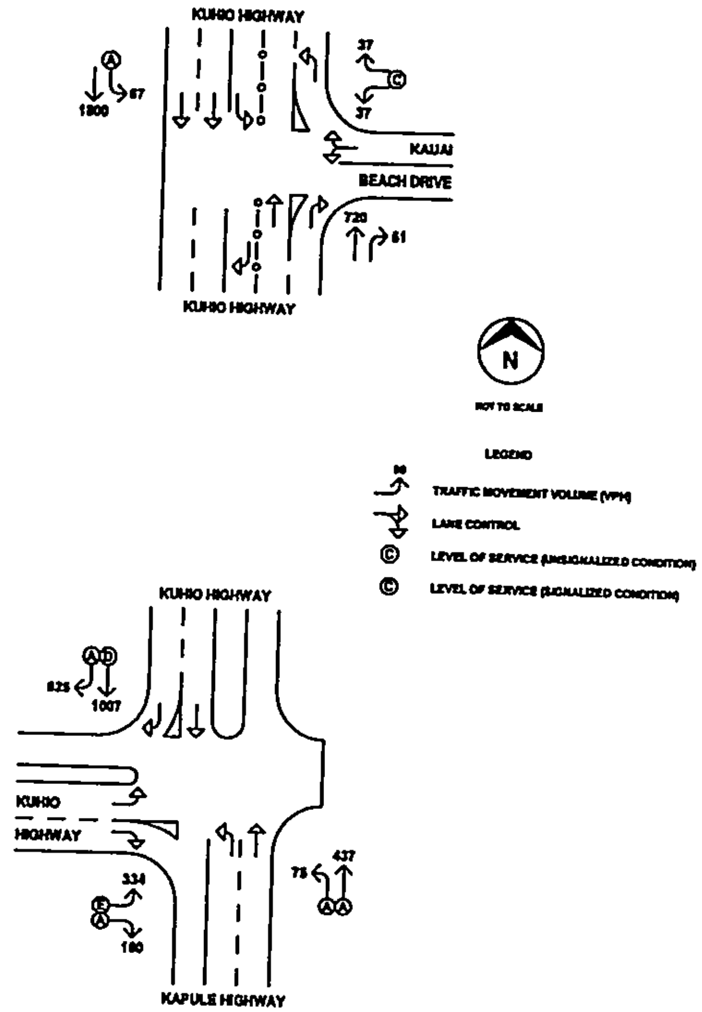


Figure 5. 2010 AM Peak Hour Traffic Without Project

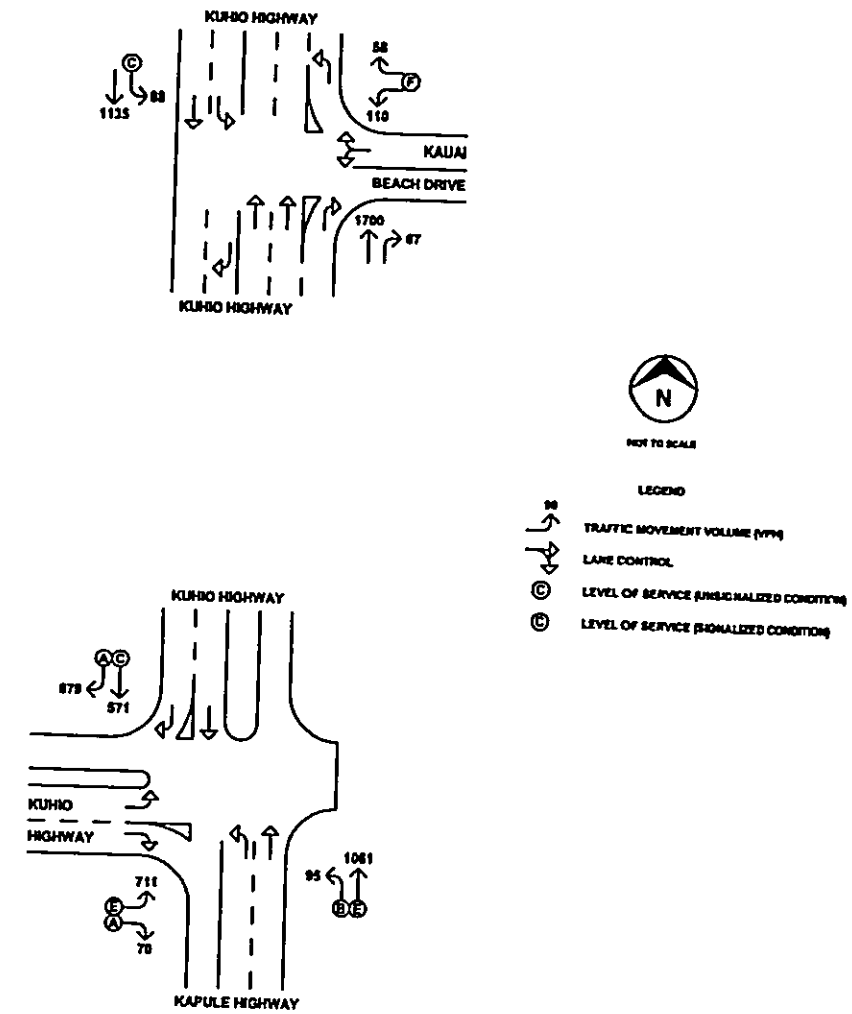


Figure 6. 2010 PM Peak Hour Traffic Without Project

3. Year 2010 Traffic Improvements Recommended Without Project

The following recommended traffic improvements should be implemented to mitigate future highway deficiencies, as discussed in the previous Sections III.C.1. and III.C.2.:

a. Widen the northbound approach of Kapule Highway at Kuhio Highway from one lane to two through lanes to match the existing north leg of Kuhio Highway. (The AM peak period contra-flow operation on Kuhio Highway is expected to continue, however, the two southbound lanes should be extended onto Kapule Highway, and merged into one lane south of its intersection with Kuhio Highway.)

b. Widen eastbound Kuhio Highway at Kapule Highway to provide an additional exclusive left-turn lane. (The second exclusive left-turn lane should be closed during the contra-flow operation on Kuhio Highway during the AM peak period of traffic.)

c. Signalize the intersection of Kuhio Highway and Kauai Beach Drive.

D. Year 2020 Peak Hour Traffic Analysis Without Project

1. Year 2020 AM Peak Hour Traffic Analysis Without Project

Under the traffic improvements recommended in the previous section, the study intersections are expected to operate at satisfactory Levels of Service, during the Year 2020 AM peak hour of traffic without the proposed project. Figure 7 depicts the Year 2020 AM peak hour traffic without the proposed project, and the results of the capacity analysis.

2. Year 2020 PM Peak Hour Traffic Analysis Without Project

During the Year 2020 PM peak hour of traffic, the left-turn movement from eastbound Kuhio Highway to northbound Kuhio Highway is expected to operate at LOS "D". The overall intersection of Kapule Highway and Kuhio Highway is expected to operate at LOS "C".

The Year 2020 PM Peak hour traffic demand without the proposed project is expected to exceed the capacity of the intersection of Kuhio Highway and Kauai Beach Drive (v/c = 1.11). Kauai Beach Drive is expected to operate at LOS "F" at Kuhio Highway under signalized conditions. Southbound Kuhio Highway is expected to operate under LOS "E" conditions at Kauai Beach Drive. The Year 2020 PM peak hour traffic without the proposed project, and the results of the capacity analysis are depicted on Figure 8.

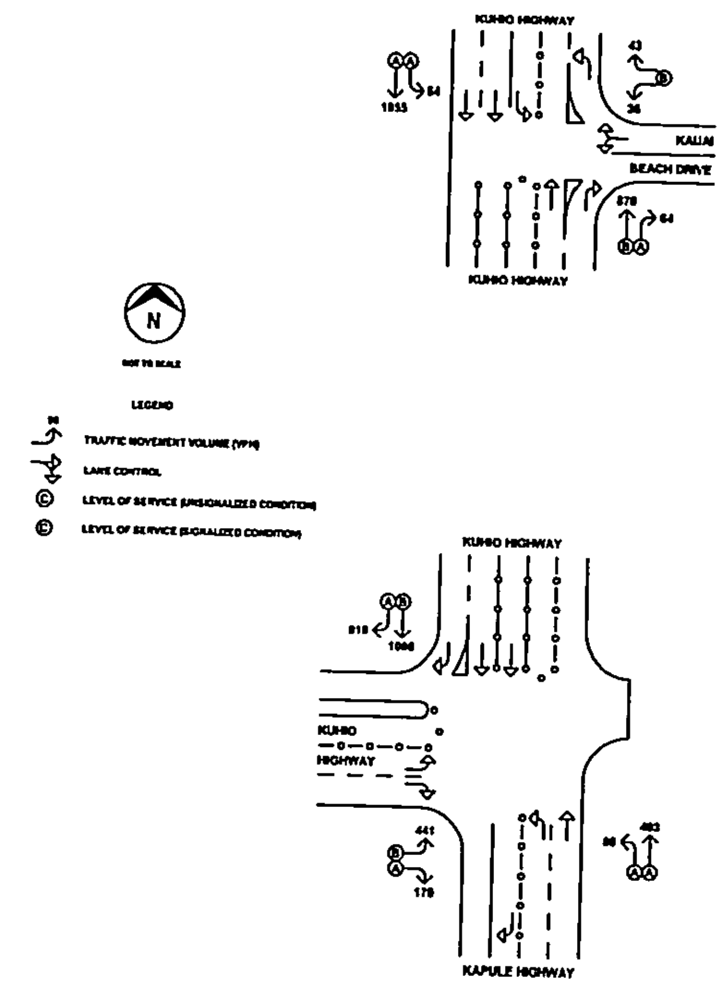


Figure 7. 2020 AM Peak Hour Traffic Without Project

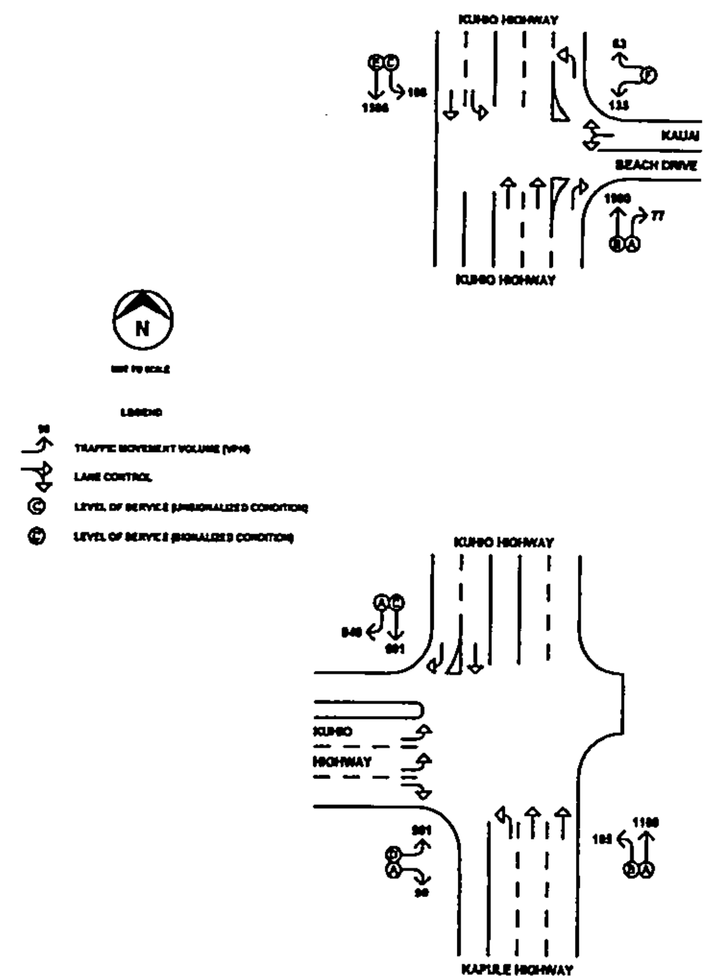


Figure 8. 2020 PM Peak Hour Traffic Without Project

3. Year 2020 Traffic Improvements Recommended Without Project

The following recommended traffic improvements should be implemented to mitigate the Year 2020 highway deficiencies, expected without the proposed project:

a. Widen Kuhio Highway from a three-lane roadway to a four-lane, divided roadway from Kapule Highway to Mailihuna Road in Kapaa, as recommended in the Phase I implementation plan of the KLRLTP.

b. Widen Kapule Highway between Rice Street and Kuhio Highway from a two-lane highway to a four-lane, divided roadway, as recommended in the Phase II implementation plan of the KLRLTP.

IV. Project-Generated Traffic

A. Trip Generation

1. Trip Generation Characteristics for the Interim Phase Development

During the AM peak hour of traffic, the Interim Phase of the proposed Master Plan is expected to generate a total of 201 vph – 107 vph entering the site and 94 vph exiting the site. The proposed project is expected to generate a total of 499 vph – 242 vph entering the site and 257 vph exiting the site, during the PM peak hour of traffic. Of the total 284 PM peak hour trips, generated by the retail component, 174 vph are expected to be pass-by trips. Therefore, the total PM peak hour trips would be reduced by the retail pass-by trips, resulting in a net PM peak hour trip generation of 325 vph (total PM trips less pass-by trips). The trip generation characteristics for the proposed project are summarized in Table 3.

Table 3. Interim Phase Trip Generation Characteristics (Year 2010)

Land Use (ITE Code)	Units	AM Peak Hour (vph)			PM Peak Hour (vph)		
		Enter	Exit	Total	Enter	Exit	Total
Single-Family Detached Housing (210)	73 DU	15	45	60	52	29	81
Shopping Center (820)	40,000 SFGFA	56	36	92	165	178	343
Golf Course (430)	177 Acres	29	10	39	18	35	53
Tennis Courts (814)	6 Courts	7	3	10	7	15	22
	Totals	107	94	201	242	257	499

2. **Trip Generation Characteristics for the Master Plan Development**

The proposed Master Plan is expected to generate a total of 378 vph during the AM peak hour of traffic – 143 vph entering the site and 235 vph exiting the site. During the PM peak hour of traffic, the proposed project is expected to generate a total of 725 vph – 391 vph entering the site and 334 vph exiting the site. The total PM peak hour trips would again be reduced by the 174 retail pass-by trips, resulting in a net PM peak hour trip generation of 551 vph.

It was assumed that only residents and guests would use the proposed beach center. Therefore, the beach center is not expected to generate external trips. The trip generation characteristics for the proposed project are summarized in Table 4.

Table 4. Master Plan Trip Generation Characteristics (Year 2020)

Land Use (ITE Code)	Units	AM Peak Hour (vph)			PM Peak Hour (vph)		
		Enter	Exit	Total	Enter	Exit	Total
Single-Family Detached Housing (210)	173 DU	33	98	131	113	63	176
Residential Condominium/ Townhouse (230)	250 DU	18	88	106	88	43	131
Shopping Center (820)	40,000 SFGFA	56	36	92	165	178	343
Golf Course (430)	177 Acres	29	10	39	18	35	53
Tennis Courts (814)	6 Courts	7	3	10	7	15	22
	Totals	143	235	378	391	334	725

B. Trip Distribution

The trip distributions of project-generated traffic were based upon their respective future traffic assignments without the proposed project. Table 5 summarizes the trip distribution used in this analysis.

Table 5. Project-Generated Trip Distribution

Phase	Peak Hour	Direction	To/From	Traffic Assignment
Interim Phase (2010)	AM	Inbound	North	18%
			South	65%
			West	17%
		Outbound	North	27%
			South	41%
			West	32%
	PM	Inbound	North	36%
			South	39%
			West	25%
		Outbound	North	56%
			South	24%
			West	20%
Master Plan (2020)	AM	Inbound	North	18%
			South	63%
			West	19%
		Outbound	North	29%
			South	31%
			West	39%
	PM	Inbound	North	33%
			South	42%
			West	25%
		Outbound	North	53%
			South	27%
			West	20%

Figures 9 and 10 depict the AM and PM peak hour project-generated traffic assignments for the Interim Phase of development, respectively. Figures 11 and 12 depict the AM and PM peak hour project-generated traffic assignments for the Master Plan development, respectively.

V. Traffic Impact Analysis

A. Year 2010 Traffic Impact Analysis

1. Traffic Improvements Proposed for the Interim Phase

In addition to the traffic improvements to mitigate Year 2010 highway deficiencies without the proposed project, as discussed previously, the following improvements are recommended to provide access to the project site:

a. Widen/restripe southbound Kuhio Highway at Kapule Highway to provide an exclusive left-turn lane to the Main Access Road.

b. Widen/restripe eastbound Kuhio Highway at Kapule Highway to provide a shared through/right-turn lane.

c. The Main Access Road should provide an exclusive left-turn lane and a shared through/right-turn lane at Kuhio Highway/Kapule Highway.

d. Widen northbound Kuhio Highway to provide acceleration and deceleration right turn lanes at the proposed Retail Access Road.

2. Year 2010 AM Peak Hour Traffic Impact Analysis With Project

With the implementation of the proposed traffic improvements, as discussed in the previous sections, the intersections within the study area are expected to operate at satisfactory Levels of Service, during the Year 2010 AM peak hour of traffic with the proposed project. Figure 13 depicts the Year 2010 AM peak hour traffic with the proposed project, and the results of the capacity analysis.

3. Year 2010 PM Peak Hour Traffic Impact Analysis With Project

During the Year 2010 PM peak hour of traffic with the proposed project, the intersections within the study area are expected to operate at satisfactory Levels of Service. The Year 2010 PM peak hour traffic with the proposed project, and the results of the capacity analysis are depicted on Figure 14.

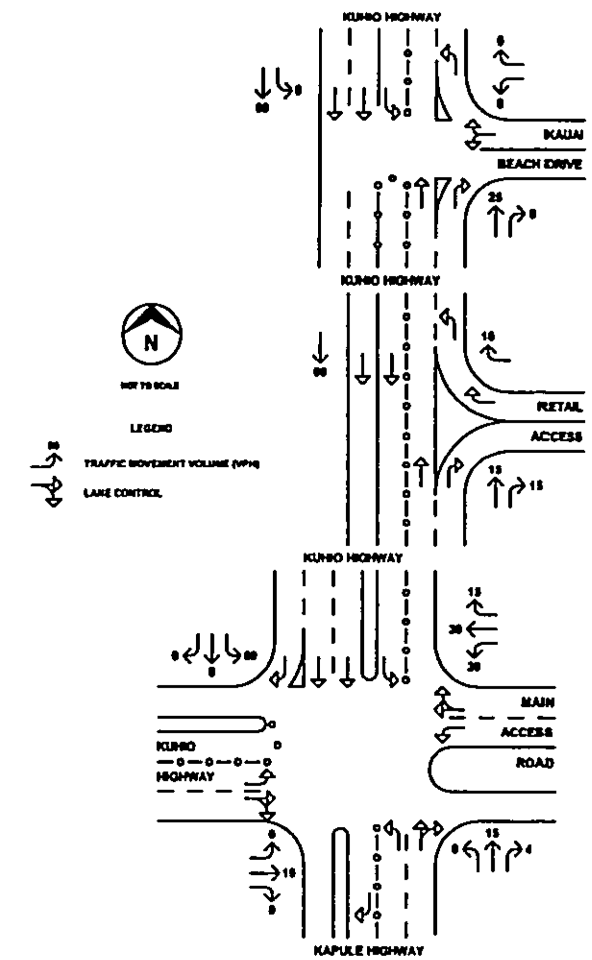


Figure 9. Interim Phase (2010) AM Peak Hour Traffic Assignment

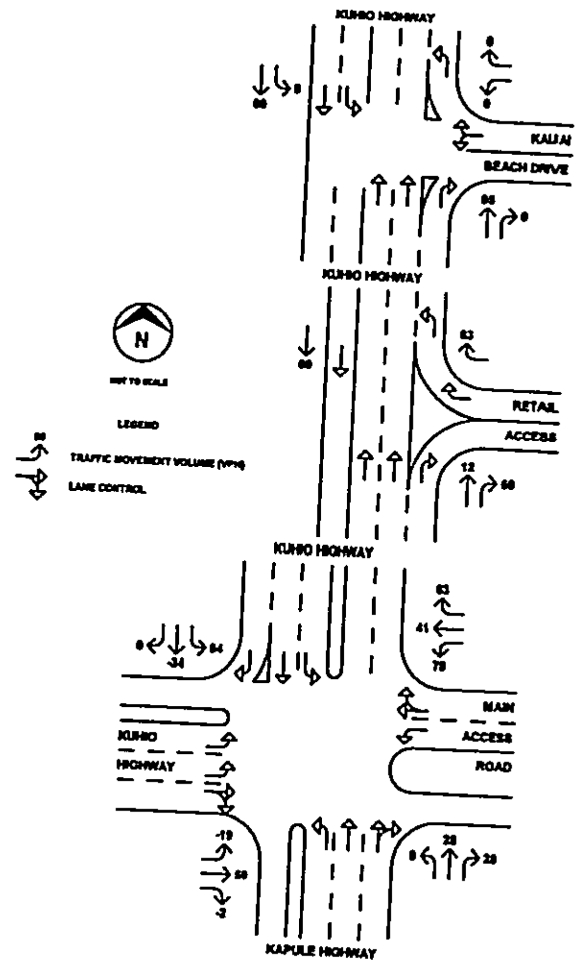


Figure 10. Interim Phase (2010) PM Peak Hour Traffic Assignment

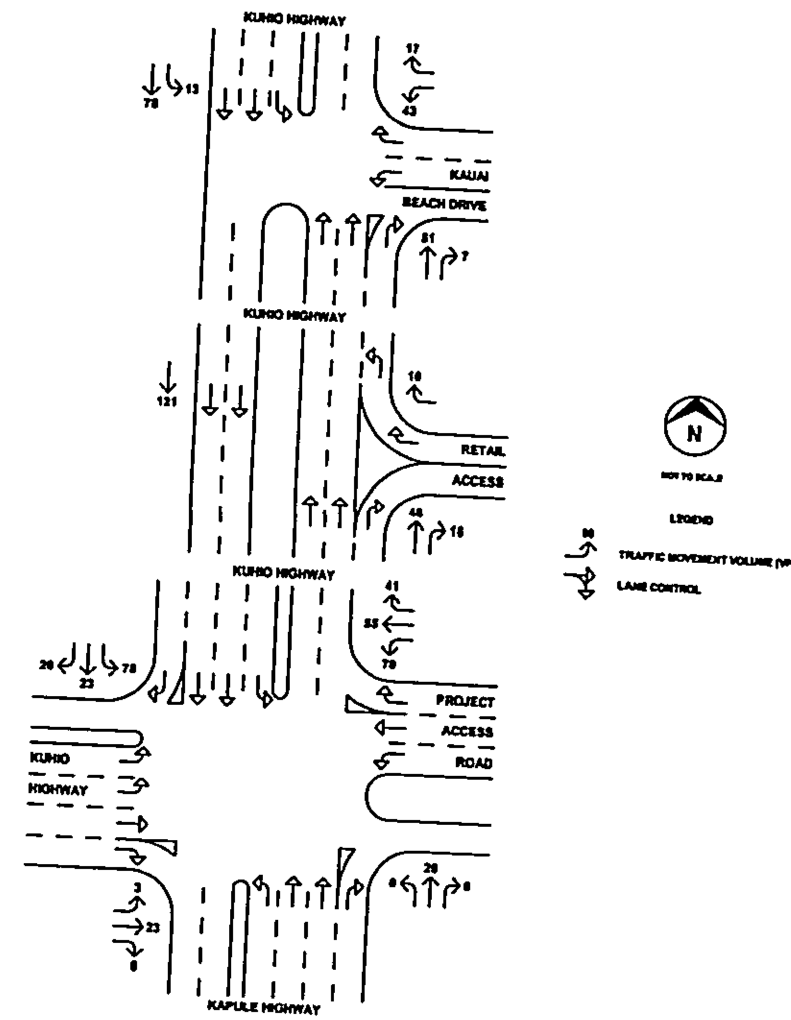


Figure 11. Master Plan (2020) AM Peak Hour Traffic Assignment

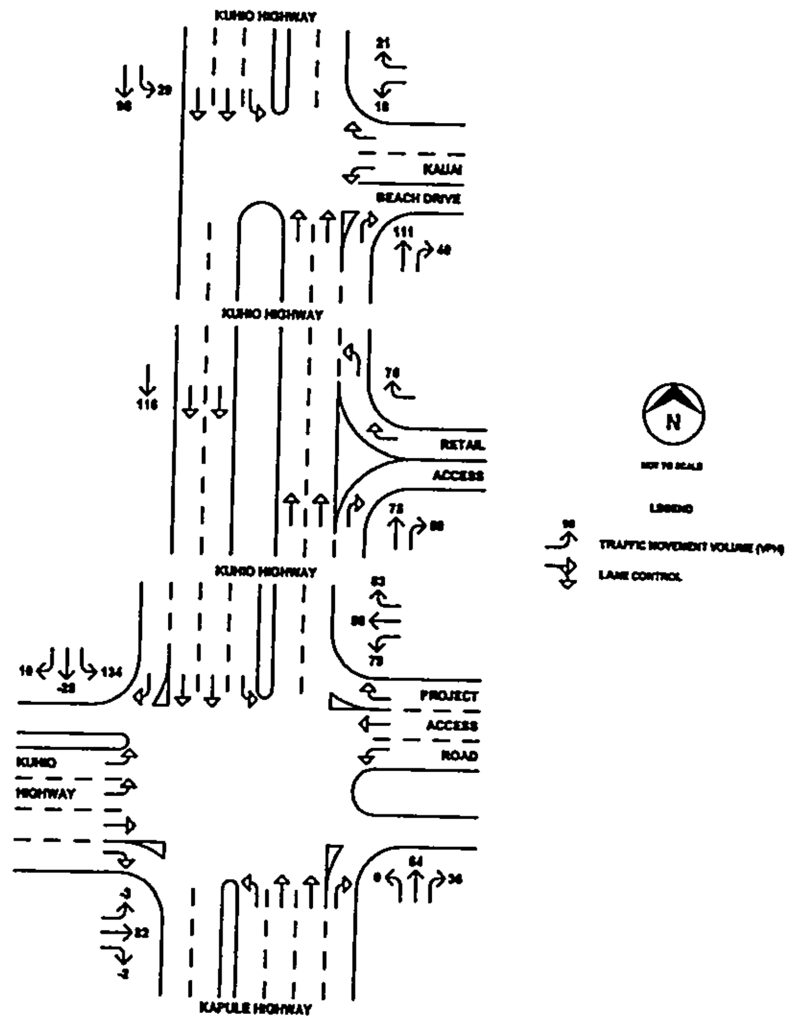


Figure 12. Master Plan (2020) PM Peak Hour Traffic Assignment

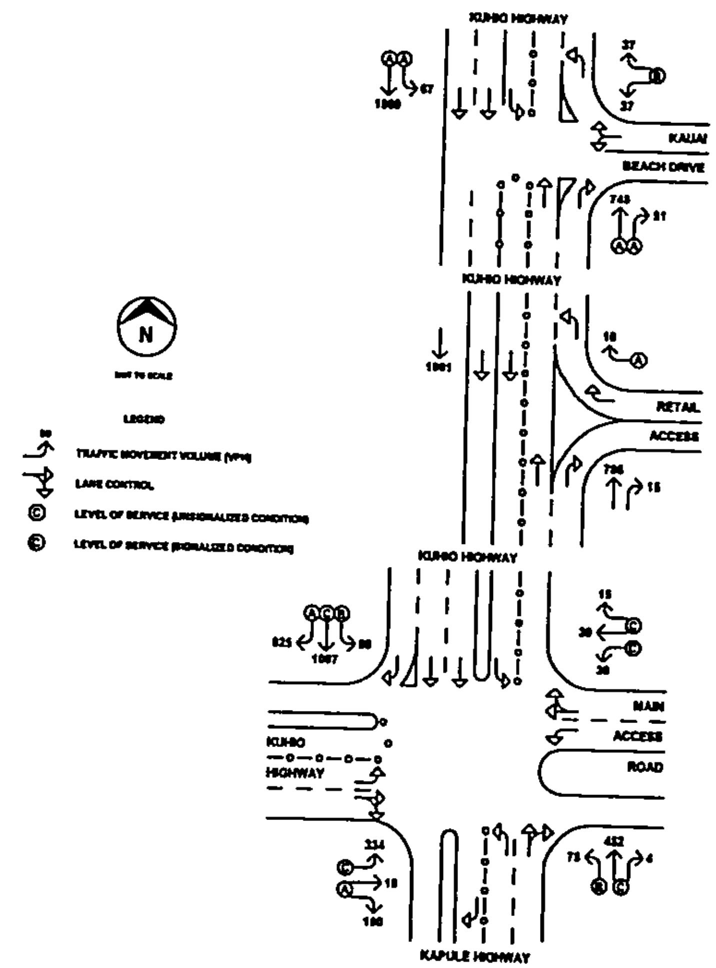


Figure 13. 2010 AM Peak Hour Traffic With Project

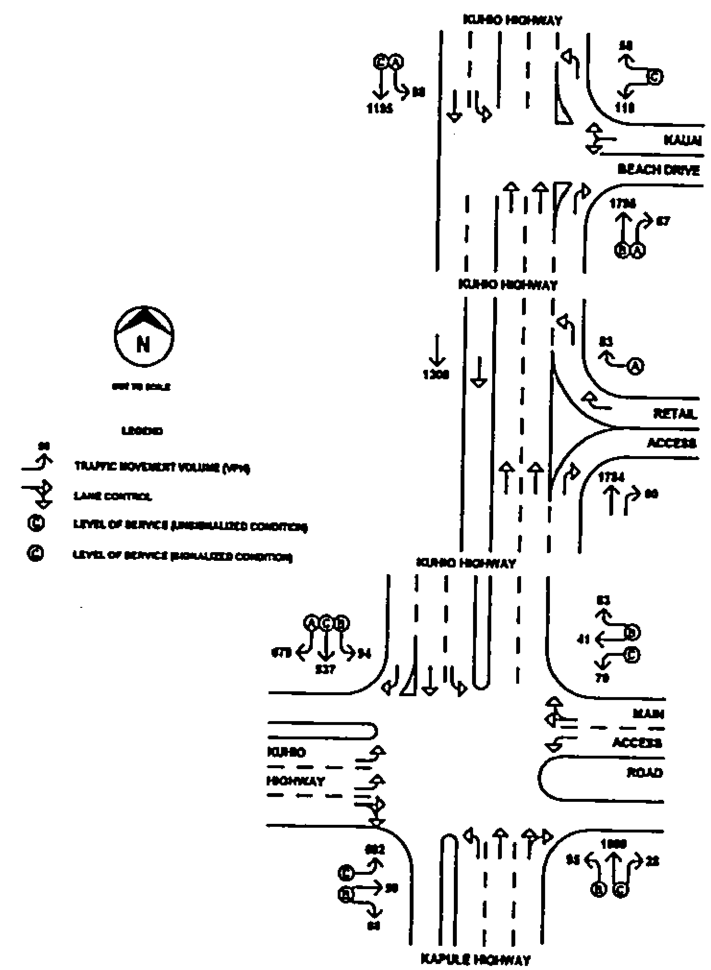


Figure 14. 2010 PM Peak Hour Traffic With Project

B. Year 2020 Traffic Impact Analysis

1. Traffic Improvements for the Full Build-Out of the Master Plan

In addition to the traffic improvements to mitigate Year 2020 highway deficiencies without the proposed project, as discussed previously, the following improvements are recommended to provide access to the project site:

a. Widen northbound Kapule Highway at Kuhio Highway to provide an exclusive right-turn lane to the Main Access Road.

b. Widen eastbound Kuhio Highway at Kapule Highway to provide a through-only lane to the Main Access Road and an exclusive right-turn lane to Kapule Highway.

c. Widen the Main Access Road to provide separate left-turn, through, and right-turn lanes at Kuhio Highway/Kapule Highway.

d. Widen Kauai Beach Drive to provide separate left-turn and right-turn lanes at Kuhio Highway.

2. Year 2020 AM Peak Hour Traffic Impact Analysis With Project

During the AM peak hour of traffic with the proposed project, the intersections within the study area are expected to operate at satisfactory Levels of Service, under the proposed traffic improvements, as discussed in the previous sections. Figure 15 depicts the AM peak hour traffic with the proposed project, and the results of the capacity analysis.

3. Year 2020 PM Peak Hour Traffic Impact Analysis With Project

During the PM peak hour of traffic with the proposed project, the intersection of Kapule Highway and Kuhio Highway is expected to operate at LOS "C". However, the left-turn movement from eastbound Kuhio Highway to northbound Kuhio Highway, the through and left-turn movements on the Main Access Road, and the left-turn movement from southbound Kuhio Highway to the Main Access Road at Kapule Highway/Kuhio Highway intersection are expected to operate at LOS "D". The other intersections within the study area are expected to operate at satisfactory Levels of Service, during the PM peak hour of traffic with the proposed project. The PM peak hour traffic with the proposed project, and the results of the capacity analysis are depicted on Figure 16.

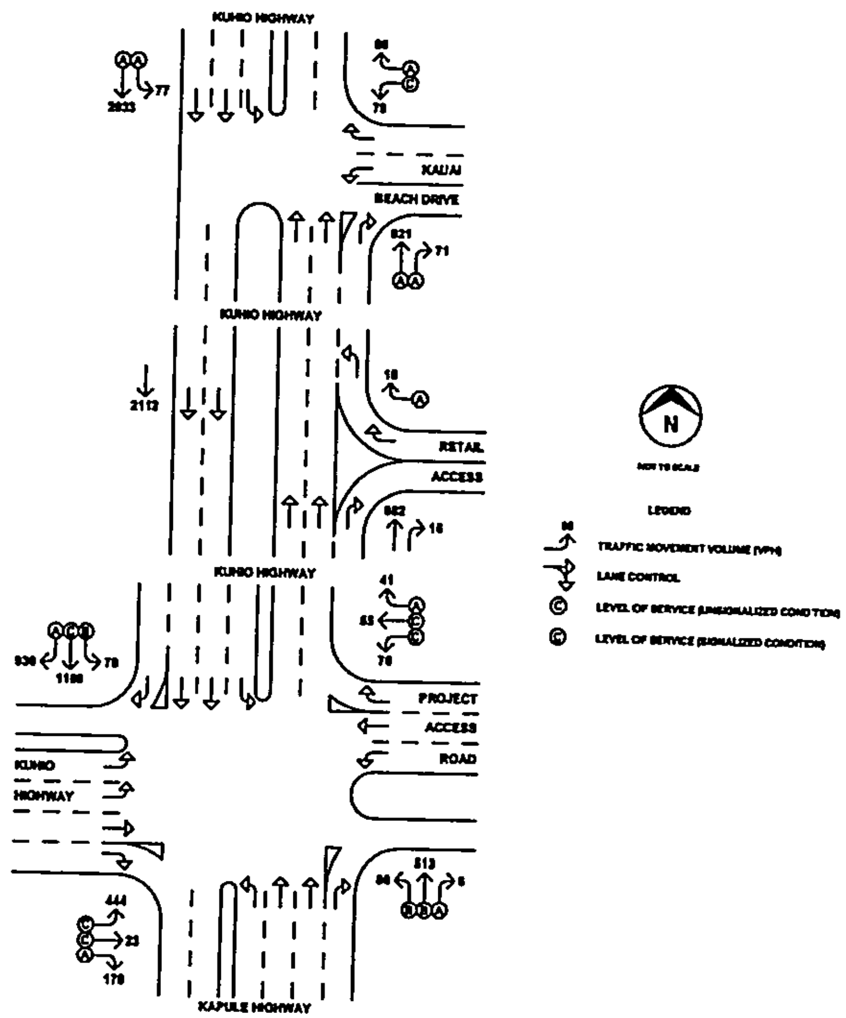


Figure 15. 2020 AM Peak Hour Traffic With Project

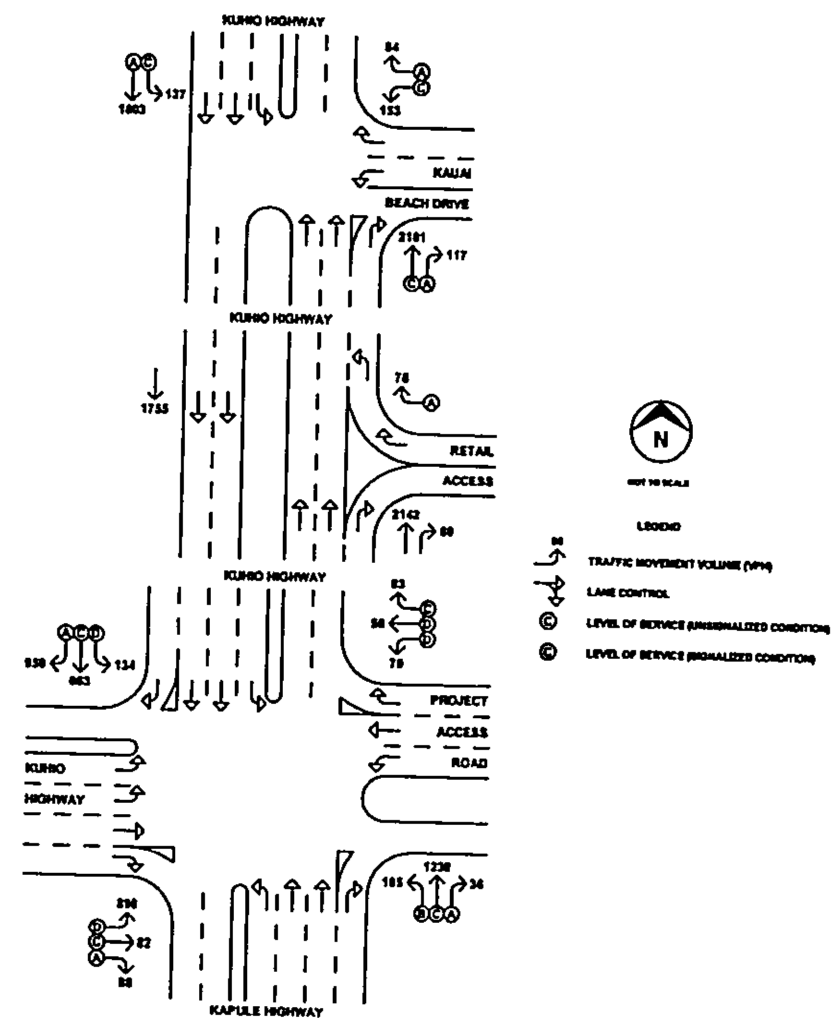


Figure 16. 2020 PM Peak Hour Traffic With Project

VI. Recommendations and Conclusions

A. Recommendations

1. Year 2010 Traffic Improvements Without Project

a. The northbound approach of Kapule Highway should be widened at Kuhio Highway from one lane to two through lanes to match the existing north leg of Kuhio Highway.

b. Eastbound Kuhio Highway should be widened at Kapule Highway to provide double left-turn lanes to northbound Kuhio Highway.

c. The intersection of Kuhio Highway and Kauai Beach Drive should be signalized to mitigate future deficiencies.

2. Year 2020 Traffic Improvements Without Project

Kapule/Kuhio Highway should be widened from a two-/three-lane highway to a four-lane, divided roadway between Rice Street in Lihue and Mailihuna Road in Kapaa, as proposed in the KLRLTP.

3. Proposed Interim Phase Access Improvements

a. Southbound Kuhio Highway should be widened/restriped at Kapule Highway to provide an exclusive left-turn lane to the Main Access Road.

b. The Main Access Road should provide an exclusive left-turn lane and a shared through/right-turn lane at Kuhio Highway/Kapule Highway.

c. The traffic signal system at the intersection of Kuhio Highway and Kapule Highway should be modified to accommodate the Main Access Road.

d. Northbound Kuhio Highway should be widened to provide a right-turn acceleration lane and a right-turn deceleration lane to the Retail Access Road.

4. Proposed Master Plan Access Improvements

a. Northbound Kapule Highway should be widened at Kuhio Highway to provide an exclusive right-turn lane to the Main Access Road.

b. Eastbound Kuhio Highway should be widened at Kapule Highway to provide an exclusive right-turn lane.

c. The Main Access Road should be widened to provide separate left-turn, through-only, and right-turn lanes at Kuhio Highway/Kapule Highway.

d. Kauai Beach Drive should be widened to provide separate left-turn and right-turn lanes at Kuhio Highway.

B. Conclusions

The traffic in the vicinity of the proposed project is expected to increase by 3.75 percent to 4.4 percent per year to the Year 2020 without the proposed project. The traffic impact analysis does not take into account the Lihue-Hanama'ulu Bypass, which was recommended in the KLRLTP as a long-range highway improvement. The proposed Bypass highway is expected to divert traffic around the Hanama'ulu and Lihue areas, including the vicinity of the proposed project.

The future highway improvements on Kapule Highway and Kuhio Highway recommended in the KLRLTP, and the intersection improvements recommended herein, are expected to mitigate the traffic impacts resulting from the development of the proposed Ocean Bay Plantation at Hanama'ulu. If the KLRLTP-proposed highway improvements were not implemented by the Year 2010, interim traffic improvements would be required to mitigate the anticipated highway deficiencies with and without the proposed project. Table 6 summarizes the traffic operations analysis of the intersections within the study area.

Table 6. Summary of Traffic Operations Analysis

Scenario	Roadway Conditions	Peak Hour	Kuhio Highway and Kapule Highway		Kuhio Highway and Kauai Beach Drive	
			LOS	V/C	LOS	V/C
Existing	Without Mitigation	AM	B	0.85	*C*	N/A
		PM	C	0.93	*E*	N/A
Year 2010 Without Project	Without Mitigation	AM	C	0.97	*C*	N/A
		PM	D	1.09	*F*	N/A
	With Mitigation	AM	A	0.77	A	.074
		PM	B	0.89	B	0.90
Year 2020 Without Project	Without Mitigation	AM	C	1.05	*D*	N/A
		PM	F	1.25	*F*	N/A
	With Mitigation	AM	A	0.82	A	0.77
		PM	B	0.78	B	0.87
Year 2010 With Project	Without Mitigation	AM	D	1.06	*C*	N/A
		PM	F	9.83	*F*	N/A
	With Mitigation	AM	B	0.78	A	0.76
		PM	C	0.84	C	0.98
Year 2020 With Project	Without Mitigation	AM	F	1.43	*F*	N/A
		PM	F	26.10	*F*	N/A
	With Mitigation	AM	B	0.82	A	0.81
		PM	C	0.92	B	0.95

Notes:
LOS A – Intersection Level of Service (signalized condition)
LOS *C* – Critical Movement Level of Service (unsignalized condition)
N/A – Not applicable

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED

OCEAN BAY PLANTATION AT HANAMA`ULU

TAX MAP KEYS (4) 3-7-3:1 & (4) 3-9-5:5

APPENDIX A

TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

FILE NAME: KAPKUH

Sec 3

PROJECT: HANAMAULU
LOCATION: Kauai
E-W STREET: Kuhio Highway
N-S STREET: Kuhio/Kapule Highway

PERIOD: AM Peak
NORTH:
TECHNICIAN: RANDY
DATE: 9/19/01

TIME		Kuhio Highway EBL	EBT	EBR	WBL	WBT	WBR	Kuhio/Kapule Highway NBL	NBT	NBR	SBL	SBT	SBR	TOTAL
06:30	06:45	52	0	27	0	0	0	3	71	0	0	122	103	378
06:45	07:00	59	0	25	0	0	0	10	70	0	0	210	162	536
07:00	07:15	54	0	29	0	0	0	18	81	0	0	206	184	570
07:15	07:30	45	0	35	0	0	0	12	106	0	0	261	219	678
07:30	07:45	70	0	49	0	0	0	18	84	0	0	232	193	646
07:45	08:00	62	0	35	0	0	0	21	106	0	0	232	152	610
08:00	08:15	75	0	22	0	0	0	24	130	0	0	193	115	559
08:15	08:30	70	0	33	0	0	0	19	109	0	0	154	127	512
AM PEAK HOUR														
07:00	08:00	231	0	148	0	0	0	67	379	0	0	931	748	2504
07:15	07:30	1.28		1.08				1.40	0.89			0.89	0.85	0.92

TRAFFIC COUNT DATA

FILE NAME: KAPKUH

PROJECT: HANAMAULU
LOCATION: Kauai
E-W STREET Kuhio Highway
N-S STREET Kuhio/Kapule Highway

PERIOD: PM Peak
NORTH:
TECHNICIAN: RANDY
DATE: 9/18/01

TIME		Kuhio Highway EBL	EBT	EBR	WBL	WBT	WBR	Kuhio/Kapule Highway NBL	NBT	NBR	SBL	SBT	SBR	TOTAL
15:30	15:45	140	0	8	0	0	0	28	218	0	0	128	127	649
15:45	16:00	147	0	19	0	0	0	23	169	0	0	123	147	628
16:00	16:15	126	0	13	0	0	0	28	176	0	0	128	105	576
16:15	16:30	128	0	13	0	0	0	23	228	0	0	137	102	631
16:30	16:45	140	0	13	0	0	0	27	240	0	0	137	109	666
16:45	17:00	155	0	18	0	0	0	19	236	0	0	89	86	603
17:00	17:15	109	0	10	0	0	0	19	248	0	0	93	101	580
17:15	17:30	130	0	12	0	0	0	17	201	0	0	104	103	567
PM PEAK HOUR														
16:15	17:15	532	0	54	0	0	0	88	952	0	0	456	398	2480
17:00	17:15	1.22		1.35				1.16	0.96			1.23	0.99	0.93

TRAFFIC COUNT DATA

FILE NAME: KUHKAU

Sec 3

PROJECT: HANAMAULU
LOCATION: Kauai
E-W STREET: Kauai Beach Drive
N-S STREET: Kuhio Highway

PERIOD: AM Peak
NORTH:
TECHNICIAN: LAURA
DATE: 9/19/01

TIME		Kauai Beach Drive EBL	EBT	EBR	WBL	WBT	WBR	Kuhio Highway NBL	NBT	NBR	SBL	SBT	SBR	TOTAL
06:30	06:45	0	0	0	5	0	3	0	118	5	5	242	0	378
06:45	07:00	0	0	0	2	0	1	0	121	9	6	367	0	506
07:00	07:15	0	0	0	3	0	0	0	126	7	7	392	0	535
07:15	07:30	0	0	0	6	0	8	0	137	9	13	456	0	627
07:30	07:45	0	0	0	5	0	6	0	139	5	10	447	0	612
07:45	08:00	0	0	0	7	0	9	0	164	5	6	344	0	535
08:00	08:15	0	0	0	5	0	9	0	189	9	7	291	0	510
08:15	08:30	0	0	0	14	0	4	0	162	13	3	247	0	443
AM PEAK HOUR														
07:00	08:00	0	0	0	21	0	21	0	566	26	36	1639	0	2309
07:15	07:30				0.88		0.88		1.03	0.72	0.69	0.90		
						0.875			1.014			0.893		0.92

TRAFFIC COUNT DATA

FILE NAME: KUHKAU

PROJECT: HANAMAULU
LOCATION: Kauai
E-W STREET Kauai Beach Drive
N-S STREET Kuhio Highway

PERIOD: PM Peak
NORTH:
TECHNICIAN: LAURA
DATE: 9/19/01

TIME		Kauai Beach Drive EBL	EBT	EBR	WBL	WBT	WBR	Kuhio Highway NBL	NBT	NBR	SBL	SBT	SBR	TOTAL
15:30	15:45	0	0	0	11	0	10	0	330	11	9	227	0	598
15:45	16:00	0	0	0	12	0	14	0	288	14	8	236	0	572
16:00	16:15	0	0	0	11	0	5	0	285	10	10	215	0	536
16:15	16:30	0	0	0	9	0	12	0	341	9	14	216	0	601
16:30	16:45	0	0	0	18	0	4	0	351	14	11	213	0	611
16:45	17:00	0	0	0	18	0	8	0	358	12	13	146	0	555
17:00	17:15	0	0	0	10	0	9	0	343	9	10	183	0	564
17:15	17:30	0	0	0	11	0	8	0	297	13	5	184	0	518
PM PEAK HOUR														
16:15	17:15	0	0	0	55	0	33	0	1393	44	48	758	0	2331
16:30	16:45				0.76		2.06		0.99	0.79	1.09	0.89		

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

OCEAN BAY PLANTATION AT HANAMA`ULU

TAX MAP KEYS (4) 3-7-3:1 & (4) 3-9-5:5

APPENDIX B

CAPACITY ANALYSIS WORKSHEETS

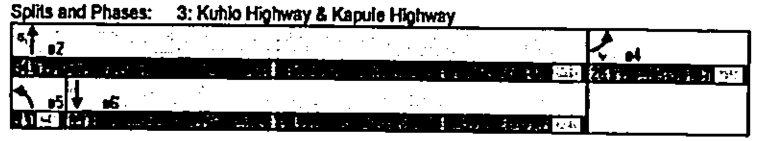
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			0
Storage Lanes	1	1	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.950		0.105			
Satd. Flow (perm)	1770	1583	196	1863	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		148				854
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1300	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	231	148	67	379	931	748
Peak Hour Factor	1.00	1.00	1.00	0.89	0.89	0.85
Lane Group Flow (vph)	231	148	67	426	1046	880
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	9.0	20.0	22.0	22.0
Total Split (s)	26.0	26.0	9.0	94.0	85.0	85.0
Total Split (%)	22%	22%	8%	78%	71%	71%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	Min	Min	Min
Act Effct Green (s)	18.2	18.2	73.2	71.5	64.8	64.8
Actuated g/C Ratio	0.18	0.18	0.72	0.73	0.66	0.66
v/c Ratio	0.70	0.36	0.30	0.31	0.85	0.66
Uniform Delay, d1	37.9	0.0	3.6	4.5	13.4	0.2
Delay	43.1	7.3	4.0	4.8	15.2	0.7
LOS	D	A	A	A	B	A
Approach Delay	29.1			4.7	8.6	
Approach LOS	C			A	A	
Queue Length 50th (ft)	153	0	11	91	542	4
Queue Length 95th (ft)	#272	57	23	129	756	21
Internal Link Dist (ft)	992			1220	3045	
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		300	470			
50th Bay Block Time %						
95th Bay Block Time %						
Queuing Penalty (veh)						

3: Kuhio Highway & Kapule Highway

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 98.4
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 10.7 Intersection LOS: B
Intersection Capacity Utilization 61.6% ICU Level of Service D
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Highway & Kapule Highway



6: Kauai Beach Dr & Kuhio Highway

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑	↱	↰	↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	21	21	584	26	36	1658
Peak Hour Factor	0.88	0.88	1.00	0.72	0.69	0.90
Hourly flow rate (veh/h)	24	24	584	36	52	1842
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	1609	584			584	
vC1, stage 1 conf vol	584					
vC2, stage 2 conf vol	1025					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	95			95	
cM capacity (veh/h)	288	455			987	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	48	584	36	52	921	921
Volume Left	24	0	0	52	0	0
Volume Right	24	0	36	0	0	0
cSH	353	1700	1700	987	1700	1700
Volume to Capacity	0.14	0.34	0.02	0.05	0.54	0.54
Queue Length (ft)	12	0	0	4	0	0
Control Delay (s)	16.8	0.0	0.0	8.9	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	16.8	0.0		0.2		
Approach LOS	C					

Intersection Summary

Average Delay	0.5		
Intersection Capacity Utilization	60.9%	ICU Level of Service	B

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			370
Storage Lanes	1	1	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.950		0.351			
Satd. Flow (perm)	1770	1583	654	1863	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		54				402
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1300	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	532	54	88	952	456	398
Peak Hour Factor	1.00	1.00	1.00	0.96	1.00	0.99
Lane Group Flow (vph)	532	54	88	992	456	402
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	9.0	20.0	20.0	20.0
Total Split (s)	45.0	45.0	9.0	75.0	66.0	66.0
Total Split (%)	38%	38%	8%	63%	55%	55%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	Min	Min	Min
Act Effct Green (s)	35.1	35.1	61.0	59.1	52.6	52.6
Actuated g/C Ratio	0.34	0.34	0.57	0.57	0.51	0.51
v/c Ratio	0.88	0.09	0.21	0.93	0.48	0.40
Uniform Delay, d1	32.3	0.0	9.4	19.1	16.5	0.0
Delay	40.5	7.3	10.5	25.4	17.8	1.6
LOS	D	A	B	C	B	A
Approach Delay	37.5			24.2	10.2	
Approach LOS	D			C	B	
Queue Length 50th (ft)	386	0	28	634	218	0
Queue Length 95th (ft)	#586	28	51	#982	307	39
Internal Link Dist (ft)	992			1220	3045	
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		300	470			370
50th Bay Block Time %	19%			14%		
95th Bay Block Time %	37%			24%		
Queuing Penalty (veh)	15			17		

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 102.9
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 22.5 — Intersection LOS: C
Intersection Capacity Utilization 88.3% — ICU Level of Service D
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Highway & Kapule Highway

ø2 ø4
ø5 ø6

6: Kauai Beach Dr & Kuhio Highway

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	65	33	1440	44	48	799
Peak Hour Factor	0.76	1.00	0.99	0.79	1.00	0.89
Hourly flow rate (veh/h)	72	33	1455	56	48	898
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	2448	727			1455	
vC1, stage 1 conf vol	1455					
vC2, stage 2 conf vol	994					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	59	91			90	
cM capacity (veh/h)	176	366			461	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	105	727	727	56	48	898
Volume Left	72	0	0	0	48	0
Volume Right	33	0	0	56	0	0
cSH	210	1700	1700	1700	461	1700
Volume to Capacity	0.50	0.43	0.43	0.03	0.10	0.53
Queue Length (ft)	63	0	0	0	9	0
Control Delay (s)	38.3	0.0	0.0	0.0	13.7	0.0
Lane LOS	E				B	
Approach Delay (s)	38.3	0.0			0.7	
Approach LOS	E					

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	59.9%	ICU Level of Service	A

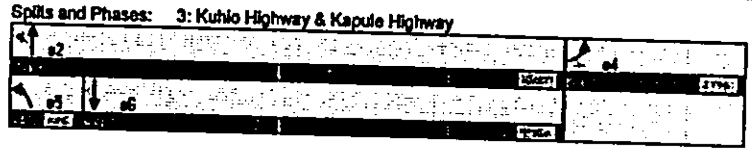
3: Kuhio Highway & Kapule Highway

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			0
Storage Lanes	1	1	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.950		0.068			
Satd. Flow (perm)	1770	1583	127	1863	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		160				958
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1300	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	334	160	75	437	1007	825
Peak Hour Factor	1.00	1.00	1.00	0.89	0.89	0.85
Lane Group Flow (vph)	334	160	75	491	1131	971
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	9.0	20.0	22.0	22.0
Total Split (s)	22.0	22.0	9.0	68.0	59.0	59.0
Total Split (%)	24%	24%	10%	76%	66%	66%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	Min	Min	Min
Act Effct Green (s)	18.0	18.0	64.1	62.1	55.1	55.1
Actuated g/C Ratio	0.20	0.20	0.70	0.70	0.62	0.62
v/c Ratio	0.92	0.35	0.42	0.37	0.97	0.72
Uniform Delay, d1	35.0	0.0	3.9	5.1	16.6	0.1
Delay	60.4	5.6	5.9	5.3	35.8	0.9
LOS	E	A	A	A	D	A
Approach Delay	42.6			5.4	19.7	
Approach LOS	D			A	B	
Queue Length 50th (ft)	189	0	11	93	581	2
Queue Length 95th (ft)	#353	51	32	137	#895	23
Internal Link Dist (ft)	992			1220	3045	
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		300	470			
50th Bay Block Time %						
95th Bay Block Time %	21%					
Queuing Penalty (veh)	16					

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 88.2
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 20.7 Intersection LOS: C
Intersection Capacity Utilization 92.2% ICU Level of Service E
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Highway & Kapule Highway



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑	↱	↰	↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	37	37	720	51	67	1800
Peak Hour Factor	0.88	0.88	1.00	0.72	0.69	0.90
Hourly flow rate (veh/h)	42	42	720	71	97	2000
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	1914	720			720	
vC1, stage 1 conf vol	720					
vC2, stage 2 conf vol	1194					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	89			89	
cM capacity (veh/h)	221	370			877	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	84	720	71	97	1000	1000
Volume Left	42	0	0	97	0	0
Volume Right	42	0	71	0	0	0
cSH	276	1700	1700	877	1700	1700
Volume to Capacity	0.30	0.42	0.04	0.11	0.59	0.59
Queue Length (ft)	31	0	0	9	0	0
Control Delay (s)	23.8	0.0	0.0	9.6	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	23.8	0.0		0.4		
Approach LOS	C					

Intersection Summary

Average Delay 1.0
Intersection Capacity Utilization 66.9% ICU Level of Service B

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			370
Storage Lanes	1	1	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.950		0.215			
Satd. Flow (perm)	1770	1583	400	1863	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		70				686
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1300	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	711	70	95	1061	571	679
Peak Hour Factor	1.00	1.00	1.00	0.96	1.00	0.99
Lane Group Flow (vph)	711	70	95	1105	571	686
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	9.0	20.0	21.5	21.5
Total Split (s)	41.0	41.0	10.0	59.0	49.0	49.0
Total Split (%)	41%	41%	10%	59%	49%	49%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	0.5	0.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	Min	Min	Min
Act Effct Green (s)	37.0	37.0	57.0	55.0	47.0	47.0
Actuated g/C Ratio	0.37	0.37	0.55	0.55	0.47	0.47
v/c Ratio	1.09	0.11	0.32	1.08	0.65	0.62
Uniform Delay, d1	32.0	0.0	10.6	22.5	20.8	0.0
Delay	79.6	5.3	11.0	65.5	21.6	1.5
LOS	E	A	B	E	C	A
Approach Delay	72.9			61.2	10.7	
Approach LOS	E			E	B	
Queue Length 50th (ft)	~512	0	27	~791	281	0
Queue Length 95th (ft)	#733	28	52	#1037	405	61
Internal Link Dist (ft)	992			1220	3045	
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		300	470			370
50th Bay Block Time %	31%			24%		
95th Bay Block Time %	46%			38%	10%	
Queuing Penalty (veh)	28			29	35	

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 100
Natural Cycle: 100
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.09
Intersection Signal Delay: 44.4 Intersection LOS: D
Intersection Capacity Utilization 104.2% ICU Level of Service F
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Highway & Kapule Highway

ø2 ø4
ø5 ø6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↑↑	↱	↰	↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	110	58	1700	67	88	1135
Peak Hour Factor	0.76	1.00	0.99	0.79	1.00	0.89
Hourly flow rate (veh/h)	145	58	1717	85	88	1275
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	3168	859			1717	
vC1, stage 1 conf vol	1717					
vC2, stage 2 conf vol	1451					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	81			76	
cM capacity (veh/h)	112	300			365	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	203	859	859	85	88	1275
Volume Left	145	0	0	0	88	0
Volume Right	58	0	0	85	0	0
cSH	212	1700	1700	1700	365	1700
Volume to Capacity	0.96	0.51	0.51	0.05	0.24	0.75
Queue Length (ft)	204	0	0	0	23	0
Control Delay (s)	98.1	0.0	0.0	0.0	18.0	0.0
Lane LOS	F				C	
Approach Delay (s)	98.1	0.0			1.2	
Approach LOS	F					

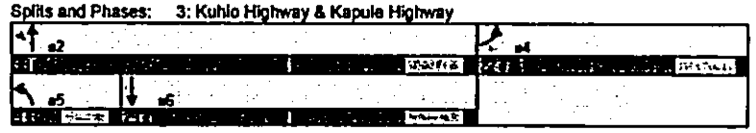
Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	81.8%	ICU Level of Service	D

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			0
Storage Lanes	1	1	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	1770	1583	1770	1863	3539	1583
Flt Permitted	0.950		0.138			
Satd. Flow (perm)	1770	1583	257	1863	3539	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		160				971
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1300	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	334	160	75	437	1007	825
Peak Hour Factor	1.00	1.00	1.00	0.89	0.89	0.85
Lane Group Flow (vph)	334	160	75	491	1131	971
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	9.0	20.0	22.0	22.0
Total Split (s)	22.0	22.0	9.0	38.0	29.0	29.0
Total Split (%)	37%	37%	15%	63%	48%	48%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	Min	Min	Min
Act Effct Green (s)	15.4	15.4	34.0	30.3	25.5	25.5
Actuated g/C Ratio	0.29	0.29	0.56	0.56	0.47	0.47
v/c Ratio	0.66	0.28	0.28	0.47	0.68	0.77
Uniform Delay, d1	18.2	0.0	5.1	6.6	12.2	0.0
Delay	17.8	3.6	6.3	7.7	13.1	2.8
LOS	B	A	A	A	B	A
Approach Delay	13.2			7.5	8.3	
Approach LOS	B			A	A	
Queue Length 50th (ft)	103	0	11	93	176	0
Queue Length 95th (ft)	179	35	26	152	242	38
Internal Link Dist (ft)	992			1220	3045	
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		300	470			
50th Bay Block Time %						
95th Bay Block Time %						
Queuing Penalty (veh)						

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 53.9
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 8.9 Intersection LOS: A
Intersection Capacity Utilization 70.9% ICU Level of Service C

Splits and Phases: 3: Kuhio Highway & Kapule Highway



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	75		430	170	
Storage Lanes	1	0		1	1	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50		50	50	50	50
Trailing Detector (ft)	0		0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1694	0	1863	1583	1770	3539
Flt Permitted	0.978				0.131	
Satd. Flow (perm)	1694	0	1863	1583	244	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	42			71		
Link Speed (mph)	25		50			50
Link Distance (ft)	832		3125			1100
Travel Time (s)	22.7		28.6			15.0
Volume (vph)	37	37	720	51	67	1800
Peak Hour Factor	0.88	0.88	1.00	0.72	0.69	0.90
Lane Group Flow (vph)	84	0	720	71	97	2000
Turn Type				pm+ov	pm+pt	
Protected Phases	8		2	8	1	6
Permitted Phases				2	6	
Detector Phases	8		2	8	1	6
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	20.0		20.0	20.0	8.0	20.0
Total Split (s)	20.0	0.0	32.0	20.0	8.0	40.0
Total Split (%)	33%	0%	53%	33%	13%	67%
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		Min	None	None	Min
Act Effct Green (s)	8.3		42.0	55.3	51.4	50.1
Actuated g/C Ratio	0.12		0.64	0.80	0.75	0.76
v/c Ratio	0.34		0.60	0.06	0.34	0.74
Uniform Delay, d1	13.1		6.9	0.0	1.9	4.2
Delay	11.4		9.1	0.5	2.6	6.1
LOS	B		A	A	A	A
Approach Delay	11.4		8.3			6.0
Approach LOS	B		A			A
Queue Length 50th (ft)	11		136	0	6	147
Queue Length 95th (ft)	40		#281	2	14	297
Internal Link Dist (ft)	752		3045			1020
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)				430	170	
50th Bay Block Time %						8%
95th Bay Block Time %						20%
Queuing Penalty (veh)						13

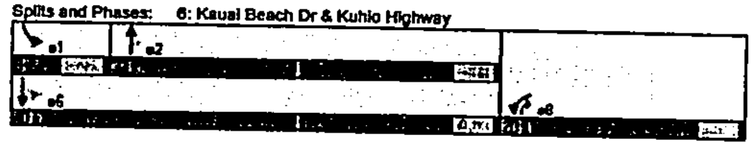
2010 AM Peak Hour
6: Kauai Beach Dr & Kuhio Highway

W/O Project
W/Mitigation

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 65.7
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 6.7 Intersection LOS: A
Intersection Capacity Utilization 66.0% ICU Level of Service B
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Kauai Beach Dr & Kuhio Highway



2010 PM Peak Hour
3: Kuhio Highway & Kapule Highway

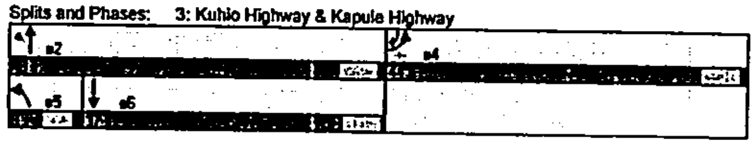
W/O Project
W/Mitigation

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			370
Storage Lanes	1	1	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	1770	1583	1770	3539	1863	1583
Flt Permitted	0.950		0.128			
Satd. Flow (perm)	1770	1583	238	3539	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		70				359
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1300	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	711	70	95	1061	571	679
Peak Hour Factor	1.00	1.00	1.00	0.96	1.00	0.99
Lane Group Flow (vph)	711	70	95	1105	571	686
Turn Type		Perm	pm+pt			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4	2			6
Detector Phases	4	4	5	2	6	4
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	9.0	20.0	21.5	22.0
Total Split (s)	44.0	44.0	9.0	46.0	37.0	44.0
Total Split (%)	49%	49%	10%	51%	41%	49%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	0.5	1.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	None	Min	Min	None
Act Effct Green (s)	36.3	36.3	38.1	35.9	29.4	71.4
Actuated g/C Ratio	0.45	0.45	0.45	0.44	0.36	0.88
v/c Ratio	0.89	0.09	0.47	0.70	0.84	0.48
Uniform Delay, d1	21.0	0.0	12.7	17.4	24.0	0.6
Delay	30.0	4.0	13.9	18.4	29.7	0.7
LOS	C	A	B	B	C	A
Approach Delay	27.7			18.0	13.9	
Approach LOS	C			B	B	
Queue Length 50th (ft)	363	0	29	248	292	19
Queue Length 95th (ft)	#592	23	57	317	#474	34
Internal Link Dist (ft)	992			1220	3045	
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		300	470			370
50th Bay Block Time %	15%					
95th Bay Block Time %	34%				20%	
Queuing Penalty (veh)	17				70	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 80.8
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 18.7 Intersection LOS: B
Intersection Capacity Utilization 84.7% ICU Level of Service D
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Highway & Kapule Highway



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	75		430	170	
Storage Lanes	1	1		1	1	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1770	1583	3539	1583	1770	1863
Flt Permitted	0.950				0.067	
Satd. Flow (perm)	1770	1583	3539	1583	125	1863
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		26		85		
Link Speed (mph)	25		50			50
Link Distance (ft)	832		3125			1100
Travel Time (s)	22.7		28.6			15.0
Volume (vph)	110	58	1700	67	88	1135
Peak Hour Factor	0.76	1.00	0.99	0.79	1.00	0.89
Lane Group Flow (vph)	145	58	1717	85	88	1275
Turn Type		pm+ov		Perm	pm+pt	
Protected Phases	8	1	2		1	6
Permitted Phases		8		2	6	
Detector Phases	8	1	2	2	1	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	8.0	20.0	20.0	8.0	20.0
Total Split (s)	20.0	10.0	60.0	60.0	10.0	70.0
Total Split (%)	22%	11%	67%	67%	11%	78%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag		Lead	Lag	Lag	Lead	
Lead-Lag Optimize?		Yes	Yes	Yes	Yes	
Recall Mode	None	None	Min	Min	None	Min
Act Effct Green (s)	11.8	22.0	55.5	55.5	65.7	63.8
Actuated g/C Ratio	0.14	0.26	0.66	0.66	0.75	0.78
v/c Ratio	0.58	0.14	0.73	0.08	0.42	0.90
Uniform Delay, d1	33.9	13.5	9.5	0.0	2.4	7.4
Delay	32.5	15.4	10.6	1.7	6.4	15.0
LOS	C	B	B	A	A	B
Approach Delay	27.6		10.2			14.4
Approach LOS	C		B			B
Queue Length 50th (ft)	75	13	296	0	9	402
Queue Length 95th (ft)	109	42	436	8	42	#935
Internal Link Dist (ft)	752		3045			1020
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		75		430	170	
50th Bay Block Time %	6%					16%
95th Bay Block Time %	30%		5%			24%
Queuing Penalty (veh)	11		2			17

2010 PM Peak Hour
6: Kauai Beach Dr & Kuhio Highway

W/O Project
W/Mitigation

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 83.7
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 13.0 Intersection LOS: B
Intersection Capacity Utilization 81.8% ICU Level of Service D
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Kauai Beach Dr & Kuhio Highway

ø1 ø2
ø6 ø8

2020 AM Peak Hour
3: Kuhio Highway & Kapule Highway

W/O Project
W/O Mitigation

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			0
Storage Lanes	1	1	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.950		0.047			
Satd. Flow (perm)	1770	1583	88	1863	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		131				724
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1000	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	441	170	80	493	1086	910
Peak Hour Factor	1.00	1.00	1.00	0.89	0.89	0.85
Lane Group Flow (vph)	441	170	80	554	1220	1071
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	9.0	20.0	22.0	22.0
Total Split (s)	35.0	35.0	9.0	95.0	86.0	86.0
Total Split (%)	27%	27%	7%	73%	66%	66%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	Min	Min	Min
Act Effct Green (s)	30.9	30.9	91.0	91.0	82.0	82.0
Actuated g/C Ratio	0.24	0.24	0.70	0.70	0.63	0.63
v/c Ratio	1.05	0.36	0.63	0.42	1.04	0.85
Uniform Delay, d1	49.5	8.9	6.1	8.3	24.0	4.8
Delay	91.2	11.6	21.6	8.5	54.3	6.8
LOS	F	B	C	A	D	A
Approach Delay	69.1			10.2	32.1	
Approach LOS	E			B	C	
Queue Length 50th (ft)	~403	26	19	181	~1107	135
Queue Length 95th (ft)	#613	89	#84	243	#1344	222
Internal Link Dist (ft)	992			920	3045	
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		300	470			
50th Bay Block Time %	23%					
95th Bay Block Time %	47%					
Queuing Penalty (veh)	60					

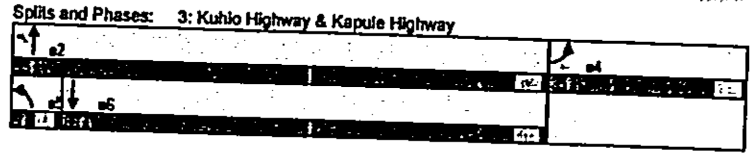
2020 AM Peak Hour
3: Kuhio Highway & Kapule Highway

W/O Project
W/O Mitigation

Intersection Summary

Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 130
Natural Cycle: 130
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 34.5 Intersection LOS: C
Intersection Capacity Utilization 103.1% ICU Level of Service F
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Highway & Kapule Highway



2020 AM Peak Hour
6: Kauai Beach Dr & Kapule Highway

W/O Project
W/O Mitigation

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	36	43	870	64	64	1955
Peak Hour Factor	0.88	0.88	1.00	0.72	0.69	0.90
Hourly flow rate (veh/h)	41	49	870	89	93	2172
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	2142	870			870	
vC1, stage 1 conf vol	870					
vC2, stage 2 conf vol	1272					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	79	83			88	
cM capacity (veh/h)	197	295			770	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	90	870	89	93	1086	1086
Volume Left	41	0	0	93	0	0
Volume Right	49	0	89	0	0	0
cSH	241	1700	1700	770	1700	1700
Volume to Capacity	0.37	0.51	0.05	0.12	0.64	0.64
Queue Length (ft)	41	0	0	10	0	0
Control Delay (s)	28.6	0.0	0.0	10.3	0.0	0.0
Lane LOS	D			B		
Approach Delay (s)	28.6	0.0		0.4		
Approach LOS	D					

Intersection Summary

Average Delay 1.1
Intersection Capacity Utilization 72.0% ICU Level of Service C

2020 PM Peak Hour
3: Kuhio Highway & Kapule Highway

W/O Project
W/O Mitigation

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			370
Storage Lanes	1	1	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	1770	1583	1770	1863	1863	1583
Flt Permitted	0.950		0.062			
Satd. Flow (perm)	1770	1583	115	1863	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		61				598
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1300	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	901	90	105	1166	949	691
Peak Hour Factor	1.00	1.00	1.00	0.96	1.00	0.99
Lane Group Flow (vph)	901	90	105	1215	949	698
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	9.0	20.0	21.5	21.5
Total Split (s)	57.0	57.0	9.0	73.0	64.0	64.0
Total Split (%)	44%	44%	7%	56%	49%	49%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	0.5	0.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	Min	Min	Min
Act Effct Green (s)	53.0	53.0	69.0	69.0	60.1	60.1
Actuated g/C Ratio	0.41	0.41	0.53	0.53	0.46	0.46
v/c Ratio	1.25	0.13	0.64	1.23	1.10	0.66
Uniform Delay, d1	38.5	7.5	15.2	30.5	35.0	3.0
Delay	134.2	9.6	49.9	122.2	86.7	4.0
LOS	F	A	D	F	F	A
Approach Delay	122.8			116.4	51.6	
Approach LOS	F			F	D	
Queue Length 50th (ft)	~948	15	43	~1262	~909	38
Queue Length 95th (ft)	#1198	49	#147	#1524	#1163	130
Internal Link Dist (ft)	992			1220	3045	
50th Up Block Time (%)				8%		
95th Up Block Time (%)	21%			24%		
Turn Bay Length (ft)		300	470			370
50th Bay Block Time %	47%			39%	38%	
95th Bay Block Time %	54%			45%	45%	
Queuing Penalty (veh)	45			44	284	

2020 PM Peak Hour
3: Kuhio Highway & Kapule Highway

W/O Project
W/O Mitigation

Intersection Summary
Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 130
Natural Cycle: 130
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.25
Intersection Signal Delay: 91.1 Intersection LOS: F
Intersection Capacity Utilization 120.5% ICU Level of Service H
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Highway & Kapule Highway

ø2	ø4
ø1 ø6	

2020 PM Peak Hour
6: Kauai Beach Dr & Kuhio Highway

W/O Project
W/O Mitigation

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↑	↱	↰	↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	135	63	1990	77	108	1505
Peak Hour Factor	0.76	1.00	0.99	0.79	1.00	0.89
Hourly flow rate (veh/h)	178	63	2010	97	108	1691
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	3917	1005			2010	
vC1, stage 1 conf vol	2010					
vC2, stage 2 conf vol	1907					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	74			61	
cM capacity (veh/h)	59	240			280	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	241	1005	1005	97	108	1691
Volume Left	178	0	0	0	108	0
Volume Right	63	0	0	97	0	0
cSH	74	1700	1700	1700	280	1700
Volume to Capacity	3.25	0.59	0.59	0.06	0.39	0.99
Queue Length (ft)	Err	0	0	0	43	0
Control Delay (s)	Err	0.0	0.0	0.0	25.7	0.0
Lane LOS	F				D	
Approach Delay (s)	Err	0.0			1.5	
Approach LOS	F					

Intersection Summary			
Average Delay	580.8		
Intersection Capacity Utilization	109.4%	ICU Level of Service	F

2020 AM Peak Hour
3: Kuhio Highway & Kapule Highway

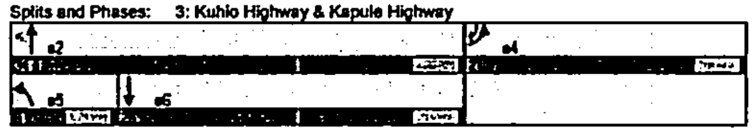
W/O Project
W/Mitigation

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰Y		↰	↑↑	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			0
Storage Lanes	2	0	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50		50	50	50	50
Trailing Detector (ft)	0		0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	3341	0	1770	3539	3539	1583
Flt Permitted	0.965		0.154			
Satd. Flow (perm)	3341	0	287	3539	3539	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	111					549
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1300	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	441	170	80	493	1086	910
Peak Hour Factor	1.00	1.00	1.00	0.89	0.89	0.85
Lane Group Flow (vph)	611	0	80	554	1220	1071
Turn Type			pm+pt			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases			2			6
Detector Phases	4		5	2	6	4
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	20.0		8.0	20.0	20.0	20.0
Total Split (s)	21.0	0.0	8.0	34.0	26.0	21.0
Total Split (%)	38%	0%	15%	62%	47%	38%
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		None	Min	Min	None
Act Effct Green (s)	14.9		27.5	23.9	19.8	41.1
Actuated g/C Ratio	0.32		0.51	0.51	0.42	0.87
v/c Ratio	0.54		0.31	0.31	0.82	0.74
Uniform Delay, d1	11.4		5.6	6.4	13.1	1.0
Delay	12.0		6.5	6.8	16.7	2.9
LOS	B		A	A	B	A
Approach Delay	12.0			6.8	10.3	
Approach LOS	B			A	B	
Queue Length 50th (ft)	67		11	45	183	30
Queue Length 95th (ft)	109		26	68	#295	56
Internal Link Dist (ft)	992			1220	3045	
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)			470			
50th Bay Block Time %						
95th Bay Block Time %						
Queuing Penalty (veh)						

Intersection Summary

Area Type: Other
Cycle Length: 55
Actuated Cycle Length: 47.3
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 9.9 Intersection LOS: A
Intersection Capacity Utilization 77.4% ICU Level of Service C
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Highway & Kapule Highway



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	75		430	170	
Storage Lanes	1	0		1	1	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50		50	50	50	50
Trailing Detector (ft)	0		0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1689	0	3539	1583	1770	3539
Flt Permitted	0.978				0.237	
Satd. Flow (perm)	1689	0	3539	1583	441	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	49			89		
Link Speed (mph)	25		50			50
Link Distance (ft)	832		3125			1100
Travel Time (s)	22.7		28.8			15.0
Volume (vph)	38	43	870	64	64	1955
Peak Hour Factor	0.88	0.88	1.00	0.72	0.69	0.90
Lane Group Flow (vph)	90	0	870	89	93	2172
Turn Type				Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases				2	6	
Detector Phases	8		2	2	1	6
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	20.0		20.0	20.0	8.0	20.0
Total Split (s)	20.0	0.0	41.0	41.0	9.0	50.0
Total Split (%)	29%	0%	59%	59%	13%	71%
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None		Min	Min	None	Min
Act Effct Green (s)	8.2		50.7	50.7	60.6	59.2
Actuated g/C Ratio	0.11		0.68	0.68	0.78	0.80
v/c Ratio	0.40		0.36	0.08	0.21	0.77
Uniform Delay, d1	14.1		5.2	0.0	1.7	4.1
Delay	13.1		5.9	1.6	2.3	6.1
LOS	B		A	A	A	A
Approach Delay	13.1		5.5			6.0
Approach LOS	B		A			A
Queue Length 50th (ft)	14		75	0	6	183
Queue Length 95th (ft)	48		126	6	14	372
Internal Link Dist (ft)	752		3045			1020
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)				430	170	
50th Bay Block Time %						10%
95th Bay Block Time %						19%
Queuing Penalty (veh)						13

2020 AM Peak Hour

6: Kauai Beach Dr & Kuhio Highway

W/O Project
W/Mitigation

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 74.1

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 8.0 Intersection LOS: A

Intersection Capacity Utilization 72.0% ICU Level of Service C

Splits and Phases: 6: Kauai Beach Dr & Kuhio Highway

ø1 ø2

ø6 ø8

2020 PM Peak Hour

3: Kuhio Highway & Kapule Highway

W/O Project
W/Mitigation

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	300	470			370
Storage Lanes	2	0	1			1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50		50	50	50	50
Trailing Detector (ft)	0		0	0	0	0
Turning Speed (mph)	15	9	15			9
Satd. Flow (prot)	3410	0	1770	3539	3539	1583
Flt Permitted	0.957		0.174			
Satd. Flow (perm)	3410	0	324	3539	3539	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	22					440
Link Speed (mph)	30			50	50	
Link Distance (ft)	1072			1300	3125	
Travel Time (s)	24.4			17.7	28.6	
Volume (vph)	901	90	105	1166	949	691
Peak Hour Factor	1.00	1.00	1.00	0.96	1.00	0.99
Lane Group Flow (vph)	991	0	105	1215	949	698
Turn Type			pm+pt			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases			2			6
Detector Phases	4		5	2	6	4
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	20.0		8.0	20.0	20.0	20.0
Total Split (s)	24.0	0.0	8.0	31.0	23.0	24.0
Total Split (%)	44%	0%	15%	56%	42%	44%
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		None	Min	Min	None
Act Effct Green (s)	18.6		25.6	23.7	17.8	41.7
Actuated g/C Ratio	0.37		0.48	0.47	0.35	0.82
v/c Ratio	0.78		0.40	0.73	0.76	0.50
Uniform Delay, d1	14.4		7.3	10.5	15.0	0.6
Delay	16.3		7.8	11.1	16.7	0.8
LOS	B		A	B	B	A
Approach Delay	16.3			10.8	9.9	
Approach LOS	B			B	A	
Queue Length 50th (ft)	141		17	148	142	11
Queue Length 95th (ft)	#210		38	212	#205	29
Internal Link Dist (ft)	992			1220	3045	
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)			470			370
50th Bay Block Time %						
95th Bay Block Time %						
Queuing Penalty (veh)						

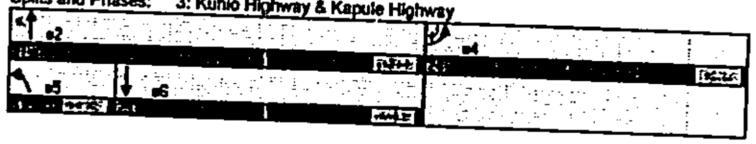
2020 PM Peak Hour
3: Kuhio Highway & Kapule Highway

W/O Project
W/Mitigation

Intersection Summary

Area Type: Other
Cycle Length: 55
Actuated Cycle Length: 50.6
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 11.8 Intersection LOS: B
Intersection Capacity Utilization 70.6% ICU Level of Service C
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Highway & Kapule Highway



2020 PM Peak Hour
6: Kauai Beach Dr & Kuhio Highway

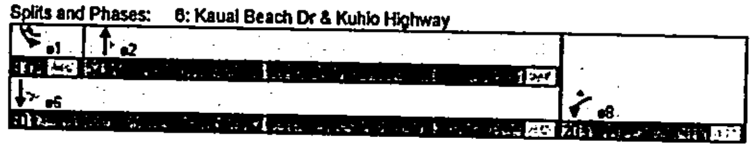
W/O Project
W/Mitigation

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↑↑	↱	↰	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	75		430	170	
Storage Lanes	1	1		1	1	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1770	1583	3539	1583	1770	3539
Flt Permitted	0.950				0.077	
Satd. Flow (perm)	1770	1583	3539	1583	143	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		11		97		
Link Speed (mph)	25		50			50
Link Distance (ft)	832		3125			1100
Travel Time (s)	22.7		28.6			15.0
Volume (vph)	135	63	1990	77	108	1505
Peak Hour Factor	0.76	1.00	0.99	0.79	1.00	0.89
Lane Group Flow (vph)	178	63	2010	97	108	1691
Turn Type		pm+ov		Perm	pm+pt	
Protected Phases	8	1	2		1	6
Permitted Phases		8		2	6	
Detector Phases	8	1	2	2	1	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	8.0	20.0	20.0	8.0	20.0
Total Split (s)	20.0	8.0	52.0	52.0	8.0	60.0
Total Split (%)	25%	10%	65%	65%	10%	75%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag		Lead	Lag	Lag	Lead	
Lead-Lag Optimize?		Yes	Yes	Yes	Yes	
Recall Mode	None	None	Min	Min	None	Min
Act Effct Green (s)	12.4	20.5	50.4	50.4	58.3	56.7
Actuated g/C Ratio	0.16	0.26	0.65	0.65	0.73	0.74
v/c Ratio	0.63	0.15	0.87	0.09	0.58	0.65
Uniform Delay, d1	30.7	18.7	11.2	0.0	2.8	5.1
Delay	29.1	18.2	17.6	1.6	10.6	5.8
LOS	C	B	B	A	B	A
Approach Delay	26.2		16.9			6.1
Approach LOS	C		B			A
Queue Length 50th (ft)	80	19	390	0	12	176
Queue Length 95th (ft)	116	47	#663	7	#38	273
Internal Link Dist (ft)	752		3045			1020
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		75		430	170	
50th Bay Block Time %	12%		3%			7%
95th Bay Block Time %	33%		19%			15%
Queuing Penalty (veh)	14		9			12

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 77.1
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 12.7 Intersection LOS: B
Intersection Capacity Utilization 81.4% ICU Level of Service D
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Kauai Beach Dr & Kuhio Highway



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	400		300	200		200	470		0	200		370
Storage Lanes	1		0	1		0	1		0	0		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	50
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1770	1615	0	1770	1771	0	1770	1861	0	0	1857	1583
Flt Permitted	0.725			0.460			0.039				0.934	
Satd. Flow (perm)	1350	1615	0	894	1771	0	73	1861	0	0	1740	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		149			15			1				839
Link Speed (mph)		30			30			50			50	
Link Distance (ft)		1072			860			1000			500	
Travel Time (s)		24.4			19.5			17.7			28.6	
Volume (vph)	334	19	160	39	30	15	75	452	4	69	1007	825
Peak Hour Factor	1.00	0.92	1.00	0.92	0.92	0.92	1.00	0.89	0.92	0.92	0.89	0.85
Lane Group Flow (vph)	334	181	0	42	49	0	75	512	0	0	1206	971
Turn Type	Perm			Perm			pm+pt			Perm		Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		6
Detector Phases	4	4		8	8		5	2		6	6	6
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		9.0	22.0		22.0	22.0	22.0
Total Split (s)	39.0	39.0	0.0	39.0	39.0	0.0	9.0	111.0	0.0	102.0	102.0	102.0
Total Split (%)	26%	26%	0%	26%	26%	0%	6%	74%	0%	68%	68%	68%
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?							Yes			Yes	Yes	Yes
Recall Mode	None	None		None	None		None	Min		Min	Min	Min
Act Effct Green (s)	35.0	35.0		35.0	35.0		107.0	107.0			98.0	98.0
Actuated g/C Ratio	0.23	0.23		0.23	0.23		0.71	0.71			0.65	0.65
v/c Ratio	1.06	0.37		0.20	0.12		0.69	0.39			1.06	0.73
Uniform Delay, d1	57.5	8.0		48.2	31.2		8.2	8.5			26.0	1.5
Delay	107.0	11.1		47.3	33.5		31.7	8.6			63.8	2.0
LOS	F	B		D	C		C	A			E	A
Approach Delay		73.3			39.9			11.6			36.3	
Approach LOS		E			D			B			D	
Queue Length 50th (ft)	~358	25		33	26		22	169			~1293	37
Queue Length 95th (ft)	#559	93		71	63		#104	221			#1531	55
Internal Link Dist (ft)		992			780			920			420	
50th Up Block Time (%)											26%	
95th Up Block Time (%)											31%	
Turn Bay Length (ft)	400			200			470					370
50th Bay Block Time %											27%	
95th Bay Block Time %	32%										32%	
Queuing Penalty (veh)	28										631	

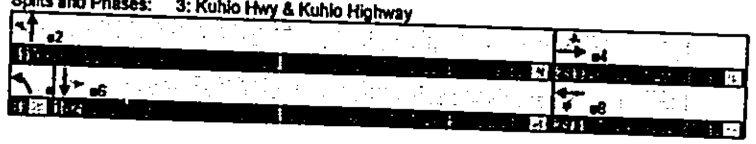
2010 AM Peak Hour
3: Kuhio Hwy & Kuhio Highway

W/Project
W/OMitigation

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 150
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 37.7 Intersection LOS: D
Intersection Capacity Utilization 125.9% ICU Level of Service H
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Hwy & Kuhio Highway



2010 AM Peak Hour
5: Retail Access & Kuhio Highway

W/Project
W/OMitigation

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑	↱		↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	10	788	15	0	1901
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	0	11	854	16	0	2066
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	1888	854			871	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	96			100	
cM capacity (veh/h)	62	302			770	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	11	854	16	1033	1033
Volume Left	0	0	0	0	0
Volume Right	11	0	16	0	0
cSH	302	1700	1700	1700	1700
Volume to Capacity	0.04	0.50	0.01	0.61	0.61
Queue Length (ft)	3	0	0	0	0
Control Delay (s)	17.4	0.0	0.0	0.0	0.0
Lane LOS	C				
Approach Delay (s)	17.4	0.0		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	60.5%	ICU Level of Service	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	37	37	745	51	67	1869
Peak Hour Factor	0.88	0.88	1.00	0.72	0.69	0.90
Hourly flow rate (veh/h)	42	42	745	71	97	2077
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	1978	745			745	
vC1, stage 1 conf vol	745					
vC2, stage 2 conf vol	1233					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	80	88			89	
cM capacity (veh/h)	210	357			859	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	84	745	71	97	1038	1038
Volume Left	42	0	0	97	0	0
Volume Right	42	0	71	0	0	0
cSH	264	1700	1700	859	1700	1700
Volume to Capacity	0.32	0.44	0.04	0.11	0.61	0.61
Queue Length (ft)	33	0	0	10	0	0
Control Delay (s)	24.9	0.0	0.0	9.7	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	24.9	0.0		0.4		
Approach LOS	C					

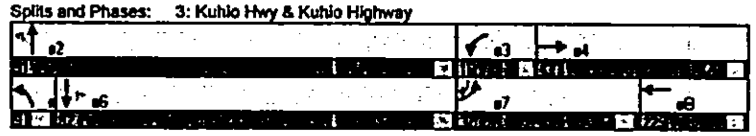
Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	69.0%	ICU Level of Service	B

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	450		300	200		200	470		370	200		370
Storage Lanes	1		0	1		0	1		0	0		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	50
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1770	1719	0	1770	1695	0	1770	1855	0	0	1848	1583
Flt Permitted	0.950			0.950			0.218				0.065	
Satd. Flow (perm)	1770	1719	0	1770	1695	0	406	1855	0	0	121	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		34			41			2				843
Link Speed (mph)		30			25			50			50	
Link Distance (ft)		1072			860			1000			500	
Travel Time (s)		24.4			23.5			17.7			28.6	
Volume (vph)	692	59	68	70	41	63	95	1089	28	94	537	679
Peak Hour Factor	1.00	0.92	1.00	0.92	0.92	0.92	1.00	0.96	0.92	0.92	1.00	0.99
Lane Group Flow (vph)	692	132	0	76	113	0	95	1164	0	0	639	686
Turn Type	Prot			Prot			pm+pt			Perm		pm+ov
Protected Phases	7	4		3	8		5	2			6	7
Permitted Phases							2			6		6
Detector Phases	7	4		3	8		5	2		6	6	7
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	22.0		8.0	22.0		9.0	22.0		22.0	22.0	20.0
Total Split (s)	37.0	43.0	0.0	16.0	22.0	0.0	9.0	91.0	0.0	82.0	82.0	37.0
Total Split (%)	25%	29%	0%	11%	15%	0%	6%	61%	0%	55%	55%	25%
Yellow Time (s)	4.0	4.0		3.5	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		0.5	1.0		1.0	1.0		1.0	1.0	1.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Recall Mode	None	None		None	None		None	Min		Min	Min	None
Act Effct Green (s)	33.0	35.1		10.4	12.4		87.0	87.0			78.0	115.1
Actuated g/C Ratio	0.23	0.24		0.07	0.09		0.60	0.60			0.54	0.80
v/c Ratio	1.71	0.30		0.60	0.62		0.33	1.04			9.83	0.49
Uniform Delay, d1	55.8	32.7		65.1	40.2		12.1	28.7			33.0	0.2
Delay	267.5	33.2		66.0	40.1		13.0	65.8			517.9	0.5
LOS	F	C		E	D		B	E			F	A
Approach Delay		229.9			50.5			61.8			250.0	
Approach LOS		F			D			E			F	
Queue Length 50th (ft)	~957	76		70	66		38	~1184			~1185	5
Queue Length 95th (ft)	#1256	138		130	133		68	#1540			#1476	28
Internal Link Dist (ft)		992			780			920			420	
50th Up Block Time (%)								13%			67%	
95th Up Block Time (%)	24%							37%			74%	
Turn Bay Length (ft)	450			200			470					370
50th Bay Block Time %	56%							27%			71%	
95th Bay Block Time %	68%							40%			77%	
Queuing Penalty (veh)	80							32			958	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 144.5
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 9.83
Intersection Signal Delay: 169.1 Intersection LOS: F
Intersection Capacity Utilization 153.7% ICU Level of Service H
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Hwy & Kuhio Highway



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑↑	↱		↑
Sign Control	Yield		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	83	1784	60	0	1300
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	0	90	1939	65	0	1413
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	3352	970			1939	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	64			100	
cM capacity (veh/h)	6	253			299	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1
Volume Total	90	970	970	65	1413
Volume Left	0	0	0	0	0
Volume Right	90	0	0	65	0
cSH	253	1700	1700	1700	1700
Volume to Capacity	0.36	0.57	0.57	0.04	0.83
Queue Length (ft)	39	0	0	0	0
Control Delay (s)	26.9	0.0	0.0	0.0	0.0
Lane LOS	D				
Approach Delay (s)	26.9	0.0			0.0
Approach LOS	D				

Intersection Summary

Average Delay	0.7		
Intersection Capacity Utilization	77.7%	ICU Level of Service	C

2010 PM Peak Hour
6: Kauai Beach Dr & Kuhio Highway

W/Project
W/O Mitigation

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↑	↱	↰	↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	110	58	1795	87	88	1195
Peak Hour Factor	0.76	1.00	0.99	0.79	1.00	0.89
Hourly flow rate (veh/h)	145	58	1813	85	88	1343
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	3332	907			1813	
vC1, stage 1 conf vol	1813					
vC2, stage 2 conf vol	1519					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	79			74	
cM capacity (veh/h)	100	279			335	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	203	907	907	85	88	1343
Volume Left	145	0	0	0	88	0
Volume Right	58	0	0	85	0	0
cSH	122	1700	1700	1700	335	1700
Volume to Capacity	1.66	0.53	0.53	0.05	0.26	0.79
Queue Length (ft)	377	0	0	0	26	0
Control Delay (s)	392.0	0.0	0.0	0.0	19.5	0.0
Lane LOS	F				C	
Approach Delay (s)	392.0	0.0			1.2	
Approach LOS	F					

Intersection Summary			
Average Delay	23.0		
Intersection Capacity Utilization	88.9%	ICU Level of Service	D

2010 AM Peak Hour
3: Kuhio Hwy & Kuhio Highway

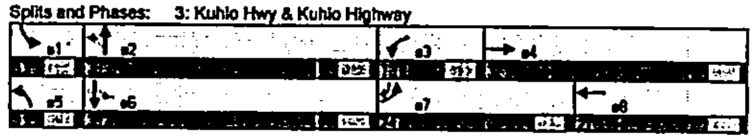
W/Project
W/Mitigation

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↱		↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	400		300	200		200	470		370	200		370
Storage Lanes	1		0	1		0	1		0	1		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	50
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1770	1615	0	1770	1771	0	1770	1861	0	1770	3539	1583
Flt Permitted	0.950			0.950			0.125			0.192		
Satd. Flow (perm)	1770	1615	0	1770	1771	0	233	1861	0	358	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		160			16							784
Link Speed (mph)		30			30			50			50	
Link Distance (ft)		1072			860			1000			500	
Travel Time (s)		24.4			19.5			17.7			28.6	
Volume (vph)	334	19	160	39	30	15	75	452	4	69	1007	825
Peak Hour Factor	1.00	0.92	1.00	0.92	0.92	0.92	1.00	0.89	0.92	0.92	0.89	0.85
Lane Group Flow (vph)	334	181	0	42	49	0	75	512	0	75	1131	971
Turn Type	Prot			Prot			pm+pt			pm+pt		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases							2			6		6
Detector Phases	7	4		3	8		5	2		1	6	7
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	22.0		9.0	22.0		9.0	22.0		9.0	22.0	20.0
Total Split (s)	24.0	32.0	0.0	13.0	21.0	0.0	9.0	36.0	0.0	9.0	36.0	24.0
Total Split (%)	27%	36%	0%	14%	23%	0%	10%	40%	0%	10%	40%	27%
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None		None	None		None	Min		None	Min	None
Act Effct Green (s)	18.6	19.7		8.2	9.3		33.1	27.1		33.1	27.1	53.1
Actuated g/C Ratio	0.28	0.30		0.12	0.13		0.45	0.41		0.45	0.41	0.80
v/c Ratio	0.67	0.31		0.20	0.20		0.35	0.68		0.29	0.78	0.68
Uniform Delay, d1	23.4	2.1		31.2	20.2		10.0	18.3		10.0	19.5	0.8
Delay	33.6	6.2		34.9	23.8		12.3	21.6		12.2	23.0	1.9
LOS	C	A		C	C		B	C		B	C	A
Approach Delay		24.0			29.0			20.4			13.2	
Approach LOS		C			C			C			B	
Queue Length 50th (ft)	157	8		20	16		18	210		18	260	21
Queue Length 95th (ft)	#329	55		54	46		49	#377		49	#433	45
Internal Link Dist (ft)		992			780			920			420	
50th Up Block Time (%)												
95th Up Block Time (%)											5%	
Turn Bay Length (ft)	400			200			470			200		370
50th Bay Block Time %											18%	
95th Bay Block Time %											38%	
Queuing Penalty (veh)											46	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 66.4
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 16.6 Intersection LOS: B
Intersection Capacity Utilization 77.6% ICU Level of Service C
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Hwy & Kuhio Highway



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑	↱		↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	10	786	15	0	1901
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	0	11	854	16	0	2066
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	1888	854			871	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	96			100	
cM capacity (veh/h)	62	302			770	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	11	854	16	1033	1033
Volume Left	0	0	0	0	0
Volume Right	11	0	16	0	0
cSH	302	1700	1700	1700	1700
Volume to Capacity	0.04	0.50	0.01	0.61	0.61
Queue Length (ft)	3	0	0	0	0
Control Delay (s)	17.4	0.0	0.0	0.0	0.0
Lane LOS	C				
Approach Delay (s)	17.4	0.0		0.0	
Approach LOS	C				

Intersection Summary

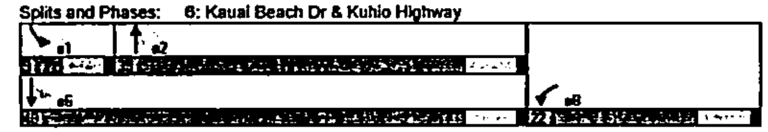
Average Delay 0.1
Intersection Capacity Utilization 60.5% ICU Level of Service B

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	75		430	170	
Storage Lanes	1	0		1	1	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50		50	50	50	50
Trailing Detector (ft)	0		0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1694	0	1863	1583	1770	3539
Flt Permitted	0.976				0.140	
Satd. Flow (perm)	1694	0	1863	1583	261	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	42			71		
Link Speed (mph)	25		50			50
Link Distance (ft)	832		2225			1100
Travel Time (s)	22.7		28.6			15.0
Volume (vph)	37	37	745	51	67	1869
Peak Hour Factor	0.88	0.88	1.00	0.72	0.69	0.90
Lane Group Flow (vph)	84	0	745	71	97	2077
Turn Type				Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases				2	6	
Detector Phases	8		2	2	1	6
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	22.0		22.0	22.0	9.0	22.0
Total Split (s)	22.0	0.0	39.0	39.0	9.0	48.0
Total Split (%)	31%	0%	56%	56%	13%	69%
Yellow Time (s)	5.0		5.0	5.0	4.0	5.0
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None		Min	Min	None	Min
Act Effct Green (s)	10.4		49.7	49.7	59.5	58.2
Actuated g/C Ratio	0.13		0.66	0.66	0.78	0.78
v/c Ratio	0.32		0.60	0.07	0.32	0.76
Uniform Delay, d1	14.6		7.6	0.0	2.1	4.9
Delay	13.1		9.3	2.1	2.6	6.9
LOS	B		A	A	A	A
Approach Delay	13.1		8.7			6.7
Approach LOS	B		A			A
Queue Length 50th (ft)	14		172	0	8	201
Queue Length 95th (ft)	45		330	6	16	377
Internal Link Dist (ft)	752		2145			1020
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)				430	170	
50th Bay Block Time %						12%
95th Bay Block Time %						21%
Queuing Penalty (veh)						15

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 75
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 7.4 — Intersection LOS: A
Intersection Capacity Utilization 69.0% — ICU Level of Service B

Splits and Phases: 6: Kauai Beach Dr & Kuhio Highway

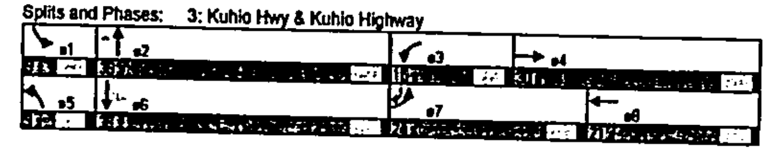


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↱		↰	↱		↰	↑↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	450		300	200		200	470		370	200		370
Storage Lanes	2		0	1		0	1		0	1		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	50
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	3433	1719	0	1770	1695	0	1770	3525	0	1770	1863	1583
Flt Permitted	0.950			0.950			0.164			0.125		
Satd. Flow (perm)	3433	1719	0	1770	1695	0	305	3525	0	233	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		60			68			3				686
Link Speed (mph)		30			25			50			50	
Link Distance (ft)		1072			880			1000			500	
Travel Time (s)		24.4			23.5			17.7			28.6	
Volume (vph)	692	59	68	70	41	63	95	1089	28	94	537	679
Peak Hour Factor	1.00	0.92	1.00	0.92	0.92	0.92	1.00	0.96	0.92	0.92	1.00	0.99
Lane Group Flow (vph)	692	132	0	76	113	0	95	1164	0	102	537	686
Turn Type	Prot			Prot			pm+pt			pm+pt		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases							2			6		6
Detector Phases	7	4		3	8		5	2		1	6	7
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	22.0		9.0	22.0		9.0	22.0		9.0	22.0	20.0
Total Split (s)	24.0	30.0	0.0	15.0	21.0	0.0	9.0	36.0	0.0	9.0	36.0	24.0
Total Split (%)	27%	33%	0%	17%	23%	0%	10%	40%	0%	10%	40%	27%
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None		None	None		None	Min		None	Min	None
Act Effct Green (s)	19.3	19.7		9.4	9.8		34.8	29.3		34.8	29.3	54.7
Actuated g/C Ratio	0.26	0.27		0.12	0.13		0.45	0.39		0.45	0.39	0.74
v/c Ratio	0.78	0.26		0.35	0.41		0.41	0.84		0.50	0.73	0.51
Uniform Delay, d1	26.6	11.9		32.3	12.5		10.7	21.4		10.8	20.2	0.0
Delay	34.4	15.6		35.0	16.2		12.7	26.9		14.1	25.2	0.7
LOS	C	B		C	B		B	C		B	C	A
Approach Delay		31.4			23.8			25.6			11.6	
Approach LOS		C			C			C			B	
Queue Length 50th (ft)	172	30		38	22		24	203		26	228	0
Queue Length 95th (ft)	#300	75		83	88		58	#390		#65	#441	30
Internal Link Dist (ft)		992			780			920			420	
50th Up Block Time (%)												
95th Up Block Time (%)											11%	
Turn Bay Length (ft)	450			200			470			200		370
50th Bay Block Time %											14%	
95th Bay Block Time %											38%	
Queuing Penalty (veh)											56	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 74.3
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 21.6 Intersection LOS: C
Intersection Capacity Utilization 77.6% ICU Level of Service C
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Hwy & Kuhio Highway



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑↑	↱		↑
Sign Control	Yield		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	83	1784	60	0	1300
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	0	90	1939	65	0	1413
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	3352	970			1939	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	64			100	
cM capacity (veh/h)	6	253			299	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1
Volume Total	90	970	970	65	1413
Volume Left	0	0	0	0	0
Volume Right	90	0	0	65	0
cSH	253	1700	1700	1700	1700
Volume to Capacity	0.36	0.57	0.57	0.04	0.83
Queue Length (ft)	39	0	0	0	0
Control Delay (s)	26.9	0.0	0.0	0.0	0.0
Lane LOS	D				
Approach Delay (s)	26.9	0.0			0.0
Approach LOS	D				

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	77.7%	ICU Level of Service	C

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↑	↱	↰	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	75		430	170	
Storage Lanes	1	0		1	1	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50		50	50	50	50
Trailing Detector (ft)	0		0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1729	0	3539	1583	1770	1863
Flt Permitted	0.968				0.068	
Satd. Flow (perm)	1729	0	3539	1583	127	1863
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	20			85		
Link Speed (mph)	25		50			50
Link Distance (ft)	832		2325			1100
Travel Time (s)	22.7		28.6			15.0
Volume (vph)	110	58	1795	67	88	1195
Peak Hour Factor	0.78	1.00	0.99	0.79	1.00	0.89
Lane Group Flow (vph)	203	0	1813	85	88	1343
Turn Type				pm+ov	pm+pt	
Protected Phases	8		2	8	1	6
Permitted Phases				2	6	
Detector Phases	8		2	8	1	6
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	22.0		22.0	22.0	9.0	15.0
Total Split (s)	22.0	0.0	59.0	22.0	9.0	68.0
Total Split (%)	24%	0%	66%	24%	10%	76%
Yellow Time (s)	5.0		5.0	5.0	4.0	5.0
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		Min	None	None	Min
Act Effct Green (s)	15.6		58.8	79.2	67.8	66.1
Actuated g/C Ratio	0.17		0.66	0.88	0.73	0.74
v/c Ratio	0.64		0.78	0.06	0.49	0.98
Uniform Delay, d1	31.3		11.4	0.0	3.2	11.0
Delay	30.2		12.5	0.2	7.0	33.4
LOS	C		B	A	A	C
Approach Delay	30.2		12.0			31.8
Approach LOS	C		B			C
Queue Length 50th (ft)	94		374	0	12	624
Queue Length 95th (ft)	133		504	3	44	#1042
Internal Link Dist (ft)	752		2245			1020
50th Up Block Time (%)						
95th Up Block Time (%)						9%
Turn Bay Length (ft)				430	170	
50th Bay Block Time %						22%
95th Bay Block Time %			10%			28%
Queuing Penalty (veh)			4			22

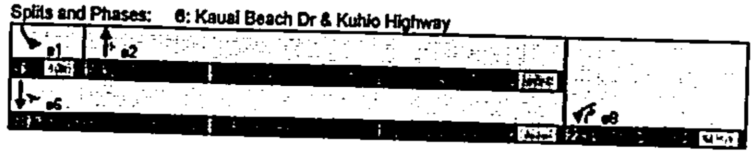
2010 PM Peak Hour
6: Kauai Beach Dr & Kuhio Highway

W/Project
W/Mitigation

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 89.7
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 21.1 Intersection LOS: C
Intersection Capacity Utilization 85.9% ICU Level of Service D
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Kauai Beach Dr & Kuhio Highway



2020 AM Peak Hour
3: Kuhio Hwy & Kuhio Highway

W/Project
W/O Mitigation

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	400		300	200		200	470		370	200		370
Storage Lanes	1		0	1		1	1		1	0		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50	50	50	50	50	50	50	50
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1770	1619	0	1770	1863	1583	1770	1863	1583	0	1857	1583
Flt Permitted	0.950			0.950			0.048				0.853	
Satd. Flow (perm)	1770	1619	0	1770	1863	1583	88	1863	1583	0	1589	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		159				45			7			500
Link Speed (mph)		30			30			50			50	
Link Distance (ft)		1072			860			1300			500	
Travel Time (s)		24.4			19.5			17.7			28.6	
Volume (vph)	444	23	170	70	55	41	80	513	6	78	1109	930
Peak Hour Factor	1.00	0.92	1.00	0.92	0.92	0.92	1.00	0.89	0.92	0.92	0.89	0.85
Lane Group Flow (vph)	444	195	0	76	60	45	80	576	7	0	1331	1094
Turn Type	Prot			Prot		Perm	pm+pt		Perm	Perm		pm+ov
Protected Phases	7	4		3	8		5	2			6	7
Permitted Phases						8	2		2	6		6
Detector Phases	7	4		3	8	8	5	2	2	6	6	7
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	22.0		21.0	22.0	22.0	9.0	22.0	22.0	22.0	22.0	20.0
Total Split (s)	32.0	33.0	0.0	21.0	22.0	22.0	9.0	96.0	96.0	87.0	87.0	32.0
Total Split (%)	21%	22%	0%	14%	15%	15%	6%	64%	64%	58%	58%	21%
Yellow Time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	5.0	5.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead			Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes			Yes	Yes	Yes
Recall Mode	None	None		None	None	None	None	Min	Min	Min	Min	None
Act Effct Green (s)	28.1	28.0		12.3	12.3	12.3	92.3	92.3	92.3		83.2	115.4
Actuated g/C Ratio	0.20	0.20		0.09	0.09	0.09	0.65	0.65	0.65		0.59	0.81
v/c Ratio	1.27	0.44		0.50	0.38	0.26	0.70	0.48	0.01		1.43	0.79
Uniform Delay, d1	57.6	8.7		64.0	63.2	0.0	9.5	13.1	0.0		30.0	3.3
Delay	168.4	12.4		63.0	62.2	16.1	34.8	13.9	5.8		191.5	4.6
LOS	F	B		E	E	B	C	B	A		F	A
Approach Delay		120.8			51.1			16.3			107.2	
Approach LOS		F			D			B			F	
Queue Length 50th (ft)	~529	28		69	54	0	27	266	0		~1698	88
Queue Length 95th (ft)	#787	106		125	102	40	#116	391	0		#2041	222
Internal Link Dist (ft)		992			780			1220			420	
50th Up Block Time (%)											45%	
95th Up Block Time (%)											50%	
Turn Bay Length (ft)	400			200		200	470		370			370
50th Bay Block Time %	28%										44%	
95th Bay Block Time %	52%										49%	1%
Queuing Penalty (veh)	77										1144	

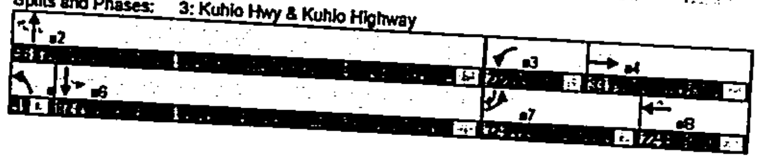
2020 AM Peak Hour
3: Kuhio Hwy & Kuhio Highway

W/Project
W/O Mitigation

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 142
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.43
Intersection Signal Delay: 91.4 Intersection LOS: F
Intersection Capacity Utilization 141.0% ICU Level of Service H
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Hwy & Kuhio Highway



2020 AM Peak Hour
5: Retail Access & Kuhio Highway

W/Project
W/O Mitigation

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑↑	↱		↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	10	982	16	0	2112
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	0	11	1067	17	0	2296
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	2215	534			1085	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			100	
cM capacity (veh/h)	37	491			639	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	11	534	534	17	1148	1148
Volume Left	0	0	0	0	0	0
Volume Right	11	0	0	17	0	0
cSH	491	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.31	0.31	0.01	0.68	0.68
Queue Length (ft)	2	0	0	0	0	0
Control Delay (s)	12.5	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	12.5	0.0			0.0	
Approach LOS	B					

Intersection Summary

Average Delay 0.0
Intersection Capacity Utilization 66.8% ICU Level of Service B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	79	80	921	71	77	2033
Peak Hour Factor	0.88	0.88	1.00	0.72	0.69	0.90
Hourly flow rate (veh/h)	90	88	921	99	112	2259
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	2274	921			921	
vC1, stage 1 conf vol	921					
vC2, stage 2 conf vol	1353					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	48	75			85	
cM capacity (veh/h)	173	273			737	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	158	921	99	112	1129	1129
Volume Left	90	0	0	112	0	0
Volume Right	68	0	99	0	0	0
cSH	205	1700	1700	737	1700	1700
Volume to Capacity	0.77	0.54	0.06	0.15	0.66	0.66
Queue Length (ft)	132	0	0	13	0	0
Control Delay (s)	64.4	0.0	0.0	10.8	0.0	0.0
Lane LOS	F			B		
Approach Delay (s)	64.4	0.0		0.5		
Approach LOS	F					

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	76.3%	ICU Level of Service	C

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	450		300	200		200	470		370	200		370
Storage Lanes	1		0	1		1	1		0	0		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50	50	50	50		50	50	50
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1770	1723	0	1770	1863	1583	1770	1855	0	0	1846	1583
Flt Permitted	0.950			0.950			0.070				0.032	
Satd. Flow (perm)	1770	1723	0	1770	1863	1583	130	1855	0	0	60	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		32				24		1				485
Link Speed (mph)		30			25			50			50	
Link Distance (ft)		1072			860			1300			500	
Travel Time (s)		24.4			23.5			17.7			28.6	
Volume (vph)	898	82	88	79	56	83	105	1230	36	134	663	959
Peak Hour Factor	1.00	0.92	1.00	0.92	0.92	0.92	1.00	0.96	0.92	0.92	1.00	0.99
Lane Group Flow (vph)	898	177	0	86	61	90	105	1320	0	0	809	969
Turn Type	Prot			Prot		custom	pm+pt			Perm		pm+ov
Protected Phases	7	4		3	8	1	5	2			6	7
Permitted Phases						8	2			6		6
Detector Phases	7	4		3	8	1	5	2		6	6	7
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	20.0	22.0		22.0	22.0	9.0	9.0	22.0		22.0	22.0	20.0
Total Split (s)	42.0	42.0	0.0	22.0	22.0	9.0	9.0	77.0	0.0	77.0	77.0	42.0
Total Split (%)	28%	28%	0%	15%	15%	6%	6%	51%	0%	51%	51%	28%
Yellow Time (s)	4.0	5.0		4.0	5.0	4.0	4.0	5.0		5.0	5.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lead	Lag		Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None		None	None	None	None	Min		Min	Min	None
Act Effct Green (s)	38.1	34.7		13.0	12.4	21.3	78.2	73.2			73.2	115.3
Actuated g/C Ratio	0.27	0.24		0.09	0.09	0.15	0.55	0.52			0.52	0.81
v/c Ratio	1.89	0.40		0.53	0.38	0.35	0.81	1.38			26.10	0.70
Uniform Delay, d1	52.6	38.0		62.2	63.1	40.6	14.1	35.0			35.5	2.4
Delay	290.4	37.0		62.3	62.2	40.2	47.6	180.6			541.0	3.2
LOS	F	D		E	E	D	D	F			F	A
Approach Delay		248.7			53.9			170.8			247.9	
Approach LOS		F			D			F			F	
Queue Length 50th (ft)	~1294	112		78	55	56	44	~1664			~1545	56
Queue Length 95th (ft)	#1624	192		138	104	111	#130	#2044			#1865	179
Internal Link Dist (ft)		992			780			1220			420	
50th Up Block Time (%)	27%							38%			75%	
95th Up Block Time (%)	42%							58%			79%	
Turn Bay Length (ft)	450			200		200	470					370
50th Bay Block Time %	65%							46%			78%	
95th Bay Block Time %	72%							51%			82%	
Queuing Penalty (veh)	121							51			1400	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Yield		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	76	2130	69	0	1755
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	0	83	2315	75	0	1908
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	3269	1158			2315	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	56			100	
cM capacity (veh/h)	7	189			213	

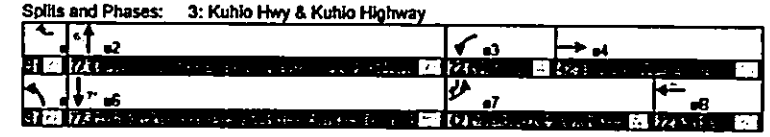
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	83	1158	1158	75	954	954
Volume Left	0	0	0	0	0	0
Volume Right	83	0	0	75	0	0
cSH	189	1700	1700	1700	1700	1700
Volume to Capacity	0.44	0.68	0.68	0.04	0.56	0.56
Queue Length (ft)	50	0	0	0	0	0
Control Delay (s)	37.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	E					
Approach Delay (s)	37.9	0.0			0.0	
Approach LOS	E					

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	75.8%	ICU Level of Service	C

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 142
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 26.10
Intersection Signal Delay: 213.6 Intersection LOS: F
Intersection Capacity Utilization 179.2% ICU Level of Service H
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Hwy & Kuhio Highway



2020 PM Peak Hour
6: Kauai Beach Dr & Kuhio Highway

W/Project
W/O Mitigation

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	153	84	2101	117	137	1603
Peak Hour Factor	0.76	1.00	0.99	0.79	1.00	0.89
Hourly flow rate (veh/h)	201	84	2122	148	137	1801
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	5					
vC, conflicting volume	4197	1061			2122	
vC1, stage 1 conf vol	2122					
vC2, stage 2 conf vol	2075					
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	62			46	
cM capacity (veh/h)	37	220			253	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	285	1061	1061	148	137	1801
Volume Left	201	0	0	0	137	0
Volume Right	84	0	0	148	0	0
cSH	49	1700	1700	1700	253	1700
Volume to Capacity	5.77	0.62	0.62	0.09	0.54	1.06
Queue Length (ft)	Err	0	0	0	73	0
Control Delay (s)	Err	0.0	0.0	0.0	34.5	0.0
Lane LOS	F				D	
Approach Delay (s)	Err	0.0			2.5	
Approach LOS	F					

Intersection Summary			
Average Delay	635.9		
Intersection Capacity Utilization	117.7%	ICU Level of Service	G

2020 AM Peak Hour
3: Kuhio Hwy & Kuhio Highway

W/Project
W/Mitigation

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	400		300	200		200	470		370	200		370
Storage Lanes	2		1	1		1	1		1	1		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.118			0.341		
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	220	3539	1583	635	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			170			45			7			675
Link Speed (mph)		30			30			50			50	
Link Distance (ft)		1072			860			1300			500	
Travel Time (s)		24.4			19.5			17.7			28.6	
Volume (vph)	444	23	170	70	55	41	80	513	6	78	1109	930
Peak Hour Factor	1.00	0.92	1.00	0.92	0.92	0.92	1.00	0.89	0.92	0.92	0.89	0.85
Lane Group Flow (vph)	444	25	170	76	60	45	80	576	7	85	1246	1094
Turn Type	Prot		pm+ov	Prot		pm+ov	pm+pt		Perm	pm+pt		pm+ov
Protected Phases	7	4	5	3	8	1	5	2		1	6	7
Permitted Phases			4			8	2		2	6		6
Detector Phases	7	4	5	3	8	1	5	2	2	1	6	7
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	22.0	9.0	21.0	22.0	9.0	9.0	22.0	22.0	9.0	22.0	20.0
Total Split (s)	21.0	22.0	9.0	21.0	22.0	9.0	9.0	38.0	38.0	9.0	38.0	21.0
Total Split (%)	23%	24%	10%	23%	24%	10%	10%	42%	42%	10%	42%	23%
Yellow Time (s)	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0	4.0	5.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lag	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	None
Act Effct Green (s)	16.9	16.5	24.9	13.7	10.9	22.0	38.2	30.7	30.7	38.2	30.7	53.5
Actuated g/C Ratio	0.24	0.22	0.33	0.18	0.14	0.28	0.48	0.43	0.43	0.48	0.43	0.75
v/c Ratio	0.55	0.06	0.27	0.24	0.22	0.10	0.38	0.38	0.01	0.22	0.82	0.81
Uniform Delay, d1	25.9	24.8	0.0	29.4	31.0	0.0	9.6	15.8	0.0	9.5	20.5	2.7
Delay	28.2	29.0	4.0	30.3	31.7	7.7	11.0	16.3	9.8	10.9	24.7	7.9
LOS	C	C	A	C	C	A	B	B	A	B	C	A
Approach Delay		21.8			25.1			15.6			16.7	
Approach LOS		C			C			B			B	
Queue Length 50th (ft)	107	12	0	25	28	0	19	105	0	20	295	38
Queue Length 95th (ft)	173	31	42	80	63	24	49	169	5	51	#482	170
Internal Link Dist (ft)		992			780			1220			420	
50th Up Block Time (%)												
95th Up Block Time (%)											15%	
Turn Bay Length (ft)	400		300	200		200	470		370	200		370
50th Bay Block Time %											22%	
95th Bay Block Time %											39%	1%
Queuing Penalty (veh)											117	

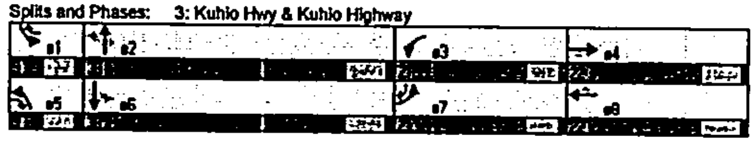
2020 AM Peak Hour
3: Kuhio Hwy & Kuhio Highway

W/Project
W/Mitigation

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 71.5
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 17.7 Intersection LOS: B
Intersection Capacity Utilization 85.5% ICU Level of Service D
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Hwy & Kuhio Highway



2020 AM Peak Hour
5: Retail Access & Kuhio Highway

W/Project
W/Mitigation

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑↑	↱		↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	10	982	16	0	2112
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	0	11	1067	17	0	2296
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	2215	534			1085	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			100	
cM capacity (veh/h)	37	491			639	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	11	534	534	17	1148	1148
Volume Left	0	0	0	0	0	0
Volume Right	11	0	0	17	0	0
cSH	491	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.31	0.31	0.01	0.68	0.68
Queue Length (ft)	2	0	0	0	0	0
Control Delay (s)	12.5	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	12.5	0.0			0.0	
Approach LOS	B					

Intersection Summary

Average Delay	0.0		
Intersection Capacity Utilization	66.8%	ICU Level of Service	B

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↑↑	↱	↰	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	75		430	170	
Storage Lanes	1	1		1	1	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1770	1583	3539	1583	1770	3539
Flt Permitted	0.950				0.224	
Satd. Flow (perm)	1770	1583	3539	1583	417	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		68		99		
Link Speed (mph)	25		50			50
Link Distance (ft)	832		2225			1100
Travel Time (s)	22.7		28.6			15.0
Volume (vph)	79	60	921	71	77	2033
Peak Hour Factor	0.88	0.88	1.00	0.72	0.69	0.90
Lane Group Flow (vph)	90	68	921	99	112	2259
Turn Type		Perm		pm+ov	pm+pt	
Protected Phases	8		2	8	1	6
Permitted Phases		8		2	6	
Detector Phases	8	8	2	8	1	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	9.0	22.0
Total Split (s)	22.0	22.0	48.0	22.0	10.0	58.0
Total Split (%)	28%	28%	60%	28%	13%	73%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	Min	None	None	Min
Act Effct Green (s)	12.0	12.0	56.3	72.6	68.7	65.3
Actuated g/C Ratio	0.14	0.14	0.68	0.83	0.76	0.78
v/c Ratio	0.36	0.24	0.38	0.07	0.27	0.81
Uniform Delay, d1	33.5	0.0	6.5	0.0	2.3	5.9
Delay	27.4	7.5	7.4	0.3	3.0	9.5
LOS	C	A	A	A	A	A
Approach Delay	18.8		6.7			9.2
Approach LOS	B		A			A
Queue Length 50th (ft)	37	0	104	0	11	297
Queue Length 95th (ft)	75	30	163	3	20	#551
Internal Link Dist (ft)	752		2145			1020
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		75		430	170	
50th Bay Block Time %						15%
95th Bay Block Time %	7%					22%
Queuing Penalty (veh)	2					21

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 83.2
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 8.9 Intersection LOS: A
Intersection Capacity Utilization 74.1% ICU Level of Service C
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Kauai Beach Dr & Kuhio Highway

ø1 ø2
ø6 ø8

2020 PM Peak Hour
3: Kuhio Hwy & Kuhio Highway

W/Project
W/Mitigation

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑	↱	↰	↑	↱	↰	↑↑	↱	↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	450		300	200		200	470		370	200		370
Storage Lanes	2		1	1		1	1		1	1		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.278			0.105		
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	518	3539	1583	196	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			88			11			39			595
Link Speed (mph)		30			25			50			50	
Link Distance (ft)		1072			860			1300			500	
Travel Time (s)		24.4			23.5			17.7			28.6	
Volume (vph)	898	82	88	79	56	83	105	1230	36	134	663	959
Peak Hour Factor	1.00	0.92	1.00	0.92	0.92	0.92	1.00	0.96	0.92	0.92	1.00	0.99
Lane Group Flow (vph)	898	89	88	86	61	90	105	1281	39	146	663	969
Turn Type	Prot		pm+ov	Prot		pm+ov	pm+pt		pm+ov	pm+pt		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8	2		2	6		6
Detector Phases	7	4	5	3	8	1	5	2	3	1	6	7
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	22.0	9.0	22.0	22.0	9.0	9.0	22.0	22.0	9.0	22.0	20.0
Total Split (s)	30.0	29.0	10.0	19.0	18.0	9.0	10.0	43.0	19.0	9.0	42.0	30.0
Total Split (%)	30%	29%	10%	19%	18%	9%	10%	43%	19%	9%	42%	30%
Yellow Time (s)	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	None	None	Min	None
Act Effct Green (s)	26.4	26.6	38.4	10.8	11.2	20.3	43.1	37.2	51.9	42.6	38.8	70.2
Actuated g/C Ratio	0.28	0.29	0.38	0.11	0.12	0.21	0.45	0.40	0.54	0.48	0.42	0.75
v/c Ratio	0.92	0.17	0.13	0.43	0.28	0.26	0.33	0.91	0.04	0.83	0.45	0.72
Uniform Delay, d1	34.0	26.0	0.0	41.0	39.9	28.5	13.0	26.9	0.0	13.5	20.9	2.3
Delay	53.8	28.3	4.9	40.4	39.0	28.1	14.4	34.1	3.3	49.8	21.7	3.6
LOS	D	C	A	D	D	C	B	C	A	D	C	A
Approach Delay		47.7			35.4			31.8			14.2	
Approach LOS		D			D			C			B	
Queue Length 50th (ft)	280	42	0	50	35	41	33	378	0	47	156	88
Queue Length 95th (ft)	#458	85	31	100	73	84	71	#585	9	#171	234	152
Internal Link Dist (ft)		992			780			1220			420	
50th Up Block Time (%)												
95th Up Block Time (%)												
Turn Bay Length (ft)	450		300	200		200	470		370	200		370
50th Bay Block Time %												
95th Bay Block Time %	5%							18%			12%	
Queuing Penalty (veh)	4							9			8	

2020 PM Peak Hour
3: Kuhio Hwy & Kuhio Highway

W/Project
W/Mitigation

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 93.2
Natural Cycle: 100
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 28.9 — Intersection LOS: C
Intersection Capacity Utilization 85.6% — ICU Level of Service D
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kuhio Hwy & Kuhio Highway

ø1 ø2 ø3 ø4
ø5 ø6 ø7 ø8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑↑	↱		↑↑
Sign Control	Yield		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	76	2130	69	0	1755
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	0	83	2315	75	0	1908
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	3269	1158			2315	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	56			100	
cM capacity (veh/h)	7	189			213	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	83	1158	1158	75	954	954
Volume Left	0	0	0	0	0	0
Volume Right	83	0	0	75	0	0
cSH	189	1700	1700	1700	1700	1700
Volume to Capacity	0.44	0.68	0.68	0.04	0.56	0.56
Queue Length (ft)	50	0	0	0	0	0
Control Delay (s)	37.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	E					
Approach Delay (s)	37.9	0.0			0.0	
Approach LOS	E					

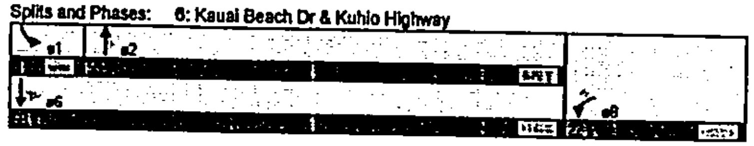
Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	75.8%	ICU Level of Service	C

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↑↑	↱	↰	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	75		430	170	
Storage Lanes	1	1		1	1	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1770	1583	3539	1583	1770	3539
Flt Permitted	0.950				0.066	
Satd. Flow (perm)	1770	1583	3539	1583	127	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		84		148		
Link Speed (mph)	25		50			50
Link Distance (ft)	832		2325			1100
Travel Time (s)	22.7		28.6			15.0
Volume (vph)	153	84	2101	117	137	1603
Peak Hour Factor	0.76	1.00	0.99	0.79	1.00	0.89
Lane Group Flow (vph)	201	84	2122	148	137	1801
Turn Type		Perm		Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8		2	6	
Detector Phases	8	8	2	2	1	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	9.0	15.0
Total Split (s)	22.0	22.0	59.0	59.0	9.0	68.0
Total Split (%)	24%	24%	66%	66%	10%	76%
Yellow Time (s)	5.0	5.0	5.0	5.0	4.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	Min	Min	None	Min
Act Effct Green (s)	15.8	15.8	55.5	55.5	64.5	64.5
Actuated g/C Ratio	0.18	0.18	0.63	0.63	0.73	0.73
v/c Ratio	0.63	0.24	0.95	0.14	0.74	0.70
Uniform Delay, d1	33.5	0.0	15.2	0.0	8.2	6.5
Delay	33.6	7.5	26.1	1.4	25.0	7.1
LOS	C	A	C	A	C	A
Approach Delay	25.9		24.5			8.4
Approach LOS	C		C			A
Queue Length 50th (ft)	104	0	548	0	24	258
Queue Length 95th (ft)	143	37	#792	9	#119	335
Internal Link Dist (ft)	752		2245			1020
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)		75		430	170	
50th Bay Block Time %	27%		12%			13%
95th Bay Block Time %	41%		23%			17%
Queuing Penalty (veh)	29		26			20

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 88.3
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 17.6 Intersection LOS: B
Intersection Capacity Utilization 87.4% ICU Level of Service D
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Kauai Beach Dr & Kuhio Highway



APPENDIX J

Ocean Bay Plantation at Hanamā'ulu Preliminary Engineering Report for Roadways, Mass Grading, On-Site Wastewater

Kodani & Associates

December 2001

OCEAN BAY PLANTATION
AT HANAMA'ULU
PRELIMINARY ENGINEERING REPORT
FOR
ROADWAYS
MASS GRADING
ON-SITE WASTEWATER

December 15, 2001

Kodani and Associates, Inc.
3145 Akahi Street
Lihue, HI 96766

INTRODUCTION

This Preliminary Engineering Report was prepared in conjunction with EWM Kauai, LLC's preparation and processing of an Environmental Impact for the 460-acre Ocean Bay Plantation at Hanama'ulu on the Island of Kauai. The location of the project site is shown on Figure No. 1. This report describes and evaluates the roadway design, mass grading, and on-site wastewater aspects of this project. The preliminary engineering reports for Storm Drainage and Water Systems were prepared separately and are not included in this report.

EWM Kauai, LLC intends to develop the subject property to provide a mixed-use residential and golf course community on their 460-acre coastal parcel in Hanama'ulu, Kaua'i. The project will include a small retail commercial center near the intersection of the project's main entry roadway and Kuhio Highway. Ocean Bay Plantation at Hanama'ulu will be master-planned community serving the U.S. mainland, international, and local Kaua'i and Hawai'i markets for single-family custom homes and quality multi-family housing.

The land used to build this proposed Master Planned Community was used in the past to grow sugar cane by the Amfac Kauai Sugar Company and has no infrastructure that satisfies County of Kauai standards. As part of this project the land must be mass graded, new roadways must be constructed, and a wastewater collection system must be installed.

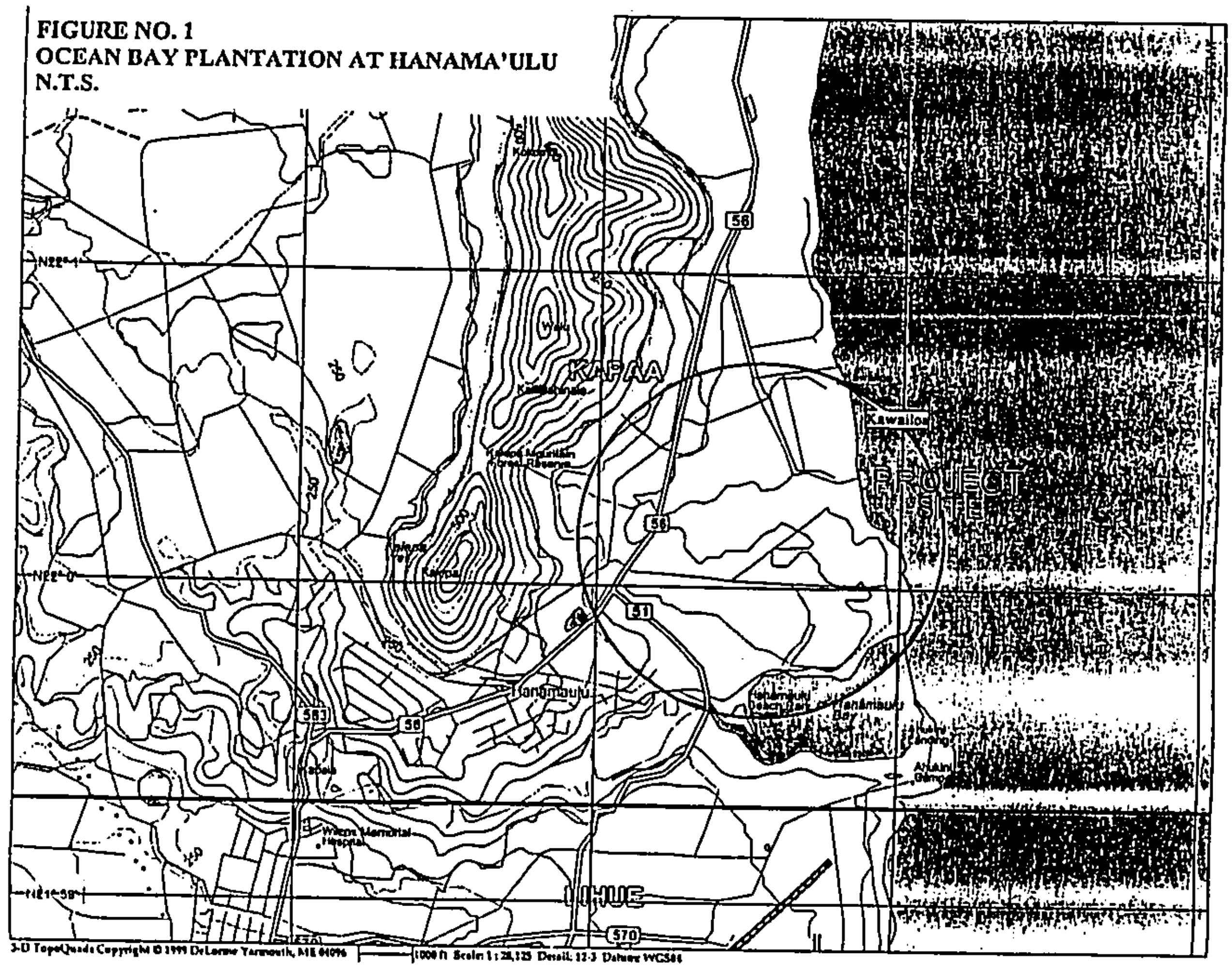
The analysis and findings contained herein are at a general concept level and reflect the preliminary nature of EWM Kauai, LLC's proposals at this early stage of the planning process.

PROJECT DESCRIPTION

The proposed components of the Master Plan for Ocean Bay Plantation at Hanama'ulu (See Figure No. 2) include:

- 18-hole golf course and golf clubhouse.
- 70 lots for single-family homes
- Up to 250 multi-family condominium homes (8 units/acre) built in two areas
- Up to 100 single-family house lots on 55 acres
- An open space corridor along the coastline, wetlands and highway buffer.
- A small-scale retail commercial center on approximately 8 acres

FIGURE NO. 1
OCEAN BAY PLANTATION AT HANAMA'ULU
N.T.S.



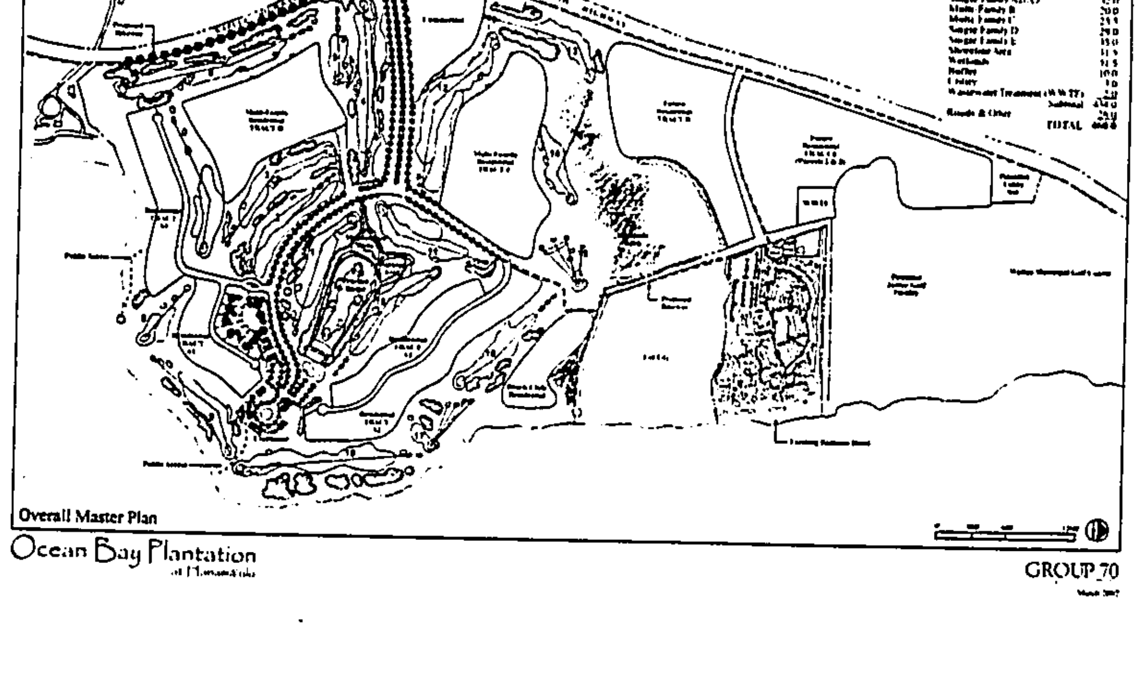


FIGURE NO. 2
OCEAN BAY PLANTATION AT HANAMA'ULU
MASTER PLAN

MASS GRADING

Approximately 375 acres of land is designated for development into roadways, a golf course, residences, and a commercial area. This area which consists primarily of abandoned sugar cane fields will be cleared and mass graded. The area to be graded does not include a 20-acre strip along the coastline that has designated for coastal renaturalization.

The mass grading work will require an NPDES Permit. Grading work will be performed in accordance with the requirements of the permit, the requirements of the County of Kauai's Grading Ordinance, and best management practices.

Figure No. 3 is a preliminary mass grading plan. It was estimated that almost a million cubic yards will be moved as part of the grading plan. The grading plan includes work to excavate ponds within the proposed golf course and was designed to provide a balanced site. Given the large area to work with, it can be assumed that the grading work should be able to be balanced on-site. Table No. 1 provides a breakdown of the estimated costs for the mass grading work.

TABLE NO. 1
MASS GRADING
ORDER OF MAGNITUDE COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
Clearing and Grubbing	375 ac	$2000/ac	$750,000
Mass Grading Exc./Emb.	960,000 cy	$7/cy	$6,720,000
Erosion Control	L.S.	L.S.	$170,000
Temporary Grassing	110 ac	$8700/ac	$957,000
		TOTAL	$8,597,000

FIGURE NO. 3

OCEAN BAY PLANTATION AT HANAMA'ULU

MASS GRADING PLAN

SCALE: 1' = 600'

Grading Area : 337 Acres
Excavation = 962,000 cy
Embankment = 960,000 cy

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

MASS GRADING

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FIGURE NO. 3

OCEAN BAY PLANTATION AT HANAMA'ULU
MASS GRADING PLAN

SCALE: 1" = 600'

Grading Area : 337 Acres
Excavation = 962,000 cy
Embankment = 960,000 cy

ROADWAY DESIGN

The roadways within the project site will be designed to County of Kauai standards. Figure No. 4 shows the different roadways and their classifications. The main entry road, designed to major road standards with a right-of-way width of 60, will connect to a collector road running north south through the project site. The remaining roads will be accessed off the collector road and will be designed to either minor road or dead-end road standards. All of the roads will be uncurbed with dimensions and cross slopes according to County of Kauai standards (see Figure No. 5 and Figure No. 6.

County of Kauai standards require a minimum pavement structure of 2 ½ inches of a.c. pavement and a 6" layer of aggregate basecourse over a compacted subgrade. This minimum pavement structure has been used in the order of magnitude cost estimate shown in Table No. 2. The actual pavement design will be determined after soil tests are completed at the project site.

TABLE NO. 3
ROADWAY SYSTEM
ORDER OF MAGNITUDE COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
On-Site Roadway Finish Grading	12470 cy	80/cy	$997,600
On-Site A.C. Paving 2.5" Thick	4490 tn	$150/tn	$673,500
On-site 6" Aggregate Basecourse	5150 cy	$90/cy	$463,500
On-Site Striping and Signing	L.S.	L.S.	$45,000
Track A Roadway Finish Grading	2522 cy	80/cy	$201,760
Track A A.C. Paving 2.5" Thick	1100 tn	$150/tn	$165,000
Track A 6" Aggregate Basecourse	1250 cy	$90/cy	$112,500
Track A On-Site Striping and Signing	L.S.	L.S.	$5,000
Track A Temporary Grassing	9000 sy	$3/sy	$27,000
Track B Roadway Finish Grading	2800 cy	80/cy	$224,000
Track B A.C. Paving 2.5" Thick	1200 tn	$150/tn	$180,000
Track B 6" Aggregate Basecourse	1400 cy	$90/cy	$126,000
Track B On-Site Striping and Signing	L.S.	L.S.	$5,000
Track B Temporary Grassing	10000 sy	$3/sy	$78,000
		TOTAL	$3,303,860

FIGURE NO. 4
OCEAN BAY PLANTATION AT HANAMA'ULU
ROAD ALIGNMENT PLAN
SCALE: 1" = 400'
October 11, 2001

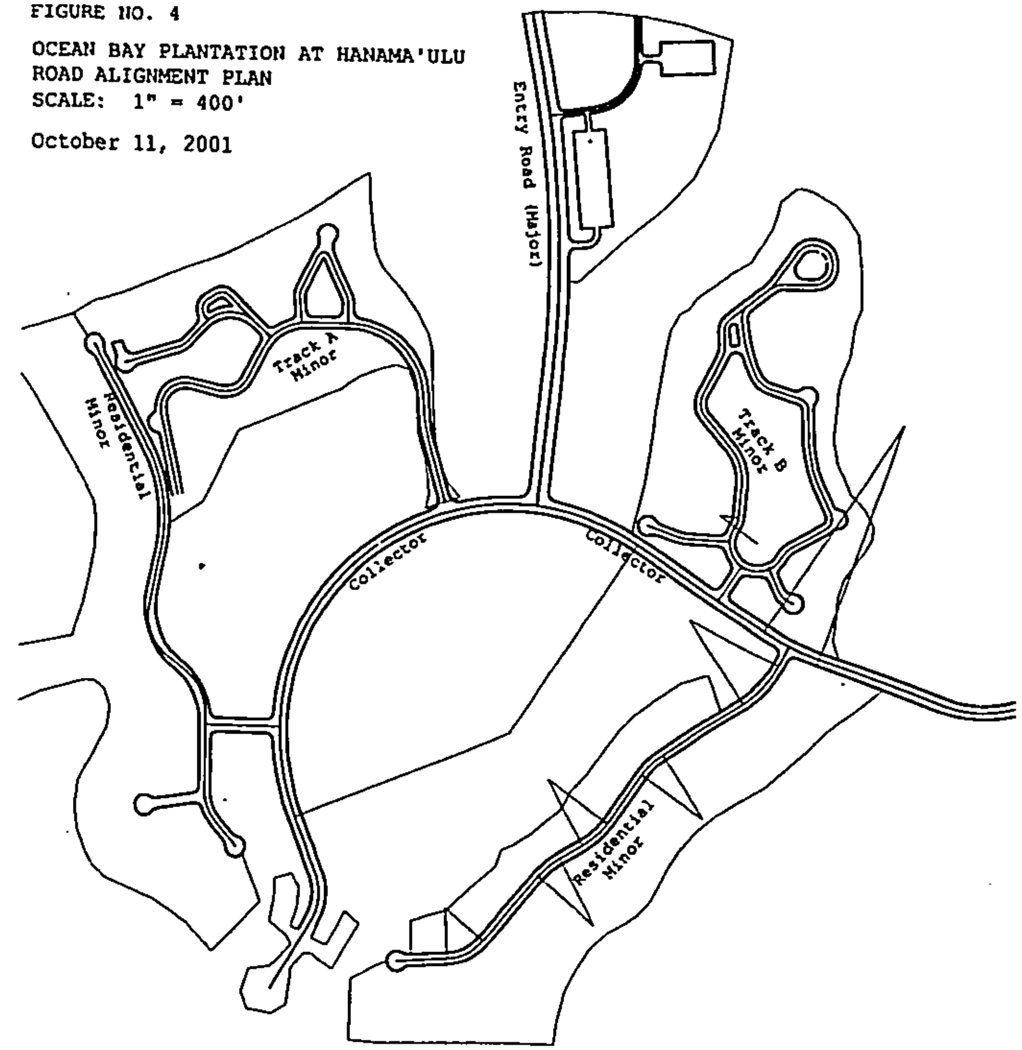
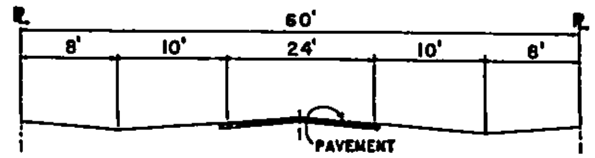
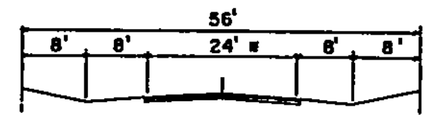


FIGURE NO. 5

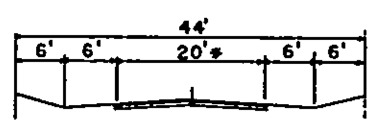


MAJOR STREET

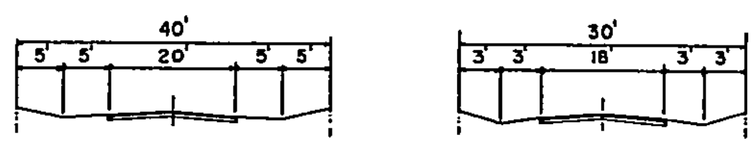


COLLECTOR STREET

* MINIMUM PAVEMENT WIDTH FOR AGRICULTURAL ROADWAYS IS 16 FEET.



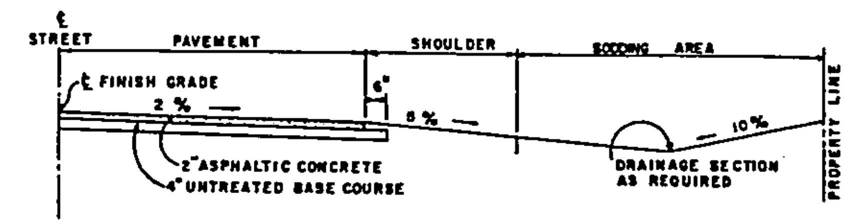
MINOR STREET



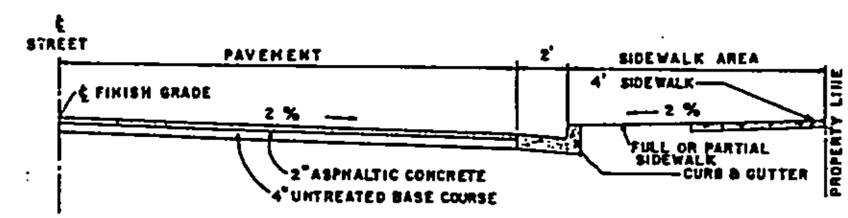
DEAD END STREETS

R-42	STANDARD DETAILS	STREET CROSS-SECTIONS WITHOUT CURB AND GUTTER SEPTEMBER 1984 NOT TO SCALE	COUNTY OF KAUAI

FIGURE NO. 6



HALF SECTION OF STREET WITH SHOULDER



HALF SECTION OF STREET WITH SIDEWALK

COUNTY OF KAUAI	ROAD PAVEMENTS AND SHOULDERS	STANDARD DETAILS	R-43

ON-SITE WASTEWATER COLLECTION SYSTEM

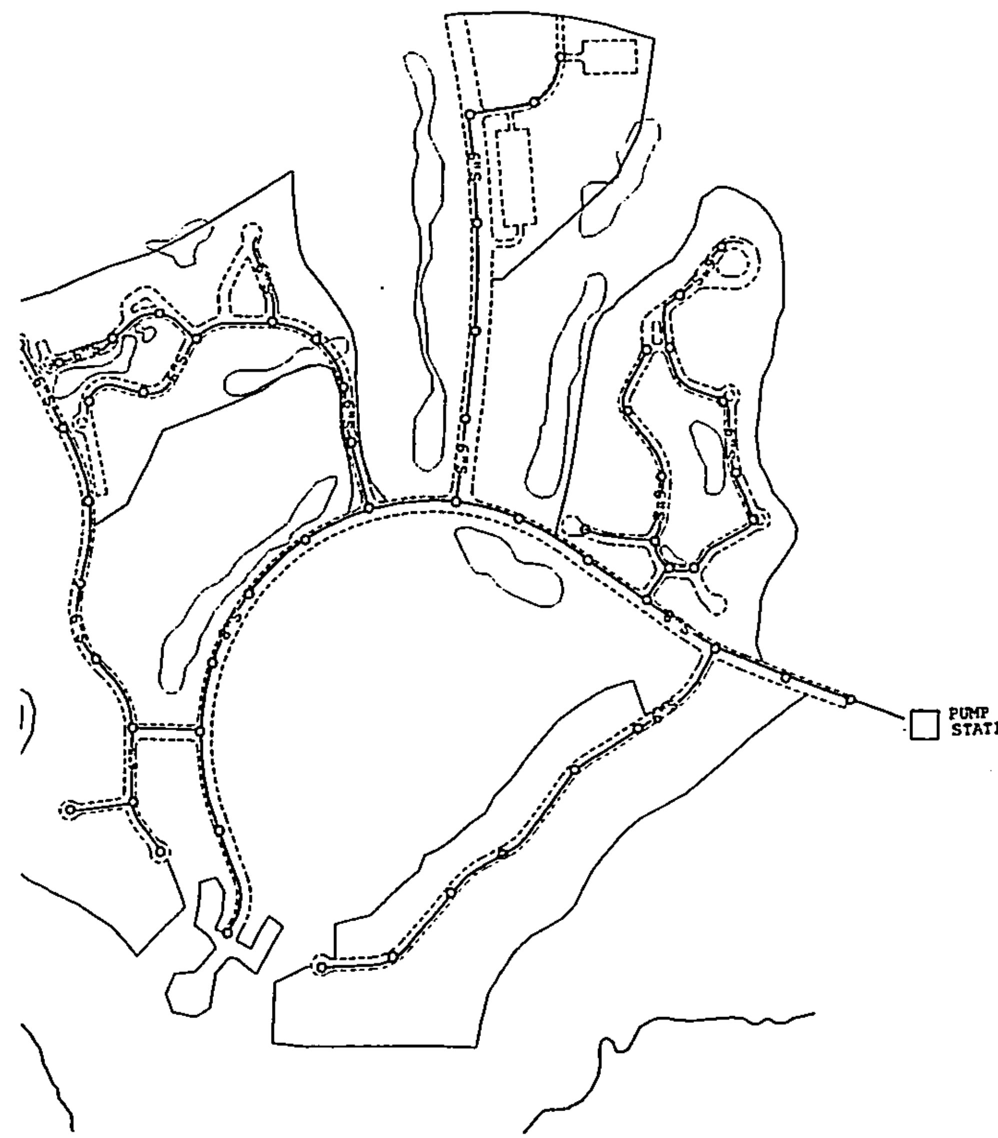
The proposed development will be served by an on-site wastewater collection and treatment facility. The proposed treatment facility will be located just mauka of the Kauai Beach Resort Property with treated effluent re-used by the proposed golf course. A description of the proposed facilities is contained in the report "Ocean Bay Plantation at Hanama'ulu, Conceptual Engineering Report for Wastewater Treatment and Effluent Disposal" which was prepared by Gray, Hong, Bills, Nojima, and Associates, Inc.. The report is dated November 5, 2001, with a revision date of November 19, 2001.

Wastewater will be collected by a system of sewer lines and will flow by gravity to wastewater pump station as shown in Figure No. 7. The wastewater would then be pumped to the wastewater treatment plant. Table No. 3 provides the order of magnitude costs for the on-site collection system.

TABLE NO. 3
ON-SITE WASTEWATER COLLECTION SYSTEM
ORDER OF MAGNITUDE COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
On-Site 8" Sewerline	3550 lf	$150/lf	$532,500
On-Site 6" Sewerline	7485 lf	$125/lf ea	$935,625
On-site Sewer Manhole	38 ea	$6000 ea	$228,000
Track A 6" Sewerline	2400 lf	$125/lf	$300,000
Track A Sewer Manhole	8 ea	$6000 ea	$48,000
Track B 6" Sewerline	3250 lf	$125/lf ea	$406,250
Track B Sewer Manhole	13 ea	$6000 ea	$78,000
		TOTAL	$2,528,375

FIGURE NO. 7
OCEAN BAY PLANTATION AT HANAMA'ULU
WASTEWATER SYSTEM MAP
Scale: 1" = 500'



APPENDIX K

Ocean Bay Plantation at Hanamā'ulu Preliminary Engineering Report for Water

Kodani & Associates

December 2001

OCEAN BAY PLANTATION AT HANAMA'ULU
PRELIMINARY ENGINEERING REPORT FOR WATER
December 15, 2001

Kodani and Associates, Inc.
3145 Akahi Street
Lihue, HI 96766

INTRODUCTION

This engineering report was prepared in conjunction with EWM Kauai, LLC's preparation and processing of an Environmental Impact for the 460-acre Ocean Bay Plantation at Hanama'ulu on the Island of Kauai. The location of the project site is shown on Figure No. 1.

EWM Kauai, LLC intends to develop the subject property to provide a mixed-use residential and golf course community on their 460-acre coastal parcel in Hanamā'ulu, Kaua'i. The project will include a small retail commercial center near the intersection of the project's main entry roadway and Kuhio Highway. Ocean Bay Plantation at Hanama'ulu will be master-planned community serving the U.S. mainland, international, and local Kaua'i and Hawai'i markets for single-family custom homes and quality multi-family housing.

The land used to build this proposed Master Planned Community was used in the past to grow sugar cane by the Amfac Kauai Sugar Company and has no infrastructure that satisfies County of Kauai standards. A critical infrastructure requirement that should be addressed for any planned community is assurance that its water system will support the development. This report will evaluate the water demand generated by the proposed Master Planned Community and identify engineering requirements for the design of water sources, storage facilities, and distribution lines.

The analysis and findings contained herein are at a general concept level and reflect the preliminary nature of EWM Kauai, LLC's proposals at this early stage of the planning process.

PROJECT DESCRIPTION

The proposed components of the Master Plan for Ocean Bay Plantation at Hanama'ulu (See Figure No. 2) include:

- 18-hole golf course and golf clubhouse.
- 70 lots for single-family homes
- Up to 250 multi-family condominium homes (8 units/acre) built in two areas
- Up to 100 single-family house lots on 55 acres
- An open space corridor along the coastline, wetlands and highway buffer.
- A small-scale retail commercial center on approximately 8 acres

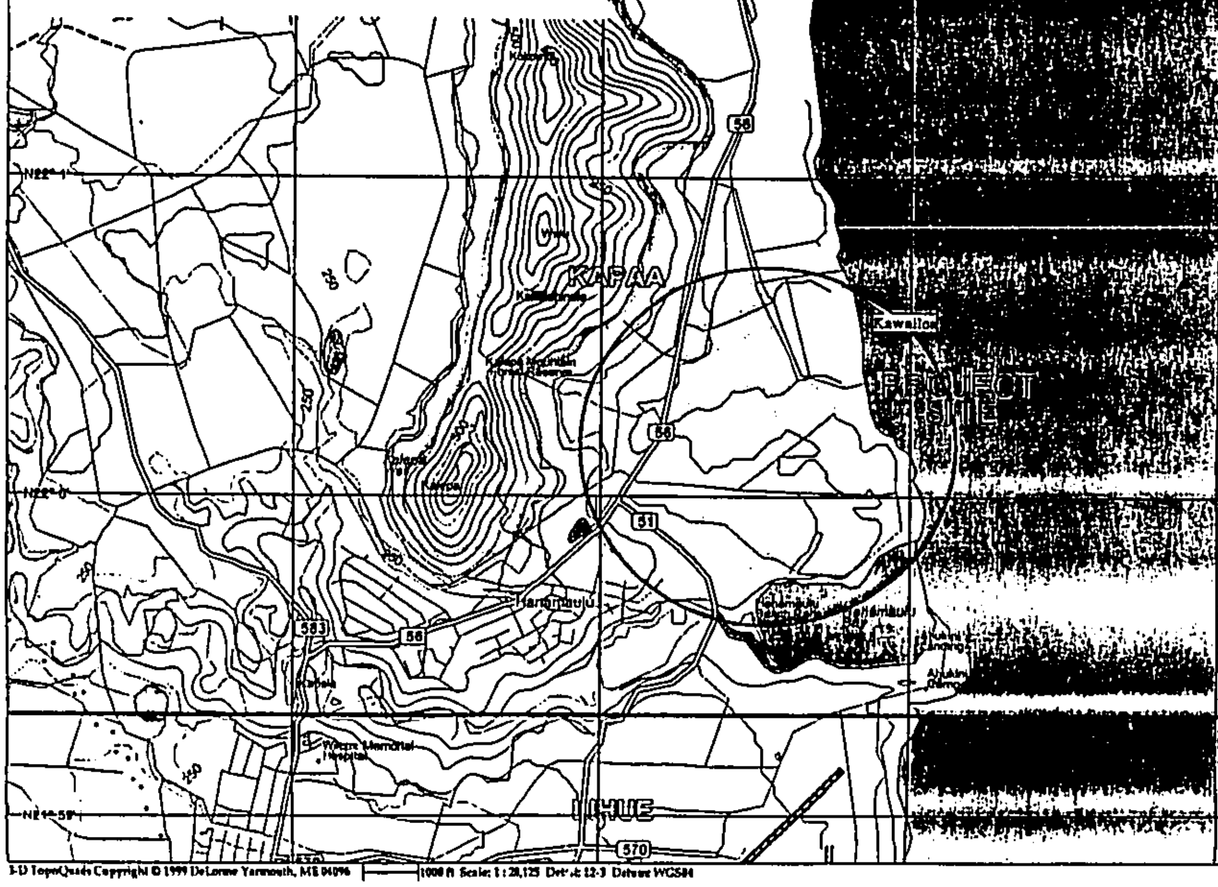


FIGURE NO. 1
OCEAN BAY PLANTATION AT HANAMA'ULU
N.T.S.

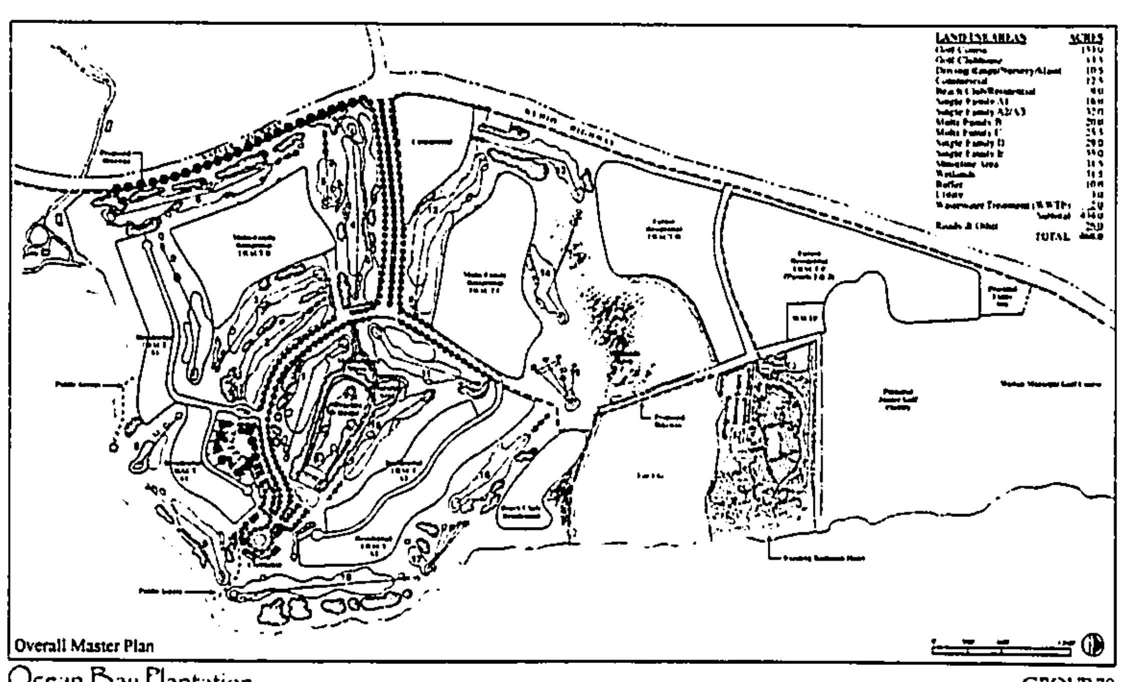


FIGURE NO. 2
OCEAN BAY PLANTATION AT HANAMA'ULU
MASTER PLAN

WATER SYSTEMS

Potable water will be supplied by the County of Kauai's Department of Water (DOW). This water will be used by the residential units, commercial areas, and the golf clubhouse. The water facilities will be built to DOW standards and will be dedicated to the DOW prior to connection.

Irrigation water will be supplied to the golf course and landscaped area by an on-site system operated by EWM, Kauai, LLC.

POTABLE WATER SYSTEM

Existing Water System. The DOW operates 13 water system planning areas. Figure No. 3 shows the location of the DOW water system service areas on the island. Ocean Bay Plantation at Hanama'ulu is located at the south end of the Wailua-Kapaa Water System. The Wailua-Kapaa and Puhi-Lihue-Hanamaulu water systems are the two largest water systems on the island and are interconnected by a 16" water main. The interconnection allows water allows water to be transferred between the two systems if necessary. The Wailua-Kapaa Water System is serves an area that stretches south from Kealia to just north of Hanama'ulu and serves resort, commercial, industrial, public and residential uses.

The Wailua-Kapaa Water System is supplied by 10 wells or tunnels located in the inland areas of the system. Major storage facilities include a two-million gallon tank located above Wailua Houselots, a 1.0 million gallon tank located near the Makaleha mountains, and a 0.5 million gallon tank located in Wailua Homesteads. Transmission mains, which transport water from the storage tanks to the various service areas, range in size from a diameter of 6 inches to 16 inches. The locations of the major facilities within the Wailua-Kapaa water system is provided by Figure No 4. The Ocean Bay Plantation at Hanama'ulu would be served by the two-million gallon tank which has an overflow elevation of 214 feet.

The DOW recently completed a Water Master Plan that determined the capacities and requirements of its water systems. The Master Plan included planning for projects that will enable the DOW to meet its water requirements through the year 2020. For the Wailua-Kapaa Water System several projects were identified for increasing both supply and storage to meet water demand requirements through the year 2020. Within the 214 service zone, from which the Ocean Bay Plantation at Hanama'ulu will be serviced, no projects were identified. Storage facilities within this zone were found to have about 590,000 gallons more capacity than the estimated volume required in 2020. Similarly, the water sources were found to have about 470 gpm more pumping capacity available than the estimated requirement in 2020.

Proposed Water System. The DOW Master Plan does not include any projections for water demands generated by the Ocean Bay plantation at Hanama'ulu. Because the Ocean Bay Plantation at Hanama'ulu site is currently classified and zoned for agricultural use, it was not been identified as being part of a DOW service area. For new developments wishing to connect to DOW operated water systems, the DOW coordinates the efforts of developers with the developer providing all needed infrastructure improvements.

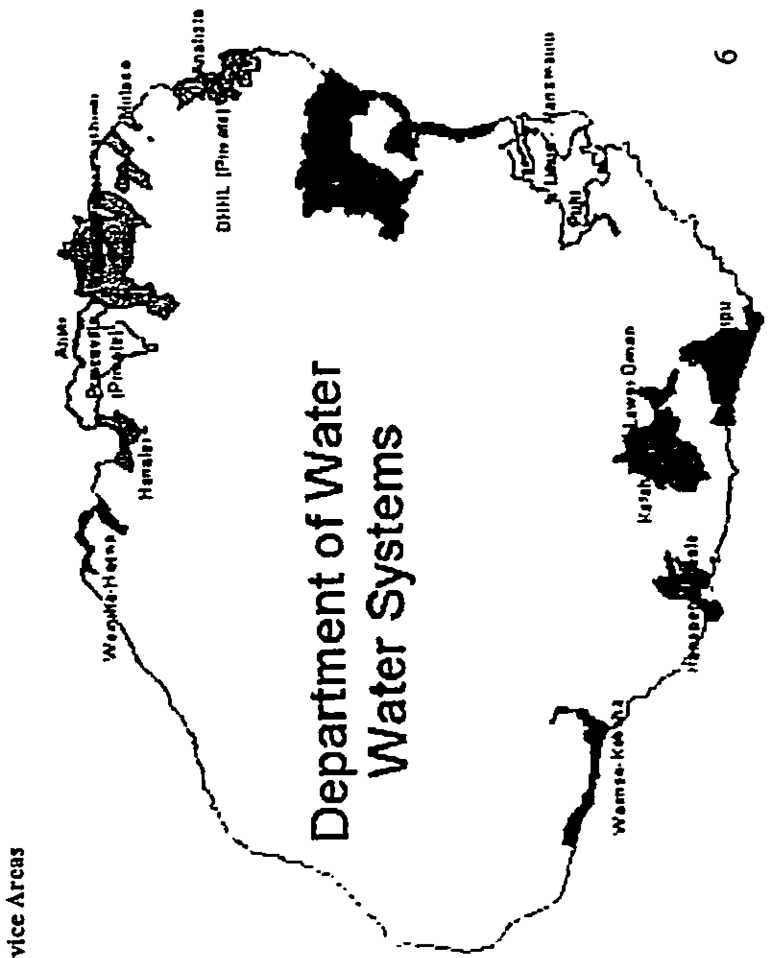
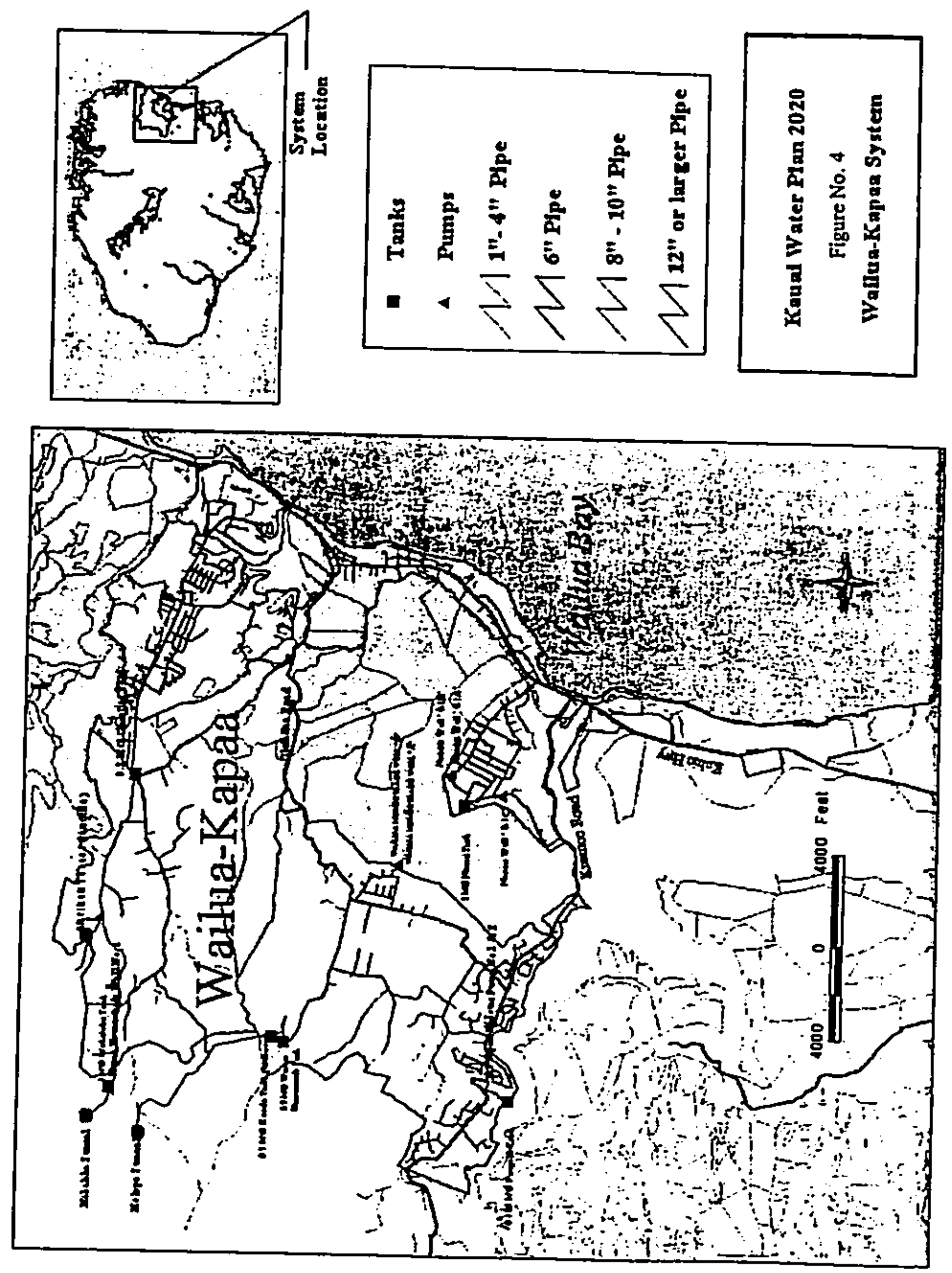


Figure NO. 3
Water Service Areas



Kauai Water Plan 2020
Figure No. 4
Wailua-Kapaa System

The following sections will discuss projected water demand and the facility improvements necessary to support the Ocean Bay plantation at Hanama'ulu Master Planned Community.

1. Water Demand. The water demand for the proposed development was calculated according to the following criteria listed in the Water System Standards, Department of Water, County of Kauai, 1985 published by the Department of Water County of Kauai:

Average Daily Demand	= 500 gallons/unit	Single Family
	= 350 gallons/unit	Multi Family
	= 3000 gallons/acre	Commercial
	= 4000 gallons/acre	Industrial
	= 2500 gallons/acre	School/Park

Maximum Daily Demand = 1.5 x Average Daily Demand

Peak Hour Demand = 3.0 x Average Daily Demand

A summary of the water demand by land use is provided in Table No. 1 below.

TABLE No. 1

Land Use	Units	Unit Demand	Average Daily Demand	Maximum Daily Demand
Single Family	170 units	500 gal/unit/day	85000	127,500
Multi family	250 units	350 gal/unit/day	87,500	131,250
Commercial	8 acres	3000 gal/acre/day	24000	36,000
Golf Clubhouse	200 users	25 gpd/user	5000	7500
Beach Club	200 users	25 gpd/user	5000	7500
Total			206,500	309,750

2. Storage Requirements. The DOW requires that storage be provided to meet the following criteria:

a. Meet maximum daily demand. Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

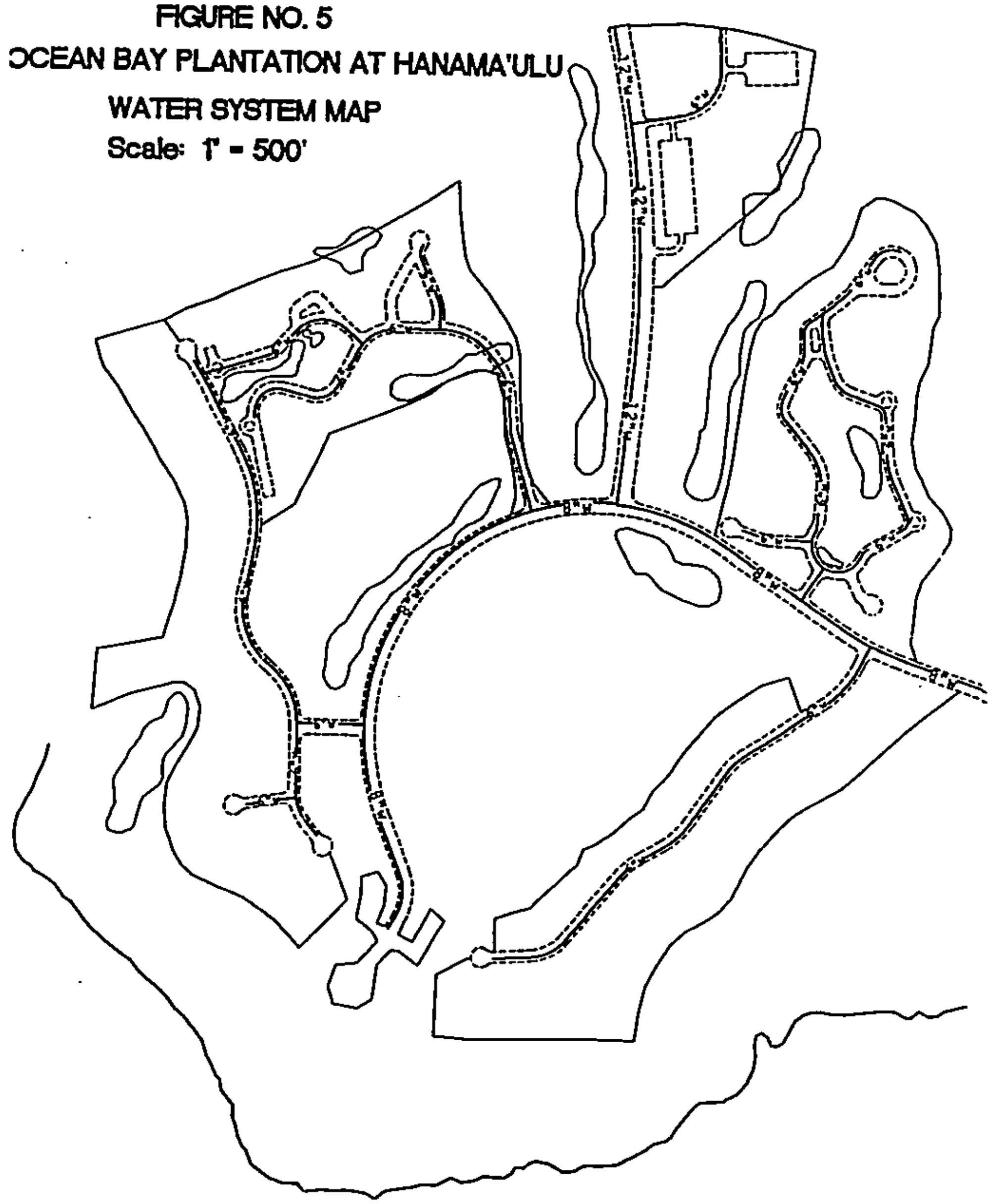
b. Meet maximum daily rate plus fire flow for the duration of the fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

FIGURE NO. 5

OCEAN BAY PLANTATION AT HANAMA'ULU

WATER SYSTEM MAP

Scale: 1" = 500'



The projected maximum daily water demand (1.5 x Average Daily Demand) for the entire Ocean Bay plantation at Hanama'ulu is about 310,000 gallons per day. Therefore, to meet the first criteria, storage capacity of 310,000 gallons must either be available in the existing system or storage capacity of at least 310,000 gallons must be added to the system.

The second criteria for water storage requirement is mathematically expressed as follows:

$V = (4/3) \times (Tf) \times (Qm + Qf - Qp)$

where: V = Storage Volume Required, million gal.
- Tf = Fire Duration, day
- Qm = Max Hour Demand, mgd
- Qf = Fire Flow, mgd
- Qp = Pump Input, mgd

Since the Ocean Bay Plantation at Hanama'ulu will be connected to the 214 service zone, the capacity of the existing 2.0 million gallon storage tank was used in these calculations. Fire flow requirements for Qf and Tf are 4.320 mgd (3000 gallons/minute) and .125 day (3 hours), respectively. The maximum day demand, Qm, for the existing 214 system plus the proposed development is 3.7 mgd. The final unknown, pump input (Qp), is and is computed to be 2.1 mgd for the existing wells feeding the Wailua Houselots Storage tank. Substituting the data into the above formula results in the following storage Volume.

$V = (4/3) \times (.125) \times (3.7 + 4.32 - 2.1)$
$V = 0.99$ million gallons

The existing 2.0 million gallon storage facility in Wailua Houselots together with the wells that supply it has enough capacity to meet this second storage requirement.

The storage requirement for the Ocean Bay Plantation at Hanama'ulu would be based on the larger requirement of these two criteria. Therefore the Ocean Bay Plantation would require 310,000 gallons of storage volume.

3. Source Requirements. The main criteria for water source (i.e. pump capacity) is that well pumps be sized to operate at a rate equal to the maximum daily demand over a 24-hour period with the largest pump considered on standby. Therefore the water sources that are developed to serve this facility will need to have a pumping capacity of about 215 gpm not including the pumping capacity of the largest pump. The number of sources developed will be dependent on the actual pumping capacity at each source.

4. Transmission Requirements. Transmission mains are sized based on the following DOW criteria:

a. Maximum daily flow plus fire flow with a residual pressure of 20 psi at critical fire hydrant.

b. Peak hour flow with a minimum residual pressure of 40 psi.

A hydraulic model of the Wailua-Kapaa water system was used to estimate the pressures within the Ocean Bay Plantation at Hanama'ulu. Residual pressures were found to meet the two transmission requirements above. Therefore improvements to the existing transmission mains between the Wailua Houselots Storage Reservoir and the project site are not required.

Transmission mains will be required as part of the development of any water sources and storage tanks that the DOW requires before it approves connection to their water system.

New water mains within the project area will also be required to bring in water from Kuhio Highway to the project site. A schematic showing the proposed transmission main improvements is displayed in Figure No. 5. Transmission main improvements are shown along the major roadways of the Master Planned Community only. As interior roadways are constructed, additional transmission mains will be required.

DOW WATER FACILITY IMPROVEMENTS

For the purpose of developing order of magnitude costs for water facility improvements that would be constructed by EWM Kauai, LLC and dedicated to the Department of Water, the following assumptions were mad:

1. A 500,000-gallon water storage tank would be constructed on Kalepa Ridge next to an existing DOW 1,000,000-gallon storage tank. EWM Kauai, LLC would be responsible for paying the cost of 60% of the cost of the tank.

2. Two on-site wells could be developed to supply water to the DOW system. Each well would have sufficient capacity to meet the projects maximum day demand of 215 gpm.

3. A 12" transmission main between the wells and the water storage tank on Kalepa Ridge would be required.

EWM Kauai, LLC would also be required to pay a Facilities Reserve Charge (FRC) to the Department of Water before service would be provided to the project. The FRC would be based on the amount of units served by the project. Based on approximately 500 units (residential, multi-family, and an equivalent unit amount for commercial areas), the FRC would amount to $1,300,000. EWM Kauai, LLC could be credited with an amount up to two-thirds of the FRC if it constructs and dedicates source and storage facilities.

ON-SITE IRRIGATION SYSTEM.

Water for irrigating the golf course and landscaped areas would be supplied by a private system constructed, operated, and maintained by EWM Kauai, LLC. The proposed water system is described and evaluated in the report prepared by Tom Nance Water Resource Engineering titled "Assessment of the Potential Effects on Surface and Groundwater of the Ocean Bay Plantation at

Hanama'ulu". The report estimated the maximum day demand to be 1,000,000 gallons per day for an area of 125 acres. Based on preliminary pump results taken at an on-site well location, it appears that a pumping capacity of 350 gpm will be achievable at that location. If a second location has similar quality and capacity, then two wells would provide sufficient supply to meet the maximum day demand.

ESTIMATED ORDER OF MAGNITUDE COST

The order-of-magnitude cost of the water system improvements for Ocean Bay plantation at Hanama'ulu Inc.'s is estimated at about $5,660,000. The cost estimate assumes that the water system would be constructed to Department of Water standards and includes the costs for improvements for source development, storage, and transmission. It also assumes that the project will receive credit for the cost of constructing these source development and storage facilities resulting in two-thirds reduction in the facilities reserve charge. The estimate does not include the cost for distribution lines along some of the minor roadways since the planning of those roadways will be performed at a later stage of the development. See Table No. 3 for a breakdown of the costs.

TABLE NO. 3
WATER SYSTEM
ORDER OF MAGNITUDE COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL
On-Site 12" Waterline	1950	$135/lf	$263,250
On-Site 8" Waterline	4835	$110/lf	$531,850
On-site 6" Waterline	11150	$90/lf	$1,003,500
On-Site 2.5" Waterline	1200	$40/lf	$48,000
350 gpm Potable Wells	2 ea	$900,000 ea	$1,800,000
500,000 gallon Storage Tank (60% of cost)	0.6 ea	$1,400,000 ea	$840,000
Off-Site 12" Waterline	5500 lf	$135/lf	$742,500
Facilities Reserve Charge	0.33 ea	1,300,000	$433,000
		TOTAL	$5,662,100

APPENDIX L

Ocean Bay Plantation at Hanamā'ulu Conceptual Engineering Report for Wastewater Treatment and Effluent Disposal

Gray, Hong, Bills, Nojima, and Associates, Inc.

November 2001

OCEAN BAY PLANTATION
AT HANAMA'ULU

CONCEPTUAL ENGINEERING REPORT
FOR
WASTEWATER TREATMENT
AND EFFLUENT DISPOSAL

November 5, 2001

Prepared by

Gray, Hong, Bills, Nojima & Associates, Inc.
841 Bishop Street, Suite 1100
Honolulu, Hawaii 96813

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FIGURE 3 - WASTEWATER TREATMENT FLOW CHART

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APPENDIX A

SIZING DATA FOR PARKSON BIOLAC-R SYSTEM AND SANITAIRE ICEAS TREATMENT SYSTEM

INTRODUCTION

Ocean Bay Plantation at Hanama'ulu is a proposed mixed-use residential and golf course community which is intended to be developed on a 460-acre coastal parcel in Hanama'ulu, Kauai. The project will also include a modest commercial area containing retail space, offices and restaurant accommodations. The project is being developed by EWM Kauai LLC. A location map is provided on Figure 1 and the project's master plan is shown on Figure 2.

The project area is not sewered and is also outside Lihue Wastewater Collection and Treatment District service area. It is therefore intended to provide on-site wastewater collection and treatment facilities to serve the 460-acre project. The State of Hawaii Department of Health Wastewater Branch has regulatory authority over such facilities in accordance with Hawaii Administrative Rules (HAR), Title 11, Chapter 62, Wastewater Systems.

A feature of the Ocean Bay at Hanama'ulu Wastewater Treatment Facilities will be reuse of treated effluent for golf course irrigation. Effluent irrigation also comes under the jurisdiction of the State of Hawaii Department of Health Wastewater Branch and is governed by the Department's "Guidelines for the Treatment and Use of Reclaimed Effluent".

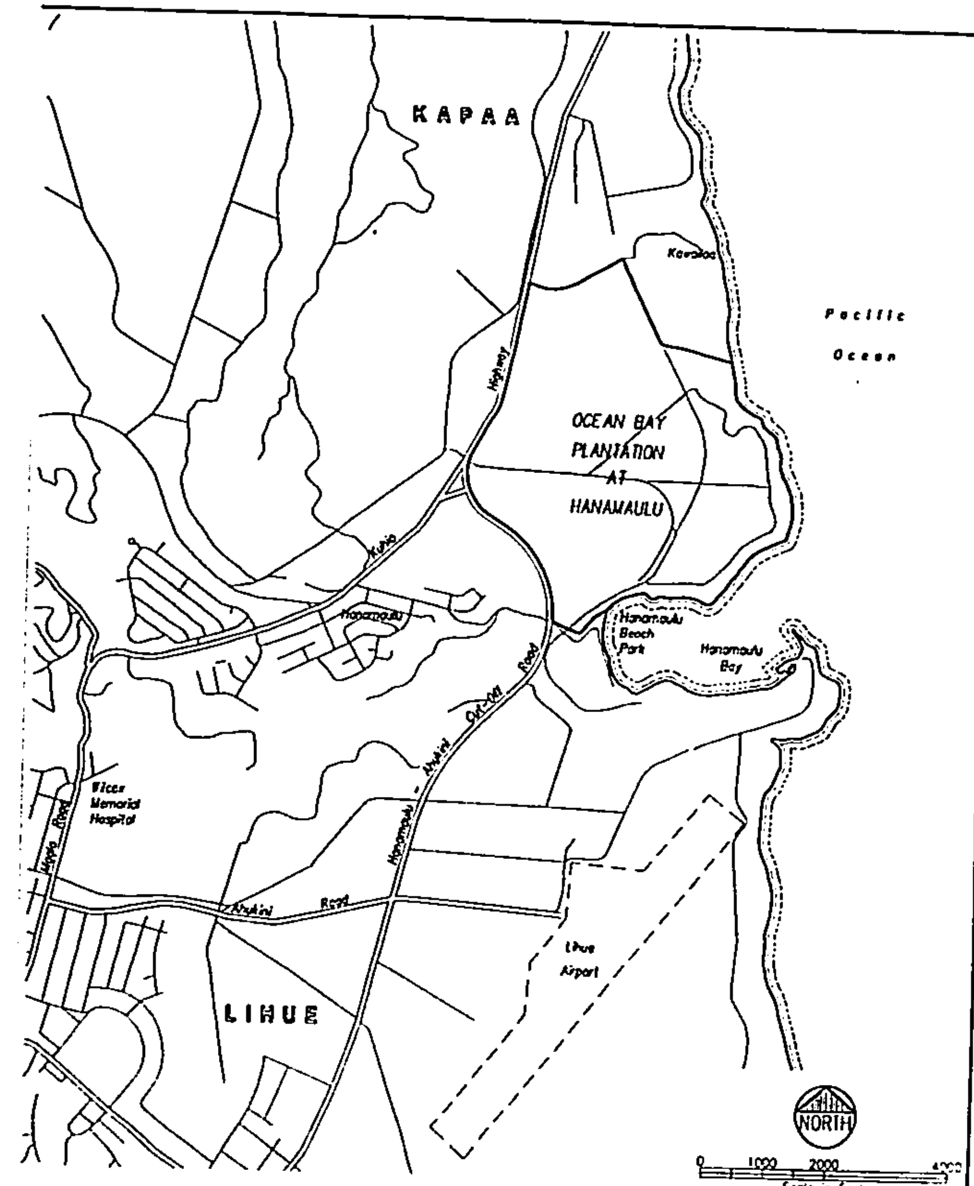
Wastewater facilities will comply with all Department of Health requirements.

PROJECTED WASTEWATER FLOWS

Table 1 estimates the project's sewage generation. Ultimate build-out of the project is estimated to generate 260,000 gallons per day (gpd) of wastewater flow. Build-out is anticipated to occur over 5 to 8 years.

All wastewater flow will be domestic in nature with anticipated strength characteristics of 200 milligrams per liter (mg/l) biochemical oxygen demand (BOD) and total suspended solids (TSS). No industrial waste sources are anticipated.

Restaurants associated with the Golf Course and Club House facilities as well as the Gateway Village commercial center will be required to design into their facilities an oversized grease trap. This will allow capture and disposal of excess grease before entering the project's collection and wastewater treatment system.



PREPARED FOR: EWM KAUAI LLC	LOCATION MAP	Gray·Hong·Bills·Nojima & Associates, Inc CONSULTING ENGINEERS 841 Bishop Street Suite 1100	FIGURE 1

Wastewater Engineer: Gray Hong Bills Nojima (Nov. 2001)
Figure 2

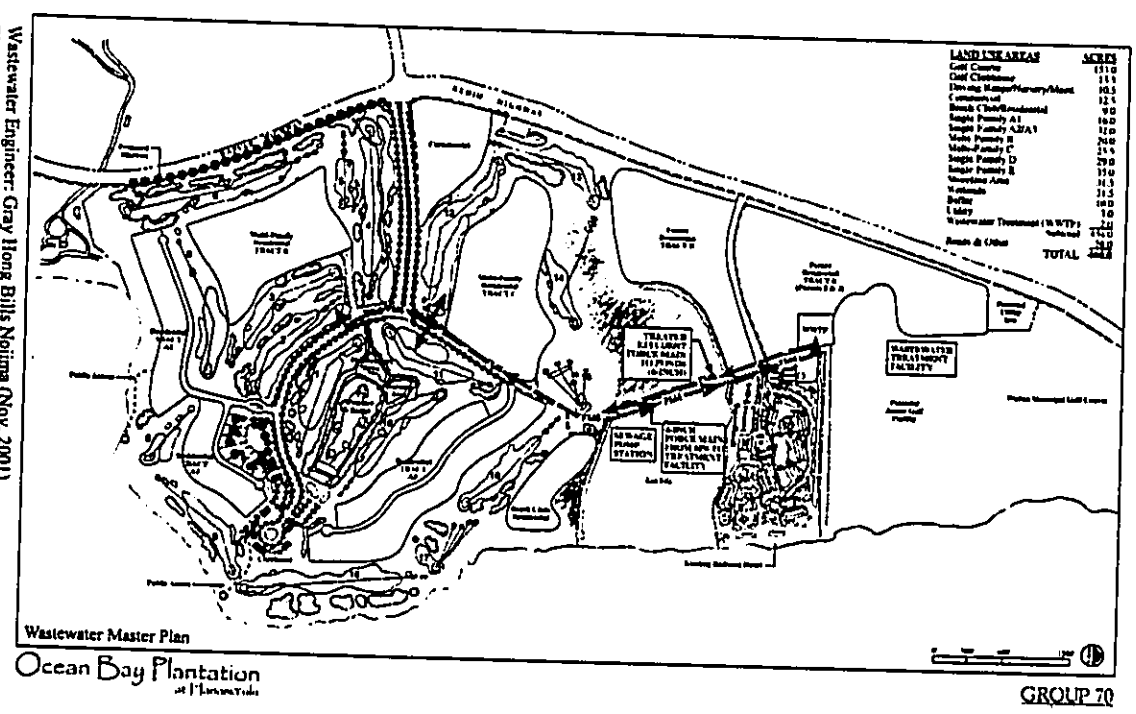


TABLE 1
WASTEWATER GENERATION FOR
OCEAN BAY AT HANAMALU

LAND USE	WASTEWATER GENERATOR (Units, Square Feet, Meals etc.)	WASTEWATER GENERATION RATE	WASTEWATER FLOW Gallons per day (gpd)
MULTIFAMILY	250 Units (2.5 Bedroooms/Unit)	200 Gallons per Bedroom	125,000 gpd
SINGLE FAMILY	170 Units (3.5 Bedrooms/Unit)	200 Gallons per Bedroom	119,000 gpd
CLUBHOUSE			
Retail (Pro Shop)	1,000 Square Feet	0.1 Gallons per Square Foot	100 gpd
Offices (Etc.)	6,000 Square Feet	0.1 Gallons per Square Foot	600 gpd
Restaurant	200 Meals	10 Gallons per Meal	2000 gpd
Employees (Including GC)	60 Employees	25 Gallons per Employee	1500 gpd
GATEWAY VILLAGE-COMMERCIAL			
Retail	20,000 Square Feet	0.1 Gallons per Square Foot	2000 gpd
Offices	5,000 Square Feet	0.1 Gallons per Square Foot	500 gpd
Restaurant	200 Meals (5,000 Square Feet)	10 Gallons per Meal	2000 gpd
Employees	40 Employees	25 Gallons per Meal	1000 gpd
BEACH CLUB	200 Users (5,000 Square Feet)	25 Gallons per User	5000 gpd
		TOTAL WASTEWATER FLOW	258,700 gpd

COLLECTION AND WASTEWATER TREATMENT PROCESS

Figure 3 provides a flow chart for the project's collection and wastewater treatment process. The following describes the individual components of the system:

Gravity Sewer System

The project's gravity collection system will consist of an 8-inch main and sewer manhole system conforming to the County of Kauai Sewer Standards. The collection system will convey sewage to the lower portion of the site to a centrally located sewage pump station. Figure 2 shows the tentative location of the project sewage pump station.

Pump Station and Force Main System

The project's pump station will deliver all sewage to the wastewater treatment facilities. Based on the project's total wastewater flow of 260,000 gpd and a peak flow factor of 5, the pump station will be designed to transfer 900 gallons per minute (gpm).

The pump station system will be a duplex system with one running pump and one standby pump. In case of power outages the pump station will be supported by an emergency generator operating on LPG fuel. The pump station will also be equipped with an auto-dialer device which will signal maintenance personnel when the high water level is reached in the wet well or the generator fails to engage.

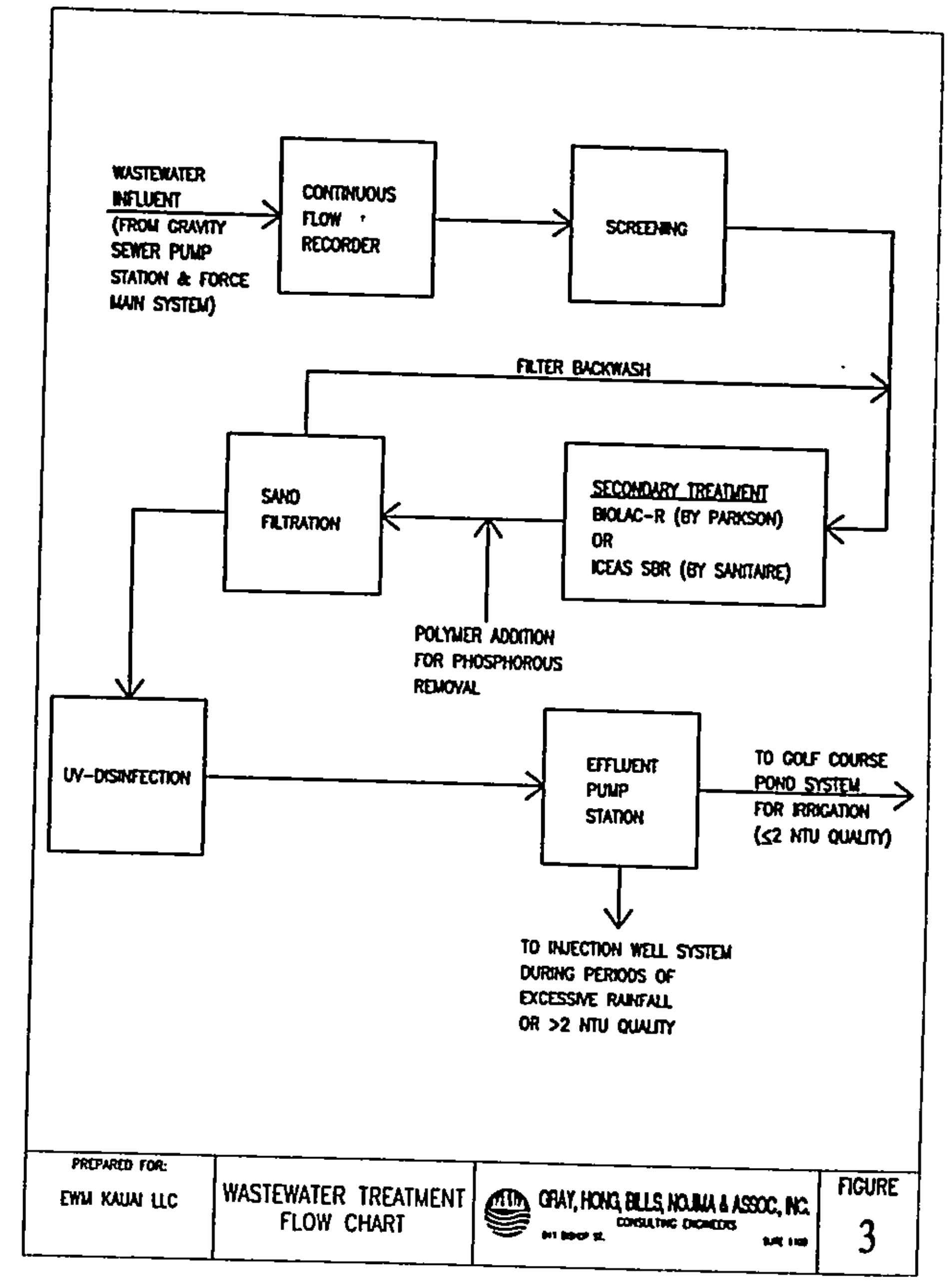
Current project plans call for one pump station. However, during the design process it may be determined more advantageous to utilize multiple pump stations. All pump stations will be designed in accordance with the features described in this section.

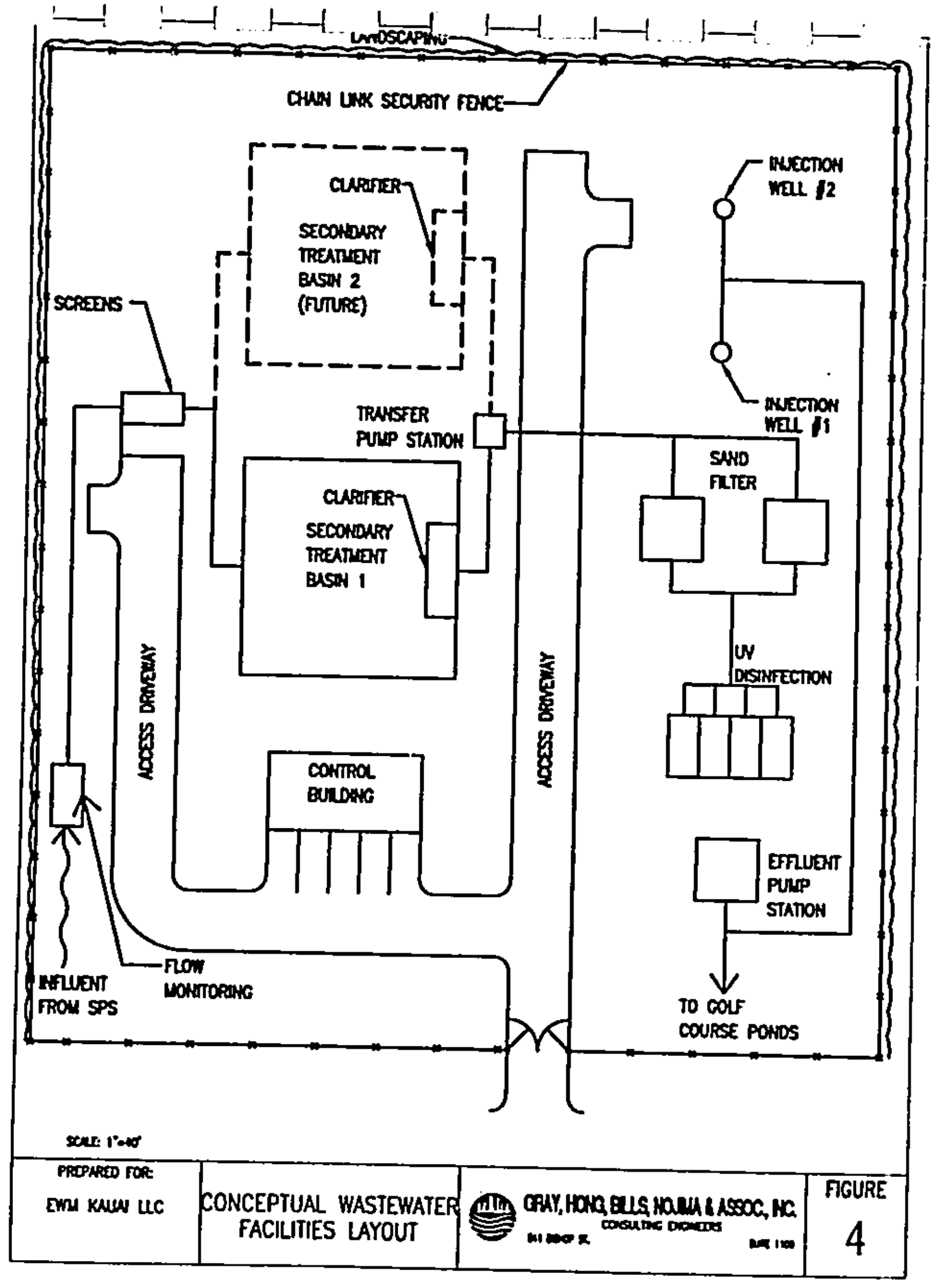
Wastewater Treatment Process

Figure 4 shows the conceptual layout of the wastewater treatment facilities. The tentative location for the facilities is shown on Figure 2. Major elements of the treatment process are:

Flow Monitoring

Wastewater entering the treatment facilities will pass through a flow monitoring device will continuously record the instantaneous flow rate entering the facility. The device will transmit the flow to a recorder located in the operations building. This device is integral in evaluating performance characteristics of the wastewater treatment process.





Screening

A self-cleaning bar screen will remove large items from the treatment process. The sizing of the bar screen will be based on the peak flow entering the plant which will ultimately be 900 gpm. Screenings will be disposed of in a commercial refuse bin (3 cubic yard typically) and transported to the County landfill. The screenings are typically larger inorganic items.

A stationary bar screen will also be designed into the headworks for use when maintenance on the self-cleaning bar screen is required. Use of the stationary bar screen will be infrequent.

Secondary Treatment Process

Two secondary treatment processes are being considered for the project. Both are similar in nature in that they provide equalization capacity to dampen peak flows and both provide excellent effluent quality that routinely exceeds 10 mg/l BOD prior to filtration. These systems are the Biolac-R System as manufactured by Parkson Corporation and the Intermittent Cycle Extended Aeration System (ICEAS) as manufactured by Sanitaire Corporation. The Parkson system is capable of producing effluent quality of 15 mg/l SS and the ICEAS system 10 mg/l SS. Appendix A provides preliminary sizing data for each system.

The Biolac system uses aerated earthen basins as its primary reactor vessel and is equipped with clarifiers to separate liquids and solids in the treatment process. The size of the basins is significantly large in comparison to the incoming volume and this relationship allows peak flow dampening.

The ICEAS system operates on the sequential batch reactor (SBR) principle. The process cycle consists of three phases that are controlled on a time, rather than flow basis. Influent is received continuously during all phases of the cycle. During the *aeration* phase, raw wastewater flows into the basin and mixes with the mixed liquor. The basin is aerated as it is filled and biological oxidation takes place simultaneously. Following aeration, *settling* takes place in the second phase which allows for solid/liquid separation. Solids are allowed to settle to the bottom of the basin, leaving a clear liquid layer at the surface. In the final *decant* phase, the treated wastewater is removed by a decanter mechanism which takes effluent from 2 to 3 inches below the water surface level while excluding scum and other floatables.

Sand Filtration

Continuous sand filtration of secondary effluent will be utilized in the treatment process. The filtration system will be redundant providing two modules each capable of handling the design peak flow. Due to the equalization features of the secondary treatment basins, a peak flow factor of three (3) will be used to size the filter modules.

A polymer addition station will be provided upstream of the sand filters adding alum to flow entering the sand filters. The alum addition will act as a coagulating agent should there be a need to remove phosphorus from the effluent stream. The use of alum addition is not anticipated on a regular basis.

Effluent quality following sand filtration will have a clarity of less than 2 NTU which is the required reuse quality for irrigation water on the project's golf course. The effluent turbidity quality will be measured downstream of the ultraviolet (UV) disinfection facility by a continuous reading turbidity monitoring device. A solenoid valve will automatically shut off effluent to the project's golf course system should the device detect turbidity levels in excess of 2 NTU.

Disinfection

Effluent disinfection will be provided by ultraviolet radiation. The effluent stream will pass through UV arrays in contact channels to produce R-1 effluent quality. Redundant contact channels will be designed into the system.

Effluent Disposal

Two options are available for treated effluent disposal. The options are described below:

1. Golf Course Irrigation (Primary Disposal System)

   All treated effluent is proposed for use on the project's golf course. Effluent discharge from the UV disinfection system will enter a receiving wet well at the wastewater treatment plant site and pumps within the wetwell will deliver the treated effluent to the golf course pond system. Effluent will be delivered to the ponds as long as storage is available and the quality of the effluent is less than 2 NTU (the regulatory limit). Pond storage availability will be controlled by liquid level sensors located within the ponds.

2. Injection Well System (Back-up Disposal System)

   There will be times when the golf course pond system is filled to capacity and/or does not need treated effluent for irrigation purposes. There may also be times when the quality exceeds 2 NTU. Effluent discharge will be redirected to an injection well system located within the treatment plant site. The injection well system will consist of two injection wells each approximately 150 feet deep. The use of injection wells is governed by the State of Hawaii Department of Health Safe Drinking Water Branch. Preliminary consultation with this branch has confirmed that the proposed siting is below their geographical control line, and therefore acceptable subject to installation and performance testing.

   It should be noted that the primary purpose of the injection well system is to dispose of treated effluent that is not needed on the golf course due to prolonged periods of rainfall. The quality of effluent will far exceed secondary treatment standards, the minimum required for ground disposal.

APPROVAL PROCESS

The following outlines the approval processing required for implementation of the proposed wastewater treatment facilities:

1. Preparation of a Preliminary Engineering Report and approval by the Department of Health Wastewater Branch.
2. Preparation of construction plans and approval by the Department of Health Wastewater Branch.
3. Preparation of a golf course management plan and approval by the Department of Health Wastewater Branch.
4. Preparation of an Underground Injection Control permit application and approval by the Department of Health Safe Drinking Water Branch.
5. Building Permit approval by the County of Kauai Building Department.

PRELIMINARY COST ESTIMATE

The following provides a preliminary cost estimate for the Ocean Bay at Hanama'ulu wastewater collection, treatment and disposal system. The cost represents the total for a 260,00-gpd facility.

Preliminary Cost Estimate
Wastewater Treatment and Disposal
At Ocean Bay at Hanama'ulu

ITEM	COST
2.0-Acre WWTP with Headworks, Secondary Treatment, Sand Filtration, UV Disinfection and Operations/Blower Building	$2,500,000
Site Sewage Pump Station Delivering Wastewater to WWTP Site	$250,000
2,500 Lineal Feet Force Main from SPS to WWTP	$250,000
Treated Effluent Pump Station Delivering Reclaimed Wastewater to Golf Course Pond System	$150,000
4,500 Lineal Feet Effluent Force Main to Golf Course Ponds	$450,000
2 Injection Wells for Back-up Effluent Disposal (200 Feet Deep)	$200,000
TOTAL	$3,800,000

APPENDIX A

SIZING DATA

FOR

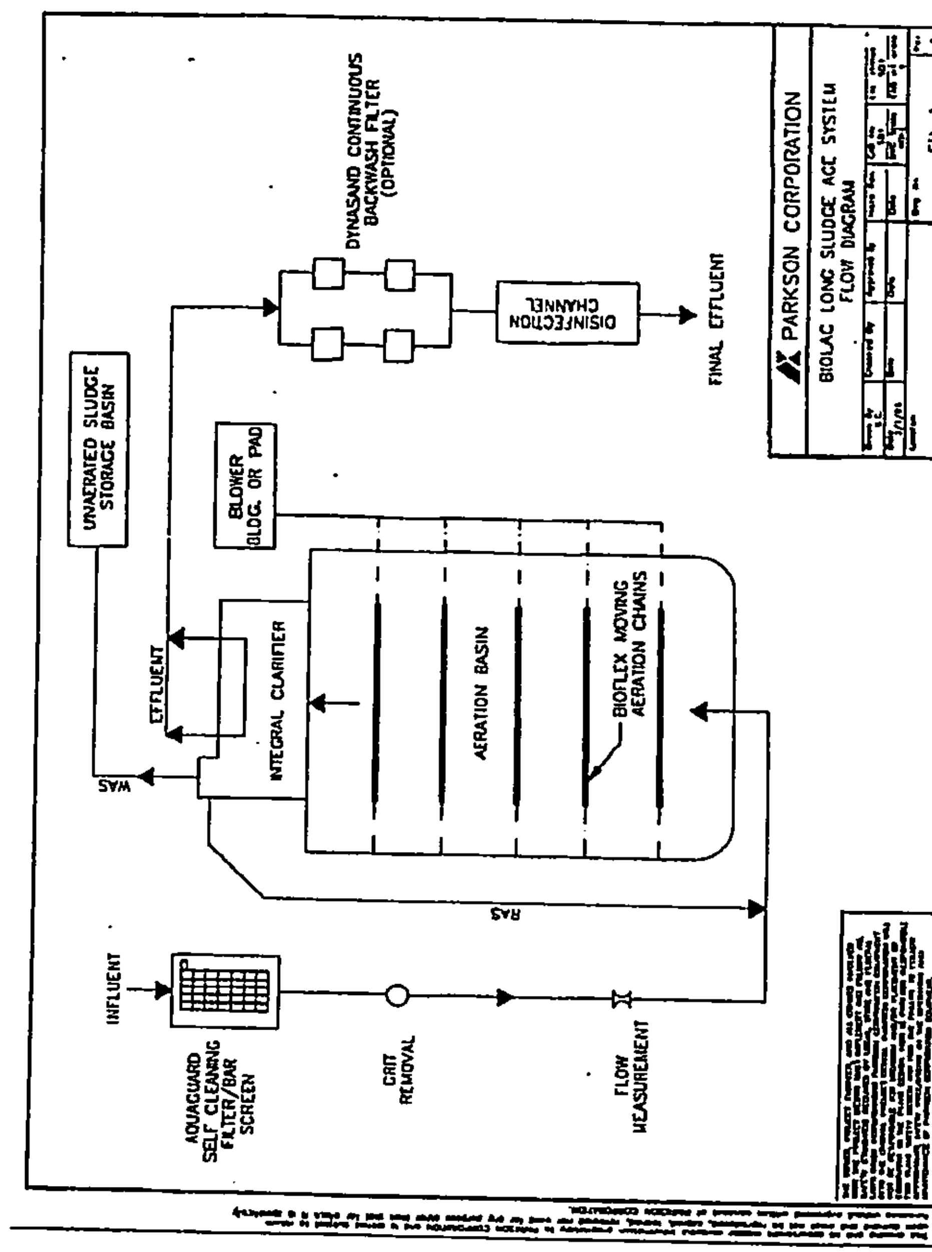
PARKSON BIOLAC-R SYSTEM

AND

SANITAIRE ICEAS TREATMENT SYSTEM

AERATED EARTHEN BASIN SYSTEM - PRELIMINARY DESIGN DATA
(BASED ON PARKSON BIOLAC-R SYSTEM)
OCEAN BAY PLANTATION

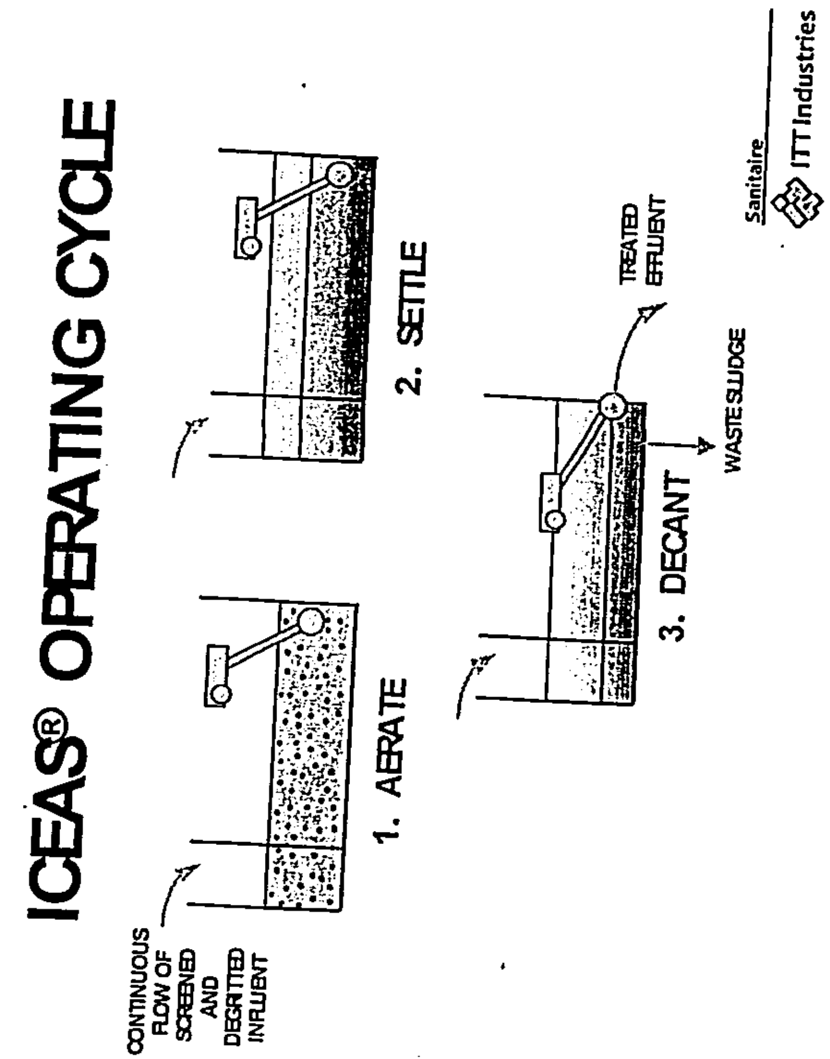
WASTE LOADINGS	
PROJECTED FLOW, GPD	
AVERAGE DRY WEATHER FLOW (ADWF)	260,000
PEAK WET WEATHER FLOW (PWWF)	910,000
WASTE STRENGTH	
5-DAY BIOCHEMICAL OXYGEN DEMAND (BOD), MG/L	200
SUSPENDED SOLIDS, MG/L	200
SECONDARY TREATMENT- AERATED EARTHEN	
AERATED BASINS	
NUMBER OF BASINS	2
BASIN WIDTH, FT	63
BASIN LENGTH, FT	63
MAXIMUM WATER DEPTH, FT	10
HYDRAULIC RESIDENCE TIME, DAYS	1.33
SOLIDS RETENTION TIME, DAYS	71
F/M RATIO, #BOD/# MLSS/DAY	0.05
TOTAL AIR RATE, SCFM/BASIN	219
CLARIFIERS	
NUMBER	2
SIDE WATER DEPTH, FT	10
TANK WIDTH, FT	20
TANK LENGTH, FT	19
EFFLUENT QUALITY	
5-DAY BOD, MG/L	10
SUSPENDED SOLIDS, MG/L	15



SEQUENTIAL BATCH REACTOR - PRELIMINARY DESIGN DATA
(BASED ON SANITAIRE ICEAS SYSTEM)
OCEAN BAY PLANTATION

WASTE LOADINGS	
PROJECTED FLOW, GPD	
AVERAGE DRY WEATHER FLOW (ADWF)	260,000
PEAK WET WEATHER FLOW (PWWF)	910,000
WASTE STRENGTH	
5-DAY BIOCHEMICAL OXYGEN DEMAND (BOD), MG/L	200
SUSPENDED SOLIDS, MG/L	200
MAXIMUM LOADING RATE, # BOD/1,000 CF-DAY	12.5
SECONDARY TREATMENT	
SEQUENTIAL BATCH REACTOR	
NUMBER OF BASINS	2
BASIN WIDTH, FT	19
BASIN LENGTH, FT	56
MAXIMUM WATER DEPTH, FT	15
ADWF CYCLE, HRS	
AERATION	2
SETTLE	1
DECANT	1
PWWF CYCLE, HRS	
AERATION	1.5
SETTLE	.75
DECANT	.75
F/M RATIO, #BOD/# MLSS/DAY	0.075
AIR RATE, SCFM/BASIN	280
SLUDGE HOLDING TANK	
NUMBER	1
STORAGE TIME, DAYS	20
TANK WIDTH, FT	20
TANK LENGTH, FT	39
MAXIMUM DEPTH, FT	15
AIR RATE, SCFM	
EFFLUENT QUALITY	
5-DAY BOD, MG/L	10
SUSPENDED SOLIDS, MG/L	10

Job No. 2855/10-31-2001



APPENDIX M

<u>Memorandum: Hanamā'ulu Project</u>

Albert Chong Associates, Inc.

December 2001

MEMORANDUM

Albert Chong Associates Inc.
Consulting Electrical Engineers
and Lighting Designers
1117 Kapahulu Avenue
Honolulu Hawaii 96816
Telephone (808) 738-5355
Fax (808) 738-5455
E-Mail alchong@lava.net

DATE: January 7, 2002

TO: Jeff Overton, GROUP 70

FROM: Rick Chong

PROJECT: HANAMAULU

MESSAGE:

Overhead power, telephone and cable television lines exist overhead along Kuhio Highway. The overhead lines are located on the project side of the highway from the northern end to the north side of the intersection with the Hanamaulu-Ahukini Cut-off Road. Just before the intersection, the overhead line transitions to the opposite side of Kuhio Highway and follows the highway to Lihue.

Power

The development's projected electrical load is estimated at 5.5 megawatts. Kauai Electric will be the power company supplying the development. Kauai Electric has indicated they would like to purchase property within the development to build a substation, which would feed the development as well as other customers. Kauai Electric will require right-of-way access to install and maintain their "looped-fed" primary distribution system, which will feed the various entities within the development. All new power lines will be installed in underground ductlines and manholes. Utility pad-mounted transformers will be required at specific development project locations. Three phase service is anticipated for all non-residential entities while single phase service is anticipated for all single-family units.

Telephone

Verizon Hawaii has overhead facilities located along Kuhio Highway. New underground facilities consisting of concrete encased ductlines and manholes will be required to distribute services throughout the development. These available services range from local dial tone (voice) to high-speed fiber lines (voice/data).

Cable Television

Garden Isle Telecommunications is the cable television provider in this part of Kauai. Garden Isle has overhead facilities along Kuhio Highway. New underground facilities consisting of concrete encased ductlines and handholes will be required to distribute services throughout the development. These available services range from standard cable television service to high-speed fiber lines.

APPENDIX N

Market and Economic Impact Studies, Ocean Bay Plantation at Hanamā'ulu, Līhu'e District, Kaua'i

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March 2002

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MARKET AND ECONOMIC IMPACT STUDIES, OCEAN BAY PLANTATION AT HANAMA'ULU, LIHŪ'E DISTRICT, KAUA'I

September 2001,
Revised March 2002

Prepared for:

EWM Kaua'i, LLC
Group 70 International, Inc.

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Alan Barker Associates
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EXECUTIVE SUMMARY

EWM Kaua'i LLC is proposing development of its land at Hanama'ulu, Kaua'i. The property, with an area of about 460 acres, would include a golf course, clubhouse, both single family and multifamily homes, and a small commercial area. The golf course is planned to open in 2005. Lot and home sales would proceed for some years after that date.

SMS conducted research to establish the market for the various elements of the proposed development and to identify the economic and demographic impacts of the project. The project is planned to maximize views from the golf course, so the overall strategy of the project is to appeal to golfers. That strategy fits well with Kaua'i's residents and visitors, who are both strongly golf-oriented. SMS estimates that the golf course can quickly attract enough golfers that play will need to be restricted to maintain the quality of the golfers' experience.

A total of 173 single family homes and 250 multifamily homes is proposed. Demand for single family homes and house lots near the golf course will be strong. Based on historical sales data, SMS expects that sales of both single family and multifamily products will proceed at a regular pace from 2005 through about 2017. The Kaua'i market is small; the estimated sales time table reflects that size and the likely existence of competing upper-end products in resort communities at Po'ipu and Princeville. Single family homes (including lot and house) are likely to be priced in the range from $695,000 to $1,450,000, while multifamily homes are likely to sell in the range from $275,000 to $475,000.

The Gateway Village commercial area proposed for the project would lie near the intersection of Kuhio Highway with the Airport Bypass. It would attract visitors above all, due to its location and to a visitor information center incorporated into the project. Based on traffic counts and visitor behavior, the commercial area could easily attract about 1,100 parties per day, supporting approximately 26,750 square feet of occupied Gross Leasable Area. That increase is a small share of the growth in retail space which will likely be needed to meet increased resident and visitor demand on Kaua'i in the next few years.

The project will support construction and operations jobs. Some 930 person-years of direct construction employment are anticipated. Over the entire construction period, the total employment on or supported by construction of the project is estimated as averaging 100 jobs on Kaua'i and 15 jobs off-island.

Approximately 220 operations jobs will be created at the project, with a total payroll of about $4.8 million. Including jobs supported by project spending and workers' spending, the total employment supported by the project on Kaua'i would come to about 250 jobs.

The Hanama'ulu project is planned to provide sites for 423 homes. The population in the residential area will include both full-time residents and vacationers. At buildout, the number of residents is estimated as about 330 persons on-site, while the average number of vacationers staying on-site would be about 100 persons.

Because it supports a local workforce, the project will tend to increase demand for workforce housing (while also supplying housing for golfers). The net increase in supply associated with the project, after new workforce housing demand is subtracted out, is estimated as 360 to 390 homes on Kauai. Less than ten homes might be needed off-island as workers come to establish their own households.

The project would support some full-time residents, some of whom would have children in DOE schools. The school population impact is estimated as, at buildout, a maximum of 2.6% of current enrollment in nearby schools. Those schools are currently under capacity with regard to classroom facilities, and can handle much more population growth than the project will bring.

Fiscal impacts of the project are positive. For the State, revenues associated with construction would total some $12.0 million (2001 dollars). For the County of Kaua'i, increased real property tax revenues would amount nearly to $500,000 per year in 2005, and then climb to about $1.6 million. Because project residents and visitors could very well be attracted to other islands of Hawai'i if the project were not built, SMS treated their presence on Kaua'i as a project impact, and used the average cost method to estimate County costs associated with services to this population. When the estimated cost of those services is accounted for, the net increase in revenues for the County reaches a high of nearly $1 million around 2015, then stabilizes at about $870,000 annually. Through 2020, the cumulative net gain for the County is estimated as $15.5 million.

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1. INTRODUCTION

1.1 PROJECT DESCRIPTION

EWM Kaua'i, LLC has acquired approximately 460 acres of land at Hanama'ulu, Kaua'i. The site is near Lihū'e, and easily reached by both the Airport cutoff road and the main highway from Lihū'e to Wailua (as shown in Exhibit 1). The property has extensive ocean frontage along Hanama'ulu Bay and the ocean. The Radisson Kaua'i and Kaua'i Beach Villas resort area is located to the north of the property, while Hamama'ulu Bay lies to the south.

Previously used for sugar cultivation by Lihū'e Plantation, the site is level. The shore along most of the coast line is rocky, with low bluffs some ten to twenty feet above ocean level rising immediately behind the shore line. On the northeast side of the property are wetlands and patches of beachfront.

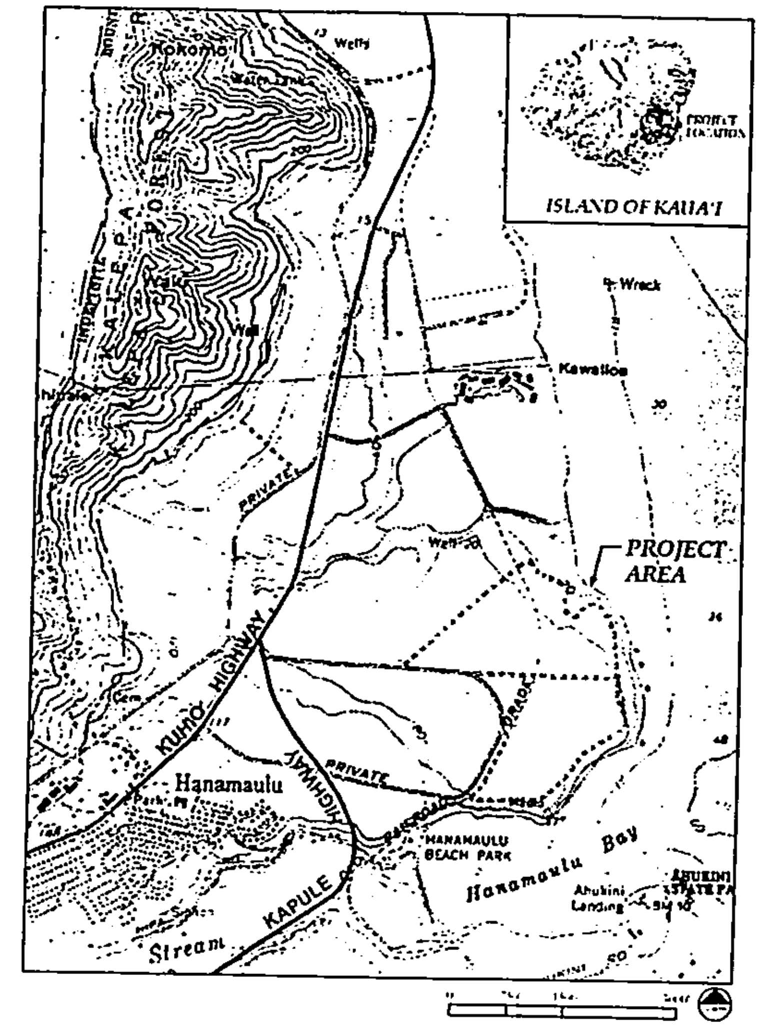
The landowner proposes to develop The Ocean Bay Plantation at Hanama'ulu, including:

- An 18-hole golf course;
- Approximately 173 large lots for single family homes, some 73 along the golf course and another 100 in an area on the northern side of the property;
- Approximately 250 multifamily units within the golf course area;
- A "Gateway Village" commercial area near the entrance to the property; and
- Roads, infrastructure and community facilities for the development.

Exhibit 2 shows a concept plan for developing the property.

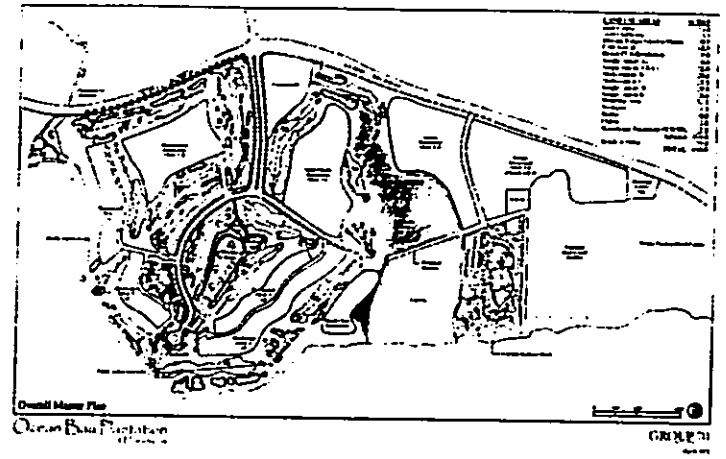
Upon acquisition of land use approvals, construction of the golf course is projected to begin in 2003, so the course could open in 2005. Lot sales and housing construction are expected to occur over the next fifteen years or so.

Exhibit 1: LOCATION MAP



SOURCE. Group 70 International.

Exhibit 2: CONCEPT PLAN



1.2 SCOPE OF THIS REPORT

This report assesses the market for the various components of the development and calculates its economic and demographic impacts. It is divided into four sections:

- This section contains introductory material;
- The next section provides information on the current and likely future economic and demographic situation;
- The third section includes market analyses for golf, housing, and commercial development, identifying demand for golf rounds, single family lots or homes, multifamily homes, and commercial space as proposed for the property;
- The fourth section contains calculations of jobs supported by the project, workforce incomes, population and housing impacts, and fiscal impacts of the project.

2. EXISTING AND ANTICIPATED CONDITIONS

This section describes economic and social conditions that provide the context in which the proposed Ocean Bay Plantation at Hanama'ulu is assessed. It deals with recent, current, and likely future conditions on Kaua'i and in the region surrounding the project.

2.1 COUNTY OF KAUA'I

The northernmost inhabited island of Hawai'i, Kaua'i stands out for its weathered terrain and lush vegetation. The inhabited islands of the County are Kaua'i and Ni'ihau. The latter, with some 230** inhabitants, is an isolated ranching community. The island of Kaua'i has nearly 60,000 residents and supports, on average, 16,000 visitors each day. Kaua'i is the least populous of Hawai'i's four counties.

The County's economy has been based on sugar cultivation for the entire twentieth century. However, the largest sugar producer, Lihū'e Plantation, finally processed its last crop in 2000, leaving only Gay and Robinson, based in West Kaua'i, to try to continue. While there is ample acreage for Gay and Robinson to continue or expand operations, as the sole producer it must now bear all the costs of getting sugar off the island.

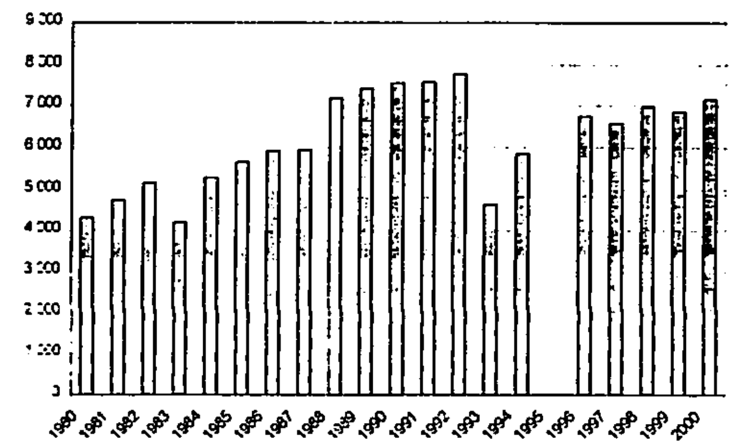
Tourism has brought additional revenue to the island. The visitor industry began with small resorts such as the Coco Palms at Wailua, which offered guests an exotic decor with signature clamshell sinks and torch-lighting ceremonies, then grew as Princeville and Poipu developed as resort areas. Visitor accommodations have also been developed in Waimea, to the south, along the east coast from Hanama'ulu through Kapa'a, and along the North Shore. The magnitude of the industry is obvious when de facto population (the average number of residents and visitors actually on the island) and resident population are compared. In 1970, the de facto population was only 7% greater than the resident population. That figure grew to 18% by 1980, then 34% by 1990. By 1990, one person in four on Kaua'i was a visitor.

Kaua'i was badly hit by Hurricane 'Iwa in 1983, but the impact of Hurricane 'Iniki in 1992 was worse. Properties on the south and north shores of the island were destroyed, and much effort was needed simply to clear wreckage and assemble the people and materiel needed to rebuild.

Hurricane 'Iniki set back tourism, reducing the visitor plant by 40%. The room inventory as of 2000 had only reached 92% of the 1992 peak. The visitor count has similarly returned to about the same level as before 'Iniki (as shown in Exhibit 4). Visitor spending had been about 12% of the State total, but then plummeted.

The most damaged hotels closed their doors. Most, but not all, have re-opened. Hotel room occupancy, a key indicator of prosperity for tourism, consequently returned to levels near that of the State as a whole by 1994. (See Exhibit 6.)

Exhibit 3: KAUA'I VISITOR PLANT INVENTORY, 1980-2000



NOTE: No Visitor Plant Inventory survey was published for 1995.

Exhibit 4: RESIDENT AND DE FACTO POPULATION, KAUA'I, 1980-1999

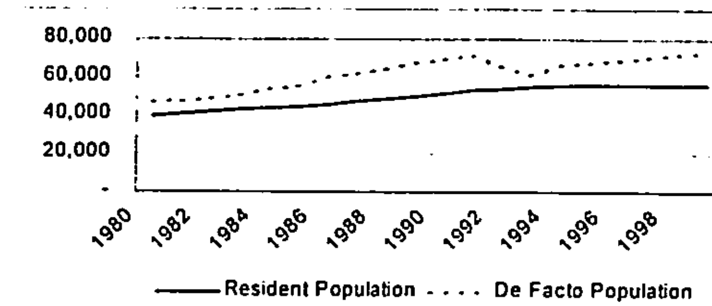


Exhibit 5: ANNUAL VISITOR SPENDING, KAUA'I AND STATE

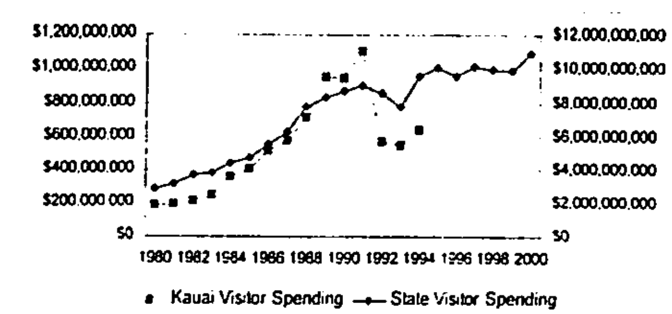
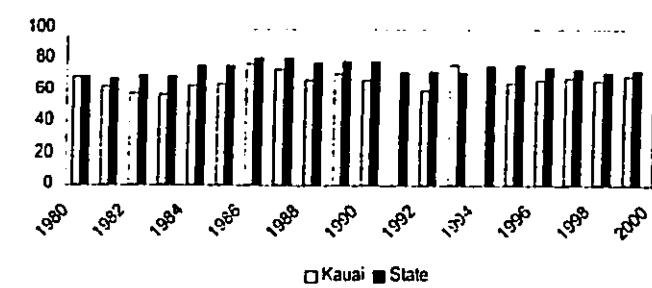
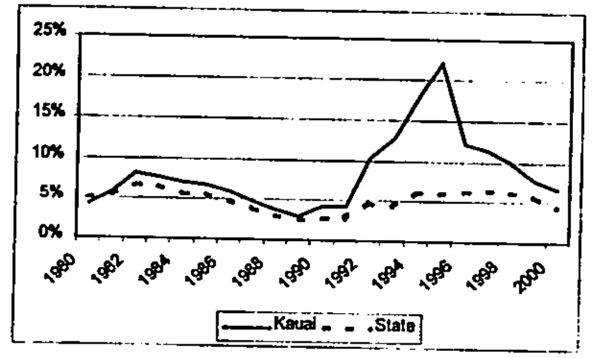


Exhibit 6: HOTEL OCCUPANCY, KAUA'I AND STATE, 1980-2000



In the 1990s, much of Kaua'i's housing and visitor plant was rebuilt or repaired. . The work of rebuilding provided many jobs soon after the hurricane, but unemployment peaked in 1996, when Federal Emergency Management funding ended, and remained high through the end of the decade (as shown in Exhibit 7):

Exhibit 7: UNEMPLOYMENT RATE, KAUA'I AND STATE, 1980-2000



Census results show Kaua'i's people in 2000 to be much like the population of the State as a whole. (See Exhibit 8 for the data currently available for the 2000 Census.) The median age, 38.4 years, is slightly above the state level (and well above that of previous decades). The ethnic mix is rich, although Whites constitute a larger bloc on Kaua'i than statewide, due to high concentration on Kaua'i's North Shore.

Compared to the rest of Hawai'i, the share of Kaua'i residents who own their homes is high. Housing vacancy rates in 2000 were lower than for the State as a whole (as shown in Exhibit 8. However, the Census counts both short- and long-term rentals, so the rental vacancy rate is far higher than the actual rate for residents of the island seeking long-term, affordable housing. Long-term rentals have been reported to be unobtainable for moderate- and low-income residents (Sommer, 2000).

Exhibit 8: YEAR 2000 CENSUS DATA, KAUA'I AND STATE OF HAWAI'I

	State of Hawaii	Kauai County	Census Tract 405 Lihue	Census Tract 404 Hanamaulu Puhi	Tracts 402.01, 402.02, 403 East Side	Census Tract 401 North Side
Population						
Total	1,211 537	58.463	5.162	6 860	18.525	6.346
Under 18	295 787	15 443	1,146	1 844	5.281	1,576
65 and older	160 601	8 069	1.233	827	1,981	661
Median Age	36 2	38 4	44.7	34 7	36 5	40 2
Ethnicity						
Persons listing one race	79 5%	76 2%	79 3%	76 3%	72 5%	86 5%
White alone	24 3%	29 5%	23 2%	12 0%	29 9%	64 1%
Black or African American alone	1 8%	0 3%	0 2%	0 3%	0 4%	0 4%
Chinese	4 6%	0 8%	1 5%	0 8%	0 9%	0 9%
Filipino	14 1%	19 1%	14 2%	43 7%	12 3%	7 8%
Japanese	16 7%	12 8%	28 0%	10 2%	11 0%	3 8%
Native Hawaiian	5 8%	8 4%	6 0%	4 4%	12 3%	6 0%
Some other race alone	10 5%	5 2%	6 2%	4 9%	5 6%	3 4%
Population of two or more races	21 4%	23 8%	20 7%	23 7%	27 5%	13 5%
Population in housing units						
Total population in group quarters	35 782	632	127	142	195	48
Total population in households	1,175 755	57.831	5.035	6 718	18 330	6.300
Households						
Total	403 240	20.183	2.008	1 970	6 284	2.436
Family households	287 068	14.572	1.281	1 558	4.555	1 623
With own children under 18 years	129 322	6.865	485	761	2.352	790
Female householder, no husband present	49 923	2.582	239	299	853	278
With own children under 18 years	23 519	1.424	125	154	511	175
Nonfamily households	28 019	1 290	101	115	460	209
Householder living alone	59 588	2.765	279	218	910	475
Total households with persons over 65	110 475	5 594	836	564	1 395	483
Average household size	2 92	2 87	2 51	3 41	2 97	2 59
Average family size	3 42	3 34	3 14	3 73	3 43	3 09
Housing Occupancy						
Occupied	403 240	20.183	2.008	1 970	6 284	2.436
Vacant	57 302	5 148	220	303	1,135	1,360
For seasonal or occasional use	25 584	3 850	71	209	769	1 076
Tenure						
Owner occupied	56 5%	61 4%	57 2%	58 7%	59 9%	63 5%
Renter occupied	43 5%	38 6%	42 8%	31 3%	40 1%	36 5%
Homeowner vacancy rate	1 5%	1 2%	0 9%	0 7%	1 7%	1 9%
Renter vacancy rate	9 8%	6 3%	8 9%	7 3%	5 4%	12 6%

SOURCE US Census 2000 SF1 (available from www.census.gov)

2.2 LIHU'E DISTRICT

Lihu'e has been the administrative and commercial center of Kaua'i for a century or more. Lihu'e Mill was the largest sugar mill on the island. Nawiliwili Harbor and Lihu'e Airport remain the major points of entry and exit for the island.

With the closing of Lihū'e Plantation, Amfac JMB sold off nearly 20,000 acres around Lihū'e. Most were acquired by Steve Case, the Chairman of America Online. He had already acquired Grove Farm Plantation, the other major landholder in the district around Lihū'e. Grove Farm has diversified from being a plantation landowner by building a major shopping center, Kukui Grove Center, a golf course, and adjacent housing. The firm was constrained by limited capital during the 1990s; Case's acquisition of Grove Farm was received as an opportunity to develop the firm's property more effectively (TenBruggencate, 2000; Conrow, 2001).

As Exhibit 8 shows, the urban and surrounding suburban parts of Lihū'e District are becoming quite different. Lihū'e is an aging community, with a median age of 44.7. The surrounding communities are younger, overall, than the average. Ethnically, both Japanese-Americans and Euro-Americans form major groups in Lihū'e, while nearly half of the people in the tract including Puhi (west of Lihū'e) and Hanama'ulu (north of Lihū'e) are Filipino.[1] Households in Lihū'e itself tend to be small, while households in the suburbs are larger than the island average. Homeownership is especially high in the suburban communities.

The share of housing held vacant for seasonal or recreational use is an indicator of the presence of visitor units and vacation homes. These amount to 3.2% of housing units and 9.2% of units in Hanama'ulu and Puhi. On the North Shore, the figure climbs to 38.5%, compared to a county average of 15.2%.

In the Hanama'ulu CDP alone, the population of 3,272 (as of 2000) had a median age of 35.3 – younger than the State median – and large households (averaging 3.62 persons per unit).

In recent years, the Lihū'e region has seen new construction of homes and roads. Despite bypass roads, traffic congestion remains a serious problem for residents.

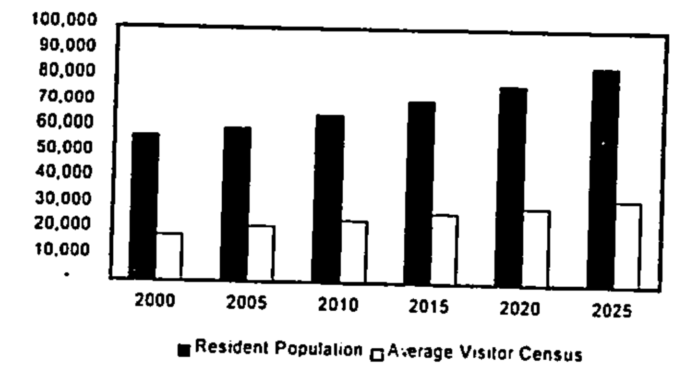
The major new commercial site is a Wal-Mart store in Lihū'e that appears very successful, to the detriment of other large retailers.

[1] Census data are rough indicators of the size and level of organization of groups in the community. As of 2000, it is possible to claim more than one ethnic identity – a practice in line with Hawai'i's complex ethnic history. However, it is hard to see, from data now available, how large are mixed populations that may well consistently identify with a single group, notably part-Hawaiians.

2.3 INDICATIONS OF THE PACE OF GROWTH ON KAUA'I

While the story of Kaua'i in the 1990s was the long, slow process of rebuilding after Hurricane 'Iniki, the next few decades are expected to involve steady growth at modest rates. Exhibit 9 shows recent State projections for Kaua'i County, which follow from the trend towards tourism being increasingly located on the Neighbor Islands. Kaua'i's share of Hawai'i tourism is projected as growing slightly, from 10.8% to 11.6% between 1998 and 2025.

Exhibit 9: RECENT STATE FORECASTS FOR KAUA'I: GROWTH IN VISITOR AND RESIDENT POPULATION



At the beginning of the decade, developers identified areas for growth in response to the booming tourism market. Since Hurricane 'Iniki, development of new areas for development has been very slow. The major projects that could be developed (if in rather different form than was proposed around 1990) include:

- *Princeville.* The Princeville Corporation is offering lots at Queen Emma Bluffs. In the past, development of much of Phase II (alongside the golf courses, stretching towards Kilauea) was planned, but then put on hold. While eventual residential development at Princeville is quite likely, no proposals for new development are currently being publicized.

- *Northeast Kaua'i, from Kilauea to Kapa'a.* With large lots sold to Hollywood celebrities, Kilauea gained some of Kaua'i's best known residents in the 1990s. Currently, large lots are being sold at Moloa'a as part of an agricultural development, with purchasers taking on responsibility for some or all of their infrastructure. Near Kapa'a, the Kulana project covers 400 acres, to be subdivided into lots ranging from two to ten acres in size. The developers still need to furnish roadways and a water system, so the prospects for this project are uncertain. Kealia Kai, a 29-lot subdivision, offers large lots near the ocean.

- *Puhi.* Grove Farm Plantation has golf-course adjacent lots for sale, and plans to extend the golf course to 18 holes. Earlier, the firm was known to be exploring resort development at Mahaulepu. No long-term plans have been announced since Steve Case acquired the firm and nearby AMFAC lands.
- *Poipu Redevelopment.* The Waiohai at Poipu Beach is only now being rebuilt, ten years after Hurricane 'Iniki. The new version will be a 231-unit Marriott vacation ownership property.
- *Kukui'ula.* Alexander and Baldwin has initial permits for some 3,100 units, and plans for some 2,300 units (instead of the larger number) on 564 residential acres within its Kukui'ula project at Lawai. The project includes both "golf course estates" and "small country villages." The Koloa Estates subdivision, with 32 units, is being developed through a partnership between the builder and the landowner.
- *Kalaheo.* The Kakela Makai project is planned in two phases, with a total of nearly 200 lots for fee simple housing. These are about 10,000 square feet each, and are priced from $95,000 to $150,000 (Beach, 2000).
- *Kapalawai Project, near Waimea.* The Robinson family, owners of the Gay and Robinson sugar plantations, is seeking permits for low-density visitor development on its family lands near Waimea. A total of 250 units is proposed, without any housing for sale to visitors.
- *Waimea.* In Waimea itself, Kikaiola Land Company is seeking to designate parts of the town as a Visitor Destination Area. Plans emphasize the history of the town, but also include expansion of the Waimea Plantation Cottages by as many as 220 units. Possible future developments include a shopping center and a golf course.

Overall, these projects emphasize visitor-oriented development – and there is a great deal of potential inventory in this category in Princeville and at Kukui'ula. (SMS thanks Dale Cua and Keith Nitta, Kaua'i Planning Department, and Scott Ezer, Helber Hastert & Fee, Planners, for personal communications drawn on for this summary.)

3. MARKET STUDIES

Market studies are conducted to identify potential demand for a project, taking into account both demand and competing supply. Market studies typically consider historical trends and emerging conditions to estimate future demand as a projection from current demand. At of late September, 2001, Hawai'i's visitor industry is facing a near-term crisis as air travel has suddenly become very difficult. Three points deserve emphasis here. First, the forecasts reported in the last section are long-term projections, crafted to show overall trends, not short-term ups and downs. Second, the project under consideration here would open in 2005 and develop over the next ten to fifteen years – well after the immediate impacts of the current crisis have been felt. Third, while we cannot predict the long-term implications of recent events, we have no basis for believing that they will reverse or even greatly change the trends on which the present market analysis is based.

3.1 KEY COMPONENTS OF THE HANAMA'ULU PLANTATION PROJECT

The project brings together several elements into a single community concept. The market studies that follow discuss demand on Kaua'i for those elements – for golf, for single family homes, for multifamily homes, and for retail and commercial space. It is important to stress at the outset that the project concept is an integrated development.

As SMS understands the matter, the golf course sets the tone for the entire project. Its quality will be important in attracting interest. As the keystone of the project, the course will not be used so heavily that golfers would feel pressured to move along. SMS expects that buyers of lots or homes in the project will have some preferential access to tee times. Hence, while the golf course will be open to visitors and Kaua'i kamaaina, project residents will see themselves as members with a special involvement in the course and will see the clubhouse as their own.

3.2 MARKET FOR GOLF

The proposed golf course takes advantage of the oceanfront acreage in the project. With five holes along the bay and ocean, it stands out among Hawai'i courses for its extensive views.

Existing Conditions

Golf has strong appeal to both residents and visitors to Kaua'i. The Island's nine courses are all open to any player. They include municipal course at Wailua, just north of the project site, two smaller courses (Puakea and Kukuiolono, both on the south side), and three resort golf areas, at Princeville, with 45 holes, Kaua'i Lagoons (about two miles south of the project) with 36 homes, and Poipu with 36 holes. Wailua sees heavy usage – 93,000 rounds were reported for 1999 (Pacific Business News, 2001). Resort courses tend to have lower usage, offering players more time in exchange for much higher fees.

Additional courses have been proposed at Kukui'ula and Waimea. No timetable has been announced for their development. Also, conversion of the Puakea course to 18 holes is expected to happen soon.

Greens fees on Kaua'i range greatly. Residents can find inexpensive golf at Kukuiolono (for $7/round) and Wailua. Resorts offer residents access for rates well below their visitor rates (e.g., $40/round at Kiahuna). Princeville and the other resorts offer Neighbor Island golf packages, in which vacationers pay little more than the cost of their rooms yet get one or two rounds of golf per person. However, when demand is strong, and listed fees are actually collected, those fees are high ($175/round on the Prince course; $170 at the Poipu Resort course).

To estimate current golf usage by residents, interisland travelers, and overseas travelers, SMS drew on the SMS Hawai'i Market Study, an extensive survey conducted with about 2,500 Hawai'i households per year, and annual studies conducted for the Kaua'i Visitors Bureau. The Hawai'i Market Study data for 1999 through 2001 shows:

- Kaua'i golfers make up about 14% of the adult population, but play far more rounds annually than do resident golfers statewide. SMS estimates that about 6,000 golfers on Kaua'i play on average 50 rounds per year, for 300,000 rounds annually. ("Rounds" are "days played last year," including 9-hole, 10-hole, 18-hole and even 27-hole days.)

- About 5% of interisland travelers visiting Kaua'i play golf every time they visit. (About as many may play occasionally. If the regular interisland players visit four times a year – less than the average – then their share of Kaua'i golf rounds comes to about 25,000 rounds per year.

Surveys for Kaua'i Visitors Bureau show that about 14% of adult overseas visitor respondents played golf on their vacation on Kaua'i, and more than half played more

than once. If we assume that no minors played, and that the average number of rounds on Kaua'i was 1.5 per visitor per year, the total number of rounds by overseas visitors comes to about 150,000 rounds, as shown in Exhibit 10.

More than 80% of respondents heard of golf on Kaua'i before they came. Kaua'i's appeal as a golf destination is already well established.

Exhibit 10: Current and Anticipated Demand for Golf on Kaua'I

	1999-2001	2005	2010	2015	2020
Residents	300,000	306,954	325,136	355,165	388,302
Interisland Visitors	25,000	25,000	25,000	25,000	25,000
Overseas Visitors	150,000	171,464	201,096	227,519	252,433
Total Rounds (1)	475,000	503,418	552,232	607,685	665,735

NOTES: Projected demand based on DBEDT forecasts of growth in Kauai residents and overseas visitors. The interisland market is held constant, since it may not grow if special rates are limited due to increasing visitor demand.
(1) Surveys ask residents and visitors about "days you played golf," so "rounds" could be 9- or 18-hole rounds. We suspect the high resident figure is partly due to a higher share of 9-hole rounds than for visitors.

Future demand can be anticipated based on projections of population growth. If demand grows in proportion to increases in the resident and overseas visitor populations, it will grow by nearly 200,000 rounds, or 40%, by 2020. (This projection is conservative. Repeat visitors play more than first-time visitors, and the share of repeat visitors is likely to increase. Also, the projection holds interisland golf demand constant, when it could easily increase in response to population growth.)

Demand for the Hanama'ulu Course

Many golfers enjoy trying new courses, so there will be interest in playing the Hanama'ulu course as soon as it opens. As indicated in Exhibit 10, there should also be ample demand for golf based on increases in resident and visitor populations. Given strong demand, SMS has estimated growth of usage of the course on the expectation that the developer will (a) seek to control the number of rounds in order to offer excellent playing conditions; (b) offer kamaaina play and preference for project residents; and (c) set aside complementary rounds for potential buyers, especially in the early years.

Exhibit 11 shows potential rounds and course expenditures based on the model of controlled development to a resort level of play.

Demand for golf is likely to continue to grow on Kaua'i. Exhibit 12 shows net additional demand after play at the project course is added to the current number of rounds on Kaua'i. It suggests that demand could support a similar course opening around 2005, and at least one more course by 2010.

Exhibit 11: ESTIMATED GOLF ROUNDS AND SPENDING AT THE OCEAN BAY PLANTATION COURSE

	2005	2010	2015	2020
Golf Rounds				
Kauai Residents (1)	6,500	23,421	28,800	28,800
Visitors	2,000	7,857	10,000	10,000
Complementary	1,500	2,293	1,200	1,200
Total	10,000	33,571	40,000	40,000
Income				
Greens Fees (2)	$575,000	$2,780,286	$3,478,000	$3,478,000
Pro Shop (3)	$200,000	$671,429	$800,000	$800,000
Total	$775,000	$3,451,714	$4,278,000	$4,278,000

NOTES: Estimates developed by SMS Research, based on other courses in Hawaii and expectation that the total number of rounds will be limitedto insure a high-quality golf experience. The projections used here are done to calculate possible cash flows, and are not based on discussions with the developer. Estimated number of rounds is shown as growing gradually from 25,000 in 2006 to 40,000 in 2013. Share of rounds changes from 65% for Kauai residents, 20% for visitors, and 15% complementary rounds, to 72%, 25% and 3%.

(1) Residents include project residents and lot-owners.

(2) Fees are estimated as $50 for residents and $125 for visitors until 2010, when these are increasedto $60 and $175.

(3) Pro shop spending is estimated as $20 per round, on average.

Exhibit 12: NET DEMAND FOR GOLF OVER AND ABOVE THE PLANTATION COURSE

	1999-2001	2005	2010	2015	2020
Total Rounds	475,000	503,418	552,232	607,685	665,735
Growth over Current Demand		28,418	77,232	132,685	190,735
Proposed Project Rounds		10,000	33,571	40,000	40,000
Remaining Demand		18,418	43,661	92,685	150,735

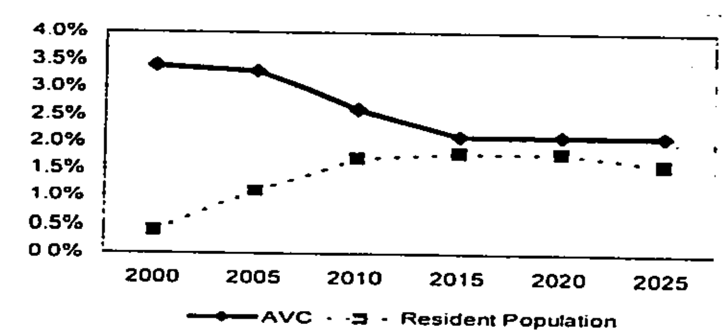
NOTES: Based on Exhibits 10 and 11

3.3 MARKET FOR HOMES

Demand

Since 1992, much of Kaua'i's population has found new or repaired housing, and the housing crisis experienced at the start of the 1990s has largely been alleviated. Serious problems remain for renters. Apart from that market, demand for new housing is largely associated with (a) population growth and (b) the continuing trend towards smaller households. The growth projections shown in Exhibit 9 imply expectations that the rates of growth for tourism and resident population are converging, as shown below:

Exhibit 13: FORECAST ANNUAL GROWTH RATES, AVERAGE VISITOR CENSUS AND RESIDENT POPULATION, KAUA'I



NOTE: Annual growth rates are for periods ending in the years shown in the exhibit.

The projection suggests that, while tourism growth will be strong, the resident population will also increase steadily. As a result, demand for housing will be felt in both the vacation and resident markets. For the resident market, the result is demand for some 10,000 additional homes by 2020. (See Exhibit 14 for calculation.)

For the vacation housing market, the projection is more difficult. No inventory or count of vacation housing exists. Exhibit 15 estimates the vacation home market on the basis of a Census category, Housing Vacant for Seasonal or Recreational Use. Some of the units in that category may be short-term vacation rentals, more appropriately treated as visitor units, while many are both vacation homes and, for some months of the year, in the visitor rental pool.

It should be stressed that these separate markets overlap, especially for the groups who form the most likely purchasers of homes in the project. Older professionals from off-island may seek vacation homes with golf privileges on Kaua'i, then retire to their Kaua'i home. Some US Mainland and Oahu residents try to telecommute from their Neighbor Island homes, with increasing success in recent years, changing from vacationers to residents long before retirement.

Exhibit 14: PROJECTED GROWTH IN RESIDENT HOUSING DEMAND

	Resident Population	Population Growth	Average HH Size	Households	Cumulative Demand
2000	57,200		2.87	19,930	
2005	60,500	3,300	2.80	21,621	1,690
2010	65,800	8,600	2.73	24,134	4,203
2015	72,000	14,800	2.66	27,085	7,154
2020	78,700	21,500	2.59	30,384	10,454
2025	85,400	28,200	2.53	33,816	13,886

NOTES. Projections of population growth are from DBEDT. Year 2000 household size is from the Census. Projected change is a reduction of average household size by 5% every decade – a slowing of the trend seen from 1980 to now.

Exhibit 15: PROJECTED GROWTH IN VACATION HOME DEMAND

	AVC	Visitor Plant	Units for Seasonal Use (1)	Vacation or Second Homes (2)		Cumulative Demand	
				Low	*High*	*Low*	*High*
2000	18,500	7,159	3,850	1,925	2,888		
2005	21,800	8,436	4,537	2,268	3,403	343	515
2010	24,800	9,597	5,161	2,581	3,871	656	983
2015	27,500	10,642	5,723	2,861	4,292	936	1,405
2020	30,500	11,803	6,347	3,174	4,760	1,249	1,873
2025	33,800	13,080	7,034	3,517	5,276	1,592	2,388

NOTES: Estimates are based on straight-line approximations from DBEDT projections and year 2000 data.
(1) Year 2000 data from Census combines vacation homes and rentals
(2) Vacation homes estimated as half to 75% of all units recognized as "for seasonal use" – using that figure as an indicator of a pool that is partly counted in that category, partly counted as occupied by residents

Supply

In section 2.3, above, proposals for new development were inventoried. It is clear that:

- Much land is available, including areas with land use permits, for new development, especially visitor-oriented development;
- New development has been extremely limited and tentative – a matter of a few lots at a time, rather than subdivisions; and
- While key landowners – Grove Farm-Lihū'e Land and Alexander & Baldwin – have large resources, they have not been ready to make capital commitments to sustained development in the current economic climate.

SMS accordingly views the various competing developers as unlikely to respond quickly to demand on Kaua'i. The project should then be able to command a significant share of the market for high-end homes.

SMS approached estimating demand for the project homes in two ways, using the global forecasts discussed earlier and examining near-term trends (since January 1998) in Kaua'i real estate sales. Based on calls to developers and realtors, SMS has attempted to estimate likely supply from competing landowners. The net demand which could be tapped by the project is shown in Exhibit 16. It shows:

- Far more demand than there are units in the project;
- Far greater demand in the resident market than the visitor market, while developers with land use permits (above all at Kukui'ula and Princeville) are more likely to target the visitor market; and
- The likelihood that Kaua'i will see a serious deficiency in housing for residents unless steps are taken to develop new product for various resident market segments.

Exhibit 16: NET RESIDENTIAL DEMAND, TO 2015

	2005	2010	2015	2020
Resident New Demand	1,690	2,513	2,951	3,299
Vacationer New Demand				
Low	343	312	281	312
High	515	468	421	468
Competition				
Resident Market	400	800	1,100	1,100
Visitor Market	450	650	650	650
Net Demand				
Low	1,184	1,375	1,482	1,862
High	1,355	1,531	1,623	2,018

NOTE: Demand estimates are for new units over five-year periods. Demand figures from Exhibits 14 and 15, estimates of timing of competition by SMS

Exhibit 16 shows that there is likely to be strong demand for new housing over the next fifteen years. For the current five years (to 2005), new demand from all market segments is likely to be about 400 homes per year. Afterwards, demand would climb to about 700 or 800 homes per year.

The problem of fitting supply to actual demand is likely to confront developers of resort areas such as Princeville. If a project can attract both visitors and residents, it will be able to respond to the combined demand, and weather competition from either side.

Demand for the Project

To learn about demand in the particular markets that the project is likely to serve, SMS examined TMK data on properties sold in the period beginning in January 1998. Exhibit 17 summarizes data on sales of single family homes for $500,000 or more. Exhibit 18 shows sales data for multifamily housing over the same period for $300,000 or more. Both show that the upper market segments have seen activity during the last few years. Prices have trended upward (as shown in Exhibits 19 and 20) in both markets.

Comparing the data from quarter to quarter, it appears that (a) price increases in the single family market have been more pronounced than in the multifamily market, and (b) sales are more consistent over time in the single family market.

In relation to potential competition, the project will have advantages due to its golf attraction, convenient location, and benefits of being part of a planned community. It can reasonably expect to capture about a third of new sales in the upper price ranges when it is most competitive. It can increase the number of sales by also supplying multifamily homes at a level somewhat below that shown in Exhibit 18. More sales occurred in the $200,000 to $300,000 range, in the period studied, than at all higher price levels. By offering multifamily units with the advantages of membership in the Ocean Bay Plantation community at about $275,000 (constant 2001 dollars), the developer can expect to increase multifamily sales by about 50%.

Calls to Realtors indicated that interest remains strong in oceanfront, ocean view and golf-related properties. Both Realtors' estimates and sales data were used to estimate the effect of the amenities in the project on the value of various residential products within the development.

Exhibit 17: SINGLE FAMILY HOUSING SALES, UPPER MARKET, KAUA'I, 1998-2001

	Quarterly Count		Mean Price	Median Price	Average $/sf	Median $/sf
Q1 98	9		$701,667	$610,000	$ 269.62	$ 232.24
Q2 98	13		$872,808	$635,000	$ 356.97	$ 276.80
Q3 98	5		$734,400	$684,000	$ 291.88	$ 232.76
Q4 98	11		$1,061,045	$675,000	$ 398.75	$ 258.32
Q1 99	8		$698,500	$629,000	$ 258.78	$ 237.28
Q2 99	13		$808,588	$630,000	$ 412.02	$ 243.90
Q3 99	11		$669,636	$675,000	$ 274.70	$ 260.34
Q4 99	16		$956,170	$806,500	$ 394.12	$ 315.11
Q1 00	20		$786,975	$615,000	$ 259.40	$ 247.93
Q2 00	19		$1,172,500	$925,000	$ 511.05	$ 409.96
Q3 00	17		$1,231,618	$700,000	$ 461.89	$ 347.10
Q4 00	18		$1,344,904	$910,000	$ 392.86	$ 355.65
Q1 01	15		$1,539,933	$850,000	$ 533.90	$ 465.47
Q2 01	20		$1,140,200	$747,500	$ 484.40	$ 333.84
Total	195					
Annual:	55.7	AVG:	$979,925	$ 720,857	$ 378.60	$ 301.19

Exhibit 18: MULTIFAMILY HOME SALES, UPPER MARKET, KAUA'I, 1998-2001

	Quarterly Count	Mean $	Median $	Mean $/sf	Median $/sf
Q1 98	7	$591,857	$600,000	$392 60	$326 57
Q2 98	11	$393,409	$355,000	$351 69	$292 81
Q3 98	3	$490,000	$530,000	$348 70	$328 41
Q4 98	1	$850,000	$850,000	$334 91	$334 91
Q1 99	13	$423 269	$395,000	$359 09	$310 56
Q2 99	9	$408,611	$422,500	$308 35	$250 18
Q3 99	11	$438,864	$412,500	$302 29	$285 47
Q4 99	10	$381,750	$342,500	$280 72	$261 87
Q1 00	20	$431,325	$350,000	$361.95	$303 02
Q2 00	35	$409,906	$360,000	$347.88	$312 20
Q3 00	20	$391,350	$391,500	$342.33	$317 44
Q4 00	21	$424,071	$375,000	$344 70	$313 64
Q1 01	22	$395,459	$378,550	$380.16	$336 47
Q2 01	14	$523,821	$400,000	$433 13	$380 54
Total	197				
Annual	56	$468 121	$440,182	$349 18	$311 01

Exhibit 19: PRICE TREND, UPPER SINGLE FAMILY MARKET, KAUA'I, 1998-2001

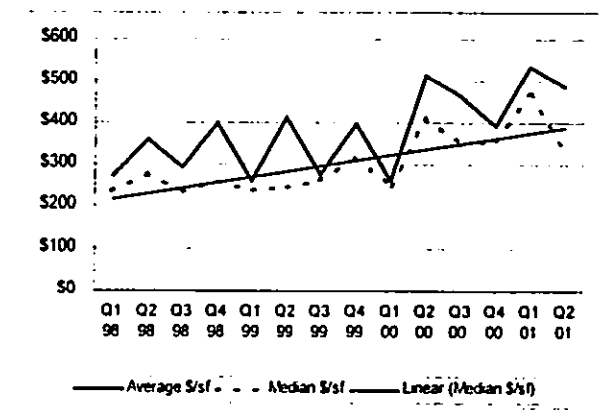


Exhibit 20: PRICE TREND, UPPER MULTIFAMILY MARKET, KAUA'I, 1998-2001

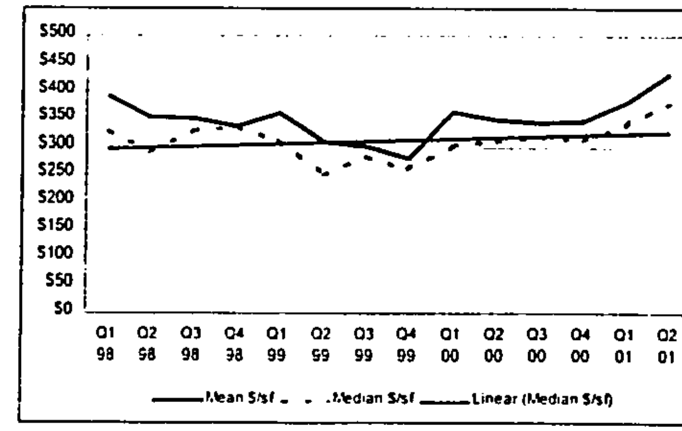


Exhibit 21: HOME SALES EXPECTED IN THE PROJECT

	Price Range	2004-2005	2006-2010	2011-2015	2016-2020	2021-Buildout	Total
Single Family	$695,000 to $1,450,000	22	47	49	45	10	173
Multifamily	$275,000 to $475,000	29	145	76	0	0	250

NOTE: Sales program developed by SMS in light of historical sales data and available information about competition.

Exhibit 21 shows the expected sales for the project. It shows sales occurring from the initial construction period until after 2015, with the single family residences in the expansion areas taking about ten years to sell out.

3.4 MARKET FOR THE GATEWAY VILLAGE COMMERCIAL CENTER

With its location on major roadways north of Lihu'e, the commercial area will serve a mix of residents and visitors to Kaua'i. Preliminary plans call for inclusion of a visitor information center, in line with our expectation that the visitor market will be the primary source of revenue for the center.

Based on historical data, SMS finds:

- Visitor expenditures on Kaua'i can be conservatively forecast to grow by 1.5% annually over the next five years (in constant dollars), and then by 1% annually for the next ten years; and
- Resident spending will grow at about the same rates in each period.

The DBEDT projections call for higher rates of growth in visitor counts and in personal income of residents. Most of the increase in visitor spending will be by Mainland US visitors.

Overall Supply and Demand

Visitor retail sales, estimated as $393 million in 2000 for Kaua'i County will growt to $465 million (in constant 2001 dollars) by 2015. Total retail expenditures will grow from $685 million to $764 million.

Kaua'i has about 1.3 million square feet of Gross Leasable Area (GLA) in shopping centers, as shown in Exhibit 22. The largest single center, Kukui Grove Shopping

Center, has about 315,000 square feet, much less than the major malls on O'ahu. Shopping centers on Kaua'i do not as a rule include large chains, but feature smaller specialty stores.

Exhibit 22: KAUA'I SHOPPING CENTERS

	Year Opened	GLA
Kukui Grove Shopping Center	1982	314,702
Kukui Marketplace	1994	145,812
Wal-Mart	2000	150,000
Kauai Village Shopping Center	1990	112,000
Princeville Center	1983	66,188
Coconut Marketplace	1975	65,500
Eleele Shopping Center	1955	61,009
Kukui Grove, Phase II (K Mart, Borders)	1998	60,000
Kapaa Shopping Center	1961	53,995
Ching Young Village	1981	41,000
Rice Shopping Center	1973	39,143
Poipu Village Shopping Center	1985	37,312
Pacific Ocean Plaza	1978	31,762
Old Koloa Town	1984	23,493
Anchor Cove Shopping Plaza	1989	20,647
TOTAL		1,222,563

The proposed Gateway Center commercial area is similar in size to the smallest competitors listed in Exhibit 22.

Overall, occupancy rates in shopping centers are high, averaging about 95%. This figure indicates that shopping centers are, making full use of space, since some vacancies are to be expected due to turnover and renovation.

Shopping centers represent about 80% of all retail centers. Thus, total GLA for Kauai can be estimated as 1.5 million square feet. By dividing the estimated total retail sales for 2001 -- $693 million – by total GLA, the average return per square foot is estimated. This is about $450 per square foot of total GLA .

As noted earlier, total retail spending is expected to rise by at least $70 million (constant 2001 dollars) by 2015. At the rates used for this retail forecast, Kaua'i could support, without any loss of return per square foot for the overall market, new retail outlets with the following GLA:

Year	Additional GLA supported by Anticipated Growth of Expenditures
2005	73,100 sq.ft.
2010	102,500 sq.ft.
2015	154,900 sq. ft.

Feasibility of the Gateway Center Commercial Area

The proposed retail center in the Hanamaulu project, with about 40,000 square feet of built area – perhaps 25,000 general retail, plus restaurant and other uses -- is well within the additional GLA supported by the year 2005, and less than a quarter of the new GLA supported by later years. By 2010, there will no doubt be new competing stores and expansion of some centers, but there is likely to be ample demand for additional retail space.

The Gateway Center is well located to attract visitors, lying about a mile and a half north of the airport and Lihū'e. Situated at the northern end of the Airport Cutoff Road, it will be attractive both to stores and offices serving visitors (e.g., vacation rental offices). SMS refined projections of the customer mix by reviewing traffic data. According to gpvernment traffic counts, some 14,760 vehicles pass along Kuhio Highway in each direction north of the Hanama'ulu intersection, while some 16,057 vehicles pass a point further south on Route 56 in each direction. This suggests that about 10% of traffic to the south is purely local, but the great majority of vehicles are on longer trips, between Lihū'e and Kapa'a or points beyond.. By way of comparison, traffic counts for Kaumualii Highway at Nawiliwili Road – in front of Kukui Grove Shopping Center – show 15,197 cars in each direction per day. The route in front of the project site is, then, well frequented.

We can estimate visitor traffic by starting from State visitor data. In 2000, the average visitor census was18,041, and the average party size was 2.06, Kaua'i saw some 8,750 parties. Nearly all visitors must rent cars, so the total visitor rental car count would be about 8,300 cars on the road. We would expect each party to pass the site, on average, three times during their stay (allowing four times for visitors staying on the east and north sides of Kaua'i and only two times for visitors on the south shore. With an average length of stay of 6.19 days, this suggests that about half the visitor cars on the road pass the Village Gateway site daily, or 4,000 cars per day. Kaua'i residents would then account for the remaining trips, i.e., 25,500 trips per day.

We can expect the Gateway Center to capture about 15% of visitor traffic and, with an appropriate retail mix, about 2% of resident traffic, for an average daily customer count of 1,100 parties. If those parties spend, on average, $30 per visit, total daily expenditures would come to approximately $33,000 per day. The revenue stream from highway visitors would support 26,750 square feet of occupied retail space at the average rate estimated above. As a result, 90% of the retail space (including general retail and restaurant) would be supported by highway visitor traffic (assuming that about 10,000 square feet were in non-retail use, such as offices). This analysis does not factor in traffic to and from the rest of the project site, which would add to sales at the Gateway Village. Consequently, the market support for the Gateway Village is strong, justifying construction of the project as planned.

4. ECONOMIC AND DEMOGRAPHIC IMPACTS

This section provides estimates of the economic and demographic impacts of the proposed project, including employment, incomes, population and housing impacts, and impacts on government revenues. The estimates are partly derived from Input-Output Models. The next section provides terminology used to estimate effects – in Input-Output modeling -- and impacts, translating the results of the models into an account of change due to the project.

4.1 TERMINOLOGY OF IMPACT ANALYSIS

Impacts and Types of Impact

In socio-economic impact analysis, an **Impact is the difference between two possible futures, with and without the proposed project**, rather than the difference between present conditions and future ones with the project. Many factors will affect the future, and, while a particular project should be viewed in relation to a changing context, it can be held accountable for those changes that it brings about, not for ones that pre-exist it or stem from different sources.

Still, the difference between the current situation and the future can profoundly affect perceptions of any project. In a related vein, perceptions are often shaped by experience with recent projects, which may have little to do with the proposed action. These comparisons are important parts of a community's response to development, and must be viewed as an impact in early phases – but the impact of stimulating a concern (e.g., about newcomers possibly coming into a community) is distinct from the eventual demographic impact (whether in fact newcomers will arrive in great numbers).

Impacts arise in relation to context. A change brought by a project may be highly significant at the local level, yet small on a regional or county scale. Again, demand for a project may be so strong that it is nearly inevitable at the State level, but the choice of a site for the project entails local impacts that are by no means inevitable.

One way to discuss the last point is to distinguish locational impacts from absolute ones. An absolute impact is a change that will occur with a project, but would not occur otherwise; a locational impact might well occur, but would not occur at the site of a project, or would perhaps be dispersed over a large area, without the project.

From an economic perspective, industries such as tourism bring new inputs into the island economy, which might otherwise go outside Hawaii; these are primary motors of

change. With an economy supported by such primary industries, people may be housed in various ways, in different places — but they must be housed. The impact of a major residential project has to do with where and how people are housed, not whether there will be economic and population growth.

The Hanama'ulu project will attract visitors and new residents to Kaua'i. Yet, it is extending Kaua'i's reputation and resources as a golf destination, not creating these. Arguably, most of its new residents and visitors would come to Hawai'i, perhaps to Kaua'i, even if the course and homes in the project were not built. It seems appropriate to view the project's population and employment as likely to occur in Hawai'i as a normal part of the ongoing growth of Neighbor Island golf-related tourism in any event, but not as necessarily likely to happen on Kaua'i without the project.

The distinction between absolute and locational impacts is important when considering secondary economic effects associated with development. When resources are spent on construction, the result is not just new construction jobs and new buildings – other jobs are supported throughout the economy. These are clearly project impacts, since new construction is precisely what is being proposed. When permanent on-site employment is considered, the analysis must be somewhat different. That employment is generated by demand for goods and services in the overall economy, not by the project in which it is located. As a result, the project cannot be said to generate new operational employment, much less the indirect and induced jobs associated with on-site employment – unless the on-site jobs would not exist in Hawaii apart from the project.

Direct, Indirect, and Induced Effects

Employment associated with both construction and operations falls into three broad types:

- Direct jobs are immediately involved with construction of a project or with its operations. Direct jobs are not necessarily on-site: construction supports construction company personnel in offices and base yards, as well as on site.
- Indirect jobs are created as businesses directly involved with a project purchase goods and services in the local economy.
- Induced jobs are created as direct and indirect workers spend their income for goods and services.

The State's Input-Output Model (reported by DBEDT in 1998) estimates Statewide employment effects. Estimations of County-level effects can be done using a study that is by now quite dated (Anderson et al, 1975) or models based on estimates developed by the Bureau of Economic Analysis, Department of Commerce for all counties in the country. (SMS has an Implan-Pro model with BEA-based County submodels.) For the present project, SMS has chosen to look at the specific indirect and induced impacts of the project, and to assess County-level impacts by inference, as discussed below.

4.2 EMPLOYMENT AND INCOMES

The project will generate short-term jobs, due to construction, and longer-term ones associated with operations.

Construction

Construction will involve a major effort in the first few years of activity, to build the golf course, clubhouse, and project infrastructure. The rest of the project will build out in time over later years, as homes are sold. (Often, single family home lots are sold, but not immediately built out. In modeling development at the project site, SMS has allowed for a share of lots sold each year to be developed as much as four years later. Accordingly, construction could extend into 2020 or 2021.)

Construction employment is estimated from construction spending, as shown in Exhibit 23. (The ratio of jobs per million dollars varies depending on the type of work for different parts of the project.) The table shows that about 925 person-years of direct employment are expected on the project over the entire construction period. In the early years, the average number of workers on the project site would usually be nearly 90 persons at a time (expecting about 20% of the construction workforce to be off-site).

Indirect jobs would be located both on Kaua'i, where construction firms would buy some materials and supplies, and on Oahu, the source of many materials and parts used throughout Hawaii. If about half the indirect jobs are on Kauai, the total number of direct and indirect construction-related jobs would be about 1,130 person-years (85% of the total of direct and indirect jobs). If nearly 85% of the induced jobs – about 1,000 person-years -- are Kaua'i-based, the total Kaua'i job impact would come to about 2,140 person-years. Over the entire construction period, the impact of construction would be to support an average of nearly 100 jobs per year on Kauai and an additional 15 jobs annually off-island.

Exhibit 23 also estimates incomes, in 2001 dollars.

Exhibit 23: CONSTRUCTION EMPLOYMENT AND INCOMES

	2003-2005	2006-2010	2011-2015	2016-2020	Cumulative to Buildout
Construction Spending (Millions 2001 $s)	$64.1	$41.4	$26.0	$13.6	$151.0
Direct Construction Employment					
Jobs (person-years)	337	290	182	120	929
Income (total for period)	$11.9	$10.2	$6.4	$4.2	$32.7
Indirect Construction Employment					
Jobs (person-years)	148	128	80	53	409
Income (total for period)	$5.6	$5.2	$3.3	$2.1	$16.2
Induced Construction Employment					
Jobs (person-years)	437	375	235	145	1,192
Income (total for period)	$13.4	$11.5	$7.2	$4.5	$36.6

NOTES: Construction employment estimated from projected construction costs. Jobs are shown in total person-years for period, not annual averages. Direct jobs include construction jobs at baseyards or offices, as well as on-site activity. Indirect and induced jobs calculated using the State Input-Output Model. Incomes based on Kauai construction industry incomes and (for indirect and induced) Statewide average incomes.

Operations

Operations jobs will be created throughout the project. The major job centers will be at the golf course and commercial area, but some jobs will be located in the residential areas as well. Exhibit 24 shows direct jobs by location within the project, while Exhibit 25 translates these numbers into industry categories, to estimate direct, indirect and induced jobs and incomes.

Once the golf course and Gateway Village are running, there would be some 220 operations jobs at the Hanamaulu project. Some of the retail and office jobs would no doubt be relocated from other areas on Kauai, but the golf and some of the retail jobs would be new.

The total number of jobs on Kaua'i associated with operations at the project would be about 250 (including indirect and induced jobs). As noted earlier, some jobs on-site would be on-island in any event, and some would also be supported by visitor expenditures that would come to Kaua'i with or without the project – the new impact that can be ascribed to the project is actually smaller than the employment and income figures in Exhibit 25.

Exhibit 24: DIRECT OPERATIONS EMPLOYMENT, BY LOCATION

	2005	2010	2015	2020	Buildout
Golf Course					
Maintenance	4	4	4	4	4
Golf course landscaping	11	11	11	11	11
Pro shop	5	5	5	5	5
Clubhouse	29	29	29	29	29
Commercial Area					
Retail	0	100	100	100	100
Gas Station	0	6	6	6	6
Offices	0	15	15	15	15
Restaurant	0	25	25	25	25
Housing Areas					
Household Services Single Family	0	2	4	6	7
Household services Multi Family	0	2	3	3	3
Security (total)	3	3	3	3	3
Landscaping/Maint. Single Family	0	1	3	4	5
Landscaping/Maint. Multi Family	1	5	8	8	8
Total	54	208	215	218	220

NOTES: Estimates based on SMS market experience and project program. US Economic Census 1997 data available over internet at www.census.gov. In housing areas, employment estimates as follows

Exhibit 25: DIRECT, INDIRECT AND INDUCED OPERATIONS EMPLOYMENT AND INCOMES

	2005	2010	2015	2000	Buildout
Direct Employment					
Jobs	54	208	215	218	220
Income (million $s)	$1.6	$4.5	$4.6	$4.7	$4.8
Indirect Employment					
Jobs	8	14	15	15	15
Income (million $s)	$0.2	$0.4	$0.4	$0.4	$0.4
Induced Employment					
Jobs	6	50	52	53	54
Income (million $s)	$0.2	$1.5	$1.5	$1.6	$1.6

NOTES: Indirect and induced jobs calculated based on a weighted average of multipliers from State Input-Output Model (DBEDT 1998). Income based on Statewide average income for 1999, adjusted for 2001 dollars in line with CPI increases.

4.3 POPULATION AND HOUSING IMPACTS

As discussed earlier, the project will bring to Kaua'i vacationers and new residents, many of whom might have gone to another Neighbor Island if the project were not built. It is not expected to attract new visitors and residents to Hawai'i. Accordingly, the resident population can be considered as a new source of jobs, revenue and expenditures at the county level, but not at the State level.

The population in question will consist of a mix of full-time residents and vacationers. SMS expects the multifamily housing and golf-adjacent homes to be largely used as vacation homes, while most of the residents of the additional single family area on the north side of the property would be island residents. Exhibit 26 shows both the expected resident population and the average on-site population in the residential parts of the project, including vacationing owners and their guests. It shows the resident population to be about 150 by the year 2010, and to come to about 330 persons at buildout. The average on-site population would come to about 430 at buildout.

Exhibit 26: RESIDENT AND AVERAGE ON-SITE POPULATION STAYING AT THE PROJECT SITE

	2005	2010	2015	2000	Buildout
Housing Built					
Annually					
SF (golf adjacent)	6	9	2	0	0
SF [illegible]	0	0	9	9	10
MF	29	29	0	0	0
Cumulative	35	224	345	391	423
Resident Population					
New	16	17	17	17	
Cumulative	16	103	190	273	333
Average On-Site Population					
New Vacationers	10	11	1	1	
Cumulative Vacationers	10	64	94	97	99
Cumulative Residents + Vacationers	26	167	284	370	431

NOTES: Average occupied household size in project estimated as 2.3 persons/household, based on Census data from Princeville, Kahala and Poipu. In golf-adjacent single family and multifamily areas [illegible] of homes are occupied by residents, [illegible] are vacant, and rest are occupied, on average, two months of the year. In the remaining single family homes, 80% are occupied by residents, 5% are vacant, and the rest are occupied on average two months.

The impact of the new construction on demand for housing is estimated in Exhibits 27 and 28. The impact is not simply the addition of new homes to the Kaua'i inventory, since jobs at the project will enable some workers to start their own households, and

Exhibit 30: IMPACT OF PROJECT ON REAL PROPERTY TAX COLLECTIONS FOR THE COUNTY OF KAUA'I

	2001	2005	2010	2015	2020	Buildout
Areas (acres)						
PROJECT AREA, BY CLASS						
Single Family		12.3	32.8	56.9	79.6	84.6
Apartment		2.3	14.0	20.1	20.1	20.1
Hotel/Resort		186.0	186.0	186.0	186.0	186.0
Commercial		12.5	12.5	12.5	12.5	12.5
Agricultural	460	0.0	0.0	0.0	0.0	0.0
Conservation		248.9	214.8	184.5	161.8	156.8
NEWLY DEVELOPED ACREAGE						
Single Family		6.2	1.4	4.5	4.5	5.1
Apartment		2.3	2.3	0.0	0.0	0.0
Hotel/Resort		0.0	0.0	0.0	0.0	0.0
Commercial		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
Land Values ($1,000s)						
Single Family		$11,209.5	$31,020.3	$46,399.5	$60,655.5	$63,823.5
Apartment		$4,500.0	$27,000.0	$38,600.0	$38,600.0	$38,600.0
Hotel/Resort		$18,523.9	$18,523.9	$18,523.9	$18,523.9	$18,523.9
Commercial		$4,356.0	$4,356.0	$4,356.0	$4,356.0	$4,356.0
Agricultural	$1,651.8					
Conservation		$5,376.7	$4,677.5	$4,019.5	$3,524.5	$3,414.5
Improved Value ($1,000s)						
Single Family		$9,540.0	$25,680.0	$38,030.0	$49,280.0	$51,780.0
Apartment		$4,841.3	$29,047.5	$41,722.5	$41,722.5	$41,722.5
Hotel/Resort		$2,200.0	$2,200.0	$2,200.0	$2,200.0	$2,200.0
Commercial		$10,400.0	$10,400.0	$10,400.0	$10,400.0	$10,400.0
Value of Owner-Occupant Exemptions (1)						
Single Family		$176.0	$552.0	$2,024.0	$3,464.0	$3,784.0
Apartment		$232.0	$1,392.0	$2,000.0	$2,000.0	$2,000.0
Taxable Land Value ($1,000s)						
Single Family		$11,033.5	$30,468.3	$44,375.5	$57,191.5	$60,039.5
Apartment		$4,268.0	$25,608.0	$36,600.0	$36,600.0	$36,600.0

Continued

Exhibit 30, Cont.

	2001	2005	2010	2015	2020	Buildout
Taxes ($1,000s)						
LAND VALUE						
Single Family		$62.2	$171.8	$250.3	$322.6	$338.6
Apartment		$37.1	$222.6	$318.4	$318.4	$318.4
Hotel/Resort		$161.2	$161.2	$161.2	$161.2	$161.2
Commercial		$37.9	$37.9	$37.9	$37.9	$37.9
Agricultural	$9.8					
Conservation		$43.6	$37.9	$32.6	$28.5	$27.7
IMPROVED VALUE						
Single Family		$44.4	$119.4	$176.8	$229.2	$240.8
Apartment		$40.2	$241.1	$346.3	$346.3	$346.3
Hotel/Resort		$18.3	$18.3	$18.3	$18.3	$18.3
Commercial		$86.3	$86.3	$86.3	$86.3	$86.3
Total Taxes		$531.1	$1,096.7	$1,428.0	$1,548.6	$1,575.4
Increase in Tax Revenues over 2001						
Annual		$521.3	$1,086.9	$1,418.3	$1,538.8	$1,565.6
Cumulative		$809.0	$5,228.3	$11,829.5	$19,282.6	

NOTES All values are in constant 2001 dollars. Land values estimated by SMS on the basis of comparison with other Kauai cases. Improved values estimated from construction costs. Rates are current 2001-2002 rates. Land conversion estimated from development and sales schedule.

Exhibit 31: AVERAGE COST OF KAUA'I COUNTY OPERATIONS

Function (1)	2000 Expenditures (in $1,000s)	Service Population Includes Visitors?	Expenditures per Resident	Expenditures per Visitor (2)
General Government	$13,192	No	$225.65	--
Public Safety	$16,550	Yes	$220.08	$220.08
Highways	$5,292	Yes	$70.37	$70.37
Health and Sanitation	$7,857	Yes	$104.48	$104.48
Recreation	$4,666	Yes	$62.05	$62.05
Public Welfare	$15,864	No	$271.35	--
Public Schools	$22	No	$0.38	--
Interest	$1,988	No	$34.00	--
Bond Redemption	$3,118	No	$53.33	--
Retirement and Pension	$2,481	No	$42.44	--
Cash Capital Improvements	$8,901	Yes	$118.36	$118.36
Miscellaneous	$7,181	No	$122.83	--
Total	$73,920		$1,325.32	$575.35
Adjusted Total (2001 Dollars)			$1,341.89	$582.54

NOTES:
(1) As reported in Hawaii State Data Book, 2000.
(2) Based on 2000 Census and DBEDT estimate of visitor count: Resident 58,463; De Facto 75,200
(3) Based on increases in CPI, Honolulu from 2000 to 2001.: 1.25%

Exhibit 32: NET REVENUE INCREASE ASSOCIATED WITH PROJECT, COUNTY OF KAUA'I

Dollar Values in $1,000s	2005	2010	2015	2020	Buildout
County Real Property Increase	$521.3	$1,086.9	$1,418.3	$1,538.8	$1,565.6
On-Site Population					
Residents	16	103	190	273	333
Vacationers	10	64	94	97	99
Total	25	167	284	370	431
Average Cost of County Services					
Residents	$21.3	$138.0	$254.6	$366.0	$446.3
Vacationers	$15.0	$97.3	$165.3	$215.3	$251.2
Total	$36.3	$235.3	$419.9	$581.3	$697.5
Net Gain in Revenues					
Annual	$485.0	$851.6	$998.3	$957.5	$868.2
Cumulative	$781.9	$4,829.1	$9,928.5	$15,494.9	

NOTES: Based on Exhibits 26, 30, and 31.

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APPENDIX O

A Condensed Integrated Golf Course Management Plan (IGCMP) for the Proposed Ocean Bay Plantation at Hanamā'ulu Golf Course

Wm. Kent Alkire, II

November 2001

A CONDENSED INTEGRATED GOLF COURSE MANAGEMENT PLAN (IGCMP) FOR THE PROPOSED OCEAN BAY PLANTATION AT HANAMA'ULU GOLF COURSE

NOVEMBER 2001

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1. SUMMARY

The Ewm Kauai, Llc, has contracted Golf Ventures International (GVI) to develop an integrated and environmentally safe approach to managing the proposed Ocean Bay Plantation At Hanama'ulu Golf Course located in Kauai, Hawaii (Figure 1) near Highway Kuhio and Hanama'ulu Road.

The approach takes the form of a plan, referred to as an Integrated Golf Course Management Plan (IGCMP), AND [1]uses the principles of "Integrated Pest Management" (IPM) and "Best Management Practices" (BMP) which are basic to the program of balanced, healthy turf management.

This concept is based on the development of a golf course that addresses, in the planning stages, the issues of reduced water demand and water quality protection. In addition to naturally achieved pest resistant practices, the project will use:

- an appropriate design to reduce turfgrass wear and environmental disease or pest problems caused by negative microclimates such as shady or poor air-circulation areas,
- efficient irrigation practices,
- an appropriate drainage water collection and outflow system,
- use of various biologically active filters (biofilters/ buffers) to purify drainage discharge,
- pesticides used on an "as needed" basis

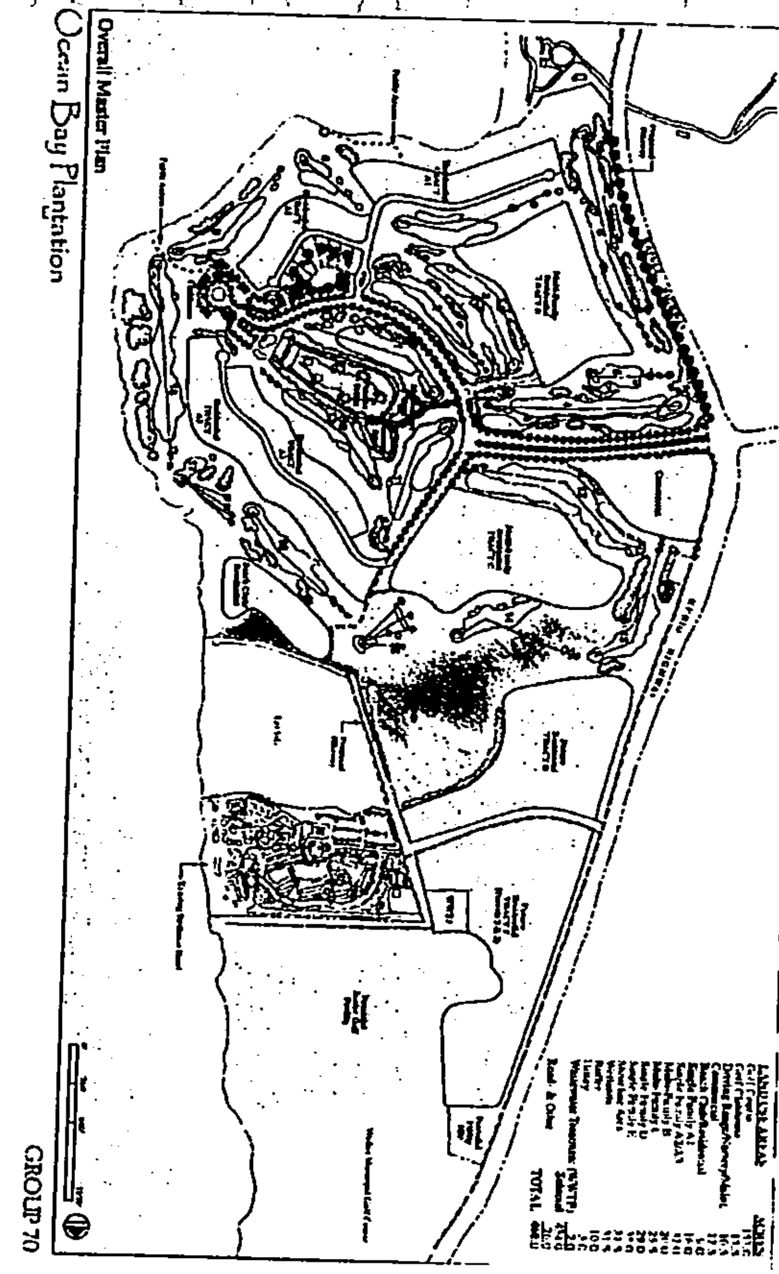

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Figure 1. Regional Location of the Project

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The operation of the golf course will be under the daily direction of an experienced, educated, Class "A" Golf Course Superintendent. Turfgrass, as part of a healthy micro-biotic ecosystem, creates a natural buffer or zone of protection. This zone, due to the makeup of biological activity and the presence of biomass, i.e. roots, stems, leaves, and thatch, helps to maintain soil stability, reduces erosion potential, and filters and deactivates conventional and alternative pesticide and fertilizer products.

Pest control is addressed on the basis of acceptable levels of pest existence and impact in the managed turf areas within the golf course boundaries. Pest thresholds are established and maximum levels of impact are set to effectively limit and reduce the use of legally acceptable federal and state tested and registered pest control products.

On-site weather station, proper irrigation, controlled drainage, effective traffic control, appropriate thatch control, surface soil compaction management, balancing of the soils, macro/micro nutrients, pH, and salinity are all management practices used to reduce overall pesticide use by creating the healthiest possible turf environment.

Site and pest appropriate turfgrass chemicals will be bought and applied by an experienced certified pesticide applicator and records of use kept and reported to the appropriate local agriculture department. All products will be EPA approved and registered by the U.S. and Hawaii State agencies, and each has undergone extensive research to identify its properties and register it as safe for use as prescribed by the label.

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Hawaii, in addition to federal law, conducts additional tests on the potential impact of pesticides on water quality. These products will be stored and mixed per existing laws and regulations with the spray equipment cleaned in a closed rinsate system to avoid potential runoff or leaching. Posting of "product use" will be done routinely to inform the patrons and workers of the actual event of application and will include the product's trade name, an outline of active ingredients, pertinent data and area of application, and total amount applied. This will be posted in an area deemed suitable for player and worker notification alike.

Foremost, the Ocean Bay Plantation At Hanama'ulu Golf Course will be managed by an educated, licensed, and experienced golf course superintendent who will have a commitment to limit unnecessary pesticide and water use to the lowest level possible while maintaining healthy turf. Nutrients will be applied at times to match the plants needs and intake thereby virtually eliminating any significant runoff or leaching potential. Pests will be controlled, not eradicated, using a variety of cultural, biological, and mechanical practices prior to a more conventional response.

The following is an outline of the steps and procedures to be used during planning, construction, grow-in and maintenance to preserve and protect the quality and health of the golf course and the environment it shares.

- The selection and use of turfgrass varieties that are suited for the site and have the capability of stabilizing the site against the forces of erosion.

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- The initial and periodic application of soil nutrients and amendments to create an optimum growing condition for the establishment and maintenance of healthy turfgrass. This is vital to maintaining a turfgrass stand that will be resistant to invasive weeds, and withstand the impact of consumptive insects and diseases, thus reducing the need for pesticides. Furthermore, healthy turf has a higher degree of live bioactive tissue and thatch, thus allowing the turf to act as a living filter. This concept is the basis for the Federal Government protecting wetlands and how reclaimed water plants work (i.e. microorganisms attack and digest sewage waste, uptake nutrients and break down chemicals found in the waste into inert substances and reduced soluble nutrients) to process sewage.
- The use of a state-of -the-art irrigation system that can (1) calculate the evaporative loss which occurs since the last irrigation cycle; (2) tell each sprinkler head how much to apply at a time to replace the lost water; (3) apply water at a rate that will prevent runoff; (4) regulate pressure at each head to get maximum uniformity of water distribution and; (5) allow the field staff to make site adjustments to compensate for shade, slope, sun exposure (relief), etc.
- The use of organic based fertilizers to enhance and stimulate the beneficial soil organisms. Their active presence has proven by research to reduce the presence and degree of disease impact to turf.
- The use of fertigation (injection of small quantities of fertilizers into the irrigation water) to supplement the nutrients required to maintain healthy turf. Soil tests will be used to verify the type and quantity of nutrients needed.
- The use of collective grading techniques to contain and direct drainage water to designated points of deposition.
- The use of vegetative materials (biofilters) to pass water through prior to discharge into designated drainage passageways.

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- The reintroduction of drainage discharge water to the atmosphere. This reintroduction of drainage water to sunlight, oxygen, biomatter, bioorganisms, etc. works synergistically to adsorb (attach to the surface), absorb (drawn into the plant or organism), utilize, and biodegrade nutrients , heavy metals and pesticides prior to the water entering drainage discharge channels (biofiltration).

- The engagement of an experienced, Class "A" Golf Course Superintendent capable of effectively managing the golf course using the principles of Integrated Pest Management (IPM).

- The use of a "scouting program" to identify pests before they become economically or aesthetically significant.

- Prior to treatment establish of acceptable limits of pest and weed impact.

- The use of cultural practices such as, nutrient balancing, environmental modification (@ shade reduction), pH adjustments, misting of heat stressed turf with water, traffic control, etc. prior to pesticide intervention.

- The use of mechanical intervention such as spiking, dethatching, aerification, sharp cutting units (mowers), hand removal of weeds, etc. prior to pesticide intervention

- The use of biointervention and bioactive products such as parasitic nematodes and Bacillus Thuringiensis to control insects or biostimulants to prevent disease infection and to promote a beneficial population of beneficial biorganisms.

- The use of an in-house or subcontract Certified Pesticide Advisor to accurately identify the target pest and advise as to the most sight appropriate biocide to use to gain control of the problem.

- The use of biocide product information to appropriately select the correct control product, rate and application procedure for its use. This would include information on product toxicity, persistence, leachability, runoff potential, efficacy, etc. This information will help make better control and environmental protection decisions by knowing the fate of the product in the specific environment and its ability to control the target pest without causing harm or accumulation.

- The use of a certified pesticide applicator to apply the recommended biocide to the target pest.

- The use of a computer controlled boom sprayer to apply all approved nutrient sprays and biocides to the golf course.

- The adherence to all federal, state and county laws concerning the selection, storage, loading, use and disposal of regulated biocides.

- The construction, use and maintenance of a state-of-the-art maintenance facility which has water quality protection features such as a Landa Water purification system.

- The development and use of an Integrated Golf Course Management Plan which identifies and illustrates the principles and practices outlined above.

TURFGRASS SELECTION

Human activities ultimately determine turfgrass quality and remain a persistent factor on the relationship of turfgrass wear, compaction, and stress. This is due to the intensity of the intended use and the need for the turf to resist and recover from damage incurred during play and maintenance.

It is important to establish appropriate turfgrass cultivars whereby normal turfgrass maintenance standards can be maintained for each playing surface (greens, tees, fairways, roughs). When turf grass species are selected and managed appropriately, the potential for total turfgrass failure is minimized.

TURFGRASS OPTIONS AND CHARACTERISTICS

The Ocean Bay Plantation At Hanama'ulu Golf Course exist in a somewhat arid environment and receives less fog than coastal golf courses in the area; thus, less pressure exists from invasive grasses such as annual bluegrass (*poa annua*) and various fungal diseases. Newer bermudagrass turf cultivars for greens are now available and are susceptible to disease and provide a more aggressive playing surface against weeds and weed seed establishment. These newer varieties limit cultivar segregation and annual bluegrass intrusion, have a reputation of adapting to a wide range of climatological conditions, and provide more upright turf growth with excellent color, texture, wear and recuperative potential.

The Ocean Bay Plantation At Hanama'ulu Golf Course is committed to the selection and utilization of proven Bermudagrass varieties in putting green surfaces that will not use growth regulators or post emergent herbicides to control annual bluegrass. These grasses have become more adaptable to wear, low mowing heights, shade and saline impacted water.

While geographic location and proven adaptability still remains an important factor in the selection of Hybrid Bermudagrass, it appears that water quality and tolerance to a high level of foot traffic might play a more significant role towards long-term turfgrass hardiness and plant community survival.

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Golf Ventures International recommends that Ocean Bay Plantation At Hanama'ulu Golf Course conduct annual irrigation water quality analysis. Subtle changes in the irrigation water quality may require neutralizing sodium bicarbonates which affect soil infiltration rates and the leaching of salts. A complete water quality test will also assist in recommending when to apply the following soil amendments.

- Application of elemental sulfur to reduce soil pH and,
- Application of gypsum, calcium sulfate salt to reduce the accumulation of sodium and other heavy metal salts from the root zone.

The following criteria will be used for deciding the specific varieties of turfgrass species for the Ocean Bay Plantation At Hanama'ulu Golf Course:

1. Climatological conditions of the site
2. Resistance to annual grasses and weeds
3. Water quality adaptability (i.e. chlorides, salt, boron, bicarbonates, etc.)
4. Wear tolerance
5. Resistance to disease and insects
6. Drought tolerance
7. Desirable for golf in the intended playing situation
8. Quality nursery sod and seed for course planting
9. Quality, certified seed varieties that are clean of harmful weeds and pests and grown and harvested in accordance with good turf growing practices.

Robinson Design, Inc., has recommended the use of Tifdwarf for the greens and Tiffgreen 328 for tees, fairways and roughs. Discussions with golf course superintendents in the area indicate that both will provide an excellent playing surface and experience minimal pressures from turfgrass pests.

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Table 1 summarizes the characteristics of each cultivar proposed for the Ocean Bay Plantation At Hanama'ulu Golf Course and looks at the respective tolerances for each variety within the proposed playing surface.

Table 1. Characteristics of Primary, Playable Turfgrass Cultivars

Area	TURFGRASS SPECIES	OPTIMAL MOWING HEIGHTS	WEAR TOLERANCE	CHARACTERISTICS
GREENS	Tifdwarf	1/8" to 5/32"	Excellent Performs better than most new Bermudagrass varieties.	Dark green, very fine textured Excellent playing characteristics for greens.
TEES	Tifgreen 328	1/4" to 1/2"	Excellent Fast rate of recovery due to rapid growth rate stolen and ryzhimonous characterstics High thatch producer	Lighter-green, fine texture, disease and pest resistant. Tolerates moderately low mowing heights with minimal scalping.
FAIRWAYS	Tifgreen 328	3/8" to 1/2"	Excellent Fast rate of recovery due to rapid rate of growth of the stolen and ryzhimonous characters of the Bermudagrass. Good cold weather temperature tolerance	Medium green, fine texture. Excellent playing characteristics for fairways. Stiff leaves, vigorous, growth with excellent ball support and disease resistant.
ROUGHS	Tifgreen 328	5/8" to 2.5"	Excellent turf characteristics for rough use. Excellent wear, heat and drought tolerance, and provides a desirable color and texture.	Medium green, fine to medium texture. Excellent playing characteristics at this height and less. Stiff leaves, vigorous, growth with excellent ball support and disease resistant. Adapted in Hawaii for use in roughs

Table 2. Turfgrass Square Foot Estimates

Area/Use	Grass and Landscape Type	Irrigated	Mgmt Intensity	Acreage	Square Footage	Approx. % of Total
Greens, Practice Green, Nursery	-Bermudagrass	Yes	VERY HIGH	2.83	123,100	1.95%
Tees, Driving Range & Tee Nursery	-Tifgreen 328	Yes	HIGH	3.39	147,500	2.34%
Fairways, Rough, Driving Range, and Aprons Around Greens & Tees	-Tifgreen 328	Yes	MEDIUM TO LOW	90	3,920,400	62.10%
Native and Improved Habitat on Golf Course	-Wetlands -Coastal Sage -Vegetation Buffers -Riparian Habitat	No (establishment only)	VERY LOW	48.7	2,121,372	33.61%
Total		Yes/No	VERY HIGH - VERY LOW	144.92	6,312,715.2	100.00%
Total Mowed Turfgrass		Yes	N/A	96.22	4,191,343.2	66.40%

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ESTABLISHED TURF

Estimated Needs:

It is estimated that the greens and tees may need between 7 and 11 lbs/N/1000 ft sq./year with 50 to 60% in water soluble form. The fairways might need between 6 and 8 lbs/N/1000 ft sq./year with the majority being water insoluble. The roughs may need an estimated 4-6 lbs/N/1000 ft sq./year in predominantly water-insoluble forms.

Biorational Influence

With biorational management techniques, however, and the utilization of biofertility, both these estimated amounts and the actual material added to achieve these amounts may be significantly reduced. Several materials on the market promise 0.5 - 1 # N/1000 ft sq. per application (with 4 to 6 application) through non-symbiotic atmospheric nitrogen fixation (*Microgrow* - Soil Technologies Corp.; *BioJect Nitrogen Supplement* - Eco Soil Systems; *Zone Biological Soil and Foliar* - Growth Resources). It may be safely estimated that nitrogen application rates for the fairways and roughs may be significantly reduced with careful biofertility management. Greens and tees may similarly see reductions of added nitrogen.

Adjustments for phosphorus, potassium, calcium, and other elements will be made based on supplemental soil testing.

Balance the Key to Success

In implementing a balanced and environmentally compatible management program at the golf course, efficient and appropriate water applications and nutrient management must be achieved.

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Too Much

Too much water can lead to soluble nutrients leaching beyond the rootzone and predisposes the turf to fungi disease, soil compaction, weed invasion, etc. Too much nitrogen or other soluble nutrients can also lead to fungi related diseases, leaching, and excessive growth.

Too Little

On the other hand, the application of too little water results in tissue and cell damage due to desiccation and salt accumulation (concentration), thus further magnifying the impact of low soil moisture to turf. This then predisposes the turf to damage from traffic and wear, disease, insect, and weed invasion.

Too little or imbalanced nutrients result in a weakened plant, vulnerability to cart and equipment wear, dormant pathogens, undesirable weeds, and predatory insects.

Irrigation's Part

Irrigation above-field capacity or below the permanent wilting point must be avoided. The use of an on-site weather station connected to a central control irrigation system is a tool to accomplish this balance. Soil moisture sensing stations, field observation, and turf canopy temperature sensors are other tools to help efficiently reapply water to match the turf's evapotranspiration usage and, therefore, maintain a desirable moisture balance within the rootzone of the turf areas.

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Table 3. Average Guidelines for Soil and Fertility Test Ranges

	Soil PPM		
Elements	Low	Opt.	Excessive
NO_3	0-10	50-100	>150
P_2O_5	0-20	25-50	>100
P_2O_5	0-10	15-30	>60
K	0-100	140-300	>500
S	0-10	25-50	>75
Ca	-	2000 – 4000	-
Mg	<100	100-500	-
Na	-	<200	-
Zn	0-1.0	1.2-3.0	>10
Mn	-	6-12	>40
Cu	<.4	.5-2.0	>5
Fe	<5.0	10-20	>50
B	<.5	.7-1.5	>2
pH	<5.5	6.3-6.5	>8

	Tissue PPM		
Elements	Low	Opt.	Excessive
N	<2	2-4	>7
P	<.1	.2-.4	>.5
K	<1	1-2	>4
S	<.2	.2-.4	>.5
Ca	<.2	.2-.5	>1.0
Mg	<.2	.2-.5	>.7
Na	-	<.02	>.4
Zn	<20	20-30	>60
Mn	<20	30-100	>120
Cu	<2	5-15	>20
Fe	<20	25-75	>100
B	<2	4-8	>10
Mo	<.5	.5-.8	>.8

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Research information on sites like golf greens containing high amounts of sand does not support the conclusion that properly managed golf courses are prone to heavy nitrate leaching.

Organic based products will be a part of the overall nutrient program to help in fortifying the soil to retain moisture and nutrients and to activate and/or enhance the beneficial effects of beneficial soil microorganism.

Below are the expected targets for optimum macro nutrient content of soil and tissue:

Table 4. Application Rates of Macro Nutrients to Supplement Deficient Soils

Optimum		Supplement Needed		Recommended Amount Per App.
% Tissue	PPM Soil	% Tissue	PPM Soil	lb/N/1000 sq.ft. per application
N +/- 5%	100 ppm	<3%	<75 ppm	0.75 lb/N/1000 sq. ft. WSN 1.50 lb/N/1000 sq.ft. WIN
P +/- 0.5%	50 ppm	<0.2%	<25 ppm	1.0 lb/P/1000 sq.ft.
K +/- 3%	300 ppm	<2%	250 ppm	1.0 lb/K/1000 sq.ft.

Table 4 projects the range of soluble and insoluble nitrate sources and illustrates recommended application rates for the actual nutrients (N) for each.

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ANTICIPATED PESTS

GVI agronomists have conducted site audits on existing golf courses located in the Oceanside area. The turfgrass pest list includes research and input received from our work and experience in Hawaii. Due to the intrinsic nature of the environment, it must be understood that this list is not and never will be a complete list. The extent of the pest injuries suggested will greatly depend on the disease host pressure, weed and seed contaminations, and the weather conditions affecting turfgrass quality on the Ocean Bay Plantation At Hanama'ulu Golf Course.

The pests on the Ocean Bay Plantation At Hanama'ulu Golf Course that are of the greatest concern to the greens, and, to a lesser degree, the tees, will be leaf contact pathogens. These pests can be identified by a combination of visual inspections. Use of turf disease detection kits (Reveal® or Dipstick®) will correctly identify the pest prior to it becoming a significant problem.

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PEST INFESTATION THRESHOLDS

There will be five major factors excluding the climate that will determine the thresholds of the anticipated turfgrass pests. They include water quality, saline or salty soil conditions, high pH, available selective weed control products, and the turfgrass species.

Bermudagrass is very aggressive against insects and disease and is very competitive against turfgrass weeds. It is known to be more susceptible to algae and mites; yet, this relationship seems directly attributable to water quality, temperature, and humidity.

Brackish water, effluent water, and salt build-up in soils are becoming more problematic for Bermudagrass and represent a key factor in controlling turf-related pest problems. Lower water quality will reduce the effects of good IPM practices. High salts, especially sodium salts, cause a high soil pH which broadens the range of conditions for disease occurrence. Insect pest pressures from leaf chewing insects will decrease under high salt conditions although potential problems still exist for soil born infestations. Salts should be tested routinely to minimize potential build-up in the root zone mix. Flushing of salts should be a normal practice when considering supplemental irrigation need, if salts above 300ppm are utilized routinely in water replacement.

IMPORTANCE OF ESTABLISHING THRESHOLDS

A golf course playing surface is a living filter that absorbs, degrades, and volatilizes most inputs from properly applied nutrient and pesticide products. An important step in Integrated Golf Course Management is to determine the acceptable levels of degradation that can occur. The lack of a significant quantity of undesirable fungi, for example, will prevent the future loss of the grass plants due to its degenerative effect (disease). The physiological control of necrosis, the predictable build-up of thatch, and a balance of parasitic natural organisms will be the measure of a successful Integrated Golf Course Management Plan.

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The Ocean Bay Plantation At Hanama'ulu Golf Course will maintain the greens as a consistent, weed-free turf that is of desirable playing quality, aesthetically appealing, and not impacted by the presence of deleterious pests. "Insect damage to the greens must also be at an absolute minimum, but the greens need not be totally free of insects. Allowing limited damage (weeds or insect damage) does carry a risk that the pathogen may spread which would force the use of a broader control" (Vittum, 1986). To produce high quality turf, it is not necessary to have absolute control over insects and weeds. For example, healthy turf can be sustained with as many as five white grubs per square foot if traffic (wear) is not excessive (Brandenburg, 1989).

As for the tees, a similar level of quality will be required. A limited amount of turf damage is acceptable in the apron areas of the tees, provided it does not interfere with aesthetic quality or function of the tee complex. As a routine operation, tee markers are rotated over the entire tee surface to create a uniform wear pattern across the tees. Rotation is necessary to maintain turf recovery. Therefore, the entire tee must be in a playable condition.

Fairways may have a slightly greater amount of pest damage than tees. Weed control will be used in most play areas. In the rough and natural areas outside the fairways, a lower level of maintenance activity is proposed for insects and fungi.

Once the level of acceptable impairment is defined and the corresponding level of management is instituted, a regular program of inspections is required. To maintain the turf at Ocean Bay Plantation At Hanama'ulu Golf Course, it will be necessary for the golf course superintendent and the management team to make daily inspections of the golf course. This process is essential to identify the type and presence of pests early, keep damage to an insignificant level, and to initiate the lowest level of response.

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Preliminary Threshold Guidelines

Turf pest threshold guidelines not only identify the standard of management; they acknowledge that Best Management Practices are functioning within the golf course operation. A site-specific IPM plan will manage turfgrass pests by establishing thresholds as a preliminary guide. In order for the preliminary thresholds to be considered as an achievable goal, the initial base-line levels should be developed with maximum levels of causal agents. These may be either infectious or non-infectious diseases, weeds, or insects. Refinement of threshold populations will be possible with the gathering of site-specific information and may need to be adjusted in future years. It will take approximately three years of data to refine the preliminary threshold guidelines.

Historical pests and related patterns of existing golf courses are often a good indication of pest density and activity. Existing courses generally provide the turf agronomist the necessary confidence that certain levels of pest are natural and acceptable. To assume otherwise might be considered over-managing, disrupt the true causal agent, and lead to misdiagnosed turf problems.

Development of economic thresholds in field crops attempts to cultivate a relationship between pest populations and the amount of damage produced. This relationship can then be used to decide if the cost of applying a control will actually result in more money being made from the crop. Obviously, turfgrass is mainly used for its ornamental value and is not harvested like a field crop. This ornamental value varies according to the turf use and, in some cases, can not even be determined. Therefore, the traditional use of "economic threshold" is replaced by "aesthetic threshold." Again, this is a value judgment because each person would value turf in a different way. Some people would not mind a few dandelions or brown spots in their lawn while others demand flawless turf.

Turf specialists have attempted to study the relationship of turf insects to damage observed and, unfortunately, do not seem to be able to come to any set rules. In the past, controls were recommended for annual grubs when populations reached 6-10 per square foot. We now know that skunks or raccoons may consider this number good enough reason to rip up the turf. On the other hand, with good irrigation and fertilizer, over 20 grubs per square foot may not be noticeable.

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Very little research has been conducted regarding preliminary thresholds for turfgrass weeds. Healthy weed free ryegrass or Bermudagrass turf provides simple diagnostic plots at ranges between 1,500-1,800 ft^2. This provides an excellent standard of measurement on the health of the turfgrass environment. Lower heights of tees and greens allow for excellent control of grasses and broadleaf weeds. Monocotyledons will be more tolerant of close mowing of turf and will be difficult to obtain exact threshold counts.

Table 5 provides suggested baseline preliminary thresholds for annual and perennial weeds. Preliminary threshold guidelines have been established for the turfgrass pest anticipated on each playing surface and turfgrass cultivar. Tables 5, 6, 7, 8 and 9 were developed around the probable pests and the recorded levels of density in Bermudagrass turf. Research will be needed to verify that the levels presented are not only tolerable but also obtainable when managing these grasses.

These thresholds set a period of time for the golf course superintendent to analyze turf pest presence and establish baseline density for implementing cultural and mechanical control methods. They also have been established for the golf course superintendent to determine when a potential pesticide may be needed for control.

In summary, pest thresholds may be recommended in some of the turfgrass manuals and pamphlets. Be aware; these thresholds are only targets, and there are many other factors which will influence the quality of the turf. On the other hand, in order to follow good pest management practices, the mere presence of a pest is no justification to apply a control product.

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Table 5. Suggested Action Levels for Weeds on the Ocean Bay Plantation At Hanama'ulu Golf Course

Number of Weeds per 1,000 sq. ft.

Weed Species	Greens	Tees	Fairways	Roughs
Grasses				
Annual bluegrass	N/A*	5	10	20
Large crabgrass	1	3	5	10
Meadow fescue	1	5	10	20
Quackgrass	1	5	10	20
Smooth brome	1	3	5	10
Saltgrass	1	5	10	20
Yellow foxtail	1	5	10	20
Broadleaf				
Alfalfa	1	3	5	10
Broad-leaved plantain	1	3	10	20
Common purslane	1	5	10	20
Curly dock	1	3	10	20
Dandelion	1	3	10	20
Knotweed	1	3	10	20
Lambsquarter	1	3	10	20
Leafy Spurge	1	3	10	20
Red Clover	1	3	10	20
White Dutch Clover	1	3	5	10

N/A* Assumes annual bluegrass will be hand picked out as soon as it is identified
Grasses are easier to control in the lower heights of tees and greens. Simple hand removal often times will prevent further spread of these grasses. Sedges are more difficult to identify and control and grow closer to the thatch canopy.

Note: This table was developed from suggested guidelines by the University of Hawaii and an IPM program written for Lihi Lani by Holtzmann et al., 1991. The IPM plan was later summarized and rewritten by GVI to include this methodology as a means to establish baseline weed threshold counts for cool season grasses.

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Table 6. Preliminary Threshold Guidelines - Turfgrass Weeds

(Monocotyledons)

Pest	Area	Cultural Management	Chemical Control
Annual bluegrass	Tees/Greens Fairways Roughs	mechanical removal Time cultural practices/ Keep dry	pre emergence post emergence post emergence
Large crabgrass	Tees/Greens Fairways Roughs	mechanical removal Reduce compaction Reduce compaction	spot treat pre emergence pre emergence
Meadow fescue	Tees/Greens Fairways Roughs	mechanical removal promote health turf mechanical removal	spot treat pre emergence pre emergence
Saltgrass	Tees/Greens Fairways Roughs	mechanical removal leach/reduce traffic leach/reduce traffic	spot treat spot treat spot treat
Quackgrass	Tees/Greens Fairways Roughs	mechanical removal promote healthy turf	spot treat spot treat spot treat
Smooth brome	Tees/Greens Fairways Roughs	mechanical removal promote healthy turf	spot treat spot treat spot treat
Yellow foxtail	Tees/Greens Fairways Roughs	mechanical removal promote healthy turf	spot treat spot treat spot treat

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Table 7. Preliminary Threshold Guidelines - Turfgrass Weeds

(Dicotyledons)

Pest	Area	Cultural Management	Chemical Control
Broad-leaved plantain	Tees/Greens Fairways Roughs	Maintain healthy turf " " " "	Mechanical removal spot treat spot treat
Common purslane	Tees/Greens Fairways Roughs	Maintain healthy turf " " " "	spot treat spot treat spot treat
Curly dock	Tees/Greens Fairways Roughs	Maintain healthy turf " " " "	mechanical removal spot treat spot treat
Dandelion	Tees/Greens Fairways Roughs	Maintain healthy turf " " " "	mechanical removal spot treat spot treat
Knotweed	Tees/Greens Fairways Roughs	Maintain healthy turf " " " "	mechanical removal spot treat spot treat
Lambsquarter	Tees/Greens Fairways Roughs	Maintain healthy turf " " " "	mechanical removal spot treat spot treat
Leafy Spurge	Tees/Greens Fairways Roughs	Maintain healthy turf " " " "	spot treat spot treat spot treat
Red Clover	Tees/Greens Fairways Roughs	Maintain healthy turf " " " "	mechanical removal spot treat spot treat
White Dutch clover	Tees/Greens Fairways Roughs	Maintain healthy turf " " " "	mechanical removal spot treat spot treat

Note: Many dicot weeds can be easily removed by hand. For those broadleaves difficult to control in groups or clusters, spot treatment with a wick applicator utilizing a post emergent herbicide will provide excellent control.

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Table 8. Preliminary Threshold Guidelines - Turfgrass Disease

Pest	Area	Cultural Management	Chemical Control
Algae	Tees/Greens Fairways Roughs	upon detection 24-48 hours 48-72 hours	spot treat 72 hours 120 hours
Anthracnose	Tees/Greens Fairways Roughs	upon detection 48-72 hours 48-72 hours	spot treat 96 hours 96 hours
Brown Patch	Tees/Greens Fairways Roughs	upon detection 24-48 hours 48-72 hours	spot treat 72 hours 96 hours
Dollar spot	Tees/Greens Fairways Roughs	24-48 hours 24-48 hours 48-72 hours	spot treat 72 hours 96 hours
Fairy ring	Tees/Greens Fairways Roughs	24-48 hours 24-48 hours 48-72 hours	72 hours 96 hours 120 hours
Fusarium patch/nivale	Tees/Greens Fairways Roughs	24-48 hours 24-48 hours 48-72 hours	spot treat spot treat 96 hours
Helminthosporium leaf spot	Tees/Greens Fairways Roughs	24-48 hours 24-48 hours 48-72 hours	spot treat spot treat 96 hours
Leaf rust	Tees/Greens Fairways Roughs	24-48 hours 24-48 hours 48-72 hours	spot treat spot treat 96 hours

Note: Currently there are no established industry standards for pest threshold guidelines. The following thresholds for insects, weeds, and disease are established as a preliminary guide to assist the golf course superintendent in deciding when to choose the appropriate form of control. We fully expect that local experience will result in the refinement of these threshold guidelines.

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Table 8. (continued)Preliminary Threshold Guidelines - Turfgrass Disease

Pest	Area	Cultural Management	Chemical Control
Moss	Tees/Greens Fairways Roughs	rake out rake out improve drainage	spot treat spot treat spot treat
Nematodes	Tees/Greens Fairways Roughs	sample counts sample counts sample counts	needle> 200/100 cc Soil lance> 200/100 cc Soil stunt> 800/100 cc Soil spiral> 3,000/100 cc Soil ring> 3,000/100 cc Soil
Pythium blights	Tees/Greens Fairways Roughs	upon detection upon detection 24-48 hours	preventive 24-48 hours 48-72 hours
Slime molds	Tees/Greens Fairways Roughs	upon detection 24-48 hours 48-72 hours	spot treat spot treat spot treat
Summer patch	Tees/Greens Fairways Roughs	24-48 hours 48-72 hours 48-72 hours	spot treat spot treat spot treat
Take all patch	Tees/Greens Fairways Roughs	upon detection upon detection upon detection	spot treat spot treat spot treat

Note: Currently there are no established industry standards for pest and nematode threshold guidelines. The following thresholds for insects, nematodes, weeds, and disease are established as a preliminary guide to assist the golf course superintendent in deciding when to choose the appropriate form of control. We fully expect that local experience will result in the refinement of these threshold guidelines.

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Table 9. Preliminary Threshold Guidelines - Turfgrass Insects*

		Insect Density	
Pest	Area	Cultural Controls	Curative Controls
Ant mounds	Greens/Tees Fairways Roughs	1-2/10 sq.ft. N/A N/A	>1-2/10 sq.ft N/A N/A
Black cutworm	Greens/Tees Fairways Roughs	1-2/sq. ft. 2-3/sq. ft. 3-4/sq. ft.	>2/sq. ft. >3/sq. ft. >4/sq. ft.
Sod webworms	Greens/Tees Fairways Roughs	1-2/sq. ft. 2-3/sq. ft. 3-4/sq. ft.	>2/sq. ft. >3/sq. ft. >4/sq. ft.
White grubs	Greens/Tees Fairways Roughs	3-4/sq. ft. 5-8/sq. ft. 8-10/sq. ft.	>4/sq. ft. >8/sq. ft. >10/sq. ft.

Note: Currently, there are no established industry standards for insect and mite pest thresholds for the pests found on this site. The following thresholds for insects and mites are established as a preliminary guide to assist the golf course superintendent in deciding when to choose the appropriate form of control. See Appendix A with Fact Sheets for additional information. We fully expect that local experience will result in the refinement of these threshold guidelines.

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Summary of Cultural/Mechanical Controls

The following will be used as inter-related cultural practices:

- The use of a mechanical spiker promotes root growth reducing the incidence of water puddling and provides beneficial oxygen to the crown area;
- Vertical mowers control excessive areas of thatch (more than 1" or 2.5 cm on fairways/roughs; more than 3/8" or 1.25 cm on tees; more than 1/4" or 1 cm on greens);
- Mechanical brushes will be used to provide upright shoot growth and prevent matting;.
- A coring machine or aerifier will be used to eliminate compacted soils and prepare the site for topdressing or overseeding;
- The use of a high pressure water injection aerifier will be used in periods of stress or when the practice may actually help reduce the need to apply a pesticide;
- A mechanical renovator on fairways and roughs will be used to control excessive thatch. Seeding or sodding will be used as a preventive means to control unwanted species of weeds wherever possible;
- Topdressing will be applied periodically to all tees and greens depending on the growth and thatch conditions of the respective areas. Wear patterns (divots) on tees will be topdressed and seeded. Markers will be moved daily to allow sufficient time for the surfaces to recover. This practice will help to eliminate the establishment of weeds that are the result of continual wear;
- Greens will be topdressed as deemed necessary by the golf course superintendent. The rate of top-dressing will be directly proportional to the need of controlling thatch or to achieve smoothness;

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- Topdressing material will be of the same material as specified in the original specification plan for new construction of golf course greens. The use of identical sand as supplied for original construction is preferred. The lack of an organic matter is permissible as long as the material is of the same particle size distribution, and
- Topdressing will be used to level playing surfaces, improve root structure when coring, control thatch, and protect new seedlings. Spot topdressing will be the practice for those areas in fairways with exposed native soils.

Chemical Controls

Occasionally, imbalances will require a traditional practice be employed to manage turf pests. When the systematic use of alternative management fails and no other measure will reduce the potential threat of turfgrass loss, it will be necessary to prevent further damage to healthy turf with the use of pesticides. Pesticides are the direct result of failures from other control measures including organic and organically synthesized materials.

a. Methods of Selecting Chemicals for the IGCM Plan

The chemical control tactic relies mainly on herbicides, fungicides, insecticides, and miticides. However, modern pesticides have changed dramatically in recent years, and special care must be taken to get the maximum efficacy out of them. As a first line of defense on this site, only pesticides with short residual activity periods (i.e. those which decompose rapidly) have been recommended. However, if stronger measures are warranted, trichlorfon (Proxol) and chlorpyrifos (Dursban) may be selected for spot treatments. Proxol will be used for spot treatment and is recommended during non-foraging periods to mitigate any adverse effects. The product breaks down rapidly in alkaline water. It is important to use water with a pH of 5.5-6.5 in order to prevent rapid breakdown and repeat applications. Non-conventional chemicals are also recommended. Examples are: Bt microbial toxins, insecticidal soaps, and parasitic nematodes that are recommended for insect and mite control.

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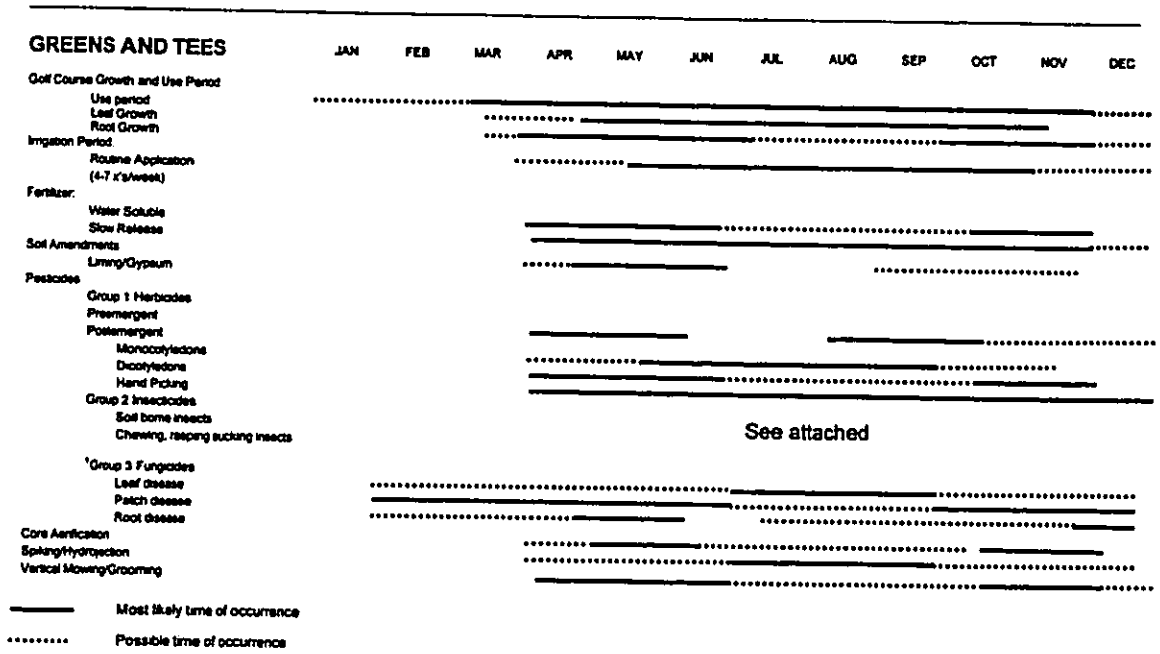
Implementation schedules that describe the most likely time for occupancy and a guideline for various levels of management are provided in Tables 10 and 11. Table 12 quantifies the specific chemical usage and the probable number of acres to be treated. The chemicals, rates, areas of application, and the pests treated are described as probable worst-case applications. The outlined quantities on Table 12 reflect as much as 50% more chemical product than what is actually anticipated during routine maintenance.

The critical selection process for each pesticide was based on local chemical effectiveness, registered product use in Hawaii, and regional experience. Environmental safety considerations were important in selecting chemicals for this plan. Sources used to obtain product information include scientific literature, environmental fate data, EPA pesticide registration standards, manufacturers' literature, (technical reports, material safety data sheets, product labels and fact sheets communications with manufacturers' representatives) and personal experience. Pertinent information was first taken from primary and secondary scientific literature. Sources obtained through interlibrary loan networks and/or industry periodicals were also used. The data coming from current literature and EPA reports were given preference over data provided by manufacturers.

Curative is the term used primarily in the description of control methods expected for use on the Ocean Bay Plantation At Hanama'ulu Golf Ccurse. Preventive describes techniques necessary to keep the inherent pest problem from becoming a major turf threat. The need for preventive measures will be determined by actual weather conditions, reliance on past disease impact, historic records, visual examinations, and the use of early detection kits such as "Reveal" (a ten-minute diagnostic test kit when disease is present). The favorable weather patterns found in the Oceanside area and the turfgrass performance of existing golf courses in the general area will help predict optimum growing conditions for turfgrass and periods of probable disease impact.

Wherever possible, weeds will be removed by hand. An ultra low-volume backpack sprayer will be used to apply spot treatment applications to those areas of disease, insects, and weeds above threshold limits. Ultra low-volume sprayers are very good for many broadleaf herbicides that are applied at low dosage and easily blend in water. Any pesticide applied as a wetable powder and/or at high applications may not work well in this type of sprayer. Pests that are slightly above threshold levels, but not excessive in population, will be treated with a proportioned droplet or a "wick type" spot applicator.

Table 10. Implementation Schedules - "High Maintenance" for the Ocean Bay Plantation At Hanama'ulu Golf Course



[1] Depending on temperatures and frost

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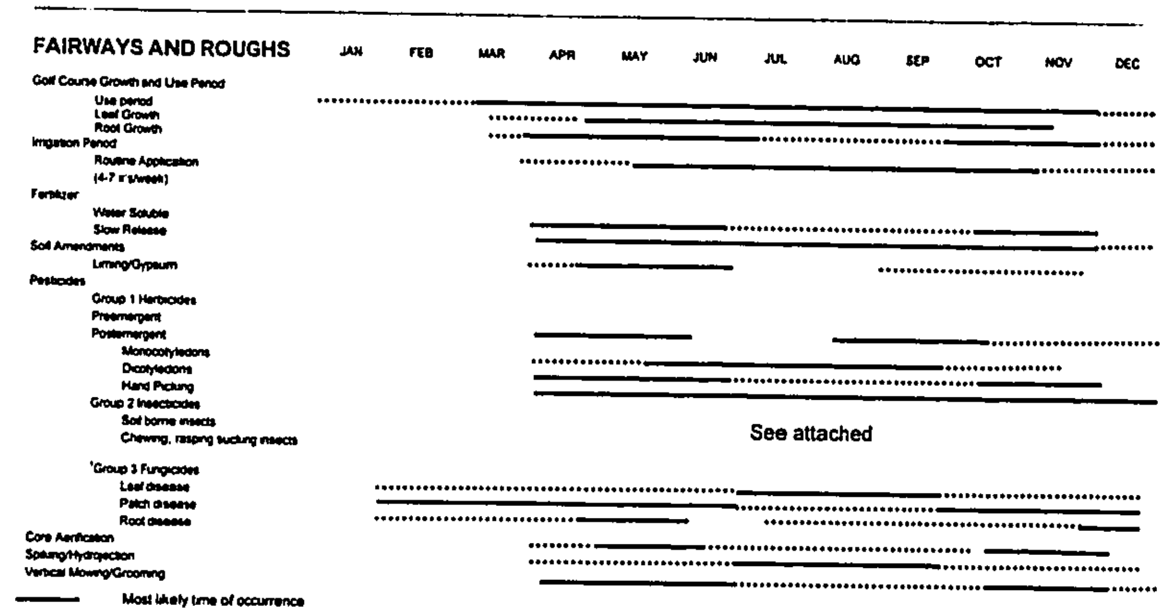
Table 11. Implementation Schedules - "Medium to Low Maintenance" for the Ocean Bay Plantation At Hanama'ulu Golf Course



[1] Depending on temperatures and frost formation.

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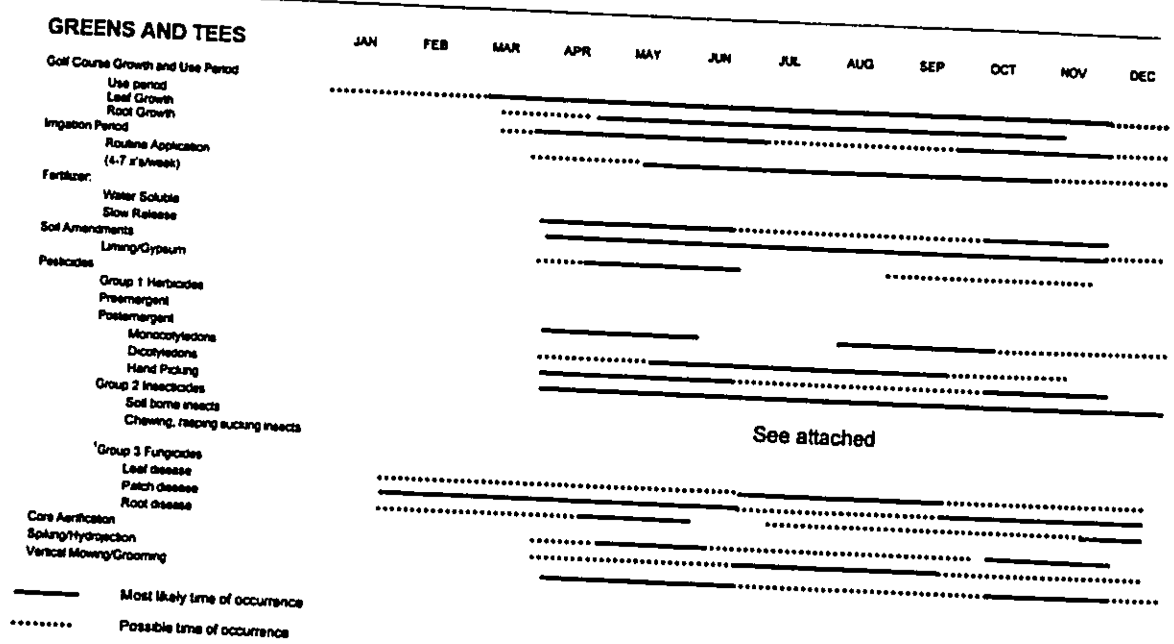
Table 10. Implementation Schedules - "High Maintenance" for the Ocean Bay Plantation At Hanama'ulu Golf Course



[1] Depending on temperatures and frost

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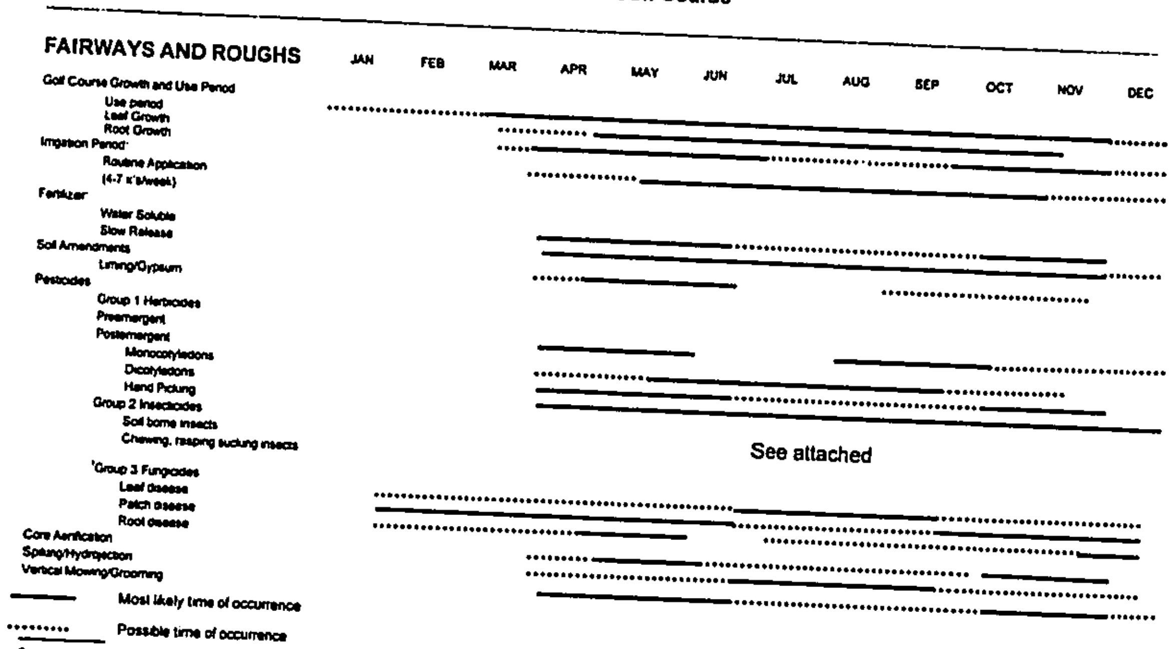
Table 11. Implementation Schedules - "Medium to Low Maintenance" for the Ocean Bay Plantation At Hanama'ulu Golf Course



[1] Depending on temperatures and frost formation.

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Table 12. Possible Pesticides usages with an Effective IPM Program

I. Herbicides (Greens/Tees/Fairways/Roughs) [1]

Common Name	Trade Name	Recom-ended Rate/ App. lb. a.i./Ac./Yr.	Projected No. of Apps/Yr (Maximum) lb.a.i./Ac.	Projected Maximum Total lbs. a.i./Ac./Yr.	Maximum Acres Treated	Areas Treated	Total lbs. a.i. used per year
Glyphosate	Roundup®	0.16	2 x's/yr	0.32	10.0	F R	3.2
Metribuzin	Sencor	0.75	2 x's/yr	1.5	25.0	T F R	37.5
MSMA	Monosodium methanearsonate	2.0	3 x's/yr	6.0	25.0	T F R	150.0
Imazaquin	Image	0.5	2 's/yr	1.0	10.0	T F R	10.0
Oxadiazon	Ronstar	4.0	2 's/yr	8.0	25.0	G T F R	200.0
Triclopyr [2]	Turflon® II Amine	0.20	1 x's/yr	0.20	5.00	F R	1.0
2-4-D	Trimec®	1.23	1 x's/yr	1.23	10.0	T F R	12.3
MCPP	Trimec®	0.65	1 x's/yr	0.65	10.0	T F R	6.5
Dicamba	Trimec®	0.14	1 x's/yr	0.12	10.0	T F R	1.2
Dicamba	Banvel®	0.50	1 x's/yr	0.50	5.0	F R	2.5
II. Insecticides (Greens/Tees/Fairways/Roughs)							
Bacillus thuringiensis	Bio-bit	0.25	1 x's/yr	0.25	15.00	F R	3.75
Isazofos	Triumph	2.00	1 x's/yr	1.00	8.00	G T	8.0
Parasitic Nematodes	Exhibit®	1B/Ac	2 x's/yr	2B/Ac	3.00	G	6.0
Potassium Salts of Fatty Acids	M-Pede®	1.35	1 x's/yr	1.35	15.00	T F R	20.25
Trichlorfon [3]	Proxol® 50 (wsp), Dylox®	8.00	1 x's/yr	8.00	3.00	G T	24.0
III. Fungicides (Greens/Tees/Fairways/Roughs)							
Chlorothalonil	Daconil 2787® (wdg)	8.00	2 x's/yr	16.00	3.00	G	48.0
Flutolanil [4]	ProStar® 50 WP	8.00	1 x's/yr	8.00	spot treat	G	8.0
Iprodione	Chipco® 26019 FLO	2.72	1 x's/yr	2.72	3.00	G	8.16
Mancozeb	Fore®	17.00	1 x's/yr	17.00	6.00	T G	102.0
Metalaxyl	Subdue® 2E	1.36	1 x's/yr	1.36	3.00	G	4.08
Triadimefon	Bayleton® 25 (wsp)	5.50	2 x's/yr	11.00	3.00	G	33.0

Note: These products have been selected to illustrate turfgrass management using IPM. It is anticipated that field monitoring will substantiate diseases as the most persistent turfgrass pest with potential problems arising from turfgrass weeds and to a lessor extent insects. WSG = water soluble granulars. WSP = water soluble packets. WDG = water dispersible granule

1. Preemergent herbicides may not be necessary for two growing seasons.
2. Post emergent herbicide used as spot treatment only.
3. May only be necessary if organically synthesized products fail.
4. Necessary during grow-in for patch type diseases.
5. Used for fairy ring control during grow-in.

Use areas and rates must comply with label recommenation. Label must be read prior to use.

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PESTICIDE USE RECOMMENDATIONS

The following policy will be used when applying pesticides.

- The pest will be properly identified. The use of disease, insect, and weed identification guides will be used. Diagnostic aid kits will be used on pathogens for which they have been developed;
- University Extension Service will be used to identify any unknown pathogens;
- The golf course superintendent will identify and document when the agreed-upon threshold limit of pest activity has been exceeded;
- Environmental conditions will be reviewed and altered if possible to reduce unfavorable conditioning triggers, pest activity (i.e. reduce shade);
- Cultural controls appropriate to the turf related problem will be used to reduce impact (i.e. fertilizers, leaching of salts, removal of mycelium, etc.);
- Mechanical practices (aerifying, spiking, verticutting, etc.) will be considered to help reduce and improve turf under stress;
- A pesticide application will be made when there is no alternative measure for control;
- The a.tual application of a pesticide will be made under the direction of a certified, licensed applicator;
- The golf course superintendent or his designated applicator will be licensed in the following qualified Hawaii pesticide applicator categories: Laws and Regulations, Aquatic, and Landscape Maintenance.
- All pesticide applications will be made in accordance with label specifications;
- In order to minimize drift from the target area, applications will not be made in winds in excess of 5 mph unless a spray shroud is used. Documentation may be verified by the Environmental Pestcaster or similar weather monitoring station;

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- No pesticide will be applied within the native grass areas or in areas of influence to the intermittent streams.
- The applicator will adhere to all label specifications for loading, mixing, and applying the compound. All protective clothing as specified by the label will be worn by the applicator;
- Liquid application of a pesticide will be made using a low pressure boom type sprayer with the boom height no higher than 18" to further minimize drift;
- The use of low-volume hollow-cone nozzles and applicator spray shields will be installed on the spray boom, and
- Notification of the application of a pesticide will be made in accordance with Hawaii State Posting Laws.

The golf course superintendent will be responsible for the administration of the above policies.

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Sammy Yoshimura
SIGNATURE OF OPERATOR

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