AECOS No. 1150C

Marine biological and water quality surveys at Hawaiʻi Kai Marina, Hawaiʻi Kai, Oʻahu

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Introduction

The Hawaiʻi Kai Marina Community Association proposes to replace an existing sand bag groin (see title page photo) outside the marina entrance channel in Hawaiʻi Kai along the south shore of Oʻahu, Hawaiʻi (See Figure 1). *AECOS* was contracted to conduct environmental surveys to support permitting for the project ("Project")[1]. Our surveys were conducted on March 17, 2015 and included both water quality sampling and biological surveys on the groin and surrounding area. This report details findings of those surveys.

Project Description

The Project site is located along the shoreline adjacent to the Hawaiʻi Kai Marina entrance channel connecting the marina with Maunalua Bay. The existing sand bag groin is proposed to be removed and a new permanent groin to be built. The permanent replacement groin will be similar in size and location as the existing sand bag groin. The major difference will be the use of rock boulders instead of sand bags (J. Barry, pers. comm.).

Marine Environment in Project Vicinity

The reef and the shoreline of Maunalua Bay in the project vicinity have been extensively modified since the 1930s (WOA, 1988). Development of the Hawaiʻi Kai Marina began in 1959 by modifying Kuapā Pond (USACE, 1975). Kuapā Pond itself was "created" by the ancient Hawaiians (legend has it, with the help of the *menehune*) by modifying an extensive wetland (Kumu Pono Associates, 1998). The wetland system was created around 11,600 years ago by the flooding of a valley (older embayment) at the end of the last glacial period, with the rise in sea level resulting from worldwide glacial melt (Stearns, 1985). Erosion of the adjacent headlands led to a build-up of sediment between the wetlands and Maunalua Bay, forming a barrier beach restricting water flow between the wetland and Maunalua Bay (Nixon, 1994).

According to WOA (1988), when Kalanianaʻole Highway was built in the late 1930s, the main channel from Kuapā Pond to Maunalua Bay was widened to 12 m (40 ft) and another channel to the west arm of the marina constructed to improve water exchange. The entrance channel was built at a natural break in the reef, probably a drainage channel for the brackish water of Kuapā Pond initially formed during a lower stand of the sea (*AECOS*, 1979). The entrance channel was again dredged in the 1940s to facilitate landing craft operations

[1] Report prepared for Sea Engineering, Inc. for environmental entitlements. This report will become part of the public record for the Project

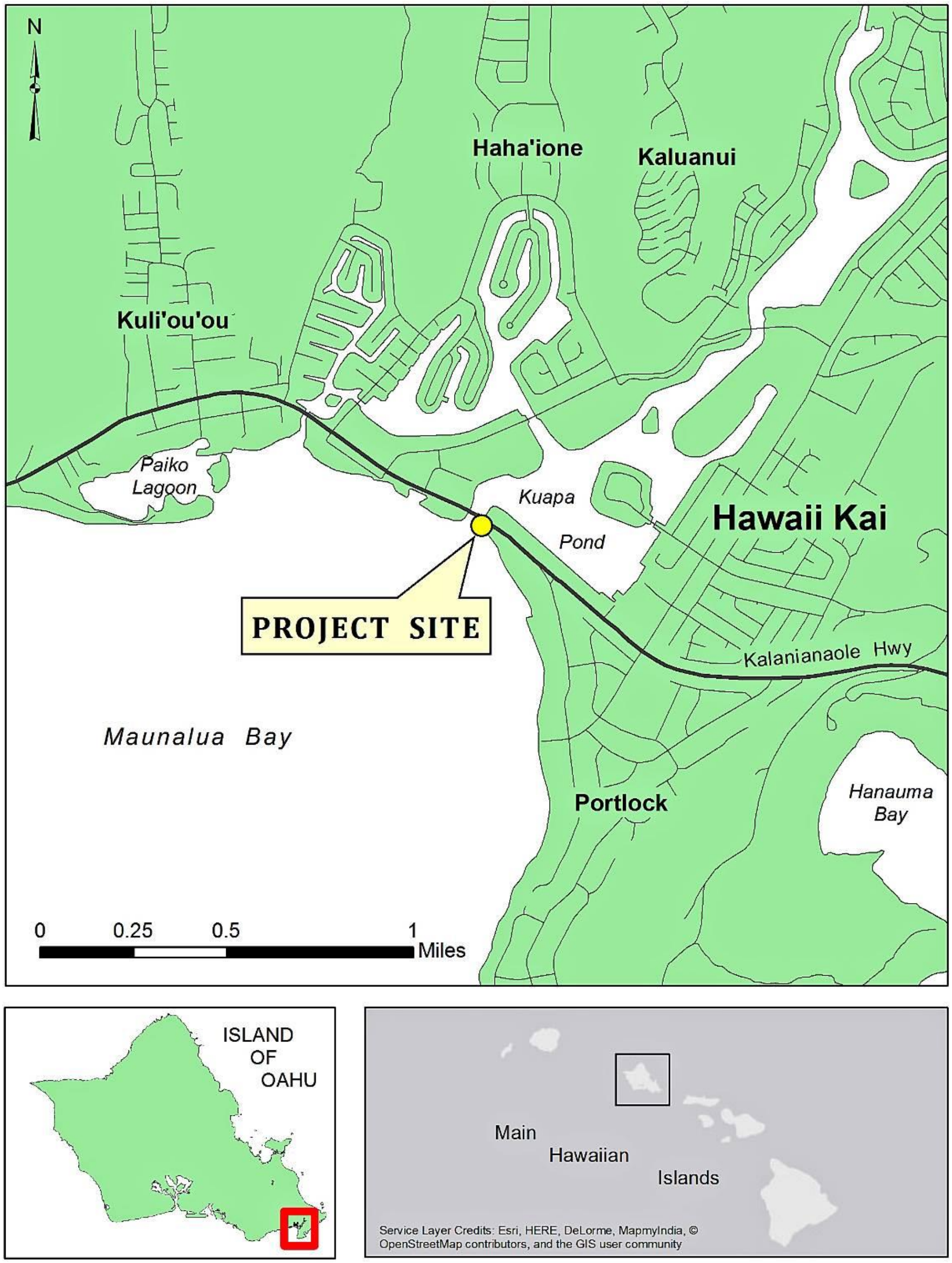

Figure 1. General location of Project area on the Island of Oʻahu.

and to service a military installation during World War II. As part of the development of the Hawaiʻi Kai community, the entrance channel was widened to 76 m (250 ft) and dredged to 1.9 m (6.2 ft) to accommodate potential runoff from a 100-year storm. At that time, an access channel from Kuliʻouʻou Stream to the entrance channel was dredged parallel to the shore and the second channel to the west arm of the marina was dredged. The material from this dredging project was used to construct Maunalua Bay Beach Park and a boat launching area. Since the 1960s, the entrance channel has largely filled in and, despite maintenance dredging once every ten years, now closely resembles the 12 m (40 ft-) wide channel that was first created in the 1930s.

<u>Maunalua Bay</u> — Maunalua Bay encompasses the area off the coast of Oʻahu between Koko Head and Diamond Head. The bay is lined by a fringing reef extending about 915 m (3,000 ft) offshore. Between the shore and reef margin is a low-relief flat and seaward of the fringing reef is a wide shelf of sand bottom with scattered limestone outcrops.

The reef flats off Maunalua Bay Beach Park (located to the north of the entrance channel) and off Portlock Beach (located to the south) were surveyed by *AECOS* biologists in November 2007 and October 2009 (*AECOS*, 2010). The reef remnants off Maunalua Bay Beach Park and Portlock Bach are highly-eroded, low-relief limestone platforms. These shallow (less than 1 m or 3 ft) reef areas are covered with a veneer of sand and silt. Some sections are exposed at low tide. The benthic communities close to shore are highly disturbed and dominated by sessile filter and suspension feeding organisms. The reef flat off Maunalua Bay Beach Park and Portlock Beach is dominated by non-indigenous algae, such as *Acanthophora spicifera* (most abundant), *Avrainvillea amadelpha,* and *Lyngbya majuscule; Gracilaria salicornia* is occasionally found. The algae grow on limestone rubble, easily rolled by waves and swells. Algal growth is most dense close to shore. Other algae present on the reef flat include species that are preferred (Arthur and Balazs, 2008) by green sea turtles (*Chelonia mydas*), such as *Ulva fasciata*, *Hypnea cervicornis*, *Spyridia filamentosa*, *Cladophora catenata*, and *C. seriacea* (as well as the abundant *A. spicifera*). A seagrass bed, consisting of both the endemic *Halophila hawaiiana* and the introduced *H. decipiens*, is located off Portlock Beach, southeast of the project site.

Very few coral colonies are present on the reef flat, with the nearest colony to the entrance channel located more than 100 m (330 ft) offshore. Coral colonies present include *Montipora capitata*, *M. flabellata*, *Pocillopora damicornis*, *Poc. meandrina*, *Porites compressa* and *P. lobata*. Other reef macro-invertebrates, such as brittle stars, sea urchins, and sea anemones, are relatively uncommon. Fish biomass and diversity are very low in the nearshore areas of low relief bottom. Fifteen species of fishes were observed on the reef flat. *Arothron hispidus* (ʻ*oʻopu hue* or stripebelly puffer) and *Acanthurus nigrofuscus* (*māʻiʻiʻi* or brown surgeonfish) are common, while *Abudefduf abdominalis* (*mamo* or Hawaiian sergeant) and *Acanthurus blochii* (*pualu* or ringtail surgeonfish) are seen occasionally (*AECOS*, 2010).

Marina entrance channel — In 2007 and 2009, *AECOS* biologists surveyed the marina mouth for proposed maintenance dredging of the Hawaiʻi Kai Marina (*AECOS*, 2010). The following description is taken from that *AECOS* report. The bottom of the entrance channel consists largely of shifting sands and silt, and does not provide suitable habitat for most reef organisms. Hard surfaces, such as areas where the channel bisects the reef flat and concrete pilings of the bridge, are colonized by primarily introduced fouling organisms. The pilings, in particular, are heavily covered with *Carijoa riisei*, an introduced octocoral, and *Amathia distans* (bushy bryozoan). *Gracilaria salicornia* (gorilla ogo), an introduced red alga, is also attached to the pilings. *Dascyllus albisella* (ʻ*aloʻilo*ʻi or Hawaiian domino damselfish), *Acanthurus triostegus* (*manini* or convict tang), *Forcipiger flavissimus* (yellow longnose butterflyfish), and juvenile wrasses (Fam. Labridae) were observed in the entrance channel in the recent surveys.

Results of a survey conducted in 1988 and reported in the Environmental Assessment (EA) for the Maunalua Ferry Terminal (WOA, 1988) indicated the presence of burrows of *Alpheus mackayi* (snapping shrimp), and larger crab species in the entrance channel. The report also indicated the presence of *Psilogobius mainlandii* (Hawaiian shrimp goby), a species commensal with *A. mackay*, in bottom sediment.

Methods

Water Quality

Water quality samples were collected on March 13, 2015 from just below the water surface at three stations in the Project area; these locations are depicted in Figure 2. Station “Bridge” was just south of the Kalanianaʻole Highway bridge, approximately 1 m (3 ft) off the shore. Station “Channel” was located in the entrance channel, approximately 3 m (9.8 ft) west from the groin. Station “East” was located approximately 5 m (16 ft) east of the groin fronting Portlock Beach.

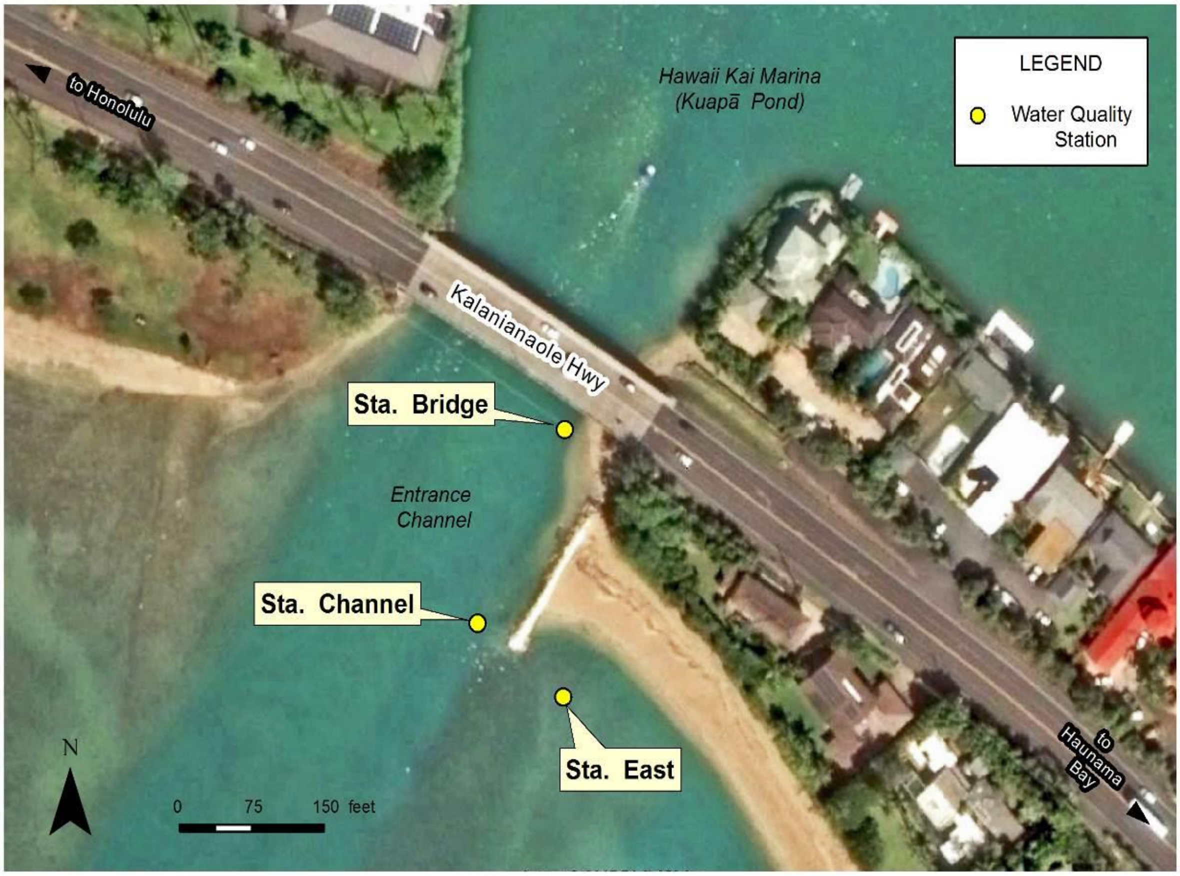

Figure 2. Location of water quality stations sampled on March 17, 2015.

Temperature, salinity, pH, dissolved oxygen (DO) and turbidity were measured in the field. Samples for total suspended solids (TSS), nutrients (ammonia, nitrate+nitrite, total nitrogen [TN], total phosphorus [TP]), and chlorophyll α were collected in appropriate containers, stored on ice, and delivered to *AECOS* Inc. laboratory on Oʻahu for analyses (*AECOS* log number 30827). Samples were analyzed by the methods as listed in Table 1.

Marine Survey

On March 17, *AECOS* biologists conducted a rapid assessment and quantitative survey of the marine community composition in the Project vicinity. The survey area included the existing sand bag groin, and the seafloor adjacent to either side of the groin and seaward from the groin structure (see Figure 3).

Table 1. Analytical methods and instruments used for water quality analyses for the Hawaii Kai Groin Project.

Analysis	**Method**	**Reference**	**Instrument**†
Temperature	SM 2550 B	SM (1998)	YSI Model PRO 20 DO meter thermistor
Salinity(field)	SM 2510-B	SM (1998)	YSI Model PRO 20 DO meter - conductivity calc.
pH	SM 4500 H+	SM (1998)	pHep HANNA meter
Dissolved Oxygen	SM 4500-O G	SM (1998)	YSI Model PRO 2030 DO meter
Salinity (salinometer)	SM 2510-B	SM (1998)	AGE Model 2100 salinometer
Turbidity	EPA 180.1 Rev 2.0	USEPA (1993)	HACH 2100N Turbidimeter
Total Suspended Solids	SM 2540 D	SM (1998)	Mettler Toledo H31 analytical balance
Ammonia	Kerouel and Aminot (1997)	Kerouel and Aminot (1997)	Seal AA3 Autoanayzer, colorimetric
Nitrate + Nitrite	Grasshoff (1983)	Grasshoff (1983)	Seal AA3 Autoanayzer, colorimetric
Total Nitrogen	Grasshoff (1983)	Grasshoff (1983)	Seal AA3 Autoanayzer, UV
Total Phosphorus	Grasshoff (1983)	Grasshoff (1983)	Seal AA3 Autoanayzer, UV
Chlorophyll *a*	SM 10200-H	SM (1998)	Turner Fluorometer

† typical instruments listed, others may have been substituted.

A total of five transects were used to survey the marine biota on the groin and surrounding bottom. Surveys on March 17 began at 10:00 AM, approximately 156 minutes before a -0.15 ft low tide (relative to MLLW; Hanauma Bay, HI. Station ID 1612301; NOAA, 2014). Underwater visibility ranged from 1 to 3 ft. Maximum water depth recorded was 5 ft (3 m). Marine biota were identified in the field and verified with various resource texts: algae (Huisman et al., 2007), macroinvertebrates (Hoover, 1999), and fishes (Hoover, 2008). A species list is presented as Appendix A.

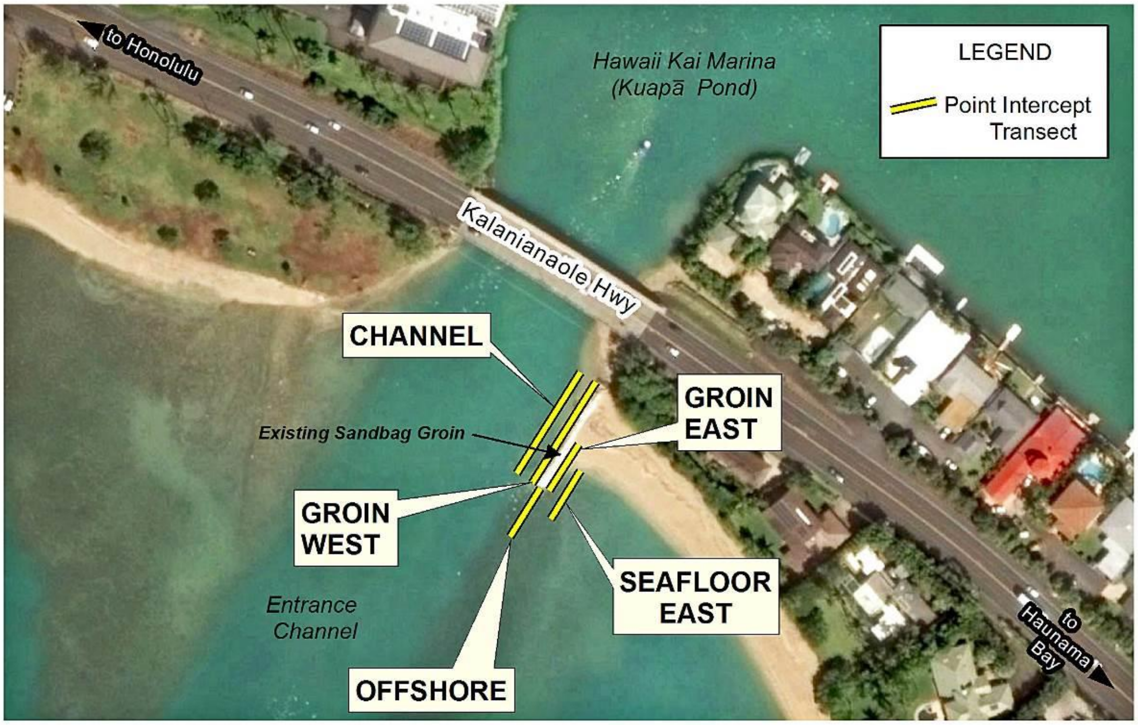

Figure 3. Approximate locations of March 2015 Hawaiʻi Kai Marina biological transect locations.

<u>Groin surveys</u> — One transect was placed parallel to the entire length of the groin on each side: one 43-m (141-ft) transect on the west side of the groin ("Groin West"); and one 23-m (75-ft) transect on the east side of the groin ("Groin East"). These transects were positioned on the groin midway between the base of the boulders and the waterline. On each transect, a line-point intercept protocol was used. At 0.5-m intervals, the bottom at each point was identified and assigned to one of the following categories: crustose coralline alga (CCA), macroalga, turf alga, macroinvertebrate, sand, rubble, or uncolonized (limestone, basalt, or man-made structure). Macroalgae were identified to a field identifiable taxon. Benthic percent cover was calculated for each transect by dividing the total number of points for a category by the total number of points sampled.

<u>Seafloor surrounding groin</u> — Three transects were used to sample the seafloor surrounding the groin: 1) a 43-m (141-ft) transect parallel to the west side of the groin and 5 m (16 ft) off the groin ("Channel"), 2) a 20-m(66-ft) transect oriented 5 m off the east side of the groin ("Seafloor East"); and 3) a 20-m (66-ft)

transect across the bottom, extending offshore from the seaward end of the groin ("Offshore").

Protected Species

Biologists recorded observations of any listed (threatened or endangered) marine species encountered during the survey.

Survey Results

Water Quality

The results of the March 13, 2015 water quality sampling event are summarized in Table 2. Temperature, DO saturation, and pH increased slightly from Sta. Bridge to Sta. East, while total nitrogen (TN) and total phosphorus (TP) concentrations decreased. No other spatial trends were apparent at the time of this sampling event.

Biological Observations

Groin — The intertidal zone of the existing sand groin is covered with macroalgae (*Spyridia filamentosa*, *Gracilaria salicornia*, *Griffithsia heteromorpha*, *Halimeda* sp.) and low-growing turf algae. Other, less frequently observed, algal species include: *Acanthophora spicifera*, *Asparagopsis taxiformis*, *Hypnea cervicornis*, *H. musciformis*, *Avrainvillea amadelpha*, *Cladophora socialis*, *Chaetomorpha antennina*, and *Padina* sp. Invertebrates are not common on the groin; those observed include a hydroid (*Pennaria disticha*), bryozoans (*Schizoporella errata* and *Reteporellina denticulate*), molluscs (*Hipponix imbricatus Dendostrea sandvichensis*, *Isognomon perna*), and a barnacle (*Euraphia hembeli*). A few juvenile mullets (*Mugil cephalus*) were observed on the west side of the groin, towards the entrance channel and bridge. Submerged stacked sand bags, with macroalgae and cyanobacteria, lie along the base of the west side of the groin (Fig. 4). Much of the east side of sand bag groin is uncolonized or coated with cyanobacteria and black tuft seaweed (*Sphacelaria* spp.). No corals were observed growing on the groin.

Seafloor beyond groin — The seafloor surrounding the groin is a relatively flat bottom of sand with patches of limestone and rubble. A large area of sand lies to the southeast of the groin, fronting Portlock beach. The reef platform seaward of the groin is coated with turf and macroalgae. Algal species observed in this area include: *G. salicornia*, *A. spicifera*, *Halimeda discoidea*, *H. opuntia*,

Table 2. Water quality conditions in the project area on March 13, 2015.

Station	Time	Temp. (ºC)	Salinity (PSU)	DO (mg/L)	DO Sat. (%)	pH
Bridge	1245	24.4	35.50	6.87	101	8.11
Channel	1257	25.3	35.30	6.80	102	8.11
East	1310	25.5	35.65	6.83	102	8.13

Station	Turbidity (NTU)	TSS (mg/L)	NH_3 (µg N/L)	NO_3+NO_2 (µg N/L)	Total N (µg N/L)	Total P (µg P/L)	Chl. α (µg/L)
Bridge	2.31	8.0	20	1	104	41	0.27
Channel	4.20	9.5	4	2	91	28	0.29
East	2.96	8.2	10	1	88	25	0.20

Figure 4. The intertidal zone on the sand bag groin is coated in macroalgae (left photo) that extends as macroalgal and cyanobacterial growth along the base of the west side of the groin (right photo).

Chnoospora minima, *Neomeris annulata*, *Griffithsia heteromorpha*, *Asparagopsis taxiformis*, and *Padina* sp. A large bed of seagrass (mixed *Halophlia decipens* and *H. hawaiiana*) was observed near the west side of the groin, located directly adjacent on the west side of the submerged sand bags. The bed extends west into the entrance channel and in the seaward direction

Few invertebrates occur on the bottom to either side of the groin and on the reef flat offshore of the groin. The invertebrates encountered include: sponges (*Iotrochota protea* and *Sigmoadocia* sp.), blue octocoral (*Sarcothelia edmondsoni*), annelid worms (*Sabellastarte spectabilis*, *Loimia medusa*, and *Salmacina dysteri*), hermit crab (*Diogenidae* sp.), and sea cucumber (*Eupata godeffroyi*). One frogfish (*Antennarius commerson*) was observed on the reef flat seaward of the groin. Figure 5 displays representative photos of the bottom in the survey area.

Figure 5. The area seaward of the groin is a relatively flat bottom of sand and patches of limestone and rubble with macroalgal cover (left photo). A bed of seagrasses (*Halophlia decipens* and *H. hawaiiana*) occurs west of the groin (right photo).

<u>Fish resources</u> — A total of 2 species of fishes were identified in the groin and surrounding area surveys: mulletfish (*Mugil cephalus*) and frogfish (*Antennarius commerson*).

Benthic Community Composition

<u>Groin</u> — Data collected from two transects on the groin were used to calculate benthic community composition (Figure 6). The dominant benthic type on the groin is macroalgae (41% mean cover) and sand (21% mean cover). Bare sandbag (as "uncolonized sandbag") mean cover is 14%, and turf algae mean cover is 13%. Invertebrate, cyanobacteria, and CCA cover are similar, at 7%, 6% and 5% cover, respectively. Rubble is minimal, at 2% mean cover. Coral cover here was zero.

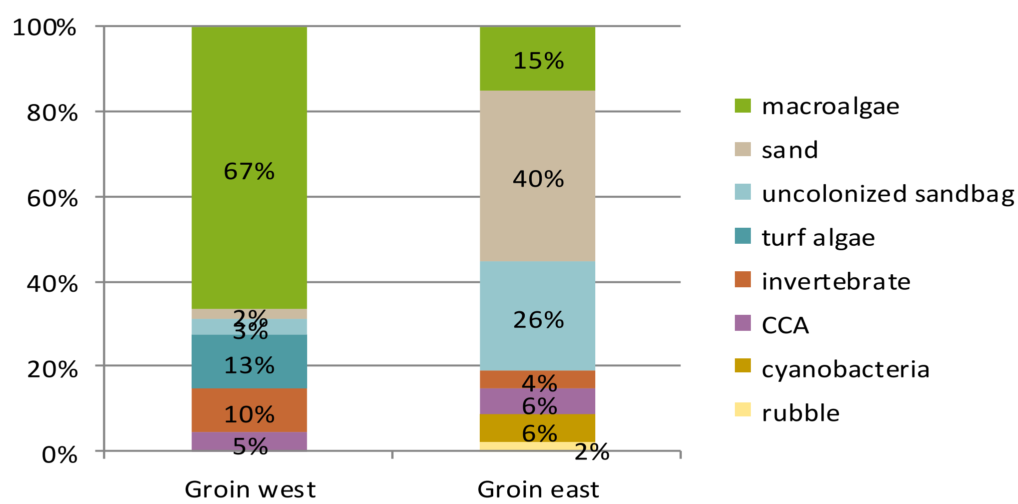

Figure 6. Mean percent benthic cover for groin, as measured using point-intercepts on two transects: one 43-m on the west side of the groin and one 23-m transect on the east side of the groin.

<u>Seafloor surrounding groin</u> — Data obtained from three transects laid on the seafloor surrounding the groin were used to calculate benthic community composition near the groin structure (Figure 7). The dominant benthic type on the seafloor is sand (54% mean cover), macroalgae and seagrass (each 13% mean cover). Rubble mean cover is 13% and bare limestone (as "uncolonized limestone") mean cover is 7%. CCA, turf, and cyanobacteria mean cover are minimal, at 4%, 2%, and 1%, respectively. Macroinvertebrate and coral cover are zero.

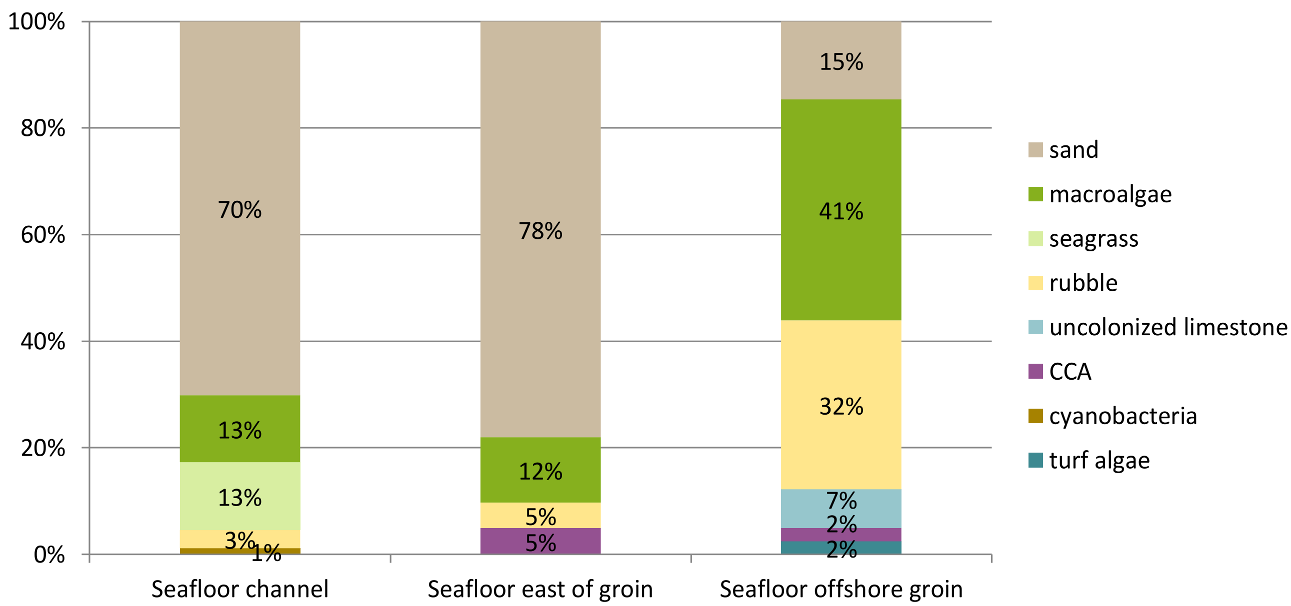

Figure 7. Mean percent benthic cover on reef surrounding groin as measured using point-intercepts on three transects surrounding the groin: one 43-m transect parallel to the west side of the groin, one 20-m transect off the east side of the groin, and one 20-m transect across the bottom, extending offshore of the groin.

Discussion

Water Quality

The Hawaii Kai Groin Project is located just off the shore in Maunalua Bay adjacent to the marina entrance channel. These waters are designated Class A marine waters (HDOH, 2014a). It is the objective of Class A marine waters that their use for recreational purposes and aesthetic enjoyment be protected. Other uses are permitted as long as compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. Class A waters cannot act as receiving waters for any discharge which has not received the best degree of treatment or control. No new industrial discharges are permitted, with exception of acceptable non-contact thermal and drydock or marine railway discharges, storm water discharges, and discharges covered by a NPDES general permit approved by the U.S. Environmental Protection Agency (USEPA).

The waters of Maunalua Bay are listed on the Hawaiʻi Department of Health 2014 list of impaired waters prepared under Clean Water Act §303(d) (HDOH, 2014a). The listing indicate that waters in these areas do not meet applicable water quality standards for nitrate+nitrite, ammonia, total nitrogen, and chlorophyll α

Table 3. Selected state water quality criteria applicable to ”dry” embayments after HAR §11-54-06 (3) (HDOH, 2014a).

Parameter	Geometric Mean value not to exceed this value	Value not to be exceeded more than 10% of the time	Value not to be exceeded more than 2% of the time
Total Nitrogen (µg N/L)	150.0	250.0	350.0
Ammonia (µg N/L)	3.5	8.5	15.0
Nitrate+Nitrite (µg N/L)	5.0	14.0	25.0
Total Phosphorus (µg/L)	20.0	40.0	60.0
Chlorophyll α (µg/L)	0.50	1.50	3.00
Turbidity (NTU)	0.40	1.0	1.50

Other "standards":

- pH units shall not deviate more than 0.5 units from ambient and not lower than 7.0 nor higher than 8.6.
- Dissolved oxygen shall not decrease below 75% of saturation.
- Temperature shall not vary more than 1C° from ambient conditions.
- Salinity shall not vary more than 10% from ambient.

State water quality criteria for embayments (see Table 3, above) comprise “wet” and “dry” criteria values based on average percent of freshwater inflow: wet criteria apply where average fresh water inflow from the land equals or exceeds one per cent of the embayment volume per day; dry criteria apply where average fresh water inflow from the land is less than one per cent of the embayment volume per day. In this case, dry criteria apply based upon the salinity results that show no significant dilution from oceanic salinity (35.20 PSU; SOEST, 1996) for Maunalua Bay.

The primary purpose of our water quality measurements was to characterize the existing aquatic environment, not to set baseline values or determine compliance with Hawaii's water quality standards. State criteria for all nutrient measurements, turbidity, and chlorophyll α are based upon having geometric mean values, which require a minimum of three separate samples per sampling station to calculate.

Water quality conditions in the project area on March 13, 2015 met state water quality criteria for pH, and DO saturation. Conditions likely comply with temperature and salinity criteria (measured values are essentially ambient). Turbidity was within a range common for Hawaiian embayments. There are no state embayment criteria for TSS, but this parameter is often measured for projects that could possibly impact sediment distribution.

Nutrients (with the exception of ammonia) were characteristic of Hawaiʻi embayments. Ammonia concentrations were elevated at Stas. Bridge and East. The reason for this is not known, but may have been due to decaying organic matter in Kaupā Pond; ammonia being an intermediate breakdown product of organic nitrogen.

Potential exists for short term impacts from construction activities on water quality of the nearshore environment. A possible impact from construction is introduction of sediment into the water from construction activity. Recommended standard best management practices (BMPs) to protect water quality during construction should be used to minimize impacts to fish and wildlife resources. Such BMPs include, but are not limited to, using silt containment devices, avoiding creating runoff during coral spawning periods, and protecting soils from erosion.

Marine Resources

In general, the marine environment on the groin and on bottom surrounding the groin is dominated by macroalgae, algal turf, and sand.

ESA-listed and state protected species

No listed (endangered or threatened; DLNR, 1998, 2002, 2007, 2009; NOAA-NMFS, 2007 and 2011; USFWS, 2015) species were encountered in the March

2015 survey. Listed marine species (sea turtles, Hawaiian monk seal, and humpback whale) can occur in the general vicinity as might state-protected species (hermatypic corals and black-lipped pearl oyster or *Pinctada margaritifera*). The Project includes work in marine waters where ESA-listed species may be exposed to project-related activity. Sea turtles and marine mammals typically avoid human activity, so exposure to such activity and equipment operation would be infrequent and non-injurious, resulting in insignificant effects on the ESA-listed marine species. Additionally, protected species BMPs require that the project manager and contractor reduce the likelihood of interactions by watching for and avoiding protected species before commencing work and by postponing or halting operations when protected species are within 50 yards of project activities (USACE, 2012).

<u>Sea turtles</u> — Of the sea turtles found in the Hawaiian Islands, only the green sea turtle is likely in the Project vicinity. The hawksbill sea turtle (*Eretmochelys imbricata*) is rare in the Hawaiian Islands and only known to nest in the southern reaches of the state (NOAA-PIFSC, 2010). In 1978, the green sea turtle was listed as a threatened species under the Endangered Species Act (ESA; USFWS, 1978, 2001). Since protection, the green sea turtle has become the most common sea turtle in the Hawaiian Islands with a steadily growing population (Chaloupka et al., 2008). Threats to the green sea turtle in Hawaiʻi include: disease and parasites, accidental fishing take, boat collisions, entanglement in marine debris, loss of foraging habitat to development, and ingestion of marine debris (NMFS-USFWS, 1998).

Green sea turtle nesting occurs mostly on beaches of the Northwestern Hawaiian Islands, with 90% occurring at French Frigate Shoals (Balazs et al., 1992). None of the Hawaiian sea turtles is known to nest in the Project vicinity.

The green sea turtle diet consists primarily of benthic macroalgae (Arthur and Balazs, 2008), which the shallow reefs of the main Hawaiian Islands provide in abundance. Red macroalgae generally make up 78% of their diet, whereas green macroalgae make up 12% (Arthur and Balazs, 2008). Turbidity (murky water) does not appear to deter green sea turtles from foraging and resting areas and construction projects in Hawaiʻi have found sea turtles adaptable and tolerant of construction-related disturbances (Brock, 1998a,b). During our survey, no green sea turtles were observed, although a food resource (seagrass, see below) occurs there.

<u>Shellfishes</u> — Shellfishes, including pearl oyster (*Pinctada margaritifera*), are regulated throughout the State of Hawaiʻi, where it is prohibited to "catch, take, kill, possess, remove, sell or offer for sale", without a permit, pearl oysters and 6

other shellfishes (DLNR, 2009). None of the regulated shellfishes was observed during our survey.

Monk seal — Oʻahu's beaches and coastline are used by the endangered Hawaiian monk seal (*Monachus schauinslandi*) for hauling out and for pupping and nursing. Currently, only the remote Northwestern Hawaiian Islands are considered critical habitat for this species (50 CFR 226.201). However, recently the waters surrounding the Main Hawaiian Islands (MHI) have been proposed as monk seal critical habitat, excluding portions (e.g., boat harbors, cliffs, active lava, and large bays with extensive runoff) of the MHI coastal environments considered hardened shorelines or developed areas that do not have the essential features that would support Hawaiian monk seal use. The Project area does not meet the definition of critical habitat for monk seal. As defined as a location delineated by the identified boundaries, Maunalua Bay and Hawaiʻi Kai Harbor delineated as all coastline and waters located inshore of the line drawn between 21°16′53.22″ N/157°43′21.77″ W east to the point 21°15′49.13″ N/157°42′41.45″ W (50 CFR 226, June 2, 2011; NOAA-NMFS, 2011). The Project area is not proposed as critical habitat for this species.

Humpback whale — The humpback whale or *koholā* (*Megaptera novaeangliae*) was listed as endangered in 1970 under the ESA. In 1993 it was estimated that there were 6,000 humpback whales in the North Pacific Ocean, and that 4,000 of those regularly came to the Hawaiian Islands. The population is estimated to be growing at between 4 and 7% per year. Today, as many as 10,000 humpback whales may visit Hawaiʻi each year (HIHWNMS, 2014). The waters of the Project area are within the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS, 2014).

Coral — Coral species are protected under Hawaiʻi state law, which prohibits "breaking or damaging, with any implement, any stony coral from the waters of Hawaiʻi, including any reef or mushroom coral" (HAR §13-95-70; DLNR, 2010). It is also unlawful to take, break or damage with any implement, any rock or coral to which marine life of any type is visibly attached (HAR §13-95-71, DLNR, 2002). On August 27, 2014, NOAA issued a final rule for listing 20 coral species as threatened under ESA (NOAA-NMFS, 2014). None of these newly listed corals occurs in Hawaiʻi.

Seagrasses — Three species of seagrasses are found in Hawaiʻi: an endemic (*Halophila hawaiiana*), an indigenous (*Ruppia maritima*), and an introduced species (*Halophila decipiens*). Seagrasses, although not types of grass, are vascular plants and not algae. In general, seagrasses thrive in areas with low sedimentation, adequate water flow, and low wave energy (Hemminga and Duarte, 2000). Previous studies have observed *H. hawaiiana* and *H. decipiens* in sand areas offshore of Portlock Beach and Maunalua Bay Beach Park (*AECOS*, 2010). Seagrass constitutes a unique habitat in Hawaiian waters and both species of *Halophila* are consumed by green sea turtles (Russell et al., 2003). The general degradation of seagrass beds by eutrophication (excessive nutrients from land runoff), sedimentation, chemical poisoning, collecting and gleaning, trampling, anchoring, etc. is a widespread threat to the recovery of depleted sea turtle stocks (NMFS and USFWS, 1998a and 1998b).

Seagrass beds are considered a Special Aquatic Site under the Clean Water Act (Subpart E of 40 CFR Part 230). Special aquatic sites are defined in the Act as "… sanctuaries and refuges, wetlands, mud flats, vegetated shallows (seagrass beds), coral reefs, and [stream] riffle and pool complexes." When a project requiring a Clean Water Act, Section 404 permit (regulating the discharge of dredged, excavated, or fill material in wetlands, streams, rivers, and other waters of the U.S.) is proposed to be conducted in a Special Aquatic Site, as part of the permitting process, all alternatives that do not result in a discharge into a Special Aquatic Site are presumed to have lesser adverse impact.

Essential Fish Habitat

The 1996 Sustainable Fishery Act amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and subsequent Essential Fish Habitat (EFH) Regulatory Guidelines (NOAA, 2002) describe provisions to identify and protect habitats of federally-managed marine and anadromous fish species. Under the various provisions, federal agencies that fund, permit, or undertake activities that may adversely affect EFH are required to consult with the National Marine Fisheries Service (NMFS).

Congress defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." (MSFCMA, 1996; NOAA, 2002). EFH provisions in MSFCMA designate that species harvested in sufficient quantities to require fisheries management are to be subdivided into similar Management Unit Species (MUS). Five MUS groups are currently managed in Hawaiian waters: bottomfish, pelagics, precious corals, crustaceans, and coral reef ecosystem. In the waters surrounding the Hawaiian Islands, EFH for coral reef ecosystem MUS as defined by the Final Coral Reef Ecosystem Fishery Management Plan (WPRFMC, 2001) and subsequent Fishery Ecosystem Plan for the Hawaiian Archipelago (WPRFMC, 2005) and "includes all waters and habitat at depths from the sea surface to 50 fathoms extending from the shoreline (including state and territorial land and waters) to the outer boundary of the Exclusive Economic Zone (EEZ)."

The proposed Project is located within waters designated as EFH (including water column and all bottom areas) for coral reef ecosystem, bottomfish, pelagic and crustacean MUS. Of the thousands of species which are federally managed under the coral reef FMP, at least 58 (juvenile and adult life stages) are known to occur in the general vicinity of Hawaiʻi Kai Marina entrance channel and Maunalua Bay (*AECOS*, 2010).

Direct Impacts

The nearshore and reef flat biological assemblages of Maunalua Bay in the vicinity of the Hawaiʻi Kai marina are poorly developed and suggest a highly disturbed environment. Maunalua Bay appears to be negatively affected by a variety of environmental disturbances, including freshwater input and sedimentation, from landward sources. Direct impacts to marine biological resources at the Hawaii Kai groin site will result in the loss of marine resources that occur on the existing groin and within the footprints of the existing and proposed structures. These communities are dominated by a number of algal species. Biological assemblages residing on and around the present groin will be impacted, but it is expected that similar assemblages will recolonize any newly placed solid structure. Recruitment of biota to the new groin structures will likely include marine species established nearby, and may possibly include corals.

It is anticipated that the fish that occur in the Project vicinity will actively avoid direct impacts from Project activities. Some impairment of ability of EFH managed species to find prey items could occur, but this effect should be temporary and spatially limited to the immediate vicinity of construction activities. Most of the MUS that use the EFH species are not tied to artificial substrates, and routinely experience turbid and sand scoured environment in the area. The new structure will maintain fish habitat in the project area, and will provide additional fish foraging resources on the new groin. Construction of the groin on essentially sand bottom is not expected to adversely affect fish populations, fish habitat, or fish foraging resources. Infaunal resources are expected to recover rapidly.

Indirect Impacts

Potential indirect impacts to coral reef ecosystems and associated EFH from construction and operation of the Project may occur from degradation of water quality. Project construction may temporarily increase the amount of suspended sediment in the water column. It is anticipated that most fishes will avoid construction areas, and that potential impacts would be temporary and minor, resulting in displacement followed by rapid postconstruction recolonization by these species. Such avoidance would occur only in those areas where active in-water work is occurring. Impacts to water quality associated with Project activities will be temporary and can be minimized using appropriate construction BMPs. Indirect impacts on EFH from construction are not expected if BMPs are implemented and adhered to. Thus, it will be necessary to enclose the groin project area with silt/sediment barriers as a BMP to contain suspended particulates during in-water work. At a minimum, water quality monitoring before, during, and after construction should be conducted for temperature, salinity, pH, DO, and particulates to insure compliance with state water quality criteria. Because the old groin will be removed in its entirety and replaced with a more stable one, biological monitoring would be unnecessary during construction. A postconstruction survey similar in scope to the preconstruction effort described herein could be conducted after one year to document recovery and/or improvements in benthic biota resulting from the Project.

References

AECOS, Inc. (*AECOS*). 1979. Hawaii Coral Reef Inventory: Island of Oahu. Part B – Sectional Map Descriptions. Prep. for: U.S. Army Corp of Engineers, Pacific Ocean Division, Fort Shafter, Hawaiʻi. 552 pp.

________. 2010. Marine biological and water quality resources at Hawaiʻi Kai Marina, Hawaiʻi Kai, Oʻahu. Prep for Anchor Environmental. *AECOS* Report No. 1150: 45 pp.

Arthur, K. E. and G. H. Balazs. 2008. A comparison of immature green turtles (*Chelonia mydas*) diets among seven sites in the main Hawaiian Islands. *Pacific Science*, 62(2): 205–217.

Balazs, G. H., H. F. Hirth, P. Kawamoto, E. Nitta, L. Ogren, R. Wass and J. Wetherall. 1992. Recovery plan for Hawaiian sea turtles. *Nat Marine Fish. Ser., S. F. S. C.*, Honolulu, Adm. Rep. H-92-01: 76 pp.

Barry, J. 2015. Pers. communication (email).

Battista, T. A., Costa, B. M., and S. M. Anderson, S. M. 2007. Shallow-Water Benthic Habitats of the Main Eight Hawaiian Islands (DVD). *NOAA Tech. Memo. NOS-NCCOS* 61, Biogeography Branch. Silver Spring, MD. Available online at URL: http://ccma.nos.noaa.gov/products/biogeography/hawaii_cd_07/default.aspx; last accessed December 1, 2011.

Brainard, R. E., C. Birkeland, C. M. Eakin, P. McElhany, M. W. Miller, M. Patterson, and G. A. Piniak. 2011. Status review report of 82 candidate coral species petitioned under the U.S. Endangered Species Act. U.S. Dep. Commerce, NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-27, 530 p. + 1 Appendix. Available online at URL: http://www.pifsc.noaa.gov/library/pubs/tech/NOAA_Tech_Memo_PIFSC_27.pdf; last accessed December 14, 2013.

Brock, R. E. 1988a. Green sea turtle population monitoring during blasting work at West Beach, Oahu. Final Report. Prep. for Alfred A. Yee Division, Leo A. Daly. 15 pp.

________. 1988b. Green turtles (*Chelonia mydas*) at Hawaiʻi Kai, Hawaiʻi: An analysis of the impacts with the development of a ferry system. Prep. for Sea Engineering, Inc. 26 pp.

Chaloupka, M., K. A. Bjorndal, G. H. Balazs, A. B. Bolten, L. M. Ehrhart, C. J. Limpus, H, Suganuma, S. Troeng, and M. Yamaguchi. 2008. Encouraging outlook for recovery of a once severely exploited marine megaherbivore. *Global Ecology and Biogeography*: 17: 297-304.

Denny, J. 2010. *A Photographic Guide to the Birds of Hawaii: the Main Islands and Offshore Waters*. University of Hawaiʻi Press. 209pp.

Grasshoff, K., M. Ehrhardt, and K. Kremling. 1983. Methods of Seawater Analysis, second revised and extended edition,

Hawaii Department of Health (HDOH). 2014a. Hawaiʻi Administrative Rules, Title 11, Department of Health, Chapter 54, Water Quality Standards. State of Hawaiʻi, Department of Health. 110 pp.

________. 2014b. State of Hawaii Water Quality Monitoring and Assessment Report: Integrated Report to the U.S. Environmental Protection Agency and the U.S. Congress Pursuant to §303(d) and §305(b), Clean Water Act (P.L. 97-117). 123 pp.

Hawaii Department of Land and Natural Resources (DLNR). 1998. Indigenous wildlife, endangered and threatened wildlife and plants, and introduced wild birds. State of Hawaiʻi, Department of Land and Natural Resources, Administrative Rule §13-124-1 through §13-124-10, with Exhibits.

________. 2002. Hawaiʻi Administrative Rules, Title 13, Department of Land and Natural Resources, Chapter 99, Protected Marine Fisheries Resources, Rules Regulating the Taking and Selling of Certain Marine Resources. 14 pp.

________. 2007. Hawaiʻi Administrative Rules. Department of Land and Natural Resources. Title 12. Conservation and Resources. Chapter 188. Fishing Rights and Regulations. 5 pp.

Hawaii Department of Land and Natural Resources (DLNR). 2009. Hawaiʻi Administrative Rules. Title 13.Department of Land and Natural Resources. Chapter 4. Protected Marine Fisheries. 15 pp.

Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS). 2014. HIHWNMS website – Resource Protection. Available online at URL: http://hawaiihumpbackwhale.noaa.gov/; last accessed April 2, 2015.

Hemminga, M. A. and C. M. Duarte. 2000. *Seagrass Ecology: An Introduction.* Cambridge University Press, Cambridge, MA. 298 pp.

Hoover, J. P. 1999. *Hawaiʻi's sea creatures: a guide to Hawaiʻi's marine invertebrates*. Mutual Publishing, Honolulu, Hawaiʻi. 366 pp.

________. 2008. *The ultimate guide to Hawaiian reef fishes, sea turtles, dolphins, whales, and seals*. Mutual Publishing, Honolulu, Hawaiʻi. 388p.

Huisman, J. M., I. A. Abbott, and C. M. Smith. 2007. *Hawaiian Reef Plants.* Hawaiʻi Sea Grant College Program, Honolulu, Hawaiʻi. 264 pp.

Kerouel, R. and A. Aminot. 1997. Fluorometric determination of ammonia in sea and estuarine waters by direct segmented flow analysis. Marine Chemistry Vol. 57, no. 3-4, pp. 265-275.

Kumu Pono Associates. 1998. Historical Documentary Research: Kawaihoa-Kuamoʻokāne, Hanauma, and Kohelepelepe - The Koko Head Regional Park and Nature Preserve, Ahupuaʻa of Maunalua, District of Kona, Island of Oʻahu. Prep. for: Group 70 International. 37 pp.

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). 1996. MSFCMA as amended through October 11, 1996. 16 U.S.C. §1801-1883. Available online at URL: www.nmfs.noaa.gov/sfa/magact/; last accessed on April 21, 2015.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and UWFWS). 1998. Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle (*Eretmochelys imbricata*). National Marine Fisheries Service, Silver Spring, MD. 95 pp. Available online at URL: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_hawksbill_pacific.pdf; last accessed April 2, 2015

_______ & _______. 1998. Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Spring, MD. 97 pp. Available online at URL: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_green_pacific.pdf; last accessed April 2, 2015.

National Oceanic and Atmospheric Administration (NOAA). 2002. Department of Commerce, National Oceanic and Atmospheric Administration. 50 CFR 600. Magnuson-Stevens Act Provisions; Essential Fish Habitat (EFH). *Federal Register* 67 (12 ,Thursday, January 17, 2002) 2343-2483.

_______. 2014. Tides and currents. Predicted tides at Haumana Bay, Hawaiʻi, HI. Station ID: 1612301. Available online at URL: http://tidesandcurrents.noaa.gov/noaatidepredictions/viewDailyPredictions.jsp?bmon=12&bday=12&byear=2014&timelength=daily&timeZone=1&dataUnits=1&datum=MLLW&timeUnits=2&interval=highlow&Threshold=greaterthanequal&thresholdvalue=&format=Submit&Stationid=1612340; last accessed January 29, 2015.

National Oceanic and Atmospheric Administration – National Marine Fisheries Service (NOAA-NMFS). 2007. Green Sea Turtle (*Chelonia mydas*). 5-Year Review: Summary and Evaluation. 105 p. Available online at URL: http://www.nmfs.noaa.gov/pr/pdfs/species/greenturtle_5yearreview.pdf.

_______. 2011. 50 CFR 226. Endangered and threatened wildlife and plants: proposed rulemaking to revise critical habitat for Hawaiian Monk Seals. *Federal Register*, 76 (106; June 2, 2011): 32026-32063. Available online at URL: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr76-32026.pdf; last accessed October 3, 2014.

_______. 2014. Department of Commerce. Endangered and Threatened Wildlife and Plants: Final Listing Determination on Proposal to List 66 Reef-building Coral Species and to Reclassify Elkhorn and Staghorn Corals. Available online at URL: http://www.nmfs.noaa.gov/stories/2014/08/docs/final_coral_rule.pdf.

Nixon, D.W. 1994. Marine and Coastal Law: Cases and Materials. Greenwood Publishing Group. 373 pp.

School of Ocean and Earth Science and Technology (SOEST). 1996. The Ocean Atlas of Hawaiʻi. Available online at URL: http://oos.soest.hawaii.edu; last accessed April 6, 2015.

Standard Methods (SM). 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. (Greenberg, Clesceri, and Eaton, eds.). APHA, AWWA, & WEF. 1100 pp.

U.S. Army Engineer District Honolulu (USACE). 1975. Final environmental statement for Department of the Army permit applications in the Hawaiʻi Kai Marina, Oʻahu, Hawaiʻi. 52 pp. + appendices.

Wilson Okamoto & Associates, Inc. (WOA). 1988. Environmental Assessment for Maunalua Bay Ferry Terminal. Prep. for: Hawaiʻi Dept. of Trans.-Harbors Div. 190 pp. + appendices.

U.S. Army Corps of Engineers (USACE). 2012. Department of Defense, Department of the Army, Corps of Engineers. Reissuance of Nationwide Permits Notice. *Federal Register*, 77 (34; Tuesday, February 21, 2012): 10184-10290. Available online at URL: http://www.gpo.gov/fdsys/pkg/FR-2012-02-21/pdf/2012-3687.pdf; last accessed January 30, 2014.

U.S. Environmental Protection Agency (USEPA). 1993. METHOD 180.1 Determination of Turbidity by Nephelometry. Revision 2.0. Environmental Monitoring Systems Laboratory. Office of Research and Development. U.S. Environmental Protection Agency. Cincinnati, Ohio. 180.1-1. 10 pp.

U.S. Fish and Wildlife Service (USFWS). 2015. USFWS Threatened and Endangered Species System (TESS). Available online at URL: http://www.fws.gov/endangered/; last accessed April 8, 2015.

Western Pacific Regional Fishery Management Council (WPRFMC). 2001. Final Coral Reef Ecosystem Fishery Management Plan. Available online at URL: http://www.wpcouncil.org/Hawaiʻi/coralreef.htm#Coral_FMP; last accessed on April 6, 2015.

______. 2005. Fishery Ecosystem Plan for the Hawaiian Archipelago. 279 pp. Available online at URL: http://www.wpcouncil.org/Hawaiʻi/HawaiʻiFEP/December12005Hawaiʻi FEP.pdf; last accessed on September 2, 2013.

Appendix A. Inventory of marine biota observed off the Hawaiʻi Kai groin and surrounding seafloor, Hawaiʻi Kai, Oʻahu (March 17, 2015)

PHYLUM, CLASS, ORDER **FAMILY** *Genus Species*	Common name, *Hawaiian name*	Status	Abundance
	ALGAE		
CYANOPHYTA	BLUE-GREEN ALGAE		
Lyngbya majuscula		---	C
RHODOPHYTA	RED ALGAE		
Acanthophora spicifera	*limu ʻakiʻaki*	Nat.	C
Asparagopsis taxiformis	*limu kohu* or *limu līpehe*	Nat.	
Gracilaria salicornia	gorilla *ogo*	Nat.	A
Griffithsia heteromorpha		Ind.	A
Hypnea cervicornis		Ind.	C
Hypnea musciformis	Hookweed	Ind.	C
Spyridia filamentosa		Ind.	A
CHLOROPHYTA	GREEN ALGAE		
Avrainvillea amadelpha	leather mudweed	Nat.	R
Cladophora socialis		Ind.	C
Chaetomorpha antennina		Ind.	O
Dictyota cf ceylanica		Ind.	R
Dictospaeria versluyii		Ind.	R
Halimeda opuntia	prickly pear halimeda		
Halimeda discoidea	rosette halimeda	Ind.	A
Neomeris sp.		Ind.	U
OCHROPHYTA	BROWN ALGAE		
Chrysonephos lewisii		Ind.	O
Chnoospora minima		Ind.	R
Lobophora variegate	variegated seaweed	Ind.	R
Padina sp.		Ind.	R
Sphacelaria spp.	black tuft seaweed	Ind.	C
MAGNOLIOPHYTA	SEAGRASS		
Halophila decipiens		Nat	C
Halophila hawaiiana		End.	C
	INVERTEBRATES		
PORIFERA, DEMOSPONGIAE, MYXILLIDAE	SPONGES		
Iotrochota protea	staining sponge	Ind	O
CHALINIDAE			
Sigmoadocia sp.	Boring sponge	Nat	O

PHYLUM, CLASS, ORDER **FAMILY** *Genus Species*	Common name, *Hawaiian name*	Status	Abundance
CNIDARIA, HYDROZOA, ANTHOATHECATA	HYDROIDS		
PENNARIIDAE			
Pennaria disticha	Christmas tree hydroid	Ind	R
CNIDARIA, ANTHOZOA, ALCYONACEA	SOFT CORALS		
XANIIDAE			
Sarcothelia edmondsoni	blue octocoral	End.	O
ANNELIDA, POLYCHAETA	ANNELID WORMS		
SABELLIDAE			
Sabellastarte spectabilis	feather duster worm	Ind	C
SERPULIDAE			
TEREBELLIDAE			
Loimia medusa	medusa spaghetti worm	Ind	O
SERPULIDAE			
Salmacina dysteri	sea frost	Ind	R
ECTOPROCTA, GYMNOLAEMATA, CHEILOSTOMATA	BRYOZOANS		
RETEPORIDAE			
Reteporellina denticulata	lace bryozoan	Ind	R
SCHIZOPORELLIDAE			
Schizoporella errata	erratic bryozoan	Ind	R
MOLLUSCA, GASTROPODA	GASTROPODS		
HIPPONICIDAE			
Hipponix imbricatus	shingly hoof shell	Ind.	R
MOLLUSCA,BIVALVIA	BIVALVES		
OSTREIDAE			
Dendostrea sandvicensis	Hawaiian oyster	Ind	O
ISOGNOMONIDAE			
Isognomon perna	brown purse shell, *nahawele*	Ind	
Unid. *Ostreidae*			O
ARTHROPODA, CRUSTACEA, CIRRIPEDIA	BARNACLES		
CHTHAMALIDAE			
Euraphia hembeli	Hembel's rock barnacle	Ind	R
DIOGENIDAE	HERMIT CRABS		
Unid. *Diogenidae*			R
ECHINODERMATA, HOLOTHUROIDEA	CUCUMBERS		
SYNAPTIDAE			
Eupata godeffroyi	Lion's paw sea cucumber	Ind.	R

PHYLUM, CLASS, ORDER **FAMILY** *Genus Species*	Common name, *Hawaiian name*	Status	Abundance
	VERTEBRATES		
VERTEBRATA, ACTINOPTERYGII, PERCIFORMES	BONY FISHES		
MUGILIDAE	MULLETFISH		
Mugil cephalus	Striped mulletfish; *ʻamaʻama*	Ind	R
ANTENNARIIDAE	FROGFISHES		
Antennarius commerson	Commerson's frogfish	Ind.	R

KEY TO SYMBOLS USED:
Abundance categories:
R – Rare – only one or two individuals observed.
U – Uncommon – several to a dozen individuals observed.
O – Occasional – seen irregularly in small numbers
C – Common – observed everywhere, although generally not in large numbers.
A – Abundant – observed in large numbers and widely distributed.
Status categories:
End – Endemic – species found only in Hawaiʻi
Ind – Indigenous – species found in Hawaiʻi and elsewhere
Nat – Naturalized – species introduced to Hawaiʻi intentionally, or accidentally.