An aquatic resources survey for shoreline improvements and nearshore dredging at 567 Portlock Road, O`ahu, Hawai`i[1]

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Introduction

A proposed project at 567 Portlock Road on East O`ahu would renovate specific shoreline facilities at 567 Portlock Road. These facilities along the shore of Maunalua Bay include a breakwater defining a small harbor, a small boat launching ramp, and associated structures such as a footbridge and stairway (Figure 1). The proposed work would entail repairing parts of the breakwater; replacing the boat ramp, footbridge, and wooden staircase; and dredging the harbor bottom. This report discusses a marine biological survey and water quality analyses undertaken for an environmental assessment and applicable permit applications for this project.

The field reconnaissance survey for this report was conducted on September 26, 2002 by two *AECOS* biologists: Susan Burr and Rodger Douglas. The biologists snorkeled the area to characterize the environment and identify whether any sensitive marine resources were present. Three water samples were collected to characterize the marine environment.

General Descriptions

Maunalua Bay — Maunalua Bay came into existence with the late series of eruptions along the southeast end off the ancient Ko`olau volcano. These eruptions defined the bay between Black Point and Koko Head as a broad coastal bight some 5 miles across, but the only significant embayment lies between Paiko Peninsula and area fronting the entrances to what is now Koko Marina (formerly Kuapa Pond). Most of the bay is

[1] Report prepared for Wilson Okamoto & Associates for the environmental assessment. This report will become part of the public record.

shallow: a fringing reef extends up to 910 m (3000 ft) off most of the coastline (Sakoda, 1975; *AECOS*, 1979). A channel and dredged basin connect the open ocean with two channels that extend into the marina at Hawaii Kai. At the Koko Head end of the fringing reef is found another, natural channel in the fringing reef. This channel leads in towards the Portlock shore.

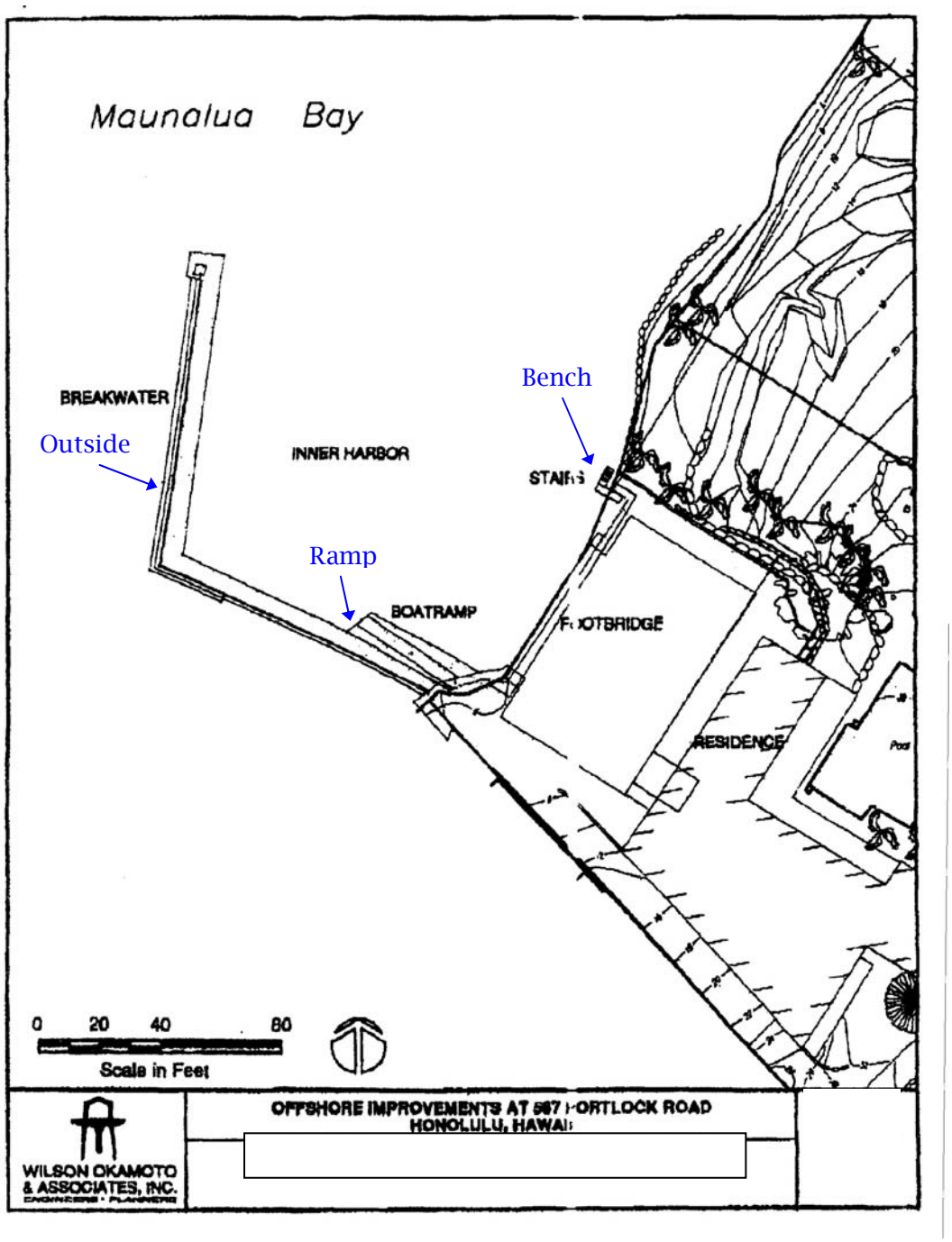

Figure 1. Map showing the project site at 567 Portlock Road and water quality sampling stations.

The surrounding land and the waters of this part of Maunalua Bay have changed significantly since the 1960's when Hawaii Kai was developed and the fishpond and associated wetlands were dredged and changed into the marina at Hawaii Kai. In prior decades, native seagrass, *Halophila hawaiiana*, formed extensive underwater meadows in eastern Maunalua Bay (Botany Department, UH Manoa, undated).

Today, many people engage in various ocean recreation activities in this part of O`ahu. Commercial and recreational activities include: scuba diving, parasailing, water sledding, and thrill craft riding. In addition, the Maunalua Bay Launch Ramp facility is a popular site for recreational boaters and fishers to launch from and Maunalua Bay Beach Park is a popular site for outrigger canoeing.

A coastal access pathway near Kawaihoa Point provides public access to the western shoreline of Koko Head. Numerous people frequent the small beach just south of the project site (Koke`e Beach Park); surf at "Pillars" or "China wall;" spearfish around Portlock Point; and cast their lines from the breakwater, footbridge, and marine bench in the project area.

567 Portlock Road – The USGS topographic map (USGS, Island of Oahu, 1970) shows the nearshore facilities at 567 Portlock Road placed in the center of a "coral reef." The Coastal Zone Atlas shows the area to have been dredged and the bottom type likely to be sand bottom with scattered rock boulders (*AECOS*, 1981). The NOAA O`ahu Benthic Habitat maps show the surrounding area to consist of hard bottom and reef rubble (NOAA, 2002a).

The reef off Ku`i Channel was described several decades ago as follows (after ECI, 1975 and AECOS, 1979, p. 498):

> Coral cover [on the reef front] is around 10 to 20% on hard bottom at -18 feet (-5 m) off the Kui gap in the reef margin. Most abundant are *Pocillopora meandrina* and *Porites lobata*, although five other species are present. The sea urchins, *Tripneustes gratilla*, *Echinometra mathaei*, and *Diadema paucispinum* are common. The majority of 21 species of fishes are associated with a sunken barge. Some of the more abundant species are *Scombroides lysan*, *Caranx melampygus*, *Abudefduf abdominalis*, *Stegastes fasciolatus*, *Thalassoma duperryi*, *Stethojulis balteata*, juvenile *Scarus* sp., and *Acanthurus nigrofuscus*.
>
> At depths of around 25 feet (8 m), the hard bottom has little vertical relief and appears sand-scoured. Moderate growths of a red alga, *Rhodymenia* sp., are present, with Lyngbya sp. growing

> epiphytically. Algal cover is less than 30%. Only a few macroinvertebrates are present — mostly a sea urchin (*Echinothrix calamaris*) in low abundance. Eleven species of fishes are recorded, none of which are abundant. *Abudefduf abdominalis* and *Acanthurus triostegus* are most numerous.

It was also noted in these sources that the reef flat east of the Ku`i Channel entrance, harbored large numbers of mussels (*Brachidontes crebristriatus*). Dense algal growth marked the outer edge of the shallow reef on the east side of the gap (*AECOS*, 1979). The seagrass, *Halophila hawaiiana*, was observed to be abundant on the reef flat (ECI, 1975).

Today, the bottom substratum of the harbor at 567 Portlock Road, around the boat ramp and basin leading towards the entrance channel, is entirely sand, as can be seen in Figure 2. The area around the boat ramp has clearly shoaled since this area was last dredged. The stairs at the northeast side of the project lead down onto a marine bench. Boulders and other debris surround the inner and outer sides of the breakwater and most of the marine life found at the project site is associated with these occurrences of hard bottom.

Figure 2. Existing shore facilities at 567 Portlock Road looking westward across Maunalua Bay.

Water Quality

Hawaii's Water Quality Standards classify the easternmost part of Maunalua Bay from Paiko Peninsula to Koko Head as a Class A embayment (State DOH, 2000). As stated in the Water Quality Standards, it is the objective of Class A waters that their use for recreation and aesthetic enjoyment be protected (State DOH, 2000).

Table 1. Analytical methods and instruments used for the September 26, 2002 water quality sampling at 567 Portlock Road, O`ahu.

Analysis	Method	Reference	Instrument
Ammonia	alkaline phenol	Karoleff in Grasshoff et al. (1986)	Technicon AutoAnalyzer II
Chlorophyll α	10200 H	Standard Methods, 18th Edition (1992)	Turner Model 112 fluorometer
Dissolved Oxygen	EPA 360.1	EPA (1979)	YSI Model 85 DO meter
Nitrate + Nitrite	EPA 353.2	EPA (1993)	Technicon AutoAnalyzer II
pH	EPA 150.1	EPA (1993)	SA 250
Salinity			YSI Model 85 DO meter
Temperature	thermister calibrated to NBS cert. Thermometer (EPA 170.1)	EPA (1979)	YSI Model 85 DO meter
Total Nitrogen	persulfate digestion / EPA 353.2	D'Elia et al. (1977) / EPA (1993)	Technicon AutoAnalyzer II
Total Phosphorus	persulfate digestion / EPA 365.1	Koroleff in Grasshoff et al. (1986) / EPA (1993)	Technicon AutoAnalyzer II
Total Suspended Solids	Method 2540D (EPA 160.2)	Standard Methods 18th Edition (1992); EPA (1979)	Mettler H31 balance
Turbidity	Method 2130B (EPA 180.1)	Standard Methods 18th Edition (1992); EPA (1993)	Hach 2100P Turbidimeter

D'Elia, C.F., P.A. Stendler, & N. Corwin. 1977. *Limnol. Oceanogr.* 22(4): 760-764.
EPA. 1979. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, EPA 600/4-79-020.
EPA. 1993. Methods for the Determination of Inorganic Substances in Environmental Samples. EPA 600/R-93/100.
EPA. 1994. Methods for Determination of Metals in Environmental Samples, Supplement 1. EPA/600/R-94/111. May 1994.
Grasshoff, K., M. Ehrhardt, & K. Kremling (eds). 1986. Methods of Seawater Analysis (2nd ed). Verlag Chemie, GmbH, Weinheim.
Standard Methods. 1992. Standard Methods for the Examination of Water and Wastewater. 18th Edition. 1992. (Greenberg, Clesceri, and Eaton, eds.). APHA, AWWA, & WEF. 1100 p.

Water samples were collected from three stations at the project site (see Figure 1). Some parameters were measured by field meter and others in water samples collected in appropriate containers and taken to the *AECOS* Laboratory in Kane`ohe (laboratory Log No. 16455). Table 1 (above) lists field instruments and analytical methods used with these samples. The tide was falling during the survey on September 26, 2002. A high tide of 1.8 ft (higher high water or HHW) occurred at 6:10 am and the afternoon low tide of 0.8 ft (higher low water or HLW) occurred at 1:25 pm (NOAA, 2002b as corrected for Maunalua Bay).

The primary purpose of the water quality measurements was to characterize the existing marine environment, not to set baseline values or determine compliance with Hawaii's Water Quality Standards (Table 2). In fact, the HDOH criteria for turbidity, nutrients, and chlorophyll α are based upon geometric mean values and a minimum of three separate samples per location would be needed to compute a geometric mean (DOH, 2000). Thus, our single sampling event cannot produce results for comparison with all State water quality criteria. Nonetheless, the results can be evaluated against the water quality criteria for embayments as long as the limitations are realized.

Table 2. State of Hawaii geometric mean criteria for embayments (HAR §11-54-06(a)(3)).

	Ammonium (µg N/l)	**Nitrate + nitrite (µg N/l)**	**Total N (µg N/l)**	**Total P (µg P/l)**	**Chl α (µg N/l)**	**Turbidity NTU**
Wet Criteria*	6.00	8.00	200.00	25.00	1.50	1.5
Dry criteria**	3.50	5.00	150.00	20.00	0.50	0.40

* Wet criteria apply when the average freshwater inflow from the land equals or exceeds one percent of the embayment volume per day.

**Dry criteria apply when the average freshwater inflow from the land is less than one percent of the embayment volume per day.

- pH shall not deviate from 7.6 to 8.6.
- Dissolved oxygen shall not be less than 75% saturation.
- Temperature shall not vary more than 1 ˚C from ambient.
- Salinity shall not vary more than 10% from natural or seasonal changes.

A review of the water quality data collected at the project site on September 26 show, in general, good water quality (Table 3). The salinity and temperature values are within the expected ranges and the waters are saturated or nearly saturated with dissolved oxygen. The waters were found to have a low concentration of the inorganic nutrients: nitrate, nitrite, and ammonium. (*Note: Total nitrogen and total phosphorus concentrations have not yet been analyzed by the laboratory. The data will be forwarded to Wilson Okamoto & Associates when the results are finalized).

Table 3. Water quality characteristics of 567 Portlock Road from samples taken on 26 September 2002.

	Time sampled	Temp. (°C)	Salinity ‰	DO (mg/l)	DO % sat	pH (pH units)
Outside breakwater	1145	28.0	34.4	6.47	100	8.16
Next to boat launch ramp	1140	28.5	33.3	6.04	94	8.14
Far side of basin near marine bench	1155	28.6	34.4	6.96	108	8.18

	Turbidity (ntu)	TSS (mg/l)	Nitrate + nitrite (µg N/l)	Ammonium (µg N/l)	Total N (µg N/l)	Total P (µg P/l)	Chl α (µg/l)
Outside breakwater	4.52	7.7	3	<1			0.80
Next to boat launch ramp	3.61	11.6	11	<1			1.02
Far side of basin near marine bench	3.61	4.6	2	<1			0.53

The turbidity and TSS values are slightly elevated and the turbidity values are greater than the State's "wet" and "dry" geometric mean criteria (1.5 ntu and 0.40 ntu, respectively). "Dry" criteria apply when the average fresh water inflow from the land is less than one percent of the embayment volume per day, but generally is defined as the period between May 1 and October 31. The salinity values ranged between 33.3 and 34.4 ppt, an indication that there was minimal freshwater inflow from the land. The turbidity and TSS values recorded from these samples probably reflect a southerly wind creating chop and stirring up the bottom sediments in and around this confined body of water. The chlorophyll α values are also slightly elevated.

Biological Survey

The biological community associated with the breakwater and previously dredged sand flats are typical for these habitat types. No rare or unusual species were observed. *Halophila hawaiiana*, the only seagrass found in Hawaiian waters, was observed growing on the sand throughout the small harbor. This seagrass bed was observed to depths of 1.8 meters (6 feet), but was not observed growing in the more turbid pool where less light is likely to reach the bottom. A listing of the aquatic biota observed in and around the project site is given in Table 4.

Table 4. Checklist of aquatic biota observed off 567 Portlock Road in the nearshore environment of Maunalua Bay.

Species	Common name	Location					
		In	Out	Bench	Ramp	Basin	Pool
	ALGAE						
CHLOROPHYTA	green algae						
Byropsis sp.		A					
Halimeda opuntia (L.) Lamouroux		A	C	C			
Neomeris annulata Dickie		A	A	A			
CYANOPHYTA	blue-green algae						
Hormothamnion enteromorphoides Bornet & Flahault		A		C			
Symploca hynoides Gomont		C		C			
PHAEOPHYTA	brown algae						
Dictyopteris plagiogramma (Montagne) Vickers			C				
Dictyota bartayresii Lamouroux		C					
Dictyota sandvicensis Kutzing		C	A	C			
Giffordia breviarticulata (J. Agardh) Doty & Abbott			C				
Padina japonica Boergesen			A				
Sargassum echinocarpum J Agardh			A				
Spatoglossum solierii (Chauvin) Montagne		U	U	U			
Turbinaria ornata (Turner) J. Agardh		A	C				
RHODOPHYTA	red algae						
Asparagopsis taxiformis (Delile) Collins & Hervey		A	A	A			
Centroceras clavulatum (C.Agardh) Montagne		P					
Galaxaura fastigiata Decaisne		U					
Grateloupia hawaiiana (Wulfen) C. Agardh			U				
Porolithon gardineri (Foslie) Foslie		C					
Porolithon onkodes (Heydrich) Foslie		A	A	A			
	PLANTS						
Monocotyledoneae							
Hydrocharitaceae							
Halophila hawaiiana Doty & Stone	seagrass					A	
	INVERTEBRATES						
CNIDAREA, OCTOCORALLIA							
ALCYONACEA, XENIIDAE							
Anthelia edmondsoni (Verrill)	blue octacoral	U	U	U			

Table 4 (continued)

Species	Common name	Location					
		In	Out	Bench	Ramp	Basin	Pool
CNIDAREA, HEXACORALLIA							
ACTINIARIA, HORMATHIIDAE							
Calliactis polypus (Forsskal)	hermit crab anemone	R					
ZOANTHINARIA, ZOANITHIDAE							
Palythoa caesia Dana	blue-gray zoanthid		C				
SCLERACTINIA, POCILLOPORIDAE							
Pocillopora damicornis (L.)	lace coral	U	C	U			
Pocillopora meandrina Dana	cauliflower coral		U				
SCLERACTINIA, PORITIDAE							
Porites lobata Dana	lobe coral	U	U	U			
SCLERACTINIA, FAVIIDAE							
Cyphastrea ocellina (Dana)	ocellated coral	U	U				
ANELLIDA, POLYCHAETA							
TEREBELLIDAE							
Loima medusa (Savigny)	medusa spaghetti worm		R				
MOLLUSCA, GASTROPODA, PROSOBRANCHIA							
NERITIDAE							
Nerita picea (Recluz)	black nerite		A				
LITTORINIDAE							
Littoraria pintado (Wood)	dotted periwinkle	A	A				
VERMETIDAE							
Serpulorbis variabilis (Hadfield & Kay)	variable worm snail		R				
ARTHOPODA, CRUSTACEA, DECOPODA							
ALPHEIDAE							
Alpheus deuteropus Hilgendorf	snapping shrimp (in *P. lobata*)		R				
DIOGENIDAE							
Dardanus gemmatus (H. Milne Edwards)	jeweled anenome crab	R					
GRAPSIDAE							
Grapsus tenuicrustatus (Herbst)	thin-shelled rock crab	A		C	A		
ECHINODERMATA, ECHINOIDAE							
ECHINOMETRIDAE							
Echinometra mathaei (de Blaineville)	rock-boring urchin	A	A	A			
Echinometra oblonga (de Blaineville)	oblong urchin		A				

Table 4 (continued)

Species	Common name	Location					
		In	Out	Bench	Ramp	Basin	Pool
ECHINODERMATA, HOLOTHUROIDEA							
ACTINOPODA, HOLOTHUROIDAE							
Actinopyga mauritiana (Quoy & Gaimard)	white-spotted sea cucumber		R				
	VERTEBRATES						
VERTEBRATA, PICES	fishes						
MURAENIDAE							
Gymnothorax sp.	moray eel	R					
ENGRAULIDAE							
Encrasicholina pupurea (Fowler)	Hawaiian anchovy			A			A
BELONIDAE							
Tylosurus crocodiles (Peron & Lesner)	houndfish						R
HOLOCENTRIDAE							
Sargocentron sp.	squirrelfish	R					
FISTULARIIDAE							
Fistularia commersonii Ruppell	coronetfish		R				
PRIACANTHIDAE							
indet.	bigeye	U	U				
CARANGIDAE							
indet.	jack				R		
MULLIDAE							
Mulloidichthys flavolineatus (Lacepede)	yellowstripe goatfish	A	A				
Mulloidichthys vanicolensis (Valenciennes)	yellowfin goatfish	R	A				
CHAETODONTIDAE							
Chaetodon lunula (Lacepede)	raccoon butterflyfish	R	R				
POMOCENTRIDAE							
Abudefduf abdominalis (Quoy & Gaimard)	Hawaiian seargent	U	U	U			
Abudefduf sordidus (Forsskal)	blackspot seargent	U	U	U			
LABRIDAE							
Gomphosus varius Lacepede	bird wrasse	R		R			
Labroides phthirophagu Randall	cleaner wrasse						
Stethojulis balteata (Quoy & Gaimard)	belted wrasse	R	R				
Thalassoma duperrey (Quoy & Gaimard)	saddle wrasse	R	R	R			
SCARIDAE							
Scarus dubius Bennett	regal parrotfish	U					
BLENNIDAE							
Blenniella gibbifrons (Quoy & Gaimard)	bullethead rock skipper	R	R				
Cirripectes vaderbilti (Fowler)	scarface blenny		U				
Entomacrodus marmoratus (Bennett)	marbled blenny			U			

Table 4 (continued)

Species	Common name	Location					
		In	Out	Bench	Ramp	Basin	Pool
ACANTHURIDAE							
Acanthurus triostegus (L.)	convict surgeonfish	U	U	U			
Ctenochaetus strigosus (Bennett)	goldring surgeon	U	U				
Zebrasoma flavescens (Bennett)	yellow tang	U					
MONOCANTHIDAE							
Pervagor spilasoma (Lay & Bennett)	fantail filefish			R			
OSTRACIIDAE							
Ostracion meleagris (Shaw & Nodder)	spotted boxfish	R					

KEY TO SYMBOLS USED IN TABLE 4:

Location :

in - inside breakwater.
out - outside breakwater.
ramp - near boat launching ramp.
basin - open basin inside breakwater.
pool - basin landward of the pedestrian bridge.
bench - marine bench on north side of basin.

Abundance categories:

R - Rare - only one or two individuals seen.
U - Uncommon – three to six individuals observed.
C - Common - six to twelve individuals observed
A - Abundant - found in large numbers and widely distributed (more than twelve individuals observed)
P - Present - noted as occurring, but quantitative information lacking.

QC:

All species were observed in the field by aquatic biologist on 26 September 2002. None was collected for identification in the laboratory or as a voucher specimen.

Pocillopora damicornis was the most common of the four species of coral found at this site although it was found in small numbers growing only on the hard surfaces of the breakwater and its associated debris and near the marine bench. The colonies were generally small, 8 cm x 8 cm (3 in x 3 in), and widely scattered. *P. damicornis* colonies were more common on the outside of the breakwater than on the inside. *P. damicornis* is an early colonizer and is likely to be one of the first species of corals to establish itself on new substrate and substrates cleared after disturbances.

Some larger colonies of *Porites lobata* (to 46 cm x 46 cm or 18 in x 18 in) were observed on the inside and outside of the breakwater and near the marine bench, although this species of coral was not as common as *Pocillopora damicornis*. A few colonies of *Cyphastrea ocellina* were observed on the inside and outside of the breakwater and a few colonies of *Pocillopora meandrina* were observed outside of the breakwater.

Two large schools of juvenile Hawaiian anchovy (*Encrasicholina pupurea*) were observed near the marine bench and in the protected waters of the pool. The estate's security

guard reported regularly seeing this school and other large schools of juvenile fishes in this area throughout the year. Small schools of the yellowstripe goatfish (*Mulloidichthys flavolineatus*) were observed on the inside and outside of the breakwater and were reported as being the target species by fishermen who are regulars there. The fishermen also reported catching bigeyes (Priacanthidae) with white lesions on the heads and around the eyes. We observed these white markings on the fish we saw, although were unable to discern the nature of the disease. Various other reef fishes and macroinvertebrates were noted around the breakwater, attracted to the habitat provided by this man-made structure.

Discussion

The nearshore improvements at 567 Portlock Road project will involve repairing the breakwater; replacing the boat ramp, footbridge, and wooden staircase, and dredging the harbor. If proper best management practices (BMPs) are employed during construction, none of these activities should have a long-term negative effect on the water quality and biological communities of the area.

A standard clamshell dredger and barge are likely to be used to dredge the harbor and the dredge spoils are likely to be disposed of in the landfill (R. Funakoshi, personal communication). While turbidity and suspended solids in the water column are likely to increase during dredging, the use of silt curtains to surround the area should minimize the effect the project has on the surrounding environment. Additional BMPs should be utilized during construction of the breakwater and other facilities to reduce the release of any fine sediments or other pollutants into the water.

During construction, destruction and displacement of marine habitat and organisms in the area will occur. For instance, much of the seagrass bed will be dredged and some of the surfaces on which coral colonies are growing may be moved or removed. However, relatively rapid recruitment and recolonization is likely to occur following construction. An adequate amount of sunlight should be able to penetrate the water to the newly dredged depth of 8 feet to allow the seagrass bed to recolonize the sandy bottom. Corals, algae, and other invertebrates will colonize new surfaces of the breakwater.

No aquatic species observed from this part of Maunalua Bay is listed as endangered, threatened, proposed or as a candidate species by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973 as amended (ESA), or by the State of Hawaii under its endangered species program (State DLNR, 1996; CFR, 1999; Federal Register, 1999, 2001).

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