FINAL ENVIRONMENTAL IMPACT STATEMENT

FOR THE INSTALLATION OF PERMANENT AND DAY-USE MOORINGS IN 'ANAEHO'OMALU BAY, SOUTH KOHALA, HAWAII

Prepared for
WAIKOLOA DEVELOPMENT COMPANY
P.O. Box 3028
Waikoloa, Hawaii 96743-3028
Telephone: 883-9661

Prepared by
BELT COLLINS & ASSOCIATES
680 Ala Moana Boulevard, Suite 200
Honolulu, Hawaii 96813
Telephone: 521-5361

For Submission to the
BOARD OF LAND AND NATURAL RESOURCES
STATE OF HAWAII

June 1990

FINAL ENVIRONMENTAL IMPACT STATEMENT

FOR THE INSTALLATION OF PERMANENT AND DAY-USE MOORINGS IN 'ANAEHO'OMALU BAY, SOUTH KOHALA, HAWAII

Prepared for
WAIKOLOA DEVELOPMENT COMPANY
P.O. Box 3028
Waikoloa, Hawaii 96743-3028
Telephone: 883-9661

Prepared by
BELT COLLINS & ASSOCIATES
680 Ala Moana Boulevard, Suite 200
Honolulu, Hawaii 96813
Telephone: 521-5361

For Submission to the
BOARD OF LAND AND NATURAL RESOURCES
STATE OF HAWAII

June 1990

FINAL ENVIRONMENTAL IMPACT STATEMENT

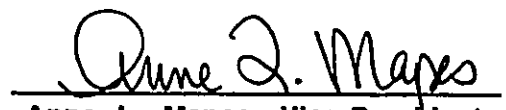
FOR THE INSTALLATION OF PERMANENT AND DAY-USE MOORINGS IN 'ANAEHO'OMALU BAY, SOUTH KOHALA, HAWAII

Prepared for
WAIKOLOA DEVELOPMENT COMPANY
P.O. Box 3028
Waikoloa, Hawaii 96743-3028
Telephone: 883-9661

Prepared by
BELT COLLINS & ASSOCIATES
680 Ala Moana Boulevard, Suite 200
Honolulu, Hawaii 96813
Telephone: 521-5361

For Submission to the
BOARD OF LAND AND NATURAL RESOURCES
STATE OF HAWAII

Submitted by



Anne L. Mapes, Vice-President
Belt Collins & Associates, Ltd.

June 1990

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

CHAPTER 1

INTRODUCTION AND SUMMARY

1.1 PURPOSE OF THIS DOCUMENT

This environmental impact statement has been prepared to accompany an application for a Conservation District Use Permit submitted by the Waikoloa Development Company to the State Department of Land and Natural Resources. The environmental impact statement is being prepared in compliance with the requirements of Chapter 343, Hawaii Revised Statutes, and the regulations adopted thereof.

1.2 PROPOSED GOVERNMENTAL ACTION

The Waikoloa Development Company is requesting a conditional use in the Resource (R) subzone. The applicant is seeking an easement over portions of the ocean floor owned by the State of Hawaii for the attachment of 10 moorings, as well as a permit to allow beach transiting.

1.3 PROJECT DESCRIPTION

The Waikoloa Development Company proposes that 5 permanent moorings and 5 transient or day-use moorings be installed in 'Anaeho'omalu Bay. *'Anaeho'omalu Bay is makai* of the Ku'uali'i Fishpond and the Royal Waikoloan Hotel at the Waikoloa Resort (see Figure 1). Locations of the proposed moorings are shown in Figure 2; the circles illustrate the swing of the mooring line around each anchor. The permanent moorings will be for recreational vessels used by mostly guests of Waikoloa Beach Resort, which presently includes two hotels--the Royal Waikoloan on 'Anaeho'omalu Bay and the Hyatt Regency Waikoloa on Waiulua Bay.

Five moorings and the stern mooring will be for boats operated by concessionaires of the Waikoloa Beach Association or WBA (WBA comprises the oceanfront property owners at Waikoloa Beach Resort and is responsible for managing beach related activities.). All of the transient moorings will be for public use on a first come-first served basis.

In addition to installing and caring for the moorings, Waikoloa Development Company will abide by the rules of the Statewide Ocean Recreation Management Plan. Under the State Plan, swimming is allowed throughout the bay. The plan designates zones for swimming only which are off-limits to boats and windsurfers.

The proposed project also includes beach transiting for boat passengers.

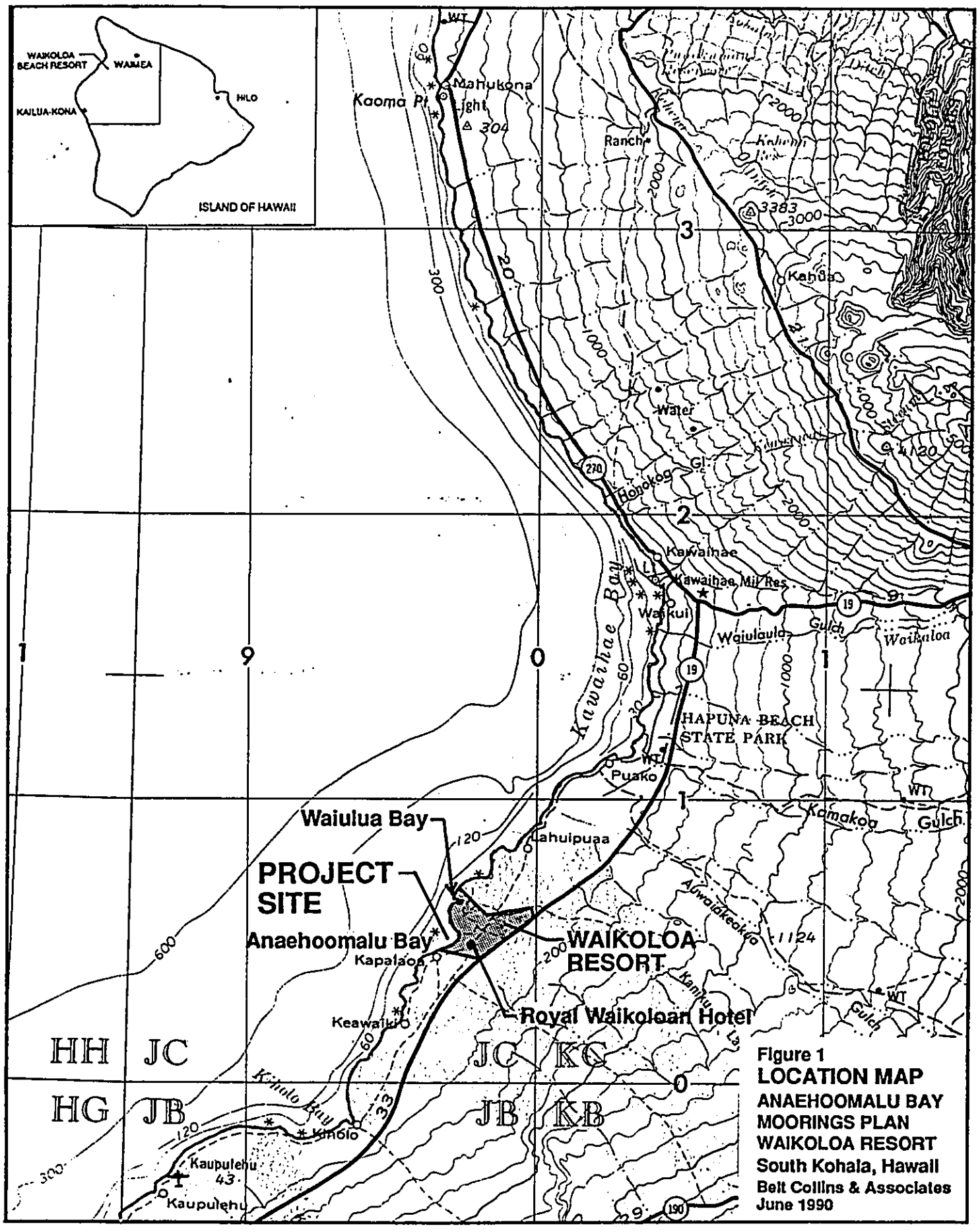
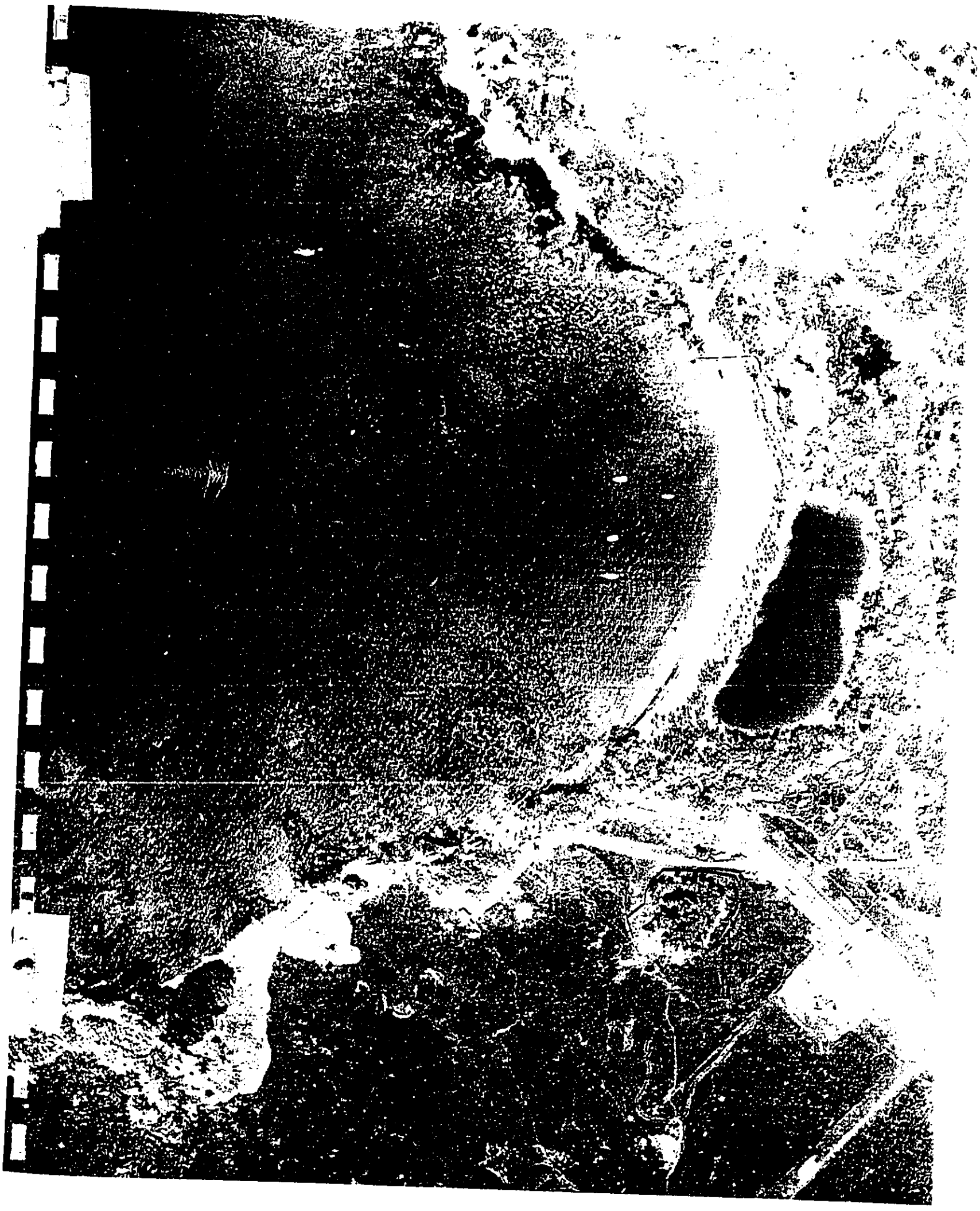


Figure 1
LOCATION MAP
ANAEHOOMALU BAY
MOORINGS PLAN
WAIKOLOA RESORT
South Kohala, Hawaii
Belt Collins & Associates
June 1990



1.4 NEED FOR THE PROJECT

The Waikoloa Development Company's objective for this project is to provide moorings for both commercial and private recreational boats in an area of the Big Island that lacks adequate mooring locations. The two State mooring areas approved for the Big Island by the Department of Transportation in 1980 are in Keauhou and Hilo. Neither is within close proximity to 'Anaeho'omalu. Moorings requested outside of the approved areas need to be considered on a case by case basis.

Another objective is to minimize adverse impacts on the marine environment, corals specifically, by offering an alternative (permanent moorings) to dropping anchor.

The project would also provide a recreational amenity for public and commercial users.

1.5 SUMMARY OF IMPACTS

1.5.1 PHYSICAL/BIOLOGICAL ENVIRONMENT

The proposed permanent and day-use moorings will be installed with minimal disturbance to the substrata. Coral heads will probably have to be removed on a selective and limited basis, but in general, the impact on the physical and biological environment will be *less* than present conditions because the availability of public moorings would reduce the potential for anchor damage to coral. No adverse impacts on nearshore water quality or biota are expected. There will be little or no impact on the resident turtle population. There is insufficient information to determine the potential impact of increased boating activity on humpback whales.

1.5.2 SOCIOECONOMIC CONSIDERATIONS

No adverse socioeconomic impacts are anticipated.

1.6 SUMMARY OF PROPOSED MITIGATION MEASURES

The use of existing moorings has resulted in no negative impact on marine communities. With an increase in proposed moorings (5 additional moorings for public day-use), all vessels will continue to comply with Coast Guard regulations. Furthermore, all WBA concessionaire boat operators will be required to adhere to rules and regulations promulgated by the Waikoloa Development Company, in cooperation with concessionaires. The Waikoloa Development Company will be responsible for monitoring the maintenance of the moorings and assist the Department of Transportation in enforcing rules and regulations, as appropriate. To minimize possible impacts of boating activities on whales in the area, boat operators will be required to adhere to rules that are similar to those of the Hawaii Whalewatching Association and guidelines of the National Marine Fisheries Service.

1.7 SUMMARY OF ALTERNATIVES

In addition to the proposed alternative, several other alternatives were considered and rejected as not meeting Waikoloa Development Company's objective: to provide moorings for commercial and recreational boats in 'Anaeho'omalu Bay. These alternatives include:

Locating other suitable mooring sites

Separate applications from each boat operator

Installing only day-use moorings

Other mooring methods and designs

1.8 SUMMARY OF UNRESOLVED ISSUES

Impact of increased boating activity on humpback whale.

1.9 SUMMARY OF COMPATIBILITY WITH LAND USE PLANS AND POLICIES

The project is basically consistent with State and County land use plans and policies.

1.10 NECESSARY APPROVALS AND PERMITS

Approval Needed	Approving Agency	Status
Conservation District Use Permit	State Dept. of Land & Natural Resources	Pending
Permit for Work in Shore Waters	State Dept. of Transportation	To be obtained after CDU Permit is granted
Department of the Army Permit	U.S. Army Corps of Engineers	Approved
Coastal Zone Management Consistency Certification	Office of State Planning	Approved

CHAPTER 2

DESCRIPTION OF PROPOSED PROJECT AND BACKGROUND

2.1 THE SETTING

'Anaeho'omalu Bay is on the South Kohala coast of the Island of Hawaii just south of the Mauna Lani Resort. Fronting 'Anaeho'omalu Bay is the Royal Waikoloan Hotel, with the Hyatt Regency Waikoloa Hotel directly north on Waiulua Bay. These two hotels are part of the Waikoloa Beach Resort, which is owned by the Waikoloa Development Company (formerly the Transcontinental Development Company).

2.2 HISTORY

'Anaeho'omalu Bay is a crescent-shaped beach with relatively protected waters and coral reefs. Two fishponds and the Royal Waikoloan Hotel are located mauka of the beach.

A wide range of recreational activities occur near and at the bay: recreational fishing, swimming, sunbathing, picnicking, snorkeling, scuba diving, windsurfing, surfing, boating, and sailing.

There are several temporary small boat moorings which add to the diversity of recreational activities available at the bay. The expansion of resort facilities at the Waikoloa Beach Resort has highlighted the need for permanent moorings, both for commercial use and public day-use.

'Anaeho'omalu Bay is a part of an area on the Big Island that lacks adequate mooring locations. In 1980, the Department of Transportation designated mooring areas for the State. The two approved for the Big Island were located at Keauhou and Hilo. Neither mooring area is within close proximity to 'Anaeho'omalu. Also, we understand that there are currently no permanent spaces available at Honokohau and Kawaihae Harbors (February 5, 1990 letter from Calvin M. Tsuda to Anne Mapes - see Chapter 9 of this EIS). In 1988, the Hyatt Regency Waikoloa boat concessionaire, Nick's Aqua Sports Waikoloa Ltd., dba Red Sail Sports, applied for permanent mooring permits at both Kawaihae and Honokohau, as well as temporary mooring permits at Kawaihae harbor, but formally withdrew these permits, choosing to remain on the list for permanent moorings at that harbor (July 20, 1989 letter from Mr. Tom Posey, Director of Operations for Red Sails Sports to Mr. Ian Birnie, District Manager of Department of Transportation, Harbors Division). Jeff McConnel, of Captain Nemo's Ocean Sports, has a slip in Honokohau and is on the wait list for a second berth in his own name (February 5, 1990 letter).

From 1981 to the present, Captain Nemo's Ocean Sports has provided beach services and ocean recreational activities at 'Anaeho'omalu Bay under a concession license agreement with the WBA.

The cost of beach cleaning, maintenance, and security is funded by assessments paid by WBA members. Throughout this period, the boating public has used the bay as temporary anchorage without compensation to either the State or the ocean-front property owners.

Concession fees are paid to the WBA for the right to do business on private property and through hotel operations. Credit is given against the fees for advertising which promotes the Waikoloa Beach Resort in addition to the specific services offered.

About half of Captain Nemo's revenues are derived from glass bottom boat, sailing, scuba diving, and catamaran cruises and charters. The other half is from the rental of diving equipment and beach gear, windsurfer and sailboat lessons and rentals, and the sale of tanning products. In 1988, a second concessionaire, Nick's Aqua Sports, was licensed to operate at 'Anaeho'omalu by the WBA. This operation is restricted to catamaran and dive boat cruise operations. For both operators, revenues are seasonal, reflecting trends in hotel occupancy and management. There are also periods when the primary vessels are in dry dock for major repairs and overhaul.

Customers of the Waikoloa Beach Resort concessionaires are primarily hotel guests. Since the beach is used by the public, local residents and tourists from other hotels also take advantage of the ocean recreation opportunities. For example, Captain Nemo's Ocean Sports estimates that nearly half of the revenues in the non-peak tourism periods come from Big Island residents. The concessionaire also offers field trips for children's groups. There is adequate public parking to accommodate these users (78 stalls plus space for expansion), as well as public restroom and shower facilities--all provided by the Waikoloa Development Company (WDC) and maintained by the WBA.

2.3 PROJECT DESCRIPTION

2.3.1 PROJECT OBJECTIVES

The project objectives are as follows:

to provide moorings for both commercial and public recreational boats in an area which lacks sufficient mooring locations; and

to minimize impacts on the marine environment within the bay by offering an alternative to dropping anchor.

2.3.2 PROJECT CONCEPT

Moorings at 'Anaeho'omalu will accommodate the needs of visitors at the Waikoloa Beach Resort and those of the public. Frequent moderate to rough sea conditions in Waiulua Bay, which fronts a Waikoloa Beach Resort hotel complex (Hyatt Regency), preclude any long-term mooring of boats in that bay.

The plan proposed by the Waikoloa Development Company features the installation of 5 permanent moorings and 5 transient or day-use moorings in 'Anaeho'omalu Bay. All of the proposed moorings will be installed in sand or sand/rubble substrate where biological diversity is the lowest.

The 5 permanent moorings will be used by commercial concessionaires under agreement with the WBA. The public day-use moorings will most likely be used by small dive boats and by sailboats.

The WBA will be responsible for installing and maintaining the moorings and for enforcing agreements with the concessionaires. Clauses will include measures to protect the bay environment such as the prohibition of live-aboards, the prohibition of dumping fuel and wastes into the water and rules to prevent whale harassment.

Passengers will transit the beach to the shoreline at the end of the ingress/egress zone. Loading and unloading of passengers will take place in the water within the ingress/egress zone.

2.3.3 BOATS TO BE MOORED

The boats to be moored are described in Table 1, which lists vessel length and type, draft, mooring requirements, vessel capacity, and frequency of loading/unloading passengers on the beach.

2.3.4 PROPOSED MOORING LOCATIONS AND METHODS

The factors to be considered in selecting mooring locations and methods are:

Type and size of boat,
Wave force and height,
Substratum, and
Water depth.

All of the proposed permanent moorings will be located in the middle section of the bay which is protected by a shallow outer reef. They will be installed in sand or sand/rubble substrate where biological diversity is the lowest. Anchors will be designed to withstand extreme wave action, and the size of boats using the moorings will be limited. Care will be taken to avoid impact of anchors, lines, and chains on living coral.

Five day-use moorings will also be situated in or near the middle section of the bay. An additional designated anchoring area will be situated outside of the outer reef in a sand pocket surrounded by an area particularly rich in biota and which offers good diving and snorkeling opportunities. Mooring sites will be selected to assure that mooring cables neither interfere with navigation nor damage live coral.

Given the sand/rubble substrate, four alternative mooring methods can be considered:

1. Marine biologist Richard Brock, who has conducted a survey of the bay, recommends heavy concrete blocks. The conventional trapezoidal shape of these anchors roughly mimics the form of the dominant coral species, *Porites lobata.* In addition, concrete serves as a suitable substratum for the settlement of many invertebrate and algal species. According to Brock, the placement of these blocks would provide sites for the possible establishment of corals and associated fish species where none presently exist.

TABLE 1. TYPES OF VESSELS TO BE PERMANENTLY MOORED AT 'ANAEHO'OMALU BAY

Vessel Length/Type	Draft (ft)	Mooring Requirements*		Vessel Capacity Passengers	Vessel Capacity Crew	No. of Trips to Beach Per Day	Minutes Spent on Beach Per Trip
A. Up to 65' Catamaran	6	Deep	R=90'	49	6	2	15-30
B. 26' Monohull	5	Deep	R=50'	4	1	2	15-30
C. 26' Glass Bottom Boat	2	Shallow	R=50'	16	4	2	15-30
D. Up to 50' Catamaran	5	Deep	R=90'	49	6	2	15-30
E. 40' Dive Boat	5	Shallow	R=60'	20	4	2	15-30
F. Stern Mooring (near ingress/egress)	5	Shallow	Linear	Not Applicable	Not Applicable	**	**

* Refers to the depth of water required at the mooring site, as well as the radius (R) of the area needed to accommodate the circular movement of the boat on the mooring line.

** Used to secure vessels during loading and unloading on the shore in periods of strong surge or surf.

2. If sand cover at a proposed mooring site is shallow, it may be possible to penetrate the sand and fasten an eyebolt to the hard substrate below. A hard substratum, either limestone or basalt, would be necessary to use what is known as the Halas mooring system. Developed by John Halas of the Key Largo National Marine Sanctuary in Florida, this system involves inserting a stainless steel eyebolt into a hole drilled into the substratum; a polypropylene line attached to the eyebolt is then connected to a mooring buoy.

   The Halas mooring system has been adapted to Hawaiian conditions by the University of Hawaii Sea Grant College Program and Hawaii Institute of Geophysics (HIG). Tests at Honokohau Harbor have indicated that an eyebolt in lava can hold at least 4,000 pounds. Material costs are low - about $100 per mooring, including the eyebolt, Parabond anchor capsule (an epoxy that is supposed to have a holding strength of 20,000 pounds or more), line, and buoy. Compared with other mooring methods, the eyebolt poses the least potential for damage to environmentally sensitive benthic communities.

   However, sand probing by Brock at the proposed mooring sites in 'Anaeho'omalu Bay indicates that hard substratum is not present. Unless appropriate substratum is encountered during site preparation, a more conventional mooring design will have to be used.

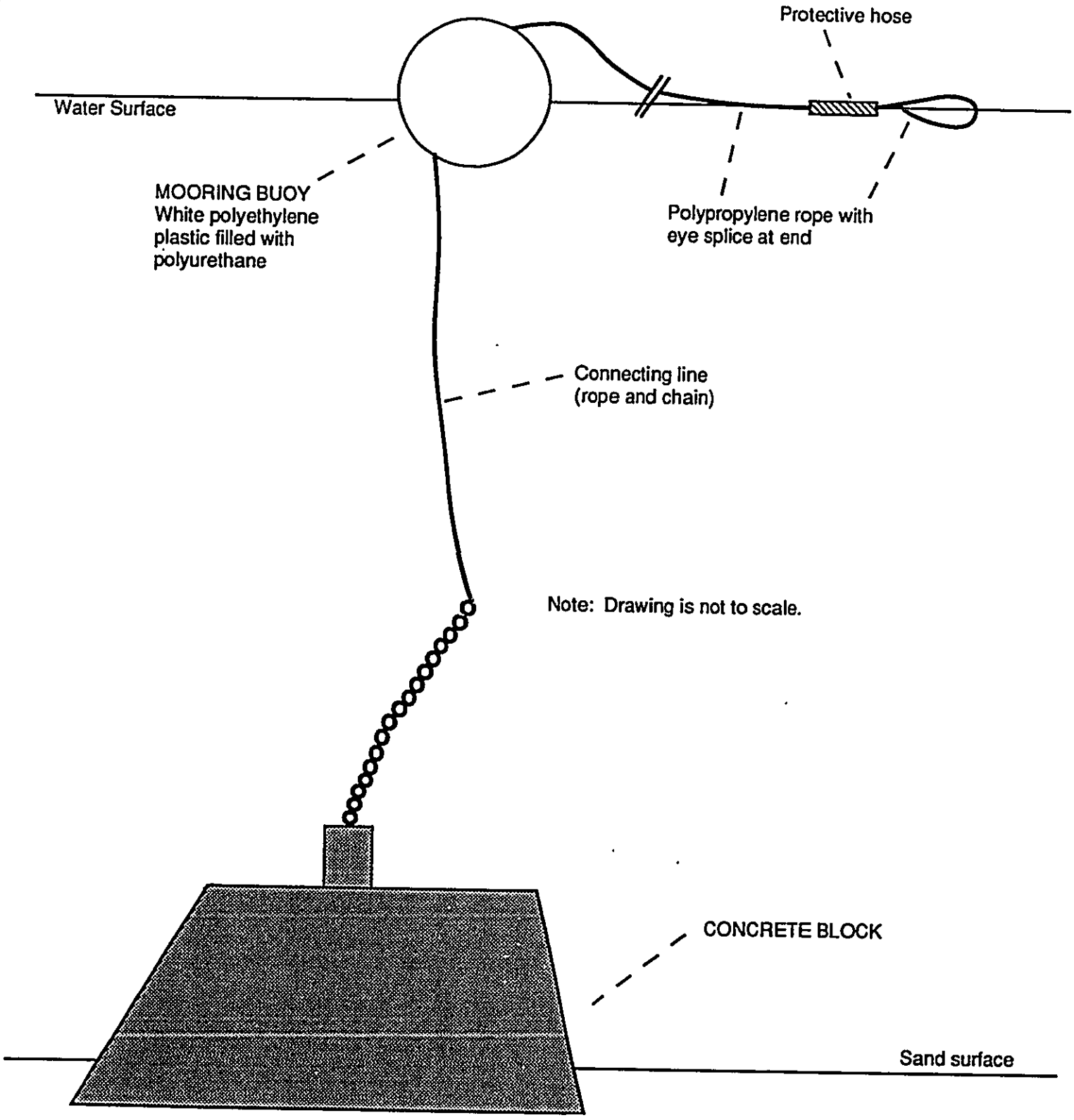
3. An alternative to concrete blocks is to use the Halas technique to secure mooring pins in large boulders. Boulders have two advantages: they are less likely to move in strong currents and waves and damage coral in the vicinity, and they blend in with the surroundings.

4. Ray Tabata of Sea Grant suggests trying screw anchors in sand substrate. John Halas has successfully deployed similar devices for mooring in sand. Preliminary tests have been carried out by HIG and Sea Grant with 8-inch diameter screw anchors in the shallow, fine sand off Makai Pier at Makapu'u. Future tests in coarser, deeper sand are planned. Screw anchors could also be used to anchor down concrete blocks in areas where the blocks are apt to be lifted by heavy waves or surge.

The first alternative listed above--heavy concrete blocks or anchors--will be used in 'Anaeho'omalu Bay, as recommended by Brock. A schematic drawing of this method is shown in Figure 3. The components of the unit would consist of a mooring buoy and pickup line, concrete block, and connecting line/chain between the mooring buoy and concrete block. To prevent any movement of the block in high surge conditions, it would be partially submerged in the sand.

The polypropylene rope would be 2 cm in diameter with a protective hose and eye splice at the end. The mooring buoy would be about 46 cm wide, striped for visibility, and made of white polyethylene plastic filled with polyurethane. The size and density of the concrete block or anchor will be appropriate for the proposed vessels. Consultation will be sought with TORCH and Sea Grant before specifications are finalized and moorings installed.

FIGURE 3. Schematic Drawing of Proposed Mooring System



2.3.5 BOATING OPERATIONS

With the installation of the proposed moorings, passengers will be picked up and dropped off by the concessionaires within the ingress/egress zone designated in the State Ocean Recreation Management Plan. A dinghy will be used to shuttle passengers between the nearshore area and the moored vessels unable to approach the beach.

Landings, loading/unloading of passengers, and resupplying will take place in waters makai of the shoreline within the ingress/egress zone. Guests will cross the beach, transit the shoreline and wade to the dinghy which shuttles them out to the catamaran, glass bottom boat, or other vessel. Passengers may be carrying snorkeling or scuba diving gear, including masks and snorkels, fins, and tanks. This will not interfere with other activities since it will take place in an area set aside for boat traffic and is outside of the exclusive zones for swimming and snorkeling as designated by the State Ocean Recreation Management Plan. These zones, characterized by diverse high coral coverage, have traditionally been used for swimming and snorkeling.

No fueling now takes place in 'Anaeho'omalu Bay, nor will it after the permanent and day-use moorings are installed; the concessionaires' boats are fueled at Kawaihae. There are no jet ski or parasail operations in the bay, and no plans for such operations exist. Under the State's Ocean Recreation Management Plan, the bay is not designated for these uses.

2.3.6 ADMINISTRATION OF MOORINGS

The Draft EIS included a management plan whereby the Waikoloa Development Company (WDC) would be responsible for the overall management of the proposed moorings in 'Anaeho'omalu Bay. *Following comments received during review of the Draft document and the BLNR public hearing,* and conversations with DOT Harbors Division and DLNR representatives, the applicant has decided to omit the management plan from the scope of this EIS.

The applicant recognizes that the management of offshore moorings is the responsibility of DOT and that any management plan would have to be in compliance with the statutory requirements of Sect. 266-16 in the State Statutes, revised by Act 379. Under this act, the Legislature has provided that no person could anchor or moor a vessel of any type on State waters without a permit from DOT.

If the applicant is successful in obtaining a CDU Permit, it will then seek the appropriate permits from DOT, which would decide which moorings would be assigned to the Waikoloa Beach Association (WBA) and which moorings would be for public day-use (these boats could be moored overnight or even up to 3 days, following State standards).

Ongoing discussions with DOT Harbors Division indicate that DOT would likely assign a number of moorings to WBA, which in turn would enter into agreements with commercial concessionaires for the use of these moorings. Although WBA would be responsible for installing and maintaining the public day-use moorings, it would have no control over their use. The public moorings would be available on a first-come/first-served basis.

If appropriate, the applicant will seek an easement from the State for use of the ocean bottom under the moorings. Any fees to DLNR and DOT will be paid by the applicant.

The applicant will follow the State Ocean Recreation Management Plan as it pertains to 'Anaeho'omalu Bay. WBA's role in management and enforcement of rules, as presented in the Draft EIS, has been modified as a result of discussions with various State agency representatives. Rules will be enforced by the DOT marine patrol unit and WBA's role is reduced to an auxiliary one to government enforcement entities. The applicant will work with DLNR and DOT officials and staff to define public and private responsibilities in the enforcement of an overall recreation management plan for the bay.

CHAPTER 3

DESCRIPTION OF AFFECTED ENVIRONMENT AND PROBABLE ENVIRONMENTAL IMPACTS

3.1 PHYSICAL ENVIRONMENT

3.1.1 EXISTING CONDITIONS

3.1.1.1 General Description

The proposed mooring facilities will be located in the nearshore waters of 'Anaeho'omalu Bay, an area covering approximately two acres. 'Anaeho'omalu, the site of the Royal Waikoloan Hotel, features a crescent-shaped sand beach, with two large fishponds situated behind the beach.

The project site itself (middle of the bay) has rather sparse coral growth; but along the lava rock shoreline at the edges of the bay, the coral reef formations are richer. There is also a reef at the mouth of the bay.

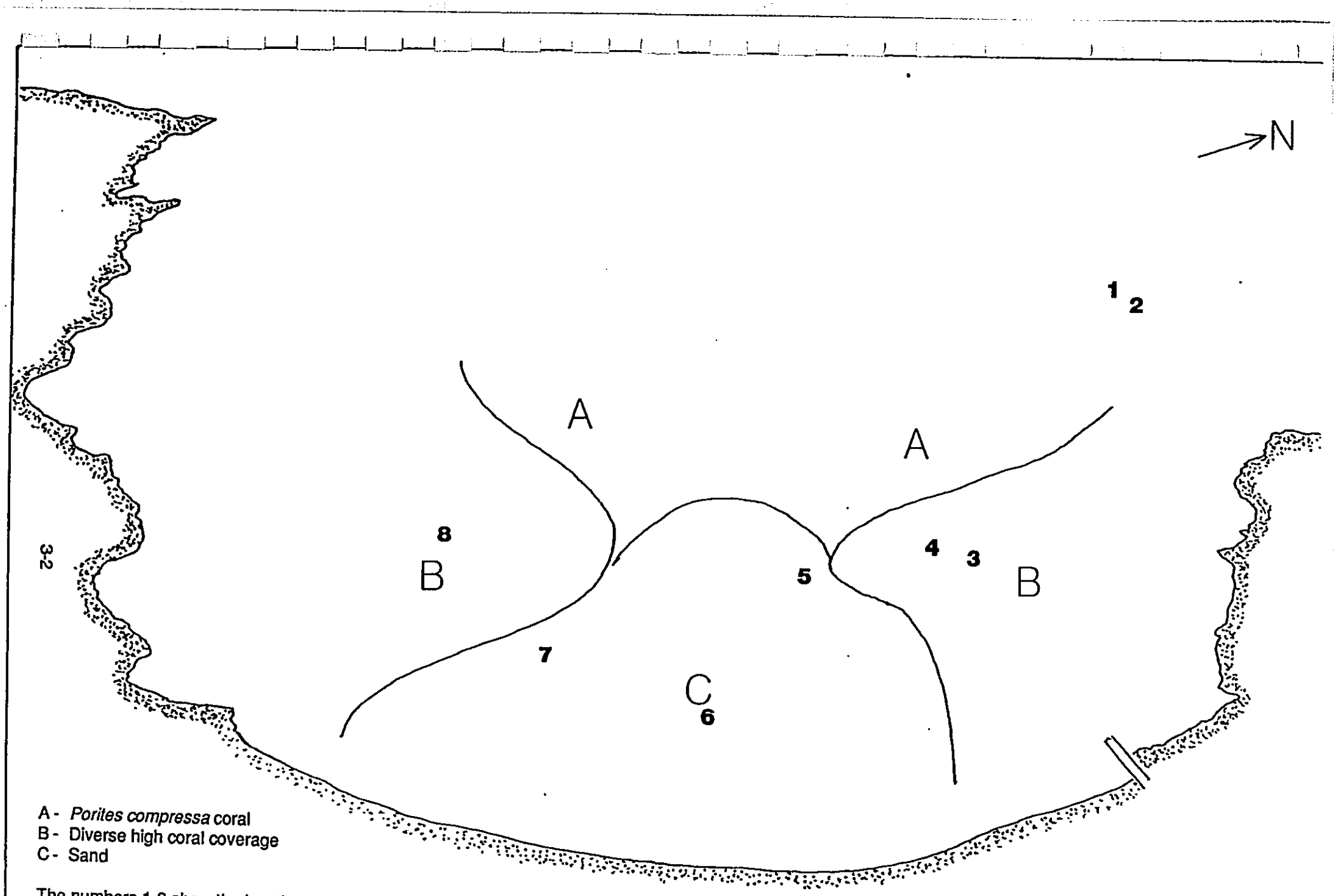
3.1.1.2 Substrate

Dr. Richard E. Brock conducted a biological survey of 'Anaeho'omalu Bay in July 1988 (see Appendix B). In this study, Dr. Brock identifies three "biotopes" in the survey area (see Figure 4). "A" indicates the biotope of *Porites compressa* coral, which comprises the middle, seaward section of the bay and continues into deeper water outside the survey area. Biotope "B", located in the northern and southern sections of the bay, is characterized by diverse high coral coverage. The middle section of the bay just offshore from the beach to the 6-meter isobath is the sand biotope ("C").

Four of the proposed moorings will be located in the sand biotope (moorings A, C, D and E in Figure 2). Scattered across this biotope are small areas of coral; these are most abundant adjacent to the biotope of diverse high coral coverage. According to Brock, live coral probably accounts for *less than 3 percent* of the substratum. In addition, small areas of rubble and dead coral comprise a minor part of the substratum in the sand biotope.

Six moorings will be situated in the transition zone between the biotope of diverse high coral coverage and the sand biotope (mooring B and 3 day-use moorings in Figure 2). Two day-use moorings will be in a transition zone bordering on the *Porites compressa* biotope. Every effort will be made to place these moorings in sand and to minimize the disturbance of live coral. An additional designated anchorage area will be in a relatively large sand pocket within the *Porites compressa* biotope.

To help determine the most effective design for a mooring at a given location, Brock mapped the substratum types and apparent sand depth at various proposed mooring sites. The results of the sand probing indicate that appropriate exposed hard substratum is not present in the areas tested; hence, the Halas design cannot be used.



A - *Porites compressa* coral
B - Diverse high coral coverage
C - Sand

The numbers 1-8 show the locations of the stations established to sample these biotopes. The scale in the foreground is approximately 1 cm = 20 m.

Source: Brock, September 1988.

FIGURE 4
'ANAEHO'OMALU BAY BIOTOPES

3.1.1.3 Topography/Bathymetry

The beach at 'Anaeho'omalu Bay is composed of a well-developed sand berm along its entire length, about 6.5 feet above sea level. It has a rather steep foreslope; the sand slopes seaward at a maximum angle of 30 degrees and levels out to 10 degrees at the high water line. The back slope ranges from 5 to 10 degrees. Within the bay, the sea floor is of relatively uniform depth. Depth in the project area does not exceed three fathoms (18 feet). The cove within 'Anaeho'omalu Bay is sheltered from the open ocean by a fringing coral reef. (Waikoloa Beach Resort EIS, 1976)

3.1.1.4 Water Levels (Tides and Waves)

The normal tidal range in a day is about 2 feet; the higher of the two daily tides averages 1.2 feet above mean sea level, and the maximum is +2 feet above mean sea level. The minimum and maximum daily tidal ranges are 0.5 and in the order of 3 feet, respectively. Four major wave types occur in Hawaiian waters. The South Kohala coast is shielded from direct exposure to two of these, the North Pacific swell (generated by far-off storms) and the northeast-tradewind wave (which occurs throughout the year). When these waves predominate, the coast is characteristically calm.

However, South Kohala is relatively unprotected from the Kona storms and the southern swells. Generated by nearby storms southwest of the islands, Kona storm waves are typically 8 to 15 feet, but under unusually severe conditions, may reach heights of 25 feet. Southern swells, which originate in the Southern Hemisphere or Western Pacific, can also produce high-breaking waves. Heavy surf conditions with swells between 8 to 12 feet have been observed at 'Anaeho'omalu (Mann, 1976, as reported in the Waikoloa Beach Resort EIS, 1976).

Like other coastal areas in Hawaii, 'Anaeho'omalu is subject to the effects of occasional tsunamis. Of 85 tsunamis observed since 1931, the 1946 wave was the greatest in magnitude. Runups recorded along the South Kohala coast during this event define the elevations below which the area might be considered vulnerable to a severe tsunami, and above which the risk is minimal. At Kawaihae, runup was 12 feet above mean low, low water.

If an earthquake were to occur west or southwest of Hawaii, inundations in South Kohala would exceed those of the 1946 wave, which originated in the Aleutians to the north. A flood hazard area map for the Puako-'Anaeho'omalu area, published by the U.S. Army Corps of Engineers and DLNR (September 1973), shows the 100-year tsunami height at the shoreline at 15 feet. (Waikoloa Beach Resort EIS, 1976).

3.1.1.5 Water Currents/Circulation

On the leeward coast of the Big Island, the current on a rising tide is to the north and tends to move toward the coast, with a nearshore velocity of about 0.4 knots. Clockwise eddies are produced in bays such as 'Anaeho'omalu by this current. On a falling tide, the current reverses and weakens (to about 0.1 or 0.2 knots), tending to produce counterclockwise eddies in the bays. Thus, the net current drift is northward along the coast. (Waikoloa Beach Resort EIS, 1976)

3.1.1.6 Salinity

Extensive portions of 'Anaeho'omalu Bay have been found to have water of relatively low salinity, due to significant basal water discharge (Cox et al, 1969, as reported in the Waikoloa Beach Resort EIS, 1976). In his July 1988 survey, Brock noted occasional low-salinity water in the northern portion of the bay adjacent to the *makaha* or water circulation channel serving Ku'uali'i and Kahapapa Fishponds.

3.1.1.7 Nearshore Water Quality

Dr. Richard Brock, who is carrying out the ongoing water quality and biological monitoring program for Waikoloa Beach Resort, has not observed any water quality problems in 'Anaeho'omalu Bay. The monitoring plan for the resort is included as Appendix A. Also in Appendix A is the January 6, 1989 report on monitoring. The results of the most recent survey will be published in a few weeks' time and will then be available for review.

In the July 1988 survey, he found no litter or sewage in the vicinity of the boats temporarily moored in the bay, indicating a strong environmental ethic on the part of the concessionaire. Brock observed that visibility in the inner portions of the bay is often 4 meters or less, and near the bottom, it may be less than 1.5 meters.

The waters in the bay are designated as Class AA under Title 11, Chapter 54, of the State of Hawaii Department of Health's Water Quality Standards. Marine waters in this class are intended to remain in their natural pristine state, with an absolute minimum of alteration of water quality caused by human actions. Uses protected in Class AA waters include oceanographic research, conservation of coral reefs and wilderness areas, compatible recreation, and aesthetic enjoyment. With the proposed moorings project, coral reefs will be preserved and the bay will provide amenities (the moorings) for compatible recreation.

3.1.1.8 Groundwater

'Anaeho'omalu Bay is not a groundwater recharge area.

3.1.1.9 Pollution from Fill Material

Since no fill material will be used, there is no possibility of contamination or pollution from such material.

3.1.1.10 Erosion

There have been no problems with erosion at or near the site. No problems are anticipated as a result of the proposed project. In a general reconnaissance of 'Anaeho'omalu Beach in December 1968, little evidence of wave erosion from several weeks of high surf was observed, and the beach was characterized as being "remarkably stable." (Mann, December 1968).

3.1.1.11 Drainage

The site is not located in or near a drainageway of a flood plain.

3.1.1.12 Existing Air Quality

The air quality at Hilo, the closest State Department of Health monitoring station, meets both State and Federal ambient air quality standards for suspended particulates and sulfur dioxide. The most severe air quality conditions on the island are due to volcanic eruptions. (Belt Collins & Associates, December 1984).

3.1.1.13 Existing Noise Levels

A noise impact analysis was carried out as part of the environmental assessment prepared for the Hyatt Regency Waikoloa Hotel by Belt Collins & Associates (December 1984). Based on motor vehicle traffic data, the noise level at the hotel entry lobby was calculated to be well within Federal standards.

3.1.2 PROBABLE IMPACTS ON THE PHYSICAL ENVIRONMENT AND SUGGESTED MITIGATION MEASURES

No significant adverse impacts on the physical environment are anticipated as a result of the moorings.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 EXISTING CONDITIONS

3.2.1.1 Plants

The nearshore waters of 'Anaeho'omalu Bay do not provide an important habitat for seaweeds. Algae such as *Porolithon gardineri* and *Mesophyllus mesomorphum* were observed by Brock in his survey, but he also noted the lack of limu species either in or outside the project site that may provide forage for the green sea turtle. Nearby vegetation on the beach includes a grove of coconut trees and other cultivated plants.

3.2.1.2 Animals

Several surveys of biological resources in the nearshore waters of 'Anaeho'omalu Bay were conducted prior to development of Waikoloa Beach Resort, including one done by faculty and students of the University of Hawaii Department of Zoology in the summer of 1972 (Brock and Brock, 1974), and another by Key, Guinther and Miller in 1971 for Sunn, Low, Tom and Hara.

In the Brock and Brock study, invertebrate and fish fauna were noted as not particularly rich in the bay itself--probably due to the high turbidity, lack of coral cover, groundwater intrusion, and fishing pressure.

Key et al. observed few animals near the beach, except for a substantial population of sea urchins attached to rocks. They characterized 'Anaeho'omalu Bay as a low-salinity, low-diversity environment. Neither survey noted any marine plants or animals that are considered rare or otherwise important.

In the July 1988 survey, Dr. Richard Brock provided updated information on the marine biota in 'Anaeho'omalu Bay. The results of the survey suggest that the area proposed for most of the boat moorings has the least biological diversity. The table below summarizes by biotope the major biological attributes quantitatively examined in the study, substantiating this conclusion.

Summary of Some Biological Parameters Measured in the Three Biotopes Identified in 'Anaeho'omalu Bay

Biotope	Coral Coverage %	Coral Species	Fish Species	Fish Biomass g/m2
A. Porites compress	68	7	28	567
B. Diverse High Coral Cover	36	8	24	79
C. Sand	18	4	12	17

Few fish or exposed invertebrates are to be found away from the coral in sand areas. Species observed by Brock include 'ulae *(Saurida flamma)* and weke *(Mulloides flavolineatus)*. More fish species are apparent near hard substratum (both live or dead coral), including hinalea lauwili *(Thalassoma duperrey)*, 'akilolo *(Gomphosus varius)*, ma'i'i'i *(Acanthurus nigrofuscus)*, uhu *(Scarus sordidus)*, 'upapalu *(Foa brachygramma)*, and 'o'opu *(Asterropteryx semipunctatus)*.

The most common species of coral in the sand biotope is *Porites lobata*; other species seen include *Montipora verrucosa* and *Pocillopora meandrina*. Brock also noted the presence of green sea turtles in the area. All individuals sighted during the survey were juveniles. They were seen in both the north and south sectors of the biotope of diverse high coral coverage. While carrying out field work for another study, Brock observed a green sea turtle resting habitat about 800 meters southwest of the project site along a series of ledges approximately 300 meters offshore of Kapalaoa. As mentioned previously, no limu species appropriate for foraging was identified in or near the bay.

There are no known nesting sites of the green sea turtle on the Island of Hawaii. Almost all reproduction by the species occurs in the northwestern Hawaiian Islands, primarily French Frigate Shoals. In recent years, a very low level of nesting has occurred on Kauai, Oahu, and Molokai. (U.S. Department of Commerce, National Marine Fisheries Service, September 1987).

Humpback whales spend the winter months in Hawaiian waters, residing in greatest numbers in the Maui-Molokai-Lanai-Kaho'olawe area and Penguin Bank. The waters around Maui County are the most important calf rearing areas. Humpback whales have been observed in the waters off 'Anaeho'omalu

Bay. However, they tend to favor waters about 46 meters (25 fathoms) in depth (Tinney, March 1988). The offshore plateau between Waiulua and 'Anaeho'omalu Bays, which extends approximately 200 meters from the shoreline, is only 2-5 meters in depth. Beyond this area, the bottom slopes to depths of 6-20 meters.

3.2.2 PROBABLE IMPACTS ON THE BIOLOGICAL ENVIRONMENT AND SUGGESTED MITIGATION MEASURES

As was discussed earlier, the proposed permanent and day-use moorings will be installed with little disturbance to the substrata, and their availability will help to prevent damage to living coral by anchors.

Selected coral heads will probably have to be removed and relocated in consultation with the marine consultant; but in general, the impact on the physical and biological environment will be *less* than existing conditions because the potential for anchor damage to coral would be decreased. No adverse impacts on nearshore water quality or biota are expected.

In his study of 'Anaeho'omalu Bay, Brock addressed two questions:

> Are the present temporary moorings and their use having an impact on surrounding marine communities?
>
> Will the deployment of additional moorings impact neighboring marine communities?

Brock concluded from his observations that the existing moorings appear to have no negative impact on the surrounding marine communities. The anchors showed little or no evidence of movement, and no litter was found in the vicinity. Brock has stated that this suggests "a thoughtful use of the facilities and the imposition of an appropriately sensitive management style." (Brock, September 1988).

Moreover, Brock noted that there is no generation or dumping of sewage from the vessels; with the proposed increase in the number of moorings, there should be no change in practice. All vessels will continue to comply with Coast Guard regulations. No live-aboards will be allowed. Brock's assessment is that if impacts were to occur, they would probably be negligible since the moorings are located in an area with poor benthic and fish community development (sand biotope).

In his report, Brock discusses the impact of coral removal in the transition zone between the biotope of diverse high coral coverage and the sand biotope. Placement of moorings in this transition zone will be minimized, and removal of coral will be highly selective and limited. According to Brock, selective coral removal may result in temporary increases in turbidity, but this impact would decline rapidly. Corals are capable of removing sediment settling on them, and the sediment load would be not much greater than presently exists in the bay on a windy afternoon.

Brock's report also addresses the potential impact on green sea turtles. His conclusion is that the presence of these animals in the area suggests that the existing levels and patterns of human use do not negatively affect the resident turtle population. With the proposed increase in the number of moorings, little or no impact should occur, given the lack of forage and distance of the project from the tentatively identified turtle resting area. In other areas where green sea turtles are known to rest in large

numbers (for example, just seaward of the Hawaii Kai entrance channel in Maunalua Bay, Oahu), heavy boat traffic does not appear to have any impact.

Furthermore, boating activities associated with the moorings should have no effect on nesting, since nearly all reproduction by green sea turtles in the Hawaiian Islands occurs at French Frigate Shoals (at least 90%) and other leeward islands (about 10%). A very low level of nesting has recently taken place on Kauai, Oahu, and Molokai; no nesting sites have been identified on the Big Island (U.S. Department of Commerce, National Marine Fisheries Service, September 1987).

Another concern is the potential impact of increased boating activity on humpback whales. Noise from boats has the potential to mask phonations of humpbacks, and breaching behavior is significantly correlated with close approach of vessels and, to some extent, with sudden changes in sound intensity or frequency resulting from changes in engine speed or propeller pitch. However, there is insufficient information to determine exactly how whales are being affected by human activities or how potential adverse effects can be avoided or mitigated, especially since the whales' responses are not consistent (Tinney, March 1988).

There will be an increase in boat traffic in the area due to the installation of moorings in 'Anaeho'omalu Bay. Captain Nemo's operations and Nick's Aqua Sports' operations will remain essentially the same. The availability of day-use moorings for the public is expected to contribute to an increase in vessel traffic.

To minimize possible impacts of boating activities on whales in the area, the Waikoloa Beach Resort boat operators will be required to adhere to rules similar to those contained in the "Whalewatching Code" of the Hawaii Whalewatching Association (a self-regulating group of operators on Maui), as well as the guidelines promulgated by the National Marine Fisheries Service (NMFS). For example, the NMFS guidelines limit vessel approach to no closer than 100 yards in most Hawaiian waters, and no closer than 300 yards in Maui's Maalaea Bay, on the north and east sides of Lanai, and to mother-calf pods.

WBA will propose rules for the Waikoloa concessionaires to place restrictions on whale watching activities, including the number of boats watching a pod at any one time, distance and direction of approach, and length of time. Boats will be required to maintain constant engine speed around whales, observe a speed limit, and avoid sudden changes in speed or direction. More stringent rules will have to be followed when in the vicinity of mother-calf pairs. These rules will be enforced by the DOT marine patrol unit, with WBA as an auxiliary on-site monitor.

3.3 SOCIOECONOMIC ENVIRONMENT

3.3.1 HUMAN USE CHARACTERISTICS

The following resources/activities occur near the site: recreational fishing, scenic areas, historic/cultural resources (Hawaiian trails, petroglyphs, fishponds, etc.), and ocean recreation. Public access, parking, restrooms, showers, and picnic facilities are provided and maintained by Waikoloa Beach Resort. 'Anaeho'omalu Bay is a public beach used for sunbathing and picnicking, and activities in the bay include swimming, snorkeling, scuba diving, windsurfing, surfing (outside the reef), boating, and sailing.

The anchoring of vessels within State waters at 'Anaeho'omalu Bay is presently unrestricted, and no fees are charged by the State to the public or to commercial operators. In conjunction with the State's Ocean Recreation Management Plan, WDC proposes to create a vehicle whereby public and commercial boating interests can co-exist within the limited space in the bay and compensate the State for the use.

As of March 17, 1989, there were 6 temporary moorings in the bay; the moorings and vessels are described in Table 2. The existing moorings are used by various small craft operated by the WBA concessionaires, and all are located outside the State's Ocean Recreation Management Plan designated swim zones.

3.3.2 SOCIOECONOMIC IMPACTS

No adverse socioeconomic impacts are anticipated. Placement of the moorings in the context of an overall State plan for 'Anaeho'omalu Bay will help to prevent conflicts between the various allowed uses.

The placement of the moorings has been changed from that shown in the Draft EIS to allow more open ocean area makai of the shoreline. Swimmers will have buoy-marked protected areas defined in the State Ocean Recreation Management Plan. Windsurfers can use the buoy-marked ingress/egress corridor to reach deeper water and avoid conflict with swimmers and snorklers. The public day-use moorings will be amenities for individual divers and commercial dive boats.

Public access to and along the shoreline for fishing, swimming, and other activities will not be affected by the project. Boat passengers walking across the public beach to the water to board vessels will not preclude the general public from enjoying the beach. See Table 1 for time spent on beach by boarding passengers. In addition, the tourism and ocean recreation industries, as well as the public, will benefit from the provision of permanent and day-use moorings. These are in short supply along the Kohala-Kona coast, and the State has been unable to keep up with the demand for moorings at Honokohau and Kawaihae.

A section of Kawaihae Harbor was recently realigned to accommodate 30 more recreational vessels, thus clearing the waiting list for moorings within the short term. There are only two State mooring locations on the island of Hawaii--Keauhou and Hilo--and neither is in close proximity to 'Anaeho'omalu. This situation has placed a burden on the small businesses that make up the ocean recreation industry.

3.4 OTHER EXISTING CONDITIONS

3.4.1 EXISTING COVENANTS, EASEMENTS, AND RESTRICTIONS

The submerged land on which the moorings would be installed is public land belonging to the State of Hawaii. Use of this submerged land requires a permit from the State Department of Land and Natural Resources (DLNR), in accordance with Title 13, Chapter 2 (Regulation No. 4), Administrative Rules of DLNR Providing for Land Use Within the Conservation District. The owner of the shore side land (the applicant) is required to provide public access to the shoreline.

TABLE 2. EXISTING MOORINGS IN 'ANAEHO'OMALU BAY

Description of Vessel	Description of Mooring	Approx. Location*	Placement Date
CAPTAIN NEMO'S OCEAN SPORTS:			
26' monohull ("Intuition")	Caterpillar tractor track w/out pads, steel w/galvanized chain attached, and rope mooring line; partly covered with sediment and encrusted with new coral growth.	"C"	Mid-88
26' glass bottom boat	Two old anchors with chains connected to a concrete block anchor at mooring location "B". The chain provides flexibility for tie-up locations, depending on wind and sea conditions.	"B"	Mid-84
42' catamaran ("Mea'u")	Composite of 3 separate anchors to a single mooring and subsurface buoy. This arrangement stabilizes the vessel in a variety of wind and sea conditions. The 3 anchors are as follows:	"A"	
	A-1 Large concrete block w/ steel shackle & multiple chains. The chains interconnect the various underwater anchors & are used to tie off vessels at locations "A" and "B". This anchor eliminates the tendency of boats to drag anchor in strong winds.	Northeast of "A"	Mid-85
	A-2 Approx. 100-lb. Danforth anchor and chain; heavily encrusted with coral and embedded in sand bottom.	Southeast of "A"	Sep-81
	A-3 Approx. 150-lb. plow anchor ("CQR"); heavily encrusted w/ coral & embedded in sand bottom.	Southwest of "A"	Sep-85
NICK'S AQUA SPORTS (DBA RED SAIL SPORTS):			
50' catamaran ("Noa Noa")	Concrete block approx. 2' thick x 4' wide x 6' long with pipe sleeves for galvanized chain attachment.	"D"	Dec-88
37' Delta dive boat	Approx. 100-lb. Danforth anchors, one each, approx. 50' apart on an east-west axis with chain and rope linkages to a mooring float.	"E"	Sep-88
OTHER:			
Stern mooring (used by both WBA concessionares)	Concrete block & tractor track with shackle and chain.	"F"	1986

* The locations refer to the sites of the proposed moorings shown in Figure 2.

3.4.2 ARCHAEOLOGICAL/HISTORIC SITES

According to the State Historic Sites Section, no archaeological or historic sites are known to exist in the submerged area proposed for installation of the moorings. Although no archaeological survey was conducted, a visual survey of the sand bottom was carried out, supplemented by sand probings at mooring locations to assess substratum conditions.

The mid-bay area is well traversed, and no underwater sites have been observed to date. In the remote event that archaeological remains are encountered during installation or the moorings, the work will be halted and the Historic Sites Section notified.

3.4.3 EXISTING UTILITIES

Not applicable.

3.4.4 ADJACENT PROPERTIES

The proposed use is compatible with existing and future uses of the abutting parcel (TMK 6-9-07:15), which is owned by Richard P. Smart (mailing address: Parker Ranch, P.O. Box 458, Kamuela, Hawaii 96743). This parcel is located south of the Waikoloa Beach Resort public access road. It has long been used for picnics, camping, and beach recreation by Parker Ranch employees. The south shore of the bay is very suitable for swimming and fishing; *pahoehoe* lava outcroppings interspersed with pocket beaches provide easy access to the bay. Like the land fronting the rest of 'Anaeho'omalu Bay, the abutting parcel is zoned "Open" by the County in accordance with the County General Plan.

CHAPTER 4

ALTERNATIVES TO THE PROPOSED ACTION

4.1 ALTERNATIVES CONSIDERED

4.1.1 OTHER SUITABLE SITES

Other mooring sites in West Hawaii include Kawaihae Harbor, Honokohau Small Boat Harbor, and Keauhou Bay. None of these is suitable. Kawaihae Harbor, about eight miles from 'Anaeho'omalu, serves primarily as a commercial harbor for interisland barges. Honokohau is too far away (approximately 25 miles from 'Anaeho'omalu Bay) and has no available slips. Keauhou, the State-designated mooring area in West Hawaii, is located even farther away than Honokohau.

4.1.2 SEPARATE APPLICATIONS FROM EACH OPERATOR

As stated earlier, each operator may apply separately for moorings. However, such a piecemeal approach would not assure consistent, sound management of the bay's resources. Public moorings would not be provided under this scenario, and the likelihood of anchor damage to live coral would be greater.

4.1.3 DAY-USE MOORINGS

Another alternative is to install only day-use moorings in 'Anaeho'omalu Bay. Permanent moorings would still have to be found for the boats temporarily anchored in the bay, and as explained above, no suitable sites are available. This is not a viable alternative for the boat operators.

4.1.4 MOORING METHODS/DESIGNS

The various alternatives are discussed in detail in Chapter 2, section 2.3.4.

CHAPTER 5

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

5.1 STATE LAND USE LAW

All lands in the State have been placed in one of four land use districts--Urban, Agriculture, Conservation, or Rural--by the State Land Use Commission. The proposed site is within the State Conservation District. Uses in the Conservation District are regulated by the State Department of Land and Natural Resources (DLNR).

Land on the shore side of 'Anaeho'omalu Bay is in the Urban District, with the exception of the two fishponds, which are in Conservation.

5.2 CONSERVATION DISTRICT RULES

The submerged land in 'Anaeho'omalu Bay is within the Resource (R) subzone of the State Land Use Conservation District. Uses within this District are regulated by DLNR under Title 13, Chapter 2 (Regulation No. 4). Lands in the (R) subzone include those designated for future park and outdoor recreational uses, forest lands with commercial potential, offshore islands, and lands and territorial waters below the vegetation or debris line.. The objective of the (R) subzone is to assure sustained use of natural resources in those areas.

The proposed use is consistent with the objective of the (R) subzone since it would help to prevent damage to living coral in the bay by anchors and makeshift moorings. In addition, the intended use would limit the mooring of boats to specific sites in the bay where the environmental impact would be the lowest and where the boats would not interfere with other recreational uses.

5.3 HAWAII STATE PLAN

The Hawaii State Plan is a series of broad goals, objectives, and policies which serve as guidelines for the future growth and development of the State. The proposed project is consistent with the overall intent of the State Plan. Discussed below are the specific objectives and policies contained in Part I of the State Plan which are through to be the most relevant to the proposed project.

PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES

Section 226-8 Economy - Visitor Industry

(a) OBJECTIVE: A visitor industry that constitutes a major component of steady growth for Hawaii's economy.

(b)(3) POLICY: Improve the quality of existing visitor destination areas.

(b)(4) POLICY: Encourage greater cooperation between the public and private sectors in developing and maintaining well-designed and adequately serviced visitor industry and related developments.

(b)(5) POLICY: Ensure that visitor facilities and destination areas are carefully planned and sensitive to existing neighboring communities and activities.

(b)(6) POLICY: Develop the industry in a manner that will provide the greatest number of primary jobs and steady employment for Hawaii's people.

The proposed action is consistent with objectives and policies in the State Plan regarding the visitor industry. By installing and managing the moorings, Waikoloa Development will preserve the marine ecosystems in the bay, work with the State in a partnership to provide much needed mooring facilities, and help support the small businesses that contribute to the economic growth and stability in the area.

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

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

(a)(2) OBJECTIVE: Effective use of Hawaii's unique and fragile environmental resources.

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

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

(b)(8) POLICY: Pursue compatible relationships among activities, facilities, and natural resources, especially within shoreline areas.

A primary objective of the proposed action is to provide mooring facilities that will have the least impact on the bay's coral communities. Hence, moorings will be installed in sand or sand/rubble areas. In addition, adherence to the State Ocean Recreation Management Plan will assure that activities in the bay are compatible with the shoreline and marine environment.

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

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

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

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

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

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

The installation and maintenance of moorings at 'Anaeho'omalu Bay will be consistent with the objectives and policies guiding planning for the physical environment. Proper State management of recreational uses in the bay is the key to preserving marine ecosystems.

Section 226-23 Social-Cultural Advancement - Leisure

OBJECTIVE: Adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.

(b)(4) POLICY: Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, or biological values.

(b)(4) POLICY: Ensure opportunities for everyone to use and enjoy Hawaii's recreational resources.

There is a shortage of moorings for recreational boats in West Hawaii, and the proposed act is intended to deal with this shortage so that both public and private needs are met at 'Anaeho'omalu Bay.

5.4 STATE FUNCTIONAL PLANS

The State functional plans provide more details to the Hawaii State Plan in twelve specific areas: agriculture, conservation lands, education, energy, health, higher education, historic preservation, housing, recreation, tourism, transportation, and water resources. Each functional plan contains "policies, programs and projects designed to implement the objectives of a specific field of activity when such activity or program is proposed, administered, or funded by an agency of the State" (Section 226-2(10)HRS).

The 12 plans were examined to determine the relationship of the proposed project to each. Four of the functional plans contain policies and implementing actions directly relevant to the project.

5.4.1 STATE CONSERVATION LANDS FUNCTIONAL PLAN

The State Conservation Lands Functional Plan addresses statewide concerns for environmentally sensitive areas such as ocean habitats, terrestrial habitats, watersheds, natural streams, shoreline, open space, natural areas, areas with endangered species, air and water quality sensitive areas, and scenic, historic and cultural sites.

The implementing actions that are relevant to the proposed project are discussed below. Related discussions are also found in the section 5.2 of this chapter.

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

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

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

This EIS document will have extensive review by government agencies and the public. Appropriate controls of the impacts on the natural resources of the bay is assured through the environmental ethic presently being practiced by the Waikoloa Resort Beach concessionaires and with the implementation of the State's Ocean Recreation Management Plan.

5.4.2 STATE HEALTH FUNCTIONAL PLAN

This functional plan "focuses primarily on public health programs under the jurisdiction of the State Health Department." Several implementing actions relate to concerns for air quality, water quality, noise within the department's purview. These topics are discussed in terms of the proposed project in chapter III of the EIS. In general, the proposed project will not have any significant adverse effect on air and water quality. Enforcement of State rules and regulations will prevent the degradation in water quality generally associated with boat operations such as the discharge of pollutants in the bay.

5.4.3 STATE RECREATION FUNCTIONAL PLAN

This plan focuses on: 1) an assessment of the present and potential demand and supply of outdoor recreation resources as well as guide State and County agencies in acquiring and preserving lands of recreational value; 2) the provision of adequate recreation facilities and programs; 3) the securing of public access to recreation areas.

This proposed project will have a significant effect on minimizing conflicts and managing the uses of the ocean recreation resources available at the bay. It will assist in protecting marine ecosystems and keeping near shore waters open to public use. Waikoloa Beach Resort has provided excellent facilities on its property for public use such as parking, restroom, shower and picnic facilities. The proposed moorings plan will enhance the coordination of ocean recreation activities for both visitor and resident alike.

5.4.4 STATE TOURISM FUNCTIONAL PLAN

The overall objective of the State Tourism Functional Plan is not only to protect the economic health of the tourist industry but to also ensure the quality of life and well-being of the people of Hawaii. The plan identifies major issue and problem area and sets forth policies and actions that would prevent growth that would be damaging to Hawaii and the industry.

Relevant guidelines that apply to this proposed project are:

Maintaining and enhancing the quality of visitor facilities which conform to certain criteria

Preserving and enhancing Hawaii's significant natural, scenic, historic and cultural sites

Fostering a social environment enhancing the Aloha Spirit

This proposed project will make the natural environment more accessible to the resident and visitor to enjoy by the addition of moorings that will be available for commercial and private use of recreational boats. The project will assist in protecting natural site providing an alternative to anchoring.

5.5 DEPARTMENT OF THE ARMY PERMIT

A permit has been obtained from the U.S. Army Corps of Engineers for installation of the proposed moorings in 'Anaeho'omalu Bay. A copy of the permit letter is reproduced in Appendix C.

5.6 COASTAL ZONE MANAGEMENT PROGRAM

The Hawaii Coastal Zone Management Act of 1977, which became Chapter 205A, Hawaii Revised Statutes, established State policies for any action affecting the coastal zone. Specific objectives and policies were established in seven broad categories. The consistency of the proposed action to the areas of concern is discussed below. An application for Coastal Zone Management Consistency Certification has been approved by the Office of State Planning.

5.6.1 RECREATIONAL RESOURCES

Installation of the proposed moorings will be consistent with the CZM program objective to provide coastal recreational opportunities accessible to the public. It is also an effort to improve coordination of coastal recreational opportunities in the coastal zone. Makeshift moorings and anchors which may damage living coral would be replaced by moorings in specific locations designed to have a minimum impact on the reef environment.

5.6.2 HISTORIC RESOURCES

No historic resources are located within the project boundaries. The moorings site is near a historic settlement area, and two Hawaiian fishponds are located mauka of the beach. These resources will not be affected by the project.

5.6.3 SCENIC AND OPEN SPACE RESOURCES

The proposed project is consistent with the CZM objective which seeks to "protect, preserve and, where desirable, restore or improve the quality of coastal scenic and open space resources." Boats

are currently moored in 'Anaeho'omalu Bay; the replacement of makeshift moorings and temporary anchors with permanent moorings will not change or adversely affect the visual environment.

5.6.4 COASTAL ECOSYSTEMS

The permanent and day-use moorings will be outside the State designated swim areas. Boating activities will be restricted to a section of the bay, and temporary anchors and makeshift moorings will be replaced by systems that are more sensitive to the integrity of coastal ecosystems. Based on a survey of the project site by marine biologist Dr. Richard Brock, appropriate mooring facilities will be installed at specified locations which will result in the least amount of disruption to the nearshore biota and habitat.

Earlier surveys of 'Anaeho'omalu Bay indicate that the middle of the bay, where the moorings would be situated, is not particularly rich in marine fauna and flora. Richer coral habitats are found in the outer part of the bay, as well as along the rocky shorelines at both ends. These areas are designated by the State for swimming and snorkeling only.

5.6.5 ECONOMIC USES

Establishment of permanent mooring facilities in 'Anaeho'omalu Bay is consistent with the CZM program objective to "provide public or private facilities and improvements important to the State's economy in suitable locations." Waikoloa Resort is within the Kohala Coast Resort Region, designated as a tourist destination area by both the State and County. Substantial investments have been made in the public infrastructure needed to stimulate and support this development. Like the other major developments in the region, Waikoloa is a self-contained, full-amenity resort.

Five of the proposed moorings at 'Anaeho'omalu Bay will accommodate boats operated by concessionaires catering to Waikoloa Resort guests. Several boats are now temporarily anchored in the bay.

Other possible mooring sites are Kawaihae Harbor and Honokokohau Small Boat Harbor. However, Kawaihae Harbor, about eight miles from 'Anaeho'omalu Bay, has anchorage for only a limited number of recreational boats and serves primarily as a commercial harbor for interisland barges. Honokohau is too far away--approximately 25 miles from 'Anaeho'omalu Bay; this distance would place a burden on the boat owners/operators.

Hence, the establishment of permanent moorings at 'Anaeho'omalu Bay would enhance the amenities provided to resort guests and the public and would be beneficial to the concessionaires, the Waikoloa Beach Resort and local boaters.

5.6.6 MANAGING DEVELOPMENT

The proposed activity will require three permits; a Department of the Army Permit (already obtained), Conservation District Use Permit, and Permit for Work in Shore Waters in the State of Hawaii. The applicant cannot apply for this latter permit from DOT until the CDU Permit is obtained.

The public will be notified of the proposed activity in the processing of the permit applications. A public hearing has been held for the CDUA since it proposes use of land for commercial purposes. In addition, public hearings were held by the Department of Transportation on the Statewide Ocean Recreation Management Plan. A proposed management plan for 'Anaeho'omalu Bay was reviewed by the public and various government agencies. The plan is no longer part of the CDUA.

5.7 SPECIAL MANAGEMENT AREA AND SHORELINE SETBACK

The proposed moorings are not located within the Special Management Area or shoreline setback; however, the project has been reviewed by the County of Hawaii Planning Department.

5.8 HAWAII COUNTY GENERAL PLAN

The Hawaii County General Plan provides the long-range direction for comprehensive development of the Island of Hawaii. The Plan contains goals, policies, and standards concerning 13 elements and LUPAG maps delineating 13 different land use categories. The elements that relate to this proposed project are:

Environmental Quality: The County of Hawaii's popularity as a visitor destination area is dependent on "the natural beauty of the island, which is accentuated by the quality of the air and water." The development of the moorings plan will enhance the attractiveness and high quality environment of the Waikoloa Beach Resort and 'Anaeho'omalu Bay.

Natural Beauty: The General Plan recognizes that Hawaii's beauty is a reflection of the interplay of various physical elements and forces; and that human modification is a factor not only in making the beauty accessible, but also in obtaining economic benefits from the experience. The proposed project will seek to balance the man-made with the natural elements through the continuance of an environmental ethic of stewardship of the bay's resources.

Natural Resources and Shoreline: Important resources for the County of Hawaii are its sandy beaches, shoreline, and pristine nearshore waters. The proposed project will protect these resources, minimize damage to live coral, and manage ocean recreation uses at 'Anaeho'omalu Bay.

Recreation: The General Plan policies for recreation are intended to encourage public access to the shoreline, preserve the quality of recreational resources, and increase the number and diversity of recreational opportunities. The proposed moorings will make available recreational opportunities for both visitors and the public.

5.9 HAWAII COUNTY ZONING

The County zoning for the beach area is "Open". Inland and to the north, the land is zoned for resort, residential, and commercial use, with open areas as well. These uses conform with the County General Plan. Structures mauka of the shoreline on Waikoloa land near the project site include public restrooms, the concessionaire's beach shack, and a restored "makaha" or water circulation gate connecting the fishpond with the open ocean. The Royal Waikoloan Hotel is located mauka of the fishponds.

CHAPTER 6

UNRESOLVED ISSUES

Although humpback whales have been observed in the waters off 'Anaeho'omalu Bay, it appears that they prefer waters about 46 meters (25 fathoms) in depth (Tinney, March 1988). Waiulua and 'Anaeho'omalu Bays are approximately 2-5 meters in depth. This plateau area extends 200 meters from the shoreline.

There is insufficient information to determine exactly how whales are affected by human activities. However, Waikoloa Development Company and WBA concessionaires will stringently abide by rules and regulations intended to mitigate potential impacts on whales due to boating activities.

CHAPTER 7

REFERENCES

Belt Collins & Associates. (December 1984). *Environmental assessment for the proposed Hyatt Regency Waikoloa Hotel, Waikoloa Beach Resort, South Kohala, County of Hawai'i, Hawai'i.* Prepared for Transcontinental Development Co.

Boise Cascade Home and Land Corp. (1976). *Waikoloa Beach Resort environmental impact statement for Boise Cascale Home and Land Corp.'s planned resort community at 'Anaeho'omalu, South Kohala, Island of Hawaii.*

Brock, R. E. *Proposed small-boat moorings for Anaehoomalu Bay, Hawaii: an assessment of biological impacts.* Prepared for Transcontinental Development Co. September 1988.

DeF. Quinn, Alonzo. (1961). *Design and Construction of Ports and Marine Structures.* McGraw-Hill Book Company, New York.

Mann, H. J. (December 1968). *Resort studies at Anaehoomalu, Hawaii; oceanographic studies at Anaehoomalu Bay, Hawaii for the month of December 1968,* Project 4392, Report No. 2.

Robinson, L. (May 1987). "New mooring system could reduce coral damage," *Makai,* Vol. 9, No. 5. Newsletter published by the University of Hawaii Sea Grant College Program.

Tabata, R. (1987 and 1988). *Information on the Halas mooring system: proposed statewide day-use mooring system submitted to State Department of Transportation (incorporated in state's ocean recreation management plan, Jan. 1988); summary of day-use moorings workship proceedings, Nov. 23, 1987; report and recommendations to the State, December 1987; and some questions and answers relating to moorings (a response to Timothy Sherwood, Guam, Feb. 9, 1988).*

Tinney, R. T., Jr. (March 1988). *Review of information bearing upon the conservation and protection of humpback whales in Hawaii.* Prepared for the Marine Mammal Commission, Washington, D. C.

U.S. Army Corps of Engineers, Honolulu District. (March 1985). *Draft environmental impact statement, U.S. Department of the Army permit application, Waikoloa Beach Resort anchialine ponds, Waikoloa, South Kohala District, Island of Hawai'i.*

U.S. Department of Commerce, National Marine Fisheries Service, Honolulu Lab, The Hawaiian Sea Turtle Recovery Team. (September 1987). *Recovery plan for Hawaiian sea turtles.*

U.S. Department of Commerce, NOAA, Office of Ocean and Coastal Resource Management, Sanctuary Programs Division, and State of Hawaii, Department of Planning and Economic Development. (December 1983). *Draft management plan and Environmental Impact Statement for the proposed Hawaii Humpback Whale National Marine Sanctuary.*

CHAPTER 8

CONSULTATION

8.1 ORGANIZATIONS AND INDIVIDUALS WHO ASSISTED IN THE PREPARATION OF THIS ENVIRONMENTAL IMPACT STATEMENT

The environmental impact statement was prepared for Waikoloa Development Company by Belt Collins & Associates with input provided by subconsultants. The following were involved:

Waikoloa Development Company:

Ken Melrose	Director of Planning; reviewed the EIS document and contributed to its content.

Belt Collins & Associates:

Anne L. Mapes	Planner with a master's degree in business administration; project manager; contributed to the organization and content of all sections.
Susan S. Rutka	Planner with a master's degree in political science; contributed to the organization and content of all sections.
Ken D. Hamilton	Project Editor/Coordinator with a master's degree in communications; contributed to the editing and revising of all sections.

Subconsultant:

Richard E. Brock	Marine biologist with a Ph.D. in marine biology; conducted the assessment of biological impacts.

8.2 OFFICIAL DOCUMENTS

The EIS Preparation Notice (EISPN) for the subject project was published in the OEQC Bulletin by the Office of Environmental Quality Control on September 8, 1989. A copy of the EISPN is presented in this chapter. Also included is a sample of a letter that was sent, along with copies of the EISPN, to various agencies, organizations, and individuals who were asked to comment on the project.

8.3 CONSULTED PARTIES

The following pages contain a list of those parties who were asked to comment on the project. Everyone who was believed to have an interest in the project or who requested consulted party status

was included in the mailing. Those who responded to the request for comments are marked with an asterisk (*).

Federal Agencies

* Department of the Army, Army Corps of Engineers, Honolulu District
* Department of Commerce, National Marine Fisheries Service
* Department of Interior, Fish and Wildlife Service
  Department of Interior, National Park Service
  Department of Transportation, U. S. Coast Guard

State Agencies

* Department of Business and Economic Development
* Department of Health
  Department of Land and Natural Resources
  Department of Transportation, Harbors Division
  Office of Environmental Quality Control
* Office of Hawaiian Affairs
  Office of State Planning
* University of Hawaii Environmental Center

State Legislators

Senator Andrew Levin
Senator Richard Matsuura
Senator Malama Solomon
Representative Jerry Chang
Representative Harvey Tajiri
* Representative Wayne Metcalf
Representative Dwight Takamine
Representative Virginia Isbel
Representative Mike O'Kieffe

Hawaii County

* Office of the Mayor
  Fire Department
  Department of Parks and Recreation
* Planning Department
* Police Department

Hawaii County Council

- * Russell S. Kokubun, Chairman
- * Takashi Domingo
  Helene H. Hale
  Lorraine R. Inouye
  Merle K. Lai, Vice Chairman
- * Robert H. Makuakane
  Harry S. Ruddle
  Spencer K. Schutte
  Stephen K. Yamashiro

Community Organizations and Other Public Interest Groups

Big Island Business Council
Big Island Chamber of Commerce
Hawaii Hotel Association
Hawaii Island Economic Development Board
* Hawaii Leeward Planning Conference
Hawaii Visitors Bureau - Big Island Chapter
* Kona Hawaiian Civic Club
Kona-Kohala Chamber of Commerce
* Life of the Land
Na Ala Hele
The Ocean Recreation Council of Hawaii (TORCH) - Hawaii Chapter
People for Access to the Shoreline (PASH)
The Waimea Hawaiian Civic Club

8.4 COMMENTS ON THE EIS PREPARATION NOTICE

Also presented in this chapter are reproductions of letters commenting on the EISPN, together with copies of letters written in response to the comments. The following is a list of agencies, organizations, and individuals who commented on the EISPN.

Responded with No Comments:

State Government:
Department of Health
Representative Wayne Metcalf

County Government:
Councilman Robert H. Makuakane
Office of the Mayor (referred to Planning Director)

Others:

Hawaii Leeward Planning Conference

Responded with Comments:

Federal Government:

U.S. Army Engineer District, Honolulu
U.S. Department of Commerce, National Marine Fisheries Service
U.S. Department of Interior, Fish and Wildlife Service

State Government:

Department of Business and Economic Development
Office of Hawaiian Affairs
University of Hawaii Environmental Center

County Government:

Russell S. Kokubun, Chairman, Hawaii County Council
Councilman Takashi Domingo
Planning Department
Police Department

Others:

Kona Hawaiian Civic Club
Life of the Land, Big Island Chapter

ENVIRONMENTAL ASSESSMENT/DETERMINATION

ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN)

Applicant:	Waikoloa Development Co. P. O. Box 3028 Waikoloa, Hawaii 96743-3028 (808) 885-1000
EIS Consultant:	Anne L. Mapes Belt Collins & Associates 680 Ala Moana Blvd., Suite 200 Honolulu, Hawaii 96813 (808) 521-5361
Location:	South Kohala, Hawaii
Tax Map Key:	NA Adjacent parcels are identified as TMK 6-9-07: parcels 11, 12, and 15.
Accepting Authority:	State Department of Land and Natural Resources for the Land Board P. O. Box 621 Honolulu, Hawaii 96809
Request:	Installation and management of 17 permanent and day-use moorings in 'Anaeho'omalu Bay.
Class of Action:	Use of State land (makai of the shoreline) and use in the Conservation District.
Determination:	Environmental Impact Statement required.

Attached and incorporated by reference is the environmental assessment prepared by the applicant for the project.

8-5

ENVIRONMENTAL ASSESSMENT

INSTALLATION AND MANAGEMENT OF PERMANENT AND DAY-USE MOORINGS 'ANAEHO'OMALU BAY, SOUTH KOHALA, HAWAII

Submitted by

WAIKOLOA DEVELOPMENT COMPANY
P. O. Box 3028
Waikoloa, Hawaii 96743-3028
Telephone: 885-1000

Prepared by

BELT COLLINS & ASSOCIATES
680 Ala Moana Boulevard, Suite 200
Honolulu, Hawaii 96813
Telephone: 521-5361

August 1989

ENVIRONMENTAL ASSESSMENT FOR THE INSTALLATION AND MANAGEMENT OF PERMANENT AND DAY-USE MOORINGS IN 'ANAEHO'OMALU BAY, SOUTH KOHALA, HAWAII

A. IDENTIFICATION OF APPLICANT

The applicant, Waikoloa Development Co., submitted an application to the Department of Land and Natural Resources for a Conservation District Use Permit. The type of use requested is a conditional use in the Resource (R) subzone. The applicant is seeking a non-exclusive easement over portions of the ocean floor owned by the State of Hawaii for the attachment of 17 moorings.

B. STATEMENT OF OBJECTIVES

It is proposed that 11 permanent moorings and 5 transient or day-use moorings be installed in 'Anaeho'omalu Bay. An additional mooring is proposed for a training platform, which will be used by novice windsurfers and then returned to shore at the end of each day. Locations of the proposed moorings are shown in Figure 1; the circles illustrate the swing of the mooring line around each anchor. The permanent moorings will be for recreational vessels used by guests of Waikoloa Beach Resort, which includes two hotels—the Royal Waikoloan on 'Anaeho'omalu Bay and the new Hyatt Regency Waikoloa on Waiulua Bay. Six of the moorings will be for boats operated by Captain Nemo's Ocean Sports, the concessionaire presently located at 'Anaeho'omalu Bay. Four will be set aside for vessels operated by the Hyatt concessionaire, Nick's Aqua Sports dba Red Sail Sports. The stern mooring next to the ingress/egress corridor will be used by both operators. All of the transient moorings will be for public use on a first come-first served basis.

In addition to the mooring locations, Figure 1 presents the ocean recreation management plan for the bay. Intended to minimize conflicts, this plan delineates areas for the various uses and has been incorporated into the recently approved Statewide Ocean Recreation Management Plan. The moorings will be installed with minimal disturbance to the substratum, and their availability will help prevent boats from anchoring in reef areas and damaging living coral. Use of the moorings will be controlled by Waikoloa Development Co., which will also be responsible for their maintenance. Figure 1 also shows the bathymetry in 'Anaeho'omalu Bay (source: Waikoloa Beach Resort EIS, 1976).

A major objective of this project is to provide moorings for both commercial and private recreational boats in an area of the Big Island that lacks adequate mooring locations. In September 1980, State mooring areas were designated by the Department of Transportation, but only two were approved on the Big Island—Keauhou and Hilo. It was recognized that moorings requested outside of the approved areas would be considered on a case by case basis. Neither of the State mooring areas is within close proximity to 'Anaeho'omalu, and no space is available at either Honokohau or Kawaihae Harbors.

Another objective is to implement an overall management and maintenance plan for the proposed moorings and bay so as to minimize the impact on the marine environment while providing an ocean-related amenity for the public and commercial users.

C. DESCRIPTION OF PROPOSED USE

1. Boats to be Moored

The boats to be moored are described in Table 1, which lists vessel length and type, draft, mooring requirements, vessel capacity, and frequency of loading and unloading passengers on the beach.

Captain Nemo's Ocean Sports, currently owned by Judy Jennett and Jeff McConnel, has operated the Waikoloa Beach Resort ocean recreation concession since 1981. Their respect for the coastal environment and sense of responsibility as unofficial "caretakers" of 'Anaeho'omalu Bay have been amply demonstrated. Mr. McConnel is an active member of TORCH (The Ocean Recreation Council of Hawaii), a volunteer group that has been involved in testing the Halas mooring system. TORCH has also advocated establishment of a statewide system of day-use moorings to reduce anchor damage at popular diving and snorkeling spots and to facilitate management of particular sites. Captain Nemo's Ocean Sports will require six permanent moorings, plus a mooring for its training platform.

It is anticipated that four permanent moorings will be required by Nick's Aqua Sports, the concessionaire serving the new Hyatt Regency Waikoloa, located north of 'Anaeho'omalu on Waiulua Bay. Waiulua Bay is presently too shallow and rocky to allow boat access to the shoreline. Plans are underway to dredge a channel and construct a dock and protective berm to enable recreational boats to pick up and drop off hotel guests. However, sea conditions preclude any long-term mooring of boats in Waiulua Bay, so permanent moorings need to be available elsewhere. 'Anaeho'omalu Bay is an ideal location and the only choice, given the lack of other alternatives. (Neither Honokohau Harbor nor Kawaihae Harbor has openings; Captain Nemo's Ocean Sports has been on the Honokohau waiting list for eight years.)

The public day-use moorings will most likely be used by small dive boats and by sailboats.

2. Proposed Mooring Locations and Methods

The factors to be considered in selecting mooring locations and methods include:

- Type and size of boat
- Wave force and height
- Substratum
- Water depth

All of the proposed permanent moorings will be located in the middle section of the bay that is protected by a shallow outer reef. They will be installed in sand substrate where biological diversity is the lowest. Five day-use moorings will be situated outside of the outer reef in a sand pocket that is surrounded by an area particularly rich in biota and which offers good diving and snorkeling opportunities. Sites will be selected to assure that mooring cables do not interfere with navigation.

Given the sand/rubble substrate, four alternative mooring methods can be considered:

- Marine biologist Richard Brock, who has conducted a survey of the bay, recommends heavy concrete blocks. The conventional trapezoidal shape of these anchors roughly mimics the form of the dominant coral species, *Porites lobata*. In addition, concrete serves as a suitable substratum for the settlement of many invertebrate and algal species. According to Brock, the placement of these blocks would provide sites for the possible establishment of corals and associated fish species where none presently exit.

- If sand cover at a proposed mooring site is shallow, it may be possible to penetrate the sand and fasten an eyebolt to hard substrate below. A hard substratum, either limestone or basalt, would be necessary to use what is known as the Halas mooring system. Developed by John Halas of the Key Largo National Marine Sanctuary in Florida, this system involves inserting a stainless steel eyebolt into a hole drilled into the substratum; a polypropylene line attached to the eyebolt is then connected to a mooring buoy.

  The Halas mooring system has been adapted to Hawaiian conditions by the University of Hawaii Sea Grant College Program and Hawaii Institute of Geophysics (HIG). Tests at Honokohau Harbor have indicated that an eyebolt in lava can hold at least 4,000 pounds. Material costs are low—about $100 per mooring, including the eyebolt, Parabond anchor capsule (an epoxy that is supposed to have a holding strength of 20,000 pounds or more), line, and buoy. Compared with other mooring methods, the eyebolt poses the least potential for damage to environmentally sensitive benthic communities.

  However, sand probing by Brock at the proposed mooring sites in 'Anaeho'omalu Bay indicates that hard substratum is not present. Unless appropriate substratum is encountered during site preparation, a more conventional mooring design will have to be used.

- An alternative to concrete blocks is to use the Halas technique to secure mooring pins in large boulders. Boulders have two advantages: they are less likely to be moved in strong currents and waves and to damage coral in the vicinity, and they blend in with the surroundings.

- Ray Tabata of Sea Grant suggests trying screw anchors in sand substrate. John Halas has successfully deployed similar devices for mooring in sand. Preliminary tests have been carried out by HIG and Sea Grant with 8-inch diameter screw anchors in the shallow, fine sand off Makai Pier at Makapu'u. Future tests in coarser, deeper sand are planned. Screw anchors could also be used to anchor down concrete blocks in areas where the blocks are apt to be lifted by heavy waves or surge.

The first alternative listed above—heavy concrete blocks or anchors—will be used in 'Anaeho'omalu Bay, as recommended by Brock. A schematic drawing of this method is shown in Figure 2. The components of the unit would consist of a mooring buoy and pickup line, concrete block or anchor, and connecting line/chain between the mooring buoy and anchor. To prevent any movement of the anchor in high surge conditions, it would be partially submerged in the sand.

3. Boating Operations

From 1981-1988, Captain Nemo's Ocean Sports has provided beach services and ocean recreational activities at 'Anaeho'omalu Bay under a concession license agreement with the Waikoloa Beach Association (WBA). Composed of the ocean-front property owners at Waikoloa Beach Resort, the Association is responsible for managing the beach at 'Anaeho'omalu Bay; the cost of beach cleaning, maintainance, and security is funded by assessments paid by WBA members. Throughout this period, the boating public has used the bay as temporary anchorage without compensation to either the State or the ocean-front property owners.

Concession fees are paid to the WBA for the right to do business on private property and through hotel operations. Credit is given against the fees for advertising which promotes the Waikoloa Beach Resort in addition to the specific services offered.

About half of Captain Nemo's revenues are derived from glass bottom boat, sailing, scuba diving, and catamaran cruises and charters. The other half is from the rental of diving equipment and

beach gear, windsurfer and sailboat lessons and rentals, and the sale of tanning products. In 1988, a second concessionaire—Nick's Aqua Sports—was licensed to operate at 'Anaeho'omalu by the WBA. This operation is restricted to catamaran and dive boat cruise operations. For both operators, revenues are seasonal, reflecting trends in hotel occupancy and management. There are also preriods when the primary vessels are in dry dock for major repairs and overhaul.

Customers of the Waikoloa Beach Resort concessionaires are primarily hotel guests, but since the beach is used by the public, local residents and tourists from other hotels take advantage of the ocean recreation opportunities. For example, Captain Nemo's Ocean Sports estimates that nearly half of the revenues in the non-peak tourism periods come from Big Island residents. The concessionaire also offers field trips for children's groups. There is adequate public parking to accommodate these users (78 stalls plus space for expansion), as well as public restroom and shower facilities—all provided by the Waikoloa Development Co.(WDC) and maintained by the WBA.

Passengers will be picked up and dropped off by the concessionaires within the ingress/egress zone designated in the State Ocean Recreation Management Plan. The catamaran and dive boat will be able to come up to the beach, while the dinghy will be used to shuttle passengers between the beach and the moored vessels unable to approach the beach. This will not interfere with other activities since it will take place in an area set aside for boat traffic and is outside of the zones designated for swimming and shorkeling. Nick's Aqua Sports will follow the same procedures, picking up and dropping off passengers in 'Anaeho'omalu Bay. If and when the access channel and loading dock proposed at the Hyatt Regency Waikoloa is constructed (dependent upon permit approval), Nick's Aqua Sports will be able to operate primarily out of Waiulua Bay. The Hyatt concessionaire's boats will still have to moor in 'Anaeho'omalu Bay, however, due to rough conditions at Waiulua which preclude long-term moorings.

4. Management and Maintenance Plan

WDC will be responsible for overall management of the proposed moorings in 'Anaeho'omalu Bay. Captain Nemo's Ocean Sports, Nick's Aqua Sports, and others could have independently applied for mooring permits, but WDC firmly believes that its coordinated approach is preferable from a resource management standpoint. For example, selection of the proposed mooring locations has been done in an organized manner, based on the findings of a marine biological survey. The effort has also been carried out in close cooperation with the State Department of Transportation during its development of the Ocean Recreation Management Plan. In addition, this approach facilitates the establishment of day-use moorings in the bay for public use. Without such moorings, anchor damage of live coral would be more likely.

The applicant will seek a non-exclusive easement over each small portion of the ocean floor where a mooring is attached (approximately 4 to 6 square feet for each site). Discussions with the DLNR Land Management Division in Hilo indicate that if the program is approved, WDC would have complete control over who ties up to its buoys. The State would have the option to grant permits to other users at the mooring locations, but this would probably be unlikely. (Personal communication, Glen Taguchi, October 4, 1988)

The proposed management plan goes beyond just controlling use of the moorings. WDC wishes to maintain control over moorings in the bay in the context of an overall ocean recreation management plan, and to this end, zones for various uses have been identified and incorporated into the approved State plan (see Figure 1). WDC shares the State's primary concerns about protecting marine ecosystems and keeping nearshore waters open to public use.

Components of the proposed management plan are as follows:

- Waikoloa Development Co. will be responsible for installation and maintenance of the moorings. This will be done in cooperation with the concessionaires, which will be assigned responsibility for regular monitoring of the moorings for maintenance purposes. WDC will bear the costs incurred for any repairs or replacements.

- Waikoloa Development Co. will assign the permanent moorings as part of the concession agreements. For example, as part of its three-year agreement to provide ocean recreation services for the Royal Waikoloan, Captain Nemo's Ocean Sports will be allowed to use up to six of the permanent moorings for the duration of the agreement.

- In cooperation with the concessionaires, Waikoloa Development Co. will develop rules for use of the permanent moorings and will be responsible for enforcement. Designed to prevent degradation in water quality associated with boat operations, the rules will assure that pollutants such as fuels, sewage, trash, and disinfectants are not discharged into the bay. The resort and the concessionaires will benefit from strict adherence to these rules.

- WDC will also develop and enforce similar rules for use of the public moorings. In addition to rules intended to prevent pollution, the maximum duration of use will be defined.

- The management plan will include regulations intended to minimize the impact of boat traffic on endangered humpback whales (see section E1, page 17).

It is important to note that the environmental ethic promoted by WDC and its concessionaire, as well as their commitment as "caretakers" of the beach and nearshore waters, have long set the tone for the use of 'Anaeho'omalu Bay. Their daily presence at the site will assure that this ethic continues for many years to come. At the same time, Waikoloa Beach Resort has always enhanced public use of the beach, providing excellent parking, restroom, shower, and picnic facilities for all to use.

D. DESCRIPTION OF AFFECTED ENVIRONMENT

1. Physical Environment

a. General Description. The proposed mooring facilities will be located in the nearshore waters of 'Anaeho'omalu Bay, an area covering approximately two acres. 'Anaeho'omalu, the site of the Royal Waikoloan Hotel, features a crescent-shaped sand beach, with two large fishponds situated behind the beach.

b. Substrate. Dr. Richard H. Brock conducted a biological survey of 'Anaeho'omalu Bay in July 1988; a copy of the complete report is attached. In this study, Dr. Brock identifies three "biotopes" in the survey area (see Figure 3). "A" indicates the biotope of *Porites compressa* coral, which comprises the middle, seaward section of the bay and continues into deeper water outside the survey area. Biotope "B", located in the northern and southern sections of the bay, is characterized by diverse high coral coverage. The middle section of the bay just offshore from the beach to the 6-meter isobath is the sand biotope ("C").

Six of the proposed moorings will be located in the sand biotope (moorings A, F, G, H, J, and K in Figure 1). Scattered across this biotope are small areas of coral; these are most abundant adjacent to the biotope of diverse high coral coverage. According to Brock, live coral probably accounts for *less than 3 percent* of the substratum. In addition, small areas of rubble and dead coral comprise a minor part of the substratum in the sand biotope.

Four moorings will be situated in the transition zone between the biotope of diverse high coral coverage and the sand biotope (moorings B, C, D, E, I, and L in Figure 1). Two others, moorings D and I, will be in a transition zone bordering on the *Porites compressa* biotope. Every effort will be made to place these six moorings in sand and to minimize the disturbance of live coral. The five day-use moorings will be installed in a relatively large sand pocket within the *Porites compressa* biotope.

To help determine the most effective design for a mooring at a given location, Brock mapped the substratum types and apparent sand depth at various proposed mooring sites. The results of the sand probing indicate that appropriate exposed hard substratum is not present in the areas tested; hence, the Halas design cannot be used.

c. Topography/Bathymetry. The beach at 'Anaeho'omalu Bay is composed of a well-developed sand berm along its entire length, about 6.5 feet above sea level. It has a rather steep foreslope; the sand slopes seaward at a maximum angle of 30 degrees and levels out to 10 degrees at the high water line. The back slope ranges from 5 to 10 degrees. Within the bay, the sea floor is of relatively uniform depth. Depth in the project area does not exceed three fathoms (18 feet). The cove within 'Anaeho'omalu Bay is sheltered from the open ocean by a fringing coral reef. (Waikoloa Beach Resort EIS, 1976)

d. Water Levels (Tides and Waves). The normal tidal range in a day is about 2 feet; the higher of the two daily tides averages 1.2 feet above mean sea level, and the maximum is +2 feet above mean sea level. The minimum and maximum daily tidal ranges are 0.5 and in the order of 3 feet, respectively.

Four major wave types occur in Hawaiian waters. The South Kohala coast is shielded from direct exposure to two of these, the North Pacific swell (generated by far-off storms) and the northeast-tradewind wave (which occurs throughout the year). When these waves predominate, the coast is characteristically calm. However, South Kohala is relatively unprotected from the Kona storms and the southern swells. Generated by nearby storms southwest of the islands, Kona storm waves are typically 8 to 15 feet, but under unusually severe conditions, may reach heights of 25 feet. Southern swells, which originate in the Southern Hemisphere or Western Pacific, can also produce high-breaking waves. Heavy surf conditions with swells between 8 to 12 feet have been observed at 'Anaeho'omalu (Mann, 1976, as reported in the Waikoloa Beach Resort EIS, 1976).

Like other coastal areas in Hawaii, 'Anaeho'omalu is subject to the effects of occasional tsunamis. Of 85 tsunamis observed since 1931, the 1946 wave was the greatest in magnitude. Runups recorded along the South Kohala coast during this event define the elevations below which the area might be considered vulnerable to a severe tsunami, and above which the risk is minimal. At Kawaihae, runup was 12 feet above mean low, low water. If an earthquake were to occur west or southwest of Hawaii, inundations in South Kohala would exceed those of the 1946 wave, which originated in the Aleutians to the north. A flood hazard area map for the Puako-'Anaeho'omalu area, published by the U.S. Army Corps of Engineers and DLNR (September 1973), shows the 100-year tsunami height at the shoreline at 15 feet. (Waikoloa Beach Resort EIS, 1976)

e. Water Currents/Circulation. On the leeward coast of the Big Island, the current on a rising tide is to the north and tends to move toward the coast, with a nearshore velocity of about 0.4 knots. Clockwise eddies are produced in bays such as 'Anaeho'omalu by this current. On a falling tide, the current reverses and weakens (to about 0.1 or 0.2 knots), tending to produce counterclockwise eddies in the bays. Thus, the net current drift is northward along the coast. (Waikoloa Beach Resort EIS, 1976)

f. **Salinity.** Extensive portions of 'Anaeho'omalu Bay have been found to have water of relatively low salinity, due to significant basal water discharge (Cox et al, 1969, as reported in the Waikoloa Beach Resort EIS, 1976). In his July 1988 survey, Brock noted occasional low-salinity water in the northern portion of the bay adjacent to the *makaha* serving Ku'ualiʻi and Kahapapa Fishponds.

g. **Nearshore Water Quality.** Dr. Richard Brock, who is carrying out the ongoing water quality and biological monitoring program for Waikoloa Beach Resort, has not observed any water quality problems in 'Anaeho'omalu Bay. In the July 1988 survey, he found no litter or sewage in the vicinity of the boats temporarily moored in the bay, indicating a strong environmental ethic on the part of the concessionaire. Brock observed that visibility in the inner portions of the bay is often 4 meters or less, and near the bottom, it may be less than 1.5 meters.

The waters in the bay are designated as Class AA under Title 11, Chapter 54, of the State of Hawaii Department of Health's Water Quality Standards. Marine waters in this class are intended to remain in their natural pristine state, with an absolute minimum of alteration of water quality caused by human actions. Uses protected in Class AA waters include oceanographic research, conservation of coral reefs and wilderness areas, compatible recreation, and aesthetic enjoyment.

h. **Groundwater.** 'Anaeho'omalu Bay is not a groundwater recharge area.

i. **Pollution.** Since no fill material will be used, there is no possibility of contamination or pollution from such material.

j. **Erosion.** There have been no problems with erosion at or near the site. No problems are anticipated as a result of the proposed project. In a general reconaissance of 'Anaeho'omalu Beach in December 1968, little evidence of wave erosion from several weeks of high surf was observed, and the beach was characterized as being "remarkably stable." (Mann, December 1968).

k. **Drainage.** The site is not located in or near a drainageway of a flood plain.

l. **Existing Air Quality.** The air quality at Hilo, the closest State Department of Health monitoring station, meets both State and Federal ambient air quality standards for suspended particulates and sulfur dioxide. The most severe air quality conditions on the island are due to volcanic eruptions. (Belt Collins & Associates, December 1984)

m. **Existing Noise Levels.** A noise impact analysis was carried out as part of the environmental assessment prepared for the Hyatt Regency Waikoloa Hotel by Belt Collins & Associates (December 1984). Based on motor vehicle traffic data, the noise level at the hotel entry lobby was calculated to be well within Federal standards.

2. **Biological Environment**

a. **Plants.** The nearshore waters of 'Anaeho'omalu Bay do not provide an important habitat for seaweeds. Algae such as *Porolithon gardineri* and *Mesophyllus mesomorphum* were observed by Brock in his survey, but he also noted the lack of limu species either in or outside the project site that may provide forage for the green sea turtle. Nearby vegetation on the beach includes a grove of coconut trees and other cultivated plants.

b. **Animals.** Several surveys of biological resources in the nearshore waters of 'Anaeho'omalu Bay were conducted prior to development of Waikoloa Beach Resort, including one done by faculty and students of the University of Hawaii Department of Zoology in the summer of 1972 (Brock and Brock, 1974), and another by Key, Guinther and Miller in 1971 for Sunn, Low,

Tom and Hara. In the Brock and Brock study, inverterbrate and fish fauna were noted as not particularly rich in the bay itself—probably due to the high turbidity, lack of coral cover, groundwater intrusion, and fishing pressure. Key et al observed few animals near the beach, except for a substantial population of sea urchins attached to rocks, and they characterized 'Anaeho'omalu Bay as a low-salinity, low-diversity environment. Neither survey noted any marine plants or animals that are considered rare or otherwise important.

In the July 1988 survey, Dr. Richard Brock provided updated information on the marine biota in 'Anaeho'omalu Bay. The results of the survey suggest that the area proposed for most of the boat moorings has the least biological diversity. The table below summarizes by biotope the major biological attributes quantitatively examined in the study, substantiating this conclusion.

Summary of Some Biological Parameters Measured in the Three Biotopes Identified in 'Anaeho'omalu Bay

Biotope	Coral Coverage (%)	Coral Species	Fish Species	Fish Biomass (g/m^2)
A. Porites compressa	68	7	28	567
B. Diverse High Coral Cover	36	8	24	79
C. Sand	18	4	12	17

Few fish or exposed invertebrates are to be found away from the coral in sand areas. Species observed by Brock include 'ulae *(Saurida flamma)* and weke *(Mulloides flavolineatus)*. More fish species are apparent near hard substratum (both live or dead coral), including hinalea lauwili *(Thalassoma duperrey)*, 'akilolo *(Gomphosus varius)*, ma'iʻiʻi *(Acanthurus nigrofuscus)*, uhu *(Scarus sordidus)*, 'upapalu *(Foa brachygramma)*, and 'o'opu *(Asterropteryx semipunctatus)*. The most common species of coral in the sand biotope is *Porites lobata*; other species seen include *Montipora verrucosa* and *Pocillopora meandrina*.

Brock also noted the presence of green sea turtles in the area; all individuals sighted during the survey were juveniles. They were seen in both the north and south sectors of the biotope of diverse high coral coverage. While carrying out field work for another study, Brock observed a green sea turtle resting habitat about 800 meters southwest of the project site along a series of ledges approximately 300 meters offshore of Kapalaoa. As mentioned previously, no limu species appropriate for foraging was identified in or near the bay.

There are no known nesting sites of the green sea turtle on the Island of Hawaii. Almost all reproduction by the species occurs in the northwestern Hawaiian Islands, primarily French Frigate Shoals. In recent years, a very low level of nesting has occurred on Kauai, Oahu, and Molokai. (U.S. Department of Commerce, National Marine Fisheries Service, September 1987).

Humpback whales spend the winter months in Hawaiian waters, residing in greatest numbers in the Maui-Molokai-Lanai-Kaho'olawe area and Penguin Bank. The waters around Maui County are the most important calf rearing areas. Humpback whales have been observed in the waters off 'Anaeho'omalu Bay. However, they tend to favor waters about 46 meters (25 fathoms) in depth (Tinney, March 1988), and the offshore plateau between Waiulua and 'Anaeho'omalu Bays which extends approximately 200 meters from the shoreline, is only 2-5 meters in depth. Beyond this area, the bottom slopes to depths of 6-20 meters.

3. **Special Sites.** The project site itself (middle of the bay) has rather sparse coral growth, but along the lava rock shoreline at the edges of the bay, the coral reef formations are richer. There is also a reef at the mouth of the bay. Two fishponds are situated inland from the beach.

4. **Human Use Characteristics.** The submerged land in 'Anaeho'omalu Bay is within the Resource (R) subzone of the State Land Use Conservation District. Uses within the Conservation District are regulated by the State Department of Land and Natural Resources (DLNR) under Title 13, Chapter 2 (Regulation No. 4). Lands in the (R) subzone include those designated for future park and outdoor recreational uses, forest lands with commercial potential, offshore islands, and lands and territorial waters below the vegetation or debris line. The objective of the (R) subzone is to assure sustained use of natural resources in those areas. The intended use is consistent with the objective of the (R) subzone since it would help to prevent damage to living coral in the bay by anchors and makeshift moorings. In addition, the intended use would limit the mooring of boats to specific sites in the bay where the environmental impact would be the lowest and where the boats would not interfere with other recreational uses.

Land on the shore side of 'Anaeho'omalu Bay is in the State Land Use Urban District, with the exception of the two fishponds, which are in Conservation. The County zoning for the beach area is "Open." Inland and to the north, the land is zoned for resort, residential, and commercial use, with open areas as well. These uses conform with the County General Plan. Structures on the beach near the project site include public restrooms, the concessionaire's beach shack, and a restored *makaha* or water circulation gate connecting the fishpond with the open ocean. The Royal Waikoloan Hotel is located mauka of the fishponds.

The following resources/activities occur near the site: recreational fishing, scenic areas, historic/cultural resources (Hawaiian trails, petroglyphs, fishponds, etc.), and ocean recreation. Public access, parking, restrooms, showers, and picnic facilities are provided and maintained by Waikoloa Beach Resort. 'Anaeho'omalu is a public beach used for sunbathing and picnicking, and activities in the bay include swimming, snorkeling, scuba diving, windsurfing, surfing (outside the reef), boating, and sailing.

The anchoring of vessels within State waters at 'Anaeho'omalu Bay is presently unrestricted, and no fees are charged by the State to the public or to commercial operators. In conjunction with the State's Ocean Recreation Management Plan, WDC proposes to create a vehicle whereby public and commercial boating interests can co-exist within the limited space in the bay and compensate the State for the use.

As of March 17, 1989, there were eight temporary moorings in the bay; the moorings and vessels are described in Table 2. Seven of the existing moorings are used by various small craft operated by the WBA concessionaires, and all are located in areas specified for such mixed use in the State's Ocean Recreation Mangement Plan. The eighth mooring, however, is located in the middle of the restricted swim zone on the north side of the bay. This mooring is used by the *Cookie Jar*, a 37-foot catamaran with no sanitary facilities occupied by a couple and dog who have lived on-board since December 1988. The *Cookie Jar's* mooring consists of a cable wrapped around a live coral outcropping, along with a Danforth anchor. Without a management plan, there is no way for the State or the adjacent property owner to protect 'Anaeho'omalu Bay from pollution and damage to live coral caused by this kind of infringement. (Note: The State's Ocean Recreation Management Plan has recently been published, but it is still too early to evaluate the plan's effectiveness.)

Brock's survey included an assessment of the impact of Captain Nemo's boats and moorings on the marine environment. It appears that the moorings and the boats using them have no negative impact on surrounding marine communities (see section E1).

5. **Other Existing Conditions**

a. **Existing Covenants, Easement, Restrictions.** The submerged land on which the moorings would be installed is public land belonging to the State of Hawaii. Use of this submerged land requires a permit from the State Department of Land and Natural Resources (DLNR), in accordance with Title 13, Chapter 2 (Regulation No. 4), Administrative Rules of DLNR Providing for Land Use Within the Conservation District. The owner of the shore side land (the applicant) is required to provide public access to the shoreline.

b. **Archaeological/Historic Sites.** None are located within the project boundaries.

c. **Existing Utilities.** Not applicable.

d. **Adjacent Properties.** The proposed use is compatible with existing and future uses of the abutting parcel (TMK 6-9-07:15), which is owned by Richard P. Smart (mailing address: Parker Ranch, P.O. Box 458, Kamuela, Hawaii 96743). This parcel is located south of the Waikoloa Beach Resort public access road. It has long been used for picnics, camping, and beach recreation by Parker Ranch employees. The south shore of the bay is very suitable for swimming and fishing; *pahoehoe* lava outcroppings interspersed with pocket beaches provide easy access to the bay. Like the land fronting the rest of 'Anaeho'omalu Bay, the abutting parcel is zoned "Open" by the County in accordance with the County General Plan.

E. POTENTIAL IMPACTS AND SUGGESTED MITIGATION MEASURES

1. Impact on the Physical/Biological Environment

As discussed earlier, the proposed permanent and day-use moorings will be installed with little disturbance to the substrata, and their availability will help to prevent damage to living coral by anchors. Selected coral heads will probably have to be removed, but in general, the impact on the physical and biological environment will be *less* than the present conditions because the potential for anchor damage to coral would be decreased. No adverse impacts on nearshore water quality or biota are expected.

In his study of 'Anaeho'omalu Bay, Brock addressed two questions:

- Are the present temporary moorings and their use having an impact on surrounding marine communities?
- Will the deployment of additional moorings impact neighboring marine communities?

Brock concluded from his observations that the existing moorings appear to have no negative impact on surrounding marine communities. The anchors showed little or no evidence of movement, and no litter was found in the vicinity. Brock stated that this suggests "a thoughtful use of the facilities and the imposition of an appropriately sensitive management style." (Brock, September 1988) Moreover, Brock noted that there is no generation or dumping of sewage from the vessels; with the proposed increase in the number of moorings, there should be no change in practice. All vessels will continue to comply with Coast Guard regulations. Brock's assessment is that if impacts were to occur, they would probably be locally negligible since the moorings are located in an area with poor benthic and fish community development (sand biotope).

In his report, Brock discusses the impact of coral removal in the transition zone between the biotope of diverse high coral coverage and the sand biotope. Placement of moorings in this

transition zone will be minimized, and removal of coral will be highly selective and limited. According to Brock, selective coral removal may result in temporary increases in turbidity, but this impact would decline rapidly. Corals are capable of removing sediment settling on them, and the sediment load would be not much greater than presently exists in the bay on a windy afternoon.

Brock's report also addresses the potential impact on green sea turtles. His conclusion is that the presence of these animals in the area suggests that the existing levels and patterns of human use do not negatively affect the resident turtle population. With the proposed increase in the number of moorings, little or no impact should occur, given the lack of forage and distance of the project from the tentatively identified turtle resting area. In other areas where green sea turtles are known to rest in large numbers (for example, just seaward of the Hawaii Kai entrance channel in Maunalua Bay, Oahu), heavy boat traffic does not appear to have any impact.

Furthermore, boating activities associated with the moorings should have no effect on nesting, since nearly all reproduction by green sea turtles in the Hawaiian Islands occurs at French Frigate Shoals (at least 90%) and other leeward islands (about 10%). A very low level of nesting has recently taken place on Kauai, Oahu, and Molokai; no nesting sites have been identified on the Big Island. (U.S. Department of Commerce, National Marine Fisheries Service, September 1987)

Another concern is the potential impact of increased boating activity on humpback whales. Noise from boats has the potential to mask phonations of humpbacks, and breaching behavior is significantly correlated with close approach of vessels and, to some extent, with sudden changes in sound intensity or frequency resulting from changes in engine speed or propeller pitch. However, there is insufficient information to determine exactly how whales are being affected by human activities or how potential adverse effects can be avoided or mitigated, especially since the the whales' responses are not consistent. (Tinney, March 1988).

There will be an increase in boat traffic in the area due to the installation of moorings in 'Anecho'omalu Bay. Captain Nemo's operations will remain the same. Nick's Aqua Sports' operations will add up to six boat trips per day. The availability of day-use moorings for the public is also expected to contribute to an increase in vessel traffic.

To minimize possible impacts of boating activities on whales in the area, the Waikoloa Beach Resort boat operators will be required to adhere to rules similar to those contained in the "Whalewatching Code" of the Hawaii Whalewatching Association (a self-regulating group of operators on Maui), as well as the guidelines promulgated by the National Marine Fisheries Service (NMFS). For example, the NMFS guidelines limit vessel approach to no closer than 100 yards in most Hawaiian waters, and no closer than 300 yards in Maui's Maalaea Bay, on the north and east sides of Lanai, and to mother-calf pods. The rules covering the Waikoloa concessionaires will place restrictions on whale watching activities, including the number of boats watching a pod at any one time, distance and direction of approach, and length of time. Boats will be required to maintain constant engine speed around whales, observe a speed limit, and avoid sudden changes in speed or direction. More stringent rules will have to be followed when in the vicinity of mother-calf pairs. These rules will be enforced by the applicant as part of its management of the bay.

The potential impacts of the project on water quality have been discussed in section D-1-g.

2. Socioeconomic Impact

No adverse socioeconomic impacts are anticipated. Placement of the moorings in the context of an overall ocean recreational management plan for 'Anacho'omalu Bay will help to prevent conflicts between the various allowed uses.

In addition, the tourism and ocean recreation industries, as well as the public, will benefit from the provision of permanent and day-use moorings. These are in short supply along the Kohala-Kona coast, and the State has been unable to keep up with the demand for moorings at Honokohau and Kawaihae. (As mentioned earlier, Captain Nemo's Ocean Sports has been on the waiting list for a mooring at Honokohau Harbor since 1980. The company has also been waiting for an opening at Kawaihae Harbor for six years.) There are only two State mooring locations on the island of Hawaii—Keauhou and Hilo—and neither is in close proximity to 'Anacho'omalu. This situation has placed a burden on the small businesses that make up the ocean recreation industry.

What Waikoloa Development Co. is attempting to do is assume responsibility, at no cost to the taxpayer, for something that has traditionally been within the purview of government. Although no precedent for this type of private sector initiative currently exists, it offers a solution that keeps coastal waters open for public use and protects marine ecosystems. It also offers an innovative approach to the management of recreational resources. WDC is requesting permission to manage the activities within 'Anacho'omalu Bay; it is not requesting the allocation of State resources. Rather, it seeks to transfer the cost of enforcement from a public entity with limited staff and financial resources and a much wider scope of responsibility, to a private entity with the ability and commitment necessary to effectively manage 'Anacho'omalu Bay.

F. ALTERNATIVES

1. **Other Suitable Sites.** Other mooring sites in West Hawaii include Kawaihae Harbor, Honokohau Small Boat Harbor, and Keauhou Bay. None of these is suitable. Kawaihae Harbor, about eight miles from 'Anacho'omalu, serves primarily as a commercial harbor for interisland barges. Honokohau is too far away (approximately 25 miles from 'Anacho'omalu Bay) and has no available slips. Keauhou, the State-designated mooring area in West Hawaii, is even farther away than Honokohau.

2. **Separate Applications from Each Operator.** As stated earlier, each operator may apply separately for moorings. However, such a piecemeal approach would not assure consistent, sound management of the bay's resources. Public moorings would not be provided under this scenario, and the likelihood of anchor damage to live coral would be greater.

3. **Day-Use Moorings.** Another alternative is to install only day-use moorings in 'Anacho'omalu Bay. Permanent moorings would still have to be found for the boats temporarily anchored in the bay, and as explained above, no suitable sites are available. This is not a viable alternative for the boat operators.

4. **Mooring Methods/Designs.** The various alternatives are discussed in detail in section C2 on page 4.

5. **Alternatives if Permit is Denied.** Alternative 2 above is the only one that would allow continued ocean recreation operations at 'Anacho'omalu Bay. This is the expedient option but not the favored one from environmental and management perspectives. Both alternatives 1 and 3 are impractical and unrealistic.

G. PARTIES TO BE CONSULTED IN THE PREPARATION OF THE EIS

Federal Agencies

Department of the Army, Army Corps of Engineers, Honolulu District
Department of Commerce, National Marine Fisheries Service
Department of Interior, Fish and Wildlife Service
Department of Interior, National Park Service
Department of Transportation, U. S. Coast Guard

State Agencies

Department of Business and Economic Development
Department of Health
Department of Land and Natural Resources
Department of Transportation, Harbors Division
Office of Environmental Quality Control
Office of Hawaiian Affairs
Office of State Planning
University of Hawaii Environmental Center

State Legislators

Senator Andrew Levin
Senator Richard Matsuura
Senator Malama Solomon
Representative Jerry Chang
Representative Harvey Tajiri
Representative Wayne Metcalf
Representative Dwight Takamine
Representative Virginia Isbel
Representative Mike O'Kieffe

Hawaii County

Office of the Mayor
Fire Department
Department of Parks and Recreation
Planning Department
Police Department

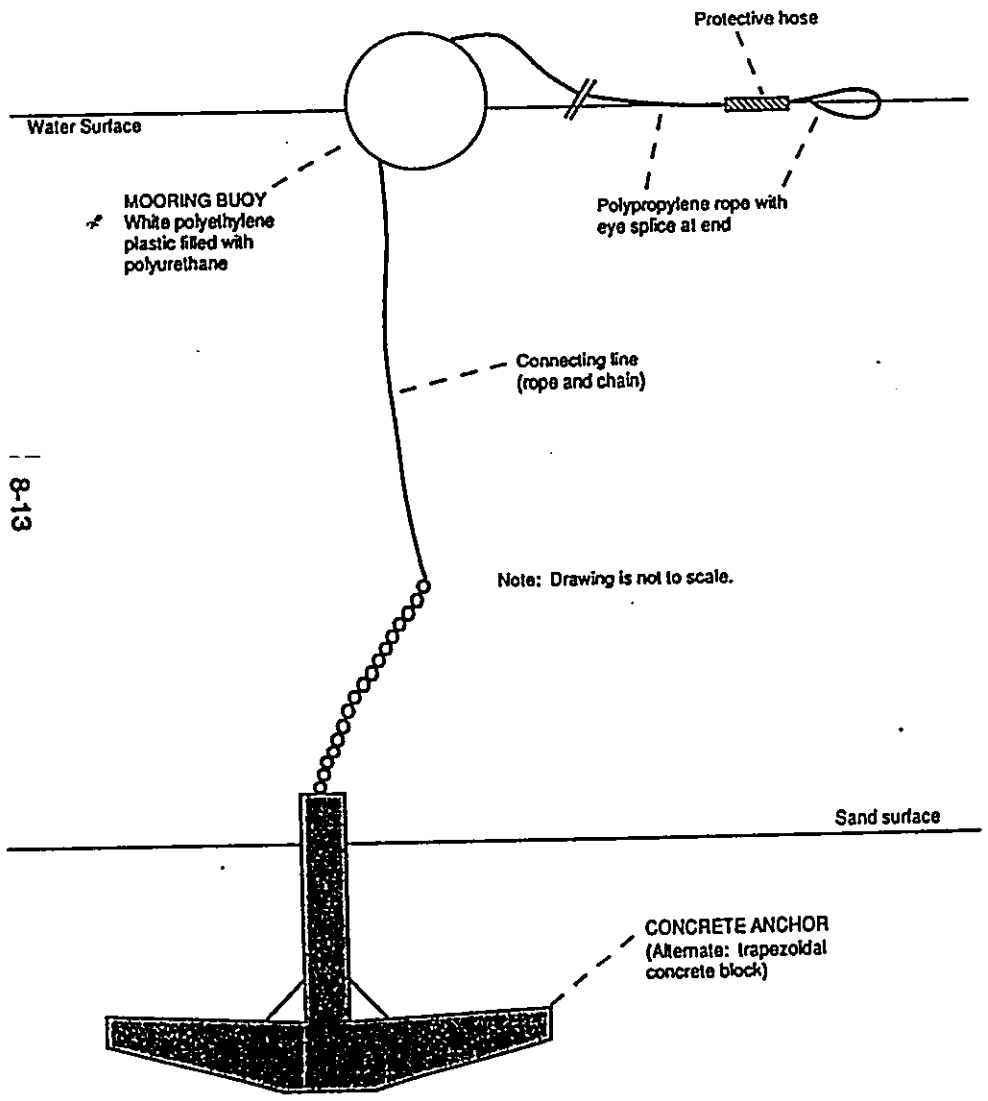
Hawaii County Council

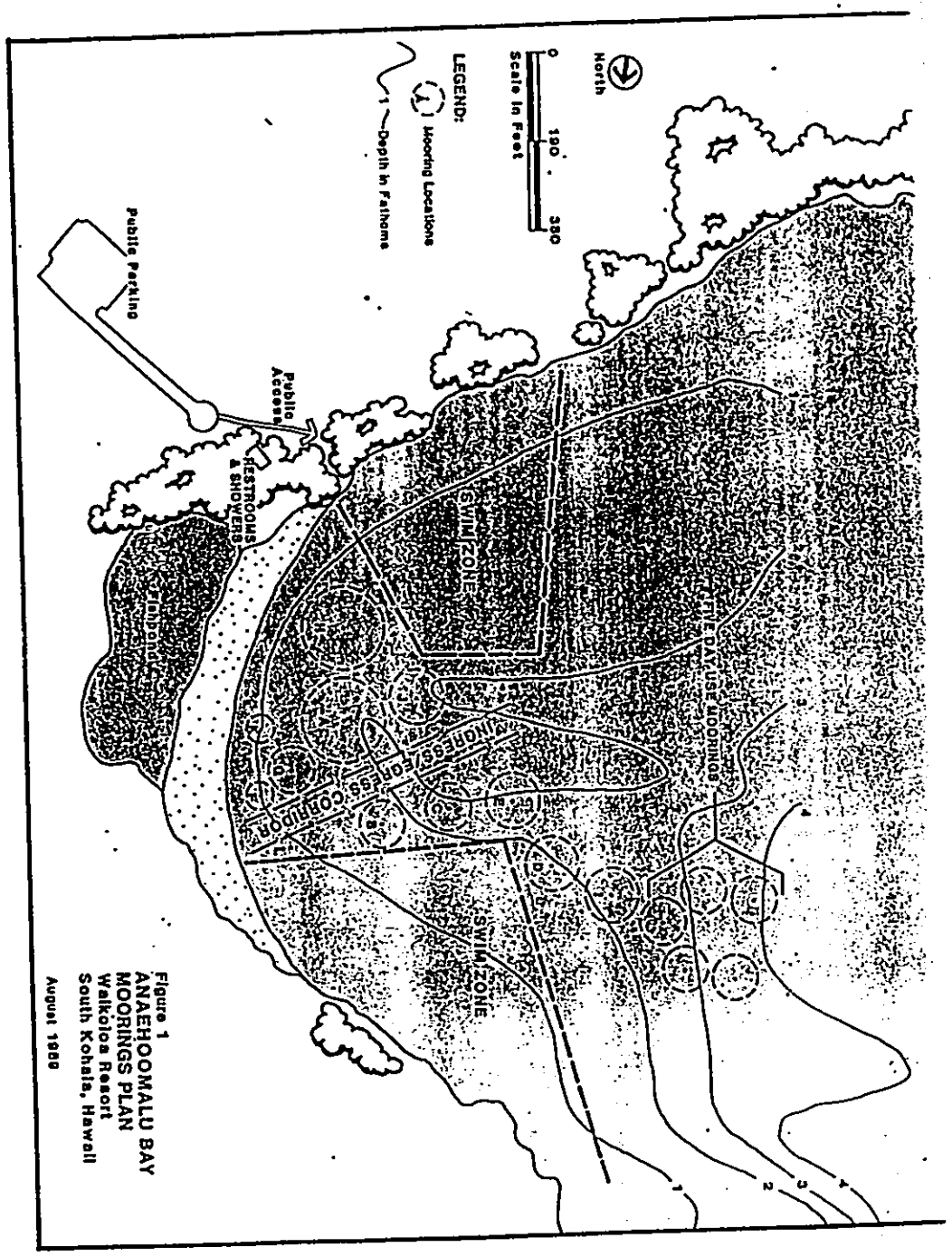
Russell S. Kokubun, Chairman
Takashi Domingo
Helene H. Hale
Lorraine R. Inouye
Merle K. Lai, Vice Chairman
Robert H. Makuakane
Harry S. Ruddle
Spencer K. Schutte
Stephen K. Yamashiro

Community Organizations and Other Public Interest Groups

Big Island Business Council
Big Island Chamber of Commerce
Hawaii Hotel Association
Hawaii Island Economic Development Board
Hawaii Leeward Planning Conference
Hawaii Visitors Bureau - Big Island Chapter
Kona-Kohala Chamber of Commerce
Life of the Land
Na Ala Hele
The Ocean Recreation Council of Hawaii (TORCH) - Hawaii Chapter
People for Access to the Shoreline (PASH)
The Waimea Hawaiian Civic Club

FIGURE 2. Schematic Drawing of Proposed Mooring System





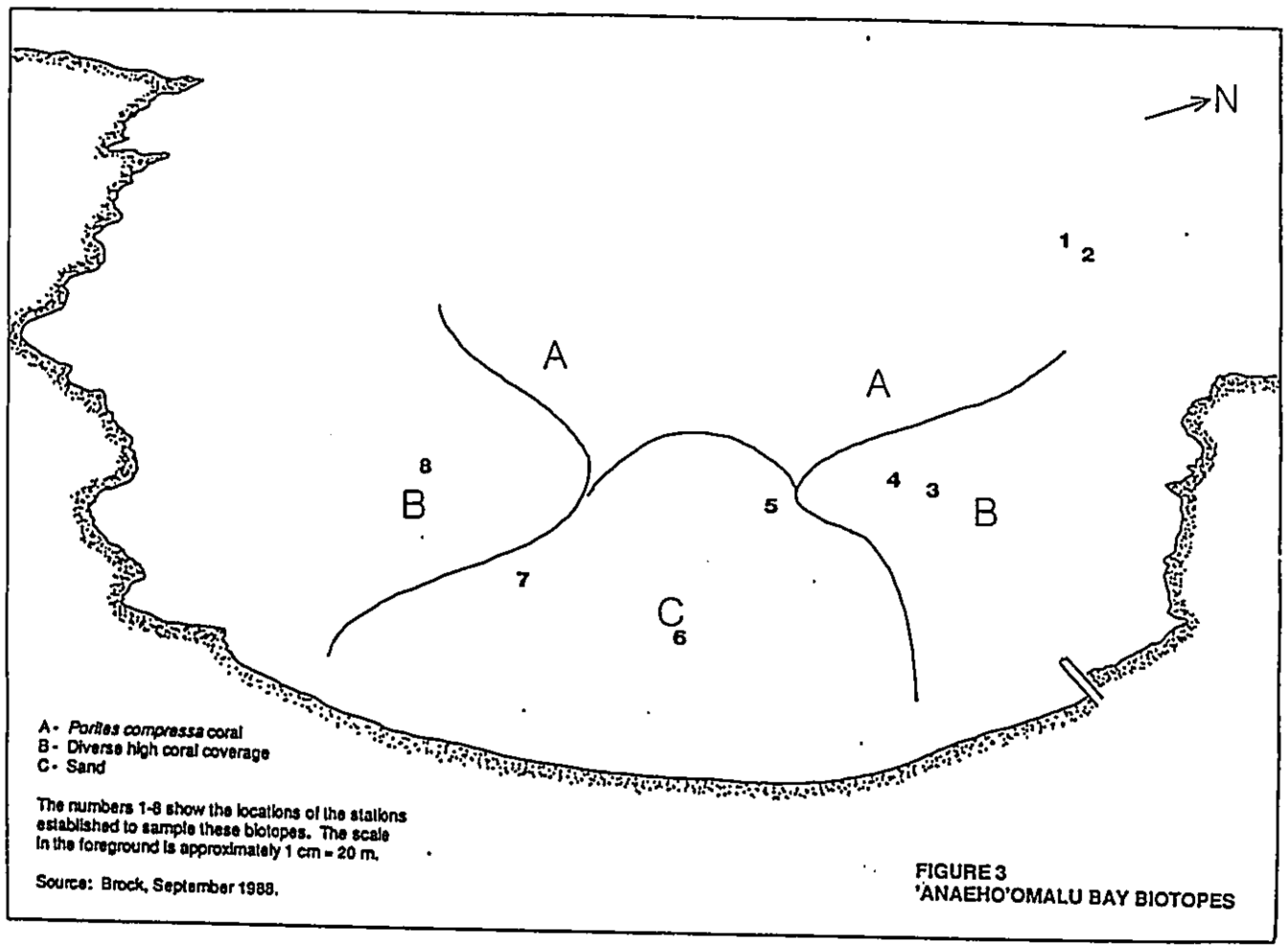


FIGURE 3
'ANAEHO'OMALU BAY BIOTOPES

TABLE 1. VESSELS TO BE PERMANENTLY MOORED AT 'ANAEHO'OMALU BAY

Vessel Length/Type	Draft (ft)	Mooring Requirements*		Vessel Capacity		No. of Trips to Beach Per Day	Minutes Spent on Beach Per Trip
				Passengers	Crew		
CAPTAIN NEMO'S OCEAN SPORTS:							
A. Up to 65' Catamaran	6	Deep	R=90'	49	6	2	15-30
B. 26' Monohull	5	Deep	R=50'	4	1	2	15-30
C. 36' Dive Boat	4	Shallow	R=60'	18	4	2	15-30
D. 30' Tender/Dive Boat	4	Shallow	R=60'	20	4	2	15-30
E. 26' Glass Bottom Boat	2	Shallow	R=50'	16	4	2	15-30
F. Dinghy	2	Shallow	R=30'	- -	2	8	5-10
G.Training Platform**		Shallow	R=50'				
NICK'S AQUA SPORTS (DBA RED SAILS SPORTS):							
H. Up to 50' Catamaran	5	Deep	R=90'	49	6	2	15-30
I. 40' Dive Boat	5	Shallow	R=60'	20	4	2	15-30
J. 40' Monohull	6	Deep	R=60'	10	2	2	15-30
K. Dinghy	2	Shallow	R=30'	- -	2	6	5-10
VARIOUS:							
L. Stern Mooring (near ingress/egress)	5	Shallow	Linear	Not Applicable	Not Applicable	***	***

*Refers to the depth of water required at the mooring site, as well as the radius (R) of the area needed to accommodate the circular movement of the boat on the mooring line.
**To be returned to shore at the end of each day.
***Used to secure vessels during loading and unloading on the shore in periods of strong surge or surf.

TABLE 2. EXISTING MOORINGS IN 'ANAEHO'OMALU BAY

Description of Vessel	Description of Mooring	Approx. Location*	Placement Date
CAPTAIN NEMO'S OCEAN SPORTS:			
26' monohull ("Intuition")	Caterpillar tractor track w/out pads, steel	"G"	Mid-88
	w/ galvanized chain attached, & rope mooring		
	line; partly covered w/ sediment & encrusted		
	w/ new coral growth.		
26' glass bottom boat	2 old anchors w/ chains connected to a concrete	"C"	Mid-84
	block anchor at mooring location "B". The		
	chain provides flexibility for tie-up locations,		
	depending on wind & sea conditions.		
36' dive boat ("Diver One")	1' thick x 4' wide x 5' long concrete block w/	"B"	Mid-85
	steel shackles, chain, & ring. This anchor is		
	connected to "A-1" by chain. "B" and "A-1"		
	are connected by chain to the subsurface moor-		
	ing buoy for "B".		
42' catamaran ("Mea'u")	Composite of 3 separate anchors to a single	"A"	
	mooring & subsurface buoy. This arrangement		
	stabilizes the vessel in a variety of wind and		
	sea conditions. The 3 anchors are as follows:		
	A-1. Large concrete block w/ steel shackle &	Northeast of	Mid-85
	multiple chains. The chains interconnect the	"A"	
	various underwater anchors & are used to tie		
	off vessels at locations "A" and "B". This		
	anchor eliminates the tendency of boats to		
	drag anchor in strong winds.		
	A-2. Approx. 100-lb. Danforth anchor &	Southeast of	Sep-81
	chain; heavily encrusted w/ coral & embedded	"A"	
	in sand bottom.		
	A-3. Approx. 150-lb. plow anchor ("CQR");	Southwest of	Sep-85
	heavily encrusted w/ coral & embedded in sand	"A"	
	bottom.		
NICK'S AQUA SPORTS (DBA RED SAIL SPORTS):			
50' catamaran ("Noa Noa")	Concrete block approx. 2' thick x 4' wide x 6'	"H"	Dec-88
	long w/ pipe sleeves for galvanized chain		
	attachment.		
37' Delta dive boat	Approx. 100-lb. Danforth anchors, one each,	"J"	Sep-88
	approx. 50' apart on an east-west axis w/		
	chain & rope linkages to a mooring float.		
OTHER:			
Stern mooring (used by both	Concrete block & tractor track w/ shackle &	"L"	1986
WBA concessionares)	chain.		
37' Wharrom catamaran	Cable wrapped around live coral outcropping,	Swim Zone**	Dec-88
("Cookie Jar"/transient user)	along w/ Danforth anchor in second location.		
*The locations refer to the sites of the proposed moorings shown in Figure 1.			
**This mooring is located in the middle of the restricted swim zone on the north side of the bay.			

BCA
BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

September 15, 1989
89-1654 (846.25)

_____

_____

_____

Dear _____:

Environmental Impact Statement (EIS) Preparation Notice
Proposed Installation and Management of Permanent
and Day-Use Moorings in 'Anaeho'omalu Bay

Waikoloa Development Company proposes to install 11 permanent moorings and 5 transient day-use moorings in 'Anaeho'omalu Bay and to manage the use and maintenance of the moorings. An additional mooring is proposed for a training platform, to be used by windsurfers and returned to shore at the end of each day. The permanent moorings will be for recreational vessels operated by Waikoloa Beach Resort concessionaires. The transient moorings will be for public use on a first come-first served basis. Moorings will be placed in submerged areas with sandy bottom, avoiding areas of live coral.

After reviewing a Conservation District Use Permit application submitted by Waikoloa Development Company, the Chairman of the Board of Land and Natural Resources determined that the proposed action and its potential impacts required the preparation of an EIS.

An EIS Preparation Notice (EISPN) was published in the September 8, 1989 issue of the Office of Environmental Quality Control Bulletin. A copy of the EISPN and Environmental Assessment is attached to this letter for your use.

We request that you or your organization assist us in preparing the 'Anaeho'omalu Bay Moorings EIS by providing comments on the proposed project as it relates to your jurisdiction and responsibility, special knowledge, or interest. Please indicate in writing specific questions, issues, and topics you believe to be of greatest concern and the reasons why they are.

The EIS Regulations stipulate that, upon publication of a preparation notice, interested groups and individuals have 30 days in which to request to become a consulted party and to make comments regarding the environmental effects of the proposed project. We hope that you will be able to respond within this time period. Thank you for your cooperation.

If you have any questions, please call me at 521-5361.

Sincerely,

Anne L. Mapes

KH:lf

Enclosure

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
ENVIRONMENTAL MANAGEMENT DIVISION
FIVE WATERFRONT PLAZA, SUITE 250
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD/CWB

October 27, 1989

C1003PQ

Ms. Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Boulevard
Suite 200
Honolulu, HI 96813

8-17

Dear Ms. Mapes:

Subject: Environmental Impact Statement (EIS) Preparation Notice for Proposed Installation and Management of Permanent and Day-Use Moorings in Anaehoomalu Bay, South Kohala, Hawaii

This letter is in response to your request dated September 15, 1989, for comments on the proposed project to install permanent and day-use moorings in Anaehoomalu Bay on the Island of Hawaii. Per telephone conversation of October 9, 1989 between Ms. Prema Qadir of the Clean Water Branch and yourself, the Department understands that the U.S. Army Corps of Engineers issued a Section 10 Permit for the subject project in 1988.

The Department of Health is the issuing authority for the Section 401 Water Quality Certification which must be secured in conjunction with a Section 404 Permit from the U.S. Army Corps of Engineers. The Department of Health does not issue Section 401 Water Quality Certifications for projects which require Department of the Army Section 10 Permits. Therefore, the Department has no jurisdiction over the subject project. Furthermore, after review of your transmittal dated September 15, 1989, the Department has no comments or objections to the subject project.

Should you have any questions, please contact the Clean Water Branch at telephone 543-8309.

Very truly yours,

JOHN C. LEWIN, M.D.
Director of Health

RECEIVED
NOV 6 1989
BELT, COLLINS & ASSOCIATES

(15)

Speaker
DANIEL J. KIHANO
Vice Speaker
EMILIO S. ALCON
Majority Leader
TOM OKAMURA
Majority Floor Leader
PETER K. APO

DISTRICT REPRESENTATIVES
1st — JERRY L. CHANG
2nd — HARVEY S. TAJIRI
3rd — WAYNE METCALF
4th — DWIGHT Y. TAKAMINE
5th — VIRGINIA ISBELL
6th — MIKE O'KIEFFE
7th — MARK J. ANDREWS
8th — HERBERT J. HONDA
9th — JOSEPH M. SOUKI
10th — ROZ BAKER
11th — DANIEL J. KIHANO
12th — SAMUEL S. H. LEE
13th — ROBERT BUNDA
14th — JOSEPH P. LEONG
15th — REB BELLINGER
16th — TERRANCE W. H. TOM
17th — MARSHALL K. IGE
18th — WHITNEY T. ANDERSON
19th — ED BYBEE
20th — CAM CAVASSO
21st — DAVID STEGMAIER
22nd — FRED HERAYAMA
23rd — BARBARA MARUMOTO
24th — FRED HEMMINGS, JR.††
25th — CALVIN K.Y. SAY
26th — LES IHARA, JR.
27th — BRIAN T. TANIGUCHI
28th — JAMES T. SHON
29th — DAVID M. HAGINO
30th — JOAN HAYES
31st — CAROL FUKUNAGA
32nd — MAZIE HIRONO
33rd — ROD TAM
34th — MIKE LIU†
35th — KENNETH T. HIRAKI
36th — DWIGHT L. YOSHIMURA
37th — DENNIS A. ARAKAKI
38th — EMILIO S. ALCON
39th — ROMY M. CACHOLA
40th — KAREN K. HORITA
41st — TOM OKAMURA
42nd — CLARICE Y. HASHIMOTO
43rd — DAVID Y. IGE
44th — ROLAND M. KOTANI
45th — JULIE DULDULAO
46th — PAUL T. OSHIRO
47th — ANNELLE C. AMARAL
48th — HENRY HAALILIO PETERS
49th — PETER K. APO
50th — EZRA R. KANOHO
51st — BERTHA C. KAWAKAMI

†Minority Leader
††Minority Floor Leader

HOUSE OF REPRESENTATIVES
THE FIFTEENTH LEGISLATURE
STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

RECEIVED
OCT 11 1989
BELT, COLLINS & ASSOC

(12)

October 6, 1989

Anne Mapes
Belt, Collins and Associates
680 Ala Moana Blvd., Suite 200
Honolulu, Hawaii 96813

Dear Ms. Mapes:

I acknowledge the receipt of and thank you for providing me with the opportunity to comment on the EIS for the Installation and Management of Permanent and Day-Use Moorings in 'Anaeho'omalu Bay.

I have no comments to make at this time.

With warm personal regards.

Sincerely,

WAYNE METCALF
Chairman
House Committee on Judiciary

ROBERT H. MAKUAKANE
Councilman

COUNTY COUNCIL
County of Hawaii
Hawaii County Building
25 Aupuni Street
Hilo, Hawaii 96720

RECEIVED
OCT 5 1989
BELT, COLLINS & ASSOCIATES

October 3, 1989

8-18

Ms. Anne L. Mapes
Belt, Collins & Associates
680 Ala Moana Blvd., Suite 200
Honolulu, Hawaii 96813

Dear Ms. Mapes:

Thank you for your letter and report dated September 15, 1989, regarding the Environmental Impact Statement Preparation Notice Proposed Installation and Management of Permanent and Day-Use Moorings in Anaeho'omalu Bay.

We appreciate your taking the time in presenting your proposal.

Very truly yours,

Robert H. Makuakane
Councilman

RECEIVED
OCT 10 [illegible]
BELT, COLLINS & ASSOCIATES

Bernard K. Akana
Mayor
Susan Labrenz
Managing Director
Gregory R. Mooers
Deputy Managing Director

Office of the Mayor
25 Aupuni Street, Rm. 213 • Hilo, Hawaii 96720 • (808) 961-8211 • Fax (808) 961-6553

October 5, 1989

Ms. Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Blvd., Suite 200
Honolulu, HI 96813

Dear Ms. Mapes:

EIS Preparation Notice
Proposed Installation and Management of Permanent and Day-Use Moorings in 'Anaeho'omalu Bay

Thank you for the opportunity to provide comments on the EIS Preparation Notice for moorings in 'Anaheo'omalu Bay. I have referred the matter to my Planning Director for his direct response to you.

Aloha,

Bernard K. Akana
MAYOR

cc: Duane Kanuha, Planning Director

HAWAII LEEWARD PLANNING CONFERENCE
P.O. BOX 835 • KAILUA-KONA, HAWAII 96745-0835

September 29, 1989

Belt Collins & Associates
680 Ala Moana Blvd
Suite 200
Honolulu, HI 96813

Dear Sirs:

8-19

We have reviewed the Environmental Assessment for the proposed "Installation and Management of Permanent and Day-Use Moorings in 'Anaeho'omalu Bay" and feel that this document addresses all of our major concerns. We, therefore, have no specific questions, nor wish to raise any new issues or topics.

Thank you for asking for our review and comments. We look forward to reviewing the EIS when completed.

Sincerely,

H. Peter L'Orange
President

HPL:sjs

OFFICE POTTERY TERRACE, ORCHID BLDG. #226, KAILUA-KONA • PHONE 329-2334 • FAX 329-7108

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF

October 4, 1989

Operations Branch

Ms. Anne L. Mapes
Belt Collins & Associates
Suite 200, 680 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Ms. Mapes:

This is in regard to your Environmental Impact Statement Preparation Notice (EISPN) regarding the proposed installation and management of permanent and day-use moorings in Anaehoomalu Bay, South Kohala, Hawaii.

Thank you for allowing us to review your project. We have reviewed the EISPN and have found that it is the same project that was authorized under Department of the Army (DA) permit no. PODCO 2051 which was issued to the Transcontinental Development Corporation (TDC). The scope and conditions of the project remain the same, and further processing will not be required. However, we would appreciate an explanation of the relationship between TDC and the Waikoloa Development Company.

As a followup to our letter of February 28, 1989, we would also like to know whether the National Marine Fisheries Service was contacted on the biological and legal status of the threatened green turtles.

Should you have any questions on this matter or on any aspect of the DA regulatory permit program, please feel free to contact the Operations Branch at 438-9258.

Sincerely,

Stanley T. Arakaki
Chief, Operations Branch
Construction-Operations Division

Copy Furnished:

National Marine Fisheries Service
Room 106, 2570 Dole Street
Honolulu, Hawaii 96822-2396

BCA
BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 30, 1989
89-2210 (846-25)

Mr. Stanley T. Arakaki, Chief
Operations Branch
Construction - Operations Division
U.S. Army Engineer District, Honolulu
Department of the Army
Fort Shafter, Hawaii 96858-5440

Dear Mr. Arakaki:

8-20

Environmental Impact Statement (EIS) Preparation Notice for Proposed Installation and Management of Permanent and Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter of October 4, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay.

In response to your inquiry, Waikoloa Development Company is the successor to Transcontinental Development Company. The change is the result of a business reorganization and is a formality only. Waikoloa Development Company is charged with development and operations at the Waikoloa Beach Resort and has assumed the rights, duties, and obligations as relate to the subject project.

Regarding the biological and legal status of the threatened green turtles, we sent a copy of the Corps of Engineers permit application to the National Marine Fisheries Service and they have completed their consultation under the Endangered Species Act. A copy of John Naughton's comment letter is enclosed for your information.

Sincerely,

Anne L. Mapes

Enclosure: Ltr to A. Mapes from J. Naughton, 10/4/89

cc: Ken Melrose

RECEIVED
OCT 5 1989
BELT, COLLINS & ASSOCIATES

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Area Office - Southwest Region
2570 Dole St. - Honolulu, HI 96822

October 4, 1989 F/SWR13:JJN

Ms. Anne L. Mapes
Belt Collins and Associates
680 Ala Moana Blvd. Suite 200
Honolulu, HI 96813

Dear Ms. Mapes:

NOAA Fisheries has reviewed the Environmental Impact Statement (EIS) Preparation Notice for the proposed Installation and Management of Permanent and Day-use Moorings in Anaeho'omalu Bay, South Kohala, Hawaii. We understand that the Waikoloa Development Company proposes to install 11 permanent moorings and 5 transient day-use moorings in Anaeho'omalu Bay and to manage the use and maintenance of the moorings. The following comments are offered for your consideration in preparing the proposed EIS for the project.

NOAA Fisheries reviewed and commented on the Army Corps of Engineers permit application and a subsequent revision of the application for the proposed project. We also completed consultation under the Endangered Species Act. Our major concern, which should be addressed in the EIS, is that all mooring anchors be placed on sand or coral rubble substrate. In addition, the scope from individual anchor lines/chains must be adjusted so they do not impact living coral colonies.

We appreciate the opportunity to comment on the subject EIS Preparation Notice. Please contact me at 955-8831 should you have any questions concerning these comments.

Sincerely yours,

John J. Naughton
Pacific Islands Environmental
Coordinator

cc: F/SWR13, Terminal Is., CA
EPA, Region 9 (E-4)
FWS, Honolulu
Hawaii CZM Program
Hawaii State Div. of Aquatic Resources
Corps of Engineers, Honolulu District

BCA
BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 21, 1989
89-2121

Mr. John J. Naughton
Pacific Islands Environmental Coordinator
National Marine Fisheries Service
Pacific Area Office - Southwest Region
2570 Dole Street
Honolulu, Hawaii 96822

8-21

Dear Mr. Naughton:

Environmental Impact Statement (EIS) Preparation Notice for
Proposed Installation and Management of Permanent and
Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter of October 4, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay.

Your concern about the placement of mooring anchors and adjustment of anchor lines/chains will be addressed in the EIS. As indicated in the environmental assessment, every effort will be made to place moorings in sand to minimize the disturbance of live coral.

Sincerely,

Anne L. Mapes

Anne L. Mapes

ALM:cq

cc: Ken Melrose

RECEIVED
SEP 25 1989
BELT, COLLINS & ASSOCIATES

United States Department of the Interior
FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

ES
Room 6307
September 22, 1989

Ms. Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Blvd., Suite 200
Honolulu, Hawaii 96813

Re: Environmental Impact Statement (EIS) Preparation Notice Proposed Installation and Management of Permanent and Day-Use Moorings in 'Anaeho'omalu Bay

Dear Ms. Mapes:

We have reviewed the referenced material dated September 15, 1989 and find that due to its nature, the proposed project will have no significant deleterious impact on fish and wildlife resources within our jurisdiction. Please do not hesitate to call on us if we may be of further assistance.

We appreciate this opportunity to comment.

Sincerely yours,

Ernest Kosaka
Field Office Supervisor
Environmental Services

cc: NMFS - WPPO
DLNR
EPA, San Francisco

(16 A)

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
BARBARA KIM STANTON
DEPUTY DIRECTOR
LESLIE S. MATSUBARA
DEPUTY DIRECTOR

RECEIVED
NOV 9 1989
BELT COLLINS & ASSOCIATES

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

KAMAMALU BUILDING, 250 SOUTH KING ST., HONOLULU, HAWAII
MAILING ADDRESS: P.O. BOX 2359, HONOLULU, HAWAII 96804 TELEX: 7430250 MDPED

October 4, 1989

Ms. Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Boulevard
Suite 200
Honolulu, Hawaii 96813

Dear Ms. Mapes:

8-22

SUBJECT: Environmental Assessment of Moorings in Anaeho'omalu Bay, Hawaii

In response to your request for comments on the EISPN and Environmental Assessment, the following concerns are outlined:

Day Use Moorings:

Are 5 day-use moorings enough? If the 5 day-use moorings are full - what then? Does this mean no more boating access in the Bay, or is anchoring to still be allowed? Will the day-use moorings limit access and if so - how so? Are these day-use moorings set aside for "public" use or use on a first-come-first-serve basis for other commercial ventures who want to operate in the bay i.e. dive boats, small 6 pax charter sailboats, etc.? Does day-use mean only during the day? Can a private sailboat/fishing boat owner stay overnight in the bay on a day-use mooring?

Permanent Moorings:

What activities will be pursued while boats are at the moorings? Are the moorings just for loading and unloading and downtime when no activity is occurring? How are moorings re-allocated if a company loses or gains another boat?

We would like to see the Waikoloa Development Companies' proposals for "controlled" access to the moorings. Lack of facilities is a problem for all boat owners and private/public small boat owners should not be excluded from the bay if they want to spend a few days tied to a day-use mooring or anchored offshore.

"Cookie Jar", pg. 9:

Lack of space in the small boat harbors is cited as one of the main reasons for establishing permanent moorings. A private/transient boater is moored/anchored off Waikoloa for the same reasons as the commercial vendors.

(16 B)

If commercial tour operators are to be "grandfathered" into moorings, why not "Cookie Jar" as long as they comply with the new Ocean Recreation Management Plans, remove cable wrapped around coral and get a holding tank for their sewage discharge. Since lack of adequate harbor facilities is a problem for all boaters why not provide a portion (percentage) of the permanent moorings for private/transient boaters who can pay a mooring fee and possibly increase the number of moorings requested.

Alternatives, pg 12:

Statements about Kawaihae Harbor are not entirely accurate. There are numerous boats moored within the southern side of the commercial harbor, although there is not much room for additional moorings. There are also other areas to anchor which could be used as mooring sites in protected bays near Waikoloa Bay, although not as ideally located. In addition, expansion plans are in the proposed stages for an expanded small boat harbor outside and to the left of Kawaihae shipping area.

Thank you for the opportunity to provide these comments.

Sincerely,

Barbara Kim Stanton
for Roger A. Ulveling

BCA
BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 30, 1989
89-2209 (846-25)

Mr. Roger A. Ulveling, Director
Department of Business and Economic Development
State of Hawaii
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Ulveling:

Environmental Impact Statement (EIS) Preparation Notice for Proposed Installation and Management of Permanent and Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter dated October 4, 1989, and received November 9, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay. Here are responses or clarifications to your comments:

Day Use Moorings. Your concerns relating to the day use or transient moorings will be addressed in the EIS. Specifically, the EIS will contain a detailed description of the management plan proposed for 'Anaeho'omalu Bay.

Permanent Moorings. No activities will take place while boats are moored. The issue of re-allocation of moorings is currently covered in the agreement between the Waikoloa Beach Association and the concessionaires. Under the agreement, the number of vessels per concessionaire is specified and limited.

Cookie Jar. The proposal to increase the number of permanent moorings in the bay and set aside a percentage for private/transient boaters will be considered. A key concern is the capacity of the bay and the maximum number of moorings that can be installed without causing congestion and safety problems.

Alternatives. We understand that a section of Kawaihae Harbor was recently realigned to accommodate 30 more recreational vessels, thus clearing the waiting list for moorings. This new information will be included in the Draft EIS. In response to your question, there are no other protected bays in the vicinity suitable for moorings which are readily accessible by land.

Sincerely,

Anne L. Mapes

cc: Ken Melrose

823

RECEIVED
OCT 6 1989
BELT, COLLINS & ASSOCIATES

STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
1600 KAPIOLANI BLVD., SUITE 1500
HONOLULU, HAWAII 96814
(808) 548-6000
(808) 946-2642

October 5, 1989

Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Blvd., Suite 200
Honolulu, Hawai'i 96813

Re: Environmental Impact Statement (EIS) Preparation Notice
Proposed Installation and Management of Permanent
and Day Use Moorings in 'Anaeho'omalu Bay

Dear Ms. Mapes:

The Land and Natural Resources Division of this office has reviewed the Environmental Assessment prepared for Waikoloa Development Co. concerning 'Anaeho'omalu Bay moorings, as requested in your September 15, 1989 letter. We have the following concerns:

1. The Conservation District Use Permit Application (CDUA) requests eleven (11) permanent moorings for commercial enterprises and five (5) transient day-use moorings for the general public. Provisions for commercial enterprises are more than double those made for the general public. Two of the commercial boats alone will accommodate approximately 95 people at a time. This ratio of commercial to public use, we feel, is weighted far too heavily in favor or commercial use. Considering the rapid population growth in West Hawaii the provision of only five (5) mooring for the general public is inadequate.

2. We question whether an ingress/egress corridor for commercial boating concerns, through the middle of the two public swimming zones, is safe or practical. Safety measures need to be addressed in detail. Additionally, it appears from the sketch attached to the Environment Assessment that the public day-use mooring will be

Ms. Anne L. Mapes
Belt Collins & Associates
October 5, 1989
page two

located some distance from the shore. How is it anticipated that people using these moorings will get from their boats to the shore? Will they be expected to swim or walk through the ingress/egress corridor, or will they be expected to come through the public swimming areas? How will they be informed?

3. The Environmental Assessment does not address public rights to shoreline and reef fishing or the manner in which this will be accommodated in the proposed management plan.

4. The Attorney General of the State of Hawaii has determined that the Office of Hawaiian Affairs is entitled to a pro rata share of income derived from submerged lands. This Office, then, has an interest in the mechanism used by the State of Hawai'i to lease submerged lands. We strongly urge that a percentage lease, which would include components of base rent and percentage of the gross revenue from rental of the moorings, be utilized.

5. Lacking precise details of Waikoloa Development Co.'s proposal to manage and in the words of the Environmental Assessment "transfer the cost of enforcement" of the bay, from the State to Waikoloa Development Co., we assume that all public rights to beach and ocean resources shall be assured and protected.

Sincerely,

Office of Hawaiian Affairs

Richard K. Paglinawan

Richard K. Paglinawan
Administrator

cc: Thomas Kaulukukui, Sr.,
Chair, Board of Trustees

William Paty,
Chair, Board of Land and Natural Resources

8-24

10 B

BCA
BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 21, 1989
89-2119

Mr. Richard K. Paglinawan, Administrator
Office of Hawaiian Affairs
State of Hawaii
1600 Kapiolani Blvd., Suite 1500
Honolulu, Hawaii 96814

Dear Mr. Paglinawan:

Environmental Impact Statement (EIS) Preparation Notice for
Proposed Installation and Management of Permanent and
Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter of October 5, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay.

Your concerns about the number of day-use or public moorings will be considered in the EIS. The issue of safety will also be addressed, as it relates to the ingress/egress corridor in the mixed use zone. Please note that the ingress/egress corridor is the only natural, safe access for boats into the bay. Rather than allow boats to enter and leave the bay at any point, and thus risk conflicts with swimmers and other users, the State's Ocean Recreation Management Plan limits boat traffic to a specific corridor.

Regarding the distance of the day-use moorings from the shoreline, the site was selected because of its sand substrate and its proximity to an area particularly rich biota which offers good diving and snorkeling opportunities. This sand pocket is a good spot for dive boats to anchor without causing damage to live coral. Access to the shoreline would be via the ingress/egress corridor. These items will be covered in the EIS.

Public rights to shoreline and reef fishing will not be affected by the proposed moorings. The State's Ocean Recreation Management Plan (ORMP) was not established to control such uses. A detailed description of Waikoloa Development Co.'s proposed management plan for the bay, based on the ORMP, will be contained in the EIS. All public rights to beach and ocean resources will be assured and protected under the plan.

In response to your suggestion regarding the formula used to determine lease payments, the terms of the lease of State land will be arranged with the Department of Land and Natural Resources, through the Land Management Division, after approval of the permit.

Sincerely,

Anne L. Mapes

ALM:cq

cc: Ken Melrose

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

October 2, 1989
RN:0239

Ms. Anne L. Mapes
Belt Collins and Associates
680 Ala Moana Boulevard, Suite 200
Honolulu, Hawaii 96813

8-25

Dear Ms. Mapes:

Environmental Impact Statement (EIS) Preparation Notice
'Anaeho'omalu Bay
(Proposed Installation and Management of Permanent and Day-Use Moorings)
South Kohala, Hawaii

Thank you for the opportunity to provide comments at this EIS preparation stage on the proposed installation of moorings in 'Anaeho'omalu Bay.

We have briefly reviewed the preparation notice materials and accompanying Environmental Assessment and note that most of the key concerns have been identified. The concerns seem to be divided into two categories: the short term impacts attendant on setting the anchors, and the longer term impacts associated with the use of the anchoring facilities.

With regard to the short term impacts, we assume that any concrete anchoring structure will be designed to withstand extreme wave action, and that appropriate limits on the size/volume of ship that can use the anchors will be strictly adhered to so as to assure mooring/ship/"wave climate" compatibility and safety.

There was no mention of the use of jet skis or para sail operations in this area. Are there any plans for these activities, or are they precluded by ordinance?

We appreciate the opportunity to provide comments and look forward to reviewing the Draft EIS when it becomes available.

Yours truly,

Jacquelin Miller
Associate Environmental Coordinator

cc: OEQC
L. Stephen Lau
Anna Ulaszewski

BCA
BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BLLTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 21, 1989
89-2120

Ms. Jacquelin Miller
Associate Environmental Coordinator
University of Hawaii Environmental Center
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

8-26

Dear Ms. Miller:

Environmental Impact Statement (EIS) Preparation Notice for
Proposed Installation and Management of Permanent and
Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter of October 2, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay.

Your suggestions regarding impacts of extreme wave action and limits on the size/volume of boats will be considered in the design of the anchor structures.

In response to your question, neither jet ski nor parasail operations currently take place in the bay. There are no plans for such operations. Under the State's approved Ocean Recreation Management Plan, 'Anaeho'omalu Bay is not designated for these uses.

Sincerely,

Anne L. Mapes

ALM:cq

cc: Ken Melrose

RUSSELL S. KOKUBUN
Chairman & Presiding Officer

COUNTY COUNCIL
County of Hawaii
Hawaii County Building
25 Aupuni Street
Hilo, Hawaii 96720

RECEIVED
NOV 17 1989
BELT, COLLINS & ASSOCIATES

November 15, 1989

Ms. Ann L. Mapes
Belt Collins and Associates
680 Ala Moana Boulevard, Suite 200
Honolulu, Hawaii 96813

Dear Ms. Mapes:

I apologize for this very late response to the Environmental Impact Statement Preparation Notice for the proposed installation and management of permanent and day use moorings for 'Anaeho'omalu Bay. Although I have obviously missed the 30 day time limit to make comments regarding the impacts of the proposed project, I hope you will still consider and respond to my questions.

I am primarily interested in three specific issues:

1. If the shoreline areas are to be used for landings, the loading/unloading of passengers, refueling, resupplying, etc., there appears to be a need to obtain a Shoreline Management Area Permit, Shoreline Setback Variance and a Shoreline Certification in order to allow these uses. Will this be done?

2. It appears from your attached map that a very small part of the sandy beach will be used for the swim zone areas. It would seem appropriate that the swim zones utilize the sandy shoreline and that the non-sandy areas be used to build ingress and egress facilities for those users of the moorings. Please reconsider the proposed uses for the shoreline areas.

3. Because these are public waters that are open to public use, it appears that the management of these waters should fall under the jurisdiction of the State Department of Transportation (DOT) and/or the State Department of Land and Natural Resources (DLNR). Waikoloa Development Company should

17 B

Russell S. Kokubun
November 15, 1989
Page 2.

be responsible for the installation and the maintenance of the moorings; however, DOT and/or DNLR should be responsible for the adoption of appropriate administrative rules, which will include public hearings that allow for public input and comment. DOT and/or DLNR rules should include the siting and the use of the moorings, both public and private, as well as the means to deal with solid waste and other contaminants. DOT and/or DLNR should be responsible for enforcement of adopted rules.

Thank you for allowing me to comment and I hope these issues will be considered in the Environmental Impact Statement. If I can provide further clarification, please do not hesitate to contact me at 961-8263.

8-27

Sincerely,

Russell S. Kokubun, Chairman
Hawaii County Council

BCA
BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 30, 1989
89-2211 (846-25)

The Honorable Russell S. Kokubun, Chairman
County Council, County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Councilman Kokubun:

Environmental Impact Statement (EIS) Preparation Notice for Proposed Installation and Management of Permanent and Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter of November 15, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay. Here are responses or clarifications to your comments:

1. County Permits. The applications for a Corps of Engineers permit for the moorings and for Coastal Zone Management consistency were both reviewed by the County of Hawaii Planning Department. The department did not indicate a requirement for any County permits since the project is located makai of the shoreline. (Note: Both the Corps permit and CZM consistency certification have been granted.) Landings, loading/unloading of passengers, and resupplying generally take place in waters makai of the shoreline, since guests must wade to a dinghy which shuttles them out to the catamaran, glass bottom boat, or other larger vessel. However, these activities are directly associated with the resort/beach concessionaire operations rather than the moorings. They are part of the operations allowed under the permits obtained by the applicant for its hotel development. For your information, no fueling occurs in 'Anaeho'omalu Bay; the concessionaires' boats are fueled at Kawaihae.

2. Swim Zones. Under the State's Ocean Recreation Management Plan (ORMP), swimming is allowed throughout the bay, not just in the "swim zones." The plan sets aside swim zones for swimming only which are off-limits to boats and windsurfers. The swim zones in 'Anaeho'omalu Bay are good areas for snorkeling, offering interesting viewing of coral and other marine life. Boats are barred from these zones to protect snorkelers and swimmers, as well as to prevent anchoring and possible damage to live coral. The ingress/egress corridor designated in the ORMP is the only safe access for boats into the bay.

3. Management. We recognize that the management of State waters falls under the jurisdiction of the Department of Transportation and the Department of Land and Natural Resources. Under our proposal, government would still retain control over the waters and submerged lands of 'Anaeho'omalu Bay. A "management agreement" between the Board of Land and Natural Resources, the Department of Transportation, and Waikoloa Development Company would transfer the cost of management and enforcement from these agencies to Waikoloa for a specified period. This agreement would be similar in concept to the lease agreement between DLNR and Network Enterprises for management of State land at Malaekahana for camping—a concept that is consistent with the Governor's encouragement of public/private sector partnerships. Details of the proposed management plan will be included in the EIS.

Please feel free to contact me if you have further questions or concerns.

Sincerely,

Anne L. Mapes

cc: Ken Melrose, WDC

8-28

LIFE OF THE LAND

October 1, 1989

Ms. Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Blvd. suite 200
Honolulu, Hawaii 96813

Dear Ms. Mapes;

Life of the Land, Big Island Chapter would like to be a consulted party in the preparation of the EIS for installing moorings in Anaeho'omalu Bay.

Two areas that should be addressed are:

1) A description of the history, legal status and impact of the moorings that are already present in the bay; and

2) A water quality and marine life analysis. From personal observation, the overall water quality appears good although the turbidity is high near the shore. However, swimming in the bay has led to some concern about the water in the immediate vicinity of the rock jetty on the north side of the bay. Please examine the water within 20 yards of that jetty.

Thanks for your attention to our comments.

Sincerely, Bill Graham

Bill Graham
LOL, Big Island Chapter
P.O. Box 155
Hawi, HI 96719

BCA
BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BLTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 30, 1989
89-2212 (846-25)

Mr. Bill Graham
Life of the Land, Big Island Chapter
P.O. Box 155
Hawi, Hawaii 96719

Dear Mr. Graham:

Environmental Impact Statement (EIS) Preparation Notice for Proposed Installation and Management of Permanent and Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

8-29

Thank you for your letter of October 1, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay.

In response to you first comment, the history, legal status, and impact of existing moorings in the bay will be addressed in the EIS. Marine biologist Dr. Richard Brock conducted an assessment of the impact of existing moorings on the marine environment. He found that the moorings and boats using them have no negative impact on surrounding marine communities.

Analyses of water quality and marine biota in the bay will be discussed in the EIS. You are correct that overall water quality is good. We assume that the rock jetty referred to in your letter is the *makaha* or water circulation channel for Ku'ualii and Kahapapa Fishponds, providing the only tidal link with the bay. Hence, the water quality in this area may differ from other parts of the bay, including lower salinity.

Regarding your concerns about the "swim zones," under the State's Ocean Recreation Management Plan (ORMP), swimming is allowed throughout the bay. The plan sets aside zones for swimming only which are off-limits to boats and windsurfers. The swim zones in 'Anaeho'omalu Bay are good areas for snorkeling, offering interesting viewing coral and other marine life. Boats are barred from these zones to protect snorkelers and swimmers, as well as to prevent anchoring and possible damage to live coral. The ingress/egress corridor designated in the ORMP is the only safe access for boats into the bay.

Life of the Land, Big Island Chapter, will be a consulted party in the EIS process, and you will receive a copy of the Draft EIS when it is published.

Sincerely,

Anne L. Mapes

Anne L. Mapes

cc: Ken Melrose

TAKASHI DOMINGO
Councilman

COUNTY COUNCIL
County of Hawaii
Hawaii County Building
25 Aupuni Street
Hilo, Hawaii 96720

RECEIVED
OCT 5 1989
BELT, COLLINS & ASSOCIATES

October 4, 1989

Ms. Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Blvd.
Suite 200
Honolulu, HI 96813

Dear Ms. Mapes,

The following comments are in reference to the EIS Preparation Notice for the "Proposed Installation and Management of Permanent and Day-Use Moorings in Anaehoomalu Bay," dated August 1989.

While the EISPN states that "Anaehoomalu is a public beach used for sunbathing and picnicking, and activities in the bay include swimming, snorkeling, scuba diving, windsurfing, surfing (outside the reef), boating, and sailing," it fails to place sufficient emphasis on the need to evaluate the degree of impact that the proposed project will have on the public's access to, and use of, the public beach.

The Royal Waikoloan and Hyatt Regency Waikoloa are already, to a large degree, dominating the use of the sandy beach and swimming area with beach umbrellas, chains, boats, etc. It now appears as though the proposed project is proposing to take away the swimming area entirely.

The two "swim zones" designated in Figure 1 are not the ideal swimming areas at Anaehoomalu. The ideal swimming area is the area just off the sandy beach --- the area the EISPN is proposing as sites for moorings.

The EISPN rightfully stresses the need to protect Anaehoomalu's physical and biological environment; however, I believe that a careful assessment of the impact that the proposed project will have on the public's right to enjoy Anaehoomalu Bay is equally important.

I believe that the EIS should take a very close look at the impact that the proposed project will have on the public's right to enjoy Anaehoomalu's sandy beach and swimming area, notwithstanding the EISPN's statement that Figure 1 is in accord with the Statewide Ocean Recreation Management Plan.

8-30 As Chairman of the Council's Committee on Planning, I will strongly oppose any improvement that will infringe upon the public's right to enjoy the shoreline and nearshore waters of our County.

Sincerely,

Takashi Domingo

Takashi Domingo, Councilman
COUNTY OF HAWAII

(6B)

BCA
BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 21, 1989
89-2122

The Honorable Takashi Domingo, Councilman
County Council
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Councilman Domingo:

Environmental Impact Statement (EIS) Preparation Notice for
Proposed Installation and Management of Permanent and
Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter of October 4, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay.

Your comments regarding the public's access to and use of the beach are well taken, and these issues will be fully addressed in the EIS. To date, Waikoloa has provided unrestricted daytime land access, along with parking (78 stalls), shower/restroom facilities, picnic facilities, and pathways along the entire ocean frontage of the bay.

Regarding the swim zones, these areas are set aside in the State's approved Ocean Recreation Management Plan for swimming only and are off-limits to boats. The central part of the bay is designated for mixed use and, therefore, boats are permitted, along with swimmers, windsurfers, etc. A primary purpose of the Ocean Recreation Management Plan is to resolve some of the conflicts between various users. The swim zones shown on the map have been designated as such because they are good areas for snorkeling, offering interesting coral and other marine life for viewing. Boats are barred from these zones to protect snorkelers/swimmers, as well as to prevent anchoring and possible damage to live coral.

Please feel free to contact me if you have further questions or concerns.

Sincerely,

Anne L. Mapes

Anne L. Mapes

ALM:cq

cc: Ken Melrose

RECEIVED
OCT 16 1989
BELT, COLLINS & ASSOCIATES

(13)

Bernard K. Akana
Mayor
Duane Kanuha
Director
William L. Moore
Deputy Director

Planning Department

25 Aupuni Street, Rm. 109 • Hilo, Hawaii 96720 • (808) 961-8288

October 12, 1989

Ms. Anne L. Mapes
Belt Collins and Associates
680 Ala Moana Boulevard, Suite 200
Honolulu, HI 96813

Dear Ms. Mapes:

EIS Notice of Preparation
Proposed Installation and Management of Permanent and Day-Use Moorings in 'Anaeho'omalu Bay, South Kohala, Island of Hawaii

We have reviewed the subject notice of preparation and although we have no direct jurisdiction over the proposed use, we submit the following comments:

8-31

1) The impacts of petroleum products to be used by the vessels need to be discussed. How and where will the vessels be fueled?

2) The Notice of Preparation indicates that Waikoloa Development Co. in conjunction with the concessionaires, will develop rules to prevent degradation of the water quality and pollution of the bay. Similar rules will be adopted for public use. Will these rules be advertised and published prior to and after their adoption? How and who will enforce these rules, especially with regard to the day-use moorings for public use?

3) The EIS should list all rules and regulations which would be applicable to the moorings including those relating to water quality, sewage/wastewater disposal, ocean mining, etc..

4) The Envionrmental Assessment says that a non-exclusive easement is being sought for the moorings, yet some will be assigned for specific users. Is the non-exclusive easement applicable then only for the 5 transient or day-use moorings?

Should you have any questions, please do not hesitate to contact this office again.

Sincerely,

DUANE KANUHA
Planning Director

VKG:lv

cc: Mayor Akana (#2214)

BCA
BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 30, 1989
89-2208 (846-25)

Mr. Duane Kanuha, Planning Director
County of Hawaii Planning Department
25 Aupuni Street, Room 109
Hilo, Hawaii 96720

Dear Mr. Kanuha:

Environmental Impact Statement (EIS) Preparation Notice for Proposed Installation and Management of Permanent and Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter of October 12, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay.

The impacts of petroleum products to be used by boats moored in the bay will be discussed in the EIS. There will be no fueling activities in the bay; vessels will be fueled at Kawaihae.

A detailed description of the proposed management plan for the bay will be included in the EIS, including rules and regulations relating to water quality, sewage/wastewater disposal, whale watching, etc., and their enforcement. It is anticipated that these rules will be publicized prior to and after their adoption. The State's approved Ocean Recreation Management Plan will form the basis for the management plan for 'Anaeho'omalu Bay.

In response to your question, a non-exclusive easement is being sought over portions of the ocean floor owned by the State of Hawaii for the attachment of both the permanent and day-use moorings.

Please feel free to call me if you have further questions or concerns.

Sincerely,

Anne L. Mapes

cc: Ken Melrose

Police Department

349 Kapiolani Street • Hilo, Hawaii 96720 • (808) 961-2244 • Fax (808) 961-2702

Bernard K. Akana
Mayor
Victor V. Vierra
Chief of Police
Wayne G. Carvalho
Deputy Chief of Police

(2)

RECEIVED
SEP 29 198.
BELT, COLLINS & ASSOCIATES

September 27, 1989

Ms. Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Blvd., Suite 2000
Honolulu, Hawaii 96813

8-32

Dear Ms. Mapes:

This is in response to your letter of September 15, 1989, regarding the Environmental Impact Statement (EIS) Preparation Notice for the proposed installation and management of permanent and day-use moorings in 'Anaeho'omalu Bay.

The notice has been reviewed and some comments have been noted for your consideration. Please refer to the enclosed memorandum submitted by Captain Lawrence Mahuna for further details.

Thank you for this opportunity to comment.

Sincerely,

VICTOR V. VIERRA
CHIEF OF POLICE

lli

Enc.

TO : VICTOR V. VIERRA, CHIEF OF POLICE

VIA : FRANCIS DE MORALES, INSPECTOR, PATROL OPERATIONS

FROM : LAWRENCE MAHUNA, CAPTAIN, SOUTH KOHALA DISTRICT

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT/PREPARATION NOTICE
PROPOSED INSTALLATION AND MANAGEMENT OF PERMANENT
AND DAY USE MOORINGS IN 'ANAEHO'OMALU BAY
RE: CHIEF'S ROUTE SLIP #40275

The undersigned has reviewed the Waikoloa Development Company's proposed installation of moorings in 'Anaeho'omalu Bay. The only concern from the police perspective is in regards to swimmers safety and use of the bay. By looking at the mooring plan submitted, the moorings indicated by the letters "K" and "F" are less than fifty feet offshore. I would think that this would interfere with bathers and swimmers using the bay for recreational swimming/windsurfing or conditioning/theraputic distance swimming. The plan also places the mooring sites in the central portion of the bay and movements of vessels attached to these moorings may present a hazard to people using the bay for recreational diving and other water sports. The "swim zones" also indicated on the map appear to be too far from the central portion of the bay itself.

Lawrence K. MAHUNA
Captain
09-22-89

BCA
BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 21, 1989
89-2118

Mr. Victor V. Vierra, Chief of Police
Hawaii County Police Department
349 Kapiolani Street
Hilo, Hawaii 96720

Dear Chief Vierra:

8-33

Environmental Impact Statement (EIS) Preparation Notice for
Proposed Installation and Management of Permanent and
Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter of September 27, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay.

Captain Mahuna's concerns about swimmers' safety and use of the bay will be addressed in the environmental impact statement.

Regarding the swim zones, these areas are set aside in the State's approved Ocean Recreation Management Plan for swimming only and are off-limits to boats. The central part of the bay is designated for mixed use and, therefore, boats are permitted, along with swimmers, windsurfers, etc. A primary purpose of the Ocean Recreation Management Plan is to resolve some of the conflicts between various users. The swim zones shown on the map have been designated as such because they are good areas for snorkeling, offering interesting coral and other marine life for viewing. Boats are barred from these zones to protect snorkelers/swimmers, as well as to prevent anchoring and possible damage to live coral.

Sincerely,

Anne L. Mapes

Anne L. Mapes

ALM:cq

cc: Ken Melrose

Kona Hawaiian Civic Club

RECEIVED
OCT 16 1989
BELT. COLLINS & ASSOCIATES

October 13, 1989

Ms. Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Blvd., Suite 200
Honolulu, HI 96813

Dear Ms. Mapes:

Thank you very much for offering the members of the Kona Hawaiian Civic Club the opportunity to review and to give our input into the preparation of the Environmental Impact Statement for the Proposed Installation and Management of Permanent and Day-Use Moorings in 'Anaeho'omalu Bay.

After talking with Mr. Ken Melrose on the above subject, I found that he has been in touch and working with the Waimea Hawaiian Civic Club members which is excellent, because they are closer to the area and therefore, we, in general, support their decisions on this matter.

After reading the prepared EIS, there were some items that we felt needed more clarifications. They are as follows:

1. On page 10, under 5.b. Archaeological/Historic Sites. You state that there are none located within the project boundaries. Question: Who looked? What about underwater? Artifacts and structures have been found underwater elsewhere.

2. On page 10, E. 1. 2nd Para., Brock concluded from his observations that the existing moorings appear to have no negative impact on surrounding marine comunities. On Page 12. F. 2. line 3. Public moorings would not be provided under this scenario, and the likelihood of anchor damage to live coral would be greater. Seems that in one instance you are saying moorings have no negative impact and then you admit there is some damage to live coral. This makes it difficult to believe all that we read.

3. Some of us have reviewed the maps and it certainly appears that the sand areas both above and below sea level will be designated as boat areas, which means that swimmers will be discouraged to use this preferred area. We say the preferred area because the public swim zones that are designated have no public facilities and includes the area fenced and marked for Parker Ranch employees and very little sand there..most of it is a combination of 'a'a and pahoehoe.

4. Of course when moorings take place on any beach, there has to be some extent of water pollution, adverse impact on the marine community, and safety problems with swimmers.

Julia A. Ka'Aua

(14 B)

However, if the above concerns can be mitigated, we would wholeheartedly be supportive of the plan. We understand that many undesirable activities are happening there anyway, and that if there is some management of the area it would help to make the area a safer and cleaner place for the locals as well as visitors.

Again, thank you for permitting us to review and comment regarding the environmental effects of the proposed project.

He ke aloha,

Mrs. Rose Akana Fujimori
President
P. O. Box 14
Kealakekua, HI 96750
Phone: 323-2797

8-34

BCA
BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELTH 7430474, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

November 21, 1989
89-2123

Mrs. Rose Akana Fujimori, President
Kona Hawaiian Civic Club
P.O. Box 14
Kealakekua, Hawaii 96750

Dear Mrs. Fujimori:

Environmental Impact Statement (EIS) Preparation Notice for Proposed Installation and Management of Permanent and Day-Use Moorings at 'Anaeho'omalu Bay, Waikoloa, Hawaii

Thank you for your letter of October 4, 1989, regarding the EIS preparation notice for the proposed moorings at 'Anaeho'omalu Bay. Here are responses or clarifications to your comments.

1. According to the State Historic Sites Section, no archaeological or historic sites are known to exist in the submerged area proposed for installation of the moorings. Although no archaeological survey was conducted, a visual survey of the sand bottom was carried out, supplemented by sand-probings at mooring locations to assess substratum conditions. The mid-bay area is well traversed, and no underwater sites have been observed to date. In the remote event that archaeological remains are encountered during installation of the moorings, work will be halted and the Historic Sites Section notified.

2. The two paragraphs cited in your letter are not conflicting because they refer to two different situations. On page 10, it is stated that the existing moorings have not resulted in negative impacts to surrounding marine communities. The point being made on page 12 is that if each operator applies for its own mooring permit, public moorings would not be provided and, hence, transient users would be more likely to indiscriminately drop anchors anywhere in the bay. Under this scenario (absence of both public moorings and a management program for the bay), the probability of anchor damage would be greater.

3. Under the State's approved Ocean Recreation Management Plan, the middle section of the bay is designated for mixed use; swimmers are allowed in this area. As shown on the map in the EIS prep notice, only two small dinghies will be moored close to the shoreline (moorings K and F), and these should not interfere with swimmers in the area.

The "swim zones" are set aside for swimmers only and are off-limits to boats, windsurfers, etc. A primary purpose of the Ocean Recreation Management Plan is to resolve some of the conflicts between various users. The swim zones shown on the map have been designated as such because they are good areas for snorkeling, offering interesting coral and other marine life for viewing. Fish prefer areas with coral substrate and rocky shorelines and, hence, these areas are preferred by snorkelers. Boats are barred from these zones to protect snorkelers and swimmers, as well as to prevent anchoring and possible damage to live coral.

Please be assured that mitigation measures will be implemented to prevent water pollution, adverse impacts on marine biota, and safety problems with swimmers. The purpose of the proposed management plan is to assure environmentally sensitive use of the bay.

8-35

Sincerely,

Anne L. Mapes

Anne L. Mapes

ALM:cq

cc: Ken Melrose

CHAPTER 9

COMMENTS ON THE DRAFT EIS AND RESPONSES

Following is a list of parties who commented on the Draft EIS. Copies of their letters and responses to them follow.

Federal Agencies

U.S. Army Corps of Engineers
U.S. Department of Agriculture

State Agencies

Department of Accounting and General Services, Public Works Division
Department of Defense
Department of Business and Economic Development, Energy Division
Office of Environmental Quality Control
Board of Agriculture
Department of Budget and Finance, Housing Finance and Development Corporation
Department of Land and Natural Resources
Department of Transportation, Harbors Division
Department of Health
University of Hawaii at Manoa

Other Organizations

The League of Women Voters
Life of the Land

RECEIVED
DEC 19 1989

BELT, COLLINS & ASSOCIATES

DEC 13 1989

RECEIVED
DEC 15 1989
ac
WAIKOLOA

(P)2219.9

Honorable William W. Paty
Chairperson
Board of Land and
Natural Resources
State of Hawaii
Honolulu, Hawaii

Dear Mr. Paty:

Subject: Permanent and Day Use Moorings
Anaehoomalu Bay, South Kohala, Hawaii
Draft EIS

Thank you for the opportunity to review the subject document. We have no comments to offer.

Should there be any questions, please contact Mr. Cedric Takamoto of the Planning Branch at 548-5742.

Very truly yours,

TEUANE TOMINAGA
State Public Works Engineer

CT:em
cc: Waikoloa Development Company
Office of Environmental Quality Control

9-2

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 2-9 Honolulu Hawaii 96813
Phone: (808) 521-5361 Fax: (808) 538-7819
Hawaii • Arizona • Nevada • New Mexico • Nigeria

February 9, 1990
90-333/846.25

Mr. Teuane Tominaga,
State Public Works Engineer
State Department of Accounting and General Services
Public Works Division
1151 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Tominaga:

Draft Environmental Impact Statement (EIS) for the Installation and Management of Permanent and Day-Use Moorings 'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your December 13, 1989 letter to Mr. William W. Paty regarding the above Draft EIS. We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

Anne L. Mapes

cc: Mr. Willaim Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

JOHN WAIHEE
GOVERNOR

RECEIVED
DEC 27 198_
COLLINS & ASSOCIATES

cc: Anne Mapes, BCA

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816-4495

ALEXIS T. LUM
MAJOR GENERAL
ADJUTANT GENERAL

MILES M. NAKATSU
COLONEL
DEPUTY ADJUTANT GENERAL

December 21, 1989

Engineering Office

RECEIVED
DEC 2 6 1989
cc
WAIKOLOA

Dr. Marvin T. Miura, Director
Officer of Environmental Quality Control
465 South King Street
Honolulu, Hawaii 96813

Dear Dr. Miura:

Proposed Installation and Management of
Permanent and Day Use Moorings
Anaeho'omalu Bay
South Kohala, Hawaii

Thank you for providing us the opportunity to review the above subject project.

We have no comments to offer at this time regarding this project.

Sincerely,

Jerry M. Matsuda
Lieutenant Colonel
Hawaii Air National Guard
Contracting & Engineering Officer

cc: Mr. William W. Paty, Chairman
State of Hawaii
Board of Land and Natural
Resources

✓Mr. Ken Melrose, Director of
Planning
Waikoloa Development Co.
Waikoloa, Hawaii 96743-3028

NATIONAL GUARD
Americans At Their Best

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

February 9, 1990
90-334/846.2500

Mr. Jerry M. Matsuda, Lieutenant Colonel
Hawaii Air National Guard Contracting & Engineer Officer
State Department of Defense
Office of the Adjutant General
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Dear Mr. Matsuda:

Draft Environmental Impact Statement (EIS) for the Installation and Management of Permanent and Day-Use Moorings 'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your December 21, 1989 letter to Dr. Marvin Miura regarding the above Draft EIS. We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

cc: Mr. Willaim Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

ENERGY DIVISION, 335 MERCHANT ST., RM. 110, HONOLULU, HAWAII 96813

JOHN WAIHEE, GOVERNOR
ROGER A. ULVELING, DIRECTOR
BARBARA KIM STANTON, DEPUTY DIRECTOR
LESLIE S. MATSUBARA, DEPUTY DIRECTOR

cc: Anne Mapes, BCA

RECEIVED
JAN 2 1990
BELT, COLLINS & ASSOCIATES

December 22, 1989

RECEIVED
DEC 28 1989
WAIKOLOA

The Honorable William W. Paty
Chairman
Board of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Subject: Proposed Installation and Management of Permanent and Day Use Moorings, Anaeho'omalu Bay, South Kohala, Hawaii

We wish to inform you that we have no comments to offer on the subject environmental impact statement.

Thank you for the opportunity to review the document.

Sincerely,

Maurice H. Kaya
Energy Program Administrator

MHK:if

cc: ✓Waikoloa Development Company
Dr. Marvin T. Miura

BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

February 9, 1990
90-335/846.2500

Mr. Maurice H. Kaya, Energy Program Administrator
State Department of Business and Economic Development
Energy Division
335 Merchant Street
Honolulu, Hawaii 96813

Dear Mr. Kaya:

Draft Environmental Impact Statement (EIS) for the Installation and Management of Permanent and Day-Use Moorings 'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your December 22, 1989 letter to Mr. William Paty regarding the above Draft EIS. We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

cc: Mr. Willaim Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:
Planning Branch

January 5, ~~1989~~ 1990

RECEIVED
JAN 10 1990
WAIKOLOA

Mr. William W. Paty, Chairman
State of Hawaii, Board of Land and
Natural Resources
P.O. Box 621
465 South King Street, Room 184
Honolulu, Hawaii 96809

Dear Mr. Paty:

We have reviewed the Draft Environmental Impact Statement (DEIS) for the Installation and Management of Permanent and Day-use Moorings in 'Anaeho'omalu Bay, South Kohala, Hawaii. The following comments are offered.

a. Appendix C of the DEIS should include the General and Special Conditions, and the plans and drawings, of the Letter of Permission. They are part of the Department of the Army (DA) permit and must be adhered to.

b. The title of the DEIS announces the proposed installation and management of moorings, but not the private implementation and enforcement of a recreation management plan for the entire bay, as is also proposed in the document. The DEIS title should be revised to accurately reflect the scope of the proposed action.

c. For clarity, it may be desirable to conduct a separate environmental assessment for implementation and enforcement of the proposed overall recreation management plan for the bay.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

BCA
BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

February 9, 1990
90-336/846.2500

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

Draft Environmental Impact Statement (EIS) for the Installation and Management of Permanent and Day-Use Moorings 'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your January 5, 1990 letter to Mr. William Paty regarding the above Draft EIS.

a. Appendix C of the Final EIS will include the General and Special Conditions as well as the plans and drawings of the Letter of Permission. As part of the Department of the Army (DA) permit, they will be adhered to.

b. The applicant proposes to follow the State Ocean Recreation Management Plan, as it pertains to 'Anaeho'omalu Bay. The Waikoloa Beach Association's proposed role in the management of uses has been modified as a result of discussions with appropriate government agency representatives after the Draft EIS was published. Essentially, the role has been reduced to an auxilliary one to government enforcement entities.

c. The applicant will work with State DLNR and DOT officials and staff to define public and private responsibilities in the enforcement of an overall recreation management plan for the bay. As mentioned above, the applicant expects to have an auxilliary role. It also expects to provide a point of contact and responsibility to government agencies through its concessionaire agreements. Given this reduced role, if a separate environmental assessment is needed, its preparation probably would be in the purview of the government agency responsible for management of the bay.

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes.

cc: Mr. Willaim Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

LIFE OF THE LAND

RECEIVED
JAN 24 1990
BELT, COLLINS & ASSOCIATES

Jan 22, 1990

Ms. Anne Mapes
Belt Collins
680 Ala Moana Blvd.
Honolulu, HI 96813

Dear Ms. Mapes;

With regard to the Draft Eis for moorings in Anaehoomalu Bay on the Big Island, we have the following comments:

9-6 It is clear to us that an analysis of current water quality in the bay is a necessity. The study of marine biota was good, but it only made passing reference to the water quality issue. Any possible impact on water quality must be examined as well.

There was also no in-depth analysis of the alternative of not having Waikoloa Land Company administer the moorings. The natural administrator would be the State of Hawaii, and a detailed examination of that alternative should be included.

As far as our comments on the content of the proposal, it appears that too many moorings are proposed, thus negatively impacting both swimmers and windsurfers. The shallow water zones set aside for swimming are too shallow for that use. Cut hands would be hard to avoid.

Sincerely,

Bill Graham

19 Niolopa Place, Honolulu, Hawaii 96817. Tel. 595-3903

BCA
BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 2nd Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELLH [illegible] Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

February 9, 1990
90-337/846.2500

Mr. Bill Graham
Life of the Land
19 Niolopa Place
Honolulu, Hawaii 96817

Dear Mr. Graham:

Draft Environmental Impact Statement (EIS) for the
Installation and Management of Permanent and Day-Use Moorings
'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your January 22, 1990 letter regarding the above Draft EIS. The following is provided in reponse to your letter.

1. As stated in the Draft EIS, Dr. Richard Brock, who conducted a biological survey of the project area and prepared an assessment of potential impacts, is also carrying out the ongoing water quality monitoring program for Waikoloa Beach Resort. To date, he has not encountered any water quality problems in 'Anaeho'omalu Bay. As supplemental material, we will include the findings of Dr. Brock's water quality monitoring of the bay in the Final EIS.

2. After the publication of the Draft EIS, the applicant and its representatives have had opportunities to discuss possible ways to administer the moorings with government officials and staff. The outcome of these ongoing discussions will be presented in a revised management plan which will be included in the Final EIS.

3. The proposed moorings siting plan has been revised to address concerns such as yours. The total number of moorings has decreased and a portion of the nearshore sandy central bay will be more accessible to swimmers. As for the shallow water zones set aside for swimming, they were selected for their interest to swimmers who are snorklers. Also, these swim zones were not designated by the applicant. Rather, they are part of the State Ocean Management Recreation Plan.

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

cc: Mr. Willaim Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

THE LEAGUE
OF WOMEN VOTERS
OF HAWAII

Jan. 22, 1990

Mr. William Paty, Chairman
Department of Land and Natural Resources
P.O. Box 621
Honolulu HI 96809

RECEIVED
JAN 24 1990
BELT, COLLINS & ASSOCIATES

Dear Mr. Paty:

I wish to comment on behalf of the League of Women Voters of Hawaii upon the "Draft Environmental Impact Statement for the Installation and Management of Permanent and Day-Use Moorings in 'Anaeho'omalu Bay, South Kohala, Hawai'i."

1. Management Plan

The DEIS does not provide sufficient information to know whether acceptance of the DEIS entails acceptance also of the Waikoloa Development Company's proposed management plan.

On the one hand, I fail to see why WDC would proceed with construction of the moorings if it were not assured control over them. This leads me to believe that, so far as WDC is concerned, acceptance of the DEIS constitutes acceptance of their management plan. On the other hand, throughout the DEIS, whenever the management plan is mentioned, it is referred to as something whose details have yet to be worked out. If the management plan is such a vital part of the WDC proposal, as it appears to be, by leaving details so vague, it would seem as though the public, and the state, are being asked to buy a pig in a poke.

9-7

Whatever the status of the management plan, it nonetheless contains some troubling features, as described in Appendix A and elsewhere.

First, the proposal calls for Waikoloa Development Company to police 'Anaeho'omalu Bay. This, WDC contends, would relieve the state of the expense and trouble of enforcing compliance with state rules (and WDC's own rules, which it would evidently have the state adopt) in the area.

But the state should convey enforcement powers to private parties only under extreme conditions. When private entities, especially ones having a large commercial interest in enforcement, are empowered to act as agents of the state, the state risks having the law enforced in a manner that is not even-handed. Is it not reasonable to think that the "deputies" paid by WDC might wink at infractions made by WDC concessionaires, while being extremely vigilant to point out violations made by private parties that may, for whatever reasons, not conform with WDC's notion of proper behavior?

I am afraid, in other words, that by deputizing employees of WDC, there is a good possibility that the public's access to the

state's waters and shores might be discouraged. Even while the public may still enjoy the right to use the new amenities, availing itself of this right may in fact become so much of a hassle that, by and by, the public no longer frequents the site. In that event, what should by rights be a public facility becomes in effect an exclusive private resort.

That brings up a second, related point. WDC says (page A-2) that its management plan "would assure public access to and along the shoreline." Would this access be only by a land route? Or will provision be made for access from the day-use moorings as well? Reading through the DEIS, I see where the commercial ventures will be able to have dinghies moored near the shore; will boats moored at the day-use moorings (the "public") be able to get to the shore via dinghy? If so, where would the dinghies be able to "park" while their users were on shore?

Duane Kanuha, planning director for the County of Hawai'i, notes (in a letter appearing on page 8-31 of the DEIS), that the WDC is seeking non-exclusive easements for the moorings, "yet some will be assigned for specific users. Is the non-exclusive easement applicable then only for the 5 transient or day-use moorings?" Ms. Anna L. Mapes replied that "a non-exclusive easement is being sought . . . for the attachment of both the permanent and the day-use moorings." But this response leaves unanswered the question of Mr. Kanuha. If I understand his question correctly, he is wanting to know how a non-exclusive easement can be used in assigning what amounts to, basically, exclusive rights to use the moorings. I do not see his question answered in the DEIS.

I am also left wondering what compensation the state will receive for assigning these "non-exclusive easements" to WDC. On Page 3-8, the DEIS states that "WDC proposes to create a vehicle whereby public and commercial boating interests can co-exist within the limited space in the bay and compensate the State for the use." Nowhere do I see any other reference to compensation to the state. If there is to be such, what is the amount that the state may expect to receive, and with what frequency? Will it be a one-time charge, or a yearly lease agreement? Beyond that, what role will the state have in setting the fees that WDC is to collect from users of its moorings? Will the state be able to ensure that the fees are reasonable and within reach of a meaningful public, not just the small "public" that forms the clientele of a world-class resort?

Moreover, I am not comforted by the assertion that although the state would have the "option to grant permits to other users at the mooring locations,...this probably would be unlikely." Why would this be unlikely? If the moorings are in public waters, and are to be considered a resource available for public use, why

should the DLNR assume, evidently, that the public would not want to avail itself of the moorings? Or am I to understand that what is unlikely is not the public's eagerness to use the moorings, but the chance that the DLNR would grant it permission to do so?

If indeed "WDC shares the State's primary concerns about ... keeping nearshore waters open to public use," I do not see how that translates into a need to have exclusive control over the moorings. Quite the contrary: One might reasonably expect a public agency to pursue the goal of public use with more vigor than a conglomerate of luxury resorts.

2. Anchoring System.

The DEIS states that "The first alternative listed above -- heavy concrete blocks or anchors -- will be used in 'Anaeho'omalu Bay." But the description that follows does not match the description given in the first reference to it (page 2-2). No mention is made on first reference to subsurface anchors; the only reference is to trapezoidal concrete blocks.

9-8

Evidently the decision has been made to go with concrete anchors rather than the sort of concrete blocks that the DEIS says Richard Brock has recommended. Why is there the departure from Brock's recommendation? Is it trivial or not? If at least part of the reasoning in favor of concrete blocks concerns their "trapezoidal shape," which "mimics the form of the dominant coral species," then why should this feature be ignored in favor of subsurface anchors (whose shape is, of course, completely irrelevant)?

I have no favored option here, but simply wish to point out an inconsistency in the DEIS that I feel should be addressed in the final statement.

3. Cumulative Impact.

Frequently the comment is heard that there is no overall management approach to developing Hawai'i's coasts. To give but one example: The report evaluating Hawai'i's Coastal Zone Management Program (written by the Office of Ocean and Coastal Resource Management (National Ocean Service, NOAA, U.S. Department of Commerce), noted that

> On Hawai'i, develpment on the Kona coast has generated pressure for increased marina development. Although State and local officials are responding to this pressure through the existing authorities, the State does not have a coordinated approach to marina planning, development and

> management. Further, the State has not addressed marina development needs and demands throughout the State (page 9).

This remark, made following an evaluation in 1988, is all the more germane in 1990. The WDC proposal is far from the only one being planned right now. There is also a marina planned in the Mauna Lani resort area, just north of the Waikoloa complex. Furthermore, the HRW Limited Partnership, owner of the Hyatt Regency Waikoloa, has announced it is in the process of preparing a Draft Environmental Impact Statement for dredging a channel in Waiulua Bay, constructing a dock and making other improvements to give recreation boats access to the hotel complex.

I would like to see the permitting agencies consider the cumulative impact of these proposed facilities rather than issue permits on a piecemeal basis. Only in such a fashion can the true extent of their impact on Hawai'i's coastal environment be considered.

4. An After-The-Fact Review.

Most troubling of all is the knowledge that the time, money and effort spent by the public in participating in this environmental review process have most probably been for naught. I have learned that the WDC has proceeded to build most, if not all, of the moorings for which permission is requested in the DEIS. This makes a mockery of the EIS review process, fails to offer environmental concerns the protections guaranteed in state and federal laws, undermines public confidence in the state permitting agencies, and, perhaps most tragically, fosters public mistrust and cynicism toward the government.

I would like to ask you, Mr. Paty, what penalties the WDC has incurred for proceeding with mooring construction before obtaining the permits needed. I believe it is within the state's power to consider each day of non-compliance with state law a separate violation; is WDC being fined to the fullest extent possible under such provisions? If not, why not?

By tolerating such actions as this, especially in an area where many further developments are planned, the state is sending a message to offending parties that they may feel free to do as they like, without regard to statutory and regulatory processes. Fines become simply another cost of doing business -- and a rather trivial one at that.

I would urge that before any further consideration be given to WDC's DEIS on the moorings, or any other proposal WDC may bring before the state or other political subdivisions, WDC be required

Mr. William Paty

Jan. 22, 1990

to tear out the moorings already built and rebuild them only when, and if, the needed permits are in hand. The question here is not just whether the moorings system proposed is one that is environmentally sound; it is also whether the state will keep faith with its citizens by adhering to the process that provides the public with meaningful input in development activities that affect Hawai'i's unique and treasured resources.

Sincerely,

Patricia Tummons

Patricia Tummons
Natural Resources Chair
League of Women Voters of Hawai'i

cc: Anne L. Mapes, Belt Collins & Associates
Office of Environmental Quality Control

BCA
BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200 Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: [illegible], Fax: (808) [illegible]
Hawaii • Singapore • Australia • Hong Kong • Saipan

February 9, 1990
90-338/846.2500

Ms. Patricia Tummons
Natural Resources Chair
League of Women Voters of Hawai'i
49 South Hotel Street, Room 314
Honolulu, Hawaii 96813

Dear Ms. Tummons:

Draft Environmental Impact Statement (EIS) for the Installation and Management of Permanent and Day-Use Moorings 'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your January 22, 1990 letter to Mr. William Paty regarding the above Draft EIS. The following is offered in response to your letter.

1. Management Plan

The management plan is the subject of ongoing discussions between the applicant and its representatives and officials and staff of the State Department of Land and Natural Resources (DLNR) and the State Department of Transportation (DOT), Harbors Division. The intent of the plan is to protect resources in the bay and to manage use; the details of the plan will be negotiated with government officials. Following discussions that have taken place since the publication of the Draft EIS, the applicant in the revised plan will not have enforcement powers, but rather, will be the on-site custodian, reporting any infractions to the appropriate State agency for enforcement. Waikoloa Beach Association emloyees will not be deputized.

The moorings siting plan has been revised to eliminate the dinghy moorings in the nearshore waters; hence, there will be no moored dinghies for either commercial or public use.

The Waikoloa Beach Association will pay whatever fees that are required by DLNR and/or DOT Harbors for easements for the moorings. We assume that the amount paid and frequency of payment will follow established DLNR and DOT schedules. Whether the easements will be "non-exclusive" or not will be decided by the appropriate government entity. Ongoing discussion with DOT Harbors, Small Boat Division, indicate that specific moorings might be assigned to the Waikoloa Beach Association by DOT. The details of any arrangement have yet to be finalized.

No fees will be charged the general public for use of the public day-use moorings.

A number of moorings will be available for first-come/first-served day use; a like number will be for commercial leased use. As to the assignment of a designated mooring to a specific user, this parallels the State's assignment of designated boat slips to specific users in State-owned harbors for a fee.

2. Anchoring System

We have reviewed the Draft EIS and see no insistency in the description of the proposed mooring system and that of the mooring system recommended by Brock. In fact, the intent is to use the type of mooring system Brock recommends.

3. Cumulative Impact

Regarding your desire to see the permitting agencies consider the cumulative impact of proposed facilities in Hawaii, the issue would seem to be best addressed by a government official. By copy of this letter, we direct comment to Mr. Paty.

4. An After-The-Fact Review

The requested permanent moorings numbered 16 in the Draft EIS: 11 moorings for Waikoloa Beach Resort concessionaires and 5 public day-use moorings, plus an additional mooring for a windsurfing training platform which is to be removed at the end of each day. There are currently 7 temporary moorings used by the concessionaires, including Captain Nemo's Ocean Sports, which has been providing services since 1981 in 'Anaeho'omalu Bay.

9-10

The applicant has complied with the conditions of an After-the-Fact Temporary Variance application for the 7 moorings in 'Anaeho'omalu Bay, including paying a fine of $7,000 to DLNR, and is diligently pursuing the CDU Permit and the fulfillment of the EIS processing requirements.

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

Anne L. Mapes

cc: Mr. Willaim Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

January 22, 1990

RECEIVED
JAN 25 19

BELT, COLLINS & ASSOCIATES
MARVIN T. MIURA, PH.D.
DIRECTOR
TELEPHONE NO.
548-6915

Ms. Anne L. Mapes
C/O Belt Collins & Associates
680 Ala Moana Blvd., Suite 200
Honolulu, HI 96813

Dear Ms. Mapes:

We have received the draft environmental impact statement "For the Installation and Management of Permanent and Day-Use Moorings in 'Anaeho'omalu Bay, South Kohala, Hawaii" and have the following remarks:

9-11

1. We have recently been advised by State Harbors that this is an after-the-fact document, that the moorings are already in place and that fines have been levied by the Board of Land and Natural Resources. Mooring permits from the Department of Transportation still have not been given. This illegal activity by the developer so early in the process leads us to conclude that the self-enforcement described in the management section will be unsuccessful.

2. The final environmental impact statement should address alternative alignments which protect the safety of swimmers in the preferred area of the beach with a sandy bottom. A discussion of swimming buoys to protect and clearly delineate this preferred swimming area should be included.

3. An alternative to the project would be for the hotels to provide transportation to other departure sites where user conflicts aren't as severe and where humpback whales won't be threatened by the increased boater traffic.

4. The socioeconomic impacts section should have included a discussion of the impacts to local, non-commercial divers and windsurfers who presently use the the bay. Placement of the moorings may preclude these existing uses.

5. Since no sewage pump-out facilities exist on the Kona Coast, a discussion of disposal options should be included with any impacts that these options may create. Cumulative impacts of open ocean dumping should be included.

Sincerely,

Marvin T. Miura, PH.D.
Director
Office of Environmental Quality Control

Stephen A. Holmes
Planner

CORRECTION

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

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

RECEIVED
JAN 25 19[illegible]

BELT, COLLINS & ASSOCIATES
MARVIN T. MIURA, PH.D.
DIRECTOR
TELEPHONE NO.
548-6915

January 22, 1990

Ms. Anne L. Mapes
C/O Belt Collins & Associates
680 Ala Moana Blvd., Suite 200
Honolulu, HI 96813

Dear Ms. Mapes:

We have received the draft environmental impact statement "For the Installation and Management of Permanent and Day-Use Moorings in 'Anaeho'omalu Bay, South Kohala, Hawaii" and have the following remarks:

9-11

1. We have recently been advised by State Harbors that this is an after-the-fact document, that the moorings are already in place and that fines have been levied by the Board of Land and Natural Resources. Mooring permits from the Department of Transportation still have not been given. This illegal activity by the developer so early in the process leads us to conclude that the self-enforcement described in the management section will be unsuccessful.

2. The final environmental impact statement should address alternative alignments which protect the safety of swimmers in the preferred area of the beach with a sandy bottom. A discussion of swimming buoys to protect and clearly delineate this preferred swimming area should be included.

3. An alternative to the project would be for the hotels to provide transportation to other departure sites where user conflicts aren't as severe and where humpback whales won't be threatened by the increased boater traffic.

4. The socioeconomic impacts section should have included a discussion of the impacts to local, non-commercial divers and windsurfers who presently use the the bay. Placement of the moorings may preclude these existing uses.

5. Since no sewage pump-out facilities exist on the Kona Coast, a discussion of disposal options should be included with any impacts that these options may create. Cumulative impacts of open ocean dumping should be included.

Sincerely,

Marvin T. Miura, PH.D.
Director
Office of Environmental Quality Control

Stephen A. Holmes
Planner

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd. Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361, Telex: BELLH 7418043, Fax: (808) 538-7819
Hawaii • Singapore • Australia • Hong Kong • Saipan

February 9, 1990
90-339/746.2500

Mr. Marvin T. Miura, Ph.D., Director
State of Hawaii
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Mr. Miura:

Draft Environmental Impact Statement (EIS) for the Installation and Management of Permanent and Day-Use Moorings 'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your January 22, 1990 letter regarding the above Draft EIS. The following is offered in response to your comments.

1. The requested permanent moorings numbered 16 in the Draft EIS: 11 moorings for Waikoloa Beach Resort concessionaires and 5 public day-use moorings, plus an additional mooring for a windsurfing training platform which is to be removed at the end of each day. There are currently 7 temporary moorings used by the concessionaires, including Captain Nemo's Ocean Sports, which has been providing services since 1981 in 'Anaeho'omalu Bay.

The applicant has complied with the conditions of an After-the-Fact Temporary Variance application for the 7 moorings in 'Anaeho'omalu Bay, including paying a fine of $7,000 to DLNR, and is diligently pursuing the CDU Permit and the fulfillment of the EIS processing requirements.

We have been informed by DOT that the applicant can seek a permit from them only after obtaining the CDU Permit.

2. The moorings plan is being revised to include fewer moorings and alternative alignments which would make the nearshore sandy central bay more accessible to swimmers. Buoys will be used to delineate the State Ocean Recreation Management Plan swim zones and ingress/egress channel.

3. There are no similar nearby departure sites which are as safe and where user conflicts are not as severe. Also, humpback whales frequent the offshore waters all along the West Hawaii coast, so that any increased boater traffic would pose the same hazard near 'Anaeho'omalu Bay or elsewhere. To lessen the threat to whales, good commercial boating practices and education of the general public would seem to be warranted. Also, whale watching procedures sanctioned by NMFS are proposed to be inserted into concession agreements for the commercial operators using the designated moorings.

4. The Final EIS will include a discussion of potential impacts to current users of the bay. Placement of the moorings will be such that they will not preclude the existing uses.

5. None of the commercial vessels will have live-aboards, and therefore the amount of waste generated will be limited, as it is now. The cumulative impact of deep water disposal from a few vessels will be negligible in the overall ocean environment.

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

cc: Mr. Willaim Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

9-12

RECEIVED
90 JAN 23 P 2:37
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

HA-2263

January 20, 1990
RE:0545

RECEIVED
JAN 25 AM 10:14
DEPT. OF LAND & NATURAL RESOURCES

William W. Paty, Chairman
Board of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

9-13

Dear Mr. Paty:

Draft Environmental Impact Statement
Anaeho'omalu Bay
Installation and Management of Permanent and Day-Use Moorings
South Kohala, Hawaii

The above referenced document proposes installation and management of 11 permanent moorings and five transient or day-use moorings. The permanent moorings will be for vessels operated by two private concessions. The transient moorings will be for public use.

This brief review was prepared with the assistance of Terry O'Halloran, Sea Grant, and Carolyn D. Cook, Environmental Center.

Our reviewers were unable to provide detailed assessments of this document due to the lack of technical specifications for the cement moorings. Although the DEIS reviews alternate methods and materials for the moorings and provides a reasonable discussion of why they cannot be used, the specifics of the chosen design (i.e., mooring dimensions and density) are not included. Figure 2 on page 2-5 provides the only technical data we find for the mooring system.

According to the DEIS, Waikola Development Company will be given exclusive control over who is granted mooring space. Our reviewers question whether such an arrangement is in the best public interest, given the growing demand for marine moorage facilities statewide.

We would prefer that a more comprehensive map of the project location be provided in the final EIS.

Thank you for the opportunity to comment on this Draft Environmental Impact Statement.

Yours truly,

John Harrison
Environmental Coordinator

cc: OEQC
L. Stephen Lau
Terry O'Halloran
Carolyn D. Cook

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

February 15, 1990
90-340/846.25

Mr. John Harrison, Environmental Coordinator
University of Hawaii at Manoa
Environmental Center
2550 Campus Road, Crawford 317
Honolulu, Hawaii 96822

Dear Mr. Harrison:

**Draft Environmental Impact Statement (EIS) for the
Installation and Management of Permanent and Day-Use Moorings
'Anaeho'omalu Bay, South Kohala, Hawaii**

9-14

Thank you for your January 20, 1990 letter to Mr. William Paty regarding the above Draft EIS. We offer the following in response to your comments.

1. As requested, the Final EIS will include more detailed specifications of the cement moorings proposed for 'Anaeho'omalu Bay.

2. Ongoing discussions with the State Department of Transportation (DOT), Harbors Division, indicate that DOT would likely assign a number of moorings to the Waikoloa Beach Association (WBA) which would in turn enter into agreements with commercial concessionaires for the use of these moorings. Although the WBA would be responsible for installing and maintaining the public day-use moorings, it would have no control over their use; the public moorings would be used on a first-come/first-served basis. The moorings plan has been revised to include fewer moorings overall and a like number of commercial and public moorings.

3. As requested, a more comprehensive map of the project location will be provided in the Final EIS.

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

Anne L. Mapes

cc: Mr. William Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

SENT BY:Xerox Telecopier 7021 : 1-26-90 ; 1:23PM ; DLNR / OCEA→ 808 538 7819:# 4

Ocac

JOHN WAIHEE
GOVERNOR

RECEIVED
90 JAN 24 P 2:10
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

YUKIO KITAGAWA
CHAIRPERSON, BOARD OF AGRICULTURE

SUZANNE D. PETERSON
DEPUTY TO THE CHAIRPERSON

FAX: 548-6100

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822-0159

January 22, 1990

HA-2263

MEMORANDUM

To: Mr. William W. Paty, Chairperson
Board of Land and Natural Resources

Subject: Draft Environmental Impact Statement (DEIS) for
Anaehoomalu Bay Permanent and Day-Use Moorings
Waikoloa Development Company
TMK: 6-9-07: 15 (abutting parcel) Waikoloa, Hawaii

The Department of Agriculture has reviewed the subject document and has no comments to offer.

Thank you for the opportunity to comment.

Yukio Kitagawa
YUKIO KITAGAWA
Chairperson, Board of Agriculture

cc: Waikoloa Development Company
OEQC

RECEIVED
90 JAN 25 AM 10:12
OEQC

9-14

BELT COLLINS & ASSOCIATES
Engineering • Planning
Landscape Architecture

February 15, 1990
90-341/846.2500

Mr. Yukio Kitagawa, Chair
Board of Agriculture
1428 So. King Street
Honolulu, Hawaii 96814-2512

Dear Mr. Kitagawa:

Draft Environmental Impact Statement (EIS) for the
Installation and Management of Permanent and Day-Use Moorings
'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your January 22, 1990 memorandum to Mr. William Paty regarding the above Draft EIS.

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

cc: Mr. William Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-2641

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

RECEIVED
JAN 23 1990
BELT, COLLINS & ASSOCIATES

cc Anne M. BA

IN REPLY REFER TO:

90:PLNG/303 jt

January 23, 1990

RECEIVED
JAN 24 1990
WAIKOLOA

MEMORANDUM

TO: The Honorable William W. Paty, Chairman
Board of Land and Natural Resources

FROM: Joseph K. Conant

SUBJECT: Draft EIS for the Proposed Installation and Management of Permanent and Day Use Moorings, Anaeho'omalu Bay

Thank you for the opportunity to review the subject draft EIS. We have no comments to offer.

JOSEPH K. CONANT
Executive Director

cc: /Ken Melrose, Waikoloa Development
Dr. Marvin T. Miura, OEQC

BCA
BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

680 Ala Moana Blvd., Suite 200, Honolulu, Hawaii 96813
Phone: (808) 521-5361 ...
Hawaii • Singapore • Australia • Hong Kong • Saipan

February 21, 1990
90-342/846.2500

Mr. Joseph K. Conant, Executive Director
State of Hawaii
Department of Budget and Finance
Housing Finance and Development Corporation
Seven Waterfront Plaza, Suite 300
600 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Conant:

Draft Environmental Impact Statement (EIS) for the Installation and Management of Permanent and Day-Use Moorings 'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your January 23, 1990 memorandum to Mr. William Paty regarding the above Draft EIS.

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

cc: Mr. William Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

JOHN WAIHEE
GOVERNOR OF HAWAII

RECEIVED
FEB 2 1990
BELT COLLINS & ASSOCIATES

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
Keith W. Ahue
MANABU TAGOMORI
RUSSELL H. FURUMOTO

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

REF:OCEA-VIN

File: HA-6/23/89-2263
180-Day Exp. Date.: 3/20/90
Doc.: 7286E

FEB - 1 1990

Ms. Anne L. Mapes
BELT COLLINS & ASSOCIATES
680 Ala Moana Blvd., Suite 200
Honolulu, Hawaii 96813

Dear Ms. Mapes:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS), for a Conservation District Use Application for the Installation of Permanent Moorings in 'Anaeho'omalu Bay, South Kohala, Hawaii; Offshore from Tax Map Key 6-9-07: 11

9-16

We have completed our review of your DEIS for permanent and day-use moorings at 'Anaeho'omalu Bay, South Kohala.

The judgment in question will be whether the Final EIS is an acceptable or non-acceptable document under Chapter 343 Hawaii Revised Statutes, as amended.

In our view, acceptance means that the document fulfills the definition of an Environmental Impact Statement (EIS), adequately describes identifiable environmental impacts, and satisfactorily responds to comments received during review of the Statement.

We are of the opinion that a major purpose in accepting or not accepting a Statement, as suggested under Title 11, Chapter 200 of the Administrative Rules, is that the document adequately discloses environmental impacts and satisfactorily responds to comments.

In our view, the document, in and of itself, should not be used as a vehicle to promote or detract from any required subsequent judgment on the proposed project itself. We have consistently maintained this posture in the past.

We should point out that the acceptability of any Statement is based upon criteria set forth, in Title 11, Chapter 200 of the Administrative Rules.

As such, we offer the following comments for your consideration at this time:

In the past, the Board of Land and Natural Resources has approved the concept of establishing moorings to reduce damage to benthic marine life and seafloor habitats from repeated anchoring. The Board has approved consolidation of scattered, ad hoc moorings into specific Mooring Areas established by the Department of Transportation (DOT).

Inasmuch as the majority of the proposed moorings, including seven after-the-fact, are for servicing the resort's commercial purpose, each mooring right-of-entry should be placed under a revocable permit and made conditional of payment of a use fee to our Department, in addition to any requirements of the DOT.

If moorings are allowed, live aboards should be prohibited, as should be all discharges of wastewater from sanitary, cooking, or engine room facilities or bilges, to protect the habitat quality and public recreational values of 'Anaeho'omalu Bay. Additionally, the moorings should be placed to prevent impact to living coral colonies from the anchor lines and/or chains.

Should it be necessary to remove selected coral heads as mentioned on page 3-6 of the DEIS, we suggest that the designated coral heads be moved to a more appropriate site and not destroyed.

Finally, the comments in the applicant's DEIS regarding the alleged activities of the 37-foot catamaran "Cookie Jar" have been noted, and remedial action should be taken to protect public aquatic resource values, especially benthic organisms such as coral, from excessive damage from moorings. The DOT and Department of Health should be notified, so that they may investigate possible violations of their Departments' respective Administrative Rules.

In addition, the DEIS fails to mention some of the current uses of the State's beach (i.e. loading and unloading equipment, etc.), under "1.5.2 Socioeconomic Considerations" or elsewhere. The DEIS states that the project objectives include the following goal: "...to implement an overall management plan and maintenance plan for the proposed moorings and for the bay..." (p. 2-1). Section "2.3.6 Management & Maintenance Plan" notes the following regarding that "management plan" :

> The proposed management plan goes beyond just controlling the use of the moorings. WDC wishes to maintain control over moorings in the bay in the context of an overall ocean recreation management plan.

Section "5.9 Hawaii County Zoning" notes that "structures on the beach near the project site include public restrooms, the concessionaire's beach shack, (etc.) ..." (underlining added); however, Chapter 5, relating to the "Relationship of the Proposed Action to Land Use Plans, Policies, and Controls for the Affected Area," fails to mention any permits granted by the Board for "structures on the beach..." or for reported use of the beach for loading and unloading passengers, equipment, supplies (i.e. SCUBA tanks), etc.

Please also note that we are planning to send to you, in a few days, additional comments from our Division of Land Management, which are expected to be pertinent and necessary for your review.

Thank you for your cooperation in this matter. Please feel free to call Jay Lembeck of our Office of Conservation and Environmental Affairs, at 548-7837, if you have any questions.

Very truly yours,

WILLIAM W. PATY

cc: Dr. Marvin Miura, OEQC
Mr. Ken Melrose, Waikoloa Development Company

9-17

3

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

February 15, 1990
90-343/846.2500

Mr. William W. Paty, Chair
State of Hawaii
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Draft Environmental Impact Statement (EIS) for the Installation and Management of Permanent and Day-Use Moorings 'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your February 1, 1990 letter regarding the above Draft EIS.

1. We agree that "each mooring right-of-way should be placed under a revocable permit and made conditional of payment of a use fee to [DLNR], in addition to any requirements of the DOT."

2. Live-aboards will not be allowed. There will be no discharges such as those you describe into 'Anaeho'omalu Bay. As stated in the EIS, moorings will be placed to prevent impact to living coral colonies.

3. The removal of coral will be done after consultation with the project's marine consultant, and where possible, coral will be moved to another location rather than destroyed.

4. Current uses of the beach will be described further in the Final EIS.

5. As requested, clarification will be provided in the Final EIS as to the public restrooms, concessionaire's beach shack, etc.

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

cc: Mr. Ken Melrose, Waikoloa Development Company

UNITED STATES
DEPARTMENT OF
AGRICULTURE

SOIL
CONSERVATION
SERVICE

P. O. BOX 50004
HONOLULU, HAWAII
96850

RECEIVED
90 JAN 26 A 8:46
RECEIVED
90 JAN 29 A 8:47

DEPT. OF LAND
& NATURAL RESOURCES
& NATURAL RESOURCES
STATE OF HAWAII

January 24, 1990

Mr. William W. Paty, Chairman
Department of Land and Natural Resources
P. O. Box 621
Honolulu, HI 96809

Dear Mr. Paty:

Subject: Draft Environmental Impact Statement (DEIS) - Proposed Installation and Management of Permanent and Day Use Moorings, Anaeho'omalu Bay, South Kohala, HI

The above-mentioned document has been reviewed as requested we offer the following comments for consideration:

9-18

While Section 3.2.2 indicates that no adverse impacts are expected that will affect near shore water quality, there is a high probability that there will be some effect caused from leakage or accidental spills of fuel, oil, or other substances.

With increased boating activity in West Hawaii waters, there is a strong possibility that encounters with humpback whales will be more frequent, therefore policing of these waters will be necessary.

'90 JAN 30 AM 7:45
DLNR
OCEA

Sincerely,

Warren M. Lee

WARREN M. LEE
State Conservationist

cc:
Ken Melrose, Director of Planning, Waikoloa Development Co.,
P. O. Box 3028, Waikoloa, Hawaii 96743-3028
Harvin T. Miura, PhD., Director, Office of Environmental Quality Control,
465 S. King Street, Room 104, Honolulu, Hawaii 96813

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

February 15, 1990
90-344/846.2500

Mr. Warren M. Lee, State Conservationist
U. S. Department of Agriculture
Soil Conservation Service
P. O. Box 50004
Honolulu, Hawaii 96850

Dear Mr. Lee:

Draft Environmental Impact Statement (EIS) for the
Installation and Management of Permanent and Day-Use Moorings
'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your January 24, 1990 letter to Mr. William Paty regarding the above Draft EIS.

1. We agree that there is always some possibility of accidental fuel leakage or spills, but the probability that such isolated incidences would have a significant long-term adverse impact is minimal. Moreover, the revised moorings plan includes fewer commercial moorings than are now in the bay, which has not been observed to be polluted by fuel.

2. We agree that, statistically, as boating acitivity increases, so will chance encounters with whales. However, to lessen impacts on whales, following whale-watching procedures sanctioned by NMFS and the education of the general public would seem to be warranted. We agree that the policing of ocean waters is desirable and should continue to be a government function.

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

Anne L. Mapes

cc: Mr. William Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

JOHN WAIHEE
GOVERNOR

RECEIVED
FEB 7 19[illegible]
BELT, COLLINS & ASSOCIATES

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ
CALVIN M. TSUDA

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

IN REPLY REFER TO:

February 5, 1990

HAR-EP 2228

Ms. Anne L. Mapes
Belt Collins & Associates
680 Ala Moana Boulevard, Suite 200
Honolulu, Hawaii 96813

Dear Ms. Mapes:

Draft EIS Anaehoomalu Bay Moorings

We have reviewed the draft environmental impact statement and have listed the questionable areas and provided the comments that follows:

2.2. HISTORY (Page 2-1) states there is no space (mooring) available at either Honokohau or Kawaihae Harbors and that Captain Nemo's Ocean Sports, a boat concessionaire, serving the Waikoloa Beach Resort has been on the Honokohau waiting list for eight years.

DOT COMMENTS: The boat concessionaire, serving the Hyatt Regency Waikoloa was offered a mooring (17 months after applying) at Kawaihae. Captain Nemo's Ocean Sports, a boat concessionaire, serving the Waikoloa Beach Resort is not on the waiting list (moorings) at either harbor.

Neither Honokohau nor Kawaihae has immediate openings. However, Jeff McConnel (now incorporated as Sail By Intuition, Inc.) has one slip in Honokohau and has been on the waiting list for a second berth (in his own name), since 1986.

6-19

2.3.5 BOATING OPERATIONS (Page 2-4) states that temporary anchorage without compensation to the State or ocean-front property owners has occurred at Anaehoomalu Bay.

DOT COMMENTS: The two primary users of moorings in the bay are Nick's Aqua Sports and Captain Nemo's Ocean Sports. DOT's jurisdiction over offshore moorings began January 1, 1989. Offshore moorings rules (upon adoption) will include appropriate mooring rates. Furthermore, shore waters are public domain and not that of the ocean-front property owner.

2.3.6 MANAGEMENT AND MAINTENANCE PLAN (Page 2.7) states that Waikoloa Development Co. would have complete control over who ties up its buoys.

DOT COMMENTS: The management of offshore moorings is the responsibility of the Department of Transportation (ACT 379, SLH 1988). Any management of offshore moorings by Waikoloa Beach Resort would have to be negotiated with the Department of Transportation.

3.3.2 SOCIOECONOMIC IMPACTS (Page 3-10) again states the inability of Captain Nemo's Ocean Sports to obtain a mooring permit at Honokohau and Kawaihae Harbors for prolong periods on the waiting list.

DOT COMMENTS: Again, we point out the concessionaire is not on the waiting list for either harbor.

4.1.3 DAY-USE MOORINGS (Page 4-1)

DOT COMMENTS: The preferred alternative is for the present moorings for the subject project to be converted to day use only if permanent mooring facilities are developed within a 5-7-mile radius of this site.

Since the "day use" moorings are to be available for visiting vessels, it should be clarified as to whether

HAR-EP 2228

visiting vessels will be limited to daylight use only, or if short term (2-3 days) mooring overnight will be allowed. It has been our experience that visiting vessels prefer at least a few days stay at destinations such as this.

If you have any questions, please call Mr. Howard Miura at 548-2559.

Very truly yours,

Calvin M. Tsuda
Deputy Director for Harbors

9-20

BELT COLLINS
& ASSOCIATES
Engineering • Planning
Landscape Architecture

February 15, 1990
90-345/846.2500

Mr. Calvin M. Tsuda, Deputy Director for Harbors
State of Hawaii Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Tsuda:

Draft Environmental Impact Statement (EIS) for the Installation and Management of Permanent and Day-Use Moorings 'Anaeho'omalu Bay, South Kohala, Hawaii

Thank you for your February 5, 1990 letter regarding the above Draft EIS. We offer the following in response to your comments.

2.2 History

Our understanding is that in 1988 the Hyatt Regency Waikoloa boat concessionaire, Nick's Aqua Sports Waikoloa Ltd., dba Red Sails Sports, applied for permanent mooring permits at both Kawaihae and Honokohau Harbors, as well as temporary mooring permits at Kawaihae Harbor. It was granted temporary mooring permits at Kawaihae Harbor, but formally withdrew these permits, choosing to remain on the list for permanent moorings at that harbor. In a July 20, 1989 letter to Mr. Ian Birnie, Mr. Tom Posey, Director of Operations for Red Sails Sports, stated: "We wish to continue our place on the waiting list for the Kawaihae Harbor mooring..."

2.3.5 Boating Operations

We agree that shore waters are "public domain and not that of the ocean-front property owner." Nick's Aqua Sports and Captain Nemo's Ocean Sports will pay the appropriate mooring fees to DOT when notified of rates and payment schedule.

3.3.2 Socioeconomic Impacts

The status of Captain Nemo's Ocean Sports applications for permanent mooring permits will be clarified in the Final EIS.

4.1.3 Day-Use Moorings

The 'Anaeho'omalu Bay moorings plan is being revised following discussions between the applicant and its representatives and officials and staff of government agencies, including DOT. The revised plan now has a reduced total number of moorings and a like number of commercial and public day-use moorings. In determining the length of stay for day-use moorings, we will take into consideration your experience that "visiting vessels prefer at least a few days stay at destinations such as this."

We appreciate your participation in the EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

Anne L. Mapes

Anne L. Mapes

cc: Mr. William Paty, Board of Land and Natural Resources
Mr. Ken Melrose, Waikoloa Development Company

cc: A. Mapes (Fax)
BCA

JOHN WAIHEE
GOVERNOR OF HAWAII

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:
EPHSD

February 7, 1990

RECEIVED
FEB 15 1990
WAIKOLOA

MEMORANDUM

To: Mr. William Paty, Chairperson
Board of Land and Natural Resources

From: Director of Health

Subject: Draft Environmental Impact Statement (DEIS)
Installation and Management of permanent and Day-Use Moorings in
'Anaeho'omalu Bay, South Kohala, Hawaii

9-22

Thank you for allowing us to review and comment on the subject DEIS. 'Anaeho'omalu Bay is classified as Class AA waters in Chapter 11-54, Water Quality Standards, and as such, it is the objective that these waters remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration or water quality from any human-caused source or actions.

As such, based on its administrative rules, the State Department of Health is opposed to any vessel moorings being established in such Class AA waters.

JOHN C. LEWIN, M.D.

cc: · Marvin T. Miura, Ph.D.
✓Waikola Development Co.
Clean Water Branch

APPENDIX A

BASELINE SURVEYS AND MONITORING PLAN

PROPOSED FOR THE WAIKOLOA BEACH RESORT

Transcontinental Development Co.

INTRODUCTION

With any coastal development the potential exists for negative impacts to occur on resident aquatic biota. These impacts may be direct, occurring during coastal construction such as seen with the removal of marine communities by dredging or they may be manifested gradually some time later following low levels of long term, chronic disturbance as might occur with the operation of coastal facilities (e.g., harbors, point source discharges, etc.). Construction impacts are addressed through the EIS mechanism but long term chronic disturbances (impacts) are often overlooked. The County of Hawaii recognizing the potential of long term chronic disturbance impacting aquatic communities with the operation of resorts on the West Hawaii coast, has required the initiation of a shoreline monitoring program for the resort development at Waikoloa. This proposed project will quantitatively address the potential for chronic low level impact on aquatic communities at Waikoloa through a program of monitoring and present a plan for mitigation if deemed necessary.

In the operation of a coastal resort the most probable chronic disturbance may come from the irrigation and upkeep of golf courses. In West Hawaii, golf courses are irrigated by a combination of brackish groundwater and resort sewage treatment plant effluent. Presently at Waikoloa there is one 18-hole course and a second similar sized golf course will be operational 6 to 12 months after the opening of the Hyatt Regency Waikoloa Hotel. The existing and the future golf courses are irrigated with low salinity well water and treated sewage effluent. Presently, sewage effluent flows are less than 10% of the irrigation volume but will comprise 15 to 20% of the volume after the Hyatt opens; fertilizers, pesticides and herbicides are also applied to these golf courses. The nutrient subsidy from fertilizers and sewage as well as the pesticides and herbicides placed on these golf courses could migrate downward to the groundwater table and move laterally in the low salinity watertable towards the shoreline. These materials would first appear in the landlocked anchialine ponds that are found at Waikoloa and later in nearshore marine waters, thus detection and manifestion of impacts would probably first occur in the anchialine pond system.

As part of the U.S. Army Corps permit process for the development of the Hyatt Regency at Waikoloa, a 4.9ha preserve (the Waikoloa Anchialine Pond Preserve Area or WAPPA) with more than 66 representative anchialine ponds was set aside in perpetuity. In January 1986 the preserve was formally established and the developer provided funds for its management; these monies

were placed in a trust at the University of Hawaii Foundation where interest generated by the account is utilized in the management and monitoring the biological and water quality characteristics of the system. Three of the objectives and responsibilities for the management of the WAPPA are (1) "maintenance of a viable anchialine pond ecosystem", (2) "expansion of scientific understanding of anchialine pond ecosystems and the effects of urban development on them", and (3) "education of residents and visitors of the unique nature and value of the anchialine pond resource in Hawaii". Along with regular quarterly monitoring as well as more frequent scientific investigations, the pond manager is responsible for guarding against the following: disposal of any kind of waste in the WAPPA; introduction of exotic species; unauthorized removal, feeding or use of pond organisms; physical or hydrological modifications to ponds; activities by hotel groundskeepers that may adversely affect ponds; and other human disruptions to the system. The pond manager must also communicate pond maintenance objectives to adjacent landowners, initiate visitor education, coordinate educational and scientific activities within the WAPPA, provide status reports of management activities to the Corps and to notify the Corps of any infractions of the established agreements and rules for the WAPPA.

The WAPPA management plan also has a mitigation plan with funds in place to deal with unforeseen environmental problems. The mitigation process may be brought into action by the WAPPA pond manager if environmentally induced problems arise.

The water quality monitoring program commenced in April 1986; this program presently monitors tide state, salinity, nutrient, pesticide and herbicide levels in the WAPPA, in inland wells situated on the Waikoloa property (serving as undisturbed groundwater controls), in the nearshore waters affronting the WAPPA and in a series of anchialine ponds in the Awakee-Makalawena area that have not been subjected to any surrounding development activities. Herbicide and pesticide analyses were initiated in 1987.

The monitoring of anchialine pond community structure, abundance and function covers the same geographical localities. Permanent quadrats are used to estimate abundance of motile fauna (primarily decapod crustaceans); chlorophyll a analyses are undertaken to monitor phytoplankton communities; if fishes are present, they are counted from the shoreline and metabolism has been roughly assessed by serial oxygen measurements.

The monitoring plan required by Hawaii County for the Waikoloa resort should have the following: (1) an initial baseline survey that utilizes and encompasses historical data to the fullest extent possible; (2) a program of periodic monitoring and (3) a mitigtion plan to be implemented if environmental conditions

warrant. These three aspects of the proposed monitoring plan are discussed below.

INITIAL BASELINE SURVEY

The initial baseline survey should establish extant environmental conditions for future reference and identify resources of significant or unusual value. Emphasis should be placed on water quality characteristics in both the anchialine pond system and nearshore marine waters as well as in conducting a quantitative description of the biota both within the anchialine pond preserve and adjacent marine communities. As noted above the initial baseline should utilize available data where it exists in quantitatively defining the existing conditions.

The existing WAPPA water quality and biological monitoring program is probably the most detailed and exhaustive of any undertaken for an anchialine system worldwide. This program has been regularly sampling anchialine and marine waters at Waikoloa since April 1986 and the program is designed and funded to continue well into the 21st century. Water quality parameters measured are those presented in the State Department of Health Regulations, Title 11, Chapter 54 as well as specific tests for petroleum products, pesticides and herbicides. To provide controls we also sample anchialine ponds at Awakee-Makalawena, North Kona on a regular basis. In a recently published paper (Pacific Science 41:200-208) we have summarized water quality work at Waikoloa from the late 1970's through November 1987. We are presently preparing the second annual report on the status of the WAPPA which also includes the results of water chemistry studies in marine waters affronting the WAPPA. Besides water chemistry, the WAPPA studies include a quantitative assessment of the fauna and flora of the Waikoloa anchialine system.

The extensive water quality database which includes data collected as recently as May 1988 should provide the needed information to establish the baseline conditions at Waikoloa for water quality parameters and the status of the anchialine pond organisms.

Baseline surveys should be conducted in nearshore marine habitats affronting the Waikoloa project area. We propose that pairs of permanently marked 25m long transects be established at two depths (3m and 10m) or distances from shore (20m and 100m) at three locations: Waiulua Bay, near Kaauaau Point affronting the WAPPA, and offshore of Kuu'alii Fishpond at Anaehoomalu Bay. As controls, we would establish permanent stations to the north and south of the project site. At each station a quantitative assessment will be made of major community components: fishes, corals, macroinvertebrates (i.e., invertebrate species greater than 2cm in some dimension) and macroalgae (limu). Methods to be

employed include benthic quadrats, photography and visual census techniques. To the extent possible, information for Waiulua Bay marine communities collected in October 1987 will be incorporated into the proposed baseline survey to serve in a supplementary fashion.

PERIODIC MONITORING PROGRAM

The objective of the periodic monitoring program is to detect changes in the water chemistry at Waikoloa that may affect marine and anchialine communities. In this proposal we focus on the monitoring of water quality because, as noted above, the most probable source of impacts to anchialine and nearshore marine biota may come through changes in the chemistry of groundwater passing through anchialine ponds and into the ocean. Nutrient input, pesticide and herbicide use on the golf course(s) with subsequent percolation of these materials to the watertable would be the probable source of change in water chemistry.

We propose that a monitoring program be adopted that targets inorganic nutrients and that such sampling be conducted on a quarterly basis. Water chemistry sampling at Waikoloa should be carried out in inland wells (mauka of golf course activities to serve as on-site controls), in anchialine ponds to sample any mauka to makai gradients that might exist, and in the ocean near the shoreline and about 100m offshore. Because we have discerned considerable natural spatial and temporal variability of nutrient levels in groundwater and undisturbed anchialine ponds on the Kona coast (Pacific Science 41:200-208), we suggest that a suitable undisturbed control site away from Waikoloa be similarly sampled at least annually. Because of their potential for environmental impact, sampling for some of the more commonly used pesticides and herbicides known to be used at Waikoloa should and will also be done annually.

The present WAPPA monitoring program more than adequately meets the objectives of the proposed periodic monitoring program as presented above. The WAPPA Pond Manager's Annual Report could serve as an annual document summarizing the status of water quality at Waikoloa.

As part of the WAPPA monitoring program report, careful analyses are made of the fate of nutrient species as they enter the anchialine system and move to the sea. We will quantitatively describe the movement of these species, their dilution and biological uptake. Thus if environmental problems arise at some future time at Waikoloa, we should be able to pinpoint source(s) of the problems and suggest selective and reasonable mitigative measures.

MITIGATION PLAN

The objective of the proposed mitigation plan is, in the case of a recognized problem, to take corrective action. We propose two phases to the mitigation plan. The first phase would commence if excessive nutrient loading is detected (i.e., above known natural concentrations found in other Kona anchialine and groundwater sources) and this loading is not being advected away but is causing quantifiable biological response in the anchialine ponds. At this point we would suggest (under the WAPPA program) changes in the application of fertilizers, pesticides and herbicides as well as irrigation schedules to golf course personnel. If loading persists, we would as a second step, initiate a program to ascertain the status of marine communities and determine if they are likewise responding to these pertubations. This aspect would involve a resurveying of the marine communities at the permanently marked transect stations. If marine communities are being affected, we would initiate the second phase of the program which would involve use of the mitigation/emergency funds held by the WAPPA Trust to alleviate the problem.

AN ASSESSMENT OF IMPACTS TO WATER QUALITY AND AQUATIC COMMUNITIES WITH PROPOSED ZONING CHANGES AT WAIKOLOA, SOUTH KOHALA, HAWAII

A-4

Prepared For:

Belt, Collins & Associates
680 Ala Moana Blvd., Suite 200
Honolulu, Hawaii 96813

By:

Richard E. Brock, Ph.D.
Environmental Assessment Co.
1804 Paula Drive
Honolulu, Hawaii 96816

6 January 1989

EXECUTIVE SUMMARY

A proposed rezoning to allow the redistribution of 3,000 hotel and 3,430 living units from 526 acres to 1,353 acres has been made by the developers of Waikoloa. This study was undertaken to address the potential for impact to the water quality of the ground and nearshore marine waters as well as to the aquatic biota with the implementation of the proposed rezoning.

Statistically the inorganic nutrient budget of the groundwater at Waikoloa has increased from 1977 to May 1988 as measured in the anchialine pools; however, in the April 1986 - May 1988 period no statistically discernible changes have occurred. It has been hypothesized that the source for the increased groundwater nutrient load is from the irrigation of the golf course and plantings with brackish water enriched with treated sewage effluent as well as from inorganic fertilizers. The high concentration of nutrients are diluted by intruding nutrient poor seawater as well as through uptake by terrestrial vegetation as the groundwater moves towards the sea. The result is that within a few meters of the shoreline no elevation of nutrients are discernible. Although statistically greater, nutrient concentrations in the Waikoloa anchialine pools presently fall into the range of values observed in the groundwater or other anchialine ponds along relatively undeveloped sections of the Kona coast. Periodic sampling of the biota of these ponds from 1972 to present has yielded no obvious change in ponds where exotic fish have not been introduced. Hence, the data suggest that the native aquatic biota of anchialine pond systems are insensitive to the increased nutrient concentrations as observed at Waikoloa.

The marine baseline survey of the waters affronting Waikoloa carried out in August 1988 found no unique or unusual marine communities but rather the fish and benthos of Waikoloa are very similar to those encountered elsewhere in other undisturbed West Hawaii reef sites; there was no evidence of man-induced disturbance in the nearshore marine communitities at Waikoloa.

Will further development negatively impact the quality of groundwater, the anchialine pools or nearshore marine communities? The studies conducted thus far suggest that the management strategies utilized have been successful in curtailing negative environmental impacts at Waikoloa. If these same strategies (i.e., those for wastewater management, monitoring programs, preserves, etc.) are pursued, then further development should not result in environmental degradation. The Waikoloa Anchialine Pond Preservation Area (WAPPA) monitoring program funded in perpetuity and run by the University of Hawaii will continue to regularly monitor the aquatic biota as well as anchialine and nearshore water chemistry to detect any environmentally detri-

mental changes that might occur. The program may undertake corrective action when an unforeseen deleterious event (environmental degradation) occurs and may tap funds from the developer to do so. The presence of a funded and ongoing monitoring program that has guidence from permit agencies such as the U.S. Army Corps of Engineers provides a safeguard that the environmental integrity of the ground and marine waters as well as the aquatic biota will remain intact with future developments at Waikoloa.

A-5

INTRODUCTION

The reclassification of approximately 860 acres of land situated between the King's Trail and the Queen Kaahumanu Highway at the Waikoloa Beach Resort, South Kohala, Hawaii has been proposed. The proposal calls for the rezoning of these lands from Agricultural to Urban to allow the redistribution of 3,000 hotel and 3,430 condominium units in this area. The developer proposes the establishment of fourteen land areas reserved for 3,365 single- or multi-family residential units (of which 160 currently exist) to be built over a 15 to 20 year period. Additionally, three golf courses, one of which has been approved and will be completed in 1989 as well as 56 acres for preserves and commercial space are proposed.

The proposed changes will not create additional units (i.e., increasing the carrying capacity) but will redistribute them from the previously permitted 526 acres (between the shoreline and the King's Trail) to the 1,353 acres in the area from the shore to the Queen Kaahumanu Highway. Nevertheless the potential for impacts associated with these proposed changes must be addressed; this document responds to this need focusing on the potential for change to the chemical characteristics of ground and nearshore marine waters as well as to the aquatic biota found in these waters with the implementation of the proposed project.

Because the chemical environment may, to a large degree, dictate the structural and functional characteristics of the aquatic communities, we will first present information on the water quality characteristics as they exist at Waikoloa and discuss changes that could occur in water chemistry with development. This will be followed with a description of extant aquatic communities at Waikoloa; we will draw on the water chemistry information and will discuss probable impacts to the aquatic biota that may be expected to occur with the proposed development.

The Waikoloa resort complex is situated in South Kohala along approximately 1.9km of shoreline. On the northern part of the property is the recently constructed Hyatt Regnecy Hotel at Waiulua Bay and to the south is the Royal Waikoloa Hotel at Anaehoomalu Bay. Between these two bays that define the northern and southern boundaries of the property, is a broad peninsula of lava that comprises most of the coast (Kaauaau Point). The beaches vary from a white coralline sand beach affronting Anaehoomalu Bay to complex rocky shorelines elsewhere.

Alteration in physio-chemical processes may be a source of change in marine communities. If changes in physio-chemical inputs are not too great, a potential for chronic low level disturbance can result in adjacent aquatic communities. In the operation of a coastal resort such as Waikoloa, chronic disturb-

ance may possibly come from the irrigation and upkeep of golf courses. In West Hawaii, golf courses are irrigated by a combination of brackish groundwater and resort sewage treatment plant effluent. Presently at Waikoloa there is one 18-hole course and a second similar sized golf course will be operational in 1989. The existing and future golf courses are irrigated with low salinity well water and treated sewage effluent. Sewage effluent flows have been less than 10 percent of the irrigation volume but should comprise 15 to 20 percent of the volume following the opening of the Hyatt (Mr. K. Melrose, pers. comm.); fertilizers, pesticides and herbicides are also applied to these golf courses. The nutrient subsidy from fertilizers and sewage as well as the pesticides and herbicides placed on these golf courses could migrate downward to the groundwater table and move laterally in the low salinity watertable towards the shoreline. These materials would first appear in the landlocked anchialine ponds that are found at Waikoloa and later in nearshore marine waters, thus chemical detection and manifestation of impacts would probably first occur in the anchialine pond system.

As part of the U.S. Army Corps permit process for the development of the Hyatt Regency at Waikoloa, a 4.9ha preserve (the Waikoloa Anchialine Pond Preserve Area or WAPPA) with more than 66 representative anchialine ponds was set aside in perpetuity. In January 1986 the preserve was formally established and the developer provided funds for its management; these monies were placed in a trust at the University of Hawaii Foundation where interest generated by the account is utilized in the management and monitoring of the biological and water quality characteristics of the system. The water quality monitoring program commenced in April 1986; this program presently monitors tide state, salinity, nutrient, pesticide and herbicide levels in the WAPPA, in inland wells situated on the Waikoloa property (serving as undisturbed groundwater controls), in the nearshore waters affronting the WAPPA and in a series of anchialine pools in the Awakee-Makalawena area that have not been subjected to any surrounding development activities. Herbicide and pesticide analyses were initiated in 1987.

A-6

EXTANT WATER QUALITY CHARACTERISTICS AT WAIKOLOA

The characteristics of mixohaline groundwater entering the ocean at Waikoloa have received considerable attention in the literature; baseline information is available in Maciolek and Brock (1974), Bienfang (1977), Ziemann (1984, 1985), U.S. Army Corps of Engineers (1985), Brock and Norris (1987, 1988) and Brock et al. (1988). The most pertinent summaries are found in the last three aforementioned documents. We have used these latter documents in developing the summary below.

Water quality has been regularly monitored at Waikoloa by the Waikoloa Anchialine Pond Preserve Program; three natural ponds in the preserve are regularly sampled. These ponds represent a range of situations from the inland/developed margin of the preserve (Pond 48) to the shoreward/ocean border (Pond 188). Pond No. 48 was selected as being representative of the inshore location (approximately 308m from the shoreline) that is close to development activities. Pond No. 155 is located in the center of the preserve (about 148m from the ocean) and Pond No. 188 is situated close to the ocean (56m away) and well away from direct developmental activities. This sampling strategy allows one to monitor the groundwater as it enters the preserve from the inland development and passes through the system. Several other locations are routinely monitored. The Waikoloa or nursery well (Well 1), located south and mauka of the WAPPA and the Royal Waikoloa Hotel is sampled; this location provides a source of unmodified groundwater before it enters and passes through the Waikoloa development and subsequently, the WAPPA. In August 1987 a second temporary Waikoloa (dust control) well (Well 2) located just mauka of the resort grounds maintenance plant was added to the regularly sampled locations. In January 1988 the monitoring program commenced sampling ocean water nutrients in the intertidal zone directly seaward of Pond No. 188 (Shoreline Station). A second ocean station approximately 75m from the shore affronting the WAPPA was established in May 1988. Other stations regularly sampled include Kuu'ali'i Fishpond at Anaehoomalu Beach, the first man-made pond (MM-1) located just outside of the WAPPA boundary, the irrigation water settling pond (to test for allochthonous nutrient input to the WAPPA system since this irrigation water is enriched with treated sewage effluent) and to serve as a control with no surrounding development, several ponds in the Awakee-Makalawena complex are also sampled. Methods used in the sampling of these pools are given in Brock and Norris (1987, 1988) and Brock et al. (1988).

The water quality data (grand means) amassed by the above studies are summarized in Table 1. This table also includes the results of a Student-Neuman-Keuls multiple range test comparatively analyzing the means for the three regularly sampled natural ponds (nos. 48, 155 and 188), the Waikoloa wells and ocean stations over 11 sampling periods. The results of these ANOVAs are discussed below.

Salinity, Dissloved Oxygen and Temperature

These parameters have been measured by Brock and Norris (1987, 1988) in the WAPPA over all stages of the tide cycle. The ANOVA results for pooled salinity data for a given location over all surveys showed that salinities in the lower part of the WAPPA (Pond No. 188 and the Shoreline station) were significantly greater than those in the middle and upper WAPPA (Pond Nos 48 and 155) while the well (No. 1) was significantly less saline than

Table 1. Results of the analysis of variance or ranked water quality parameters from five locations in the WAPPA and Waikoloa. Based on the Student-Neuman-Keuls multiple range test, those ponds with the same letter designation are not significantly different for a given parameter ($P<0.05$). Although the original data were ranked for the non-parametric analysis, actual grand means are presented in the body of the table. Data from Brock and Norris (1988).

	LOCATION					
	Wells	48	155	188	Shore line	Ocean
Distance from shore (m)	1200	310	170	60	0	-75
Variable						
NO_3 (uM)	49.0 A	91.5 B	63.4 C	51.4 A	2.7 D	0.7 -
PO_4 (uM)	2.2 A	5.7 B	3.2 C	2.5 D	0.4 E	0.3 -
SiO_2 (uM)	823.2 A	736.4 B	717.7 B	643.1 C	65.4 D	12.0 -
Salinity (o/oo)	1.7 A	5.8 B	7.0 B	10.7 C	33.8 C	- -
TOC (mg/l)	0.5 A	1.0 B	1.1 B	0.8 BA	0.7 A	- -
Chlorophyll a (mg/m^3)	- -	0.09 AB	0.12 A	0.08 B	- -	- -
NH_4+ (uM)	0.19 A	0.89 B	1.03 B	0.72 AB	0.62 AB	- -

all other locations (Table 1; $P<0.05$). Salinities sampled in these locations illustrate a consistent gradient that increases in a seaward direction. Salinity gradients are the result of the intrusion and subsequent mixing of seawater with seaward flowing groundwater. These gradients are dependent on rock porosity and their location is variable and related to the tide state and groundwater outflow at any given time; at low tides the salinity gradient is closer to the ocean while on a rising tide it is pushed further inland.

Field measurements for dissolved oxygen (DO) and temperature made between the hours of 0700 to 1530 hours show that DO concentrations are lowest in the groundwater of Well No. 1 (93.8% saturation) and highest in Pond No. 155 in the afternoon (up to 151% saturation). Likewise temperatures range from 23.1 to 29.8°C with the lowest having been recorded in Well No. 1 and the highest in the shallow water over sun heated pahoehoe lava in Pond 155. The measurement of dissolved oxygen and temperature in the Waikoloa anchialine ponds has provided little new or useful information. Both parameters vary predictably with the diurnal-nocturnal cycle where lowest values are encountered in the early morning hours and highest values are obtained in the afternoon under high solar insolation. The lack of variability in oxygen and temperature measurements is probably related to low water residence times and the mixing of groundwater with well oxygenated seawater.

Nutrients

Concentrations of silicate (SiO_2) show a consistent gradient that varies inversely with salinity, decreasing in a seaward direction. Silicate concentrations are greatest inland and decrease steadily towards the ocean; the concentrations in the wells were significantly higher than all other sampled locations and the middle and upper WAPPA locations in turn exhibited significantly higher silicate levels than the lower WAPPA or at the shoreline and ocean. Seawater typically exhibits a low concentration of silicate relative to groundwater (Bienfang 1980), suggesting that dilution and/or uptake of groundwater silicate is occurring as this nutrient species passes through the WAPPA to the ocean.

Nitrate concentrations are consistently lowest in the Waikoloa wells (Table 1). These locations are presumably representative of natural groundwater that supplies the WAPPA. As this groundwater enters the WAPPA, the highest nitrate concentrations are consistently recorded (Pond 48); this concentration is significantly higher ($P<0.05$) than any measured elsewhere in the system. Pond 48 is the most distant from the shoreline and a trend of statistically significant decreasing nitrate concentrations are apparent in the remaining stations heading makai. Nitrate concentration in Pond 188, however, was

statistically indistinguishable from the Waikoloa wells. This pattern suggests that allochthonous nitrogen input to the WAPPA is occurring somewhere between the wells and Pond 48 and that nitrate concentration decreases as it moves through the pond system towards the ocean. Regression analysis of the nitrate data for Pond 48 and for the Waikoloa wells show that there has not been any significant increase in this nutrient species in the 1986-1988 period at these locations.

Phosphate (PO_4^{-3}) concentrations in the sampled locations at Waikoloa behave similarly to that of nitrate, namely, phosphate concentration is lowest in the groundwater at the Waikoloa wells, highest in Pond 48 (most inland), and decreases in ponds located closer to the shoreline; further reduction of phosphate occurs moving seaward. The increase in phosphate from the wells to Pond 48 and its subsequent reduction as water moves through the WAPPA is statistically significant ($P<0.05$, Table 1). Again regression analysis of phosphate concentrations through time at the Waikoloa wells and at Pond 48 result in fitted lines with slopes that do not differ significantly from zero suggesting that there has not been any significant increase in this nutrient species through the 1986-1988 period.

Similar to the phosphate and nitrate data, total organic carbon (TOC) concentrations in the groundwater show an initial increase from the wells to Pond 48 with subsequent reduction through the WAPPA (Table 1). This overall trend is statistically significant ($P<0.05$), however as with phosphate, TOC concentrations in the lower WAPPA are indistinguishable from the wells.

Mean ammonium (NH_4^+) concentrations in the sampled locations are given in Table 1. Highest ammonium concentrations are in Pond 155 and ammonium decreases in both a mauka and makai direction. Mean ammonium levels in the Waikoloa wells are significantly less than those found in Ponds 48 or 155 (which are not statistically separable); however, mean ammonium levels in Pond 188 and the shoreline station are intermediate, being statistically indistinguishable from either the wells or from Ponds 48 and 155 (Table 1). Thus when considered together, the mean ammonium levels are interrelated and not really different.

Chlorophyll *a* as a measure of phytoplankton activity (biomass) has been regularly assessed at three WAPPA locations: Ponds 48, 155 and 188 (Table 1). The results of the ANOVA indicate that the biomass of phytoplankton in the sampled ponds did not exhibit any obvious trends or statistically significant differences between ponds or through time. Thus phytoplankton response to the nutrient gradient was low suggesting that pond water residence time is short relative to phytoplankton turnover.

Brock and Norris (1988) did not include the man-made pond (MM-1) in the above statistical analyses because it did not

represent part of the natural anchialine system at Waikoloa. The nutrient measurements made at this location indicate that this pond closely resembles the natural situation. Salinity, silicate, nitrate, phosphate and TOC measurements from MM-1 are presented in Table 2 and concentrations were similar to those of its nearest sampled neighbor (Pond 155). Brock and Norris (1988) sampled water quality parameters at a control site lacking any surrounding development. The control area selected was Awakee which contains a number of ponds that resemble WAPPA ponds in their physiography as well as distance from shore. Three ponds were sampled; the makai pond was located approximately 75m from shore, the middle pond approximately 150m from shore and the mauka pond about 250m inland. Since ponds in the WAPPA extend more than 325m from shore, the Awakee pools are most directly comparable to middle and lower WAPPA ponds. Indeed, their water chemistry most closely resembles that of WAPPA ponds 155 and 188 (Table 2).

The results of the WAPPA irrigation water chemistry sampling by Brock and Norris (1988) are given in Table 3. The irrigation settling pond was sampled in order to provide water quality information on irrigation water that is routinely applied to the golf course and surrounding plantings. The irrigation water is enriched with treated sewage effluent and the concentration of phosphate is over three times that observed in any WAPPA pool. Similarly, ammonium concentration as well as silicate is high. Chlorophyll a provides a measure of aquatic plant activity; in the irrigation pond chlorophyll *a* is an order of magnitude greater than that measured anywhere else. These high chlorophyll *a* values suggest that nutrients (i.e., ammonium, phosphates and silicate) are not limiting in this pond.

In servicing the golf course and surrounding grounds, Waikoloa personnel apply a variety of fertilizers, herbicides and pesticides. Fertilizers used on the golf course include "21-7-14" (N:P:K) at 275 lbs/acre/6 weeks and "22-0-16" at 60 lbs/green/month; herbicides include "Dal-E-Rad 120" at 1 gallon/100 every 8 weeks, "Roundup" at 5 gallons/year (maximum) and a fungicide "Dithane M-45" at 3 lbs/100 gallons/month. Insecticides used include "Sevin" at a rate of 12.5 lbs/month and "Spectracide" at 12.5 lbs/month.

Because of fiscal constraints, Brock and Norris (1988) established an annual herbicide and pesticide sampling protocol. Sampling commenced in June 1987 and was repeated in June 1988. Samples are taken from an anchialine pool in the Awakee complex to serve as a natural control that has no surrounding development; samples are also taken at the Waikoloa Well 1 to provide a groundwater standard. In the WAPPA, Pond 155 was selected for pesticide and herbicide sampling because it is situated in the center of the system. In order to minimize costs, analyses are limited to those compounds that are either

Table 2. Mean water quality parameters from the man-made WAPPA pond (MM-1), Ku'ali'i Fishpond (located on the Anaehoomalu Beach grounds) and the three ponds from the Awakee, Hawaii anchialine pond system. Because of a lack of sufficient sample sizes, statistical analyses were not conducted on these data. Data from Brock and Norris (1988).

	POND				
	WAPPA	Awakee			Anaehoomalu
	MM-1	Makai	Middle	Mauka	Ku'ali'i
Distance From Shore (m)	170	75	150	250	25
Variable					
NO_3 (uM)	75.3	59.1	66.2	66.6	0.23
PO_4 (uM)	4.2	5.9	6.2	6.4	1.0
SiO_2 (uM)	687	739	755	755	308
NH_4 (uM)	0.7	0.5	0.3	0.4	0.7
Salinity (o/oo)	8.5	7.7	7.2	7.1	25.5
TOC (mg/l)	0.9	1.0	1.1	1.0	-
Chl a (mg/m^3)	0.2	0.05	0.01	0.01	-

Table 3. Water quality parameters from the settling pond which is used to irrigate the Waikoloa golf course. This pond has a butyl rubber liner and is located approximately 900m mauka of the shoreline and about 300m makai of the Waikoloa Well 2. Data in the body of the table are means and are from Brock and Norris (1988).

	N	Mean	Minimum	Maximum	Std Dev
NO_3 (uM)	6	42.6	22.7	75.2	±21.5
PO_4 (uM)	6	18.3	11.7	24.1	±4.8
SiO_2 (uM)	6	859	800	901	±44
NH_4 (uM)	6	7.3	2.0	9.6	±2.9
Salinity (o/oo)	4	1.7	1.6	1.8	±0.1
TOC (mg/l)	2	3.3	3.3	3.9	±0.1
Chl a (mg/m^3)	4	12.0	7.0	22.4	±7.0

common to several products or are used in large quantities. Brock and Norris (1988) present the results of their pesticide and herbicide sampling for June 1987; in that series analyses were conducted for arsenic, diazinon and carbaryl in water. In June 1988 they added an organic halide screen to the analyses and sampled both water and sediments. Arsenic is an active component of the herbicides "Dal-E-Rad 120" and "Weedhoe". Analyses were made for the insecticide "Spectracide" as well as for carbaryl which is found in "Sevin". Petroleum products such as "Volck Oil Supreme" may be detected by use of total organic carbon (TOC) analyses.

The results of Brock and Norris's (1988) analyses on the June 1987 pesticide and herbicide samples are presented in Table 4. Arsenic was the only component found at all three sampled locations; interestingly, the concentrations were all equal suggesting that low levels of arsenic contamination are natural in Kona coast groundwater. Carbaryl was not detected with the procedures used (detection limits = 0.2 ug/l) and diazinon was found at the Waikoloa Well in a concentration of 0.07ug/l which is near the limits of detection (0.05ug/l). The well is situated adjacent to the Waikoloa plant nursery; as Brock and Norris (1988) report, a tractor was pushing dirt about on the day of pesticide/herbicide sampling and a film of dust was apparent on the surface of the water in the well -- this may well have been the source of the diazinon for the field sampling procedure does not call for filtered water.

Table 4. Pesticide and herbicide concentrations found in anchialine ponds (Awakee - control station and WAPPA Pond 155) and a groundwater control station (Waikoloa Well 1) for the sampling period of June 1987. Data from Brock and Norris (1988).

Location	CONSTITUENT		
	Arsenic mg/l	Diazinon ug/l	Carbaryl (Sevin) ug/l
Awakee (Control)	<0.002	ND*	ND
Waikoloa Well 1	<0.002	0.07	ND
WAPPA Pond 155	<0.002	ND	ND

* "Not Detected"

STATUS OF THE AQUATIC COMMUNITIES IN THE WAIKOLOA ANCHIALINE POOL SYSTEM

All of the studies to date conducted at Waikoloa have not noted any change in the anchialine pool communities; the first descriptions were done by Maciolek and Brock (1974) in 1972. All studies have noted the undisturbed quality of the anchialine communities. The Waikoloa anchialine system is dominated by an assemblage of organisms that are commonly associated with anchialine waters in the salinity range of 1 to 15 ppt. Characteristic species include the red shrimps Halocaridina rubra and Metabetaeus lohena (collectively called 'opae'ula), the glass shrimp (Palaemon debilis), snails (Melania sp., Assiminea sp. and Theodoxus cariosa), cyanophyte mats dominated by the orange crust alga, Schizothrix coricola and the angiosperm, Ruppia maritima. With the introduction of exotic fish in most of the other anchialine pools along the Kona coast in the last several years, the natural value of the Waikoloa preserve has increased.

Halocaridina rubra will frequently occur in concentrations exceeding thousands of individuals per square meter in a given

pond; at other stages of the tide and/or in other nearby anchialine pools these shrimp may be scarce. These shrimp, as well as a number of other co-occurring faunal components utilize the anchialine pond habitat and the rock interstices within the underlying mixohaline watertable. The apparent abundance of 'opae'ula in a given pond or pond system can be very misleading, for nothing is known of the population size of these hypogeal shrimp in subterranean interstitial waters.

Because of its abundance Halocaridina rubra is an appropriate species to monitor in anchialine systems and density estimates for this species have been made in Waikoloa ponds for some time. Bienfang (1977) censused 'opae'ula in 46 Waikoloa ponds, some of which overlapped with the WAPPA ponds and found a mean density of 147±218 shrimp/1000cm^2 (n=46). Ziemann (1986) conducted H. rubra censuses at Waikoloa and estimated a mean H. rubra abundance of 143±48 shrimp/1000cm^2 (n=160). As part of the management program at the WAPPA, Brock and Norris (1988) have monitored the abundance of 'opae'ula. These authors found a mean density of H. rubra of 95±63 shrimp/1000cm^2 (n=304). As these authors report, there are no apparent trends in these data collected in the April 1986 - May 1988 period. Thus they concluded that there has been no change in the population size of H. rubra over the last 2.5 years. Apparently the variance in census data for H. rubra is great enough among all of the studies and differences in sampling methodologies with the earlier studies led Brock and Norris (1988) to conclude that the earlier data was of limited comparative value; thus no conclusions could be drawn with respect to changes in the population size of these shrimp in the 1977-1986 period.

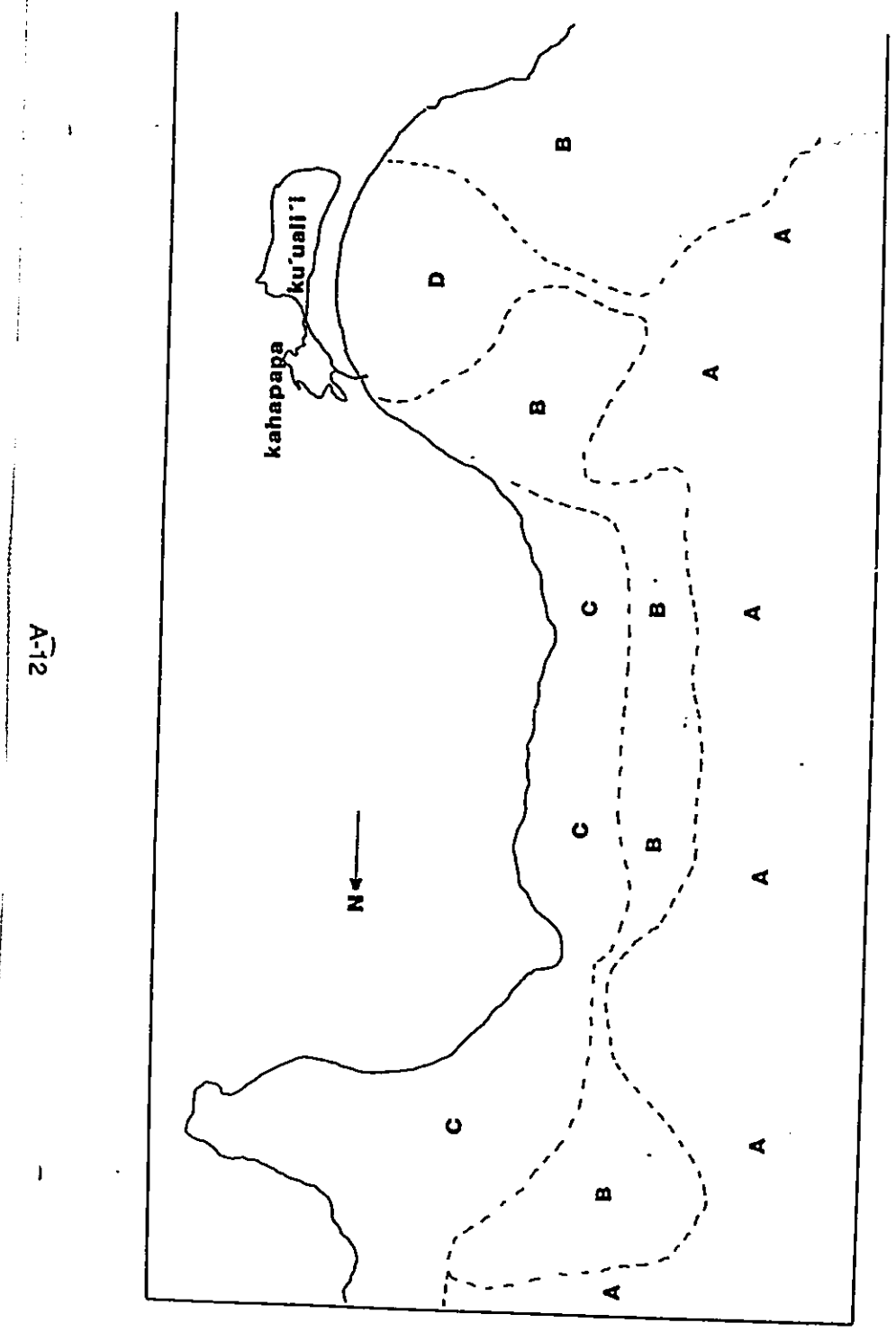
A-11)

Figure 1. Map of the nearshore waters affronting the Waikoloa development and vicinity showing the boundaries of the 4 biotopes recognized in this study. These are the biotope of Porites compressa (A), the biotope of diverse high coral coverage (B), the biotope of low coral coverage (C), and the biotope of sand (D). Scale: 1cm = 72m. From Brock and Norris (1988a).

STATUS OF THE NEARSHORE MARINE COMMUNITIES AT WAIKOLOA

Unlike the anchialine pool system at Waikoloa, the marine communities in the area have not received the same level of attention until recently. Dollar (1987) studied the marine benthos and fishes in Waiulua Bay and Brock (1988) quantitatively described the marine communities present in Anaehoomalu Bay. The most comprehensive study of the nearshore marine communities at Waikoloa was completed by Brock and Norris (1988a). The present summary is based primarily on this latter study.

Brock and Norris (1988a) examined approximately 58ha of nearshore waters affronting the Waikoloa shoreline extending from the beach to about the 20m isobath. In this area four major biotopes or zones were recognized. The physical extent of each is shown in Figure 1. Biotopes were delimited by physical characteristics including water depth, relative exposure to wave action, and the major structural components of benthic communities including the amount of sand, hard substratum, and vertical relief present as



well as the biological attributes of relative coral coverage, fish abundance and dominant species of the coral community. Biotopes were named for distinctive features of each as shown in Figure 1.

Between the two bays (Waiulua and Anaehoomalu), the biotopes approximately parallel the shoreline; in the more protected bays, this zonation is not quite so evident. The zonation along the more open coastline is probably related to a number of physical parameters including water depth and wave exposure. Below the general features of each biotope are discussed.

Biotope of Porites compressa

The biotope of Porites compressa occurs as a continuous band affronting the entire Waikoloa site. North of Anaehoomalu Bay the shoreward boundary of this biotope is defined by a sharp vertical drop from water of about 10m in depth into the biotope of Porites compressa that commences at 12 to 15m in depth. This biotope continues seaward beyond 20m in depth (outside of any of the surveys). Offshore of Anaehoomalu Bay the change in depth into the biotope of Porites compressa is gradual commencing at about 7m in depth, 300m from shore. North of Waiulua Bay the biotope of Porites compressa commences within 60m of shore in 10m of water.

As the name implies, this biotope is dominated by the finger coral, Porites compressa. This zone is a common element along the West Hawaii coast below depths where wave impact is lesened (usually below 10m). In the Waikoloa area Porites compressa will have a local coverage of about 60 percent. The coral typically occurs in mounds that range in size from 2 x 3m to over 10 x 20m in dimensions and will attain heights of up to 2m. These coral thickets are spaced from 1 to 10m apart; intervening space is often sand or sometimes hard substratum with other species of corals (e.g., Porites lobata, P. evermanni, Montipora verrucosa, Pocillopora meandrina) being present. Invertebrate species other than ocrals that are commonly seen in this biotope include the sea urchins Heterocentrotus mammillatus, Tripneustes gratilla and Echinometra mathaei; because of the large amount of cover afforded by the coral in this biotope not many other invertebrate species are diurnally encountered. Fishes are a conspicuous element of the biotope of Porites compressa and the most common are herbivorous including the ma'i'i'i (Acanthurus nigrofuscus), na'ena'e (A. olivaceus), kole (Ctenochaetus strigosus), lau'ipala (Zebrasoma flavescens) and uhus (Scarus rubroviolaceus, S. sordidus and S. taeniurus). The most abundant carnivorous fish in this biotope is the ubiquitous hinalea lauwili (Thalassoma duperrey).

In quantitatively sampling this biotope, Brock and Norris (1988a) found 7 coral species (Porites lobata, P. compressa,

Montipora verrucosa, M. patula, M. flabellata, Pavona varians, Pocillopora meandrina) having an overall coverage of 67.9 percent. Macroinvertebrates encountered in the sampled stations included sea urchins (Heterocentrotus mammillatus, Tripneustes gratilla, Echinometra mathaei) as well as a bivalve, Spondylus tenebrosus. Thirty-eight species of fishes were censused as given in Appendix A (Stations 1-D and 1-E) and the estimated mean standing crop was 566g/m^2. The exceptionally high biomass was due to the presence of a large school of umaumalei (Naso literatus) and the chance encounter of a kahala (Seriola dumerili) in the censuses.

The transition zone between the biotope of Porites compressa and the more shoreward biotope of diverse high coral coverage occupies an area where water depth increases rapidly from about 5-6m to about 10m. Much of the substratum in this transition area is pahoehoe in the form of sharp drops forming channels with an orientation perpendicular to shore and into the prevailing seas. Corals seen in the transition zone are dominated by Porites lobata and P. compressa. Coverage is typically about 30 percent. A number of fishes are usually seen including the kole (Ctenochaetus strigosus), lau'ipala (Zebrasoma flavescens), ma'i'i'i (Acanthurus nigrofuscus), mempachi (Myripristes amaenus), hinalea lauwili (Thalassoma duperrey) and uhu (Scarus sordidus).

Brock and Norris (1988a) found 7 coral species (Porites lobata, P. compressa, Pavona varians, Montipora verrucosa, M. patula, M. flabellata, Pocillopora meandrina) in their survey of this transition zone; mean coverage was estimated to be 49 percent. Diurnally exposed macroinvertebrates seen included the sea urchins (Heterocentrotus mammillatus, Echinometra mathaei, and Tripneustes gratilla) and the sea cucumber (Holothuria atra). Forty-three species of fishes were found in the quantitative censuses and the mean standing crop of fishes was estimated to be 98g/m^2 (Stations 4-A, 4-B, 5-A, 5-B Appendix I). In terms of biomass, the most important families of fishes were surgeonfishes, parrotfishes and wrasses and the most abundant species at these stations were the kole (Ctenochaetus strigosus), lau'i pala (Zebrasoma flavescens), kikakapu (Chaetodon multicinctus), uhu (Scarus sordidus), maiko (Acanthurus nigroris), mempachi (Myripristes amaenus) and the ubiquitous hinalea lauwili (Thalassoma duperrey).

Biotope of diverse high coral coverage

Inshore of the biotope of Porites compressa and the transition area is the biotope of diverse high coral coverage. This biotope is well developed at depths of 5 to 8m occurring at distances from 100 to about 200m offshore. However, in Anaehoomalu Bay this biotope commences only a few meters offshore of the beach in water less than 3m in depth. The distribution of this

biotope in the study area is shown in Figure 1. As the name implies, this biotope is dominated by a number of corals; the most abundant species is Porites lobata. Other coral species commonly encountered in this biotope include Porites evermanni, P. (Synaraea) convexa, Pavona varians, P. duerdeni, Montipora verrucosa, M. patula, M. flabellata, Porites compressa, and Pocillopora meandrina. Fish species commonly seen in the biotope of diverse high coral coverage include the ma'i'i'i (Acanthurus nigrofuscus), hinalea lauwili (Thalassoma duperrey), and 'omaka (Stethojulis balteata). The substratum of the biotope of diverse high coral coverage is comprised of corals wirh intervening open sand or basaltic substratum; in some areas the topography is highly irregular while in others (e.g., Anaehoomalu Bay) it is much less rugose.

In their quantitative survey of six stations that sampled the biotope of diverse high coral coverage, Brock and Norris (1988a) found 13 species of corals (Porites lobata, P. compressa, P. evermanni. P. (Synaraea) convexa, Pavona duerdeni, P. varians, Montipora verrucosa, M. patula, M. flabellata, Pocillopora meandrina, Leptastrea purpurea, L. bottae, Cyphastrea ocellina) having a mean coverage of 43.5 percent. Macroinvertebrate species encountered in the census areas included sea urchins (Tripneustes gratilla, Heterocentrotus mammillatus, Echinometra mathaei), sea cucumbers (Actinopyge mauritiana), starfish (Linckia multiflora), bivalves (Pinctada margaritifera, Pinna muricata, Spondylus tenebrosus), cone shell (Conus leopardus) and triton's trumpet (Tritonalia tritonis). Sixty-two species of fishes were censused in the areas sampled (Appendix I, Stations 1-A, 1-B, 2-C, 2-D, 3-C, 3-D). Estimated standing crops ranged from 49 to 389g/m^2 with an overall mean of 126g/m^2. The families of fishes contributing the most to this biomass included the surgeonfishes, triggerfishes, wrasses and parrotfishes. In terms of numbers, the most abundant fish species at these stations were the hinalea lauwili (Thalassoma duperrey), 'omaka (Stethojulis balteata), ma'i'i'i (Acanthurus nigrofuscus), maiko (Acanthurus nigroris), na'ena'e (Acanthurus olivaceus), umaumalei (Naso literatus), kole (Ctenochaetus strigosus), 'alo'ilo'i (Dascyllus albisella), humuhumu 'ele'ele (Melichthys niger), damselfish (Stegastes fasciolatus) and uhus (Scarus sordidus and S. rubroviolaceus).

Biotope of low coral cover

The biotope of low coral cover occurs as a near-continuous band north of Anaehoomalu Bay and into Waiulua Bay. This zone is located shoreward of the biotope of diverse high coral coverage and extends from the shore to about 120m offshore; maximum depths encountered in this biotope are about 4m. As noted above, this biotope may be characterized by the presence of considerable "open" space not occupied by corals or other sessile species of macroinvertebrates. Also present are numerous loose basalt

boulders and coral rubble. The major structuring force in this biotope is the occasional impingement of high energy (surf) conditions that serve to scour the substratum and dislodge corals; the result is that there is little coral present. Corals are slow growing (e.g., hemispherical heads of Porites lobata are known to radially increase in diameter at a rate of about 1cm/year) thus heavy storm action does not have to impact a given locality very often to keep the community at an early or pioneering stage of succession.

The quantitative studies by Brock and Norris (1988a) found 8 species of corals (Porites lobata, P. compressa, Pavona duerdeni, P. varians, Pocillopora meandrina, Cyphastrea ocellina, Montipora verrucosa, M. verrilli) having a mean coverage of 4.9 percent in this biotope. Because of a general lack of cover macroinvertebrates were more obvious than in other areas and 11 species were noted in the quantitative surveys; these included sea urchins (Echinometra mathaei, E. oblongata, Heterocentrotus mammillatus, Tripneustes gratilla, Echinothrix diadema), sea cucumbers (Holothuria atra), starfish (Linckia diplax), cones (Conus miles, C. ebraeus), tiger cowries (Cypraea tigris) and bivalves (Spondylus tenebrosus). Thirty-nine fish species were censused (Appendix I) and the estimated standing crops at four stations sampling this biotope (Stations 2-A, 2-B, 3-A, 3-B) ranged from 58 to 240g/m^2 with a mean of 107g/m^2. The families of fishes contributing the greatest biomass to the standing crop were the surgeonfishes, triggerfishes, wrasses and parrotofishes. The most abundant fishes at these four stations were the damselfishes (Chromis vanderbilti, C. ovalis), hinalea lauwili (Thalassoma duperrey), 'omaka (Stethojulis blateata), ma'i'i'i (Acanthurus nigrofuscus), na'ena'e (Acanturus olivaceus), humuhumu 'ele'ele (Melichthys niger), and uhus (Scarus rubroviolaceus, S. sordidus and juvenile Scarus spp.).

A-14

Biotope of sand

The biotope of sand is located in Anaehoomalu Bay and represents a seaward extension of the beach. This biotope commences on the shore where it has its greatest width; it extends about 150m seaward roughly in the shape of a triangle. In Anaehoomalu Bay this wedge of sand serves to divide the biotope of diverse high coral coverage into northern and southern segments. In total this biotope encompasses about 1.5ha of inner Anaehoomalu Bay. As the name implies, the substrate of this biotope is sand. Scattered across the biotope are small areas of coral; these are most abundant adjacent to the biotope of diverse high coral coverage and become less obvious towards the middle of the biotope. Live coral probably accounts for less than 3 percent of the substratum present. .There are also small areas of rubble and dead coral that likewise comprise only a small fraction of the substratum in the biotope.

In the biotope of sand one encounters few fishes or exposed invertebrates away from the coral on the sand. Species seen include the 'ulae (Saurida flamma) and weke (Mulloides flavolineatus); invertebrates occasionally seen include the terebra (Terebra crenulata) and numerous holes dug by a variety of cryptic species including callianassid and alpheid shrimps, holothurians and annelid worms. Near the emergent hard substratum whether it be live or dead coral, more fish species are apparent including the ubiquitous hinalea lauwili (Thalassoma duperrey), 'akilolo (Gomphosus varius), ma'i'i'i (Acanthurus nigrofuscus), uhu (Scarus sordidus), 'upapalu (Foa brachygramma) and 'o'opu (Asterropteryx semipunctatus). The most common species of coral in this biotope is Porites lobata; other coral species encountered include Montipora verrucosa and Pocillopora meandrina.

Brock and Norris (1988a) established only one station (Station 1-C) to sample this low diversity biotope. Only one small coral colony (Pocillopora meandrina) was encountered in the quantitative survey comprising a coverage of 0.04 percent. In the invertebrate census two sea urchin species (Echinometra mathaei and Echinothrix diadema) and only one fish species (the 'o'opu - Asterropteryx semipunctatus) were seen. The estimated standing crop of fish was 0.01g/m^2.

The green sea turtle (Chelonia mydas) is protected by federal and state statues; it is on the list of threatened species. Brock and Norris (1988a) recorded 14 separate sightings of green turtles both affronting the Waikoloa coastline and further to the south off Kapalaoa. All individuals seen were immature having straight line capapace lengths of 60cm or less. Most of the turtle sightings were made well offshore at distances greater than 200m from shore; these authors also note that they were unable to identify any concentration of algae or limu in the Waikoloa area that would serve as forage for green turtles.

A second smaller turtle species, the hawksbill (Eretmochelys imbricata), is infrequently encountered in Hawaiian waters. No hawksbill turtles have been reported in any of the surveys conducted at Waikoloa. The endangered humpback whale (Megaptera novaeangliae) is known to winter in Hawaiian waters. Usually these animals remain well offshore. However, female humpback whales with calves will "rest" in selected areas inshore of the 40 fathom isobath around the islands. Along the Kona coast three known areas where this activity is known to occur includes an area in the vicinity of Keauhou Bay, a section near the old Kona airport and offshore of the "Red Hill" area. There is no information or evidence to suggest that humpback whales utilize the "shallow" waters affronting the Waikoloa shoreline.

POTENTIAL IMPACTS

A characteristic feature of West Hawaii is its diffuse groundwater discharge at the shoreline (Cox et al. 1969). This discharge is the result of the island's geologically young lavas; estimates of this discharge range from 1 to 4 million gallons per day per mile of coastline in the Waikoloa area (U.S. Army Corps of Engineers 1985). The high porosity of these young lavas will not support water contained above sea level near the shoreline (Cox et al. 1969), resulting in a system where groundwater moves rapidly through the lava towards the sea and seawater readily intrudes. Anchialine pools are defined as brackish water land-locked ponds that show tidal rhythms -- thus they are restricted to depressions in the lava that extend down into the watertable. The characteristic mixohaline water is the result of seaward flowing groundwater interfacing and mixing with warmer, more saline waters intruding from below. Such a simple dilution model is illustrated by the distributional pattern of the two conservative species, silicate and salinity with proximity to the sea as shown by Brock and Norris (1988) in the Waikoloa anchialine pools.

Brock and Norris (1988) hypothesized that a dilution model provided the simplest explanation for the patterns observed for salinity, silicate, nitrate, phosphate and TOC; typically concentrations were low in the mauka (inland) wells and highest in the most inland anchialine pools. These authors found that the concentration of these nutrients is subsequently reduced as groundwater continues through the anchialine pond system towards the ocean. Since seawater is relatively low in nutrients, the dilution model would explain this reduction, but biological uptake probably accounts for some portion of this reduction. If the dilution model is correct, additional nutrient input must be occurring between the Waikoloa wells and the WAPPA. Brock and Norris (1988) concluded that the probable source was from the Waikoloa golf course which is heavily fertilized with sewage enriched irrigation water and commercial fertilizers. Leaching of these materials through the thin topsoil to the groundwater beneath may be occurring.

Has the water quality characteristics of the anchialine pools at Waikoloa changed? Brock and Norris (1988) concluded that there had not been any statistically significant changes in the water quality parameters they measured from the April 1986 - May 1988 period. However, comparative analysis with earlier data has shown significant changes. Bienfang (1977) reported water quality data for 50 Waikoloa anchialine ponds overlapping with the WAPPA. The grand means for Bienfang's (1977) data and those for Brock and Norris (1988) are presented in Table 5. A Wilcoxon Rank Sum ANOVA of these data show statistically significant increases in nutrient concentrations for nitrates and phosphates

Table 5. Wilcoxon rank-sum comparison of 4 water quality parameters between Bienfang (1977) and Brock and Norris (1988) for anchialine pools at Waikoloa[1]. Those parameters where the difference in grand means between the two studies could not be attributed to random variability (P<0.05) are noted with an asterisk. Although silicate and total organic carbon were not measured in the Beinfang (1977) study, grand means for these variables are presented for the Brock and Norris (1988) study. Data from Brock and Norris (1988).

Source (N)	Bienfang (1977) (88)	Brock & Norris (1988) (33)
Salinity (o/oo)	6.6	7.8*
Nitrate (uM)	17.8	68.8*
Orthophosphate (uM)	1.2	3.8*
Ammonium (uM)	0.9	0.9
Silicate (uM)	-	699
Total Organic Carbon (mg/l)	-	0.9

[1]Only natural ponds were included in the calculation of grand means for all variables.

between the two studies.

How do these significant increases in inorganic nutrient species at Waikoloa compare to other Kona coast anchialine systems? Table 6 presents water quality data from a number of Kona anchialine ponds at locations well removed from the WAPPA and represent nutrient concentrations in anchialine ponds not subjected to any surrounding development. It is interesting to note that the grand means for salinity, nitrates, phosphates, silicates, total organic carbon and ammonium in the WAPPA ponds (Table 5) fall within the ranges of concentrations observed in anchialine pools in locations with no surrounding development. Thus despite a nutrient subsidy from the golf course, the nutrient chemistry of the WAPPA ponds is similar to that found in anchialine ponds with no nearby development. These data support the contention that the Waikoloa development has significantly altered the water chemistry of the WAPPA ponds, however, mean concentrations of these nutrient species are within the range of natural variability encountered in Kona coast anchialine ponds not subjected to any surrounding development. To better put this into perspective, reported natural groundwater nutrient levels in other locations may be considerably greater than those found by Brock and Norris (1988) at Waikoloa. Johannes (1980) reported groundwater nitrate levels between 115 to 380uM from Perth, Australia, and Marsh (1977) noted nitrate concentrations in Agana, Guam groundwater of 178uM.

Thus far, the monitoring program at Waikoloa has documented statistically significant increases in nitrate and phosphate concentrations in the anchialine ponds since 1977, but no statistically significant increases have occurred since the inception of the monitoring program in April 1986. Although statistically greater, nutrient concentrations in the WAPPA presently fall into the range of values observed in the groundwater or other anchialine ponds along relatively undeveloped sections of the Kona coast. Periodic sampling of the biota of these ponds from 1972 (Maciolek and Brock 1974) to present has yielded no obvious change in ponds where exotic fish have not been introduced. Hence, the data suggest that the native aquatic biota of anchialine pond systems are insensitive to the increased nutrient concentrations observed in this monitoring program. It appears that these nutrient species are in excess and thus are not limiting. Brock and Norris (1988) do point out that the nutrient loading in the WAPPA appears to have enhanced the growth of terrestrial vegetation surrounding the pools and some enroachment has occurred but the aquatic biota is unaffected. Possible mechanisms to the apparent insensitivity of the aquatic biota to the excess nutrients may be the characteristic short water residence time of ponds and the usual presence of large numbers of the herbivorous shrimp ('opae'ula). Through their grazing, these crustaceans appear to keep many macroalgal species and possibly phytoplankton from otherwise dominating the system.

Table 6. Salinity and nutrient data from 27 anchialine ponds along the Kona, Hawaii coast. Data are from Ziemann (1986; source Z below) and Brock and Norris (1988; source B&N below).

Source	Location	Sal (o/oo)	SiO_2 (uM)	NO_3 (uM)	PO_4 (uM)	NH_4 (uM)	TOC (mg/l)
Z	Kapalaoa	7	-	20.8	1.2	1.1	-
Z	Kapalaoa 4	6	-	39.9	1.5	0.6	-
Z	Akahu Kaimu 1	6	-	52.7	1.5	2.2	-
Z	Pueo Bay 1	5	-	44.0	0.7	1.4	-
Z	Pueo Bay 3	3	-	52.5	1.1	1.9	-
Z	Waiaelepi 2	1	-	47.9	1.8	2.4	-
Z	Luahinewai 1	1	-	38.2	2.0	2.6	-
Z	Kona Village 1	4	-	2.2	1.0	7.8	-
Z	Kukio Bay 1	5	-	53.1	1.2	0.3	-
Z	Kukio Bay 2	5	-	53.1	1.1	0.5	-
Z	Kukio Bay 3	4	-	53.1	1.1	1.3	-
Z	Kukio Bay 4	5	-	53.1	0.6	0.6	-
Z	Kukio Bay 7	5	-	52.3	1.0	6.1	-
Z	Kukio Bay 8	6	-	53.2	0.5	0.9	-
Z	Kua Bay	6	-	0.5	0.7	14.8	-
Z	Makalawena N-1	8	-	3.8	3.8	5.6	-
Z	Makalawena N-5	7	-	33.4	3.8	8.5	-
Z	Makalawena T-1	7	-	21.4	3.3	7.8	-
Z	Queen Liliuokalani 1	14	-	11.7	0.6	2.2	-
Z	Queen Liliuokalani 11	6	-	29.1	0.7	1.7	-
Z	Queen Liliuokalani 13	10	-	20.4	0.7	3.0	-
B&N	Awakee Mauka	7	761	62.3	6.6	0.7	0.8
B&N	Awakee Middle	7	766	62.3	6.3	0.4	0.9
B&N	Awakee Makai	7	734	52.5	6.0	0.5	0.7
B&N	Awakee Mauka	8	748	70.8	6.2	0.2	1.3
B&N	Awakee Middle	8	744	70.1	6.0	0.2	1.3
B&N	Awakee Makai	8	744	65.6	5.8	0.5	1.4
	MEAN	6.1	749	41.5	2.5	2.8	1.1
	S.D.	2.6	12	20.9	2.2	3.5	0.3

Similarly, as pointed out by Brock and Norris (1988) any elevation of nutrients reaching the ocean is rapidly lost to the system. With the extremely low inorganic nutrient concentrations that typify marine waters, benthic algae rapidly strip out the nutrients found in incoming groundwater; at Waikoloa no evidence of nutrient loading (elevation) can be found in the ocean samples (75m offshore; Brock and Norris 1988). The marine baseline survey of the waters affronting Waikoloa carried out in August 1988 found no unique or unusual marine communities but rather the marine fish and benthos of Waikoloa are very similar to those encountered elsewhere in other West Hawaii reef sites; there was no evidence of man-induced disturbance in these communities (Brock and Norris 1988). The fine condition and lack of disturbance in the fish and coral communities affronting the Waikoloa coastline represent a resource of value to the developer, residents and visitors alike.

Despite the changes that have occurred at Waikoloa altering the physical appearance of the coastal plain over the last 10 years, further development is planned and allowed under the existing permits. Studies of the water chemistry show some local change but these changes fall within the range of natural variability encountered in Kona coast groundwater; aquatic biota in anchialine pools and in the marine environment appear to be unaffected by man's activities. Will further development negatively impact the quality of groundwater, the anchialine pools or nearshore marine communities? The studies conducted thus far suggest that the management strategies utilized have been successful in curtailing negative environmental impacts at Waikoloa. If these same strategies (i.e., those for wastewater management, monitoring programs, preserves, etc.) are pursued, then further development should not result in environmental degradation. If the disposal of treated sewage effluent through the irrigation of golf courses and plantings constitutes the greatest known potential environmental hazard, the proposed increase in golf courses and open landscaped space will decrease the focus of impacts by spreading the irrigation over a much larger area.

Irrespective of whether the continued development at Waikoloa is to occur on just the makai parcel (526 acres between the King's Trail and the shoreline) or over the entire area (between the shoreline and the Queen Kaahumanu Highway) as proposed, the monitoring program for the Waikoloa Anchialine Pond Preservation Area will continue to regularly monitor the aquatic biota as well as anchialine and nearshore water chemistry and should be able to detect any environmentally detrimental changes that might occur. Besides a monitoring function, the program as stipulated under agreement with the U.S. Army Corps of Engineers and the developer may undertake corrective action when an unforeseen deleterious event (i.e., environmental degradation) has taken place; the developer will provide funds for such corrective actions. The presence of a funded and ongoing monitoring program that has guidence from permit agencies such as the U.S. Army Corps of Engineers provides a further safeguard that the environmental integrity of the ground and marine waters as well as the aquatic biota will remain intact with future developments at Waikoloa.

LITERATURE CITED

Bienfang, P.K. 1977. Survey of the aquatic biota and water quality characteristics of the anchialine ponds at Anaehoomalu, Hawaii. Report prepared for Boise Cascade Co., Honolulu, Hawaii. Oceanic Institute, Makapuu, Waimanalo, Hawaii. 150p.

Bienfang, P. 1980. Water quality characteristics of Honokohau Harbor: a subtropical embayment affected by groundwater intrusion. Pac. Sci. 34:279-291.

Brock, R.E. 1988. Proposed small-boat moorings for Anaehoomalu Bay, Hawaii: An assessment of biological impacts. Prepared for Transcontinental Development Co., Waikoloa, Hawaii. 39p.

Brock, R.E. and J.E. Norris. 1987. The Waikoloa anchialine pond program first status report. Prepared for the U.S. Army Corps of Engineers. Hawaii Institute of Marine Biology, unpublished report. 48p.

Brock, R.E. and J.E. Norris. 1988. The Waikoloa anchialine pond program second status report. Prepared for the U.S. Army Corps of Engineers. Hawaii Institute of Marine Biology, unpublished report. 65p.

Brock, R.E. and J.E. Norris. 1988a. Quantitative baseline survey of the marine communities at Waikoloa, Hawaii. Prepared for Transcontinental Development Co., Waikoloa, Hawaii. 53p.

Brock, R.E., J.E. Norris, D.A. Ziemann and M.T. Lee. 1988. Characteristics of water quality in anchialine ponds of the Kona, Hawaii coast. Pac. Sci. 41:200-208.

Cox, D.C., F.F. Peterson, W.M. Adams, C. Lau, J.F. Chemuui and R.D. Huber. 1969. Coastal evidence of groundwater conditions in the vicinity of Anaehoomalu and Lalamilo, South Kohala, Hawaii. Water Resources Research Center Tech. Report no. 24. University of Hawaii, Honolulu.

Dollar, S. (Marine Research Consultants). 1987. Baseline assessment of the marine environment at Waiulua Bay, South Kohala, Hawaii. Prepared for Belt, Collins & Associates, Honolulu, Hawaii. 53p.

Johannes, R.E. 1980. The ecological significance of the submarine discharge of groundwater. Mar. Ecol. Prog. Ser. 3: 365-373.

Maciolek, J.A. and R.E. Brock. 1974. Aquatic survey of the Kona coast ponds, Hawaii Island. Univ. Hawaii SeaGrant Advisory Report AR-74-04. 73p.

Marsh, J.A., Jr. 1977. Terrestrial inputs of nitrogen and phosphorus on fringing reefs in Guam. pp.332-336. In: Proceedings of the 2nd International Coral Reef Symposium, Vol. I. Great Barrier Reef Committee, Brisbane, Australia.

U.S. Army Corps of Engineers. 1985. Final impact statement U.S. Department of the Army permit application. Waikoloa Beach Resort. Waikoloa, South Kohala District, Island of Hawaii. Various sections and appendices.

Ziemann, D.A. 1984. Impact analysis of the Hyatt Regency Waikoloa Hotel development on the aquatic resources of the Waikoloa Beach Resort area, Hawaii. Report prepared for Belt, Collins & Associates, Honolulu, Hawaii. Oceanic Institute, Makapuu, Waimanalo, Hawaii. 26p.

Ziemann, D.A. 1985. Anchialine pond survey of the northwest coast of Hawaii Island. Report prepared for Belt, Collins & Associates, Honolulu, Hawaii. Oceanic Institute, Makapuu, Waimanalo, Hawaii. 33p. plus appendices.

Ziemann, D.A. 1986. Waikoloa Beach Resort anchialine pond monitoring program. Report prepared for Transcontinental Development Co., Waikoloa, Hawaii. Oceanic Institute, Makapuu, Waimanalo, Hawaii. 17p. plus appendices.

APPENDIX B

B-1

PROPOSED SMALL-BOAT MOORINGS FOR ANAEHOOMALU BAY, HAWAII: AN ASSESSMENT OF BIOLOGICAL IMPACTS

By
Dr. Richard E. Brock
Environmental Assessment Co.
1804 Paula Drive
Honolulu, Hawaii 96816

For
Transcontinental Development Co.
P.O. Box 3028
Waikoloa Village Station
Waikoloa, Hawaii 96743

September 1988

INTRODUCTION

Because there are few sand beaches along the West Hawaii coast, Anaehoomalu Bay is a favored recreational area. Nearby resort development at Waikoloa has provided public access and needed facilities (restrooms, etc.) on the bay. The relatively protected waters and coral reefs make Anaehoomalu Bay an excellent snorkeling site and local winds foster windsurfing activities.

There are several small boat moorings present in the bay which contribute to the diversity of activities available to the visitor and resident alike. With the ongoing expansion of resort facilities at Waikoloa, the need for a number of additional permanent moorings was identified. Prior to any development of moorings, an assessment of extant marine communities and an analysis of potential impacts to these communities from the deployment of moorings should be made. This document presents the results of a quantitative survey of marine communities in Anaehoomalu Bay and makes an assessment of the proposed development of moorings on these communities.

MATERIALS AND METHODS

The fieldwork which provided the database for this survey of the marine macrobiota of Anaehoomalu Bay was conducted between 14 through 18 July 1988. The area encompassed in these surveys is given in Figure 1 and encompasses the northern part of Anaehoomalu Bay from the shoreline seaward to the approximate 10m isobath situated more than 300m from shore. The southern terminus of the study site follows an imaginary line running seaward and affronting the Parker Ranch Recreational Center at Anaehoomalu Bay.

The quantitative sampling of macrofauna of marine communities presents a number of problems; many of these are related to the scale on which one wishes to quantitatively enumerate organism abundance. Marine communities in the study area may be spatially defined in a range on the order of a few hundred square centimeters (such as the community residing in a Pocillopora meandrina coral head) to major biotopes covering many hectares. Recognizing this ecological characteristic, we designed a sampling program that attempted to delineate major extant communities in the limits of the study area and quantitatively describe these communities. Thus, a number of methods were used.

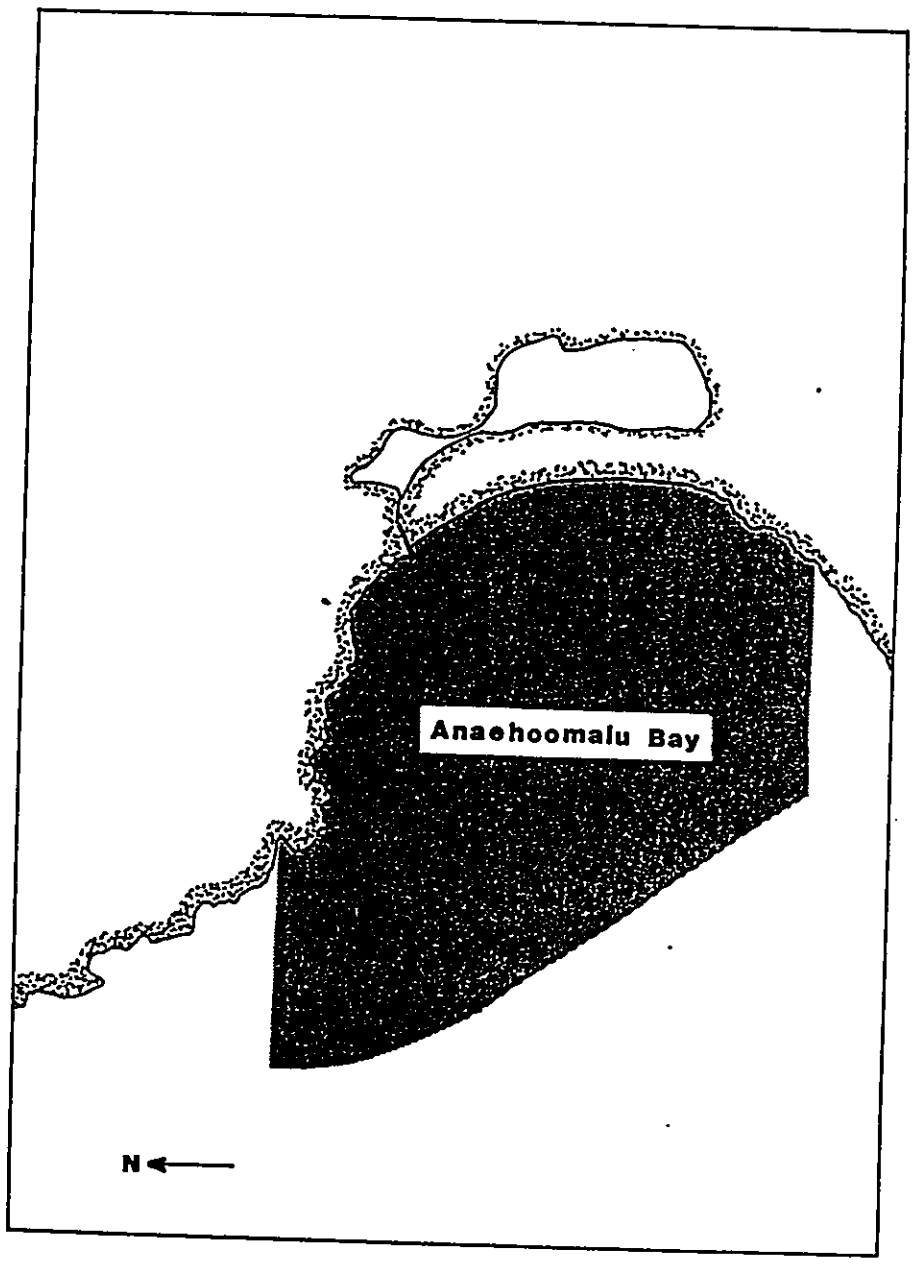


Figure 1. Map of Anaehoomalu Bay and environs showing the area encompassed in this survey (uniformly stippled) and the shoreline area (roughly stippled). Also shown are Ku'uali'i and Kahapapa Fishponds behind Anaehoomalu Beach. Scale: 1cm = 50m.

B-2

To obtain an overall perspective on the extent of the major communities or "zones" occurring in the study area, divers were slowly towed behind a skiff over the study site; over some areas this was accomplished by swimming. This exercise allowed the qualitative delineation of major biotopes based partially on large structural elements (e.g., amount of sand, hard substratum, fish abundance, coral coverage or dominant coral species). Within each biotope in the study area, stations were established and quantitative studies conducted, including visual enumeration of fish, counts along benthic transect lines and cover estimates in benthic quadrats. Besides these quantitative measures, a qualitative reconnaissance was made in the vicinity of each station by swimming and noting the presence of species not encountered in the transects. Qualitative observations were also made in the areas surrounding existing moorings. All assessments were carried out using SCUBA.

The location of stations were subjectively chosen as being representative of the biotope. For possible future reference, some station locations were noted using a sextant and determining angles between prominent landmarks. Immediately following site selection, a visual fish census was undertaken to estimate the abundance of fishes. These censuses were conducted over a 25 x 4m corridor and all fishes within this area to the water's surface were counted. A single diver equipped with SCUBA, transect line, slate and pencil would enter the water, count and estimate sizes (standard lengths) of all fishes encountered in the prescribed area (method modified from Brock 1954). The 25m transect line was paid out as the census progressed, thereby avoiding any previous underwater activity in the area which could frighten wary fishes. In the laboratory, length estimates of all fishes made in the field were used in calculating fish standing crop or biomass; this was accomplished through the use of linear regression techniques.

Fish abundance and diversity is often related to small-scale topographical relief over short linear distances. A long transect may bisect a number of topographical features (e.g., cross coral mounds, sand flats, and algal beds), thus sampling more than one community and obscuring distinctive features of individual communities. To alleviate this problem, a short transect (25m in length) has proven adequate in sampling many Hawaiian benthic communities (see Brock 1982).

Besides frightening wary fishes, other problems with the visual census technique include the underestimation of cryptic species such as moray eels (family Muraenidae) and nocturnal species, e.g., squirrelfishes (family Holocentridae), aweoweos (family Priacanthidae), etc. This problem is compounded in areas of high relief and coral coverage that afford numerous shelter sites. Species lists and abundance estimates are more accurate for areas of low relief, although some fishes with cryptic habits

or protective coloration (e.g., the nohus, family Scorpaenidae; the flatfishes, family Bothidae) might still be missed. Obviously, the effectiveness of the visual census technique is reduced in turbid water and species of fishes which move quickly and/or are very numerous may be difficult to count. Additionally, bias related to the experience of the diver conducting counts should be considered in making any comparisons between surveys. In spite of these drawbacks, the visual census technique probably provides the most accurate nondestructive assessment of diurnally active fishes presently available (Brock 1982).

After the assessment of fishes, an enumeration of epibenthic invertebrates (excluding corals) was undertaken using the same transect line as established for fishes. Exposed invertebrates usually greater than 2cm in some dimension (without disturbing the substratum) were censused in a 25 x 4m area. As with the fish census technique, this sampling methodology is quantitative for only few invertebrate groups, e.g., some of the echinoderms and holothurians. Most coral reef invertebrates (other than corals) are cryptic or nocturnal in their habits making accurate diurnal assessment of them in areas of topographical relief very difficult. This, coupled with the fact that the majority of these cryptic invertebrates are small, necessitates the use of methodologies beyond the scope of this survey (e.g., see Brock and Brock 1977). Recognizing constraints on time and the scope of this survey, the invertebrate censusing techniques used here attempted only to assess those few macroinvertebrate species that are diurnally exposed.

Exposed sessile benthic forms such as corals and macrothalloid algae were quantitatively surveyed by use of quadrats and the point-intersect method. The point-intersect technique only notes the species of organism or substratum type directly under a point. Along the previously set fish transect line, 50 such points were assessed (once every 50cm). These data have been converted to percentages. Quadrat sampling consisted of recording benthic organisms, algae and substratum present as a percent cover in six one-meter-square frames placed at five-meter intervals along the transect line established for fish censusing (at 0, 5, 10, 15, 20 and 25m). If macrothalloid algae were encountered in the 1 x 1m quadrats or under one of the 50 points, they were quantitatively recorded as percent cover. Underwater photography was used to provide a permanent record of benthic community structure and cover at stations.

There are a number of mooring designs that are used in shallow water applications; substratum composition will often dictate the most acceptable and cost-effective design for a mooring at a given location. Thus knowledge of the substratum is central to the selection of the most appropriate configuration. In this analysis important parameters include the presence or absence of sand and/or hard substratum. If sand is present, its apparent

depth should be known as well as the composition of any hard substratum (whether it be basalt or limestone). Accordingly, we mapped the substratum types and apparent sand depth around each of the existing and proposed mooring locations in Anaehoomalu Bay using a 2m long compressed air operated sand probe. In this analysis, mapping was confined to a circle with a 20m diameter. We used a 20m long transect line and at every 5m along this line completed a point intercept inventory of the substratum type, composition and apparent sand depth. This was carried out along the diameter in a sea/shore (mauka-makai) direction with the center being at the proposed or existing anchor points.

During the course of the fieldwork, notes were taken on the number of green sea turtles seen within and adjacent to the study area. Additionally, a one-hour period was spent anchored at a location seaward of the study site in an effort to identify local area use patterns by resident green sea turtles.

Simple methods of data reduction and analysis have been used and are described where met with in the text. Diversity (H') is calculated as described by Pielou (1966), where:

$$H' = \sum -p_i \ln p_i$$

where p_i is that proportion of the individuals censused belonging to species i. This is the Shannon-Wiener index.

RESULTS

The qualitative reconnaissance defined three biotopes in the study area. Inshore is the biotope of diverse high coral coverage which occurs as a near continuous feature throughout Anaehoomalu Bay from just offshore of the beach to about the 7m isobath close to 300m offshore; seaward of this is the biotope of Porites compressa coral which continues into deeper water outside of the survey area. Bisecting and dividing the biotope of diverse high coral coverage into northern and southern portions is a wedge of sand that occurs from the beach affronting Kuu'ali'i Fishpond to about the 6m isobath; this is the biotope of sand. The approximate boundaries of these biotopes are shown in Figure 2. It should be noted that the boundaries of each biotope are not sharp but rather grade from one to another; these are ecotones or zones of transition. Biotopes were delimited by physical characteristics including water depth, relative exposure to wave action, and the major structural composition of the benthic communities. The latter included the amount of sand, hard substratum, and vertical relief present as well as the biological attributes of relative coral coverage, fish abundance

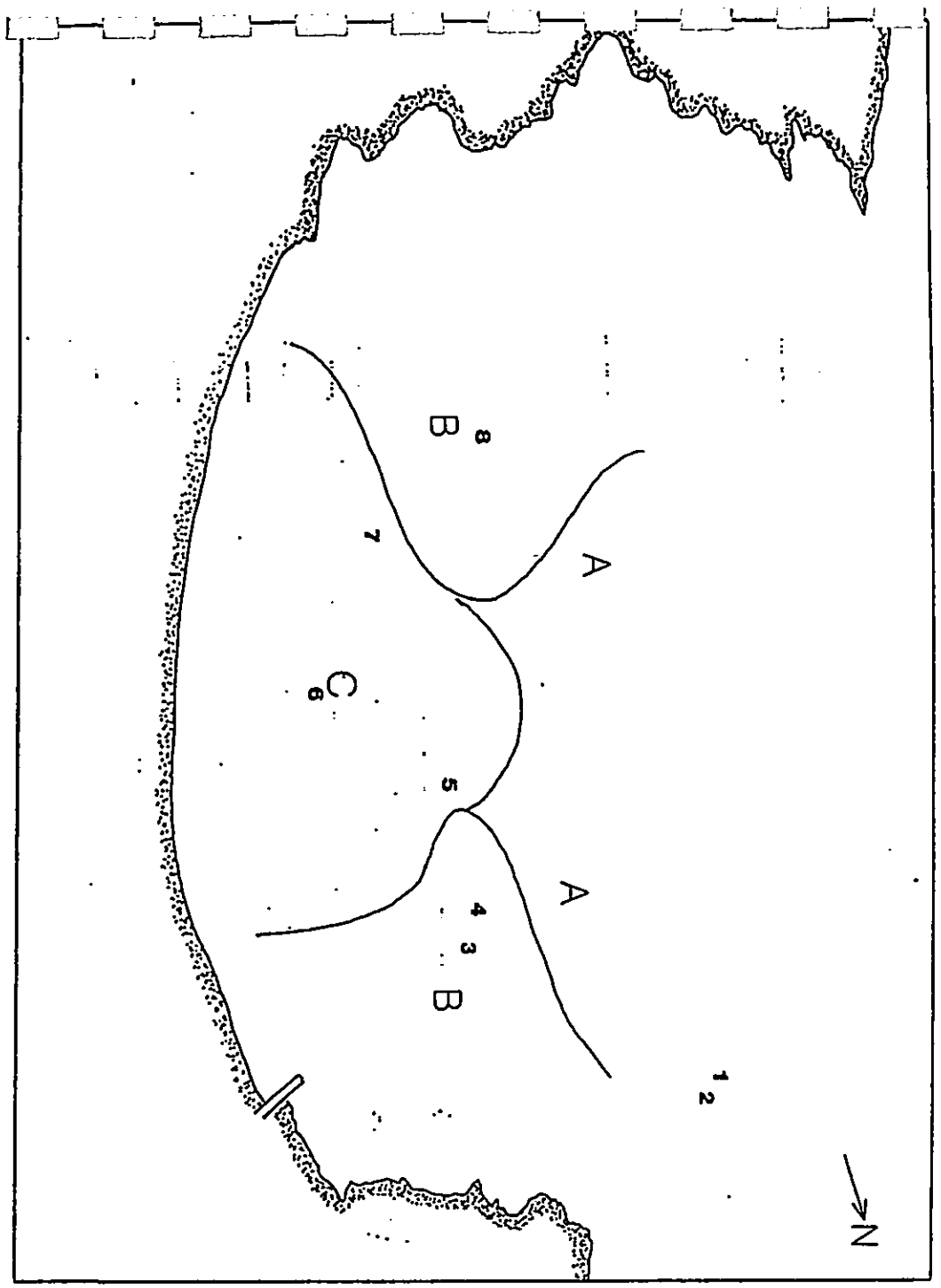


Figure 2. Map of Anaehoomalu Bay in oblique view showing the approximate boundaries of the three biotopes recognized in the study area where A indicates the biotope of Porites compressa coral, B the biotope of diverse high coral coverage and C the biotope of sand. Also given are the locations of the 8 quantitative stations numbered 1 through 8 that were established to sample these biotopes. In the foreground the scale is approximately 1cm = 20m.

and dominant species of the coral community. Biotopes were named for distinctive features of each as described below.

Eight stations were established in Anaehoomalu Bay to quantitatively describe the marine communities resident to the three biotopes noted above. The locations of these stations are also given in Figure 2; the biotopes and the results of surveys at each station are described below:

Biotope of Porites compressa Coral

The biotope of Porites compressa is a commonly recognized element of coral zonation along the West Hawaii coast. The Porites compressa zone is usually seen below depths of 10m where wave surge is lessened. At Anaehoomalu the biotope of Porites compressa commences at about 7m depth about 300m offshore and continues into deeper water seaward of the study site. In the Porites compressa zone are usually seen a number of fishes and invertebrates. The ramose growth form of Porites compressa provides considerable cover for many juvenile fishes; dominant species include the kole (Ctenochaetus strigosus), lau'i pala (Zebrasoma flavescens), ma'i'i'i (Acanthurus nigrofuscus), hinalea lauwili (Thalassoma duperrey), 'aki lolo (Gomphosus varius) and uhu (Scarus sordidus). Invertebrates usually encountered in the Porites compressa biotope include the bivalve (Spondylus tenebrosus), sea urchins (Heterocentrotus mammillatus, Tripneustes gratilla and Echinometra mathaei) and corals, Porites lobata as well as Montipora verrucosa.

Two quantitative stations (Stations 1 and 2) sampled the biotope of Porites compressa. The location of these stations are given in Figure 2. Station 1 was established at a depth of 9m in an area dominated by thickets of the coral Porites compressa. Between these mounds of coral are areas of open sand and basalt rubble that range in size from 1 x 5m to more than 10 x 50m spaced from 1 to 10m apart. This station was carried out at the base of a slope dominated by Porites compressa. Table 1 presents the results of the quantitative survey conducted at Station 1. Six coral species were present (Porites lobata, P. compressa, Montipora verrucosa, M. flabellata, M. patula and Pavona varians) comprising a mean coverage of 40 percent; the most abundant species was Porites compressa with a mean estimated coverage of 24 percent. In the 25 x 4m invertebrate census three sea urchin species were present. The most common of these was the slate pencil urchin, Heterocentrotus mammillatus. Thirty-three species of fishes were noted over the 100m^2 sampled (Appendix A). The most common fishes included the uhus (Scarus sordidus and S. taeniurus), kole (Ctenochaetus strigosus), ma'i'i'i (Acanthurus nigrofuscus), lau'ipala (Zebrasoma flavescens) and na'ena'e (Acanthurus olivaceus). In total 213 fishes were censused having an estimated biomass of 203g/m^2 (see Table 2); 49 percent of the

Table 1. Summary of the benthic community analysis for Station 1 in the Biotope of Porites compressa in Anaehoomalu Bay, Hawaii. Results of the six - 1m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 9.3m; mean coral coverage is 40 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5	6
Corals						
Porites lobata	19	9	27	9	4	0.01
P. compressa	11	60	50.5	19	4	
Montipora verrucosa	1.25	6	7		1.5	
M. flabellata	6	11	6			
M. patula			5.5			
Sand	59.75		4	62	60.5	69.99
Rubble	3			10	30	30
Hard Substratum		14				

B. 50 - Point Analysis

	Percent of Total
Corals	
Porites lobata	12
P. compressa	26
P. varians	2
Montipora verrucosa	12
M. flabellata	6
Sand	16
Rubble	24
Hard Substratum	2

C. Invertebrate Census (25 x 4 m)

Species	Number
Phylum Echinodermata	
Echinometra mathaei	11
Heterocentrotus mammillatus	28
Tripneustes gratilla	15

D. Fish Census (25 x 4 m)

33 Species
213 Individuals
Diversity (H') = 2.73
Standing Crop (g/m^2) = 203

Table 2. Summary of biomass estimates for all families of fishes observed during each census in Anaehoomalu Bay, Hawaii. Calculations are based on visually estimated lengths of individuals. Numbers in the body of the table are estimated total biomass in grams.

FAMILY	Transect Number 1	2	3	4	5	6	7	8
ACANTHURIDAE	4,478	84,697	513	834	814		1,142	2,805
APOGONIDAE					2			
BALISTIDAE	914	193	386	386				432
CARANGIDAE	5,448							
CHAETODONTIDAE	386	101	85	324	145		17	371
CIRRHITIDAE				164				
DIODONTIDAE			1,209					
FISTULARIIDAE			49					
GOBIIDAE			1	1		1	1	
LABRIDAE	1,523	417	1,026	1,115	70		826	1,136
LUTJANIDAE					66			
MONACANTHIDAE	414		16	33	486		65	65
MULLIDAE	1,617	97	271	327	236		157	1,853
OSTRACIIDAE							14	
POMACENTRIDAE	21	137	63	56	2		139	188
SCARIDAE	5,461	7,224	1,816	1,639	26		575	5,884
SYNODONTIDAE				14	14			
TETRAODONTIDAE	4				337			658
ZANCLIDAE		110		55				
TOTAL	20,261	92,977	5,436	4,948	2,198	1	2,935	13,374

standing crop is comprised of herbivorous species (surgeonfishes and parrotfishes). Twenty-seven percent of the estimated biomass was comprised of a single kahala (Seriola dumerili) that wandered through the census area.

In the vicinity of Station 1 were seen the coral, Cyphastrea ocellina, sea cucumber (Holothuria atra), hihimanu (Aetobatus narinari), moano kea (Parupeneus cyclostomus), lau wiliwili nukunuku'oi'oi (Forcipiger longirostris), pili ko'a (Paracirrhites arcatus), hilu pili ko'a (Paracirrhites forsteri), 'a'awa (Bodianus bilunulatus) and eightline wrasse (Pseudocheilinus octotaenia).

Station 2 was established in an area of Porites compressa mounds that are from 2 to 8m in width and up to 10m in length. Between the mounds are depressions that are from 0.5 to 2m wide and from 1 to 10m long with sand and rubble present. This station was carried out close to Station 1 along the seaward sloping Porites compressa thickets that appear to form a series of spurs and grooves oriented into the prevailing seas. Table 3 presents the results of the quantitative survey carried out at Station 2. In the quadrat survey were found 7 coral species having an estimated mean coverage of 96 percent. As in the preceding station, the dominant coral species is Porites compressa having an estimated local coverage of 82 percent. The invertebrate census found one bivalve (Spondylus tenebrosus) and 3 sea urchin species. In the latter group, the slate pencil urchin (Heterocentrotus mammillatus) and the black sea urchin (Tripneustes gratilla) were the most abundant. In the $100m^2$ fish survey, 22 species (291 individuals) were encountered that comprised an estimated standing crop of $930g/^2$. Approximately 200 individuals umaumalei (Naso literatus) were censused that contributed close to 90 percent of the standing crop. Such a high standing crop and large number of umaumalei are unusual. These fishes may have been aggregated for the purpose of spawning. In the vicinity of Station 2 was seen the cornetfish (Fistularia petimba), pili ko'a (Paracirrhites arcatus), lau wiliwili nukunuku 'oi'oi (Forcipiger flavissimus) and the coralline alga, Porolithon gardineri.

The Biotope of Diverse High Coral Coverage

Inshore of the biotope of Porites compressa is the biotope of diverse high coral coverage. This biotope commences only a few meters offshore of Anaehoomalu beach but is best developed at distances of 50m or more from shore. As the name implies, this biotope is dominated by a number of corals; the most abundant species is Porites lobata. Other coral species commonly seen in this biotope include Porites evermanni, P. (Synaraea) convexa, Pavona varians, P. duerdeni, Montipora verrucosa, M. patula, M. flabellata, Porites compressa and Pocillopora meandrina. Fish

Table 3. Summary of the benthic community analysis for Station 2 in the Biotope of Porites compressa in Anaehoomalu Bay, Hawaii. Results of the six - 1m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 7.3m; mean coral coverage is 96 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5	6
Algae						
Porolithon gardineri			3	2	1	
Corals						
Porites lobata	41	2			1	12
P. compressa	47	91	96.25	98	95.7	64
Pavona varians					0.1	
Montipora verrucosa		2				14
M. flabellata		1				
M. patula	12					
Pocillopora meandrina			0.75		0.2	
Sand		4				
Hard Substratum					2	10

B. 50 - Point Analysis

	Percent of Total
Corals	
Porites lobata	8
P. compressa	76
Montipora verrucosa	4
M. patula	2
M. flabellata	2
Sand	6
Hard Substratum	2

C. Invertebrate Census (25 x 4 m)

Species	Number
Phylum Mollusca	
Spondylus tenebrosus	1
Phylum Echinodermata	
Echinometra mathaei	13
Heterocentrotus mammillatus	26
Tripneustes gratilla	21

D. Fish Census (25 x 4 m)
22 Species
291 Individuals
Diversity (H') = 1.39
Standing Crop (g/m^2) = 930

species commonly encountered in the biotope of diverse high coral coverage include the ma'i'i'i (Acanthurus nigrofuscus), hinalea lauwili (Thalassoma duperrey) and 'omaka (Stethojulis balteata). The biotope of diverse high coral coverage is comprised of live corals with intervening sand patches. These sand patches vary in size from 20m to less than a square meter in size spaced 1 to 15m apart. Between these sand patches the coral occurs in mounds; some open hard substratum is also apparent. Three stations (numbers 3, 4 and 8) sampled this biotope; the location of these stations are shown in Figure 2.

Station 3 was established approximately 125m offshore of the makaha for Kuu'ali'i Fishpond in the biotope of diverse high coral coverage. Water depth at this station varied from 1.5 to 2.3m; the substratum is dominated by mounds of live coral with Porites lobata being the most common species. The maximum diameter of coral colonies does not exceed 2m. Between the areas of coral are depressions of sand and rubble that range in size from 1 x 2m to 10 x 20m spaced from 3 to 15m apart. Table 4 presents a summary of the quantitative data collected at this station. Overall mean coral coverage was estimated at 36 percent and 9 coral species were recorded. In the 100m^2 examined for macroinvertebrates, the sea urchin Echinometra mathaei was the most abundant (94 individuals); only two other invertebrate species were encountered. In the census of fishes 22 species (55 individuals) were noted. The standing crop of fishes was estimated to be 54g/m^2. The most common species of fishes seen were the hinalea lauwili (Thalassoma duperrey), the ma'i'i'i (Acanthurus nigrofuscus) and the 'alo'ilo'i (Dascyllus albisella). In the vicinity of this station were seen the coral (Pocillopora molokensis), uhus (Scarus sordidus, S. psittacus and S. perspicillatus), kala (Naso unicornis), 'ulae (Saurida flamma), 'opule (Anampses cuvier), aki'lolo (Gomphosus varius), moa (Ostracion meleagris), lau wiliwili nukunuku 'oi'oi (Forcipiger flavissimus), kikakapu (Chaetodon ornatissimus), toby (Canthigaster jactator), humuhumu nukunuku apua'a (Rhinecanthus rectangulus) and to'au (Lutjanus fulvus).

Station 4 was established approximately 30m seaward of Station 3 in the biotope of diverse high coral coverage. At this station the substratum is dominated by live corals occurring in low mounds; the most common species is Porites lobata which attains a maximum colony diameter of about 2m. Between the coral mounds are small sand channels that range in size from 0.5 to 5m in width, 2 to 30m in length spaced from 1 to 10m apart. These channels have an approximate orientation that is perpendicular to shore. Water depth at this station is similar to the preceding one with depth over the coral mounds being about 1.2m and 3m in the deeper sand bottom areas. Table 5 presents a summary of the quantitative survey at Station 4. Ten species of corals were recorded at this station and the most abundant were Porites lobata and P. compressa. Mean coral coverage was estimated at 57

Table 4. Summary of the benthic community analysis for Station 3 in the Biotope of Diverse High Coral Coverage in Anaehoomalu Bay, Hawaii. Results of the six - 1m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 2.4m; mean coral coverage is 36 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5	6
Algae						
Porolithon gardineri						2
Corals						
Porites lobata			3	86.25	34.5	0.5
P. compressa	26	7		2	20	
P. evermanni		2.5	8		11	
P. (synaraea) convexa				0.75		0.75
Pavona duerdeni	3					
P. varians	2	1	1			
Montipora verrucosa	0.5					
Pocillopora meandrina			1	3	1.5	
Leptastrea purpurea						0.01
Sand	13	63.5	3		27	
Rubble	14	4	6			
Hard Substratum	41.5	22	78	8.	6	96.75

B. 50 - Point Analysis

	Percent of Total
Corals	
Porites lobata	26
P. compressa	8
P. evermanni	2
Pavona duerdeni	2
P. varians	2
Montipora verrucosa	6
Sand	10
Rubble	8
Hard Substratum	36

C. Invertebrate Census (25 x 4 m)

Species	Number
Phylum Echinodermata	
Echinometra mathaei	94
Heterocentrotus mammillatus	1
Tripneustes gratilla	4

D. Fish Census (25 x 4 m)
22 Species
55 Individuals
Diversity (H') = 2.65
Standing Crop (g/m^2) = 54

Table 5. Summary of the benthic community analysis for Station 4 in the Biotope of Diverse High Coral Coverage in Anaehoomalu Bay, Hawaii. Results of the six - 1m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 2.1m; mean coral coverage is 57 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 1	2	3	4	5	6
Algae						
Porolithon gardineri			4	1		
Mesophyllum mesomorphum				1		
Corals						
Porites lobata	75.25		7	0.5		40
P. compressa	13	17	3	91.5		28
P. evermanni						18
P. (synaraea) convexa						1
P. varians	2	13	14			4
Montipora verrucosa			1.5		7.5	
Pocillopora meandrina	1.25		0.75		1	
Leptastrea purpurea						0.01
Sand	3.5		6		12	
Rubble					71.49	
Hard Substratum	5	70	63.75	6	8	9

B. 50 - Point Analysis

	Percent of Total
Corals	
Porites lobata	24
P. compressa	20
Pocillopora damicornis	2
Pavona varians	6
Montipora flabellata	2
Sand	18
Hard Substratum	20

C. Invertebrate Census (25 x 4 m)

Species	Number
Phylum Mollusca	
Conus leopardus	1
Pinctada margaritifera	1
Phylum Echinodermata	
Echinometra mathaei	107
Tripneustes gratilla	22

D. Fish Census (25 x 4 m)
25 Species
77 Individuals
Diversity (H') = 2.76
Standing Crop (g/m^2) = 49

percent. The invertebrate survey found four species including the pearl oyster (Pinctada margaritifera) but the most common species were the sea urchins Echinometra mathaei and Tripneustes gratilla. In the fish census we recorded 25 species and 77 individuals with and estimated standing crop of 49g/m^2. The most common fish species were the ma'i'i'i (Acanthurus nigrofuscus), kole (Ctenochaetus strigosus) and hinalea lauwili (Thalassoma duperrey - see Appendix A). In the vicinity of Station 4 were seen the coral Montipora patula, nunu (Aulostomus chinensis), moa (Ostracion meleagris), manini (Acanthurus triostegus), 'o'opu hue (Arothron meleagris), lau hau (Chaetodon unimaculatus), kikakapu (C. multicinctus), lau wiliwili nukunuku 'oi'oi (Forcipiger flavissimus), palani (Acanthurus dussumieri) and pili ko'a (Cirrhitops fasciatus).

Station 8 also sampled the biotope of diverse high coral coverage. This station was located approximately 120m from shore directly affronting the Anaehoomalu Bay public beach access. The substratum at this station is an old pahoehoe flow with coral colonies scattered across it. On the pahoehoe are small depressions filled with sand and rubble. These pockets of sand and the open substratum between areas of coral are from 0.5 to 2.5m wide and 1.5 to 5m in length. These open areas are spaced from 0.5 to 6m apart. Water depth over the live coral is about 0.75m; in the deeper open substrate areas it is about 2m. The dominant coral in this area is Porites lobata which attains a maximum diameter of not more than 2m. Table 6 presents a summary of the survey conducted at Station 8. Six coral species were encountered in the quadrat survey and mean cover was estimated at 14 percent. Common coral species included Porites lobata and Montipora verrucosa. In the invertebrate census four sea urchin species were seen; the most abundant was the urchin, Echinometra mathaei. In the fish census 25 species (132 individuals) were encountered. Common fishes included the ma'i'i'i (Acanthurus nigrofuscus), kole (Ctenochaetus strigosus), hinalea lauwili (Thalassoma duperrey) and the uhus (Scarus sordidus and S. perspicillatus). In the vicinity of Station 8 was seen the coral Porites compressa, uhu (Scarus psittacus), kihikihi (Zanclus cornutus), lau'ipala (Zebrasoma flavescens) and paku'iku'i (Acanthurus achilles).

Biotope of Sand

As noted above, the biotope of sand occurs as a wedge that divides the biotope of diverse high coral coverage into two (Figure 2). The biotope of sand commences on the shore where it has its greatest width; it extends about 150m seaward roughly in the shape of a triangle. In total this biotope encompasses about 1.5ha of inner Anaehoomalu Bay. As the name implies, the substrate of the biotope of sand is primarily sand. Scattered across the biotope are small areas of coral; these are most

Table 6. Summary of the benthic community analysis for Station 8 in the Biotope of Diverse High Coral Coverage in Anaehoomalu Bay, Hawaii. Results of the six - 1m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 1.5m; mean coral coverage is 14 percent (quadrat method).

A. Quadrat Survey

	Quadrat Number					
Species	1	2	3	4	5	6
Corals						
Porites lobata	11	7	3.5	1.5	3	2
P. evermanni			7			
Montipora verrucosa	6	4.5	2	5	6	
M. patula	1.5			4.5		
M. flabellata		8				
Pocillopora meandrina	6	0.75	3.5		0.25	1.75
Sand	. 4			2		6
Rubble				4	4	90.25
Hard Substratum	71.5	79.75	84	83	86.75	

B. 50 - Point Analysis

	Percent of Total
Corals	
Porites lobata	20
Montipora verrucosa	10
M. patula	4
M. flabellata	4
Sand	6
Rubble	2
Hard Substratum	54

C. Invertebrate Census (25 x 4 m)

Species	Number
Phylum Echinodermata	
Echinometra mathaei	109
Heterocentrotus mammillatus	7
Tripneustes gratilla	14
Echinothrix calamaris	1

D. Fish Census (25 x 4 m)

25 Species
132 Individuals
Diversity (H') = 2.60
Standing Crop (g/m^2) = 134

abundant adjacent to the biotope of diverse high coral coverage and become less obvious towards the middle of the biotope. Live coral probably accounts for less than 3 percent of the substratum present. There are also small areas of rubble and dead coral again comprising only a small part of the substratum in the biotope.

One encounters few fishes or exposed invertebrates away from the coral on the sand. Species seen include the 'ulae (Saurida flamma) and weke (Mulloides flavolineatus); invertebrates occasionally seen include the terebra (Terebra crenulata) and numerous holes dug by a variety of cryptic species including callianassid and alpheid shrimps, holothruians and annelid worms. Near the emergent hard substratum whether it be live or dead coral, more fish species are apparent including the ubiquitous hinalea lauwili (Thalassoma duperrey), 'akilolo (Gomphosus varius), ma'i'i'i (Acanthurus nigrofuscus), uhu (Scarus sordidus), 'upapalu (Foa brachygramma) and 'o'opu (Asterropteryx semipunctatus). The most common species of coral in this biotope is Porites lobata; other coral species seen include Montipora verrucosa and Pocillopora meandrina.

Three stations sampled this biotope (Stations 5, 6 and 7). Station 5 and 7 were established in the ecotone or zone of transition between the biotopes of diverse high coral coverage and sand. Station 6 sampled the biotope of sand. Following the qualitative overview of the biotope and evirons, only one station was established in the biotope of sand because of the relative low diversity of species present. It was noted however that benthic and fish community development is much greater in the transition zones between the biotopes than in the biotope of sand; thus two stations were erected to sample these areas. The location of all stations are shown in Figure 2.

Station 5 sampled the transition between sand and coral and was established about 60m south of Station 4. In this transition area corals that dominate the substratum in the biotope of diverse high coral coverage become more dispersed and sand occupies a greater percentage of the bottom. The transect line at Station 5 sampled both coral and sand. The substratum at this station is sand with small patches of live coral. These patches range in size from 1 x 1m to 5 x 10m and are spaced from 3 to 30m apart. Water depth at this station was about 3.7m. Below about 3m was a noticeble nephloid layer that appeared to be comprised of suspended carbonate materials. There was no obvious movement of water near the substratum but wind induced mixing and salinity stratification may be responsible for the formation of the layer. On the surface of the sand were patches of unidentified yellow-brown diatoms. These patches ranged up to 2m in diameter and were spaced from 5 to 25m apart.

Table 7 presents the results of the survey carried out at

Table 7. Summary of the benthic community analysis for Station 5 in the transition zone between the Biotopes of Diverse High Coral Coverage and Sand in Anaehoomalu Bay, Hawaii. Results of the six - 1m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 3.7m; mean coral coverage is 18 percent (quadrat method).

A. Quadrat Survey

	Quadrat Number					
Species	1	2	3	4	5	6
Corals						
Porites lobata	11			1		
P. compressa		88.25				
Montipora verrucosa	3.5	1.75				
Sand	79.5	7	100	99	100	100
Hard Substratum	6	3				

B. 50 - Point Analysis

	Percent of Total
Corals	
Porites lobata	14
P. compressa	6
Montipora flabellata	4
M. verrucosa	2
Pocillopora meandrina	2
Sand	64
Hard Substratum	8

C. Invertebrate Census (25 x 4 m)

Species	Number
Phylum Echinodermata	
Echinometra mathaei	17
Heterocentrotus mammillatus	1

D. Fish Census (25 x 4 m)

18 Species
42 Individuals
Diversity (H') = 2.72
Standing Crop (g/m^2) = 22

Station 5. Mean coral coverage was estimated to be 18 percent and Porites lobata was the dominant coral species. Other corals include Porites compressa, Montipora verrucosa, M. flabellata and Pocillopora meandrina. Exposed invertebrates were found only on hard substratum at this station and included the sea urchins Heterocentrotus mammillatus and Echinometra mathaei. In the sand were seen callasinid and alpheid burrows (species unidentified) that had a mean density of 34 burrows/m^2. Eighteen fish species (Appendix A) were censused; the most common species were the 'akilolo (Gomphosus varius), hinalea lauwili (Thalassoma duperrey) and uhu (Scarus sordidus). The biomass of fishes was estimated to be 22g/m^2. Invertebrate species seen in the vicinity of this station include the soft coral (Anthelia edmondsoni -- an indicator of occasional lower salinity conditions), wana (Echinothrix diadema) and terebra (Terebra crenulata). Fishes seen in the neighborhood of Station 5 include the mamo (Abudefduf abdominalis), manini (Acanthurus triostegus), kupipi (Abudefduf sordidus), damselfishes (Plectroglyphidodon johnstonianus and Stegastes fasciolatus), lau wiliwili (Chaetodon miliaris), toby (Canthigaster jactator), humuhumu lei (Sufflamen bursa), 'alo'ilo'i (Dascyllus albisella) and moano kea (Parupeneus cyclostomus). One small patch of the alga, Microdictyon japonicum was also seen.

Station 6 was established about 60m from shore in 3m of water; this station was close to the present mooring for the "Me'au". The substratum at this station was sand but in the vicinity of the station were seen a few dead Porites lobata colonies (to 1m in diameter) that were spaced from 10 to 35m apart. Table 8 presents the results of the survey at this station; one coral colony (Pocillopora meandrina) was encountered but coverage did not exceed 0.04 percent. In the invertebrate census two sea urchin species (Echinometra mathaei and Echinothrix diadema) and only one fish species (the o'opu - Asterropteryx semipunctatus) were seen. The estimated standing crop of fish was 0.01g/m^2. Cryptic invertebrates in the sand included unidentified callianassid and alpheid shrimp burrows which occurred in an average density of 43 burrows/m^2. In the vicinity of Station 6 were seen the terebra (Terebra crenulata), the box crab (Calappa calappa), 'upapalu (Foa brachygramma), weke pueo (Upeneus arge) and coral (Montipora verrucosa).

Station 7 was placed in the transition area between the biotopes of diverse high coral coverage and sand along the southern border of the biotope of sand (Figure 2). This station was located about 75m from shore in about 1.5m of water. Being in the transition area, the substratum is comprised of both live coral and sand. The dominant coral species is Porites lobata that attains a maximum diameter of 2m. Sand and rubble patches are dispersed between the areas of coral; these sand/rubble areas range in size from 0.5 to 4m in width and 1 to 10m in length spaced from 2 to 8m apart. With the rubble are areas of basalt

Table 8. Summary of the benthic community analysis for Station 6 in the Biotope of Sand in Anaehoomalu Bay, Hawaii. Results of the six - 1m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 3m; mean coral coverage is 0.04 percent (quadrat method).

A. Quadrat Survey

	Quadrat Number					
Species	1	2	3	4	5	6
Corals						
Pocillopora meandrina		0.25				
Sand	100	87.75	100	100	100	100
Hard Substratum		12				

B. 50 - Point Analysis

	Percent of Total
Sand	100

C. Invertebrate Census (25 x 4 m)

Species	Number
Phylum Echinodermata	
Echinometra mathaei	8
Echinothrix diadema	2

D. Fish Census (25 x 4 m)

1 Species
1 Individual
Diversity (H') = 0
Standing Crop (g/m^2) = 0.01

cobble and rocks that range up to 60cm in diameter. Table 9 presents the results of the benthic survey carried out at Station 7. Six coral species were recorded in the survey comprising a mean coverage of 37 percent. The most common coral species were Porites lobata and P. compressa. The invertebrate census found two urchin species, Tripneustes gratilla and Echinometra mathaei. In the fish survey 18 species (70 individuals) were censused that comprised a mean standing crop of 29g/m^2. The most abundant species were the ma'i'i'i (Acanthurus nigrofuscus) and hinalea lauwili (Thalassoma duperrey). In the vicinity of this station were seen the corals Pavona varians and Porites (Synaraea) convexa as well as the toby (Canthigaster jactator) and weke (Mulloides flavolineatus).

Most of the proposed moorings are to be placed in the biotope of sand where biological diversity is lowest. The approximate locations of existing and proposed moorings in Anaehoomalu Bay are shown in Figure 3. To assess substratum conditions at each of these sites for the purpose of mooring design determination, sand probing was carried out at each location using the methods described above. The results of the sand probing (i.e., apparent sand depths) at each of these stations is given in Table 10. In total 10 sites were examined, each at 5 locations over a 20m long "transect". All sites had a veneer of sand with the minimum apparent depth of 5cm at the existing "glass bottom boat" mooring; maximum apparent sand depth was 110cm at proposed mooring site P6. Over the entire area mean apparent sand depth was 46cm. We are using the term "apparent sand depth" rather than "actual sand depth" because once into the sand, the air-injection probe cannot distinguish between a solid substratum (basalt or limestone) and an "apparent" solid substratum of coral rubble. Where feasible, we attempted to define the substratum type under the sand veneer but in the case where "hard" material was encountered and discerned (e.g., recon-solidated rubble) we were unable to determine its thickness.

Also shown in Figure 3 are two areas proposed to have a number of additional moorings; the first is in the northern part of the biotope of sand offshore of the "Beach Shack" where 5 to 10 shallow draft moorings are proposed and the second is offshore of the existing "Me'au" mooring that will have 3 to 4 big boat moorings. Because exact locations could not be assigned to any of these potential 14 mooring sites, we did not attempt sand probing for any of these; visual inspection of these areas suggests that apparent sand depths and bottom conditions as given in Table 10 are representative for the entire area.

Because some coral exists in the area where the 5 to 10 shallow draft moorings are proposed, we carried out a series of six 30m point intersect transects (once every 50cm) to assess live coral coverage in this area. In this analysis we found

Table 9. Summary of the benthic community analysis for Station 7 in the transition zone between the Biotopes of Diverse High Coral Coverage and Sand in Anaehoomalu Bay, Hawaii. Results of the six - 1m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 1.5m; mean coral coverage is 36 percent (quadrat method).

A. Quadrat Survey

	Quadrat Number					
Species	1	2	3	4	5	6
Algae						
Porolithon gardineri		1		1.5		
Corals						
Porites lobata		12	42	19	80.75	3
P. compressa				38		
P. evermanni						6
Montipora verrucosa			1			7
Pocillopora meandrina	1		1.5	1.5	1.25	
Sand	6				9	
Rubble						64
Hard Substratum	93	87	55.5	40	9	20

B. 50 - Point Analysis

	Percent of Total
Corals	
Porites lobata	22
P. compressa	2
P. evermanni	4
Sand	26
Rubble	4
Hard Substratum	42

C. Invertebrate Census (25 x 4 m)

Species	Number
Phylum Echinodermata	
Echinometra mathaei	103
Tripneustes gratilla	2

D. Fish Census (25 x 4 m)
18 Species
70 Individuals
Diversity (H') = 2.26
Standing Crop (g/m^2) = 29

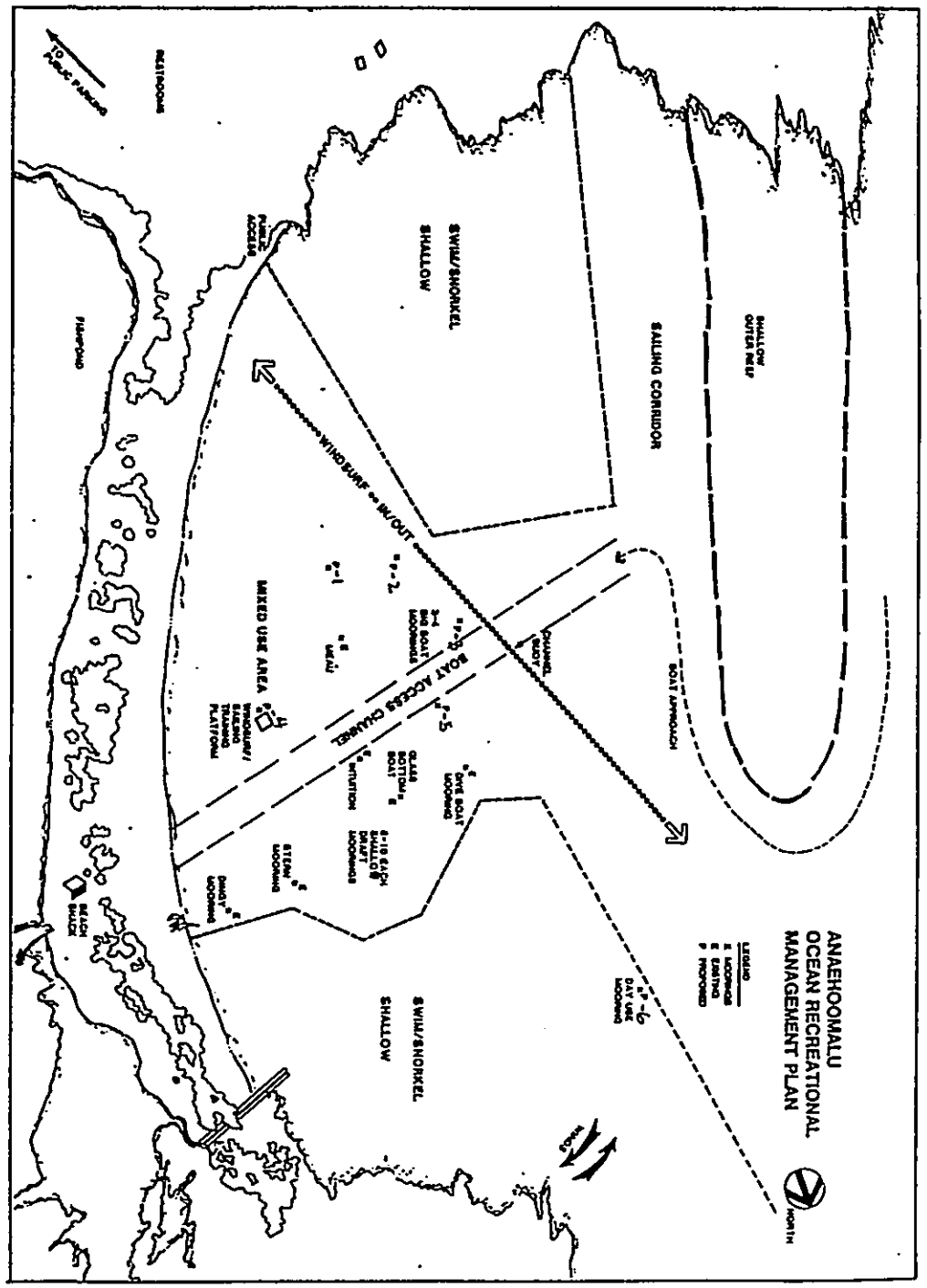


Figure 3. Map of Anaehoomalu Bay showing the location of existing and proposed moorings. Existing moorings are labeled according to names of boats that currently use them: proposed moorings are numbered P1 through P6. Also shown are two areas of clustered proposed moorings: 5-10 shallow draft moorings and 3-4 large boat moorings.

Table 10. Sand depths (cm) at various mooring locations inside Anaehoomalu Bay. Depths were measured with an air-injection probe. Existing stations are labelled according to names of the boats that currently use the moorings. Proposed stations are labelled P1-P8 and their locations are shown on the map. All transects were oriented perpendicular to the shoreline with origins at the inshore extent of the line. For existing stations, the center of the transect lies over the existing mooring anchor. Transect lines for proposed moorings were laid on the bottom according to their apparent location in Figure 3.

STATION	Water Depth (m)	Predominant Substrate Type	Apparent Sand Depth (cm) Distance from transect origin (m) 0	5	10	15	20	Mean
Existing								
"Glass Bottom Boat"	2.6	thin sand veneer over reconsolidated rubble	8	8	20	5	8	10
"Intuition"	2.6	shallow sand over reconsolidated rubble	15	47	25	15	15	23
"Me'au"	2.6	deeper sand over unknown hard bottom	72	73	78	20	65	62
"Dive-boat Mooring"	3.7	shallow sand over reconsolidated rubble, occasional large Porites lobata boulders	30	40	35	40	35	36
Proposed								
P1	2.6	deeper sand	85	85	60	65	60	71
P2	3.0	deeper sand	50	60	45	50	55	52
P3	3.4	deeper sand	45	45	55	75	75	59
P4	3.0	moderately deep sand w/ occasional small rocks	80	100	10	5	20	43
P5	3.7	deeper sand	75	55	70	60	45	61
P6	3.4 - 4.8	deep sand adjacent to large live coral reef	110	60	45	10	live coral	45

six species of coral present. These species and their estimated coverage were: Porites lobata - 15%, P. compressa - 13%, P. evermanni - 0.3%, Montipora verrucosa - 2%, M. patula - 0.3%, and Pocillopora meandrina - 0.3%. In summary corals comprised an estimated 31 percent of the benthic coverage and non-living geological components made up the remainder (i.e., sand - 61%, rubble - 4% and hard substratum - 4%).

During the field work all sightings of green sea turtles (Chelonia mydas) were noted. The results of these sightings are presented in Table 11. Along with the counts in this table are given estimates of straight line carapace lengths; all individuals sighted were juveniles (sexually mature adults are from 75-80cm) suggesting that use of inner Anmaehoomalu Bay is only by juveniles and thus may have only commenced recently with the expansion of populations under Federal and State protection. Green sea turtles were seen in both the north and south sectors of the biotope of diverse high coral coverage near Stations 3, 4 and 8 on 14 and 15 July. While carrying out other field studies (i.e., a related marine baseline survey), a green turtle resting habitat was identified about 800m southwest of the project site along a series of ledges approximately 300m offshore of Kapalaoa. To assess use of the project site by green sea turtles, a one hour period was spent in observation from a vessel anchored approximately 350m offshore of Anaehoomalu Beach (about 50m seaward of the project area) on the morning of 18 July 1988. Five small green sea turtles were observed during this time; underwater observations suggest that these individuals were both foraging and resting on the Porites compressa substratum. However no potential forage (appropriate limu species) could be identified either in or outside of the project site. Additionally, obervations were made along the shoreline in an attempt to identify potential intertidal algal forage but none was found.

DISCUSSION

The results of this survey suggest that the area proposed for most of the additional boat moorings has the least biological diversity of any in the study area. Some of the major biological attributes quantitatively examined in this study are presented as a summary by biotope in Table 12. Important biological characteristics such as mean number of coral species, coverage, fish species and standing crop substantiate the lower biological diversity in the biotope of sand. However surrounding this area of lower biological diversity are well developed benthic and fish communities; interestingly, these diverse high coral coverage communities occur in very shallow water (less than 1m in depth) and in the northern inner reaches of Anaehoomalu Bay, are found adjacent to the makaha serving Ku'uali'i and Kahapapa Fishponds and are thus exposed to occasional low-salinity water. Visibil-

Table 11. Summary of green sea turtles (Chelonia mydas) sighted in Anaehoomalu Bay, Hawaii from 14 through 18 July 1988.

Date	Number	Estimated Size (cm)	Location	Comments
14 July	3	40-60	Shallow snorkel area (N end of bay)	Sighted while conducting in-water transect work
15 July	2	50	Shallow snorkel area (S end of bay)	Sighted while conducting in-water transect work
18 July	5	40-50	Middle Anaehoomalu Bay	Counted from boat at surface during a 1-hour observation/census period

Table 12. Summary of some quantitative biological parameters measured in the three biotopes identified in this study.

	Means			
Biotope	Coral Coverage	Coral Species	Fish Species	Fish Biomass
P. compressa	68	7	28	567
Diverse High Coral Cover	36	8	24	79
Sand	18	4	12	17

ity in the inner portions of the bay is often 4m or less and near the bottom it may be less than 1.5m; this low clarity is probably due to wind mixing of fine carbonate materials as well as the input of materials from Ku'uali'i and Kahapapa Fishponds. Physical conditions such as low salinity and high turbidity usually impede the growth and success of corals but in the study area these factors do not appear to be having much of a negative effect where live corals are found.

Two questions to be addressed by this study are (1) Are the present moorings and their use in Anaehoomalu Bay having an impact on surrounding marine communities? and (2) Will the deployment of additional moorings impact neighboring marine communities and if so, identify and quantify these impacts.

To answer the first question, we examined the present moorings in inner Anaehoomalu Bay which utilize a variety of materials but show a commonality in design. The typical design is comprised of an anchor attached to a length of chain which is coupled to a short length of rope that is tied to a small unobtrusive float. Anchors vary from concrete blocks to galvanized steel ship anchors; chains in use vary in size as do the ropes and floats. In some cases, anchors and chains appeared to be partially buried in the sand and showed little or no evidence of movement. Visual reconnaissance of these materials showed little biological community development on them; this may be related to the area of placement (on shifting sand substratum which is not favorable for most fish or coral reef benthos) as well as to the low profiles which must be occasionally scoured by moving sand. In short, the present moorings appeared to have no negative impacts to surrounding marine communities. Likewise, use of these moorings by vessel traffic does not appear to be impacting marine communities; one measure of negative impact through use is the deposition of trash on the bottom from the moored vessels -- no litter was found in the vicinity of the present moorings which suggests a thoughful use of the facilities and the imposition of an appropriately sensitive management style.

The present moorings are located in an area with poor benthic and fish community development (i.e., the biotope of sand), thus if impacts were to occur, they would be probably be locally negligible. Other potential sources of impacts with the present moorings include the disposal of human wastes from the vessels. There is no generation or dumping of sewage from the vessels presently using the moorings because they are small (lack restrooms), are for day-use only (i.e., single dives, or short trips) and are located adjacent to shoreside restroom facilities. With the proposed increase in moorings there should be no change with respect to sewage (i.e., no generation or release of sewage), again for the reasons stated above.

If the proposed deployment of additional moorings in

Anaehoomalu Bay is to occur, some consideration should be given to the selection of the most appropriate design that would have the least impact to benthic communities. A relatively new concept in mooring design utilizes eyebolts that are attached to the substratum which serves as the "anchor" rather than the use of a mooring with a conventional anchor. The eyebolt system was developed for use on coral reefs in sanctuaries such as the Key Largo National Sanctuary as a mean of reducing anchor damage to corals. This anchoring method is based on the "Halis system" where a hole is drilled into the substratum and an eyebolt inserted and held with epoxy; the eyebolt serves as the anchor for the mooring. Normally a line and float are attached to the eyebolt and users tie their vessels to the float thereby eliminating anchor damage to corals as occurs with conventional mooring techniques. The Key Largo moorings have been in place for 2 to 4 years with no serious problems.

The Halis system has been modified by University of Hawaii engineers and is presently in use in the islands. A number of "Hawaiian Eyebolts" were deployed about 4 months ago around Molokini Island (a State sanctioned conservation area). The Hawaiian Eyebolts have been quite successful in reducing anchor damage because dive tour operators (the principal users of the area) have been regularly using them. Prerequisites for either the Hawaiian Eyebolt or Halis systems are the presence of a hard substratum (limestone or basalt) into which a 7/8 inch diameter x 18 inch deep hole is drilled. The hole receives some epoxy glue and a 3/4 inch diameter monel stainless steel eyebolt is then inserted. A tautline mooring and float complete the unit.

The presence of solid substratum is necessary for the successful use of the Hawaiian Eyebolt system. Our sand probing studies in Anaehoomalu Bay indicate that appropriate exposed hard substratum is not present around the either the existing or proposed mooring sites; this suggests that the eyebolt mooring method may not be the most appropriate for this site. This is unfortunate because the eyebolt system probably poses the least potential for damage to environmentally sensitive benthic communities of any mooring design; however the development of moorings of an alternative design on sand/rubble substratum as is found in inner Anaehoomalu Bay, will have little or no impact to surrounding communities.

Unless appropriate solid substratum is encountered during any site preparation, the information above (i.e., presence of sand) suggests that a conventional mooring design should be used. Concrete with its high mass to volume ratio could be poured into a highly stable trapezoidal configuration to serve as the anchor; such a design would roughly mimic the shape of the locally dominant coral species, Porites lobata. The minimum size of these anchors would be related to the anticipated vessel size and impinging wave height. Concrete has the additional advantage

over many other materials in that it serves as an appropriate substratum for the settlement of many invertebrate (including corals) and algal species (Brock et al. 1965, Bailey-Brock 1987, Fitzhardinge and Bailey-Brock 1987). Thus the placement of concrete anchors would provide sites for the possible establishment of corals and other sessile reef components where none exist today. Benthic community development on concrete anchors will foster the colonization of coral reef fishes. In summary impacts associated with the development of concrete block anchors would serve to enhance benthic community development in those areas presently occupied by sand.

Some of the proposed moorings will be situated in the transition zone between the biotope of diverse high coral coverage and the biotope of sand. In the transition zone benthic community development is greater than in the biotope of sand, thus the opportunity for negative impact is greater. The proposed 5 to 10 small boat moorings (Figure 3) are proposed for the transition zone. Water depth between coral mounds is 3 to 3.5m on a sand substratum; on the tops of the shallowest coral knolls water depth ranges from 1 to 1.2m. The shallow water conditions suggest that some coral removal may be required. A worst case scenario would be the total removal of all coral in the area. What impacts would this have? Our point intersect data from the six 30m transects carried out in this area estimate live coral coverage at 31 percent (note however that coral coverage data from nearby Station 5 show a mean of only 18 percent). The remainder of the substratum is comprised of sand (61%), rubble (4%) and hard substratum (4%). The total area in question is about 1970m^2; thus about 610m^2 would be directly impacted. This 610m^2 loss of coral would amount to 0.7 percent of the coral in the biotope of diverse high coral coverage in Anaehoomalu Bay. Coral species with greatest vertical growth in the transition zone are Porites lobata and P. evermanni. The estimated coverage of Porites lobata is 15 percent and 0.3 percent for P. evermanni. If all Porites lobata and P. evermanni were to be removed, about 301m^2 of substratum would be directly impacted. If coral removal is to occur, it would be a selective removal of certain large heads rather than a complete removal program, thus the direct impact would be considerably less than that as stated above.

Secondary impacts to the surrounding benthic communities with selective coral removal in the transition area include the possible impacts due to temporary increases in turbidity. These impacts would be construction related and would decline rapidly following cessation of coral removal. It is interesting to note that in natural and relatively unpolluted areas, dredging has no significant effect on water quality (Windom 1972). Potentially under extreme conditions with high suspended sediment loads, light levels could decrease or simple burial of benthic communities could occur. Many benthic species including corals are capable of removing sediment settling on them, but there are thresh-

following cessation of coral removal. It is interesting to note that in natural and relatively unpolluted areas, dredging has no significant effect on water quality (Windom 1972). Potentially under extreme conditions with high suspended sediment loads, light levels could decrease or simple burial of benthic communities could occur. Many benthic species including corals are capable of removing sediment settling on them, but there are threshold levels of deposition where cleaning mechanisms may be overwhelmed and the individual becomes buried. However, the impact of sedimentation on Hawaiian reefs may be overstated. Dollar and Grigg (1981) studied the fate of benthic communities at French Frigate Shoals following the accidental spill of 2000 tons of kaolin clay. These authors found after two weeks there was no damage to the reef corals and associated communities except where the organisms were actually buried by the clay deposits for a period of more than two weeks. The small scale of the proposed development will probably not create a suspended sediment load much greater than presently exists on a windy afternoon in inner Anaehoomalu Bay.

The presence of green sea turtles in the Anaehoomalu Bay area suggests that the present levels and patterns of use by man are not deleterious to or negatively affecting the resident turtle population. The tentative identification of resting areas more than 800m to the south of the project area and the absence of appropriate forage (i.e., limu) in the study area argue that with the proposed increase in the number of moorings, little or no impact should occur. The possibility of increased boat traffic in and out of Anaehoomalu Bay affecting the resident turtle population is small. Other areas where green sea turtles are known to rest in large numbers such as just seaward of the Hawaii Kai Entrance channel on Oahu, up to 40 turtles may be seen (Mr. J. Naughton, NMFS, pers. comm.). Numerous vessels pass by this resting area daily yet no known impact to these turtles has occurred albiet the heavy boat traffic and inshore use by jet skis has been ongoing for a number of years.

Long-term impacts could derive from changes in water quality associated with the operation of an increased number of moorings. Water quality changes may come about through the introduction of a number of pollutants including fuels from boats, sewage from improperly operated shoreside and boat heads, and trash. Marine sanitation devices may discharge disinfectants or other chemical additives of greater potential harm to marine biota than untreated waste, the latter posing potentially a health problem. Trash of various kinds can smother or mechanically damage corals or other sessile biota. As noted above, the day-use of the vessels and their small size precludes sewage problems; if management of the facilities continues as it has in the past, there should never be a problem with litter. Conclusive evidence of specific damage to submerged corals caused by floating oils is lacking (Grant 1970, Rutzler and Sterrer 1970, Johannes 1975).

natural environment represents in terms of attracting a diverse clientele.

In conclusion, the expansion of mooring facilities in Anaehoomalu Bay should increase the range and number of recreational opportunities available to bay users. The focusing of this expansion in that part of the bay with the least biological diversity considerably alleviates the potential for negative impact to the marine biota. If this expansion requires the removal of some coral, the employment of selective removal methods would further lessen any impacts.

LITERATURE CITED

Bailey-Brock, J.H. 1987. Recruitment and community development on an artificial reef in Hawaiian waters. Abstract. Fourth International Conference on Artificial Habitats for Fisheries. Miami, Florida. November 1987.

Brock, R.E. 1982. A critique of the visual census method for assessing coral reef fish populations. Bull. Mar. Sci. 32:269-276.

Brock, R.E. and J.H. Brock. 1977. A method of quantitatively assessing the infaunal community residing in coral rock. Limnol. Oceanogr. 22:948-951.

Brock, R.E., R.M. Buckley and R.A. Grace. 1985. An artificial reef enhancement program for nearshore Hawaiian waters. pp.317-336. In: D'Itri, F.M. (ed.). Artificial reefs marine and freshwater applications. Lewis Publishers, Inc., Chelsea, Mich.

Brock, V.E. 1954. A preliminary report on a method of estimating reef fish populations. Jour. Wildl. Mgmt. 18:297-308.

Dollar, S.J. and R.W. Grigg. 1981. Impact of a kaolin clay spill on a coral reef in Hawaii. Mar. Biol. 65:269-276.

Fitzhardinge, R.C. and J.H. Bailey-Brock. 1987. The colonization by corals and other sessile organisms on materials used in artificial reef construction. Abstract. Fourth International Conference on Artificial Habitats for Fisheries. Miami, Florida. November 1987.

Grant, E.M. 1970. Notes on an experiment upon the effect of crude oil on live corals. Fish. Notes (NS), Dept. Primary Ind., Brisbane 1:1-13.

Johannes, R.E. 1975. Pollution and degradation of coral reef communities. Chapter 2. In: Ferguson-Wood, E.J. and R. E. Johannes (eds.). Tropical marine pollution. Elsevier Oceanography Series, 12. Elsevier Scientific Publishing Co., New York.

Pielou, E.C. 1966. the measurement of diversity in different types of biological collection. Jour. Theoret. Biol. 13: 131-144.

Rutzler, K. and W. Sterrer. 1970. Oil pollution damage observed on tropical communities along the Atlantic seaboard of Panama. Bioscience 20:222-224.

Shinn, E.A. 1972. Coral reef recovery in Florida and in the Persian Gulf. Environmental Conservation Dept., Shell Oil Co., Houston, Texas. 9p.

Spooner, M. 1970. Oil spill in Tarut Bay, Saudi Arabia. Mar. Pollution Bull. 1:166-167.

Windom, H.L. 1972. Environmental aspects of dredging in estuaries. J. Waterways, Harbors and Coastal Engin. Div., Proc. Amer. Soc. Civil Eng., WW4:475-487.

APPENDIX A. Results of the quantitative visual censuses conducted at 8 stations (transect size 25m x 4m) in Anaehoomalu Bay, Hawaii. Entries in the body of the table represent the total number of individuals of each species observed during each census. Census totals are presented at the end of the table, along with estimates of standing crop (g/m^2) and diversity (H') of fishes in each.

FAMILY and Species	Station Number 1	2	3	4	5	6	7	8
ACANTHURIDAE								
Acanthurus nigrofuscus	20	3	8	13	3		24	32
Acanthurus dussumieri	1				2		1	
Acanthurus olivaceus	11							
Acanthurus achilles	1	6						
Ctenochaetus strigosus	33	12	3	8	3		1	17
Ctenochaetus hawaiiensis					3			
Zebrasoma flavescens	12	10						
Zebrasoma veliferum		1		1				
Naso unicornis	2							
Naso lituratus	5	200	1	1	2		1	4
APOGONIDAE								
Foa brachygramma					4			
BALISTIDAE								
Melichthys niger	1	1	2	1				1
Melichthys vidua	2							
Sufflamen bursa	2							
Rhinecanthus rectangulus				1				2
CARANGIDAE								
Seriola dumerili	1							
CHAETODONTIDAE								
Chaetodon miliaris	2	1	1					1
Chaetodon auriga	2		1	3				
Chaetodon lunula				1				
Chaetodon ornatissimus	2	1		1	1			3
Chaetodon trifasciatus			1					1
Chaetodon multicinctus	4	4						4
Chaetodon quadrimaculatus								
Chaetodon unimaculatus	2		1		1	2	1	
CIRRHITIDAE								
Cirrhitus pinnulatus				1				
DIODONTIDAE								
Diodon histryx			1					
	37							

FAMILY and Species	Transect Number 1	2	3	4	5	6	7	8
FISTULARIIDAE								
Fistularia commersoni			1					
GOBIIDAE								
Gnatholepis anjerrensis			3	3				
Asterropteryx semipunctatus						3	3	
LABRIDAE								
Labroides phthirophagus								1
Cheilinus rhodochrous	2	1						
Thalassoma duperrey	20	9	12	11	4		14	17
Thalassoma purpureum							1	2
Thalassoma ballieui				1				1
Gomphosus varius	5	1	1	5	6		3	2
Stethojulis balteata	1		5	5			2	6
Anampses cuvier	2							
LUTJANIDAE								
Lutjanus fulvus					1			
MONACANTHIDAE								
Pervagor spilosoma	4		1	2	2		4	4
Cantherhines sandwicensis	1				1			
MULLIDAE								
Parupeneus multifasciatus	2	1	1	1	1		1	1
Parupeneus porphyreus			1					
Mulloides vanicolensis	4			1				
Mulloides flavolineatus								5
OSTRACIIDAE								
Ostracion meleagris							1	
POMACENTRIDAE								
Dascyllus albisella			6				3	
Chromis ovalis					2			
Chromis hanui		1						
Abudefduf abdominalis		5	1	5				1
Abudefduf sordidus							1	1
Stegastes fasciatus	1	3	2	2			3	5
Plectroglyphidodon imparipennis				1				
Plectroglyphidodon johnstonianus	2	2	1					
		38						

FAMILY and Species	Transect Number 1	2	3	4	5	6	7	8
SCARIDAE								
Calotomus sp		1	1					
Scarus rubroviolaceus	2	1		1				
Scarus perspicillatus	4						2	9
Scarus taeniurus	10							
Scarus sordidus	48	25		5	4		3	10
SYNODONTIDAE								
Saurida gracilis				1	1			
TETRAODONTIDAE								
Arothron meleagris					1			1
Canthigaster jactator	1							
ZANCLIDAE								
Zanclus cornutus		2		1				
Total Number of Families	10	8	11	12	8	1	9	9
Total Number of Species	33	22	22	25	18	1	18	25
Total No. of Individuals	213	291	55	77	42	3	70	132
Total Biomass (g)	20261	92977	5435	4948	2197	1	2935	13374
Standing Crop (g/m^2)	203	930	54	49	22	.01	29	134
Diversity (H)	2.73	1.39	2.65	2.76	2.72	0	2.26	2.60

APPENDIX C

DEPARTMENT OF THE ARMY
U. S ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

Operations Branch

February 28, 1989

LETTER OF PERMISSION
NO. 2051

Transcontinental Development Co.
P.O. Box 3028
Waikoloa, Hawaii 96743-3028

Dear Sir:

Your written request dated July 6, 1988, for a permit to perform work in navigable waters of the United States, State of Hawaii, pursuant to Section 10 of the River and Harbor Act of 3 March 1899 (33 U.S.C. 403), is hereby approved.

You are hereby authorized to install and maintain 17 commercial moorings, in accordance with the plans and drawings attached hereto, which are incorporated in and made a part of this permit, subject to the General and Special Conditions (copy attached). Notice of Authorization, Eng Form 4336, must be displayed at the work site (copy attached).

You must notify the Chief, Operations Branch 72 hours in advance of the time the work will begin and when it is completed. The work must be completed on or before December 31, 1992. This permission, if not previously revoked or specifically extended, shall be null and void if the work is not done within this time limit.

attachments

BY AUTHORITY OF THE SECRETARY OF THE ARMY:

Stanley T. Arakaki — 28 Feb 89

STANLEY T. ARAKAKI — DATE
Chief, Operations Branch
Construction-Operations Division
For and in behalf of District Engineer
F. W. WANNER, Colonel, CE
U.S. Army, Corps of Engineers

Transferee hereby agrees to comply with the terms and conditions of this permit.

TRANSFEREE — DATE

Copies Furnished:

U.S. Environmental Protection Agency, San Francisco, CA
U.S. Fish & Wildlife Service, Honolulu, HI
Natl Marine Fisheries Service, Honolulu, HI (2 cys)
State Dept of Land & Natural Resources, Honolulu, HI
Office of State Planning, CZM Program Office, Honolulu, HI State
Harbors Div, Dept of Transportation, Honolulu, HI
State Dept of Health, Envt'l Health Svcs Div, Honolulu, HI
State Historic Preservation Officer, Honolulu, HI
Dept of Planning, County of Hawaii, Hilo, HI
Dept of Public Works, County of Hawaii, Hilo, HI

This notice of authorization must be conspicuously displayed at the site of work.

United States Army Corps of Engineers

28 February 19 89

A permit to INSTALL 17 COMMERCIAL MOORINGS

at ANAEHOOMALU BAY, SOUTH KOHALA, ISLAND OF HAWAII

has been issued to TRANSCONTINENTAL DEVELOPMENT CO. on 28 Feb 19 89

Address of Permittee P.O. BOX 3028, WAIKOLOA, HAWAII 96743-3028

Permit Number

2051

STANLEY T. ARAKAKI
C, OPS BR, Const-Ops Div
FOR *District Commander*

ENG FORM 4336, Jul 81 (ER 1145-2-303) EDITION OF JUL 70 MAY BE USED *(Proponent: DAEN-CWO)*

I. GENERAL CONDITIONS:

a. That all activities identified and authorized herein shall be consistent with the terms and conditions of this permit; and that any activities not specifically identified and authorized herein shall constitute a violation of the terms and conditions of this permit which may result in the modification, suspension or revocation of this permit, in whole or in part, as set forth more specifically in General Conditions h or i hereto, and in the institution of such legal proceedings as the United States Government may consider appropriate, whether or not this permit has been previously modified, suspended or revoked in whole or in part.

b. That the permittee agrees to make every reasonable effort to prosecute the construction or work authorized herein in a manner so as to minimize any adverse impact of the construction or work on fish, wildlife and natural environmental values.

c. That the permittee agrees that it will prosecute the construction or work authorized herein in a manner so as to minimize any degradation of water quality.

d. That the permittee shall permit the District Engineer or his authorized representative(s) or designee(s) to make periodic inspections at any time deemed necessary in order to assure that the activity being performed under authority of this permit is in accordance with the terms and conditions prescribed herein.

e. That the permittee shall maintain the structure or work authorized herein in good condition and in accordance with the plans and drawings attached hereto.

f. That this permit does not convey any property rights, either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to property or invasion of rights or any infringement of Federal, State, or local laws or regulations, nor does it obviate the requirement to obtain State or local assent required by law for the activity authorized herein.

g. That this permit does not authorize the interference with any existing or proposed Federal project and that the permittee shall not be entitled to compensation for damage or injury to the structures or work authorized herein which may be caused by or result from existing or future operations undertaken by the United States in the public interest.

h. That this permit may be summarily suspended, in whole or in part, upon a finding by the District Engineer that immediate suspension of the activity authorized herein would be in the general public interest. Such suspension shall be effective upon receipt by the permittee of a written notice thereof which shall indicate (1) the extent of the suspension, (2) the reasons for this action, and (3) any corrective or preventative measures to be taken by the permittee which are deemed necessary by the District Engineer to abate imminent hazards to the general public interest. The permittee shall take immediate action to comply with the provisions of this notice. Within ten days following receipt of this notice of suspension, the permittee may request a hearing in order to present information relevant to a decision as to whether his permit should be reinstated, modified or revoked. If a hearing is requested, it shall be conducted pursuant to procedures prescribed by the Chief of Engineers. After completion of the hearing, or within a reasonable time after issuance of the suspension notice to the permittee if no hearing is requested, the permit will either be reinstated, modified or revoked.

i. That this permit may be either modified, suspended or revoked in whole or in part if the Secretary of the Army or his authorized representative determines that there has been a violation of any of the terms or conditions of this permit or that such action would otherwise be in the public interest. Any such modification, suspension, or revocation shall become effective 30 days after receipt by the permittee of written notice of such action which shall specify the facts or conduct warranting same unless (1) within the 30-day period the permittee is able to satisfactorily demonstrate that (a) the alleged violation of the terms and the conditions of this permit did not, in fact, occur or (b) the alleged violation was accidental, and the permittee has been operating in compliance with the terms and conditions of the permit and is able to provide satisfactory assurances that future operations shall be in full compliance with the terms and conditions of this permit; or (2) within the aforesaid 30-day period, the permittee requests that a public hearing be held to present oral and written evidence concerning the proposed modification, suspension or revocation. The conduct of this hearing and the procedures for making a final decision either to modify, suspend or revoke this permit in whole or in part shall be pursuant to procedures prescribed by the Chief of Engineers.

j. That in issuing this permit, the Government has relied on the information and data which the permittee has provided in connection with his permit application. If, subsequent to the issuance of this permit, such information and data prove to be false, incomplete or inaccurate, this permit may be modified, suspended or revoked, in whole or in part, and/or the Government may, in addition, institute appropriate legal proceedings.

k. That any modification, suspension, or revocation of this permit shall not be the basis for any claim for damages against the United States.

l. That no attempt shall be made by the permittee to prevent the full and free use by the public of all navigable waters at or adjacent to the activity authorized by this permit.

m. That if the display of lights and signals on any structure or work authorized herein is not otherwise provided for by law, such lights and signals as may be prescribed by the United States Coast Guard shall be installed and maintained by and at the expense of the permittee.

n. That this permit does not authorize or approve the construction of particular structures, the authorization or approval of which may require authorization by the Congress or other agencies of the Federal Government.

o. That if and when the permittee desires to abandon the activity authorized herein, unless such abandonment is part of a transfer procedure by which the permittee is transferring his interests herein to a third party pursuant to General Condition r hereof, he must restore the area to a condition satisfactory to the District Engineer.

p. That if the recording of this permit is possible under applicable State or local law, the permittee shall take such action as may be necessary to record this permit with the Register of Deeds or other appropriate official charged with the responsibility for maintaining records of title to and interests in real property.

q. That there shall be no unreasonable interference with navigation by the existence or use of the activity authorized herein.

r. That this permit may not be transferred to a third party without prior written notice to the District Engineer by the transferee's written agreement to comply with all terms and conditions of this permit and thereby agreeing to comply with all terms and conditions of this permit. In addition, if the permittee transfers the interests authorized herein by conveyance of realty, the deed shall reference this permit and the terms and conditions specified herein and this permit shall be recorded along with the deed with the Register of Deeds or other appropriate official.

s. That in issuing this permit, the Federal Government does not assume any liability for the following:

(1) Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

(2) Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

(3) Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

(4) Design or construction deficiencies associated with the permitted work.

(5) Damage claims associated with any future modification, suspension, or revocation of this permit.

II. SPECIAL CONDITIONS

a. That the permittee, upon receipt of a notice of revocation of this permit or upon its expiration before completion of the authorized structure or work, shall, without expense to the United States and in such time and manner as the Secretary of the Army or his authorized representative may direct, restore the waterway to its former conditions. If the permittee fails to comply with the direction of the Secretary of the Army or his authorized representative, the Secretary or his designee may restore the waterway to its former condition, by contract or otherwise, and recover the cost thereof from the permittee.

b. That the anchor systems (including chain, rope, and anchors) do not impact living coral colonies.

c. That the following information be provided to the U.S. Coast Guard at least 30 days prior to the start of construction:

1. Project start date.

2. Project completion date.

3. Agency/contractor performing work with the name of a point of contact, address and telephone number.

4. If vessels are involved, names, call signs and radio frequencies they guard, on VHF-FM.

5. Hours of operation of the project, i.e. 0800 - 1700 Mon - Fri, 24 hours a day.

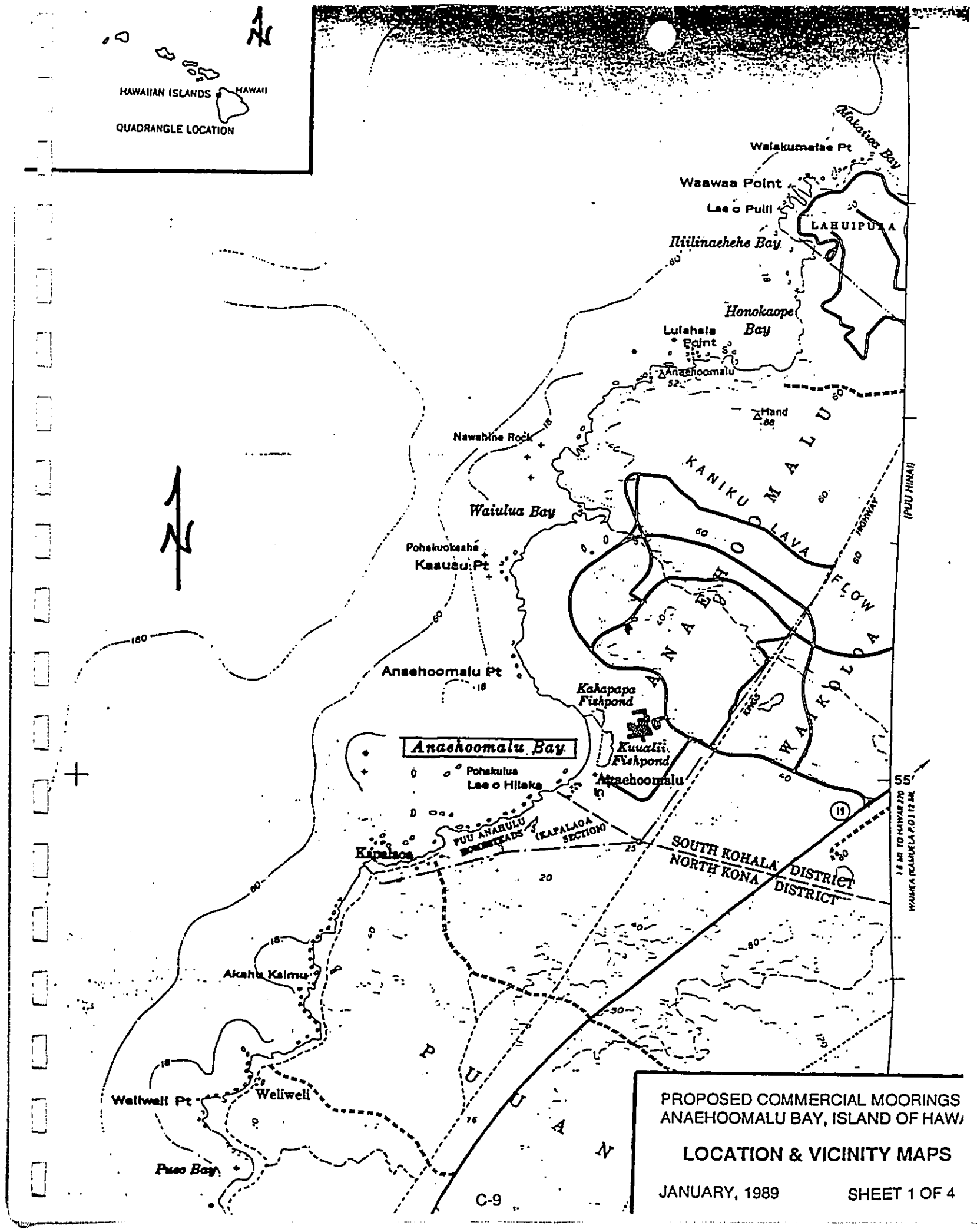
6. Any special request of maritime public, i.e. reduction of speed, wide berth.

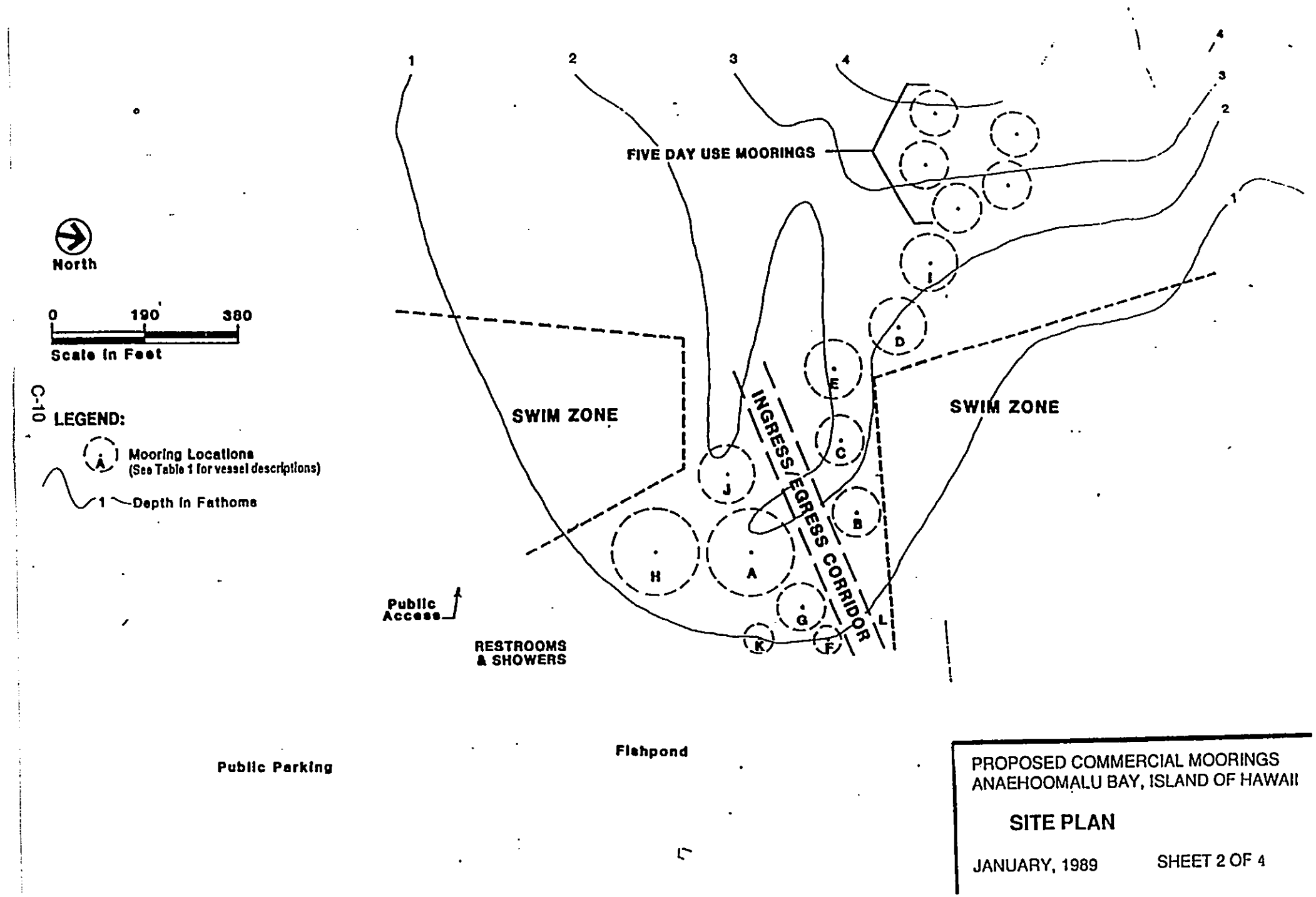
7. General scope of project and how it will affect the maritime public, i.e. degree of encroachment of navigable waters and how obstructions will be marked, i.e. signs, lights.

8. The information should be sent to:

Commander (oan)
Fourteenth Coast Guard District
Prince Kuhio Building
300 Ala Moana Boulevard
Honolulu, Hawaii 96850-4982

Phone: (808)541-2315

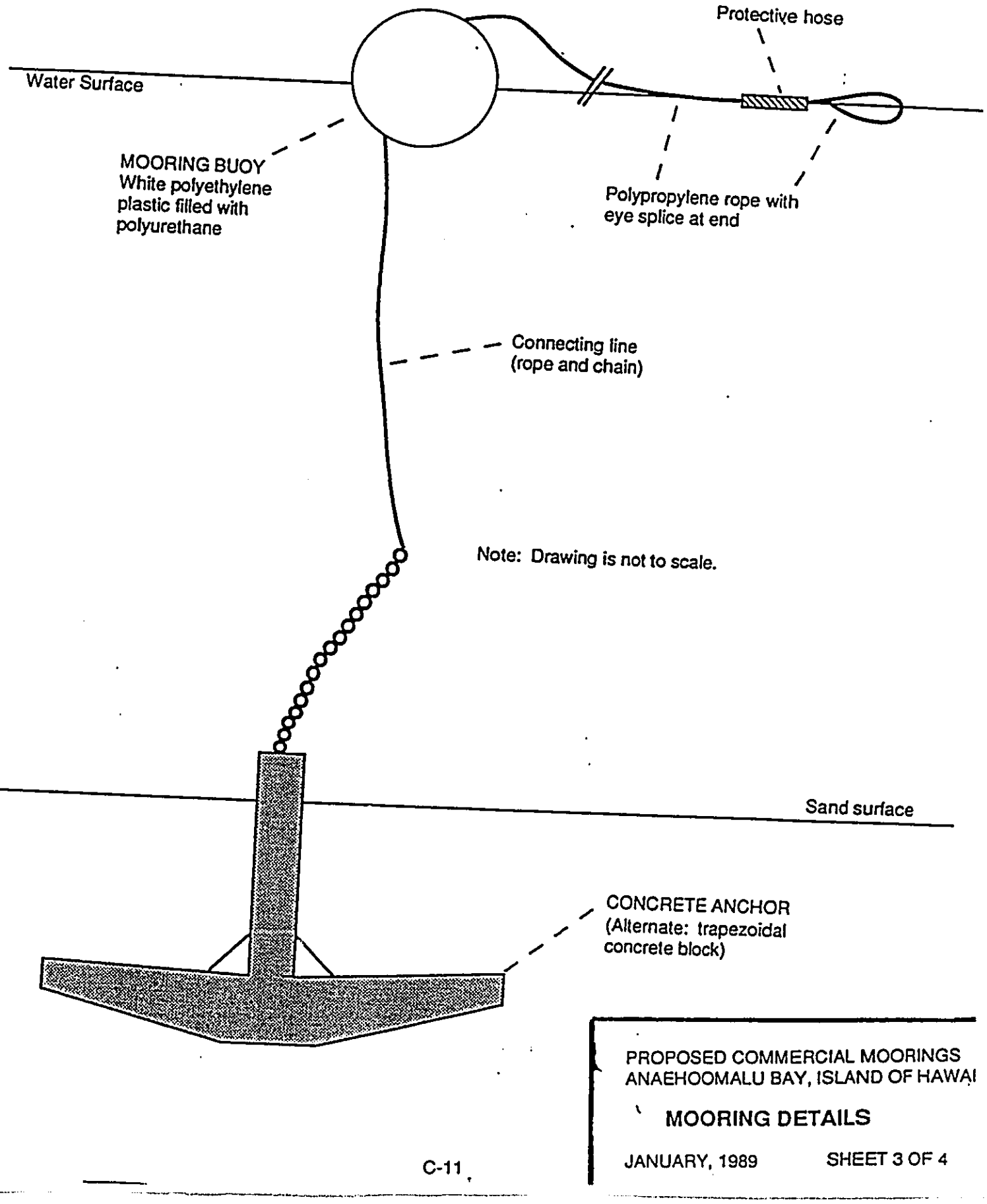

HAWAIIAN ISLANDS
HAWAII
QUADRANGLE LOCATION
Makaiwa Bay
Walakumaiae Pt
Waawaa Point
Lae o Puili
LAEUIPUIA
Iiilinaeheho Bay
Honokaope Bay
Lulahala Point
Anaehoomalu
Hand
Nawahine Rock
KANIKUO LAVA FLOW
(PUU HINAI)
Waiulua Bay
Pohakuokeaha
Kasuou Pt
Anaehoomalu Pt
Kahapapa Fishpond
Kuualii Fishpond
Anaehoomalu Bay
Pohakulua
Lae o Hilaka
Anaehoomalu
PUU ANAHULU BOUNDARIES (KAPALAOA SECTION)
Kapalaoa
SOUTH KOHALA DISTRICT
NORTH KONA DISTRICT
WAIKOLOA
55
Akaha Kaimu
PUUANAHULU
Weliweli Pt
Weliweli
Puuo Bay
PROPOSED COMMERCIAL MOORINGS
ANAEHOOMALU BAY, ISLAND OF HAWA
LOCATION & VICINITY MAPS
JANUARY, 1989
SHEET 1 OF 4



PROPOSED COMMERCIAL MOORINGS
ANAEHOOMALU BAY, ISLAND OF HAWAII

SITE PLAN

JANUARY, 1989 SHEET 2 OF 4



PROPOSED COMMERCIAL MOORINGS
ANAEHOOMALU BAY, ISLAND OF HAWAI

MOORING DETAILS

JANUARY, 1989 SHEET 3 OF 4

TABLE 1 - VESSEL DESCRIPTIONS

VESSELS TO BE PERMANENTLY MOORED AT 'ANAEHO'OMALU BAY

Vessel Length/Type	Draft (ft)	Mooring Requirements*		Vessel Capacity		No. of Trips to Beach Per Day	Minutes Spent on Beach Per Trip
				Passengers	Crew		
CAPTAIN NEMO'S OCEAN SPORTS:							
A. Up to 65' Catamaran	6	Deep	R=90'	49	6	2	15-30
B. 26' Monohull	5	Deep	R=50'	4	1	2	15-30
C. 36' Dive Boat	4	Shallow	R=60'	18	4	2	15-30
D. 30' Tender/Dive Boat	4	Shallow	R=60'	20	4	2	15-30
E. 26' Glass Bottom Boat	2	Shallow	R=50'	16	4	2	15-30
F. Dinghy	2	Shallow	R=30'	- -	2	8	5-10
G.Training Platform**		Shallow	R=50'				
NICK'S AQUA SPORTS:							
H. Up to 50' Catamaran	5	Deep	R=90'	49	6	2	15-30
I. 40' Dive Boat	5	Shallow	R=60'	20	4	2	15-30
J. 40' Monohull	6	Deep	R=60'	10	2	2	15-30
K. Dinghy	2	Shallow	R=30'	- -	2	6	5-10
VARIOUS:							
L. Stern Mooring (near ingress/egress)	5	Shallow	Linear	Not Applicable	Not Applicable	***	***

*Refers to the depth of water required at the mooring site, as well as the radius (R) of the area needed to accommodate the circular movement of the boat on the mooring line.

**To be returned to shore at the end of each day.

***Used to secure vessels during loading and unloading on the shore in periods of strong surge or surf.

PROPOSED COMMERCIAL MOORINGS
ANAEHOOMALU BAY, ISLAND OF HAWAII

VESSEL DESCRIPTIONS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, CA 90731

NOV 25 1988

November 21, 1988 F/SWR14:ETN

Everette A. Flanders
Chief, Construction-Operations Division
U.S. Army Engineer District, Honolulu
Fort Shafter, HI 96858-5440

Dear Mr. Flanders:

This is in reference to Endangered Species Act coordination on an application for a permit to place 16 commercial moorings and a moored platform in Anaehoomalu Bay, South Kohala, island of Hawaii (File No. 2051). On July 15, 1988, we received a request to review the subject application. Since there was insufficient information on listed species in the project area, we have witheld our comments until the environmental assessment which was being prepared was completed. On November 8, 1988, we received a copy of the biological survey conducted by Environmental Assessment Co. for the applicant. Small but consistent numbers of juvenile green turtles (Chelonia mydas) were observed both inside and just outside of Anaehoomalu Bay, which suggests that the Bay is being used for resting and feeding.

Based on the information provided in the application and the green turtle sighting data in the assessment we believe that the placement of the moorings is not likely to adversely affect the Hawaiian population of green turtles. However, in order to more completely document the aggregation of green turtles that utilize Anaehoomalu Bay and insure that no adverse impacts occur, we recommend that the applicant undertake a concerted effort to census and estimate the number of individuals within and around the project site, and characterize the resting and foraging habitat. Users and owners of moorings should be made aware of the presence of green turtles, and efforts to educate the resort guests regarding the biological and legal status of green turtles should be instituted.

This concludes Section 7 consultation for this action. Please contact Mr. Eugene Nitta, Pacific Area Office (808-955-8831), for for further information or assistance in developing the scope and duration of the green turtle surveys for Anaehoomalu Bay. If new

2.051

information reveals effects of the project on listed species that have not been previously considered, reinitiation of consultation may be required at that time.

Sincerely yours,

E.C. Fullerton
Regional Director

cc:
F/SWR14, Nitta

JOHN WAIHEE
GOVERNOR

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS DIVISION
79 SO. NIMITZ HWY. • HONOLULU, HAWAII 96813

FEB 6 1989

IN REPLY REFER TO:

February 1, 1989

HAR-B 3006

Mr. Stanley Arakaki
Chief, Operations Branch
Construction-Operations Division
U. S. Army Engineer District, Honolulu
Fort Shafter, Hawaii 96858-5440

Dear Mr. Arakaki:

Application File No. 2051

Thank you for your letter of January 18, 1989 regarding Transcontinental Development Company's proposal to install sixteen moorings in Anaehoomalu Bay.

The mooring plan has been reviewed and is consistent with our Ocean Recreation Management Area rules. We also intend to incorporate the mooring area in our proposed rules to establish offshore mooring areas. We recommend that all mooring buoys meet U. S. Coast Guard marking requirements. Transcontinental Development Company must make separate arrangements with us for private management of the area, either by lease or permit. Effective January 1, 1989, all mooring or anchoring in State waters require a permit from the Department under provisions of Act 379, Session Laws of Hawaii, 1988, so an alternative solution would be for each user to execute a permit with us for use of the mooring.

We have no objections to the approval of this application, subject to provisions that the mooring buoys be marked accordingly and necessary mooring permits are obtained from the Department.

Very truly yours,

David K. Higa
Chief

2051