

DRAFT ENVIRONMENTAL ASSESSMENT

Prepared in Accordance with Hawaii Revised Statutes, Chapter 343

Honolulu Marine Shipyard at Ke‘ehi Lagoon

Tax Map Keys (TMKs): 1-2-025:024 (por.) & 035
Honolulu, O‘ahu, Hawai‘i

August 2007

Honolulu Marine, LLC
123 Ahui Street
Honolulu, Hawai‘i 96813



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Prepared by:
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PROJECT SUMMARY

Project:	Honolulu Marine Shipyard at Ke'ehi Lagoon
Landowner/Applicant	State of Hawai'i, Dept. of Transportation, Harbors Division (Owner)/Dept. of Land and Natural Resources, Division of Boating and Ocean Recreation (Manager)/ Honolulu Marine, LLC (Applicant)
Accepting Agency	State of Hawai'i, Board of Land and Natural Resources
Agent	R.M. Towill Corporation
Location	4 Sand Island Access Road, Honolulu, Hawai'i
Tax Map Key	(1) 1-2-025: 024 (por.) and 35
Proposed Action	Development of a shipyard facility at Ke'ehi Lagoon
Land Area	Ke'ehi Lagoon Small Boat Harbor: 71,351 square feet/1.64 acres Kalihi Channel: 20,900 square feet/0.48 acres
Present Use	Vacant
State Land Use District	Urban
Zoning	I-3, Waterfront Industrial
Primary Urban Center Development Plan Land Use Designation	Major Parks and Open Space
Special Management Area	Yes
Permits Required	Special Management Area Permit, Shoreline Setback Variance, Conservation District Use Permit, Building Permit, Grading Permit, NPDES NOI-B, NOI-C & NOI-G, Department of the Army Permit, Water Quality Certification, CZM Federal Consistency Determination, Private Aids to Navigation Permit
Anticipated Determination	Finding of No Significant Impact (FONSI)

SECTION 1

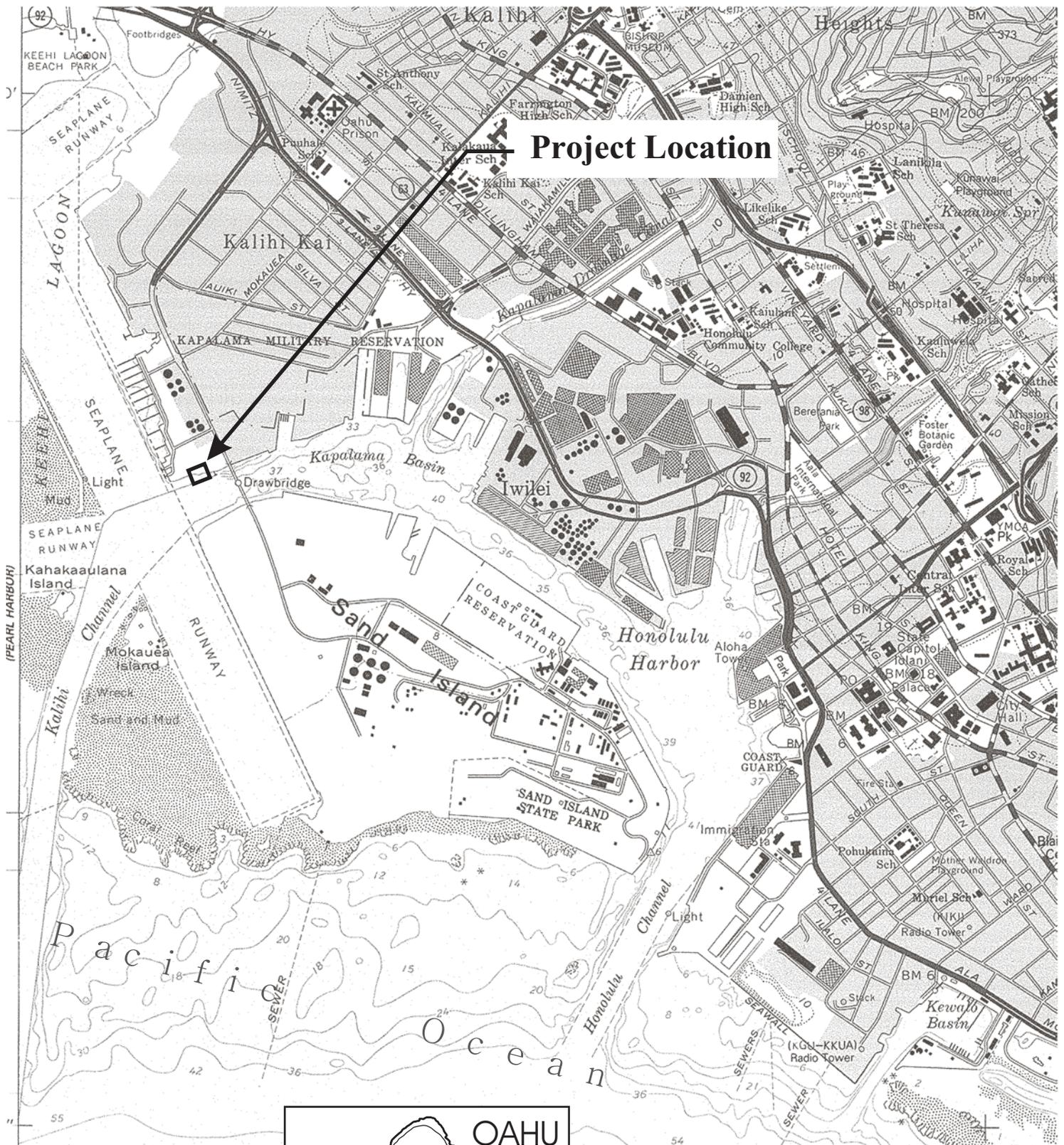
INTRODUCTION

1.1 INTRODUCTION

Honolulu Marine, LLC (Honolulu Marine), currently operates a shipyard facility at 123 Ahui Street on a 103,597 square-foot waterfront lot at the Ewa edge of Kewalo Basin. Honolulu Marine's operational activities at the Kewalo Shipyard include the construction of new vessels and the repair and maintenance of maritime vessels owned by P&R Water Taxi, Ltd. (a sister company to Honolulu Marine), the United States Navy, and other government and private parties involved in marine research, fishing, and commercial tugboat and barge services.

The Kewalo Shipyard is currently under a lease agreement with the Hawai'i Community Development Authority (HCDA). HCDA has been tasked with redevelopment of the Kaka'ako business district which includes the present location of Honolulu Marine. Although the present lease arrangement with Honolulu Marine will allow the temporary use of the site for maritime operations, HCDA will eventually require the future use of the site for other purposes that will require the relocation of Honolulu Marine. In May 2005, the Hawai'i State Legislature recognizing the importance of the maritime services provided by Honolulu Marine to the State of Hawai'i adopted Senate Concurrent Resolution No. 134, S.D.1, H.D.1, authorizing the lease of both fast and submerged land at the Ke'ehi Lagoon Small Boat Harbor for the redevelopment, management, and operation of a commercial ship repair facility (see **Appendix B**).

The proposed site for the relocation will involve the use of a 71,351 square-foot vacant site adjacent to the Ke'ehi Lagoon Small Boat Harbor, and approximately 20,900 square feet of submerged land in the Kalihi Channel. See **Figure 1, Project Location**. The improvements planned to allow use of the site for a small boat shipyard include construction of a 120' x 64' floating dry dock, a 135' x 30' finger pier, and a 40' x 200' two-story combination office building, storeroom and fabrication shop. Site improvements will require grading and paving of the lot and installation of a chain-link fence along the perimeter of the property to address security requirements. See **Figure 2, Site Plan**.



Project Location

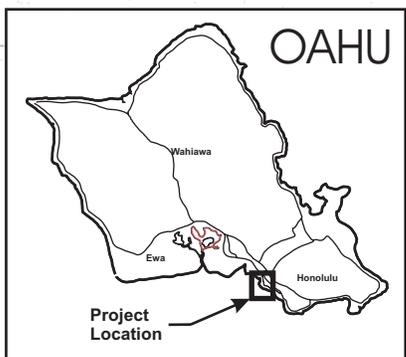
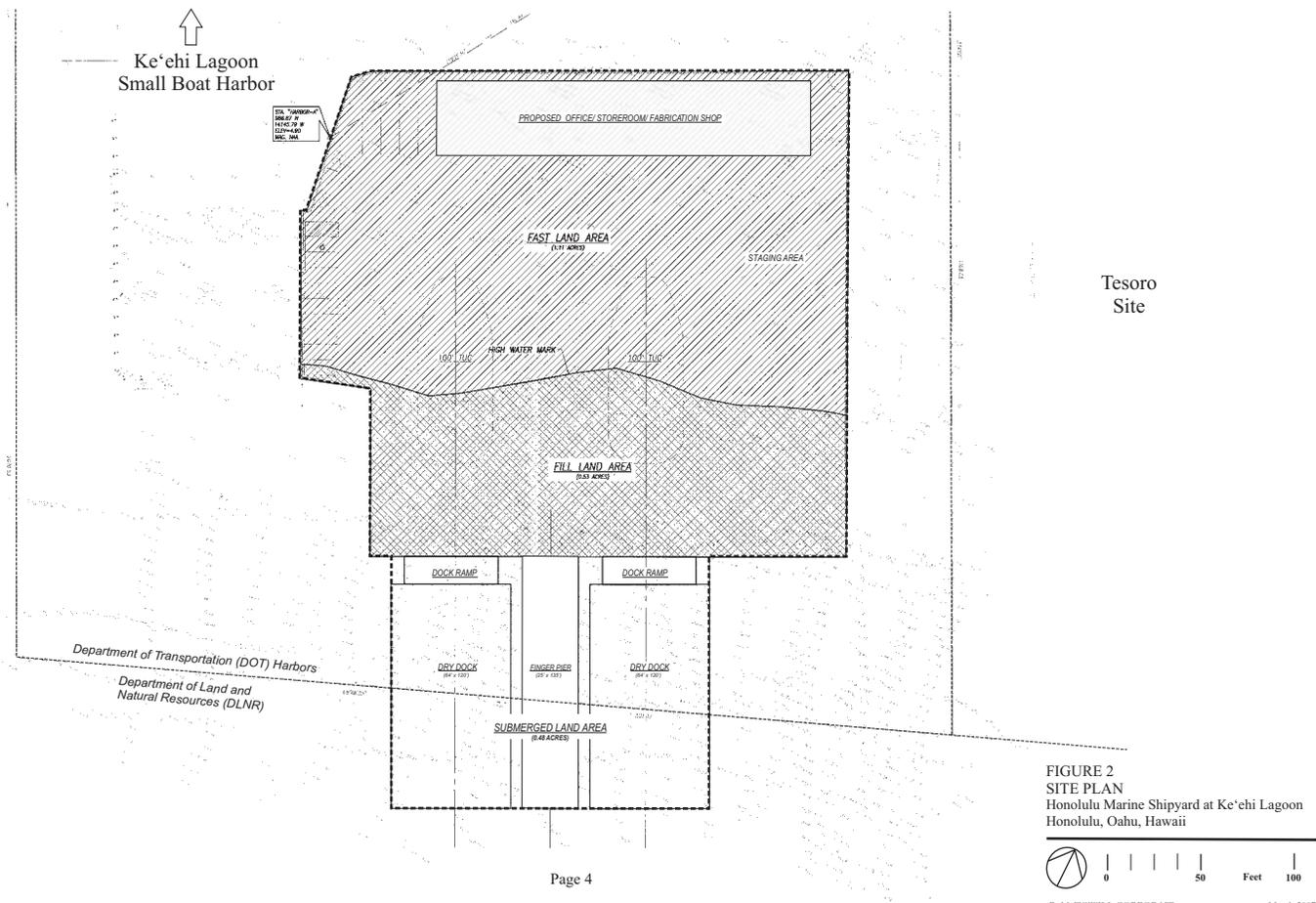


FIGURE 1
PROJECT LOCATION
 Honolulu Marine Shipyard at Ke'ehi Lagoon
 Honolulu, O'ahu, Hawai'i



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Tesoro Site

FIGURE 2
SITE PLAN
Honolulu Marine Shipyard at Ke'ehi Lagoon
Honolulu, Oahu, Hawaii



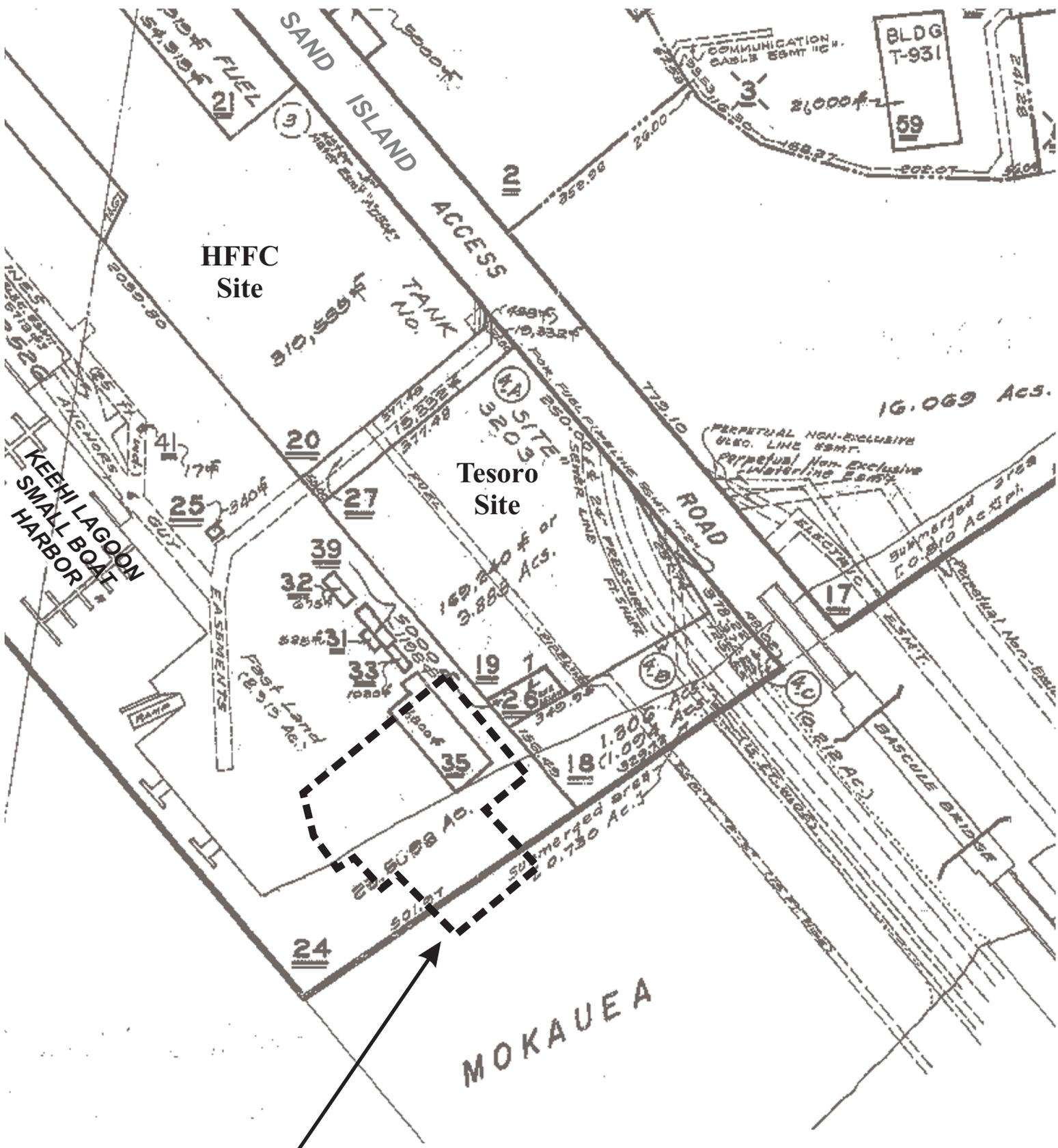
The fast land (un-submerged land) at the proposed Ke'ehi Lagoon location represents less than half of the currently available land at the Kewalo Shipyard. Honolulu Marine proposes the use of a floating dry dock to facilitate the movement of vessels to and from the water to maximize the available space of the site. The total area of use will involve approximately 1.11 acres (48,351 square feet) of fast land, 0.53 acres (23,000 square feet) of fill land, and 0.48 acres (20,900 square feet) of submerged land, for a total area of approximately 92,251 square or about 2.2 acres. The fast land will be leased from the Department of Land and Natural Resources (DLNR), the managing agency for the property. A portion of the submerged land within the Ke'ehi Small Boat Harbor property remains under jurisdiction of the DLNR. The remainder of the area is under jurisdiction of the State Department of Transportation, Harbors Division (SDOT-Harbors). See **Figure 2, Site Plan** for detail.

Honolulu Marine proposes to commence construction of the site in early 2008 for a period of approximately 10 – 12 months. The cost of the project is projected at approximately \$10.0 million: \$5.5 million will involve land development, \$2.9 million will be for the floating dry dock, and \$1.6 million will be for the two-story building. Honolulu Marine is investigating the possibility of receiving State and/or Federal funding support to assist in the relocation effort.

1.2 PROJECT LOCATION

The proposed activity is located on the western end of Honolulu Harbor on the Island of O'ahu. The street address is 4 Sand Island Access Road, and is immediately south of the Ke'ehi Lagoon Small Boat Harbor. The site includes an unimproved area within Tax Map Keys (1) 1-2-025: Parcels 024 (portion) and 35. The area of parcel 24 is 1,026,666 square feet and parcel 35 is 11,800 square feet. Both parcels are owned by the SDOT-Harbors and managed by DLNR, Division of Boating and Ocean Recreation (DOBOR). See **Figure 1, Project Location and Figure 3, TMK Map**.

Adjacent to the east is a property owned by the SDOT-Airports Division, leased to Tesoro Hawaii Corporation (Tesoro) for use as a fuel storage area. Property further north is also used by the Honolulu Fueling Facilities Corporation (HFFC) as a fuel storage area. The project area is bordered to the south by the Kalihi Channel. See **Figure 3, TMK Map**. Across Kalihi Channel is the University of Hawaii's Marine Education and Training Center (METC).



Project Area

FIGURE 3
TMK MAP
 Honolulu Marine Shipyard at Ke'ehi Lagoon
 Honolulu, O'ahu, Hawai'i



Access to the project site is via the Ke‘ehi Lagoon Access Road, which connects to the Sand Island Access Road. See **Figure 1, Project Location**.

The project site is entirely within the Special Management Area (SMA) as defined in Chapter 205A of the Hawai‘i Revised Statutes (HRS) and Chapter 25 of the Revised Ordinances of Honolulu (ROH). See **Figure 4, SMA Boundary Map**.

1.3 PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

The purpose of this Draft Environmental Assessment (DEA) is to inform interested parties of the proposed project and to seek public comment on subject areas that should be addressed prior to the acceptance of the Final Environmental Assessment (FEA). This DEA describes existing conditions at the site and addresses the potential for adverse environmental impacts as a result of the proposed action.

This EA complies with Chapter 343, Section 343-5-1, HRS, which states an environmental assessment shall be required for actions which, “propose the use of state or county lands or the use of state or county funds, other than funds to be used for feasibility or planning studies for possible future programs or projects which the agency has not approved, adopted, or funded, or funds to be used for the acquisition of unimproved real property; provided that the agency shall consider environmental factors and available alternatives in its feasibility or planning studies”. The subject property is owned by the SDOT-Harbors, under management by the DLNR - DOBOR, which necessitates the preparation of this EA.

SECTION 2

PROJECT DESCRIPTION

2.1 PROPOSED ACTIVITIES

Honolulu Marine plans to construct a small boat shipyard facility on an unimproved portion of a waterfront parcel located at 4 Sand Island Access Road in Oahu. The proposed facility will involve construction of a 120' x 64' floating dry dock, a 135' x 30' finger pier, and a 40' x 200' two-story combination office building, storeroom and fabrication shop. See **Figure 2, Site Plan**.

The proposed project will involve the use of approximately 2.2 acres of total area including fast, submerged, and fill land, to provide the necessary space for operations and allow movement of boats from the floating dry dock onto the shipyard. Improvements will include grading and paving of the lot, installation of a chain-link fence along the perimeter of the property, and provision of utilities, and security lighting (i.e. water, sewage, electricity, etc.). The maximum height for the proposed office building will be approximately 30 feet. See **Figure 2, Site Plan; Figure 5, 3D View Mauka; Figure 6, 3D View Makai; Figure 7, Existing Condition; and Figure 8, Proposed Condition**.

Proposed activities will include site preparation, backfilling, and construction of the facility and associated improvements. Site preparation will involve the following:

- Clear and grade site, prepare for concrete/asphalt concrete (AC) pavement surface;
- Dispose of debris at an approved landfill facility;
- Determine load bearing requirements for concrete/AC pavement surface based on soil conditions;
- Design drainage system in accordance with Department of Health water quality regulations; and
- Establish utilities, e.g., sewer, water, power, telephone, site access and driveway, security perimeter fencing, security lighting, etc.

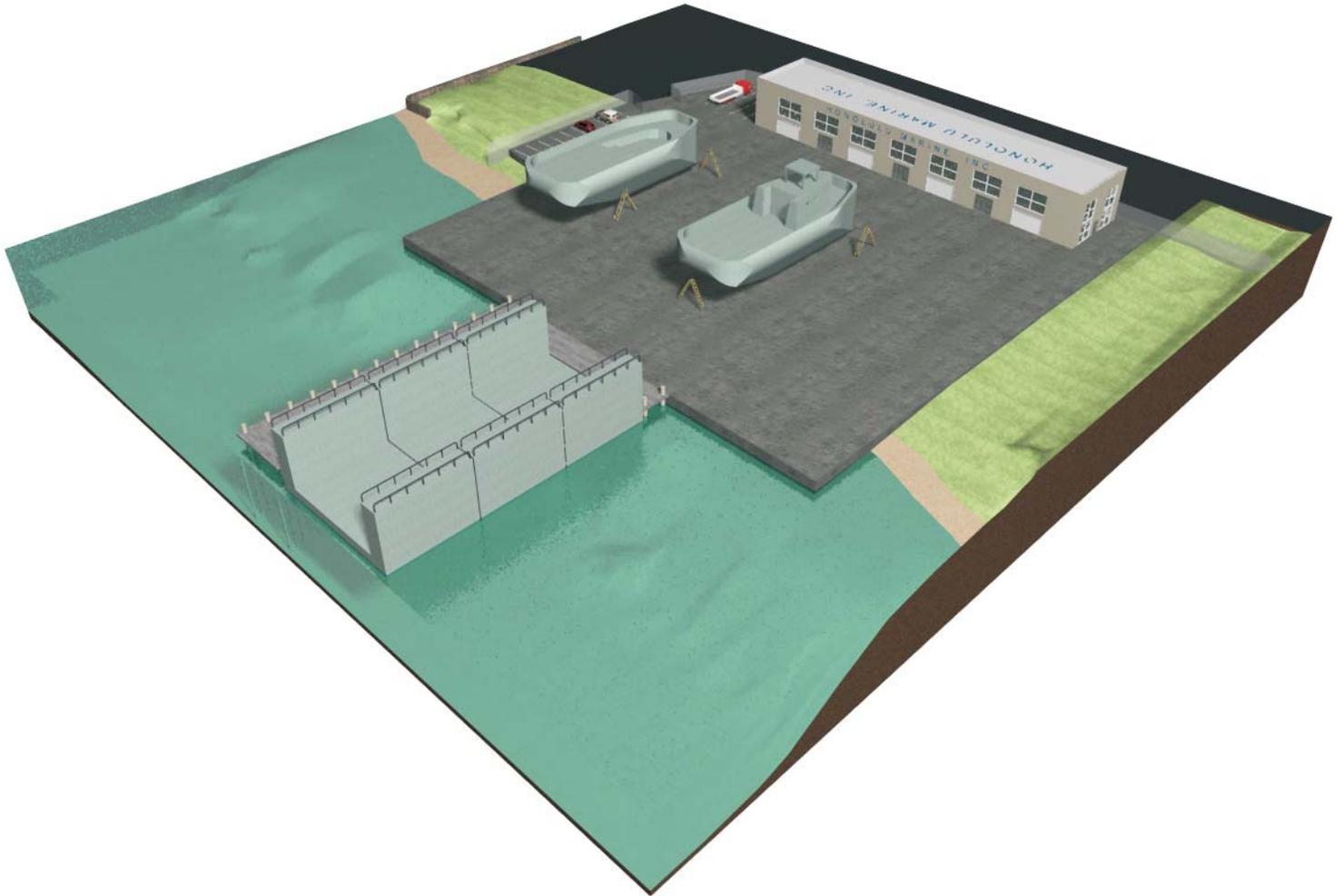


FIGURE 5
3D View Mauka
Honolulu Marine Shipyard at Ke'ehi Lagoon
Honolulu, O'ahu, Hawai'i



Not to Scale

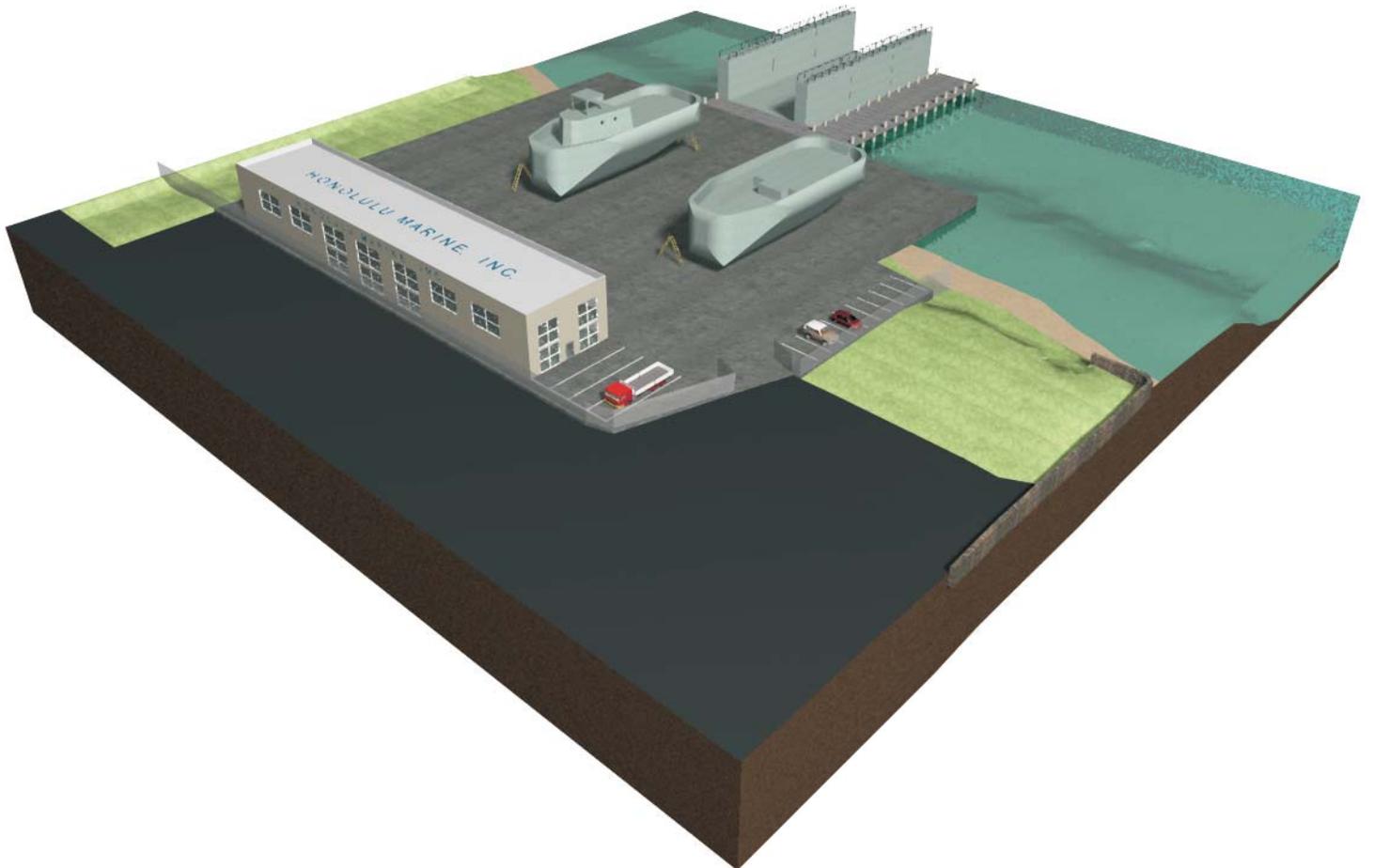


FIGURE 6
3D View Makai
Honolulu Marine Shipyard at Ke'ehi Lagoon
Honolulu, O'ahu, Hawai'i



Not to Scale



View from Bridge Facing West

FIGURE 7
EXISTING CONDITION
Honolulu Marine Shipyard at Ke'ehi Lagoon
Honolulu, O'ahu, Hawai'i

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View from Bridge Facing West

FIGURE 8
PROPOSED CONDITION
Honolulu Marine Shipyard at Ke'ehi Lagoon
Honolulu, O'ahu, Hawai'i

Backfill activities will involve:

- Installation of steel sheet-pile bulkhead at the seaward edge of the site; and
- Filling, grading and tamping down of the area within the bulkhead with recycled and/or clean imported fill material.

Facility construction will include:

- Installation of concrete/AC pavement;
- Construction of the stormwater drainage system;
- Construction of the two-story combination office building, storeroom and fabrication shop;
- Installation of perimeter fencing and lighting;
- Construction of the 135-foot finger pier; and
- Other accessory improvements.

The proposed two-story building will provide approximately 12,000 square feet of total floor area as follows:

Two-Story Building Utilization	
First Floor:	5,500 square feet shop and work space 2,500 square feet office space
<u>Second Floor:</u>	<u>4,000 square feet office space</u>
Total Footage:	12,000 square feet

The shop and work spaces will be located on the first floor and office spaces will be located on the first and second floors. The first floor shop and work spaces will provide for the storage of materials including boat parts, pumps, transformers, and consumable supplies including nuts, bolts, pipe fittings and other related supplies. The remainder of the first floor will be occupied by work shops for woodworking, welding, machining, and mechanical/fabrication work. See **Figure 9, Floor Area Plan (Proposed)**.

Production of the smaller components of boats such as the pilot house and power plant will take place in the first floor work area. A small portion of the work area will be set aside for storage of a small supply of fuel and lubricants necessary for boat testing and maintenance.

The fuel storage area will consist of a petroleum pit, and/or an enclosure with a containment berm to handle the potential for accidental spills and to prevent the release of petroleum, oil, and lubricant based products to State waters.

The majority of construction and maintenance activities on the exterior surfaces of boats will occur in the yard area. The yard will be constructed of concrete or AC pavement that will be designed and installed to meet the load bearing requirements of the vessels using the facility. Boats will be moved to and from the facility and floating dry dock, using a wheeled dolly and tractor and crane to facilitate movement.

Movement of boats from the yard to the ocean will be accomplished by loading the boat onto the wheeled dolly and rolling it onto the floating dry dock. A tractor will be used to facilitate moving the dolly supported boat. The floating dry dock will be flooded and submerged to allow the boat to float freely into the Kalihi Channel. Seawater inside the dry dock will be pumped out to bring the dry dock back to the surface as required. The dolly will be moved to and from the dry dock and the yard area as needed.

The floating dry dock will be constructed of three individual 40-foot sections. Each section will be welded at key points to form a single structure. As required for maintenance, each section can be detached and raised out of the water by the other two sections for service.

The dry dock dimension is 64 feet wide by 30 feet high by 120 feet in length. The dry dock draft, when empty, is approximately 3 feet. The dry dock will be mobilized from one side of the finger pier to the other to bring boats on and off the yard (see **Figure 2, Site Plan**). Movement of the dry dock in the water will be through the use of a tug and/or work boats as required to maintain control.

The floating dry dock will incorporate a filtration system to ensure appropriate handling of sea water that is used for ballast as the dock is raised and lowered during boat repair and maintenance activities.

Lifting and movement of equipment and materials will be facilitated using a wheeled crane (Grove RT-75, 50-ton). A tractor will also be used to move the dolly supported vessels at the shipyard and on and off the dry dock

SECTION 3 ALTERNATIVES

3.1 ALTERNATIVES TO THE PROPOSED ACTION

The following site selection criteria were used to investigate potential alternative locations for the relocation of the small boat shipyard:

- A. The location must have direct deep-water access to accommodate delivery and launching of new and repaired vessels.
- B. The location must be in an area that is designated and zoned for waterfront and maritime industrial uses.
- C. The location must have reasonable access to basic utilities (i.e., water, sewer, electricity, communications infrastructure). Extraordinary requirements for development and construction to obtain access to basic infrastructure services would result in an infeasible project.
- D. The location must be available for acquisition and long-term lease. A long-term lease is a necessary project requirement based on the major construction and site work necessary for the new shipyard.

3.2 ALTERNATIVE SITES

Potential alternative sites in Honolulu Harbor and the Barbers Point Deep Draft Harbor were evaluated. The assistance of the SDOT-Harbors Division was also sought by Honolulu Marine to identify potential relocation sites that could meet the criteria for development of the small boat shipyard.

3.2.1 BARBERS POINT DEEP DRAFT HARBOR

The Barbers Point Deep Draft Harbor is located in the 'Ewa District of O'ahu. The Deep Draft Harbor was initially proposed to provide relief to the growing need for harbor facilities on O'ahu. Since commencing operations the facility has become increasingly important in helping

to meet O‘ahu's harbor requirements. Future plans for the use of the Barbers Point Harbor, however, make it an unacceptable alternative and discount it from further consideration.

The SDOT-Harbors Division has a plan in place to expand the Barbers Point Deep Draft Harbor. Space that could be made available to Honolulu Marine is within an area that is planned to be excavated as part of the future harbor expansion plan. The projected excavation of the site could begin as soon as within the next 5 years. Any lease of the site would therefore be conditioned on a short-term use agreement, subject to termination by the SDOT upon start-up of the expansion project.

Substantial resources and effort would be required to prepare and utilize the Barbers Point site for shipyard operations. The effort involved would include site grading and installation of environmental controls, modifications to the shoreline to permit vessel access to the water, and the installation of specialized heavy machinery and equipment related to shipyard operations.

In addition to the short term availability of the Barbers Point site, basic utility infrastructure to support shipyard operations would need to be developed and constructed. These utilities include water, sewer, telephone and electrical connection and service. Site preparation and construction to provide these utilities would add effort, resources, and delay before the site could be utilized.

The limited availability of the site, lack of infrastructure, and the major commitment of resources needed to use the site for as short a period of time as 4 years, assuming a one year period of construction, make the Barbers Point site an impractical and infeasible alternative. This infeasibility is especially compounded when the effort and expense of relocating from the Barbers Point site in approximately 5 years to a new location is taken into consideration.

3.2.2 HONOLULU HARBOR

Honolulu Marine coordinated with the SDOT-Harbors Division to investigate potential sites for a new small boat shipyard in Honolulu Harbor. Based on the existing shortage of space within Honolulu Harbor, no potential sites could be identified with the exception of the Ke‘ehi Lagoon site, described below.

3.3 NO ACTION ALTERNATIVE

The No Action Alternative would involve the continued operation of the Kewalo Shipyard until such time that the landowner, HCDA, requires the use of the site for other purposes. Based on prior notifications that the use of the Kewalo site would be subject to termination, Honolulu Marine consulted with the SDOT-Harbors Division to explore an alternative site that would address the criteria necessary to maintain and avoid disruption to shipyard operations.

The No Action Alternative would avoid use of the Ke'ehi Lagoon site precluding the potential for environmental impacts disclosed in this document. However, because of concern involving the eventual closure of the Kewalo Shipyard, failure to consider the need for relocation to a new site would expose the shipyard to significant potential hardship. This would represent the potential loss of a small vessel shipbuilding, maintenance, and repair facility providing service to Hawaii's governmental, private, and military clients.

The closure of the Kewalo Basin facility without relocation to a new site would also represent the loss of:

Capitol investment in specialized shipbuilding equipment that maintains Hawaii's maritime activities in research, commerce, and trade.

Trained laborers who specialize in shipbuilding and repair would be forced to find new employment. While some employees may find comparable work at a limited number of small boat construction and repair establishments, there are many who would be forced to retrain to find employment elsewhere. Employees who remain unemployed would be forced to seek assistance from the State for unemployment benefits until new jobs can be found.

Honolulu Marine's existing clients including Hawai'i based fishing fleet vessels, governmental vessels (e.g., University of Hawai'i, National Oceanographic and Atmospheric Administration, U.S. Coast Guard, among others) and the U.S. Navy would

be forced to utilize services elsewhere. These services and capabilities which include the construction of larger tug boats, 100 feet in length, would need to be met by U.S. mainland shipyards.

Taking No Action does not accomplish the stated purpose of the proposed action which is to relocate the present shipyard facility at Kewalo Basin to a new site in order to continue operations. It is anticipated that this relocation will be unavoidable based on prior landowner (HCDA) notifications that Honolulu Marine will need to vacate the current site.

The No Action Alternative also fails to meet the intent of Senate Concurrent Resolution No. 134, S.D.1, H.D. 1, calling for the lease of submerged and fast lands for the proposed project.

Because the No Action Alternative does not address the need to relocate the shipyard facility and fails to recognize the passage of Senate Concurrent Resolution No. 134, it is rejected from further consideration.

3.4 PREFERRED ALTERNATIVE

Based on the selection criteria listed in Section 3.1, above, the Ke‘ehi Lagoon site is identified as the preferred alternative that meets the following criteria:

The Ke‘ehi Lagoon site is adjacent to the Kalihi Channel which facilitates the ready access of vessels into Honolulu Harbor and the shipyard facility.

The site zoning designation is I-3 (Waterfront Industrial District) and supports the proposed land use.

The site has the capability of providing the required utilities necessary to support the shipyard.

The Ke‘ehi Lagoon site is currently available for lease directly from the State. In accordance with Senate Concurrent Resolution No. 134, the State Legislature has passed

a resolution to allow the lease of approximately 50,000 square feet of fast land and approximately 20,800 square feet of submerged land to Honolulu Marine for the development and operation of a shipyard facility (see **Appendix B**).

The preferred alternative involves construction of a new shipyard facility comprising a floating dry dock, a finger pier, and a two-story combination office building, storeroom and fabrication shop. Improvements will also include grading and paving of the site, installation of a chain-link fence along the perimeter of the property, and the provision of utilities (i.e. water, sewage, electricity, etc.) and security lighting. See **Figure 2, Site Plan; Figure 5, 3D View Mauka; Figure 6, 3D View Makai; and, Figure 8, Proposed Condition.**

According to **Figure 2**, the area of use will require approximately 1.11 acres of fast land, 0.53 acres of fill land, and 0.48 acres of submerged land, for a total area of approximately 2.2 acres.

According to Senate Concurrent Resolution No. 134, approximately 50,000 square feet of fast land and 20,800 square feet of submerged land have been identified for the proposed project. The proposed use of the site including, submerged land, will represent a total area that is approximately 30 percent greater than indicated in the resolution, but is based on additional information and detail provided by a land and submerged land survey.

The increase in the area of use is considered to be consistent with and would maintain the intent of the Resolution supporting the use of the site. The proposed project is not anticipated to adversely affect the use of either the Ke'ehi Lagoon Small Boat Harbor or the adjoining Kalihi Channel: (1) the increased area of use is comprised of submerged land and does not require additional fast land within the Ke'ehi Lagoon Small Boat Harbor property; and (2) there is sufficient space within the Kalihi Channel to accommodate the planned request for the use of the area without adversely affecting existing uses. (See Section 4.2.1, Access).

As required, Honolulu Marine will continue to advise the legislative authors of the Resolution concerning this project and will coordinate all area requirements with SDOT-Harbors and DLNR.

SECTION 4
DESCRIPTION OF THE AFFECTED ENVIRONMENT,
IMPACTS AND MITIGATION

4.1 PHYSICAL ENVIRONMENT

4.1.1 CLIMATE

South Oahu has a mild semitropical climate which is characterized by abundant sunshine, persistent northeast trade winds, relatively constant temperatures and moderate humidity. Severe storms are infrequent in this region of Oahu.

Mean monthly temperatures range from mid-80° F in the summer months, to low-70° F during the winter. Annual average rainfall is less than 30 inches with most of the rainfall occurring between October and March.

The construction and operation of the proposed shipyard facility is not expected to adversely affect the climate of the area therefore no mitigation measures are proposed.

4.1.2 TOPOGRAPHY AND SOILS

The site is located at the western end of Honolulu Harbor, adjacent to Kalihi Channel and the Ke‘ehi Lagoon Small Boat Harbor. The site is relatively flat and has an elevation ranging from 3 feet to 5 feet above MSL. The makai portion of the site has experienced limited wave-derived erosion due to lack of shoreline stabilization/hardening structures.

Information on soil type is obtained from the Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, as prepared by the U.S. Department of Agriculture, 1972. According to the Soil Survey, the soil association at the project location is classified as “fill land, mixed” (FL) which consists of material dredged from the ocean or hauled from nearby areas.

A coastal engineering assessment undertaken for this project indicates the bottom composition consists of scattered sand and rubble. Just offshore of the site, there is an approximately 80-foot wide gentle slope extending to the 6 to 8 foot water depth. Seaward of the shelf the bottom drops off at approximately a 2 to 1 slope to the existing channel bottom at 34 feet. See **Appendix C**.

Earthwork will consist of minor grading to level the site and install the drainage control system. Sheet pile bulkheads will be installed at the seaward edge of the site and backfilled to utilize the 23,000 square feet of land makai of the project site. See **Figure 2, Site Plan**.

During construction, if groundwater needs to be removed, a National Pollutant Discharge Elimination System (NPDES) dewatering permit (Notice of Intent - Form G) will be filed with the State Department of Health, Clean Water Branch (DOH-CWB), to address proper treatment of dewatering effluent in accordance with State water quality standards. Silt fences, silt curtains and other necessary erosion control measures will also be utilized during construction to prevent any untreated construction storm water runoff from entering State waters. No further mitigation measures are anticipated.

CH2M Hill conducted a Phase I and II Environmental Site Assessment (ESA) in early 2006 (see **Appendix D, Phase I and II ESA**). The objectives of the investigation were as follows:

Evaluate the historic uses of the site and surrounding area, and determine whether historic use of the site and surrounding areas resulted in adverse impacts to the soil and groundwater; and,

Conduct sampling to evaluate the geology and hydrogeology of the site. Assess whether chemicals of potential concern (COPCs) are present in shallow soil or groundwater at the site.

Samples were collected and analyzed for total petroleum hydrocarbon (THP) constituents, volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), and eight Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium,

chromium, lead, mercury, selenium, and silver). The results of the laboratory testing are summarized below:

Eight RCRA metals, THP-diesel-range organics, THP-oil-range organics, and PAHs were detected in the soil samples. However, the concentrations of these constituents were found to be below the current DOH environmental action levels (EALs).

The metal arsenic was detected at one location at a concentration above DOH EAL, however the concentration is below the EPA preliminary remediation guideline (PRG) for the industrial occupational worker scenario of 16 ppm.

2-Butanone was detected in three of the four soil samples at concentrations below the DOH EAL.

One of the groundwater samples contained dissolved selenium at a concentration above the DOH EAL, but below the applicable marine chronic ambient water quality criteria (AWQC). Groundwater samples also contained arsenic, barium, cadmium, chromium, lead, and silver at concentrations below the respective DOH EALs and applicable AWQC. PAHs, THP-gasoline, and acetone were detected in groundwater samples at concentrations above the laboratory reporting limit, but below the respective DOH EALs and applicable chronic AWQC.

The report concluded that based on the results of the laboratory analyses that additional action or investigation is not needed. However, the report does recommend that a soil management plan be created to outline procedures for the handling of potentially impacted soils or groundwater at the site during construction. The report further recommended the use of engineered controls to mitigate potential arsenic exposure pathways for both the site and facility workers.

The proposed project will involve minor grading, excavation and backfill activities to prepare the site for development. Excavated material will be used on-site for fill material. Imported fill will be limited to clean and uncontaminated material for backfill purposes. Any excess fill material is

planned to be disposed of at an approved waste facility in accordance with the soil management plan prepared for the project and will ensure compliance with State and federal regulations.

Engineered controls to mitigate against potential arsenic exposure pathways will include paving of the entire site with concrete and/or AC pavement, and use of clean, uncontaminated soil cover. The implementation of these controls is expected to be sufficient to reduce the potential threat to human health or the environment by eliminating the exposure pathway.

The implementation of the proposed mitigation measures described above is expected to result in no adverse impact to the topography or soil conditions on the project site. No further mitigation measures are proposed or are anticipated to be required.

4.1.3 SURFACE WATER

Introduction

The project site is located within the shoreline of Honolulu Harbor. No surface water resources are located nearby with the exception of the Class "A" waters of the harbor (DOH-CWB, Water Quality Standards Map of the Island of Oahu). Class "A" waters are intended to be protected for recreational purposes and aesthetic enjoyment. According to the standards for Class "A" waters, discharges are not permitted unless they have received the best degree of treatment or control compatible with the established criteria for the receiving water.

Section 303(d) of the federal Clean Water Act also requires states to develop a list of impaired waters, commonly referred to as the "303(d) list." A water body is considered impaired if: (a) the current water quality does not meet the established water quality standards; or (b) the designated use that is described in Chapter 11-54, Hawai'i Administrative Rules (HAR), is not being achieved. The waters of both Ke'ehi Lagoon and Honolulu Harbor are listed by DOH as "impaired."

Water Quality Assessment

An assessment of near-shore water quality was undertaken by AECOS, Inc., for the proposed project to assess the level of impairment and to characterize the existing aquatic environment (see **Appendix E – Water Quality and Biological Surveys**).

Nearshore waters at the proposed site represent a mix of waters from offshore, Ke‘ehi Lagoon, and Honolulu Harbor. During the period of sampling the predicted tides for Honolulu Harbor were a morning low of 0.0 feet (higher low water, HLW) at 1012 hours and a predicted afternoon high tide of 1.0 feet (lower high water or LHW) at 1539 hours (NOAA/NOS, 2007). Winds were less than 10 knots until 1300 hours when easterly trade winds increased to 15-20 knots. Skies were partly cloudy with 40 percent cloud cover. Within the preceding month of February, 0.68 inches of rain fell at the nearby Aloha Tower rain gage station (HI-26 Aloha Tower Aloha1; NOAA/NWS, 2007a).

Ke‘ehi Lagoon is listed by the DOH-CWB as an impaired water body for chlorophyll α , total nitrogen, total phosphorus, total suspended solids, turbidity, and enterococcus during both wet and dry seasons (Koch et al., 2004). Waters in Honolulu Harbor near the site are impaired for turbidity, total nitrogen, and chlorophyll α , during dry season based on data from two sampling stations on nearby Sand Island (Koch et al, 2004). Levels of these parameters likely exceed state criteria at any time.

The scope of the water quality sampling precluded detailed research and statistical analysis of historical data. The limited amount of data from samples collected are insufficient to set baseline values or determine compliance with Hawai‘i Water Quality Standards in the project area because state criteria for nutrient measurements, turbidity, and chlorophyll α are based upon geometric mean values (HDOH, 2004) and a minimum of three separate sampling events per sampling location would be needed to compute a geometric mean.

Water samples were collected from five locations located within and outside of the proposed project site. Dissolved oxygen, temperature, pH, and salinity were measured by field meters. Chlorophyll α , turbidity, TSS, ammonia, nitrate + nitrite, total nitrogen and total phosphorus were measured in water samples collected in appropriate containers and taken to the AECOS

laboratory in Kāne‘ohe immediately after collection (AECOS, Inc. Laboratory Log No. 22609). The results of the water quality sampling on March 2, 2007, are provided in Table 4-1, Comparison of Current and Historical Water Quality Data and includes a comparison between mean results from the AECOS survey and historical means obtained by combining eight previous water quality surveys from Ke‘ehi Lagoon and Honolulu Harbor. The historical mean values are the average of the geometric means from up to eight water quality studies undertaken in Ke‘ehi Lagoon and Honolulu Harbor.

Table 4-1
Comparison of Current and Historical Water Quality Data
(Arithmetic Means)

		Temp. (°C)	Salinity (‰)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat.)*	pH	TSS (mg/L)
AECOS 2007	mean	24.6	33.8	5.98	88	8.16	9.6
	n	8	8	8	8	8	8
Historical Data**	mean	26.5	34.88	5.61	86	8.26	4.92
	n	>362	>374	>362	>362	>303	>365
		Turbidity (NTU)	Ammonia (µg N/L)	Nitrate + Nitrite (µg N/L)	Total N (µg N/L)	Total P (µg P/L)	Chl α (µg /L)
AECOS 2007	mean	2.82	<1	<1	123	25	1.04
	n	8	8	8	8	8	6
Historical Mean**	mean	1.74	8.43	3	156	24	0.74
	n	>378	>90	>90	>90	>89	>125

*% saturation is calculated using the mean salinity, temperature and mg/L DO values.
**One historical survey incorporated did not give number of samples for reported means. The number (n) reported is the minimum number of samples used in calculating the means for each parameter.

The average temperature for Honolulu Harbor waters (Aloha Tower station, NOAA 2007b) in March is given as 24.4°C. Based on this average, the temperatures obtained seem normal. Salinities also appear normal for inshore, somewhat confined waters. All samples showed adequate levels of dissolved oxygen (DO) and appropriate pH values.

Particulates in the samples were elevated relative to the geometric mean criteria for turbidity, TSS, and chlorophyll. All stations sampled ranged from 1.44 to 6.70 NTU, and were above the state geometric mean criterion for turbidity. There is no criterion for TSS in marine waters and

all sampling values that ranged from 0.70 to 1.34 µg/L were above the state geometric mean criterion for chlorophyll α .

Inorganic nutrients were under the geometric mean criteria values whereas some total nitrogen and total phosphorous values were greater than the criteria.

The sampling mean results for each parameter are similar to historical mean values found in Ke‘ehi Lagoon and Honolulu Harbor.

Water Quality Assessment Report Conclusion

Ke‘ehi Lagoon is listed as an impaired water body for chlorophyll α , total nitrogen, total phosphorus, totals suspended solids, turbidity and enterococcus during both wet and dry seasons (Koch et al, 2004). Waters in Honolulu Harbor near the site are impaired for turbidity, total nitrogen and chlorophyll α during dry season conditions based on data from two sampling stations on nearby Sand Island (Koch et al, 2004). The levels of these parameters can be expected to exceed state criteria at any given time and water quality can potentially be impacted by construction activities involving dredging and fill activity. A Best Management Practices (BMP) plan should be prepared and implemented to minimize these impacts on water quality. Long term operational impacts such as increased pollutant loads in storm discharges should similarly be controlled and treated to the best degree possible prior to discharge in order to conform with HAR §11-54-03(c)(2)(A)(i) and (iii).

Proposed Project Mitigation

Construction of the proposed project will involve the use of a Construction Best Management Practices (BMPs) Plan as required by Chapter 11-55, HAR, Water Pollution Control, and the grading, soil, erosion, and sediment control provisions for construction projects as promulgated in Chapter 14, Articles 13 through 16, ROH, 1990, as amended. (See also Section 4.1.10, Water Quality, for further discussion and identification of control measures that will be proposed).

Management of water quality with operation of the facility will involve use of a drainage control system consisting of a trench drain inlet to collect storm water and to direct it to an on-site filtration system for treatment prior to discharges to State waters. The storm water treatment

system is intended to capture suspended solids and has the capacity to handle accidental or inadvertent releases of petroleum-associated products.

The normal operation of the facility does not involve the use of a large volume of petroleum product. Only small amounts of diesel, gasoline, and related lubricants are kept on site for boat mechanical testing and for use in machinery and equipment. To address the potential for accidental spills, all petroleum products will be stored in a covered area with measures to contain spills (containment barriers will be employed). In the event of any accidental spill during normal operations, it will be immediately isolated and cleaned up as required by the facility's best management practices regarding accidental spills. To address the potential for pollutants entering Kalihi Channel, an NPDES industrial storm water permit application will be filed with DOH-CWB for the project. The NPDES industrial storm water permit application process will require the development and use of a Spill Prevention Plan (SPP) and Storm Water Pollution Control Plan (SWPCP). Both documents will be prepared in accordance with the requirements of Section 6, Chapter 11-55, HAR, Appendix B.

The mitigation measures described above are anticipated to be sufficient to ensure against inadvertent or accidental spills of pollutants to state waters. No adverse impacts to surface waters are therefore anticipated. As required, the applicant intends to further consult with the State DOH-CWB during construction and operation of the facility to meet all regulatory requirements.

4.1.4 FLORA/FAUNA

The proposed project site is located within the maritime industrial locale of Honolulu Harbor. The project site area is comprised of introduced fill material and has been used for boating and related maritime industrial activities for several decades. No threatened or endangered flora or fauna are known to inhabit the site.

Terrestrial flora found at the project site include native and introduced species with mostly herbaceous plants including grasses and weedy species typical of disturbed areas. No plant species were observed within the project area that are listed as threatened or endangered, or

which are otherwise considered to be rare or special by the State of Hawai‘i or federal government. (See **Appendix E** for further detail).

A marine biological survey of the project site was conducted by AECOS, Inc., and included the identification of macro-algae, coral and other macro-invertebrates, and fishes present. Protected or regulated species present at the site include: ‘*opihi* (*Cellana spp.*) and stony corals such as *Pocillopora damicornis*. The potential for adverse impacts from the proposed project are not anticipated to negatively impact the small ‘*opihi* population at the site. The proposed activities involving fill and pier construction, however, may impact coral colonies at the site in the form of direct impact to colonies within the work area, and from burial by sediment plumes associated with construction activities.

Mitigation to ensure against adverse impacts will involve the use of a Construction Stormwater Best Management Practices (BMPs) Plan that will include the use of stormwater runoff berms, silt curtains, silt screens, and other related protective measures. Direct contact with corals will be avoided during construction to minimize adverse impacts to marine organisms.

The threatened *honu* or Pacific green sea turtle was not observed during the survey. However, it is possible that *honu* may utilize waters near the site. Construction activities from the proposed project are not anticipated to negatively impact the green sea turtle given that the existing conditions of the site involve human presence and regular boating traffic that may deter regular use of the shoreline and nearshore waters.

Introduced terrestrial fauna observed at the site include the Common Indian Mynah (*Acridotheres tristis*), House Sparrow (*Passer domesticus*), Spotted or Lace-necked Dove (*Streptopelia chinensis*), Zebra Dove (*Geopelia striata*), and Cardinal (*Cardinalis cardinalis*). Cats, rats and mice may also inhabit the area based on the nearby use of the Ke'ehi Small Boat Harbor.

Although none were observed, it is possible that foraging seabirds may also be attracted to the area due to the shoreline location and relatively flat surrounding topography. Because of concern for overflights of seabirds to the area, external shielding may be utilized on lighting fixtures.

Although further mitigation for the site is not proposed, regulatory review of the project will be required from the Department of the Army, Corps of Engineers; Department of Land and Natural Resources (DLNR); the Office of Coastal Zone Management; and the Department of Health. Regulatory review of the project from these agencies may involve the addition of mitigation measures in the form of monitoring and/or other controls to reduce the potential for impacts to marine flora and fauna. The applicant intends to coordinate the review of the project with these agencies, as required, thereby reducing or ameliorating the potential for adverse impacts to the environment.

4.1.5 SCENIC AND VISUAL RESOURCES

The project area is located in an industrial area adjacent to properties with existing fuel storage and shipping container facilities. Major land uses in the area are primarily industrial in nature and include bulk fuel storage facilities, shipping container storage yards, and the Sand Island Wastewater Treatment Plant (SIWWTP), Oahu's largest wastewater treatment facility serving the majority of the population in urban Honolulu. The Ke'ehi Lagoon Small Boat Harbor is located immediately to the north and west of the site. The Sand Island State Recreational Area is located at the end of the Sand Island Access Road (Sand Island Parkway), approximately 1.6 miles from the project site. Pedestrian and vehicular views of the surrounding area include tall cranes and stacked shipping containers associated with container yard operations and large fuel storage tanks located adjacent to the project site at the Tesoro and the HFFC facilities.

Existing pedestrian views of the ocean from street level along the Sand Island Access Road are limited by improvements and topography along the road (see **Photo 1, View from Sand Island Access Road**). Existing fuel storage tanks and other improvements on adjacent properties (Tesoro and HFFC), and other elevated structures in and around the Sand Island industrial area already hinder views westward and mauka from vantage points around the project site, i.e. Ke'ehi Lagoon Small Boat Harbor (see **Photo 2, View from Ke'ehi Lagoon Small Boat Harbor**).



Photo 1: View from Sand Island Access Road



Photo 2: View from Ke'ehi Lagoon Small Boat Harbor

The City and County of Honolulu, Coastal View Study (1987), indicates “Continuous Coastal Views” from the Sand Island Bridge. Because of the existing land use and nearby structures, and the scale of the facility in relation to adjacent structures (i.e. fuel storage tank yards), the proposed project is not expected to significantly impact or degrade the existing views as identified by the City (see **Figure 8**).

The proposed height of the facility building and other structures associated with the proposed shipyard will be below the established 60-foot maximum building height limit.

The proposed shipyard facility is expected to have minimal visual impact due to existing industrial uses of the surrounding area including the Tesoro and HFFC fuel storage facilities immediately adjacent and to the north of the subject property, the Matson shipping facility across Sand Island Access Road and the UH METC facility across Kalihi Channel.

As required, landscaping will also be incorporated into the design of the facility. No further mitigation measures are therefore anticipated or proposed.

4.1.6 HISTORIC/ARCHAEOLOGICAL RESOURCES

Cultural Surveys Hawai‘i, Inc. conducted a Cultural Impact Assessment, an archaeological literature review, and a field inspection of the proposed project in March 2007 (see **Appendix F – Cultural and Archaeological Assessment**). The following is a summary of the investigations:

- A review of the archaeological literature found no archaeological properties in the vicinity of the project area. Several traditional fishponds once existed somewhat inland, but all of these were filled as “reclamation” land beginning in early twentieth century.
- Some human burials have been found in coastline or coastal estuarine environments in Kalihi Kai, however these are scattered and are not near the project area.
- Because the dry land portion of the project area is believed to be entirely 20th century fill land development of this land seems exceedingly unlikely to adversely impact any land resources.

- The potential for adverse impacts as a result of the proposed project to near shore resources and fishing access is unclear. However, given the long-tradition of use of coastal resources in the vicinity and the issue involving the Hawaiian effort to access and reside on Mokauea Island, the study recommends that the project attempt to minimize adverse impacts to the coastal environment and coastal access for purposes of fishing and use of other coastal resources.
- The proposed construction is within a heavily industrialized area and on land that is composed entirely of fill material. It is therefore highly unlikely that significant historic or archaeological resources are present at the project site. However, should any unidentified deposits be uncovered during construction, work will cease in the immediate area and the State Historic Preservation Office will be contacted.

Regarding the proposed project's potential impact to access to and the continued occupation of Mokauea Island, the shoreline fronting the existing site was not used for boat landing and launching due to the shallow and rocky foreshore. Boat launching facilities are readily accessible from the adjacent Ke'ehi Lagoon Small Boat Harbor and from across the Kalihi Channel at the UH METC facility.

Fishing activities along the shoreline have been recognized as a resource utilized by area residents by Cultural Surveys Hawai'i and the State DLNR. The potential impact to fishing along the shoreline, however, will be limited to the immediate area fronting the shipyard including the finger pier, and floating dry dock. Fishing from this location will need to be prohibited to maintain security of the site and the safety of the public from the movement and use of machinery and heavy equipment associated with shipyard operations.

Mitigation of impacts to the public using this section of shoreline can be mitigated to some degree by maintaining access on either side of the shipyard containing shoreline suitable and accessible for fishing. An access easement on the eastern boundary of the site will be maintained allowing access to the area fronting the Tesoro tank site and the Sand Island Bridge. Shoreline access along the western boundary of the site will continue to be provided from the Ke'ehi

Lagoon Small Boat Harbor and will not affect fishing activities into the Kalihi Channel. See also **Section 4.2.1. Access.**

4.1.7 BEACH EROSION AND SAND TRANSPORT

The project area is located adjacent to the Kalihi Channel which serves as an outlet for the Honolulu Harbor. The two major streams, the Kalihi Stream and the Kapalama Stream empty into this waterway. The shoreline of the property is sheltered from storm-generated waves due to its inland location (see **Appendix C – Coastal Engineering Assessment**).

The shoreline at the project site is composed of fill material including large blocks of concrete waste and dredge material (See **Figure 7, Existing Condition**). The shoreline's inland location and its close proximity to the deep channel prevent any accretion of sand along its length.

The proposed project will involve filling of approximately 23,000 square feet to provide adequate space for operational activities and to allow the movement of boats from the floating dry dock onto the shipyard. The seaward edge of the facility will be stabilized with sheet pile bulkheads, backfilled, and paved to provide a stable work surface. The seaward edge will be designed to prevent erosion on adjacent shoreline areas on both sides of the facility by an appropriate design provided by a qualified marine engineer.

The proposed project is not anticipated or expected to impact the shoreline area, beach processes, or to influence sand transport. No further mitigation measures are proposed or expected to be required.

4.1.8 NOISE

Construction of the boatyard facility will involve some generation of noise. Construction equipment is expected to include, but not be limited to, a compactor, grader, bulldozer, concrete mixer, concrete delivery trucks, cranes, welders and powered hand tools. All combustion powered equipment will be muffled in accordance with industry recognized engine operating practices.

Shipyard operations are anticipated to generate noise from the operation of machinery, and metal and wood working activities. Noise generation from the normal operation of the facility is anticipated to be consistent with the industrial area surroundings and the waterfront industrial zoning of the site. The normal operating hours of the facility are planned to be from Monday through Friday, from 7 am to 5 pm. On occasion, the shipyard can be expected to operate on extended work hours and weekends to meet the delivery requirements of government, private, and military clients.

Because the proposed project will be located in an industrial area and is not within proximity to residential areas, the construction and operation of the boatyard is not expected to significantly increase nor result in adverse noise levels in the area.

No further mitigation measures are planned or proposed beyond the adherence to regulated safe working practices to prevent adverse noise impacts to the general public and shipyard employees.

4.1.9 AIR QUALITY

No information was collected on air quality. Construction activities are expected to have little or no impact since the project will be of limited duration and where engine exhausts may be a source of potential air pollution, all internal combustion equipment will be governed in accordance with applicable state and county regulations.

During construction, fugitive dust may be generated which can constitute a nuisance to the nearby Tesoro tank site, the Ke'ehi Lagoon Small Boat Harbor, and the general public transiting the area along the Sand Island roadway. As required to reduce the potential incidence of fugitive dust, the construction contractor will erect dust fencing and regularly wet disturbed soil areas.

Operation of the facility will involve intermittent operation of internal-combustion machinery including a crane, forklifts and other machinery. Exhaust-producing activities from machinery and equipment are expected to be of temporary duration and sporadic in nature. Use of vehicles

and equipment within the project site will be governed under applicable State and Federal standards and regulations for vehicle exhausts.

Sandblasting activities may occasionally be required to remove fouling organisms, paint, and rust from boat hulls and maritime equipment exposed to seawater. Sandblasting is a generic term for the process of smoothing, shaping and cleaning a hard surface by forcing solid particles across a surface at high speeds; the effect is similar to that of using sandpaper, but provides a more even finish with even cleaning at corners and crannies. Historically, sandblast material was sand that had been sieved to a uniform size. Other materials for sandblasting have been developed to supplement the use of sand and include steel grit, steel shot, copper slag, glass beads, metal pellets, dry ice, garnet, powdered abrasives of various grades, and other materials.

Existing operations involving sandblasting are conducted in accordance with State and federal regulations. However, alternatives to traditional sandblasting practices are under consideration to promote a more efficient and environmentally "friendly" operation. Alternative sandblasting methodologies, including wet blasting or slurry blasting and sponge blasting, are under investigation by Honolulu Marine. These alternative methods involve the use of an enclosed space to capture and significantly limit the atmospheric loss of dust and other pollutants.

Enclosures that are under consideration include the use of the following:

- Sandblasting Cabinet – a sealable containment allowing sandblasting to be limited to the space within the containment. Advantages include the ability to control, treat and contain all waste byproducts. A disadvantage is the limited size of the cabinet that does not permit work on vessel hulls or structures.
- Dome Shelter or Sandblast Tent – This structure is a large enclosure that is semi-rigid or inflated to maintain the shape of the structure and to limit the escape of airborne and expended sandblast product. All sandblasting work would be contained within the enclosure to capture dust and related pollutants associated with sandblasting. Treatment systems including the use of air filters, wet filters, and other filtration apparatus would be used to handle and capture expended sandblast associated waste. The advantages of this system are that larger pieces of equipment and entire vessels can be handled within an enclosure. The

disadvantage of this system is the large size and mobilization requirements to erect the structure.

The use of conventional or alternative sandblasting methods will be based on meeting federal regulatory standards including the requirements of the Clean Air Act, Clean Water Act, and state standards as provided in HAR, Chapter 11-54, Water Quality Standards, and Chapter 11-55, Water Pollution Control. The use of alternative methods will also be considered if the alternative: (1) can meet quality workmanship requirements; (2) practicality of use given the limited space available at the proposed shipyard site; and (3) constitutes a feasible and environmentally beneficial option to conventional sandblast practices.

The selection of either conventional or alternative methods will require on-site mitigation to ensure against inadvertent discharges of sandblast media and expended product. Mitigation to ensure against discharges from alternative methods will be met through the capture of expended sandblasting media within the enclosed spaces. The disposal of the expended media and products will be to an appropriate facility approved by the DOH.

Mitigation measures to address conventional sandblasting activities involve adherence to industry safe practices that include:

The sandblasting work area is enclosed using fine mesh dust screens to capture and limit the discharge of expended media. Expended media on the dust screens and on the ground is collected in sealed containers. The media is submitted for laboratory analysis of lead and other potential contaminants as required by the DOH. The results of the analysis are submitted to the DOH for review and approval for disposal at an acceptable disposal facility.

Sandblasting operations are terminated during periods of inclement weather and high winds to reduce the possibility of discharges into the air and water column.

With the proposed mitigation measures described above, the proposed project is expected to have minimal to no impact to the existing air quality or environment. No further mitigation measures are anticipated or proposed.

4.1.10 WATER QUALITY

Potential impacts to water quality include the generation of silt (during grading and shoreline improvement activities), erosion, and storm water runoff from the project site discharging into the Kalihi Channel. Construction activities will temporarily disturb soils on the property, however silt fences, berms and other applicable erosion control measures will be implemented to prevent soil and construction related debris from discharging into the Kalihi Channel. As required, exposed soils will be covered with PVC sheet plastic and/or the use of berms to prevent inadvertent contact and mixing with storm water. During construction of the shoreline improvements and finger pier, silt curtains will be employed around the work area to limit the migration of silt and sediments.

HAR, Chapter 11-54-3 (c) (2), states that no new industrial discharges shall be permitted within embayments, with the exception of:

- (A) Acceptable non-contact thermal and dry dock or marine railway discharges, in the following water bodies: (i) Honolulu Harbor, Oahu; (ii) Barbers Point Harbor, Oahu; (iii) Ke'ehi Lagoon Marina Area, Oahu; (iv) Ala Wai Boat Harbor, Oahu; and (v) Kahului Harbor, Maui.

This section also states that storm water discharges associated with industrial activities must meet, at the minimum, the basic water quality criteria applicable to all waters as specified in HAR, Section 11-54-4, and all applicable requirements specified in HAR, Chapter 11-55, Water Pollution Control. This section adds that any stormwater generated discharges must also be covered by an NPDES general permit addressing discharges of construction stormwater.

On-site drainage incorporating a package storm water treatment system will be designed to prevent untreated storm water from discharging into Kalihi Channel. The unit proposed will be an Aqua-Filter™ storm water treatment system. The Aqua-Filter™ is designed to allow

untreated storm water to enter the system through a tangential pipe, producing a vortex flow pattern which allows suspended contaminants to settle. Hydrodynamic and gravitational drag forces direct the solids to migrate toward the center of the chamber. The collected solids are held in the sediment storage area at the bottom of the tank with the filtered discharges directed through an outlet pipe. This step in the process removes suspended solids and floating debris. The next step involves the filtered discharges from the outlet pipe entering a filtration chamber where dissolved oil, fine silt and clay, nutrients (phosphates), and heavy metals are removed. Following this step the treated stormwater is discharged (see **Appendix G – Aqua Filter Manual**).

A treatment system to handle discharges during work activities on boats on the floating dry dock is also proposed during periods when the dry dock is raised on the surface of the water. The treatment system utilizes a 2-inch high lip along the perimeter of the dry dock. Discharges are fed to a two-stage filtration system involving the use of baffles to remove solids, suspended sediments, and other pollutants before discharge into Kalihi Channel. Solids, sediments, and other pollutants that collect in the treatment system will be removed during regular maintenance for disposal at a facility approved by the DOH and/or City & County of Honolulu.

The raising and lowering of the dry dock will also involve the flooding of water and filling of air in the ballast tanks of the structure. Discharges of ballast water will be subject to filtration using the treatment system described above.

To ensure against spillage of petroleum, oils, and lubricants on the dry dock during periods when it is raised, the following will be practiced:

All petroleum, oil, lubricant, and solvent associated products will be kept in covered, sealed containers until ready for use.

Only enough product will be transported to the dry dock to accomplish the work activity. Product transported to the dry dock during the work day shall be removed at the end of the work day and stored under cover in the appropriate storage spaces of the shipyard building.

Spill kits to handle potential spills will be kept on or within close proximity to the dry dock. Employees responsible for work on the dry dock shall be trained in the proper use and handling of the spill kits. All spills will be collected and disposed of immediately to prevent releases to the water. In the event of accidental releases to the water the site supervisor will be immediately notified and the appropriate authorities notified including the DOH, DOT-Harbors Division, and/or U.S. Coast Guard.

Additional mitigation measures to ensure protection of water quality will also be provided through the conditions imposed as part of the water quality associated environmental permit applications that will be filed for this project. The detailed mitigation measures that will be prepared for these permits will be developed during the permitting process that will follow the completion of the subject HRS, Chapter 343, Environmental Assessment:

Department of the Army Permit Application, Section 404/Title 10 Rivers and Harbors Act of 1899, Corps of Engineers. This permit application will govern work activities in the water and require review and approval of mitigation measures to address environmental and water quality concerns.

Section 401 Water Quality Certification (WQC), DOH. This permit application will govern the water quality of discharges associated with construction of the project. A Water Quality Monitoring Plan (WQMP) and a Section 401 WQC Best Management Practices (BMPs) Plan to address 401 WQC related permitting concerns will be prepared.

Coastal Zone Management (CZM) Federal Consistency Determination, Office of Coastal Zone Management. This application will govern the review of the project in relation to the State of Hawai'i coastal zone management law as promulgated in HRS, Chapter 205A. The major concerns will involve the protection, preservation, and/or appropriate management of Hawai'i's coastal resources.

Conservation District Use Permit Application, Department of Land and Natural Resources. This application will govern the use of land within the State's Conservation District, defined for this project, as all work within the submerged coastal waters.

National Pollutant Discharge Elimination System (NPDES), Notice of Intent Form C, Construction Stormwater Permit Application, DOH. This application will govern the generation and management of stormwater associated with the construction of the project. A Construction Stormwater BMPs Plan will be prepared as part of the permit application.

NPDES, Notice of Intent Form B, Industrial Stormwater Permit Application, DOH. This application will govern the operation of the shipyard which is classified by the DOH as an industrial activity. A Storm Water Pollution Control Plan (SWPCP) incorporating BMPs and good housekeeping practices will be prepared for this application.

All project activities with the potential for impacts to water quality will be addressed in accordance with regulatory standards. It is therefore anticipated that based on the application of the mitigation measures described above, as well as additional measures that would be implemented during the environmental permitting process, that no adverse environmental impacts to water quality would result.

4.1.11 FLOOD HAZARD

The subject property is located at the outlet of Honolulu Harbor. According to Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM), Map No. 15003C0353 E, dated November 20, 2000, the project site is in an area designated as Zone AE (EL 5) (see **Figure 10, FEMA FIRM Map**). The Zone AE (EL 5) designation is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined in the Flood Insurance Study by detailed methods of analysis. The Base Flood Elevation determined for this zone at the project location is 5 feet.

Although the proposed facility will be located within 5-feet of the base flood elevation it is noted that no habitable structures are proposed that would constitute an unreasonable risk to life or property. Given the requirement for the proposed project to be located within proximity of the shoreline, the proposed use is considered reasonable and is not anticipated to have a significant impact on flood conditions. No further mitigation measures are planned or proposed.

Keehi Lagoon

SHORELINE

MOKAUEA

SAND ISLAND ACCESS ROAD

ZONE X

ZONE AE
(EL 5)

M 110

Sand Island

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY AND COUNTY
OF HONOLULU,
HAWAII

PANEL 353 OF 395
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:	NUMBER	PANEL	SUFFIX
COMMUNITY			
HONOLULU CITY AND COUNTY OF	15001	0353	E

MAP NUMBER
15003C0353 E

EFFECTIVE DATE:
NOVEMBER 20, 2000



Federal Emergency Management Agency

NOTE: COASTAL BASE FLOOD ELEVATIONS
APPLY ONLY LANDWARD OF THE SHORELINE
SHOWN ON THIS MAP.

Project Location

Zone X is the flood insurance rate zone that corresponds to areas outside the 1-percent annual chance floodplain. No Base Flood Elevations or depths are shown within this zone. Insurance purchase is not required in these zones.

Zone AE corresponds to areas within the 1-percent annual chance floodplains. In most instances, Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

FIGURE 10
FEMA FIRM MAP
Honolulu Marine Shipyard at Ke'ehi Lagoon
Honolulu, Oahu, Hawaii



0 500 Feet 1000

R. M. TOWILL CORPORATION

March 2007

4.2 PUBLIC FACILITIES

4.2.1 ACCESS

Existing shoreline access is provided by the Ke‘ehi Lagoon Access Road leading to the Ke‘ehi Lagoon Small Boat Harbor located immediately north of the project area (see **Figures 1 and 2**).

A portion of shoreline fronting the proposed project will be required to construct and operate the shipyard finger pier and ramp that will allow access to the floating dry dock. This area of shoreline will require fencing for security from public entry and to maintain public safety from the movement and use of machinery and heavy equipment associated with shipyard operations. The area of secured shoreline will be approximately 260 linear feet in length.

The cultural impact assessment undertaken for this project as well as comments received from the Department of Land and Natural Resources indicates that the site is used for recreational fishing activities along the shoreline fronting the project site. It is possible that some fishing activities may also occur for subsistence purposes.

Other uses of the shoreline for activities such as picnicking were not observed and are not known to occur with any frequency in the area. The only exception involves the use of the larger Ke'ehi Lagoon Small Boat Harbor property for ocean boating purposes to the north of the project site. The proposed project involving the development of a shipyard will involve some loss of shoreline access that is unavoidable due to the need for the location of the shipyard next to the shoreline. Although some loss of access to the shoreline will result from the need for maintain security and public safety of the site, access to the shoreline on either side of the planned shipyard is intended to remain open. These areas will include the shoreline fronting the Tesoro facility adjacent to the Sand Island Access Road, next to the existing bascule bridge. Access to this area will be provided with an access easement on the eastern boundary of the project site between the shipyard and the Tesoro facility. The easement access will be approximately 50 feet in width to allow maintenance access to the bridge and to accommodate access to the shoreline. The stretch of shoreline that will be made accessible will be approximately 400 linear feet in length.

Shoreline access to the west of the proposed shipyard is provided through the Ke'ehi Lagoon Small Boat Harbor. The stretch of shoreline fronting this area is approximately 100 linear feet and will run from the edge of the project site towards the existing parking area of the Ke'ehi Lagoon Small Boat Harbor.

While some loss of shoreline will be unavoidable as a result of the project, it is anticipated that sufficient shoreline access will be maintained to permit the continued use of the area for fishing. No other potential adverse impacts to use of the shoreline for fishing purposes are anticipated.

Access to ships that may potentially use this area of the Kalihi Channel will be accommodated by the project. The Kalihi Channel is approximately 500 feet wide up to the location of the Sand Island Bridge. Should the Channel be reopened in the future to accommodate maritime traffic, sufficient space will be available to accommodate ships. Approximately 400 feet of Channel width will be provided with the planned finger pier and floating dry dock in place. See **Figure 11, Kalihi Channel Access**.

Although the project will involve some loss of shoreline access it is noted that the project is proposed within an area that is designated for maritime industrial uses. While some loss of the shoreline will be unavoidable the project will allow for the maintenance of an approximately 50 foot wide public access easement along the eastern boundary of the proposed shipyard. Access to the west of the shipyard will not be affected and will allow for continued opportunities for recreational and potential subsistence fishing.

No further mitigation measures are anticipated to be required.

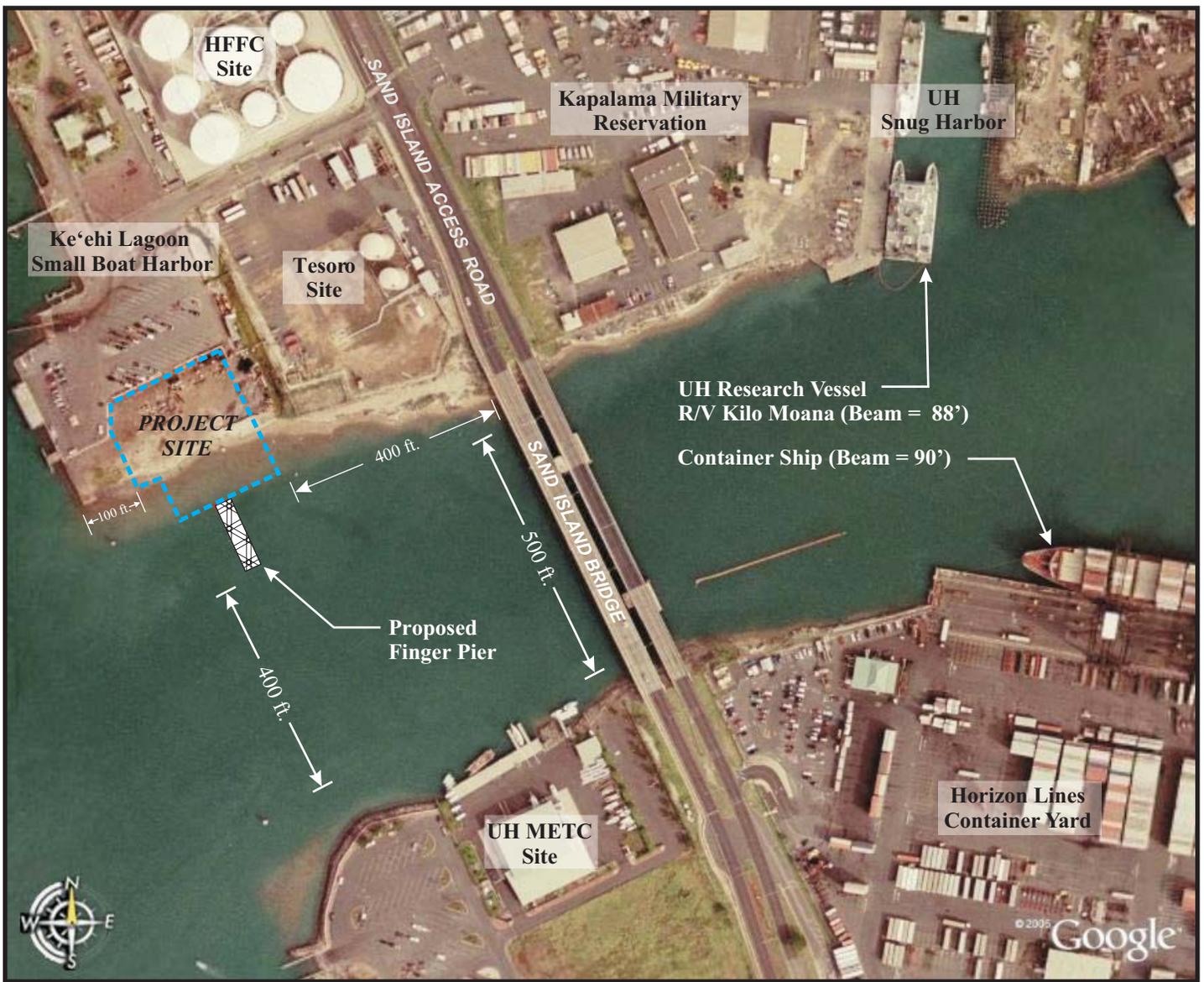
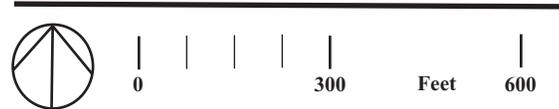


FIGURE 11
 KALIHI CHANNEL ACCESS
 Honolulu Marine Shipyard at Ke'ehi Lagoon
 Honolulu, Oahu, Hawaii



R. M. TOWILL CORPORATION

June 2007

4.2.2 TRAFFIC AND ROADWAYS

Vehicular traffic data was collected at the Sand Island Bridge fronting the proposed project site over a 24-hour period in late 2004. Morning traffic volumes to Sand Island peaks between 6:00 a.m. and 7:00 a.m. Approximately twice as many vehicles are traveling to Sand Island than leaving during this 24-hour period. Afternoon traffic volumes from Sand Island peaks between 3:00 p.m. and 4:00 p.m. Approximately 300 more vehicles are traveling from Sand Island than entering during this period.

The volume of traffic during the period between the AM and PM peak is relatively constant at between 400 and 550 vehicles per hour in both directions.

Peak AM (PM) Traffic Volumes
Sand Island Access Road at Sand Island Bridge
October 2004

360 (751)	1,005 (491)
Sand Island Access Road (North Bound From Sand Island)	Sand Island Access Road (South Bound To Sand Island)
AM Peak = 6:00 - 7:00 AM	PM Peak = 3:00 - 4:00 PM

The proposed project is not expected to significantly alter the total volume of traffic on Sand Island Access Road. Construction-related work, including delivery of building supplies, construction vehicles and other related traffic may affect traffic flow on Sand Island Access Road. However, these effects are expected to be short-term and will be experienced primarily during the initial and final stages of the project when construction equipment is moved to and from the project site. Occasional increases in construction traffic may result from the periodic movement of construction materials and when vehicles leave the site to remove debris.

Construction activity is planned during the daytime hours with no night work anticipated to be required.

In the long-term, the operation of the facility is not expected to significantly add to the existing level of traffic flow along Sand Island Access Road. Normal operational traffic will be limited to

the movement of employee vehicles and routine delivery of supplies which will occur twice daily during non-peak periods.

Honolulu Marine employs approximately 30 employees who typically work in shifts throughout the workday. The early shift begins at 7:00 am and ends at 3:00 pm. The late shift begins at 9:00 am and ends at 5:00 pm. Approximately half of the employees currently drive to the Kewalo Basin site and the remainder are either dropped off or arrive using the City Bus. Similar conditions are expected for the Ke'ehi Lagoon site which is anticipated to add a maximum of 15 vehicles to the morning and afternoon peak travel times. The remaining employees will commute outside of periods of peak traffic hours, or will seek alternative methods of transportation (e.g., they will be picked up or will use the City Bus).

To minimize the need for the storage of materials, delivery of large ship components (e.g., power plants and related prefabricated structural units) are delivered on an as-needed basis. Deliveries from large trucks hauling this material are planned to be staggered, primarily occurring during non-peak traffic hours. The added volume of this traffic is expected to be negligible and would not significantly add to existing levels of traffic.

The required number of parking stalls needed to accommodate employee vehicles will be provided at the facility, therefore the proposed project is not expected to impact parking availability at the Ke'ehi Lagoon Small Boat Harbor or other nearby areas..

The project is not expected to have a significant impact to the existing traffic volume; therefore no additional mitigation measures are proposed or are anticipated to be required.

SECTION 5
RELATIONSHIP TO STATE AND COUNTY LAND USE
PLANS AND POLICIES

5.1 STATE LAND USE DISTRICT

The project site and the surrounding area are within the State Urban District. Areas surrounding the project site are currently developed and are in industrial use. The proposed project is consistent with this current land use designation.

5.2 HONOLULU WATERFRONT MASTER PLAN

The purpose of the Honolulu Waterfront Master Plan is to represent,

“...a comprehensive, long range vision for the Honolulu waterfront. It recognizes the importance of the Port of Honolulu as a lifeline of state-wide commerce and, at the same time, provides for the recreational, cultural and economic needs of the growing population. The plan directly addressed the major planning issues concerning public access and use of the waterfront, long-term integrity of commercial maritime operations, plan implementation, relocation needs, and financial feasibility.”

The proposed project is consistent with the short and long-term plans of the Honolulu Waterfront Master Plan. The proposed project will vacate the current site at Kewalo Basin to allow for other uses including redevelopment as identified in the Waterfront Master Plan. The proposed new location for the facility was proposed by SDOT and is supported by the State Legislature (see **Appendix B**). The proposed project will enable Honolulu Marine to continue its tug boat construction and small boat maintenance operations to support the shipping industry thus helping to ensure the long-term integrity of Hawai'i's commercial maritime operations.

5.3 GENERAL PLAN

The current edition of the General Plan for the City & County of Honolulu was adopted in 1977, revised in 1992, and was last updated in October 2006. The Plan is a comprehensive statement of objectives and policies for the future development of Honolulu. The proposed project is consistent with the following objectives and policies of the City and County of Honolulu's General Plan:

Economic Activity

The objectives and policies for economic activity as stated in the General Plan, "attempt to address the need for an adequate standard of living for residents and future generations. Issues of employment opportunities, viability of major industries, diversification of the economic base, and the location of jobs are addressed in terms of what government can do to provide, encourage, and promote economic opportunities for our people."

Objective A: To promote employment opportunities that will enable all the people of Oahu to attain a decent standard of living.

Policy 1: Encourage the growth and diversification of Oahu's economic base.

The proposed project will provide boat repair and maintenance services to private companies, federal agencies and the military. The facility also constructs tugboats for shipping companies based in Hawai'i as well as for other ports of call. This function plays an essential role in the State's economic well-being by providing an important service to Hawaii's shipping industry.

Policy 2: Encourage the development of small businesses and larger industries which will contribute to the economic well-being of Oahu residents.

The proposed project will help to maintain the continued operation and well-being of the shipping industry for Oahu and State.

Policy 3: Encourage the development in appropriate locations on Oahu of trade, communications, and other industries of a nonpolluting nature.

The proposed project location is in an area designated for waterfront industrial uses and is adjacent to facilities with similar land uses including the Ke‘ehi Lagoon Small Boat Harbor, the UH METC, and shipping container storage yards. Potential use of the Kewalo Basin for other activities also make it necessary for Honolulu Marine to relocate its operation from Kewalo Basin to a new proposed site. This relocation is supported by the legislature.

Policy 4: Encourage the development of local, national, and world markets for the products of Oahu-based industries.

Honolulu Marine is one of only a handful of shipyards on Oahu with only two other shipyard facilities capable of providing similar services. The Honolulu Marine facility is the only shipyard in the State that builds larger steel vessels including tugboats that support the shipping industry.

Objective F: To increase the amount of Federal spending on Oahu.

Policy 4: Encourage the military to purchase locally all needed services and supplies which are available on Oahu.

Honolulu Marine’s clients include Federal agencies and the military. The proposed project will allow Honolulu Marine to continue to provide services that support and encourage local spending by the military.

Objective G: To bring about orderly economic growth on Oahu.

Policy 3: Maintain sufficient land in appropriately located commercial and industrial areas to help ensure a favorable business climate on Oahu.

The relocation of the Kewalo Basin shipyard will allow the State (HCDA) to reuse the Kewalo Basin area for other purposes. The proposed relocation site is zoned for waterfront industrial use and has direct deep-water access and will maintain the established land use designation.

Physical Development and Urban Design

The objectives and policies in Physical Development and Urban Design “deal with the coordination of public facilities and land development, compatibility of land uses, and specification of certain land uses at particular locations. Urban design emphasis is contained in objectives to create and maintain attractive, meaningful, and stimulating environments and to promote and enhance the social and physical character of Oahu's older towns and neighborhoods”.

Objective A: To coordinate changes in the physical environment of Oahu to ensure that all new developments are timely, well-designed, and appropriate for the areas in which they will be located.

Policy 2: Coordinate the location and timing of new development with the availability of adequate water supply, sewage treatment, drainage, transportation, and public safety facilities.

The project will take place in a location that has adequate water supply and sewage treatment facilities. A drainage system will be constructed in accordance with State and Federal regulations and a NPDES General Permit Coverage Authorizing Discharges of Storm Water Associated with Industrial Activities will be filed with the DOH to address and maintain the environmental quality of storm water runoff.

The project location is within an existing industrial area with air, ground and harbor related transportation linkages. The added vehicular traffic from the proposed project is not expected to have significant impacts to the existing traffic volume in the area. Fire protection is provided by the City & County Fire Department out of the Kalihi Kai Fire Station # 31, and police service is provided by the Kalihi Police Station. Coordination of the proposed project with these agencies as well as the SDOT, Department of Planning and Permitting (DPP), Department of Environmental Services (ENV), Department of Design and Construction (DDC), and other departments of government, as applicable, will be provided as a part of the project's environmental documentation review process.

Policy 5: Provide for more compact development and intensive use of urban lands where compatible with the physical and social character of existing communities.

The proposed location of the shipyard is in an area zoned for waterfront industrial activities and is located away from residential uses. Uses immediately surrounding the site include two bulk fuel storage facilities, a small boat harbor facility, and a boat maintenance/marine propulsion facility. The proposed relocation site is owned by the State and managed by DOBOR and is currently vacant. The proposed project will result in a more compact, efficient and compatible development in an existing urban waterfront industrial area.

Policy 6: Encourage the clustering of developments to reduce the cost of providing utilities and other public services.

The proposed project is located in an industrialized area along Sand Island Access Road with access to existing basic infrastructure. The construction and operation of the shipyard facility will not necessitate the need for major development of new utilities or other public services. The proximity to existing utilities used by adjoining waterfront industrial activities will reduce the public costs of providing these services in comparison to alternative locations that were considered.

Policy 7: Locate new industries and new commercial areas so that they will be well related to their markets and suppliers, and to residential areas and transportation facilities.

The proposed project involves the relocation of an existing shipyard facility that is currently sited at the Kewalo Basin area. The proposed relocation of the shipyard is in an industrially-zoned location fronting Kalihi Channel across from Sand Island. This location is well suited for use as a shipyard based on access for boats requiring repair and maintenance. Vessels constructed at the site can be launched directly into the water as well. The site is adjacent to existing industrial and ocean-related properties including bulk fuel storage facilities, the Ke‘ehi Lagoon Small Boat Harbor, and a boat maintenance/marine propulsion (UH METC) facility. No residential areas are located near the proposed site and the planned use is consistent with the zoning designation of the property.

Objective B: To develop Honolulu (Wai’alae-Kahala to Halawa), Aiea, and Pearl City as the Island's primary urban center.

Policy 8: Foster the development of Honolulu's waterfront as the State's major port and maritime center, as a people-oriented mixed-use area, and as a major recreation area.

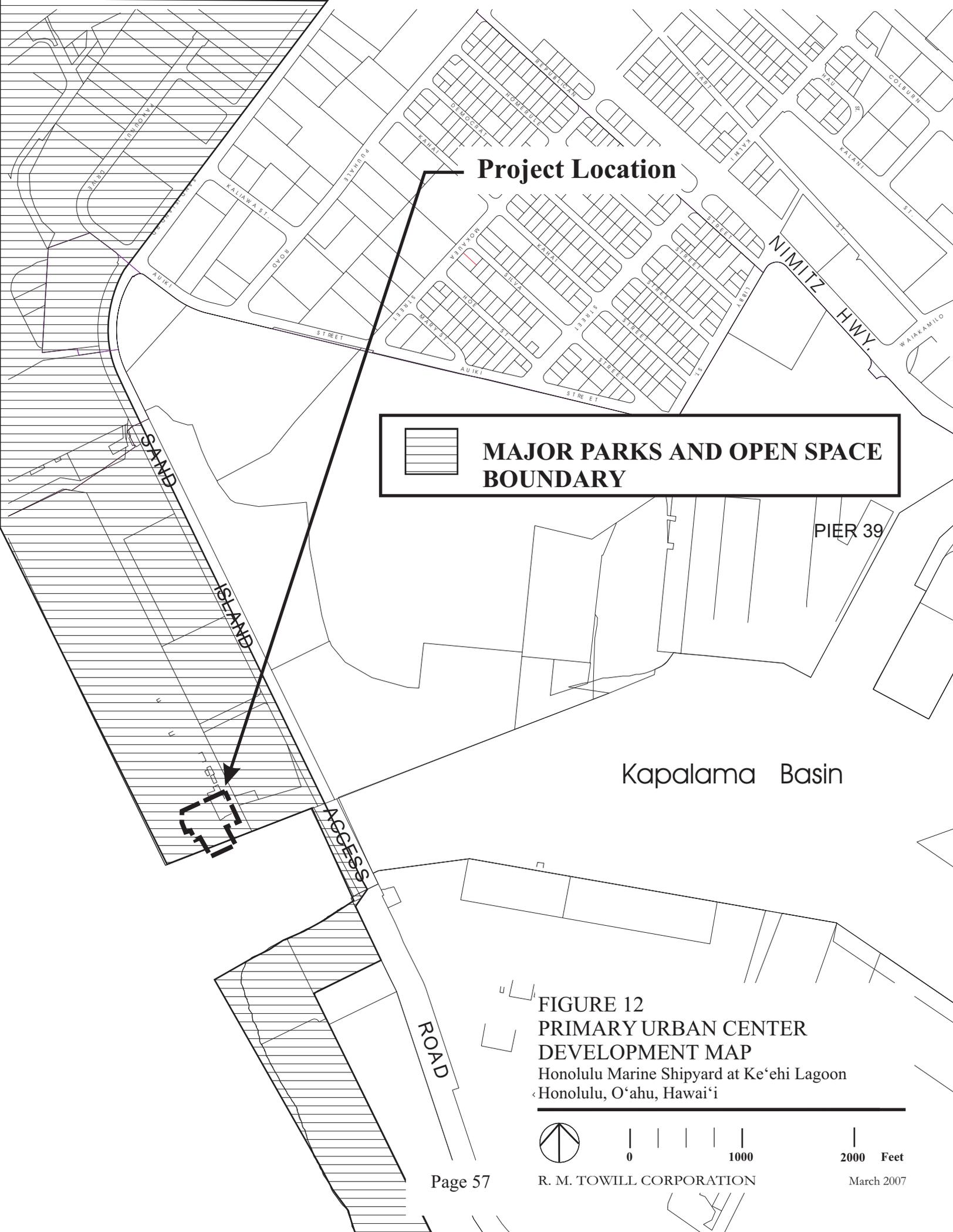
The proposed project plays an important role by providing a support service to the State’s maritime industry. The relocation of the shipyard facility to the new location will maintain a vital maritime activity serving the State within Honolulu’s waterfront.

5.4 PRIMARY URBAN CENTER DEVELOPMENT PLAN

The project site is designated for major parks and open space in the Primary Urban Center (PUC) Development Plan Land Use Map (March 2004). See **Figure 12, PUC Development Plan**. While the proposed project is not consistent with this designation, the following is noted to provide the context of land use for the existing and planned use of the site.

The proposed site is a vacant area adjacent to the Ke‘ehi Lagoon Small Boat Harbor. An important quality making this site desirable for the intended use is the waterfront industrial zoning of the property, access to a deep-water channel, and the availability of utilities. The proposed activity is also consistent with the PUC Development Plan, Section 3.4.2.4, Military, Airport, Harbor, and Industrial Area objective to, “[R]eserve areas around Honolulu Harbor, particularly around Kapalama Basin and the Sand Island container yards, for harbor-related uses.”

The PUC Development Plan notes in Section 3.4.1.4, Military, Airport, Harbor and Industrial Uses that, “A prerequisite to full development of the waterfront for commercial and recreation activities, however, will be the prior development and modernization of maritime support facilities.” The proposed project is consistent with this intent as it will relocate from its present site at Kewalo Basin, which in turn will allow for the upgrading and modernization of the Honolulu Marine shipyard to continue to provide repair, maintenance and construction services supporting the maritime industry.



Project Location

MAJOR PARKS AND OPEN SPACE BOUNDARY

PIER 39

Kapalama Basin

ACCESS ROAD

FIGURE 12
PRIMARY URBAN CENTER
DEVELOPMENT MAP
 Honolulu Marine Shipyard at Ke'ehi Lagoon
 Honolulu, O'ahu, Hawai'i



0 1000 2000 Feet

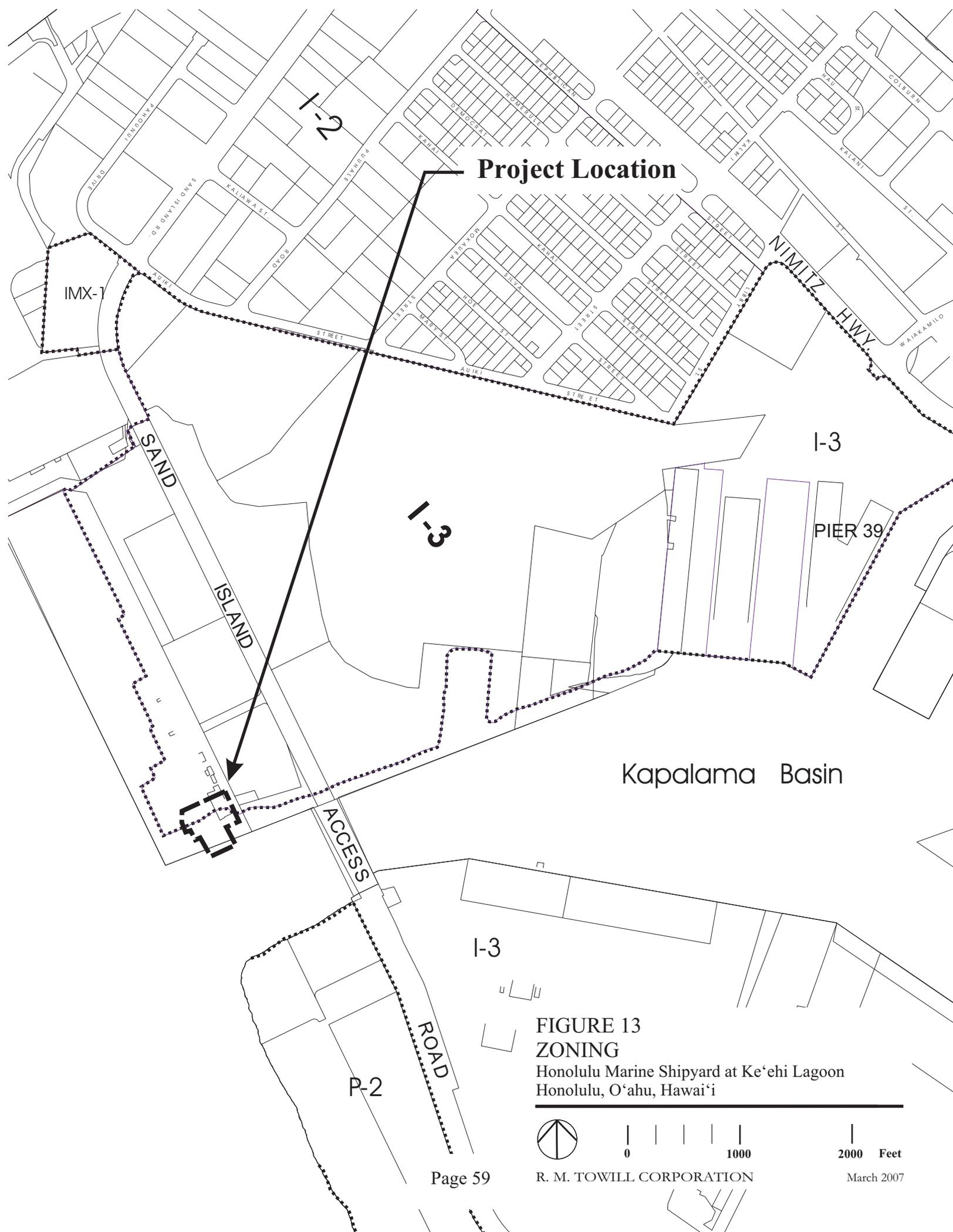
The proposed activity will also be consistent with the I-3 Waterfront Industrial District zoning of the site. According to the Land Use Ordinance (LUO) the intent of the I-3 District is to, "...set apart and protect areas considered vital to the performance of port functions and to their efficient operation. It is the intent to permit a full range of facilities necessary for successful and efficient performance of port functions" (Chapter 21 of the Land Use Ordinance, Section 21.3.130(f), ROH). The proposed project will allow Honolulu Marine to continue shipyard operations and provide repair and maintenance services to support the successful and efficient performance of port functions.

The proposed site is within a vacant and unused portion of the Ke‘ehi Lagoon Small Boat Harbor under management by DOBOR. Relocation of the shipyard facility within the context of surrounding land uses and the consideration of alternative sites in coordination with the SDOT, indicate that no other viable alternative is available to support the proposed project. At the same time the proposed use is not an unreasonable request given the surrounding land uses that support and promote the maritime activities within the Honolulu Harbor.

5.5 ZONING

The project site is designated I-3, Waterfront Industrial District. See **Figure 13, Zoning**. The intent of the I-3, Waterfront Industrial District, is to set apart and protect areas considered vital to the performance of port functions and to their efficient operation. This zoning designation is intended to permit a full range of facilities necessary for successful and efficient performance of port functions. It is intended to exclude uses which are not only inappropriate but which could locate elsewhere (Chapter 21 - Land Use Ordinance, Section 21-3.130(f), ROH).

The facility provides repair and maintenance services to vessels, as well as the construction of tugboats. The nature of the facility necessitates the need to be adjacent to the ocean that has deep-water access. The proposed use of the site is therefore consistent with the I-3 zoning designation.



Project Location

IMX-1

I-2

I-3

I-3

PIER 39

Kapalama Basin

ACCESS ROAD

SAND ISLAND

ISLAND

P-2

I-3

**FIGURE 13
ZONING**

Honolulu Marine Shipyard at Ke'ehi Lagoon
Honolulu, O'ahu, Hawai'i



5.6 SPECIAL MANAGEMENT AREA

The City and County of Honolulu has designated the shoreline and certain inland areas of Oahu as being within the Special Management Area (SMA). SMA areas are designated sensitive environments that should be protected in accordance with the State's Coastal Zone Management policies, as set forth in Chapter 25, Shoreline Management, ROH, and Section 205A, Coastal Zone Management, HRS.

As shown in Figure 4, the entire project site is within the SMA area.

5.6.1 SPECIAL MANAGEMENT, SECTION 25, ROH

The potential effect of the proposed project was evaluated based on the review guidelines in Section 25, ROH. The following is a discussion of the applicability of the guidelines to the proposed project:

- (a) All development in the Special Management Area shall be subject to reasonable terms and conditions set by the Council to ensure that:
 - (a.1) Adequate access, by dedication or other means, to publicly owned or used beaches, recreation areas and natural reserves is provided to the extent consistent with sound conservation principles;

The proposed project involves the relocation of a shipyard facility from Kewalo Basin to a new location adjacent to the Ke‘ehi Lagoon Small Boat Harbor in Honolulu, Oahu. Honolulu Marine is proposing to lease 1.1 acres of fast land, 0.53 acres of fill land, and 0.48 acres of submerged land to accommodate the project.

Facility improvements proposed include construction of a 120’ x 64’ floating dry dock, a 135’ x 30’ finger pier, and a 40’ x 200’ two-story combination office building, storeroom and fabrication shop. See **Figure 2, Site Plan; Figure 5, 3D View Mauka; Figure 6, 3D View Makai; and Figure 8, Proposed Condition**. Improvements will also include a grading and paving of the site and installation of a chain-link fence along the perimeter of the property.

The shoreline area within and immediately adjacent to the proposed project site is composed of fill material and does not receive natural accretion of beach sand due to its inland location. The general area is not normally used as a recreational area except for fishing activities. See **Figure 7, Existing Condition**. While access to the shoreline fronting the proposed shipyard will be restricted for security and safety reasons, access to the shoreline on both sides of the proposed facility will not be hindered. There will be an access easement on the eastern boundary between the site and the Tesoro facility to allow maintenance access to the Sand Island Bridge and to the shoreline for fishing activities. Access to the shoreline to the west of the project site will continue to be provided by the Ke‘ehi Lagoon Small Boat Harbor.

The project will not adversely affect access to publicly owned or used beaches, recreation areas or nature reserves.

(a.2) Adequate and properly located public recreation areas and wildlife preserves are reserved;

The proposed location is an oceanfront site located within an area designated for waterfront industrial use. The area is composed of fill material and has been reserved for industrial use for many decades. The shoreline at the site is not an established recreational area and does not have any facilities that support recreational use such as swimming and park activities. The Ke‘ehi Lagoon Small Boat Harbor is located immediately north of the site and provides boat launching and trailer parking.

The project site is within an urbanized industrial area of Honolulu. The area surrounding the site is not designated as a wildlife preserve. There is no critical plant or animal habitat in the area, and none will be affected by proposed improvements or project activities.

(a.3) Provisions are made for solid and liquid waste treatment disposition and management which will minimize adverse effects upon Special Management Area resources;

Solid waste. Solid waste from the proposed project will be disposed of at an approved refuse facility. Materials to be disposed of include construction-related debris and expended construction materials. Disposal of construction and demolition debris will be at an approved facility. All solid waste material generated from the daily operation of the site will be contained in covered bins and regularly collected and disposed of at an approved refuse facility. No further mitigation measures are anticipated.

Liquid waste. The proposed facility will connect to the City's wastewater treatment system. This connection will be coordinated with the City ENV and DDC as part of the environmental documentation and plan review process. NPDES permit applications for construction and industrial stormwater discharges will be filed with the DOH, Clean Water Branch, to address proper environmental treatment of both construction and operations related discharges of storm water with the proposed facility. An on-site storm water collection and treatment system will be constructed to ensure storm water runoff is sufficiently treated prior to discharges into State waters.

Construction activities will result in a temporary increase in wastewater generation. Portable toilets will be used during construction and will be discharged off-site in compliance with State and County regulations. Wastewater generated as a result of operation of the facility will be addressed as noted above.

(a.4) Alterations to existing land forms and vegetation; except crops, and construction of structures shall cause minimum adverse effect to water resources and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation or failure in the event of an earthquake.

The project lies on a relatively flat area with elevations averaging 4.5 feet above MSL. The proposed improvements will involve alteration of the existing land form through grading, shoreline protection involving construction of a drainage control system and pier, and paving of the site. All necessary environmental and building permit approvals will be obtained prior to construction. Modifications to existing land forms that will result from this project will not create

conditions that would adversely affect water resources, scenic resources, or recreational amenities.

The proposed height of facility structures including the shipyard building and security lighting will be below the established 60 foot maximum height limit for the area. The scale of the proposed shipyard facility is not anticipated to significantly detract from existing scenic resources of the surrounding area. See also Section 4.1.5, Scenic and Visual Resources.

In the short-term, stormwater runoff from construction activities and industrial operation of the facility will be regulated under the NPDES permit program. All project activities will comply with DOH regulations as set forth in HAR, Title 11, Chapter 54, Water Quality Standards, and Chapter 55, Water Pollution Control.

The Uniform Building Code (UBC) provides minimum design criteria to address potential for damage due to seismic disturbance. The UBC scale is rated from Seismic Zone 0 through 4, with 0 being the lowest level for potential seismic induced ground movement. The Island of Oahu has been designated within Seismic Zone 2A. To mitigate the potential hazard from earthquakes, structural elements in this project will be built, at a minimum, in compliance with standards for the UBC Seismic Zone 2A.

(b) No development shall be approved unless the Council has first found that:

(b.1) The development will not have any substantial, adverse environmental or ecological effect except as such adverse effect is minimized to the extent practicable and clearly outweighed by public health and safety, or compelling public interest. Such adverse effect shall include, but not be limited to, the potential cumulative impact of developments, each one of which taken in itself might not have a substantial adverse effect and the elimination of planning options;

The proposed project is not anticipated nor expected to involve substantial degradation of environmental quality. The general area is designated for waterfront industrial use and is consistent with existing surrounding land uses in the area.

A biological assessment did not find any rare, threatened, or endangered flora or faunal resources at the site. Mitigation measures to minimize impacts to the surrounding environment, including the use of silt and dust fencing, berms, stormwater and industrial BMPs, and other practices as described in this EA will be implemented during construction and operation of the facility. These activities will be in accordance with State, Federal, and City & County of Honolulu regulations. With the proposed mitigation measures proposed for this project, no significant adverse impacts on rare, threatened or endangered species are anticipated.

(b.2) The development is consistent with the objectives and policies set forth in Section 25-3.1 and area guidelines contained in HRS Section 205A-26;

The proposed project is in compliance with the objectives and policies set forth in HRS, 205A-2, and the Special Management Area guidelines contained in HRS, 205A-26. This document is further prepared to summarize the proposed Ke‘ehi Lagoon Small Boat Shipyard’s impacts in relation to the subject HRS, 205A-26, and ROH, Section 25, Special Management Area, as the nature of the facility necessitates the need locate within the SMA.

Section 5.6.2, Coastal Zone Management, HRS 205(A), references the project's compliance with the State's objectives and policies for the Coastal Zone.

(b.3) The development is consistent with the County General Plan, Development Plans and Zoning.

The proposed project is consistent with the City & County of Honolulu General Plan (See **Section 5.3 - General Plan**). The project is consistent with Section 3.4.2.4, Military, Airport, Harbor, and Industrial Area of the Primary Urban Center Development Plan (See **Section 5.4 - Primary Urban Center Development Plan**).

The proposed shipyard facility will be located in an area zoned for waterfront industrial (I-3) activities and is not located in proximity to residential areas (See **Section 5.5 – Zoning**). The proposed project will not endanger or disrupt nearby residential communities and will be in compliance with LUO requirements for the I-3 zoning district.

(c) The Council shall seek to minimize where reasonable:

(c.1) Dredging, filling or otherwise altering any bay, estuary, salt marsh, river mouth, slough or lagoon;

The fast land existing at the Ke'ehi Lagoon location represents less than half of the current land use of the Kewalo Basin shipyard. Honolulu Marine proposes the use of a floating dry dock for the movement of vessels to and from the water to maximize the available space of the site. The use of land will also be used to provide adequate space for construction and allow the movement of boats from the floating dry dock onto land. The seaward edge of the facility will be stabilized with sheet pile bulkheads or similar method, backfilled and paved to provide a stable work surface. See **Figure 2, Site Plan**.

The project will involve filling and alteration of the shoreline fronting the project site to provide access to the deep-water channel necessary for shipyard operations. This potential impact to the shoreline should be considered in relation to the history of the project area involving extensive prior modification to accommodate use as an active working harbor. Fast land or surface land in the area is comprised almost entirely of fill material that was deposited during dredging activities to develop the Honolulu Harbor and Ke'ehi Lagoon. Kalihi Channel, which fronts the project site, is a man-made channel that once provided secondary access to Honolulu Harbor.

Construction of the fixed bridge spanning the channel does not currently allow marine vessel access through the Kalihi Channel to other areas of Honolulu Harbor.

(c.2) Any development which would reduce the size of any beach or other area usable for public recreation;

The shoreline area within and immediately adjacent to the proposed project site is composed mostly of fill material interspersed with some sand and does not receive natural accretion of beach sand due to its inland location. The general area has the appearance of fill land, dirt, and urban debris consisting of blocks or chunks of disposed concrete and discarded liquor bottles, soda cans, fast food packages, cigarette butts, etc. This quality of the shoreline does not readily lend itself to uses associated with recreational activities. As noted in this document, the Ke'ehi

Lagoon Small Boat Harbor is located adjacent to the proposed site and the area is known to be used for occasional fishing (See Section 4.1.6, Historical and Archaeological Resources, and Section 4.2.1, Access). The proposed project involving the development of a shipyard will involve some loss of shoreline access that is unavoidable due to the need for the location of the shipyard next to the shoreline. Although some loss of access to the shoreline will result from the need for maintain security and public safety of the site, access to the shoreline on either side of the planned shipyard is intended to remain open. It is therefore anticipated that sufficient shoreline access will be maintained to permit the continued use of the area for fishing. These areas include the shoreline fronting the Tesoro facility adjacent to the Sand Island Access Road, next to the existing bascule bridge, and the area adjoining the Ke'ehi Lagoon Small Boat Harbor. No other potential adverse impacts to use of the shoreline for fishing purposes are anticipated. See **Figure 7, Existing Condition**.

(c.3) Any development which would reduce or impose restrictions upon public access to tidal and submerged lands, beaches, portions of rivers and streams within the Special Management Area and the mean high tide line where there is no beach;

The project is not anticipated to result in the adverse reduction or restriction of public access to tidal and submerged lands, beaches, portions of rivers, and streams within the Special Management Area. While access to the shoreline fronting the proposed shipyard will be restricted for security and safety reasons, access to the shoreline on both sides of the proposed facility will be maintained. There will be an access easement on the eastern boundary between the site and the Tesoro facility to allow public and maintenance access to the bridge and shoreline area. Access to the shoreline to the west of the project site will continue to be via the Ke'ehi Lagoon Small Boat Harbor. See **Figure 2, Site Plan**.

(c.4) Any development which would substantially interfere with or detract from the line of sight toward the sea from the state highway nearest the coast;

The project area is located in a waterfront industrial area with adjacent to properties in industrial use. The proposed shipyard facility will be consistent with these surrounding industrial land uses.

Existing fuel storage tanks and other improvements on adjacent properties (Tesoro and HFFC), and other elevated structures in and around the Sand Island industrial area currently impedes views westward and mauka from vantage points near the project site and from the Ke‘ehi Lagoon Small Boat Harbor. It is noted that the proposed height of the building and lighting associated with the facility will be below the established 60-foot maximum building height limit and landscaping will be incorporated into the facility design to provide a visual buffer from nearby areas.

The City & County of Honolulu, Coastal View Study (1987), indicates “Continuous Coastal Views” from the Sand Island Bridge. Because of existing land use and nearby industrial structures including cargo gantry cranes and fuel tanks, the proposed project is not expected to significantly impact or degrade the existing views as identified by the City. See also Section 4.1.5, Scenic and Visual Resources.

(c.5) Any development which would adversely affect water quality, existing areas of open water free of visible structures, existing and potential fisheries and fishing grounds, wildlife habitats, or potential or existing agricultural uses of land.

No adverse effects are anticipated to water quality, open water, fisheries or fishing grounds, wildlife habitats, or potential or existing agricultural uses of land. During construction, erosion control measures will be implemented to handle on-site storm water runoff. Construction storm water from the site will be collected and treated in accordance with DOH requirements before it is discharged into State waters. A filtration treatment system will also be designed, built and maintained to on-site to treat shipyard generated runoff and effluent before being discharged into the Kalihi Channel.

The proposed shipyard facility will also not result in changes to the existing land use. The METC, a boat repair facility, is located across the channel from the site. Boat ramp facilities and a boat harbor also exist in close proximity to the site. Shoreline access to areas adjacent to the proposed facility will be provided and maintained.

The project site is composed of fill material and does not support important wildlife habitats or agricultural use.

As noted in this EA, no adverse effects to water quality are expected to result from construction or the use of the planned facility.

5.6.2 COASTAL ZONE MANAGEMENT, HRS 205(A)

The State of Hawai'i designates the Coastal Zone Management Program (CZMP) to manage the intent, purpose and provisions of the federal Coastal Zone Management Act, and HRS, Chapter 205(A)-2, as amended, for the areas from the shoreline to the seaward limit of the State's jurisdiction, and any other area which a lead agency may designate for the purpose of administering the Coastal Zone Management Program.

The following is an assessment of the project with respect to the CZMP objectives and policies set forth in Section 205(A)-2.

1. Recreational resources

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

A) Improve coordination and funding of coastal recreational planning and management; and

B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

(i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

(ii) Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;

- (iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;
- (iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;
- (v) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;
- (vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;
- (vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and
- (viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.

Discussion:

No existing recreational facilities will be adversely affected by the proposed project. The project area is located in a waterfront industrial area adjacent to properties in industrial use. The proposed shipyard facility will be consistent with the surrounding industrial land uses.

The shoreline along the project site is composed of fill material and includes large chunks of concrete waste, dredge material, and urban debris (**Figure 7, Existing Condition.**). The Kalihi Channel, which fronts the project site, connects the Honolulu Harbor and Ke‘ehi Lagoon. These two inland water bodies are accessible to large maritime vessels and ocean recreation traffic, and are adjacent to industrial properties. The shoreline’s inland location and its close proximity to the deep channel prevent any accretion of sand along its length. Because of the extensive physical alteration of the general area during construction of this portion of the Honolulu Harbor, the site does not feature any fishponds or other unique coastal resources.

The Sand Island State Recreational Area is located approximately 1.5 miles southeast of the project site. This 140-acre park provides picnicking and camping facilities with bathroom and showers.

The proposed site is the only available relocation site that Honolulu Marine and SDOT were able to find that satisfied all the development criteria for the operation of the shipyard facility. The State Legislature has also offered its support for the facility's relocation to the proposed site through Senate Concurrent Resolution No. 134, S.D.1, H.D.1, authorizing the lease of both fast and submerged land at the Ke'ehi Lagoon Small Boat Harbor for the redevelopment, management, and operation of a commercial ship repair facility (see **Appendix B**).

Water quality will be protected during construction through the application of BMPs in accordance with NPDES, Section 401 Water Quality Certification, and other permitting requirements. The project will not adversely alter the existing shoreline area.

2. Historic resources

Objective: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

- (A) Identify and analyze significant archaeological resources;
- (B) Maximize information retention through preservation of remains and artifacts or salvage operations; and
- (C) Support state goals for protection, restoration, interpretation, and display of historic resources.

Discussion:

No adverse impacts to historic resources associated with construction of the proposed Honolulu Marine shipyard facility are expected. See Section 4.1.6. Historic/Archaeological Resources.

The proposed project is within an existing industrialized area and on land that is composed entirely of fill material. It is highly unlikely that significant historic or archaeological resources

are present at the project site. However, in the unlikely event that unidentified archaeological remains or deposits are uncovered during construction, work will cease in the immediate area and the State Historic Preservation Office will be contacted. As appropriate, mitigative measures will be proposed and coordinated with SHPD prior to the resumption of work.

No adverse impacts to cultural practices are expected as a result of this the proposed project. See Section 7.1, Impacts to Traditional/Cultural Resources. The project site is dominated by common and introduced plant species not identified with traditional or cultural gathering practices. Project activities will not diminish the availability of any plant type for use in cultural practices.

3. Scenic and open space resources

Objective: Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

- (A) Identify valued scenic resources in the coastal zone management area;
- (B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural land forms and existing public views to and along the shoreline;
- (C) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and
- (D) Encourage those developments that are not coastal dependent to locate in inland areas.

Discussion:

The proposed improvements conform to the CZMP Objective 5, Economic Uses, which encourages the provision of public or private facilities and improvements important to the State's economy in suitable locations.

The proposed project area is located in a waterfront industrial area and is adjacent to properties with existing fuel storage facilities. The UH METC, which conducts boat maintenance training activities, is located directly across Kalihi Channel from the project site. The proposed facility is consistent with the surrounding industrial land uses.

Because of the possibility of the loss of the existing Kewalo Basin site, Honolulu Marine is attempting to relocate to a more secure location that is consistent with the State's future plans for land use in the Kaka‘ako Community Development District. Alternative relocation sites were examined by Honolulu Marine in collaboration with SDOT-Harbors. The proposed project site adjacent to the Ke‘ehi Lagoon Small Boat Harbor was the only location identified that met all the development criteria for the shipyard facility.

The facility provides repair and maintenance services to vessels, as well as the construction of tugboats. The nature of this activity requires the need to be adjacent to the ocean and to deep-water access for the launching and recovery of vessels.

The proposed shipyard facility is expected to have minimal visual impact due to the existing industrial uses of the surrounding area including the Tesoro and HFFC fuel storage facilities immediately adjacent and to the north of the subject property and the UH METC across the Kalihi Channel. Additionally, landscaping will be incorporated into the design of the proposed facility.

4. Coastal ecosystems

Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

- (A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;
- (B) Improve the technical basis for natural resource management;
- (C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;
- (D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and
- (E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water

quality through the development and implementation of point and nonpoint source water pollution control measures.

Discussion:

The proposed project is not expected to have any adverse effects on marine resources. As stated elsewhere in this document and above, the nature of the facility necessitates its need to be adjacent to the ocean and deep-water access. The proposed facility will include construction of a 120' x 64' floating dry dock, a 135' x 30' finger pier, and a 40' x 200' two-story combination office building, storeroom and fabrication shop. The proposed project will involve filling of approximately 23,000 square feet of submerged land to provide adequate space for construction and allow movement of boats from the floating dry dock onto the facility. The fast land at the existing Sand Island location represents less than half of the currently available land at the Kewalo Basin site. Honolulu Marine proposes to use a floating dry dock for movement of vessels to and from the water. The floating dry dock will assist in maximizing the available space of the site. The seaward edge of the facility will be stabilized with sheet pile bulkheads or similar method, backfilled and paved to provide a stable work surface. The seaward edge will be designed to prevent erosion on adjacent shoreline areas on both sides of the facility. See **Figure 2, Site Plan; Figure 5, 3D View Mauka; Figure 6, 3D View Makai; and Figure 8, Proposed Condition.**

During construction, all activities will be covered under an NPDES permit application to address proper treatment of storm water discharges during construction. Measures to reduce and prevent sediment discharges in storm water runoff during construction will be in place and functional before project activities begin and will be maintained throughout the construction period. Runoff and discharge pollution prevention measures will be incorporated into a site-specific Construction Stormwater BMPs plan by the project contractor. An NPDES permit application addressing discharges of storm water associated with industrial activities will also be filed with DOH for the new facility to ensure proper operation of the facility.

5. Economic uses

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

- (A) Concentrate coastal dependent development in appropriate areas;
- (B) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and
- (C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:
 - (i) Use of presently designated locations is not feasible;
 - (ii) Adverse environmental effects are minimized; and
 - (iii) The development is important to the State's economy.

Discussion:

The proposed project has been assessed for potential social, visual, and environmental impacts in accordance with Chapter 25, ROH. With the implementation of the mitigation measures identified in this document, no adverse impacts are expected to result.

The County zoning designation for the project site is Waterfront Industrial (I-3). The proposed improvements are in compliance with the LUO requirements for the I-3 zoning district.

While an alternative site for the proposed project was investigated by the applicant, the proposed location adjacent to the Ke'ehi Lagoon Small Boat Harbor was the only location identified that met all the development criteria for the shipyard facility. The proposed project area is located in a waterfront industrial area adjacent to properties in industrial use and is considered to be consistent with the surrounding industrial land uses.

The proposed facility provides boat repair and maintenance services to private companies, federal agencies and the military. The facility also constructs tugboats for shipping companies based in Hawai'i and the other ports of call. The planned facility is anticipated to be an essential

part of the State's economic well-being by providing an important service to Hawaii's shipping industry.

6. Coastal hazards

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.

Policies:

- (A) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;
- (B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;
- (C) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and
- (D) Prevent coastal flooding from inland projects.

Discussion:

The subject property is located at the outlet of Honolulu Harbor. According to FEMA FIRM Map No. 15003C0353 E, dated November 20, 2000, the project site is in an area designated as Zone AE (EL 5). See **Figure 10, FEMA FIRM Map**. A coastal engineering assessment was conducted to determine the potential impacts on flooding events to the project site (see **Appendix C – Coastal Engineering Assessment**).

The development of the project will be in compliance with the requirements of the Federal Flood Insurance Program, the City & County of Honolulu Drainage, Grading and Development standards for Flood Hazard Districts, and the LUO, Section 21-9.10, Flood Hazard Districts.

7. Managing development

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

- (A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;

- (B) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and
- (C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Discussion:

The project site is within the State Urban Land Use District. Land uses within this designation are subject to regulation by the City & County of Honolulu. The county's zoning designation is I-3, Waterfront Industrial.

All improvement activities will be conducted in compliance with State and County environmental rules and regulations. This EA document is prepared to identify and, where necessary, propose mitigation measures to address the potential for impacts anticipated from the construction and operation of the project. This document will be published for public review in compliance with procedures set forth in ROH, Chapter 25.

8. Public participation;

Objective: Stimulate public awareness, education, and participation in coastal management.

Policies:

- (A) Promote public involvement in coastal zone management processes;
- (B) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and
- (C) Organize workshops, policy dialogues, and site-specific mitigation to respond to coastal issues and conflicts.

Discussion:

Public involvement in the project will consist of public hearings before the Department of Planning and Permitting, and the Honolulu City Council, for the approval of the SMA permit

application that is anticipated to be filed for this project. Additionally, public notice of the proposed action will be provided in the Office of Environmental Quality Control (OEQC) Bulletin. See Section 8, Agencies, Organizations, and Individuals Consulted for a list of agencies, organizations and individuals consulted for this project. All written public comments will be provided with a written response. Where appropriate, mitigation measures will be developed to address issues and concerns raised during public review of the project (See **Appendix A - Comments Received**).

9. Beach protection;

Objective: Protect beaches for public use and recreation.

Policies:

(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;

(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

Discussion:

The shoreline at the project site is composed of fill material including large chunks of concrete waste, dredge material, and urban debris (See **Figure 7, Existing Condition**). The shoreline's inland location and its close proximity to the Kalihi Channel prevent any accretion of sand along its length. The proposed project will involve filling of approximately 23,000 square feet of submerged land to provide adequate space for construction and allow movement of boats from the floating dry dock onto the facility. The seaward edge of the facility will be stabilized with sheet pile bulkheads or similar method, backfilled and paved to provide a stable work surface. The seaward edge will be designed to prevent erosion on adjacent shoreline areas on both sides of the facility. See **Figure 8, Proposed Condition**.

10. Marine resources

Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

- (A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;
- (B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;
- (C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;
- (D) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and
- (E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Discussion:

Marine biological, water quality, and coastal engineering assessments were conducted to determine the effect of the proposed project on marine and coastal resources. These studies are included in this EA (see **Appendices C and D**).

The Army Corps of Engineers, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the U.S. Coast Guard will also be consulted on the proposed project. All necessary permit applications and environmental and building permit approvals will be secured prior to the initiation of construction activities. See Section 6, Necessary Permits and Approvals for further detail.

Honolulu Marine's boatyard facility plays an essential role in the State's economic well-being by providing a crucial service to Hawaii's shipping industry.

SECTION 6

NECESSARY PERMITS AND APPROVALS

6.1 CITY AND COUNTY OF HONOLULU

Special Management Area Permit

Shoreline Setback Variance

Grading Permit

Building Permit

6.2 STATE OF HAWAI'I

NPDES NOI-B, Discharges of Storm Water Associated With Industrial Activities

NPDES NOI-C, Discharges of Storm Water Associated With Construction Activities

NPDES NOI-G, Discharges Associated With Construction Activity Dewatering

Covered Source Permit, State of Hawai'i Department of Health Clean Air Branch

Plan Approval by Department of Transportation, Airports Division

6.3 FEDERAL

Department of the Army Permit (Section 404, Clean Water Act)

Department of the Army Permit (Section 10, Rivers and Harbors Act)

Water Quality Certification (Section 401, Clean Water Act)

Coastal Zone Management Federal Consistency Review

Section 7 – Endangered Species Act Consultation

SECTION 7

CULTURAL IMPACT ASSESSMENT

7.1 IMPACTS TO TRADITIONAL/CULTURAL RESOURCES

A cultural impact assessment, archaeological literature review, and field inspection was conducted for the proposed project (see **Appendix F – Cultural and Archaeological Assessment**). The following provides a summary of the findings of the assessments:

The land on which the project area is located is composed entirely of fill material.

A review of the archaeological literature found no archaeological properties in the vicinity of the project area and because the land is composed entirely of fill material it is highly unlikely that significant historic or archaeological resources are present at the project site.

There are no plants on the property that are of significant importance for traditional or cultural use. Plant cover in the project area is limited to grass and other weedy species that are either common or introduced varieties. There is a drainage ditch at the eastern edge of the site that contains vegetation including ‘aki‘aki (*Sporobolus virginicus*), an indigenous coastal rush grass, Kiawe (*Prosopis spp.*) and tropical almond or false Kamani (*Terminalia catappa*). The drainage area will not be impacted by the proposed project.

The potential for adverse impacts as a result of the proposed project to near shore resources and fishing access is unclear. However, given the long-tradition of use of coastal resources in the vicinity and the issue involving the Hawaiian effort to access and reside on Mokauea Island, the study recommends that the project attempt to minimize adverse impacts to the coastal environment and coastal access for purposes of fishing and use of other coastal resources.

The cultural impact assessment report further indicated that the general area of the project site, including the Ke‘ehi Lagoon Small Boat Harbor, is used by recreational fishermen. Because of the nature of the proposed project, the loss of access to the shoreline fronting the immediate area of the site is unavoidable. As noted in Section 4.1.6, Historic/Archaeological Resources, the immediate area fronting the shipyard including the finger pier and floating dry dock will need to be prohibited from public entry to maintain security and safety from the movement and use of machinery and heavy equipment associated with shipyard operations. The maintenance of access on either side of the facility will be provided, however, to help minimize the loss of coastal access. The shoreline east of the project site fronting the Tesoro property will remain accessible through an access easement (see **Figure 2, Site Plan**), and the shoreline area to the west of the project area will remain accessible through the state's Ke‘ehi Lagoon Small Boat Harbor.

No other impacts to the use of flora and fauna associated with cultural practices are anticipated.

SECTION 8

AGENCIES AND ORGANIZATIONS CONSULTED

The following agencies, organizations, and individuals were/will be contacted regarding the preparation of the Draft and Final EA for this project.

8.1 CITY AND COUNTY OF HONOLULU

Department of Planning and Permitting
Department of Environmental Services
Department of Design and Construction
Fire Department
Police Department

8.2 STATE OF HAWAI‘I

Department of Health - Clean Water Branch
Department of Land and Natural Resources –
 Division of Boating and Ocean Recreation
 Land Division
 State Historic Preservation Division
Department of Transportation - Harbors Division
University of Hawai‘i - Marine Center at Snug Harbor

8.3 FEDERAL GOVERNMENT

U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Fish and Wildlife Service
National Marine Fisheries Service

8.4 ORGANIZATIONS AND INDIVIDUALS

The Kalihi/Palama Neighborhood Board No. 15

Sand Island Business Association

Owners of property within 300 feet of project site

Honolulu City Council

SECTION 9

SUMMARY OF IMPACTS AND SIGNIFICANCE DETERMINATION

9.1 SHORT TERM IMPACTS

Short term impacts associated with the proposed project are expected to be minimal. The construction contractor will need to access the project site via Ke‘ehi Lagoon Access Road. Noise will be generated from construction and related mobilization of equipment.

Construction equipment is expected to include, but not be limited to, a compactor, grader, bulldozer, concrete mixers, concrete delivery trucks, cranes, pile driver, welders and powered hand tools. All equipment will be muffled in accordance with standard engine operating practices. The work will be limited to weekday daylight hours and engine exhausts will be governed in accordance with applicable state and county regulations. Upon construction completion, noise levels will return to ambient levels.

Dust and associated nuisance problems are expected to be slight to insignificant due to the limited scope and scale of the project. Fugitive dust will be controlled with the use of dust screens and/or regular wetting of the soil by the contractor.

Construction activity will temporarily disturb soil on the property and the bottom substrate fronting the site. To minimize soil erosion and sediment suspension, silt fences, berms, silt curtains and other applicable erosion control devices will be utilized to prevent construction-related soil and silt from leaving the active work area. If required, exposed soils will be covered with PVC sheet plastic or similar material to prevent inadvertent contact and mixing with storm water.

All necessary environmental permit applications and building permit approvals will be secured prior to initiation of construction activities.

9.2 LONG TERM IMPACTS

Long term benefits derived from this project include employment benefits as well as tax benefits to the State and City & County of Honolulu. The facility will continue to provide repair and maintenance services, including the construction of tugboats and other maritime vessels to support Hawaii's shipping industry.

No long term adverse impacts are anticipated. Upon completion, all construction equipment used on-site will be demobilized and all debris and waste materials will be disposed of at an approved refuse facility. The shipyard will employ mitigation measures to contain and prevent petroleum and other potential petroleum, oil, and lubricant (POL) associated product from entering State waters. Proposed mitigation measures will include, but will not be limited to, use of a properly engineered fuel containment pit, on-site drainage system with an oil-water separator and fuel-handling BMPs. Spill containment kits will be employed on-site to handle inadvertent spills or releases of POL-associated product.

9.3 SIGNIFICANCE CRITERIA

Based on the significance criteria set forth in HAR, Title 11, Chapter 200, Environmental Impact Statement Rules, the proposed project is not anticipated to result in significant environmental impacts. The recommended preliminary determination for the proposed project is a Finding of No Significant Impact (FONSI). The findings and reasons supporting this determination are summarized as follows:

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

The proposed project will not result in the adverse loss of natural or cultural resources. There are no threatened or endangered species of plants or wildlife that inhabit the project site. Given the history, industrial use of the area, and the composition of the underlying soils,

historic or archaeological sites are not known to be present at the site. However, in the unlikely event of a discovery of significant historic or archaeological resources, the State Historic Preservation Division will be immediately notified for appropriate action and treatment.

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

The subject property is zoned for waterfront industrial use and is currently vacant. The proposed use is consistent with the industrial designation of the site and will be contained entirely within the property. The proposed action does not curtail beneficial uses of the environment.

3. *Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 343, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders*

The proposed project is consistent with the environmental policies, goals and guidelines expressed in HRS, Chapter 343. Potential sources of adverse impacts have been identified and appropriate measures have been developed to either mitigate or minimize potential impacts to negligible levels.

4. *Substantially affects the economic and social welfare of the community or state*

The proposed project will use an industrially-zoned site for a shipyard facility which will continue to provide for the construction of tug boats, and ship repair and maintenance to support the State's maritime industry. The operation of the facility will be regulated in accordance with County, State and Federal regulations. The proposed project is expected to maintain the social and economic environment of Oahu by allowing the relocation of the existing shipyard from Kewalo Basin to the Ke'ehi Lagoon site.

5. *Substantially affects public health*

Factors affecting public health, including air quality, water quality, and noise levels, are expected to be only minimally affected, or unaffected, by the proposed project. Under normal operating conditions, the proposed relocation of the shipyard facility does not pose a direct threat to public health and safety. Potential impacts will be mitigated in accordance with Federal, State and City and County of Honolulu regulations.

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

The proposed activity is expected to have little to no substantial secondary or indirect impacts such as population changes or effects on public facilities based on the limited scope and scale of the project.

7. *Involves a substantial degradation of environmental quality*

Impacts to air and water quality, noise levels, natural resources, and land use associated with the planned improvements are anticipated to be minimal. Mitigation measures will be employed as practicable to further minimize potentially detrimental effects to the environment. The proposed project does not involve substantial degradation of environmental quality.

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

The proposed improvements are not expected to cause adverse cumulative impacts to the environment, nor does the proposed project involve a commitment for larger actions. The area of use is limited and is not likely to be further expanded.

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

There are no rare, threatened or endangered plant or animal species on the subject property. BMPs will be implemented to minimize the impact to the marine environment.

10. *Detrimentially affects air or water quality or ambient noise levels*

On a short-term basis, ambient air and noise conditions may be affected by construction activities related to the proposed facility improvements, but these are short-term potential impacts and can be controlled by mitigation measures as described in this EA. Once the project is completed, air and noise in the project vicinity will be allowed to return to preconstruction conditions. Erosion control measures and other BMPs will be employed to prevent untreated storm water runoff from construction activities entering State waters.

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

A portion of the project area is located within an area determined by the Federal Emergency Management Agency to be within the 1-percent annual chance floodplain with a Base Flood Elevation of 5 feet. The proposed action is not expected to have a significant impact on flood conditions.

The proposed project will involve the filling of land to provide adequate space for operation of the shipyard. The seaward edge of the facility will be stabilized with sheet pile bulkheads or similar method, backfilled, and paved to provide a stable work surface. The seaward edge will be designed to prevent erosion on adjacent shoreline areas on both sides of the facility.

12. *Substantially affects scenic vistas and viewplanes identified in county or state plans or studies*

The Primary Urban Center Development Plan as well as the City & County of Honolulu's Coastal View Study (1987) identifies important views that are to be protected. The Coastal View Study, indicates there are "Continuous Coastal Views" from the Sand Island Bridge only. Existing views of the ocean from the Sand Island Access Road and the Ke'ehi Small Boat Harbor are constrained by existing improvements in the area. Existing pedestrian (street level) views of the ocean are blocked along the Sand Island Access Road by existing and on-going industrial work in the area as well as topography. The addition of fuel storage tanks planned by a fuel storage facility will further constrain panoramic views from a pedestrian point of view. View relief is available in the form of view channels from the Ke'ehi Lagoon Small Boat Harbor Access Road and from the higher elevation of the surface of the Sand Island Bridge.

From a regional perspective, the proposed project will not obstruct any significant scenic features and viewplanes due to its elevation close to sea level and a number of industrial activities in close proximity to the project site. Additionally, the proposed office building and associated structures at the facility will be below the established 60-foot maximum building height limit. The site improvements will not substantially affect any existing views from surrounding areas.

13. *Requires substantial energy consumption*

Construction and daily activities associated with the proposed site improvements will not require substantial amounts of energy. The planned relocation of the facility to the proposed project site is anticipated to require the same energy requirement for the operation of the small boat shipyard.

SECTION 10

FINDINGS

In accordance with the provisions set forth in HRS, Chapter 343, and the significance criteria in HAR, Section 11-200-12 of Title 11, Chapter 200, it is anticipated that the proposed project will have no significant adverse impacts to water quality, air quality, existing utilities, noise levels, social welfare, archaeological sites, or wildlife habitat. All anticipated impacts are expected to be temporary in duration and will not adversely impact the environmental quality of the area. It is expected that an Environmental Impact Statement (EIS) will not be required, and that a Finding of No Significant Impact (FONSI) will be issued for this project.

REFERENCES

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Appendix A

Comments Received

Appendix B

Senate Concurrent Resolution (S.C.R. NO. 134)

SENATE CONCURRENT RESOLUTION

AUTHORIZING THE LEASE OF SUBMERGED LANDS AT KEEHI SMALL BOAT HARBOR FOR REDEVELOPMENT, MANAGEMENT, AND OPERATION BY HONOLULU MARINE, INC., FOR A COMMERCIAL SHIP REPAIR FACILITY.

1 WHEREAS, Honolulu Marine, Inc., dba Kewalo Shipyard
2 (Honolulu Marine), currently operates a commercial marine
3 railway/ship repair facility at 123 Ahui Street, a 103,597
4 square foot waterfront parcel on the Ewa boundary of Kewalo
5 Basin; and

6
7 WHEREAS, the land under Honolulu Marine's facility is owned
8 by the Hawaii Community Development Authority (Authority) and
9 leased by the Department of Transportation Harbors Division to
10 Honolulu Marine pursuant to Harbor Lease No. H-86-23; and

11
12 WHEREAS, the term of Honolulu Marine's lease is for 35
13 years and expires in 2021; and

14
15 WHEREAS, the Authority is tasked with redeveloping the
16 Kakaako business district, which includes the parcel occupied by
17 Honolulu Marine; and

18
19 WHEREAS, the Authority has already advised Honolulu Marine
20 that it must vacate the Kewalo Basin property as soon as
21 possible; and

22
23 WHEREAS, Honolulu Marine has been working closely with the
24 Authority and the Department of Transportation, Harbors
25 Division, in an effort to identify an alternate site for
26 Honolulu Marine to move; and

27
28 WHEREAS, Honolulu Marine has identified and inspected a
29 parcel under the management of the Department of Land and
30 Natural Resources, Division of Boating and Ocean Recreation,
31 located adjacent to the Keehi Small Boat Harbor; and

32

SCR134 HD1 HMS 2005-3806



1 WHEREAS, the unimproved dirt lot, which covers 50,400
2 square feet of total area, is currently used, on a month-to-
3 month tenancy, as a base yard for a nearby construction project;
4 and

5
6 WHEREAS, although the Division of Boating and Ocean
7 Recreation's parcel is only one-third the size of Honolulu
8 Marine's existing facility, if the necessary improvements and
9 submerged lands lease are granted, it is the best option
10 available, given the Authority's need to have Honolulu Marine
11 vacate its existing facility as soon as possible; and

12
13 WHEREAS, Honolulu Marine proposes to operate a ship repair
14 facility using a newly constructed 120' x 64' floating drydock
15 in lieu of a commercial marine railway; and

16
17 WHEREAS, if established, Honolulu Marine will have the
18 ability to perform ship repairs on shore, on the drydock, and in
19 the water; and

20
21 WHEREAS, in addition, the scope of operations Honolulu
22 Marine anticipates it will undertake at the new facility
23 includes, but is not limited to:

- 24 (1) The construction of new commercial vessels;
- 25
- 26 (2) Repair and maintenance of vessels owned by Honolulu
27 Marine's sister company, P&R Water Taxi, Ltd.;
- 28
- 29 (3) Repair and maintenance of vessels owned by the United
30 States Navy; and
- 31
- 32 (4) Repair and maintenance of private commercial tugs,
33 barges, and fishing vessels;
- 34

35
36 and

37
38 WHEREAS, Honolulu Marine is interested in a long-term lease
39 of the fast and fronting submerged lands under which a minimum
40 term of 25 years is necessary to ensure that Honolulu Marine can
41 recapture funds it will be required to invest in relocating and
42 developing the parcel as necessary to resume operations; and

43

SCR134 HD1 HMS 2005-3806
[Barcode]

1 WHEREAS, under Honolulu Marine's proposal, the fast land
2 parcel that Honolulu Marine is interested in leasing at Keehi
3 Small Boat Harbor would require the following minimum
4 improvements:

5
6 (1) Installing a chain link fence around the entire
7 boundary;

8
9 (2) Grading and leveling the property;

10
11 (3) Providing utilities and security lighting (i.e.,
12 water, sewage, electricity, etc.);

13
14 (4) Erecting a 40' x 100' fabrication shop;

15
16 (5) Erecting a 40' x 100' two-level combination office
17 building and storeroom; and

18
19 (6) Paving the surface of the lot;

20
21 and

22
23 WHEREAS, because Honolulu Marine seeks to employ the use of
24 a floating drydock, a 135' x 25' finger pier is required to
25 secure the position of the drydock and maximize operating
26 efficiency; and

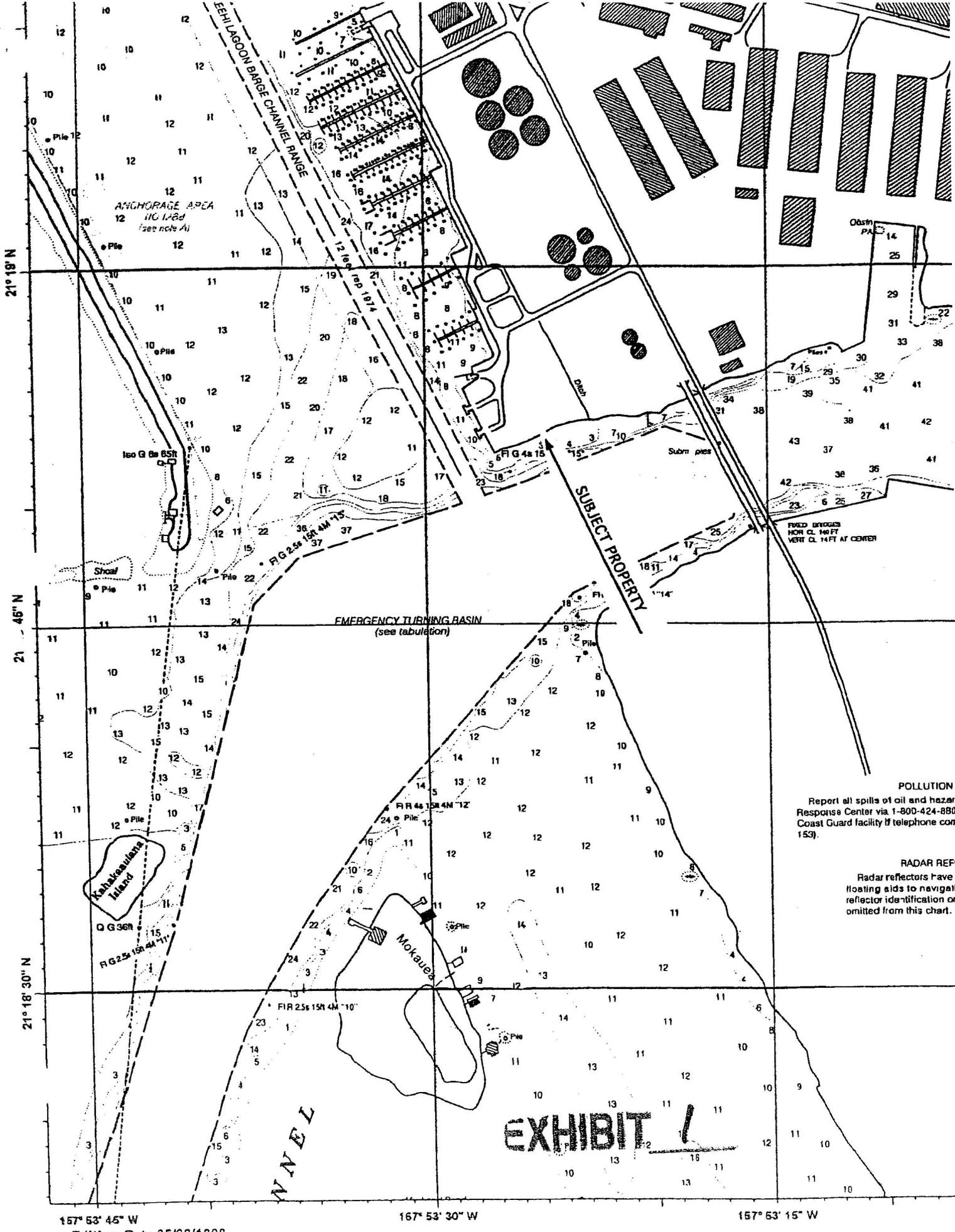
27
28 WHEREAS, a finger pier would allow Honolulu Marine to
29 secure the floating drydock and haul vessels out of the water on
30 one side, while simultaneously having the capability of
31 performing in-water repairs on vessels secured on the opposite
32 side of the pier; and

33
34 WHEREAS, in total, Honolulu Marine anticipates it will need
35 to lease a total area of 130' x 160' (20,800 square feet) of
36 submerged land area for its operation; and

37
38 WHEREAS, there are multiple incidental benefits that will
39 favorably accrue to the area if the Division of Boating and
40 Ocean Recreation leases the Keehi Small Boat Harbor parcel to
41 Honolulu Marine such as:

42
43 (1) The generation of revenue for the State over a long
44 term;

SCR134 HD1 HMS 2005-3806
██



157° 53' 45" W

167° 53' 30" W

157° 53' 15" W

21° 18' N

21° 45' N

21° 18' 30" N

NO. 11000

NO. 11000

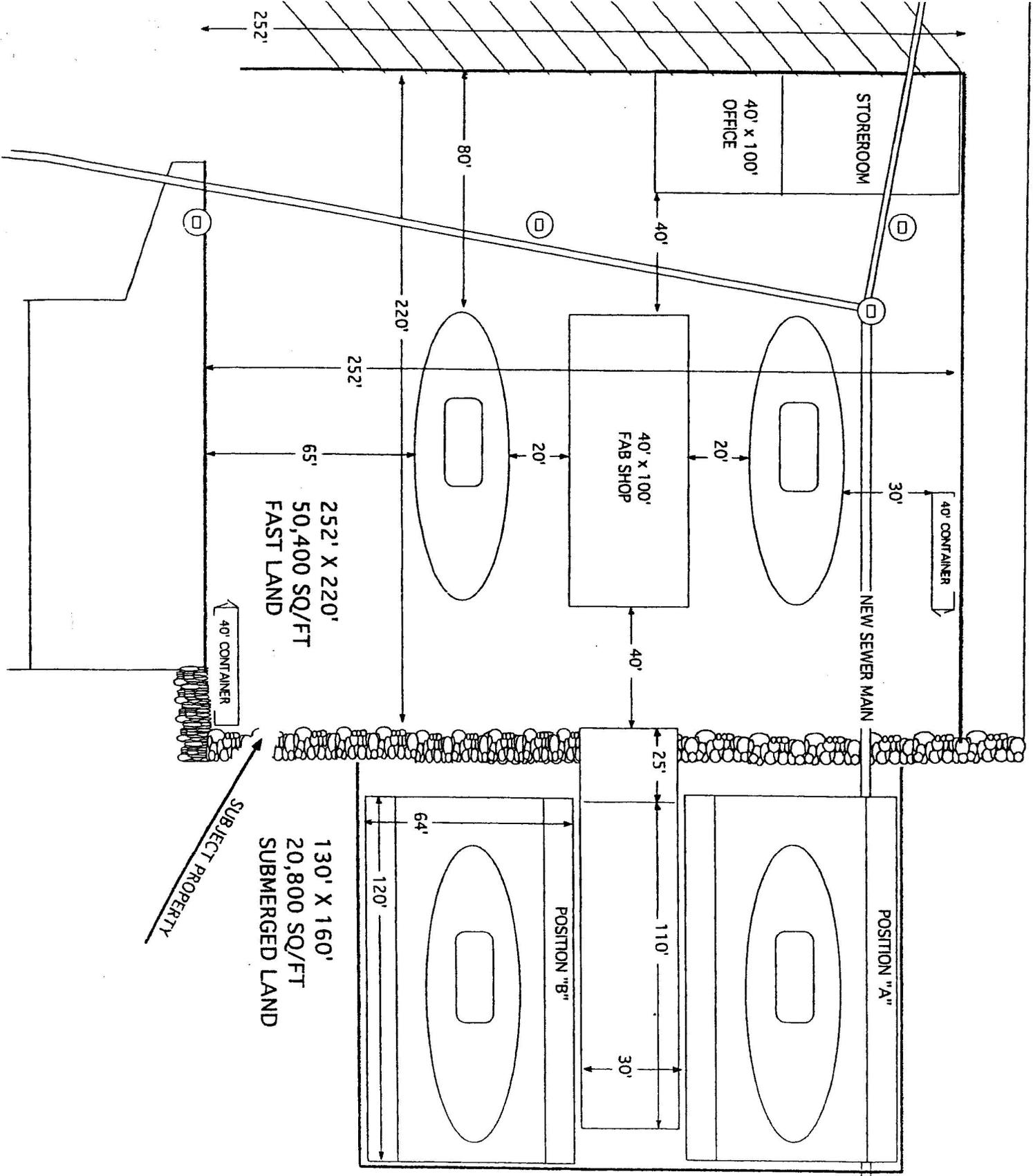


EXHIBIT 3

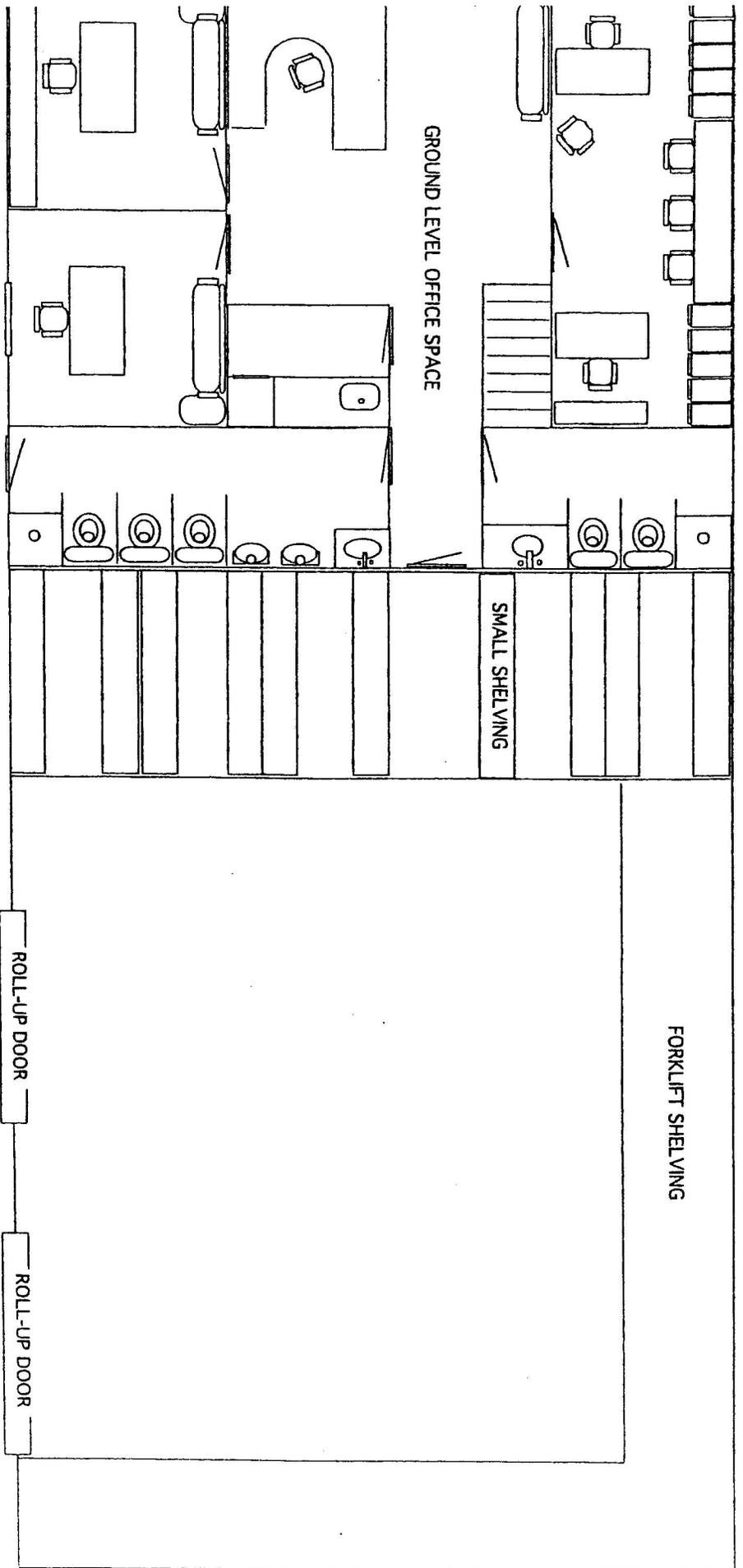


EXHIBIT 4

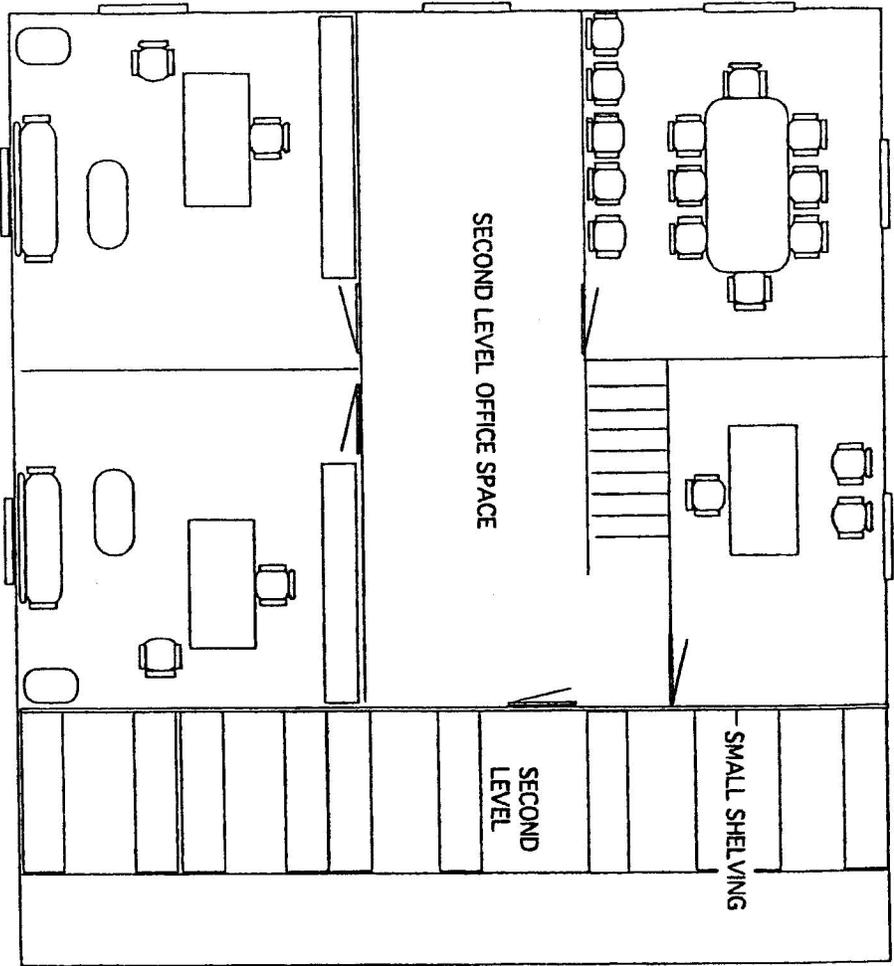
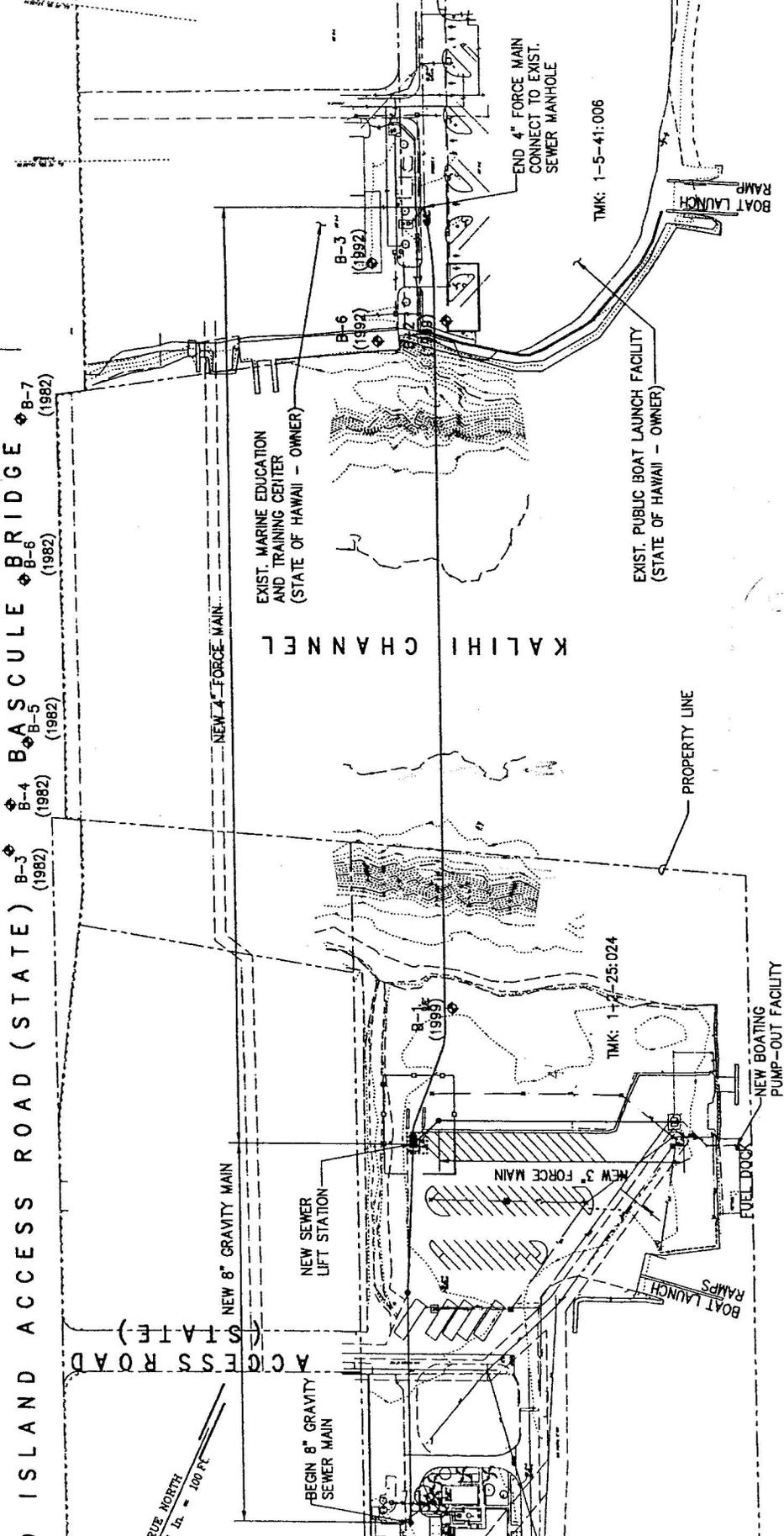


EXHIBIT 5



GENERAL SITE PLAN

SCALE: 1" = 100'

Revised 11-2001

ISLAND ACCESS ROAD (STATE) B-3 (1982) B-4 (1982) B-5 (1982) B-6 (1982) B-7 (1982)

ACCESS ROAD (STATE)

TRUE NORTH
1 in. = 100 ft.

NEW 8" GRAVITY MAIN

BEGIN 8" GRAVITY SEWER MAIN

NEW SEWER LIFT STATION

EXIST. MARINE EDUCATION AND TRAINING CENTER (STATE OF HAWAII - OWNER)

KALIHU CHANNEL

NEW 4" FORCE MAIN

NEW 3" FORCE MAIN

END 4" FORCE MAIN CONNECT TO EXIST. SEWER MANHOLE

TMK: 1-5-41:006

TMK: 1-2-25:024

PROPERTY LINE

EXIST. PUBLIC BOAT LAUNCH FACILITY (STATE OF HAWAII - OWNER)

BOAT LAUNCH RAMP

NEW BOATING PUMP-OUT FACILITY

FUEL DOCK

BOAT LAUNCH RAMPS

Appendix C

Coastal Engineering Assessment

**COASTAL ENGINEERING ASSESSMENT
OF PROPOSED SITE FOR
KEWALO SHIPYARD**

Prepared for:

R. M. Towill Corporation
Honolulu, Hawaii

Submitted by:

Sea Engineering, Inc.
Makai Research Pier
Waimanalo, Hawaii 96795

January 12, 2007

#6-65

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1.0 INTRODUCTION

Kewalo Shipyard, Inc. has been in business since 1920, and is currently a ship repair company capable of docking any vessel smaller than an oceangoing vessel of Panamax beam (Maritime Business Strategies, LLC. 2006). The shipyard is planning to relocate from its present site at Kewalo Basin to a proposed site at the west end of Honolulu Harbor, adjacent to Ke'ehi Small Boat Harbor. Sea Engineering, Inc. has been contracted by R. M. Towill Corporation to conduct a bathymetric survey of the site, to prepare a report describing the coastal and oceanographic conditions at the site, and to determine the oceanographic design criteria. The bathymetric survey has been completed and submitted under separate cover. This report includes the site description and the oceanographic design criteria. Subsequent work will include working with R. M. Towill Corporation and Kewalo Shipyard to develop a concept plan for the site.

The proposed site is shown in Figures 1-1 and 1-2. Figure 1-1 shows the project site with respect to Sand Island, Kapalama Basin, Honolulu Harbor and Ke'ehi Lagoon. The site is bordered by Honolulu Harbor and Kapalama Basin to the east, and Ke'ehi Lagoon to the west. Kalihi Channel separates the project site from Sand Island, which is to the south-southeast.

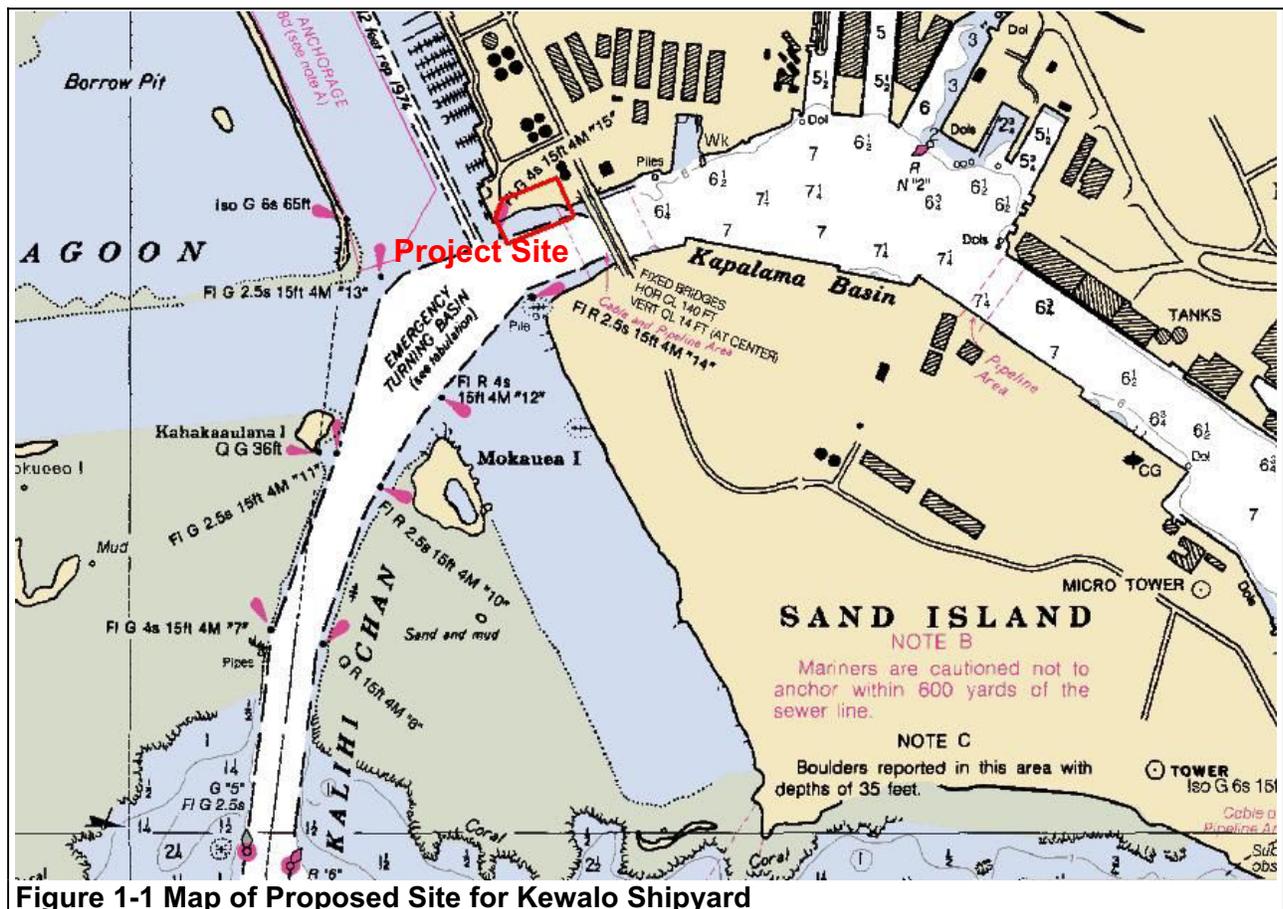




Figure 1-2 Aerial Photo of Proposed Site for Kewalo Shipyard

Figure 1-2 shows an aerial photo of the proposed site location, designated by the white box. The Sand Island Bascule Bridge is now a fixed bridge restricting the size of boats that can travel under it.

2.0 ENVIRONMENTAL SETTING

2.1 General

The climate at Sand Island is characterized by persistent trade winds, relatively constant temperatures and infrequent severe rainstorms. The prevailing northeasterly trade winds account for about 60 percent of the winds affecting the Island. The monthly range in temperature on Sand Island averages only seven degrees Fahrenheit between the warmest months (August and September) and the coolest months (January and February). Rainfall on Sand Island is relatively low, about 20 to 25 inches per year. Approximately 50 percent of the total annual rainfall occurs during the three wettest months from December through February.

2.2 Winds

The wind climate in Ke'ehi Channel and Lagoon is dominated by the prevailing trade winds, which approach from the sector north through northeast. Wind data recorded at Honolulu International Airport (Figure 2-1) shows trade winds from the northeast and east-northeast occur 60 percent of the time, with speeds averaging 11 knots. Peak speeds recorded were in the range of 41 to 47 knots. Wind speeds exceed 16 knots only 8.4 percent of the time. During the summer, the trades occur 80 to 90 percent of the time, with typical speeds of 8 to 20 knots. During the winter months, the trade winds occur less frequently, and the frequency of the southerly or westerly winds, known as Kona winds, increases due to localized low-pressure systems and frontal systems. During a typical winter season, two or three Kona storm wind events may occur. Heavy rains are generally associated with these events. Winds associated with infrequent hurricanes can be as high as 80 knots.

The waters of the project site are minimally exposed to local trade winds, and there is little exposed fetch for the generation of wind waves. The project site is exposed to Kona storm winds and there is a large exposed fetch for the generation of wind waves during these storms. There will also be an effect from the winds on vessel operations at the site, due to the wind acting on the sail area of the vessels.

2.3 Tides

Tides around Ke'ehi Lagoon are semidiurnal, with a marked diurnal inequality. The mean tide range is 1.2 feet. Various water levels, referenced to Mean Lower Low Water (MLLW) datum are:

Mean Higher High Water (MHHW)	1.9 ft.
Mean Sea Level (MSL)	0.9 ft.
Mean Lower Low Water (MLLW)	0.0 ft.

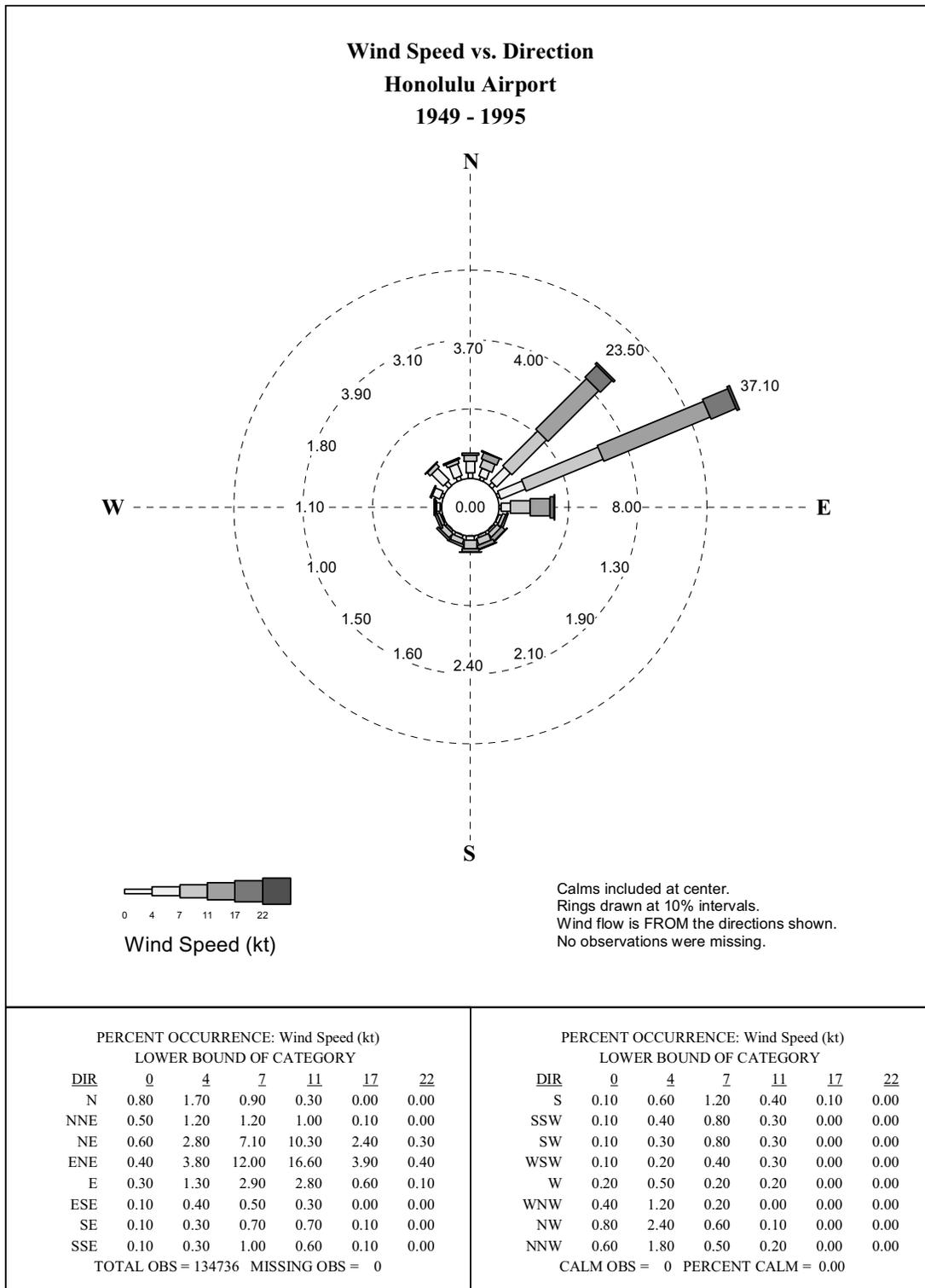


Figure 2-1 Wind Rose Diagram of Wind Direction and Speed at Honolulu International Airport

2.4 Wave Climate

The coastline off Ke'ehi Lagoon is exposed to three general wave types: south swell, Kona storm waves and hurricane generated waves. The lagoon, based on its location on the south shore, is protected from winter season North Pacific swells and the waves generated by the prevailing northeast tradewinds.

South swells primarily occur during the months of April through September. These swells approach from directions ranging from southeast through southwest and deepwater wave heights are typically five feet or less. Breaker heights on the fringing reef can reach heights of 15 feet, but typical heights during south swell occurrences are 6 feet or less.

Ke'ehi Small Boat Harbor and the proposed shipyard site are sheltered from the south swell by Sand Island, which extends from the Honolulu Harbor Entrance Channel to the Kalihi Channel. The area is further protected by the small islands located on the reef west of Sand Island and by the Honolulu International Airport Reef Runway. Incoming waves are attenuated as they move shoreward up the long entrance channel. As a result, the lagoon and proposed project site are typically calm, with the exception of Kona storms or hurricanes. During typical conditions, there are negligible waves in the project area, except for boat wakes from passing vessels (discussed in Section 2.9).

Kona storm waves are generated by local low-pressure systems, and occur most commonly during the winter months when the tradewind pattern weakens. The low pressure systems result in winds and waves approaching from the sector south through west. Deepwater wave heights during severe Kona events may be up to 15 feet. Like south swells, deepwater waves resulting from Kona storms will attenuate as they move up the long entrance channel. However, the local winds generating the waves will also generate waves in the channel and basin offshore of the site, and wave conditions at the site will be much more severe during Kona Storm events than during the occurrence of south swell.

Infrequent hurricanes generate large waves that affect the Hawaiian Islands, particularly the south and west coasts. The wind speeds and wave heights associated with the hurricanes may be much greater than those associated with Kona storms, and present the worst-case design situation. Two notable hurricanes affected the south coast of Oahu in recent years, Hurricane Iwa in 1982 and Hurricane Iniki in 1992. Maximum deepwater wave heights associated with these events were in excess of 40 feet.

2.5 Water Level Rise

Water level rise above the normal still water level will occur during storms or hurricanes. The rise is due to wave setup, wind setup and barometric pressure effects. Bretschneider and Noda (1985) evaluated the possible inundation limits for the south coast of Oahu due to hurricane-induced water level rise and wave effects. The worst-case hurricane was predicted to result in a total water level rise inside the harbor of 3.2 feet above the normal tide level. If this coincided with MHHW, the total water level height would be 5.1 feet above MLLW. During Hurricane Iwa, the measured water level rise was 2.1 feet above the normal tide level.

2.6 Tsunami

Based upon historical records, tsunami Runup is not a serious problem in Ke'ehi Lagoon. The predicted water level rise during the occurrence of 50 and 100 year tsunamis are 3.3 feet and 4.0 feet above the prevailing sea level (M&E Pacific, 1978), respectively. Recorded tsunami Runup heights along the coast between Ala Moana Park and Pearl Harbor have typically been 5 feet or less (Loomis, 1976).

2.7 Currents

Currents in Mamala Bay off Ke'ehi Small Boat Harbor are tidally driven, with typical speeds of 0.8 feet per second (24 cm/s). The currents usually reverse with the tide, with flood currents setting to the west and ebb currents setting to the east. Overall net transport is to the southwest. Surface currents are affected by the prevailing winds.

Inside the harbor, currents are generally much weaker. Sea Engineering has previously (2001) measured currents for a 43 day period from November 28, 2000 to January 9, 2001, in the Kalihi Channel by the Sand Island Bascule Bridge, just east of the proposed project site. Measurements were obtained with a bottom mounted Aanderaa DCM 12 acoustic Doppler current meter, which measured currents in five overlapping cells (or bins) extending throughout the water column. The water depth at the current meter location was 38 feet (12m). Measurements were obtained at 20-minute sampling intervals.

The current data is summarized in Table 2-1. The current flow in this channel area is characterized by a predominant flow out of the harbor, and a lesser component of flow into the harbor. Overall net transport is to the west (276 degrees) in the surface 3 meters, and the west-southwest (between 245 to 250 degrees) in the rest of the water column. The occurrence of flow into the harbor increases with water depth. Between the water surface and the 4.5-meter depth, currents flow out of the harbor approximately 45% of the time, and into the harbor about 25% of the time. However, at water depths of 6 to 9 meters, currents flow out of the harbor 40% of the time and into the harbor about 32% of the time.

Current speeds were weakest in the surface layer; the average current speed was 4.8 cm/s and the maximum recorded speed was 25 cm/s. Below the surface, the average current speed was about 8.7 cm/s and the maximum recorded speed was 40 to 43 cm/s. The maximum current speeds were recorded between December 9 and 12, when the tidal range was 2.6 feet (0.85m), the maximum for the year.

A noteworthy feature of the current flow revealed by the current meter data is that the greatest occurrence of flow into the harbor occurred during ebb tides, when currents would be expected to flow out of the harbor. This feature, and the predominance of flow out of the harbor, indicate the currents in this channel are complex, and not simply governed by tidal flow into and out of the harbor.

**Table 2-1 Current Data Summary for Overall Record
(11/28/00 – 01/09/01)**

Cell Depth (meters)	Average Speed (cm/s)	Maximum Velocity (cm/s / TN)		Net Transport (cm/s / TN)	% Flow	
		Raw Data	1-Hr-Av. Data		In (ENE)	Out (WSW)
0-3	4.8	25.0 / ENE	21.3 / W	2.0 / W	22	45
1.5-4.5	8.8	38.0 / ENE	29.7 / WSW	2.4 / WSW	26	46
3-6	8.7	43.0 / ENE	29.9 / ENE	2.0 / WSW	28	44
4.5-7.6	8.7	41.0 / ENE	31.6 / ENE	1.6 / WSW	29	42
6-9	8.7	40.0 / ENE	28.6 / ENE	1.0 / WSW	32	40

There are several possible explanations for the complexities of the flow in the channel. First, Ke`ehi Lagoon is located immediately adjacent to Kalihi Channel, and has a surface area five times greater than Honolulu Harbor. The bathymetry of the lagoon is complex, and a broad reef flat separates the lagoon from the ocean. Two channels have been dredged through the reef (Kalihi Channel and a channel next to the reef runway), and a third channel adjacent to Sand Island is blocked from the ocean by a narrow band of reef. There are numerous islands and the interior of the lagoon has a broad flat area in the middle. Wind is a major force driving the circulation in Ke`ehi Lagoon. Previous studies comparing flow in Ke`ehi Lagoon before and after construction of the airport reef runway found that flow into and out of Honolulu Harbor significantly increased following construction and that flow in Ke`ehi Lagoon is up to 5 times larger than would be expected if flow in the lagoon were simply tidally driven, (Edward K. Noda and Associates, 1977). Because of the much larger size of Ke`ehi Lagoon, flow in the lagoon is an important factor influencing the flow in the channel and into Honolulu Harbor. Secondly, Honolulu Harbor has two entrances, and there may be a net circulation system governed by the interaction between the two entrances and the surrounding ocean. Thirdly, currents may vary significantly within the channel and harbor basin. The majority of the flow in the channel may be restricted to only a portion of the channel, or there may be eddies within the channel. Finally, wind, fresh water input or regional offshore currents could be important factors governing circulation in the vicinity.

2.8 Water Quality

Available information indicates that the double entry configuration of the harbor results in the absence of serious circulation problems within the harbor. Thermal studies conducted by the Hawaiian Electric Company estimated the harbor flushing time at about six hours (Proposed Honolulu Corporation Yard FEIS, July 1989).

Even though the proposed site for the Kewalo Shipyard is outside the Honolulu Harbor and Kapalama Basin Complex it is important to look at these two areas as well since Kalihi Channel and the surrounding Ke`ehi Lagoon serve as one of two exits for water and runoff from Kapalama Basin. Water quality in Ke`ehi Lagoon area is constantly in a state of flux, being influenced by numerous factors which include: storm runoff, wind conditions, tidal state, and even the movements of large ships inside Honolulu Harbor which can cause resuspension of sediments into the water column.

A major storm event will cause a temporary decrease in both salinity and temperature near stream mouths and the formation of plumes (often visible because of high turbidity/TSS levels) that spread out over much of the surface layer of the basin. Strong winds can resuspend sediments and nutrients into the water column, while tidal flushing and water exchanges between Ke'ehi Lagoon and Honolulu Harbor vary with wind direction.

Ke'ehi Lagoon is designated in HAR §11-54-06 (DOH, 2004) as a Class A embayment. The applicable water quality standards are summarized in Table 2-2.

Table 2-2 State of Hawaii Water Quality Criteria for Embayments
(HAR §11-54-06)(DOH, 2004)

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	200.0	350.0	500.0
(µg N/l)	<i>150.0</i>	<i>250.0</i>	<i>350.0</i>
Ammonia	6.0	13.0	20.0
(µg N/l)	<i>3.5</i>	<i>8.5</i>	<i>15.0</i>
Nitrate + Nitrite	8.0	20.0	35.0
(µg N/l)	<i>5.0</i>	<i>14.0</i>	<i>25.0</i>
Total Phosphorus	25.0	50.0	75.0
(µg P/l)	<i>20.0</i>	<i>40.0</i>	<i>60.0</i>
Chlorophyll α	1.50	4.50	8.50
(µg/l)	<i>0.50</i>	<i>1.50</i>	<i>3.00</i>
Turbidity	1.5	3.0	5.0
(ntu)	<i>0.4</i>	<i>1.0</i>	<i>1.5</i>

Two values: upper, "wet" criteria apply when the average fresh water inflow from the land equals or exceeds one percent of the embayment volume per day; lower, "dry" criteria apply when the average fresh water inflow from the land is less than one percent of the embayment volume per day.

Other "standards":

- pH units shall not deviate more than 0.5 units from a value of 8.1, except at coastal locations where and when freshwater from stream, storm drain or groundwater discharge may depress the pH to a minimum level of 7.0.
- Dissolved oxygen shall not decrease below 75% saturation.
- Temperature shall not vary more than 1 C° from ambient conditions.
- Salinity shall not vary more than 10% from natural or seasonal changes considering hydrologic input and oceanographic factors.

The State standards for embayments are divided into "wet" and "dry" categories depending upon the influx of freshwater (see footnotes in Table 2-2). Based upon estimated stream flows and basin volumes, we can compute the average number of days per year that the basin will qualify as a wet or dry embayment (Table 2-3).

The percent of time that Ke’ehi Lagoon fits the “wet” embayment category is very low (3 percent or less). Therefore, in the discussion that follows, we will use the “dry” embayment State criteria as the standard for comparison with existing data.

Generally the poorest water quality in the harbor occurs in the Kapalama Basin because of its location with respect to the Kapalama Stream. (Sea Engineering, September 2002). The water quality then improves as one moves toward either exit of the basin; i.e. Ke’ehi Lagoon via Kalihi Channel or Honolulu Harbor.

Table 2-3 Estimates of “Wet” and “Dry” Conditions in Ke’ehi Lagoon

1% basin volume (million gallons)	23.9
“wet embayment”	
rain days > 1% volume	11
% of time	3
“dry embayment”	
rain days < 1% volume	354
% of time	97

A synopsis of water quality data for Ke’ehi Lagoon is presented in Table 2-4, together with summary data for Honolulu Harbor and Kapalama Basin for comparative purposes. These data have been compiled from various studies (AECOS, 1979, 1982b; Oceanit Laboratories, 1990) plus several DOH monitoring stations (USGS, 1999). Most of the data for Ke’ehi Lagoon were collected near the Sand Island bascule bridge.

**Table 2-4 Summary of Water Quality Data for Honolulu Harbor
Ke'ehi Lagoon / Kapalama Basin Complex.
(1977 – Present)**

Location		Salinity y (‰)	Temp (°C)	DO (% sat)	Turbidity y (ntu)	NO ₃ +NO ₂ (µg/l)	NH ₃ (µg/l)	TN (µg/l)	TP (µg/l)	Chl. a (µg/l)
Ke'ehi Lagoon	mean	33.7	25.4	95	2.7	1.8	3.7	167	22	0.32
	stdev	3.2	1.6	10	1.2 – 5.8	0.5 – 5.7	1.4	102	11 - 47	0.13
	n	282	213	209	284	42	9.7	272	180	0.77
Kapalama Basin	mean	34.6	25.7	95	1.9	2.2	5.1	137	31	0.26
	stdev	0.6	1.5	9	1.2- 2.9	1.0 - 4.8	2.5	97 - 193	16 - 59	0.08
	n	38	37	36	19	19	10.3	19	19	0.84
Honolulu Harbor	mean	34.9	25.9	85	0.7	4.3	6.8	124	20	0.36
	stdev	0.3	0.8	21	0.3 – 1.5	2.0 - 9.0	3.2	101	13 - 32	0.14
	n	17	13	17	24	21	14	153	21	0.92

— grayed cells indicate that mean (or geometric mean) values are noncompliant with an applicable State water quality criterion.

Ke'ehi Lagoon has been labeled an impaired waterbody. It is listed as a Water Quality-Limited Segment (WQLS) on the Hawaii Department of Health's Clean Water Act (CWA) §303(d) List of Impaired Water Quality Bodies for Hawaii (DOH, 2004) and is also listed on the U.S. Environmental Protection Agency's Revised 2002 List (EPA, 2002).

The pollutants for which the harbor is listed are metals, nutrients, pathogens, turbidity, pesticides, oil & grease, toxic organics, sediment/siltation and toxic organics.

2.9 Surrounding Harbor Operations

The Marine Education and Training Center (METC) is directly across the Kalihi Channel from the proposed site for the Honolulu Shipyard. This channel once served as a second entrance to the Honolulu Harbor. However, the Sand Island Bascule Bridge, now in a fixed position, limits vertical clearance to approximately 15 feet or less. Thus, the Kalihi Channel and proposed site for the shipyard are only exposed to boat wakes resulting from smaller personal and commercial watercraft. Access to Honolulu Harbor by small boats is restricted and the primary source of wake-generated waves would be from small boats accessing the slips or launch ramps of the Ke'ehi Small Boat Harbor.

3.0 SHORELINE SETTING AND BOTTOM CHARACTERISTICS

3.1 Shoreline Conditions

As discussed in Section 1.0, the proposed site for the relocation of the Kewalo Shipyard is located on the southwest corner of the Ke'ehi Small Boat Harbor. The proposed site, along with much of the rest of the southern coast of Oahu, is underlain by a broad elevated coral reef, covered by alluvium carried out from the mountains. The shoreline of the proposed site is roughly 435 feet long and is shown below in Figure 3-1 and Figure 3-2. Figure 3-1 shows the eastern three-quarters of the site, looking northeast toward the bascule bridge. The remaining section is shown in Figure 3-2. The beach and nearshore bottom consist primarily of a mixture of coarse sand, cobbles and boulders. Fifteen feet offshore the bottom turns to silt with a small mixture of cobble and intermittent boulders.



Figure 3-1 East section of proposed site

Figure 3-1 and Figure 3-2 also show the gradual slope of the existing beach face. The shoreline has scattered vegetation along the beach berm ranging from grass to small trees and bushes. The gradual slope of the beach face and location and types of vegetation are the result of minimal wave action at the site location.

There are also sections of debris that appear to have either washed up the beach or, more likely, been dumped at the site from the Ke'ehi Small Boat Harbor parking lot.



Figure 3-2 West section of proposed site

3.2 Bottom Conditions

The following description of the nearshore bottom conditions at the site are based upon diving investigations conducted on November 30, 2006. The investigation consisted of a visual check of the bottom conditions and water jet probing into the bottom to determine whether hard or soft bottom conditions are present at the site. The area covered by the diving survey extended approximately 400 feet along the shoreline, centered on the proposed relocation site. The depths covered extended from the shoreline to the 25-foot water depth.

The bottom conditions at the proposed site vary little from east to west. Just offshore there is a gentle slope, approximately 80 feet wide, extending to the 6 to 8 foot water depth. The bottom composition on this shelf is visually very similar to the immediate shoreline area, and the surface consists of scattered sand and rubble. Seaward of the shelf there is a break in slope, and the bottom drops off at approximately a 1 on 2 slope to the existing channel bottom at 34 feet. The slope appears to be primarily limestone and numerous dead small coral formations are common on the slope throughout the area, an indication of underlying hard bottom material.

Water jet probing was conducted using a centrifugal pump and 100 feet of 1-1/2 inch fire hose that was necked down to a 1-inch diameter, eight foot long pipe section. This arrangement provides a high velocity flow of water that allows a diver to "jet" the pipe section into soft sediments. This type of system is capable of jetting tens of feet into sand or mud bottom materials. Conversely, "refusal" occurs when hard bottom material is encountered.

Probes were made along five profiles extending from the shoreline to the 25-foot water depth. The profiles were equally spaced from east to west along the relocation site. Numerous probes were made along each profile as the diver either walked or swam seaward from the shoreline. With only two exceptions, the probe results were similar throughout the area. Refusal was typically encountered at distances into the bottom ranging from zero to 3 feet, and there was no apparent pattern of refusal depth with distance offshore or water depth. Near the west end of the site, one probe at the 25-foot water depth penetrated 7 feet into the sediment before refusal and one at the 10-foot water depth penetrated 4 feet into the bottom.

The results are indicative of a limestone shelf beneath an intermittent veneer of thin sediment. Underwater limestone surfaces are typically irregular, with scattered pockets of sand and gravel. At this site most of the refusals were apparently caused by hard bottom material, but several felt like the refusal occurred in a gravel substrate. The jet probe can typically penetrate only a short distance into gravel because the high pressure jet is diffused by the porous material. The refusal in gravel is more gradual than the refusal encountered when hitting a solid substrate.

Based upon these results, the dredging will probably require the removal of typical limestone shelf material.

4.0 DESIGN CRITERIA

4.1 Waves

The design wave for the site is based upon a model Hawaiian hurricane developed by Hariguchi (1984), with sustained winds of 65 knots. The model hurricane is defined by Hariguchi as the probable hurricane that will strike the Hawaiian Islands in the future, and the characteristics are based upon past hurricanes that have impacted the islands (Dot and Iwa). This is in contrast to a possible “worst case” hurricane that is defined as the worst possible hurricane that has not yet, but could, strike the islands.

The maximum fetch possible for the site would be for winds blowing west to east down the seaplane runway in Keehi Lagoon. Sustained winds of 65 knots would generate waves 3.1 feet high with a period of 3 seconds at the proposed shipyard site.

4.2 Winds

The sustained design winds speed at the site would be 65 knots, again based upon Hariguchi’s model hurricane.

4.3 Water Level Rise

As discussed in Section 2.6, water level rise above the normal still water level will occur during Kona storms and hurricanes due to breaking wave setup, wind setup and barometric pressure effects. Bretschneider and Noda (1985) evaluated the possible inundation limits for the south coast of Oahu due to hurricane-induced water level rise and wave effects. The worst case hurricane was predicted to result in a total water level rise inside the harbor of 3.2 feet above the normal tide level. If this coincided with Mean Higher High Water (MHHW), the total water level height would be 5.1 feet above Mean Lower Low Water (MLLW). During Hurricane Iwa in 1982, the measured water level rise was 2.1 feet above the normal tide level.

4.4 Tsunamis

The predicted water level rise during the occurrence of 50 and 100 year tsunamis are 3.3 feet and 4.0 feet above the prevailing sea level (M&E Pacific, 1978), respectively. Recorded tsunami Runup heights along the coast between Ala Moana Park and Pearl Harbor have typically been 5 feet or less (Loomis, 1976).

4.5 Currents

Although, as described in Section 2.7, currents are moderate in the channel, the water flow will be broadside to vessels approaching the facility or moored at the pier. The 2001 Sea Engineering study included measurements taken during a 2.8 foot tidal range. The measured data are therefore probably are a good indication of the maximum currents that would occur at the site. The maximum recorded speed in the surface layer was 25 cm/s, or about 0.5 knot; the maximum in the subsurface layer was 43 cm/s, or approximately 0.9 knot.

Currents near the shoreline and in the basin that will be dredged for the proposed facility will be less than the maximums above, which were measured in the main channel. However, it is also possible that a tsunami or hurricane event could cause an increase in the maximum currents.

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Appendix D

Phase I and II

Environmental Site Assessment

Final Report

**Phase I and II Environmental Site
Assessment
Keehi Lagoon Facility
Keehi Small Boat Harbor,
Oahu, Hawaii**

May 8, 2006

Prepared for

Honolulu Marine LLC

Prepared by



CH2MHILL

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Executive Summary

This report has been prepared to document the activities and results of the Phase I and II Environmental Site Assessment (ESA) that was conducted from February through March 2006 at the proposed Honolulu Marine LLC (Honolulu Marine) Keehi Lagoon shipyard facility located at the Keehi Small Boat Harbor, Oahu, Hawaii (hereinafter referred to as the "Site"). The investigation was conducted to document the environmental condition of an undeveloped parcel of land comprising the proposed site for the new facility, which is located at the southern portion of Keehi Small Boat Harbor.

Honolulu Marine is planning to construct a new shipyard repair facility on the Site. The facility development area will also include a portion of the submerged land toward the shoreline, parallel to the Sand Island Access Road bridge (Figure 1-1). The parcel of land is currently owned by the State of Hawaii. As part of the assessment of pre-existing conditions at the Site, CH2M HILL conducted a Phase I and limited Phase II ESA for the Site before the occupation or construction of the proposed new shipyard facility.

The Phase I ESA component of this assessment was conducted in compliance with the *ASTM E 1527-05, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* (American Society for Testing and Materials [ASTM], 2005). The Phase II portion of the investigation was conducted according to the Scope of Work outlined in the CH2M HILL proposal dated January 18, 2006. The objectives of the investigation were as follows:

- Evaluate the historic uses of the Site and vicinity, and determine, to the extent practical, whether historic activities resulted in adverse environmental impacts to soil or groundwater.
- Conduct sampling to evaluate the geology and hydrogeology of the Site, and to assess whether chemicals of potential concern (COPCs) are present in shallow soil or groundwater at the Site.
- Evaluate available documentation for environmental contamination identified at properties surrounding the Site and assess whether chemicals of potential concern originating at these properties have migrated on to the Site.
- Collect and evaluate data in a manner that will support decision-making about future use of the Site by Honolulu Marine.

To meet these objectives, the CH2M HILL's investigation included the following activities:

- Available, existing records were reviewed, which included investigation documents, government databases, and historical photographs and maps. These documents were used to determine whether recognized environmental conditions existed, or whether releases of hazardous materials were listed or referenced for the Site or adjacent properties.

- A site visit was conducted to perform a visual survey of the Site and to interview personnel with knowledge of these properties' histories.
- Four subsurface soil samples were collected and analyzed for total petroleum hydrocarbon (TPH) constituents, volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), and eight Resource Conservation and Recovery Act (RCRA) metals.
- VOC and lower explosive limit (LEL) levels were measured in soil headspace samples and the workspace atmosphere.
- Two temporary microwells were installed in borings completed during the investigation. Liquid levels in the temporary microwells were measured to evaluate the depth to shallow groundwater and to assess whether separate phase hydrocarbons (SPHs) were present.
- Two groundwater samples were collected (from the shallow aquifer) and analyzed for TPH constituents, VOCs, PAHs, and eight RCRA metals.

Soil and groundwater laboratory analytical results were evaluated and validated by CH2M HILL chemists to determine the overall quality and usability of the data.

The results and findings of the Phase I and II ESA are summarized below:

- Eight RCRA metals, TPH-diesel-range organics (TPH-D), and TPH-oil-range organics (TPH-O), and PAHs were detected in soil samples at concentrations above the laboratory reporting limit. With the exception of arsenic, the detected concentrations of these chemicals in soil samples collected during the investigation are below current State of Hawaii Department of Health (HDOH) environmental action levels (EALs).
- The metal arsenic was detected in subsurface soils at one location at a concentration exceeding the HDOH EAL. This concentration is also in excess of the maximum allowable background concentration (22 parts per million [ppm]) for arsenic that is recognized by the HDOH and the EPA preliminary remediation guideline (PRG) for the residential user/exposure scenario (1.6 ppm), but it is below the PRG for the industrial occupational worker scenario of 16 ppm.
- 2-Butanone was detected in three of the four soil samples at concentrations below the HDOH EAL.
- One of the shallow groundwater samples collected at the Site contained dissolved selenium at a concentration exceeding the HDOH EAL, but below applicable marine chronic ambient water quality criteria (AWQC). The metals arsenic, barium, cadmium, chromium, lead, and silver were detected in groundwater samples at concentrations above the laboratory reporting limit, but below the respective HDOH EALs and applicable AWQC. PAHs, TPH-gasoline, and acetone were detected in groundwater samples at concentrations above the

laboratory reporting limit, but below the respective HDOH EALs and applicable chronic AWQC.

- Releases of hazardous substances were identified at multiple locations within one half mile of the Site. Previous investigations conducted at the Hawaii Fueling Facilities Corporation (HFFC) Bulk Fuel Storage Facility, Tesoro Fuel Terminal, Kapalama Military Reservation, McKesson Drug Company/Sealmasters, and the University of Hawaii Marine Center included soil and groundwater sampling and laboratory analysis, and risk analysis.
- Based on the types and quantities of chemicals present at adjacent sites, it is possible that contaminants could migrate on to the Site at concentrations requiring removal or additional investigation.
- Construction debris, automotive parts (including engine parts, car seats, heavy equipment tires, and batteries), compressed gas cylinders, crushed 55-gallon drums, abandoned boating equipment, asphalt debris and soil stockpiles were present at the Site at the time of this site assessment.

Recommendations are presented below and are based on the proposed future land use at the Site (industrial use as a shipyard).

Although arsenic concentrations present in the soil and selenium concentrations in the groundwater samples exceeded HDOH EALs, additional investigation is not recommended at this time based on the following rationale:

- Although the detected concentration of arsenic in one subsurface soil sample exceeds the HDOH EAL, the concentration is below the EPA industrial use PRG for arsenic in soil. Because the Site is planned to be developed for industrial use, no further investigation is recommended to delineate arsenic contamination. Engineered controls to mitigate potential exposure pathways for both site and facility workers should be included in construction and development planning.
- Additional action is not recommended in response to the presence of selenium in groundwater samples at concentrations exceeding the HDOH EAL because the shallow aquifer beneath the Site is not a drinking water source and the detected selenium concentrations are below applicable AWQC.

It is recommended that a soil management plan that outlines procedures for the handling of any potentially impacted soils or groundwater at the Site during construction activities be created as part of the development planning activities.

It is recommended that the abandoned automotive parts, marine and construction debris, and soil stockpiles presently located on the property be disposed of according to applicable rules and regulations.

Waste characterization samples from the soil piles may be required by the disposal facility before acceptance of soil to the facility. Surface soil conditions below the stockpiles should be evaluated following the removal of the stockpiles. If stained soil or other evidence of

potentially hazardous materials or petroleum products is observed, additional soil sampling should be considered to document any potential pre-existing environmental impacts resulting from the soil stockpiles.

Appendix E

Water Quality and Biological Surveys

**Water quality and biological
surveys of the proposed
small boat shipyard site,
Ke‘ehi Lagoon, Honolulu,
O‘ahu, Hawai‘i**



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April 16, 2007

Water quality and biological surveys of the proposed small boat shipyard site, Ke'ehi Lagoon, Honolulu, O'ahu, Hawai'i.

April 16, 2007

Draft

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Introduction

AECOS, Inc. biologists conducted a reconnaissance marine survey of the Honolulu Marine, LLC proposed small boat shipyard site On March 2, 2007. The site is located at Ke'ehi Lagoon on the south coast of O'ahu (Fig. 1) adjacent to the Ke'ehi Small Boat Harbor and fronting Kalihi Channel leading into Honolulu Harbor. Ke'ehi Lagoon and Honolulu Harbor are ranked as Class A State embayment waters by the Hawaii Department of Health (HDOH). Discharges from drydock activities are acceptable into Honolulu Harbor and the Ke'ehi Lagoon Marina Area if controlled and treated to the best degree possible (HAR §11-54-03(c)(2)(A)(i) and (iii); HDOH, 2004).

The purpose of this marine survey was to ascertain biological resources and assess water quality of the area. The survey team documented aquatic flora and fauna found within the near-shore marine environment. The team also conducted a botanical survey of the site itself, and measured various water quality parameters in the adjacent waters. This report presents findings from the survey.

Site Description

Ke'ehi Lagoon was once an extensive lagoon and wetland behind a broad fringing reef along O'ahu's south shore. Man-made changes have affected the area extensively. Indeed, there is no other nearshore area of comparable size in the Hawaiian Islands that has undergone more extensive change than that which has occurred between the main entrance channel of Honolulu Harbor on the east and Pearl Harbor entrance channel on the west. From fill lands supporting Honolulu International Airport to the dredged channels of Ke'ehi and the Honolulu port system, Ke'ehi Lagoon is surrounded by the commercial gateways to Hawai'i (AECOS, 1990).

The proposed ship yard is consistent with other uses of the nearby area, which include numerous boat moorings, a state small boat harbor and ramp facility, and the numerous commercial piers of Honolulu Harbor. Commercial boat maintenance facilities are situated northeast along the same shore as the proposed facility and across the Kalihi Channel.



Figure 1. Location of proposed Ke'ehi Lagoon Shipyard outlined in red.

The project site currently has no buildings or associated docks. The south shore is an unimproved shoreline of coarse sand, cobbles, and boulders. The west shoreline is a seawall. The north property line abuts a paved parking lot for the state boat ramp and small boat harbor. A drainage ditch along the length of the eastern boundary empties into Kalihi Channel during periods of heavy rainfall. Both the terrestrial and marine environments are influenced by anthropogenic factors. Abandoned boats, building debris, and other trash litter the site. An abandoned fishing vessel is anchored just offshore. Below the waterline, monofilament fishing line is seen tangled on coral heads.

Bottom conditions off the south side of the proposed site vary little from east to west. Just offshore there is a gentle slope, approximately 25 m (80 ft) wide, extending from -1.8 m to -2.5 m (-6 to -8 ft) water depth. The bottom composition on this shelf is visually very similar to the immediate shoreline area and consists of sand and rubble (SEI, 2007). Seaward from the shelf the bottom slopes at approximately 45 degrees to a depth of -10 m (-33 ft).

Water Quality

Nearshore waters at the proposed site represent a mix of waters from offshore, Ke'ehi Lagoon, and Honolulu Harbor. During this March 2, 2007 sampling event, the predicted tides for Honolulu Harbor were a morning low of 0.0 feet (higher low water, HLW) at 1012 and a predicted afternoon high tide of 1.0 feet (lower high water or LHW) at 1539 (NOAA/NOS, 2007). According to these predictions, the early afternoon sampling event represented an incoming (flooding) tide. Winds were less than 10 knots until 1300 when easterly trade winds increased to 15-20 knots. Skies were partly cloudy with 40 percent cloud cover. Within the preceding month of February, 0.68 inches of rain fell at the nearby Aloha Tower rain gage station (HI-26 Aloha Tower Aloh1; NOAA/NWS, 2007a).

Ke'ehi Lagoon is listed by HDOH as an impaired water body for chlorophyll α , total nitrogen, total phosphorus, total suspended solids, turbidity, and enterococcus during both wet and dry seasons (Koch et al., 2004). Waters in Honolulu Harbor near the site are impaired for turbidity, total nitrogen and chlorophyll α during dry season based on data from two sampling stations on nearby Sand Island (Koch et al, 2004). Levels of these parameters likely exceed state criteria at any time.

The primary purpose for the present water quality assessment using both historical and collected water quality data is to characterize the existing aquatic environment. The scope of this project precluded detailed research and statistical analysis of historical data. The limited amount of data from samples collected during this survey is insufficient to set baseline values or determine compliance with Hawai'i Water Quality Standards in the project area because state criteria for nutrient measurements, turbidity, and chlorophyll α are based upon geometric mean values (HDOH, 2004) and a minimum of three separate sampling events per sampling location would be needed to compute a geometric mean.

Water samples were collected from five locations located within and outside of the proposed work site (Fig. 2) on March 2, 2007. Station 1 is located at the shore adjacent to the drainage ditch in 0.3 m (1 ft) of water. Station 2 is located 25 m (80 ft) east of the south end of the seawall. Station 3 is situated mid-channel approximately 50 m (165 ft) east of the property line. Station 4 is located 15 m (50 ft) seaward of the property in the middle of Kalihi Channel. Station 5 is in Seaplane

Runway D, 20 m (65 ft) west of shore. At Stations 3, 4, and 5 both surface and a deep subsurface sample were collected, the latter at approximately 1 m (3 ft) above the channel bottom. Deep samples were collected using a Niskin type bottle sampler.

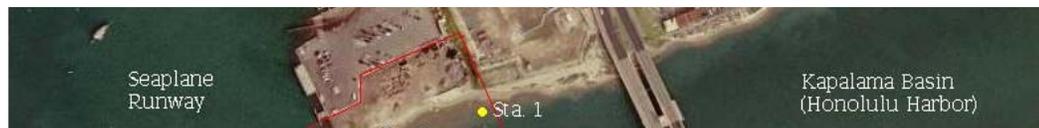


Figure 2. Water quality sampling stations surrounding the proposed small boat shipyard site, Ke'ehi Lagoon .

Dissolved oxygen, temperature, pH, and salinity were measured by field meters. Chlorophyll α , turbidity, TSS, ammonia, nitrate + nitrite, total nitrogen and total phosphorus were measured in water samples collected in appropriate containers and taken to the AECOS laboratory in Kāne'ohe immediately after collection (AECOS, Inc. Laboratory Log No. 22609). Table 1 lists the analytical methods and references used for both field and laboratory measurements.

Samples from Stas. 1 and 2 were utilized for the Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) Notice of Intent (NOI) Form G application for construction dewatering. The field measurements, nutrient and particulate data from these stations are also presented herein as part of the water quality characterization of the project site. Additional parameters at these two stations were analyzed for inclusion in the NPDES permit application.

Table 1. Analytical methods and instruments used for water quality analyses off a proposed shipyard site in Ke'ehi Lagoon on March 2, 2007.

Analysis	Method	Reference	Instrument
Ammonia nitrogen	alkaline phenol	Karloeff in Grasshoff et al. (1986)	Technicon AutoAnalyzer II
Chlorophyll α	10200 H	Standard Methods 20 th Edition (1998)	Turner Model 112 fluorometer
Dissolved Oxygen	EPA 360.1	EPA (1979)	YSI Model 550A DO meter
Nitrate + Nitrite	EPA 353.2	EPA (1993)	Technicon AutoAnalyzer II
pH	EPA 150.1	EPA (1979)	Hannah pocket pH meter
Salinity	bench salinometer	Grasshoff in Grasshoff et al. (1986)	AGE Model 2100 salinometer
Salinity (field)	Refractive index	---	Hand held refractometer
Temperature	Thermister calibrated to NBS cert. thermometer (EPA170.1)	EPA (1979)	YSI Model 550A 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 20th Edition (1998); EPA (1979)	Mettler H31 balance
Turbidity	Method 2130B (EPA 180.1)	Standard Methods 20th Edition (1998); EPA (1993)	Hach 2100N Turbidimeter

D'Elia, C.F., P.A. Stendler, & N. Corwin. 1977. *Limnol. Oceanogr.* 22(4): 760-764.
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Results of some of the water quality analyses, especially temperature, measured for this survey could vary depending upon collection time (morning, noon, and night), stage of the tide, sea state, weather and seasonal changes. Thus, these results are at best a snapshot of water quality conditions that may or may not be typical over a long period of time. Nonetheless, these results can be evaluated in relation to the water quality criteria for marine waters (Table 2) as long as limitations regarding a possible lack of temporal representativeness are realized. Dry criteria apply when the average fresh water inflow from the land is less than one per cent of the embayment volume per day as described in HAR §11-54-06 (HDOH, 2004). Dry

embayment criteria are used for comparison as Ke'ehi Lagoon falls into this category 97% of the time (SEI, 2007).

Table 2. State of Hawaii water quality criteria for Class A "dry" embayments (HAR §11-54-06).

	Ammonia ($\mu\text{g N/l}$)	Nitrate + nitrite ($\mu\text{g N/l}$)	Total N ($\mu\text{g N/l}$)	Total P ($\mu\text{g P/l}$)	Chl α ($\mu\text{g/l}$)	Turbidity NTU
Geometric mean not to exceed the given value	3.50	5.00	150.00	20.00	0.50	0.40
Not to exceed the given value more than 10% of the time	8.50	14.00	250.00	40.00	1.50	1.00
Not to exceed the given value more than 2% of the time	15.00	25.00	350.00	60.00	3.00	1.50
<ul style="list-style-type: none"> • pH shall not vary more than 0.5 units from 8.1 and not be depressed more than 7.0 where stream, ground or storm waters discharge fresh water into coastal waters. • 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 ambient. 						

Water quality results for March 2, 2007 are presented in Table 3. A discussion of these results follows. Temperature and salinity criteria are based on ambient conditions in the water quality regulations and baseline measurements typically represent ambient conditions. Temperatures ranged from 24.2 to 25.6°C. As might be expected, Stations 1 and 2 located in shallow water were elevated compared to temperatures from the six stations located further offshore and in deeper water. The average temperature for Honolulu Harbor waters (Aloha Tower station, NOAA 2007b) in March is given as 24.4°C. Based on this average, the temperatures obtained seem normal. Salinities also appear normal for inshore, somewhat confined waters. All samples showed adequate levels of dissolved oxygen (DO) and appropriate pH values.

Particulates in the samples were elevated relative to the geometric mean criteria for turbidity, TSS, and chlorophyll. All sampling stations (ranging from 1.44 to 6.70 NTU) were above the state geometric mean criterion for turbidity. Six of the eight turbidity values exceeded the criterion (1.50 NTU) not to be exceeded more than 2% of the time, whereas the other two values exceeded the criterion (1.00 NTU) not to be exceeded 10% of the time. Stas. 2 and 5-12' show dramatically elevated levels for turbidity and total suspended solids (TSS). Station 2 levels are likely elevated due to heavy onshore wind and wind waves that suspended sediment in the shallow sampling station. Station 5-12' elevated levels for turbidity and TSS may be due to

the Niskin type sampler disturbing the bottom. There is no criterion for TSS in marine waters. All sampling values (ranging from 0.70 to 1.34 µg/L) were above state geometric mean criterion for chlorophyll α . All station values were below the criterion (1.50 µg/L) not to be exceeded 10% of the time.

Table 3. Water quality characteristics at proposed Ke'ehi small boat drydock and nearby waters from samples collected on March 2, 2007.

STATION	Time Sampled	Temp. (°C)	Salinity (‰)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat.)	pH --	Tot. Susp. Solids (mg/L)
Sta. 1-0'	13:24	25.0	33.75	6.19	91	8.12	7.0
Sta. 2-0'	13:28	25.6	33.86	6.29	93	8.18	18.0
Sta. 3-0'	14:03	24.5	33.79	6.11	90	8.18	4.4
Sta. 3-30'	14:00	24.4	33.88	5.82	85	8.18	7.7
Sta. 4-0'	14:29	24.5	33.70	6.02	88	8.16	5.6
Sta. 4-34'	14:25	24.2	33.98	5.86	85	8.14	8.1
Sta. 5-0'	14:30	24.5	33.71	6.25	91	8.16	6.2
Sta. 5-12'	14:35	24.2	33.71	5.32	78	8.16	19.8

STATION	Turbidity (NTU)	Ammonia (µg N/L)	Nitrate + Nitrite (µg N/L)	Total N (µg N/L)	Total P (µg P/L)	Chl α (µg /L)
Sta. 1-0'	2.02	<1	<1	124	24	---
Sta. 2-0'	4.34	<1	<1	167	52	---
Sta. 3-0'	1.40	<1	<1	120	20	0.94
Sta. 3-30'	2.36	<1	<1	117	28	1.34
Sta. 4-0'	1.44	<1	<1	108	17	1.05
Sta. 4-34'	2.54	<1	<1	113	18	0.70
Sta. 5-0'	1.76	<1	1	121	22	1.06
Sta. 5-12'	6.70	<1	<1	116	19	1.17

Inorganic nutrients were under the geometric mean criteria values whereas some total nitrogen and total phosphorous values were greater than the criteria. All

stations had less than 1 µg N/L of ammonia nitrogen and nitrate + nitrite nitrogen except Station 5-0' which was at the detection limit of 1 µg N/L for nitrate + nitrite nitrogen. These values were below the criteria (3.50 and 5.00 µg N/L, respectively). Station 2 had an elevated level for total nitrogen (167 µg N/L) that was below the criterion (250 µg N/L) not to be exceeded 10% of the time. All other total nitrogen values met the geometric mean criterion. Stations 3-0', Station 4-0', Station 4-34' and Station 5-12' met the geometric mean criterion for total phosphorus. Station 1, Station 3 -30' and Station 5-0' were elevated but within the criterion (40 µg P/L) not to be exceeded 10% of the time. Station 2-0 at 52 µg P/L was close to the criterion (60 µg P/L) not to be exceeded 2% of the time.

Table 4. Comparison of current and historical water quality data (arithmetic means).

		Temp. (°C)	Salinity (‰)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat.)*	pH	TSS (mg/L)
<i>AECOS</i>	mean	24.6	33.8	5.98	88	8.16	9.6
2007	<i>n</i>	8	8	8	8	8	8
Historical Data**	mean	26.5	34.88	5.61	86	8.26	4.92
	<i>n</i>	>362	>374	>362	>362	>303	>365
		Turbidity (NTU)	Ammonia (µg N/L)	Nitrate + Nitrite (µg N/L)	Total N (µg N/L)	Total P (µg P/L)	Chl α (µg /L)
<i>AECOS</i>	mean	2.82	<1	<1	123	25	1.04
2007	<i>n</i>	8	8	8	8	8	6
Historical Mean**	mean	1.74	8.43	3	156	24	0.74
	<i>n</i>	>378	>90	>90	>90	>89	>125

*% saturation is calculated using the mean salinity, temperature and mg/L DO values.

**One historical survey incorporated did not give number of samples for reported means. The number (n) reported is the minimum number of samples used in calculating the means for each parameter.

The March 2, 2007 mean results for each parameter are similar to historical mean values found in Ke'ehi Lagoon and Honolulu Harbor. Table 4 (above) shows a comparison between mean results from the present survey and historical means obtained by combining eight previous water quality surveys from Ke'ehi Lagoon and Honolulu Harbor. The historical mean values are the average of the geometric means from up to eight water quality studies undertaken in Ke'ehi Lagoon and

Honolulu Harbor (not all parameters were measured in each of the nine surveys). The data used to calculate the historical means are found in Appendix A.

Terrestrial Flora

A survey of terrestrial plants at the proposed small boat shipyard site was undertaken. This survey included the drainage ditch along the east property boundary. Essentially all of the fast land surrounding Ke'ehi Lagoon consists of fill material deposited from dredging in the lagoon or other sources (Foote et al., 1972). The climate in the area is dry, coastal. The flora is mostly herbaceous plants typical of disturbed areas, with elements of dry coastal scrub and coastal strand assemblages.

The survey yielded 36 species of plants. Of these, six (17%) are indigenous—native to Hawai'i, but not unique to the Hawaiian Islands—three are considered Polynesian introductions, while the remaining 27 species are introduced species that have become naturalized in Hawai'i. A flora listing is provided in Table 5. Plant names follow the *Manual of the Flowering Plants of Hawai'i* (Wagner et al., 1999) for native and naturalized flowering plants.

The site appears to have been cleared and graded at some point in time, but then not maintained. The majority of the vegetation is occasional grasses (*Panicum maximum*, *Cynodon dactylon*, *Chloris barbata*), salt bush (*Atriplex suberecta*) and pickleweed (*Batis maritima*). Much of the species diversity occurring on the property is associated with the drainage ditch along the east property line. Here, dense patches of pickleweed and cattail (*Typha* sp.) have overtaken the waterway. Kiawe (*Prosopis pallida*), 'ae'ae (*Bacopa monnieri*), and Indian fleabane (*Pluchea indicans*) occur along the fence that lines the north property boundary. A lone American or red mangrove tree (*Rhizophora mangle*) is growing in the inter-tidal zone along the southern shore.

None of the plant species observed in the project area is listed as threatened or endangered, or are otherwise considered rare or special by the state or federal governments (HDLNR, 1998; Federal Register, 2005; USFWS, 2005, 2006).

Table 5. Checklist of plants (flora) observed at proposed Ke'ehi Boat Yard project site.

FAMILY	<i>Genus species</i>	Common name	Status	Abundance
DICOTYLEDONES -- FLOWERING PLANTS				
AIZOACEAE	<i>Sesuvium portulacastrum</i> (L.) L	'akulikuli	Ind.	U
AMARANTHACEAE	<i>Amaranthus viridis</i> L.	slender amaranth	Nat.	O
	<i>Alternanthera pungens</i> Kunth	khaki weed	Nat.	O
APOCYNACEAE	<i>Plumeria rubra</i> L.	plumeria	Nat.	U
ASTERACEAE (COMPOSITAE)	<i>Calyptocarpus vialis</i> Less.	Straggler daisy	Nat.	U
	<i>Pluchea carolinensis</i> (Jacq.) G. Don	sourbush	Nat.	O
	<i>Pluchea indica</i> (L.) Less.	Indian fleabane	Nat.	C
	<i>Pluchea x fosbergii</i> Cooper. & Galang	sourbush hybrid	Nat.	R
BATAACEAE	<i>Batis aritime</i> L.	pickleweed	Nat.	C
BORAGINACEAE	<i>Cordia subcordata</i> Lam.	<i>Kou</i>	Pol.	O
	<i>Heliotropium curassavicum</i> L.	seaside heliotrope; <i>nenā</i>	Ind.	U
CHENOPODIACEAE	<i>Atriplex suberecta</i> Verd.	Salt bush	Nat	C
CLUSIACEAE	<i>Calophyllum inophyllum</i> L.	<i>kamani</i>	Pol.	U
COMBRETACEAE	<i>Terminalia catappa</i> L.	false kamani	Nat.	O
FABACEAE	<i>Alysicarpus vaginatum</i> (L.) DC	Alyce clover	Nat.	O
	<i>Acacia farnesiana</i> (L.) Willd.	<i>klu</i>	Nat.	U
	<i>Leucaena leucocephala</i> (Lam.) deWit	<i>koa haole</i>	Nat.	U
	<i>Prosopis pallida</i> (Humb. & Bonpl. Ex Willd.) Kunth	<i>kiawe</i>	Nat.	U
GOODENIACEAE	<i>Scaevola taccada</i> (J. Gaertn.) Roxb.	<i>Naupaka kahakai</i>	Ind.	C
MALVACEAE	<i>Sida ciliaris</i> L.	---	Nat.	U
	<i>Thespesia populnea</i> (L.) Sol ex Correa	<i>milo</i>	Ind.	C
MORACEAE	<i>Ficus microcarpa</i> L.	Chinese banyan	Nat.	U
RHIZOPHORACEAE	<i>Rhizophora mangle</i> L.	American mangrove	Nat.	U
SOLANACEAE	<i>Nicotiana glauca</i> R.C. Graham	tree tobacco	Nat.	U
SCROPHULARIACEAE	<i>Bacopa monnieri</i> (L.) Pennell	'ae'ae	Ind.	A

Table 5 (continued).

FAMILY			
<i>Genus species</i>	Common name	Status	Abundance
MONOCOTYLEDONES -- FLOWERING PLANTS			
ARECACEAE			
<i>Cocos nucifera</i> L.	coconut palm; <i>niu</i>	Pol.	R
CYPERACEAE			
<i>Cyperus involucratus</i> Rottb.	umbrella sedge	Nat.	O
<i>Cyperus polystachyos</i> Rottb.	manyspike flatsedge	Nat.	O
PANDANACEAE			
<i>Pandanus tectorius</i> S. Parkinson ex Z	<i>hala</i>	Ind.	R
POACEAE (GRAMINEAE)			
<i>Cenchrus echinatus</i> L.	sandbur	Nat.	C
<i>Chloris barbata</i> (L.) Sw.	swollen fingergrass	Nat.	C
<i>Cynodon dactylon</i> (L.) Persoon	Bermuda grass	Nat.	C
<i>Eleusine indica</i> (L.) Gaertn.	wire grass	Nat.	C
<i>Panicum maximum</i> Jacq.	Guinea grass	Nat.	A
<i>Sporobolus diander</i> (Retz.) P. Beauv.	dropseed	Nat.	C
TYPHACEAE			
<i>Typha</i> sp.	cattail	---	C
Legend:			
Status = distributional status			
End. = endemic; native to Hawaii and found naturally nowhere else			
Ind. = indigenous; native to Hawaii, but not unique to the Hawaiian Islands			
Nat. = naturalized; exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation			
Pol. = Polynesian introduction before 1778			
Abundance = occurrence ratings for plants			
R - Rare - only one or two plants seen			
U - Uncommon - several to five plants observed			
O - Occasional - found between five and ten times; not abundant anywhere			
C - Common - considered an important part of the vegetation and observed numerous times			
A - Abundant - found in large numbers; may be locally dominant			

Marine Biological Survey

AECOS, Inc. biologists snorkeled the waters adjacent to the proposed small boat shipyard site for a marine reconnaissance survey. The marine biological survey included identification of macro-algae, coral and other macro-invertebrates, and fishes present, with notes on relative abundances. Specimens were identified in the field or photographed for verification of identity from various published texts: algae were identified using Magruder and Hunt (1979), coral species were identified using Fenner (2005), macro-invertebrates were identified using Hoover (2006) and

Severns (2001); and fish species were identified using Randall (1996) and Hoover (1993). It should be noted that cryptic and nocturnal species would not be encountered during this daytime survey. The resulting checklist of marine biota observed in the nearshore waters of Ke'ehi Lagoon is given in Table 6.

Table 6. Checklist of marine biota observed off the proposed Ke'ehi Boat Yard project site, March 2, 2007.

PHYLUM, CLASS, ORDER, FAMILY Genus <i>species</i>	Common name	Abundance	Status
ALGAE			
PROTISTA, CYANOBACTERIA			
<i>Lyngbya majuscula</i>	blue green alga	A	Ind.
CHLOROPHYTA			
<i>Cladophora seriacea</i>		U	Ind.
<i>Dictyosphaeria cavernosa</i>	bubble alga	U	Ind.
RHODOPHYTA			
<i>Galaxaura rugosa</i>		R	Ind.
<i>Hydrolithon reinboldii</i>		U	Ind.
<i>Peysonellia rubra</i>		C	Ind.
<i>Porolithon onkodes</i>		C	Ind.
INVERTEBRATES			
PORIFERA, DEMOSPONGIAE			
Undetermined	---	C	
DYSIDEIDAE			
<i>Dysidea cf avara</i>	acquisitive sponge	C	End?
CHONDRILLIDAE			
<i>Chondrosia chucalla</i>	meandering sponge	C	Ind.
SPIRASTRELLIDAE			
<i>Spirastrella vagabunda</i>	vagabond boring sponge	U	Ind.
ANCHINOIDAE			
<i>Phorbas sp.</i>	red phorbas	A	Ind.
CNIDARIA, HYDROZOA			
PENNARIIDAE			
<i>Pennaria disticha</i>	Christmas tree hydroid	A	Ind.
CNIDARIA, ANTHOZOA,			
OCTOCORALLIA			
TELESTIDAE			
<i>Carijoa riisei</i>	snowflake coral	U	Int.
CNIDARIA, ANTHOZOA,			
HEXACORALLIA,			
SCLERACTINIA			
POCILLOPORIDAE			
<i>Pocillopora damicornis</i>	lace coral	A	Ind.
ACROPORIDAE			
<i>Montipora patula</i>	sandpaper rice coral	R	End

Table 6 (continued).

PHYLUM, CLASS, ORDER, FAMILY	Genus <i>species</i>	Common name	Abundance	Status
PORITIDAE				
	<i>Porites sp.</i>	indet. lobe coral, <i>pohaku puna</i>	R	
	<i>Porites lobata</i>	lobe coral, <i>pohaku puna</i>	R	Ind.
SIDERASTREADAE				
	<i>Psammacora stellata</i>	stellar coral	R	Ind.
FAVIDAE				
	<i>Cyphastrea ocellina</i>	ocellate coral	R	Ind
	<i>Leptastrea sp.</i>	favid coral	R	Ind
PLATYHELMINTHES				
	Undetermined.	---	R	
ANNELIDA, POLYCHAETA				
CHAETOPTERIDAE				
	<i>Chaetopterus sp.</i>	parchment worm	C	Int.
SABELLIDAE				
	<i>Sabellastarte spectabilis</i>	featherduster worm	A	Ind.
SERPULIDAE				
	<i>Spirobranchus giganteus.</i>	Christmas tree worm, <i>kio</i>	R	Ind.
TEREBELLIDAE				
	<i>Liomia medusa.</i>	medusa spaghetti worm, <i>kauna oa</i>	R	Ind.
BRYOZOA				
VESICULARIDAE				
	<i>Amathia distans</i>	white bushy bryozoan	U	Int.
MOLLUSCA, GASTROPODA				
PATELLIDAE				
	<i>Cellana exarta</i>	black-foot opihi, <i>opihl makaiauli</i>	R	End.
SIPHONARIDAE				
	<i>Siphonaria normalis</i>	false limpet, <i>opihl-awa</i>	C	Ind.
TROCHIDAE				
	<i>Trochus intextus</i>	woven top, <i>ha upu</i>	U	Ind.
NERITIDAE				
	<i>Nerita picea</i>	black nerite, <i>pipipi</i>	U	Ind.
LITTORINIDAE				
	<i>Littoraria pintado</i>	dotted periwinkle, <i>pipipi kolea</i>	C	Ind.
VERMETIDAE				
	<i>Serpulorbis variabilis</i>	variable worm snail <i>kauna oa</i>	R	End.
THAIDIDAE				
	<i>Morula granulata</i>	granular drupe <i>maka awa</i>	U	Ind.
	<i>Morula uva</i>	grape morula <i>maka loa</i>	U	Ind.
MOLLUSCA, BIVALVIA				
PINNIDAE				
	<i>Streptopinna saccata</i>	baggy pen shell <i>nahaweke</i>	C	Ind.

Table 6 (continued).

PHYLUM, CLASS, ORDER, FAMILY	Genus <i>species</i>	Common name	Abundance	Status
PTERIIDAE	<i>Pinctada margaritifera</i>	black-lipped pearl oyster, <i>pa</i>	C	Ind.
ISOGNOMONIDAE	<i>Isognomon californicum</i>	black purse shells	C	End.
	<i>Isognomon perna</i>	brown purse shell <i>nahawele, papaua</i>	C	Ind.
SPONDYLIDAE	<i>Spondylus violacescens</i>	cliff oyster, <i>okupe</i>	R	Ind.
CHAMIDAE	<i>Chama macreophylla</i>	rock oyster	R	Int.
OSTREIDAE	<i>Crassostrea gigas</i>	Japanese oyster	C	Ind.
ARTHROPODA, CRUSTACEA, CIRRIPEDIA				
CHTHAMALIDAE	<i>Chthamalus proteus</i>	proteus rock barnacle	C	Int.
CRUSTACEA, STOMATOPODA				
GONODACTYLIDAE	<i>Gonodactyleus mutatus</i>	Philippine mantis shrimp	R	Ind.
CRUSTACEA, DECAPODA				
ALPHEIDAE	<i>Alpheus deuteropus</i>	petroglyph shrimp	R	Ind.
	<i>Alpheus mackayi</i>	snapping shrimp	A	Ind.
	<i>Alpheus sp.</i>	goby shrimp (Hermit crabs)	A	Ind.
DECAPODA, ANOMURA				
DIOGENIDAE	<i>Calcinus laevimanus</i>	left-handed hermit crab, <i>unauna</i>	U	Ind.
	<i>Calcinus latens</i>	hidden hermit crab <i>unauna</i> (True Crabs)	U	Ind.
DECAPODA, BRACHYMURA				
PORTUNIDAE	<i>Charybdis erythroductyla</i>	rainbow swimming crab, <i>papa i ako ako a</i>	R	Ind.
CARPILIDAE	<i>Carpilus convexus</i>	convex crab, <i>kukuau</i>	R	Ind.
XANTHIDAE	<i>Liomera sp.</i>	liomera crab	R	Ind.
TRAPEZIIDAE	<i>Trapezia tigrina</i>	red-spotted guard crab	R	Ind.
GRAPSIDAE	<i>Graspus tenuicrustatus</i>	thin-shelled rock crab, <i>a'ama</i>	C	Ind.
OCYPODIDAE	<i>Ocypode sp.</i>	ghost crab <i>ohiki</i>	R	Ind.
CRYPTOCHIRIDAE	<i>Hapalocarcinus marsupialis</i>	coral gall crab	U	Ind.

Table 6 (continued).

PHYLUM, CLASS, ORDER, FAMILY Genus <i>species</i>	Common name	Abundance	Status
ECHINODERMATA, ECHINOIDEA TOXOPNEUSTIDAE <i>Tripneustes gratilla</i>	collector urchin, <i>hawa e maoli</i>	R	Ind.
ECHINODERMATA, HOLOTHUROIDEA HOLOTHURIIDAE <i>Holothuria cinerascens</i>	ashy sea cucumber <i>loli pua</i>	R	Ind.
CHORDATA, UROCHORDATA (TUNICATA) Undetermined	---	U	
ASCIDIIDAE <i>Phallusia nigra</i>	black sea quirt	C	Int.
VERTEBRATA, PISCES			
MURAENIDAE <i>Gymnothorax flavimarginatus</i>	yellow margin moray <i>puhi paka</i>	R	Ind.
HOLOCENTRIDAE <i>Sargocentron sp.</i>	squirrelfish, <i>ala ihi</i>	R	Ind.
APOGONIDAE <i>Apogon sp.</i> <i>Foa brachygramma</i>	cardinalfish, <i>upapalu</i> bay cardinalfish, <i>upapalu</i>	R O	Ind. Ind.
POLYNEMIDAE <i>Polydactylus sexfilis</i>	six-fingered threadfin <i>moi</i>	R	Ind.
MULLIDAE <i>Parapeneus multifasciatus</i>	many bar goatfish <i>moana</i>	R	Ind.
CHAETODONTIDAE <i>Chaetodon auriga</i> <i>Chaetodon lunula</i> <i>Chaetodon lunulatus</i> <i>Chaetodon ornatissimus</i> <i>Forcipiger sp.</i>	threadfin butterflyfish <i>kikakapu</i> raccoon butterflyfish <i>kikakapu</i> oval butterflyfish <i>kapuhili</i> ornate butterflyfish <i>kikakapu</i> indet. <i>lau wiliwili nuku nuku oi oi</i>	O C O O R	Ind. Ind. Ind. Ind. Ind.
KUHLIIDAE <i>Kuhlia sandvicensis</i>	Flagtail, <i>aholehole</i>	U	Ind.
POMOCENTRIDAE <i>Abudefduf vaigensis</i> <i>Plectroglyphidodon johnstonianus</i>	Indo-pacific sergeant <i>mamo</i> blue eye damselfish	C U	Ind. Ind.

Table 6 (continued).

PHYLUM, CLASS, ORDER, FAMILY	Genus <i>species</i>	Common name	Abundance	Status
POMOCENTRIDAE (cont.)				
	<i>Stegastes fasciolatus</i>	Pacific gregory	R	End.
	<i>Dascyllus albisella</i>	Hawaiian dascyllus <i>alo ilo i</i>	A	End.
LABRIDAE				
	<i>Cirrhilabrus jordani</i>	flame wrasse, <i>hinalea</i>	R	End.
	<i>Stethojulis balteata</i>	belted wrasse, <i>omaka</i>	R	End.
	<i>Thalassoma duperrey</i>	saddle wrasse <i>hinalea lauwili</i>	U	End.
SCARIDAE				
	<i>Chlorurus perspicillatus</i>	spectacled parrotfish <i>uhu ahu ula</i>	R	End.
	<i>Chlorurus sordidus</i>	bullethead parrotfish, <i>uhu</i>	U	Ind.
	<i>Scarus psittacus</i>	palenose parrotfish, <i>uhu</i>	U	Ind.
BLENNIDAE				
	<i>Plagiotremis goslinei</i>	Ewa blenny	R	End.
GOBIDAE				
	<i>Asterropteryx semipunctatus</i>	halfspotted goby <i>'o'opu</i>	C	Ind.
	<i>Gnatholepis anjerensis</i>	eyebare goby	O	Ind.
	<i>Psilogobius mainlandi</i>	Hawaiian shrimp goby	C	End.
ZANCLIDAE				
	<i>Zanclus cornutus</i>	moorish idol, <i>kihikihi</i>	C	Ind.
ACANTHURIDAE				
	<i>Acanthurus blochii</i>	ring-tail surgeonfish <i>pualu</i>	R	Ind.
	<i>Acanthurus leucopareius</i>	whitebar surgeonfish <i>maikoiko</i>	R	Ind.
	<i>Acanthurus triostegus</i>	convict surgeonfish <i>manini</i>	C	End.
	<i>Ctenochaetus strigosus</i>	goldring surgeonfish <i>kole</i>	R	Ind.
	<i>Zebrasoma flavescens</i>	yellow tang, <i>lau impala</i>	C	Ind.
BALISTIDAE				
	<i>Balistes polylepis</i>	finscale triggerfish <i>humu humu</i>	R	Ind.
OSTRACIIDAE				
	<i>Ostracion meleagris</i>	spotted boxfish, <i>moa</i>	R	End.
TETRADONTIDAE				
	<i>Arothron hispidus</i>	stripe belly puffer <i>'o'opu hue</i>	O	Ind.
DIODONTIDAE				
	<i>Diodon hysterix</i>	Porcupinefish, <i>kokala</i>	R	Ind.

KEY TO SYMBOLS USED:

Abundance categories:

R - Rare - only one or two individuals observed.

U - Uncommon - several to a dozen individuals observed.

O - Occasional - regularly observed, but in small numbers.

C - Common - observed everywhere, although generally not in large numbers.

A - Abundant - observed in large numbers and widely distributed.

Table 6 (continued).

Status categories:

End - Endemic - species found only in Hawaii

Ind. - Indigenous - species found in Hawaii and elsewhere

Int. - Introduced - species were introduced to Hawaii intentionally or accidentally.

The inter-tidal zone of the proposed site is easily separated into two distinct biotopes: seawall or hardened shoreline (southwestern exposure) and natural or undeveloped shoreline (southeastern exposure). The seawall located along the west side of the property exhibits a typical gradation common to armored shores in Hawaii. The nerite snail (*Nerita picea*), black purse shell (*Isognomon californicum*), proteus rock barnacle (*Chthalamus proteus*), and false limpet (*Siphonaria normalis*) are common near the high water mark. Black-foot 'opihi (*Cellana exarta*) and dotted periwinkles (*Littorina pinctada*) were also observed in this zone. Lower on the seawall, Japanese oyster (*Crassostrea gigas*) are dominant with the vermetid worm (*Serpulorbis variabilis*) also present. The grapsid crab, (*Graspus tenuicrustatus*) is abundant in the intertidal zones.

The narrow swath of beach along the southeast shore differs from the east end to the west end of the project area. The east end is primarily composed of coarse sand which gives way to gravel and shell hash at the shoreline. The west end is primarily composed of cobble size stones and rip rap, likely remainders of the hardened shoreline. Biota is similar along the entire stretch of shoreline. Unidentified *Ocypode* crab holes are rare. Inspection of rock undersides and crevices, just below the waterline, reveals diogenid hermit crabs (*Calcinus laevimanus*, *Calcinus lateens*), brown purse shells (*Isognomon perna*), encrusting coralline red algae (*Peysonella rubra*), unidentified flatworms, several mollusks, and the convex crab (*Carpilus convexus*). Small amounts of unidentified green algae, possibly *Cladophora* sp., are also present.

The shore gently slopes towards Kalihi Channel and abruptly drops at the dredged margin, giving way to the ship channel roughly 25 m (80 ft) from shore. The majority of marine biota occurs along the gentle slope in 1 to 3 m (3 to 10 ft) depths. The bottom is primarily silt that appears to be largely of terrigenous origin. Feather duster worms (*Sabellastarte spectabilis*) are noticeable in abundance. Various burrows are ubiquitous throughout the area. Identified burrow usage includes alpheid shrimp (*Alpheus* sp.), gobies (*Psilogobius mainlandi*, *Asterropteryx semipunctatus*), and a mantis shrimp (*Gonodactyleus mutatus*). The few exposed areas of hard substratum are commonly covered with sponges (*Dysidea* cf *avara*, *Phorbas* sp.) with an occasional small lace coral (*Pocillapora damicornis*) colony. Most colonized hard bottom is man-made debris: concrete, tires, and buoy lines. Cardinalfish (*Foa brachygramma*), damselfish (*Abudefduf vaigiensis*, *Dascylus albisella*) and raccoon butterfly fish (*Chaetodon lunula*) are fishes observed most

abundantly in the water column. Macroalgae are conspicuously absent except for *Lyngbya majuscula*, which is uncommon, and a few small patches of *Cladophora seriacea* confined to a 10 m² area.

The substrata change noticeably off the southern most point of the property. The bottom composition transitions from primarily fine sediments to an area of shell debris and rubble intermixed with fine sediments. Increased hard bottom supports abundant coral growth of lace coral (*P. damicornis*; Fig. 3). Although seven species of scleractinian corals were sighted, all others were rare in the area. Baggy pen shells (*Streptopinna saccata*) and black-lipped pearl oysters (*Pinctada margaritifera*) are interspersed between corals. The coral symbionts red-spotted guard crab (*Trapezia tigrina*) and coral gall crab (*Hapalocarcinus marsupialis*) occur with some regularity. Fish abundance is greater off the west side with surgeonfish (*Acanthurus* spp., *Zebrasoma flavescens*, *Ctenochaetus strigosus*) and Hawaiian damselfish (*Dascyllus albisella*) most prevalent. Green bubble-algae (*Dictyosphaeria cavernosa*) is the only macroalgae that is conspicuous.

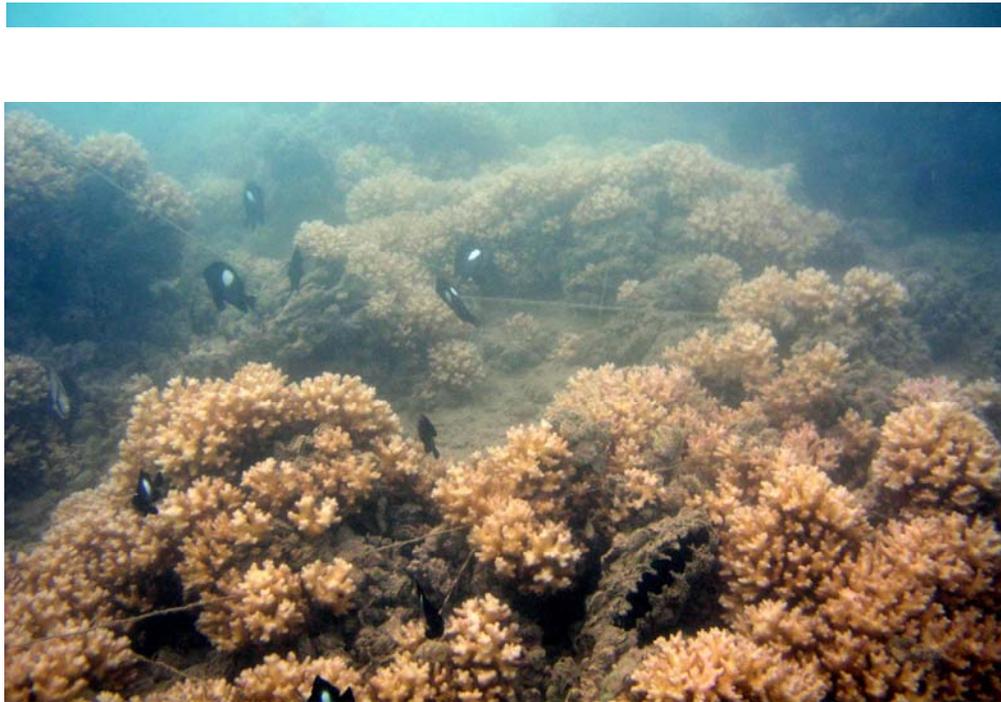


Figure 3. Coral assemblage of *Pocillopora damicornis* with *Dascyllus albisella* off the southern most point of the site.

The channel marker and buoys (Fig. 4) just offshore host a colorful display of sponges, bushy bryozoan (*Amanthia distans*), tunicates (including *Phallusia nigra*),

soft coral (*Carijoa riisei*), and a hydroid (*Pennaria disticha*). Most of these species are introduced, commonly from ballast water or ships hulls, with invasive characteristics (Coles et al., 1997).

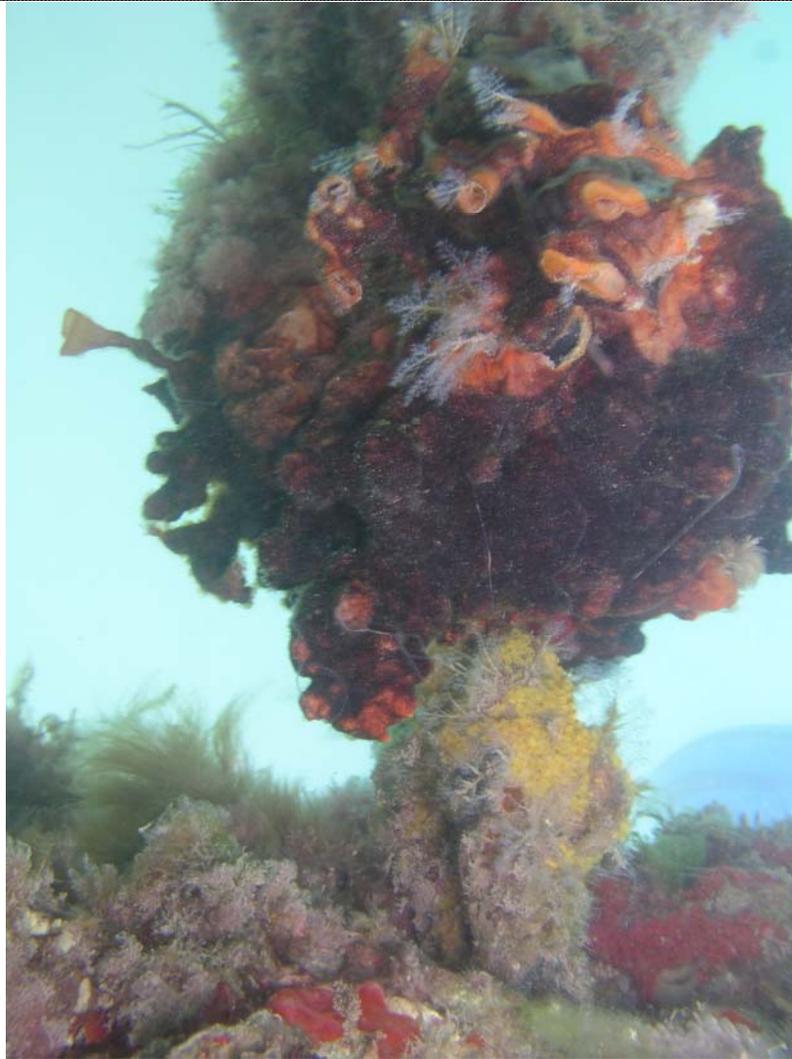


Figure 4. Various marine invertebrates attach to buoys and channel markers off the site.

The western exposed shallow reef area has less coral cover than the southern point. Similar species occur here although in lower abundance. This area is fished regularly and hooks with attached broken monofilament lines are quite common. Moorish idols (*Zanclus cornutus*) and *manini* (*Acanthurus triostegus*) are the most sighted fishes along this area.

The slope down to the channel bottom and the channel bottom itself are similar, each having little observable marine biota, exceptions being blue-green algae

(*Lyngbya majuscula*), which covers most exposed substrate, and an occasional sponge (*Phorbas* sp., *Dysidea* cf. *avara*). Numerous burrows appearing similar to those observed on the shallow shelf are present on the channel bottom. Observing in and around a few burrows yielded no identifiable critters, however snapping shrimp (*Alpheus mackayi*) can be heard clearly near channel bottom.

Conclusions

Ke'ehi Lagoon is listed as an impaired water body for chlorophyll α , total nitrogen, total phosphorus, total suspended solids, turbidity and enterococcus during both wet and dry seasons (Koch *et al*, 2004). Waters in Honolulu Harbor near the site are impaired for turbidity, total nitrogen and chlorophyll α during dry season based on data from two sampling stations on nearby Sand Island (Koch *et al*, 2004). Levels of these parameters can be expected to exceed state criteria at any given time. Water quality will be impacted by construction activity (dredging and fill activity). A Best Management Practices (BMP) plan should be prepared and implemented to minimize these impacts on water quality. Long term operational impacts such as increased pollutant loads in storm discharges should be controlled and treated to the best degree possible prior to discharge in order to conform with HAR §11-54-03(c)(2)(A)(i) and (iii).

Protected or regulated species present at the proposed site include: the 'opihi (*Cellana* spp.) and stony corals like *Pocillopora damicornis*. The State of Hawai'i prohibits taking, possessing, selling, and offering for sale 'opihi smaller than 1.25 in or 3.18 cm (HDLNR, 1998). However, this rule does not protect the species from other sorts of destruction. The 'opihi is neither a listed species nor a candidate for listing under federal endangered species statutes (Federal Register, 2005; USFWS, 2005, 2006). Impacts from the proposed renovations are not anticipated to negatively impact the small 'opihi population at the site.

It is unlawful to take, break or damage, with any implement, any stony coral from the waters of the State, including any reef or mushroom coral (HDLNR, 1998). Filling of one half acre of Kalihi Channel to build dry docks and piers will inevitably cover a small amount of live coral. Monitoring will likely be required by HDLNR. *Poc. damicornis* affinity for shallow and protected near-shore locations suggests it is resilient in the face of changes in water quality such as increased sediment and nutrient loads common in the lagoon/ship channel environment. However, *Poc. damicornis*' branches are thinner and more delicate than other pocilloporid corals and can break easily (Fenner, 2005). Controlling sediment plumes that may settle on coral colonies and avoiding direct contact with coral colonies during construction would be necessary to prevent loss of additional corals because of their proximity to the half acre fill site.

The *honu* or Pacific green sea turtle is protected by both state and federal endangered species laws. The *honu* is listed as a threatened species in Hawaiian waters by Department of Land and Natural Resources (HDLNR, 1998) and U.S. Fish and Wildlife Service (Federal Register, 2005; USFWS, 2005, 2006). Though not observed during this survey, it is possible that *honu* may utilize waters near the site. The impacts from the proposed renovations are not anticipated to impact green sea turtle populations given that the nature of the proposed facility (small boat repair) is consistent with other uses along the shoreline in this area.

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Appendix A.

Historical water quality data for Ke'ehi Lagoon and Honolulu Harbor.

Appendix A. Historical water quality data Ke'ehi Lagoon and Honolulu Harbor.

Study	N = # of samples	Temp	Sal.	D.O.	pH	TSS	Turb.	NO3-NO2	NH3+	TN	TP	Chl <i>a</i>
AECOS 1979	N=71*	26.4	34.70	6.6	-	5.5	1.6	3	4	115	39	0.15
AECOS 1982	N=6	-	-	-	-	4.36	1.7	4	5	191	40	0.16
OI 1986	N=3	26.9	34.68	-	8.15	5.30	2.1	1	16	235	4	1.13
Oceanit 1990	N= unknown	-	-	-	-	6.35	1.0	4	-	109	21	0.46
AECOS 1991	N=6	28.1	35.17	3.7	8.28	-	0.8	5	9	135	19	0.64
OI 1992	N=36	24.7	34.70	6.4	8.40	3.2	1.7	-	-	-	-	1.92
AECOS 1992	N=6	28.0	35.17	4.9	8.26		1.9	1	8	149	21	0.71
AECOS 1995	N=252**	25.0	34.56	6.4	8.19	4.8	3.1	-	-	-	-	-
Means		26.5	34.88	5.6	8.26	4.92	1.7	3	8	156	24	0.74

* n=72 for turbidity, NO3-NO2, NH3+ and TN

** n=240 for dissolved oxygen and temperature

Historical Water Quality References

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Appendix F

Cultural and Archaeological Assessment

**A Cultural Impact Evaluation, Archaeological Literature
Review and Field Inspection for the Development of a Small
Shipyard at Ke‘ehi Lagoon Small Boat Harbor,
Kalihi Kai, Kona, O‘ahu
TMK: [1] 1-2-025:024**

**Prepared for
R.M. Towill Corporation**

**Prepared by
Hallett H. Hammatt, Ph.D.
and
David W. Shideler, M.A.**

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Management Summary

Reference	A Cultural Impact Evaluation, Archaeological Literature Review and Field Inspection for the Development of a Small Shipyard at Ke'ehi Lagoon Small Boat Harbor, Kalihi Kai, Kona, O'ahu TMK: [1] 1-2-025:024 (Hammatt and Shideler 2007)
Date	March 2007
Project Number (s)	Cultural Surveys Hawai'i, Inc. (CSH) Job Code: KALIH 4
Project Location	The project location is at the south end of the Ke'ehi Lagoon Small Boat Harbor off of Sand Island Access Road.
Land Jurisdiction	Department of Transportation, Division of Harbors
Agencies	R. M. Towill Corporation/ DOT, Division of Harbors
Project Description	The proposed project is the construction of a building and docks associated with a small shipyard
Project Acreage	71,200 square feet
Area of Potential Effect (APE) and Survey Acreage	Because the proposed project may involve dredging, the waters off the project area may be affected
Historic Preservation Regulatory Context	The project requires compliance with the State of Hawai'i environmental review process [Hawai'i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed project's effect on traditional cultural practices.
Fieldwork Effort	A field inspection was carried out by K.W. Bushnell, B.A. on December 17, 2006
Number of Historic Properties Identified	None
Findings	No archaeological or historical sites were identified during the field inspection. The land component of the project area is believed to be entirely 20 th century fill. Historic and archival research and previous cultural studies suggest there are rich traditions associated with the Mokauea Fishery where the project area is located.
Mitigation Recommendation	The potential for adverse impact of the proposed project to near shore resources and fishing access is unclear to us at this time. Given the long-tradition of utilization of coastal resources in the vicinity and the expressed concerns associated with the struggle for access to and residence on Mokauea Island and vicinity we recommend that the project attempt to minimize adverse impact to the coastal environment and minimize adverse impact to coastal access for purposes of fishing and accessing other coastal resources.

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Section 1 Introduction

1.1 Project Background

At the request of R.M. Towill Corporation, Cultural Surveys Hawai'i, Inc. conducted this cultural impact evaluation, archaeological literature review and field inspection study for the development of a small shipyard at Honolulu Harbor at Ke'ehi Lagoon, Kalihi Ahupua'a, Honolulu (Kona) District TMK: (1) 1-2-025:024. The proposed shipyard is situated at the south end of the Ke'ehi Lagoon Small Boat Harbor and at the intersection of the Seaplane Runway "D" and the sea channel that leads into the Kapālama Basin of Honolulu Harbor. The project area is approximately 71,200 square feet and includes fast land and a submerged area. The Ke'ehi Lagoon Small Boat Harbor is situated on the causeway that connects Sand Island to the Kapālama mainland. The parcel and the adjacent parking lot and small boat harbor are devoted to waterfront industrial and recreational activities. The area is under consideration of development for a small shipyard.

1.2 Scope of Work

The following Scope of Work was proposed to meet the Hawaii Revised Statutes Chapter 343 requirements for an environmental assessment.

1. Historical and previous archaeological background research to include study of archival sources, historic maps, Land Commission Awards, and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near this property.
2. A field inspection of the project area to identify any surface archaeological features and to investigate and assess the potential for impact to such sites. This assessment identifies any sensitive areas that may require further investigation or mitigation before the project proceeds.
3. Preparation of a report that contain the results of research and findings.

This report assesses the likelihood that the proposed project will impact cultural practices. This assessment is based on the background research and the review of land use within the vicinity of the project area.

1.3 Environmental Setting

1.3.1 Project Area Description

The current project area (Figures 1-3) is located on the southern leeward coast of Honolulu just west of the north end of the causeway leading to Sand Island. This area is also known as the Kalihi Basin as it is flanked on the east and west sides with fresh water streams. To the east Niuhelewai Stream, or what is today known as the Kapālama Drainage Canal, drains into the

Kapālama Basin. To the west, Kalihi Stream empties into the Kalihi Basin or what is now more popularly known as Ke'ehi Lagoon.

Elevation at this project area is approximately sea level to 6 ft (0-1.8 m) above sea level and this area receives approximately 600-800 millimeters (20-30 inches) of precipitation annually (Giambelluca et al. 1986:138). Temperatures on Sand Island range between 52 and 95°F, with a monthly low of 52-80°F in January, to a monthly high of 65-95°F in September (Armstrong 1983: 62-64). Vegetation in the project area is sparse with the exception of the eastern edge of the parcel. This area that borders on the Sand Island Access Road contains a depression that is filled with intertidal water and some vegetation, primarily a native rushgrass, *'aki'aki*. The remaining part of the project area consists of fill. Soil underlying the project area consists of Fill land, mixed (F1), containing areas filled with material dredged from the ocean and hauled from nearby areas. This land type is generally used for urban development, including airports, housing areas, and industrial facilities (Foote et al. 1972:31).

The modern Hawaiian shoreline configuration, including that of the current project area, is primarily the result of: (1) rising sea level following the end of the Pleistocene (Stearns 1978; MacDonald et al. 1983); (2) the mid to late Holocene c. 1.5-2.0 m high-stand of the sea (see summary in Dye and Athens 2000:18-19); and, particularly in the case of the current project area (3) post-contact human landscape modification.

At the end of the Pleistocene, between approximately 20,000 and 5-6,000 years ago, water previously locked in glacial ice returned to the world's oceans, and the sea-level rose over 100 m to approximately its current level. In the vicinity of the current project area, rising sea levels flooded the previously dry, earlier Pleistocene reef deposits, which had formed hundreds of thousands of years previously when sea level was comparable to modern levels. When sea level reached approximately modern levels, the now coastal regions became depositional environments, where for tens of thousands of years previously, during the lower sea-levels, they had been erosional environments.

A high stand of the sea for the Hawaiian Islands, c. 1.5 to 2.0 m above present sea level, has been well documented between 4,500 and 2,000 years ago (Stearns 1978; Athens and Ward 1991; Fletcher and Jones 1996; Grossman and Fletcher 1998; Grossman et al. 1998; Harney et al. 2000). During this high stand, there appears to have been an increase in coral reef production and the production of detrital reef sediments. Littoral environments appear to have been augmented substantially by the deposition of marine sediments. "What this means is that the great shoreline sand berms must have developed around the islands at this time because this was when calcareous sand was being produced and delivered to the shorelines in large quantities" (Dye and Athens 2000: 19). The Kalihi and Kapālama estuaries were likely greatly affected by the deposition of marine sediments during this elevated sea level. The subsequent drop in sea level to its present level, c. 2000 years ago, most likely created a slightly erosional regime that may have removed sediments deposited during the preceding period of deposition (Dye and Athens 2000:19). However, the net gain in sediments would have been substantial. The many lagoonal/estuary environments on the southern coasts that pre-contact Hawaiians utilized for the construction of fishponds was a direct result of the deposition from this later Holocene high stand.

The pre-contact construction of fishponds in the vicinity of the project area helped create the modern land form we see today. Fishpond walls served as sediment anchors for the accumulation of detrital reef sediments. They also likely affected long shore sediment transport, resulting in new littoral deposition and erosion patterns. In the post-Western contact period, when the fishponds were no longer utilized, they became obvious locations for the deposition of fill. These reclaimed areas provided valuable new land near the heart of growing urban Honolulu. Additionally, the O'ahu coastline in the vicinity of the project area was greatly altered by the expansion of Honolulu Harbor, the Honolulu Airport and associated industrial infrastructure which required massive excavations, dredging and filling episodes. The Sand Island Causeway and Ke'ehi Small Boat Harbor are part of this 19th and 20th century transformation of the industrial hub of Hawai'i's capital, Honolulu.

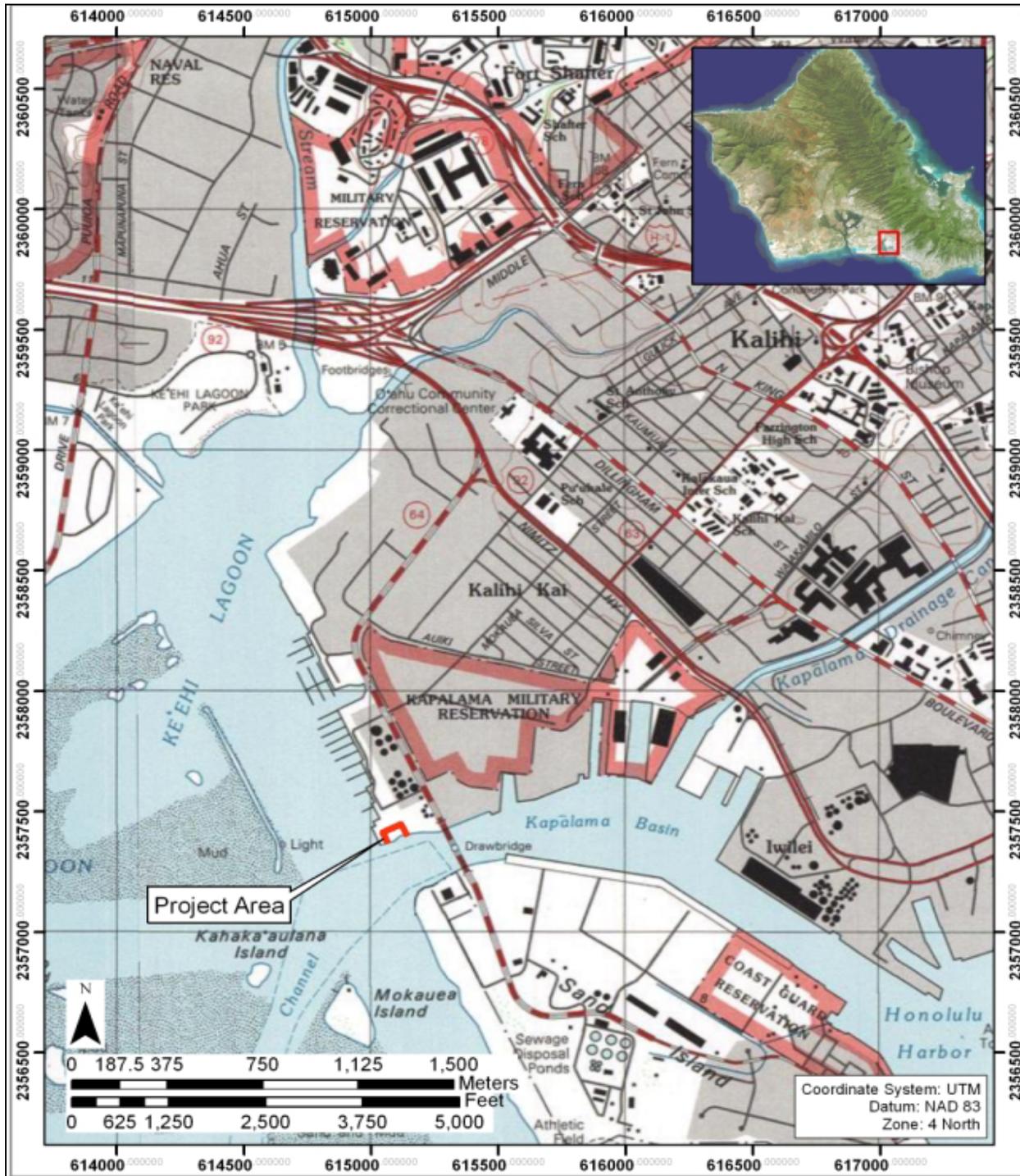


Figure 1. Portion of 1998 Honolulu Quad with location of project area

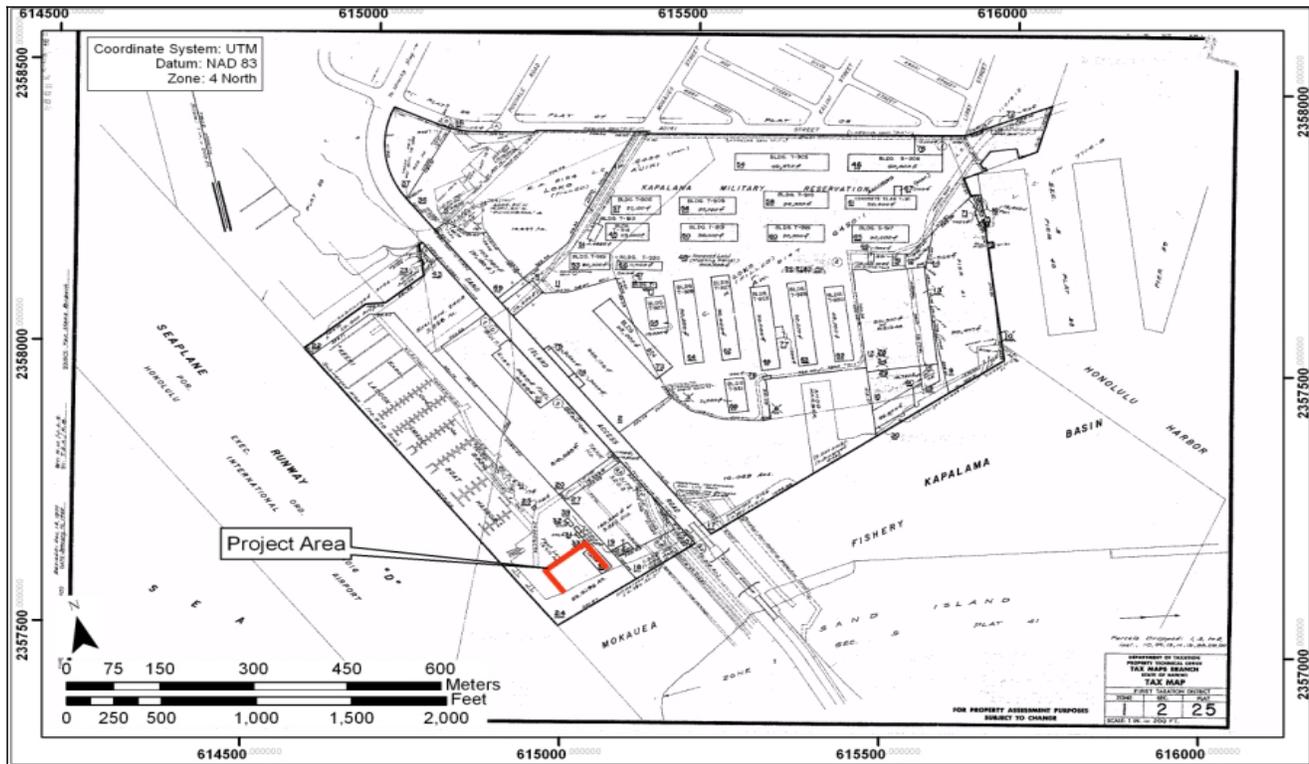


Figure 2. Tax Map Key (TMK) 1-2-25 showing location of project area

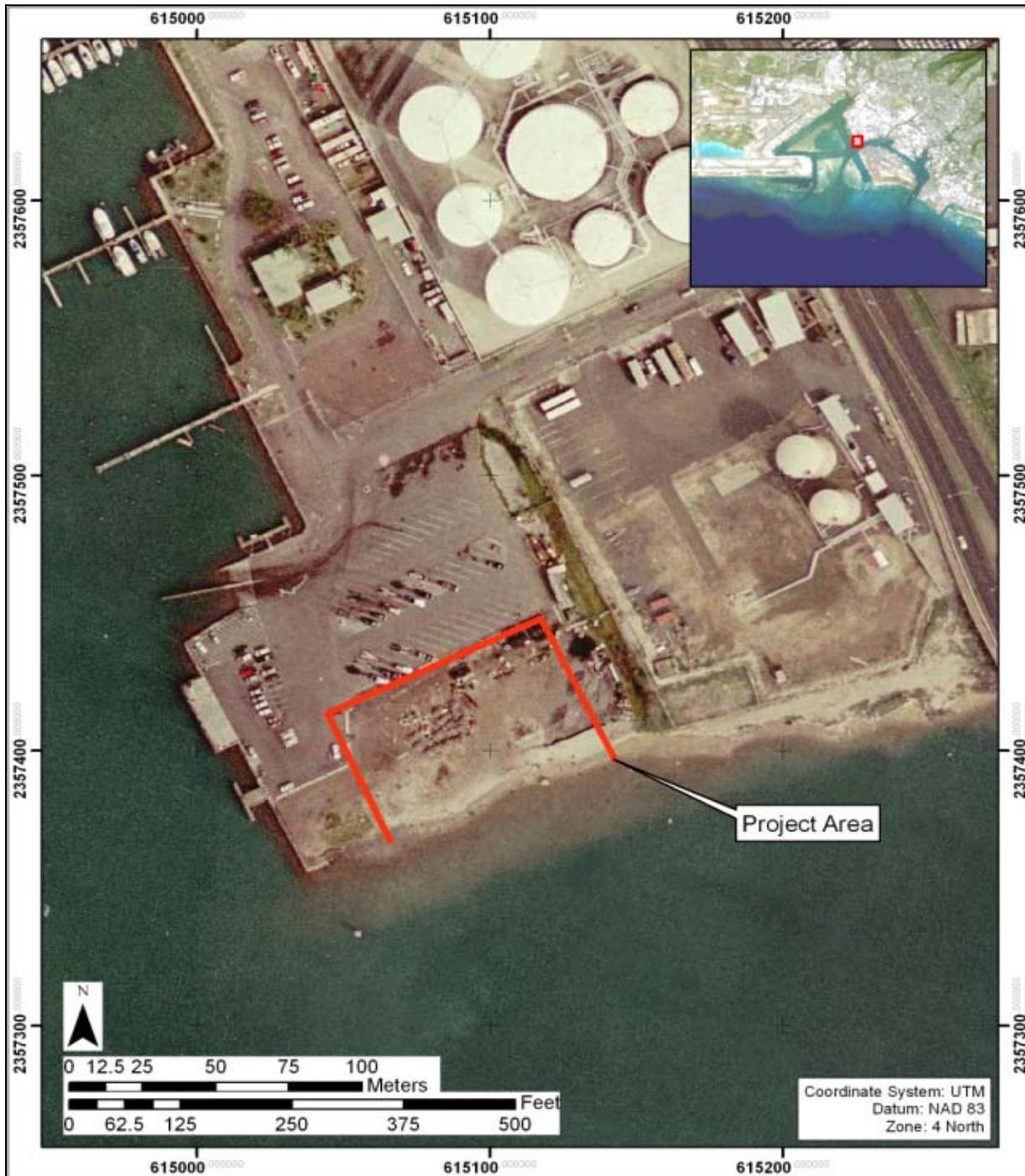


Figure 3. Aerial Photo of Kalihi Kai with Project Area denoted in red

Section 2 Methods

2.1 Field Methods

This project included a field inspection that consisted of a visual reconnaissance of the surface of the project area. The entire parcel was traversed and field notes were taken. The types of soils and fills were recorded in addition to any plants and other items of interest that were found in the area. Because the project also consists of a submerged portion, this area was also inspected.

In addition to the above, activities that people were engaged in on and adjacent to the property were noted. This was done to obtain cultural context and explore the cultural traditions that may be associated with the area.

2.2 Document Review

Background research included a review of previous archaeological studies, cultural impact studies, fishpond studies and other relevant cultural texts on file at the Cultural Surveys Hawai'i Inc. library and at State Historic Preservation Division of the Department of Land and Natural Resources; a review of geology and cultural history documents at Hamilton Library of the University of Hawai'i; a study of historic maps at the Survey Office of the Department of Accounting and General Services. Information on Land Commission Awards was accessed through Waihona Aina Corporation's Māhele Data Base (Waihona 'Aina Corporation 2000<waihona.com>).

Section 3 Background Research

3.1 Traditional and Historical Background

3.1.1 Mythological and Traditional Accounts

Kalihi was first the earthly residence of Papa, in her human form of Haumea, “where she marries her children and grandchildren, begetting the Hawaiian race. Kaieie Heiau in Kalihi was built for her worship “ (in Landrum and Klieger 1991:10). Haumea is the mother of Pele whose sister Kapo made Kalihi her home and thus famous in legend (Pukui et al. 1974). Haumea is known for her regeneration abilities, whether this is manifested as food for the people or the powers of female reproduction to secure the existence of humankind (Beckwith 1970).

Most of the recorded myths are situated in the *mauka* areas of Kalihi and there is very little documented information for the *mā kai* areas. This is quite surprising considering the abundance of fishpond and extensive fisheries in the area. One story was found relating to the waters of the Kalihi Basin. A shark guardian of Moanalua, Makali'i is known to frequent the waters of Kalihi Kai, particularly near Kahaka'aulana, the little islets off Sand Island (Oppenheimer 1976:15). It was at Kahaka'aulana that Makali'i had his cave. Native Hawaiians (*Kanaka maoli*) who inhabited Mokauea in the 1970s have noted during the time of Makali'i's residence in his cave at Kahaka'aulana, that the sand patterns change above his cave and also that the *akule* fishing is good (Oppenheimer 1976:15).

Kahaka'aulana was also noted as a place in Kalihi harbor that was used as a passage for travelers going from Kou to Pu'uloa.

Kahakaaulana: The narrow place in the Kalihi harbour inlet, and formerly the place where travelers used to swim across to Kalaekao or Puuloa to avoid the long detour by way of Moanalua (in Sterling and Summers 1978: 322).

In *Place Names of Hawaii*, Kahaka'aulana is listed as the old name for Sand Island (Pukui, Elbert and Mookini 1974:62). As a literal translation, ‘the floating swimmers pass by’, perhaps this refers to the travelers who would make their way to or from Pu'uloa by swimming through the channels of Moanalua, Kalihi and Kapālama instead of walking. As an alternative Pukui, Elbert and Mookini suggest this refers to the fishermen's containers that float by as fishermen fished for crabs and seaweed (Pukui, Elbert and Mookini 1974:62).

There is some evidence that the people of Kalihi Kai were also producing salt (in Sterling and Summers 1978: 327). Salt pans can be identified on an 1870 Monsarrat map, adjacent to Loko Apili, northwest of the project area (Landrum and Klieger 1991:18). A later Monsarrat map does not depict the salt pans suggesting that they were no longer in use in Kalihi Kai at the end of the 19th century.

The waters of Kalihi Kai were traditionally noted for their calmness. Mary Kawena Puku'i recorded one *'ōlelo no 'eau* or Hawaiian proverb for the ocean off of Pu'uhale, “*Ke kai nehe o Pu'uhale*”, “the murmuring sea of Pu'uhale” (Puku'i 1983:186). Today, the waters are still

distinguished for their tranquility by the fishermen who fish off the pier at Ke'ehi Small Boat Harbor (Conversation with G. Fujishima, 12/17/06). Part of what makes the place so pleasing are the perpetually calm waters, created by the extensive reef that protects the inshore areas from the breakers.

At Ke'ehi the fishponds were famous for their *'anae* or mullet. Two *'olelo no'eau* refer to methods used to drive the large schools of mullet into nets: Creating noise by talking or shouting was one method, "*Ka i'a leo nui o Ke'ehi*", "Loud-voiced fish of Ke'ehi" (Puku'i 1983:185). Another method was slapping the water with hands or *lau*, leaves or vines to scare fish into the awaiting nets, "*Ke kai kā 'anae o Ke'ehi*" "the mullet-driving sea of Ke'ehi" (Puku'i 1983: 148).

In the legend of the traveling mullet (*'anae holo*), Ihuopalaai of Pu'uloa furnishes his sister, living in Lā'ie at the time, with *'anae* via his fishgod, Ku'ula. This variety of *'anae* is said to make its run from October through March along the following route beginning at Pu'uloa: "Kumumanu, Kalihi, Kou, Kalia, Waikiki, Kaalawai and so on around to the Koolau side, ending at Laie, and then returning by the same course to their starting point" (Thrum 1998: 271). It is no doubt that the fishing grounds at Kalihi Kai were rich in *'anae*.

3.1.2 Early Historic Period

Early explorers were impressed with the extensive networks of fishpond and ponded fields for taro present in southeast O'ahu in the early 1800s. Baron Otto von Kotzebue, an explorer who traversed between Nu'uanu and Moanalua remarks on how beautiful the scene is

I have seen whole mountains covered with such fields, through which the water gradually flowed; each sluice formed a small cascade, which ran through avenues of sugarcane, or banana, into the next pond, and afforded an extremely picturesque prospect" (*in* Landrum and Klieger 1991:13).

In his history of Hawai'i written in the 1860s, John Papa 'Ī'ī recounts the trail from Nu'uanu to Moanalua,

When the trail reached a certain bridge, it began going along the banks of taro patches, up to the other side of Kapalama, to the plain of Kaiwiula on to the taro patches, up to the other side of Kapalama, to the plain of Kaiwiula; on into Kahauiki and up to the other side; turned right to the houses of the Portuguese people...('Ī'ī 1959: 95)

Numerous taro pondfields or *lo'i* were claimed during the Māhele, particularly along the Kalihi and Niuhelewai Streams, which served as the eastern and western boundaries of Kalihi. However, on the flat of Kaluapuhi where Kalihi Kai meets the ocean, there is no indication of taro *lo'i* or fresh water sources.

The United States Fish Commission Report for 1903 (Cobb 1905: 748) lists twelve fishponds located on the periphery of Ke'ehi Lagoon which were in operation in 1901 with a total of 857 acres. Some of these fishponds were located just inland of the present project area. The fishponds that were once nearest the project area were Loko Auiki and Loko Ananoho. A review of the cartographic renditions of these *loko* (Figure 4) suggest that the fishponds were being utilized

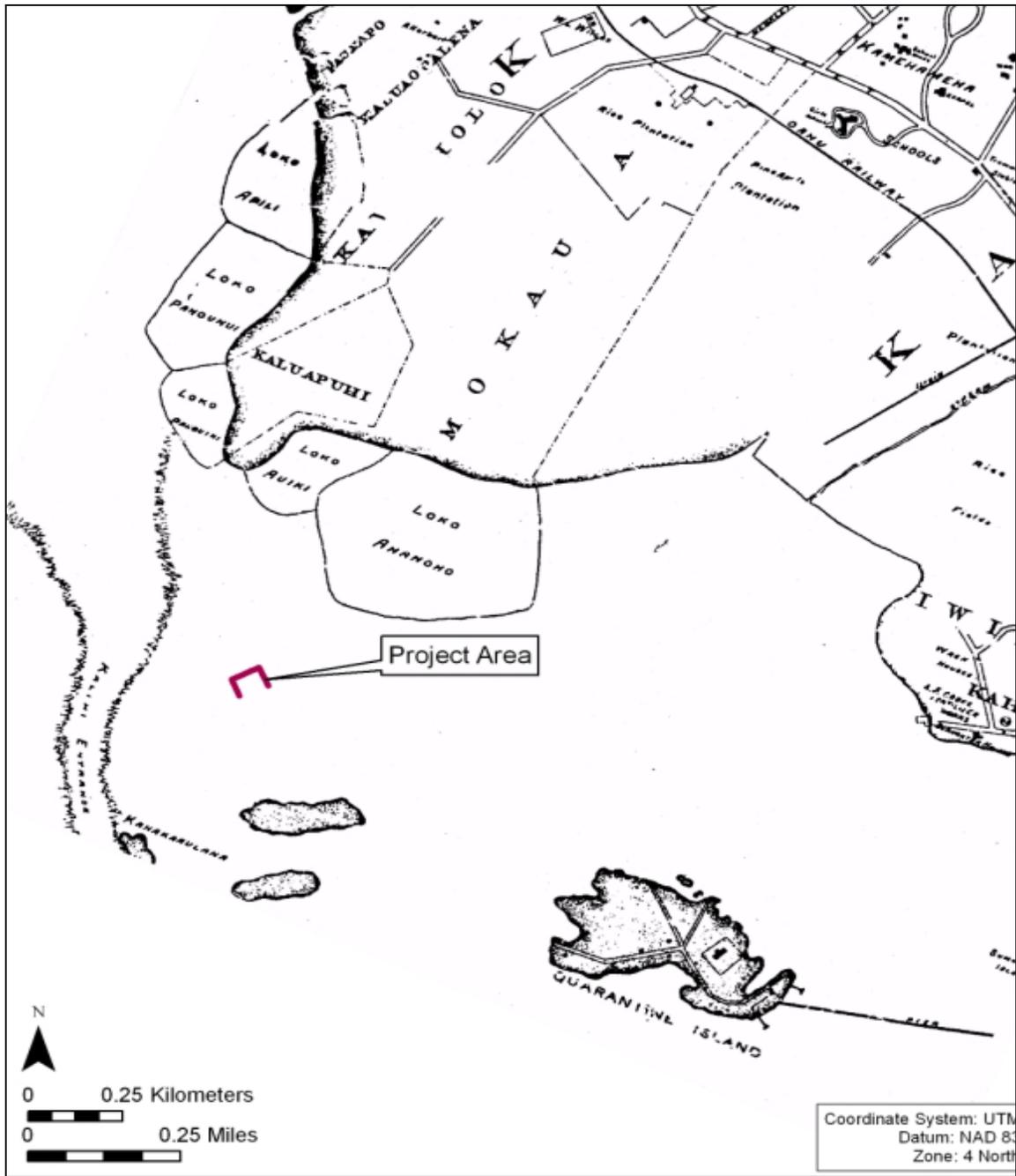


Figure 4. Portion of 1897 Monsarrat Map showing location of current project area; notice the project area is in the water

and that towards the end of the nineteenth century their use became more commercial (Athens and Ward 2002). By 1901, Loko Auiki had been partially filled. This may have been the result of lack of maintenance or reflect patterns of infilling, as was beginning to occur at the nearby Kewalo Basin (Honolulu Harbor). Ananoho and Auiki were completely filled during World War II at which time an Army port and warehouse complex was built (Athens and Ward 2002:1). Later, this became part of the Kapalama Military Reservation. Today, this area where the Plant Quarantine and Measurement Standards and Commodities (MS & C) buildings are situated is used by the Department of Agriculture. A paleo-environmental study of these two *loko* was conducted in 2002 (Athens and Ward 2002). It was surmised that though cores taken from both fishponds showed characteristic fishpond sediments, the sediments had probably been disturbed during filling. Based on the pollen analysis, it was impossible to provide an accurate chronological assessment of the age of the fishponds (Athens and Ward 2002:43). Tentative chronologies of the nearby Kūwili and Weli Fishponds (Table 1) suggest that Ananoho and Auiki were probably constructed sometime between the 16th and 17th centuries.

Table 1. List of Former Fishponds in the Kalihi Kai, Iwilei Areas Subjected to Palynological Studies

Fishpond	Location	Size	Date	Reference
Auiki and Ananoho	Kalihi Kai, O'ahu	Auiki 12 acres Ananoho 52 acres	No date recorded	Athens and Ward 2002
Kūwili	Honolulu Harbor, Kapālama, O'ahu		A.D. 1500	Athens and Ward 1997
Weli	Ke'ehi Lagoon (Ft. Shafter flats), Kahauiki, O'ahu	30 acres	A.D. 1650	Athens and Ward 2000
Apili and Pahounui	Kalihi Kai, Ke'ehi Lagoon, O'ahu	Apili 28 acres Pahounui 26 acres	No date recorded	Moore 2004

Other fishponds in Kalihi Kai were Pahounui, Pahouiki, Weli and Apili. Weli Fishpond was approximately 30 acres and it was constructed of mostly earth embankments (Sterling and Summers, 1978:322). One of the meanings of *weli* is “phosphorescent light on water, believed caused by a ghost that was interfering with fishing” and suggests a phenomenon unique to that fishpond. The other large fishpond, Apili, was noted for its *awa*, a fish “which vied with the *'ama 'ama* (mullet) in popularity” (Titcomb, 1972:70).

“Apili” in Hawaiian meaning ‘caught, snared, or stuck’: Land surrounding the fishpond in Kalihi, Oahu belonging to the Adams’ family. It was there that Capt. Alexander Adams had his famous gardens, which was quite a place of resort for strangers and whale men, about 1850. The fishpond is yet famous for the superior flavor of its fish, particularly the awa [milkfish], which, eaten raw, is esteemed a rare treat by native epicures (Sterling and Summers, 1978: 323).

A *kama'āina* born in Kalihi recalls fishponds in the vicinity of the former Apili Pond when he was a youngster in the 1930s. At that time, the Apili Pond was split into several ponds and was operated by the Hamada Family who would harvest the fish from tin boats (pers. communication, G. Kaeliwai, 7/16/02 in Bushnell and Hammatt 2002:7).

3.1.3 Mid- to late-1800s

Māhele Accounts

Records of the Land Commission Awards associated with the Kuleana Act of 1850 allow us to reconstruct something of the land use pattern in Kalihi at that time. Undoubtedly residential patterns had changed from pre-contact times as a result of massive depopulation owing to introduced diseases on the one hand and in-migration into greater Honolulu from out-lying areas on the other hand. The pattern of land-holdings circa 1850 suggest the majority of Hawaiians in the *ahupua'a* were living relatively close to Kalihi Stream inland of present day Dillingham Boulevard and seaward of the confluence of Kalihi and Kamaikai Streams.

The *kuleana* located nearest the project area were concentrated on a piece of land that jutted into the sea at Pu'uhale named Kaluapuhi (Figure 4). Today, this land is located near the intersection of Auiki Street and Sand Island Access Road, approximately one mile from the project area. At the time of the Māhele, the *makai* tip of Kaluapuhi land separated Loko Auiki from Loko Pahouiki. Land Commission Awards 3237, 1255, 7234 and 2038 are clustered in this area. Lands in Kalihi Kai were principally awarded to very notable people, including advisors to the Kamehameha line or to royalty themselves, most likely on account of the abundant fishponds in the locality. Queen Kalama was awarded a houselot in Puuhale, Kalihi Kai (LCA 2038) adjacent to Loko Auiki. Kalama Kapakahaili, a descendant of the Moana family from Hawai'i Island, was married to Kauikeaouli, Kamehameha III (Kamakau 1961:341). As Dowager Queen, Kalama was awarded some of the richest lands in the kingdom, including Waikalalulu water rights, fronting Honolulu (Smith and Rosendahl: 1990:14).

Another high ranking *ali'i*, Kaunuohua, received land in Kalihi during the Māhele (<waihona.com>) Kaunuohua was a female descendant of a high ranking *ali'i* of Hawai'i Island, Kalaninui'īamamao, father of Kalani'ōpu'u (Kame'eleihiwa 1992:249). She was also Kamehameha IV, Alexander Liholiho's guardian. Though she had many lands prior to the Māhele, most of these were lost with the exception of three, Pu'ulena in Waikīkī, Mokauea in Kalihi and Kalaupapa on Moloka'i (Ibid:264). Land Commission Award 6450 to Kaunuohua names 5 *'ili* in Kalihi being awarded to her including Kaluaopalena, Keauhou, Mahani, Niau and Mokauea (Barrère n.d.:286)

Hewahewa, a descendant from the Paoa priestly class who served three of the Kamehameha's, was awarded the 'ili of Kaluapulu in Kalihi which included fishponds at Kalihi Kai (Kamakau 1961; LCA 3237). A second *kahuna* of the same Hewahewa line, Nahinu, was also awarded lands in Kalihi, near the outlet of the Kalihi Stream (Bushnell and Hammatt 2002: 6). Nahinu also served as *konoiki* for Kalihi Kai during the time of the Māhele (Landrum and Klieger 1991:22-23). Kamakau mentions the two *kahuna* as contemporaries skilled in diagnosis of illness:

Boki returned and lived at his place at Beretania and devoted himself to medicine, in which he was proficient, and all those joined him who were skilled in placing pebbles [in diagnosis], such as Kaa, Kuauau, Kinopu, Kahiolo, Nahinu, Kekaha, Hewahewa, and their followers and other kahunas besides (Ibid: 291).

Apparently, *kahuna* were given lands near fresh water because it was important for them to practice their *ho'oponopono* there (Bushnell and Hammatt 2002:6).

Other noted landowners in Kalihi Kai area were John Papa 'Ī'ī and Mr. Adams. 'Ī'ī held the position of treasurer and spokesman to the Chiefs of the Hawaiian Kingdom during the 1840s (Kamakau 1961).

Growth of Honolulu Harbor and Sand Island

The first harbor facilities were developed on the shore of "Honoruru" town in 1825 when the hulk of an old ship was sunk to create a small wharf (Alexander 1908). This wharf served the growing sandalwood trade and the subsequent whaling industry. Through the 1850s, the commercial development of Honolulu and its harbor facilities appears to have been concentrated above the southeast side of Nu'uuanu Stream, far removed from Kalihi Kai. In 1856, the outskirts of town in Iwilei became the site of a new prison along with a new road connecting it to what is now King Street.

In 1872 the small island off Iwilei—"Ka-moku-'ākulikuli"—became the site of a quarantine station to handle the influx of immigrant laborers drawn to the islands' developing sugar plantations. The site is described as "little more than a raised platform of sand and pilings to house the station, with walkways leading to the harbor edge wharf, where a concrete sea wall had been constructed" (Beechert 1991:105) and as "a low, swampy area on a reef in the harbor" (van Hoften 1970:3). By 1888, Kamoku'ākulikuli Island had been expanded and was known as "Quarantine Island". A pier and tramway had been built connecting the island to the Honolulu harbor (Renard 1975:A4). If vessels arrived at the harbor after 15 days at sea and contagious disease was aboard, quarantine and disinfecting procedures were required at Quarantine Island (Renard 1975:A3).

Following the initiation of Dillingham's Oahu Railway and Land Company (O.R. & L.), a railroad track was built across Kūwili Fishpond in 1889. This and the construction of associated infrastructure such as a depot, buildings, store houses and stations would eventually lead to the expansion of Honolulu Harbor towards Kapālama Basin and Iwilei. John Hungerford writes of O.R. & L.'s influence on the harbor:

Honolulu in the years to follow was outgrowing its small harbor where, according to an entry on company records, on a single day in 1901 were 24 deepwater sailing vessels, six of them unloading coal and four loading sugar at railroad wharves. The company had led the way, in conjunction with other private interests, in creating some 500 acres of waterfront land (Hungerford 1963:14).

The increasing prominence of the harbor and its activities over the traditional use of the fishponds and adjoining *kalo* patches becomes apparent in 1896 when an outbreak of cholera caused the infilling of Kawa Pond. Between 1895 at the beginning of O.R. & L.'s development of their railroad and 1901, Kūwili Pond was filled and an estimated 6,000,000 cubic yards of mud, sand, loose coral as well as blasted hard coral was used to fill low land near the harbor and terminal (McGerry et al. 1997:20).

3.1.4 1900s

Dredging of the harbor continued into the 20th century. Following annexation of the Hawaiian Islands in 1898 and the establishment of the Honolulu Engineer District in 1905, federally-funded dredging of the harbor was initiated and completed in December 1908. It was at this time that reclamation projects would create Sand Island; as a history of the Honolulu Engineer District notes:

As anticipated, enlarging the small island just seaward of the lighthouse calmed the entire harbor; indeed reclamation of this land, today known as Sand Island, has eliminated the need for a breakwater in Honolulu Harbor...A separate project to reclaim Quarantine Island, a low, swampy area on a reef in the harbor, was adopted in February 1906 and was carried out by contract until funds were exhausted in March 1908. Continued reclamation over the next four decades would result in the absorption of Quarantine Island into an enlarged Sand Island. (van Hoften 1970:3).

Quarantine Island became the largest United States quarantine station of the time period, accommodating 2,255 individuals (Renard 1975:A6). This space included two hospitals and a crematorium. Besides operating as a quarantine, the station had other objectives such as implementing plague preventive measures, immigration inspection and also as a marine-hospital relief (Renard 1975:A9). During Wilson's administration in 1920, Sand Island was taken under the control of the War Department. Despite this, quarantine measures continued there until 1927.

During reclamation projects in the first two decades of the 20th century, Sand Island and Quarantine Island were joined to the Kalihi Kai peninsula. In 1925 and 1926, a channel was dug from the Kalihi Channel into Kapālama Basin creating a true island out of "Sand Island". This is the channel that lies to the southern seaward boundary of the project area. By 1941, reclamation projects and dredging of the harbor had enlarged Sand Island to 410 acres (Renard 1975:A20). Another 100+ acres were added to Sand Island between 1940 and 1945 from the spoils of Ke'ehi Lagoon's seaplane channel, located on the western seaward boundary of the project area. Between 1946 and 1952, the Ke'ehi seaplane channels were used by Naval Air Squadrons for transporting "Mars" flying boats between Hawai'i and the continental U.S. A dirt causeway was

constructed connecting Sand Island to the mainland in 1943 (Renard 1975:A29). It is unknown whether this causeway is in the same location as the Bascule Bridge, adjacent to and east of the project area. Built in conjunction with the dredging of the Kapalama turning basin between 1959 and 1962, the Bascule Bridge was intended to be a drawbridge to allow harbor traffic entering Honolulu Harbor to leave by way of Kalihi Channel (www.hawaii.gov/dot/harbors/oahu/history.htm:7). The bridge however, was not used much as a drawbridge (Smith and Rosendahl 1990:A3).

A 1945 USGS map illustrates the location of the current project area on the periphery of the newly reclaimed land (Figure 5). The seaplane channel and the bridge connecting Sand Island to Kalihi Kai are also depicted. There is no land use indicated on the 1945 map for the vicinity of the study parcel.

3.1.5 Modern Land Use

The Ke'ehi Small Boat Harbor, adjacent to the project area, was built as a marina in 1967-1968 and has been operating as such ever since. The study parcel seems to be serving as a holding area for construction materials for the Department of Transportation, Harbors Division.



Figure 5. 1945 USGS showing project area on edge of seaplane channel

3.2 Previous Archaeological Research

Many of the earliest recorded archaeological sites in the coastal areas were fishponds and *heiau*. McAllister (1933) references Thrum in the mention of two *heiau* in Kalihi Kai, Kaoleo and Haunapo. There is an *'ili* in Kalihi Kai named Haunapo which may be associated with the *heiau* (Figure 4) No details are known of these two *heiau*. McAllister also records five fishponds in Kalihi Kai (that he lumps under two site numbers), Ananoho and Auiki (Site 73) and Pahouiki, Pahounui and Apili (Site 74). A very brief description is provided for each pond:

Ananoho: A 52 acre oval-shaped pond with walls approximately 4700 feet long. The walls are 3 feet high and 6 feet wide and constructed of coral. McAllister also notes the new houses and makaha (1933:90)

Auiki: A 12 acre pond adjoining Ananoho. The walls extend 900 feet and the pond is partially filled (1933:90)

Pahouiki: A 14 acre pond enclosed in a coral stone wall 1050 feet in length. There are two makaha and one house on this loko. (McAllister 1933:91)

Pahounui: A 26 acre pond opened to Loko Pahouiki. A wall 2600 feet surrounds this larger pond and there are two makaha and one house on the wall. (McAllister 1933:91)

Apili: A 28 acre pond adjoining Loko Pahounui. The wall surrounding Apili is 1500 feet. (McAllister 1933:91)

Archaeological studies did not resume in the Kalihi Kai area until the 1980s. In 1986, Cultural Surveys Hawaii conducted an archaeological reconnaissance of a parcel on Sand Island, TMK 1-2-25: por.36, por. 7 to determine the presence or absence of archaeological sites (Hammatt 1986) (Figure 6). This site is situated approximately ¼ mile north of the project area near the intersection of Sand Island Access Road and Auiki Street. No archaeological or historical resources were found during the survey. Hammatt concludes that the land was previously low lying marsh land containing fishponds, but since the 1920s has been filled with coral fill dredged from the creation of Honolulu Harbor (Hammatt 1986).

Excavation work on the corner of Robello Lane and North King Street in Kapālama exposed two human burials in 1991, SHPD Site 50-80-14-3373 (Dunn et. al 1991). In addition, several historic artifacts were recovered including glass, porcelain, metal, ceramics, plastic and concrete. Abundant faunal remains representing several taxa such as dog, bird, rat, cattle and pig were intermixed in the burial fill. Historical research suggests these burials may be associated with a cemetery used for small pox in the 19th century in the area of Keone'ula, however the authors indicates that there is insufficient evidence to substantiate this (Ibid:7).

Several studies were undertaken to fulfill the requirements of an environmental impact assessment for the proposed development of the City and County of Honolulu Bus Repair Shop Facility in Kalihi, O'ahu (TMK 1-2-16:17). Beginning 1991, the studies for this 4.2 acre lot included a historical literature search (Landrum and Klieger 1991), an archaeological survey with subsurface testing (Folk et al. 1993), a mitigation plan for human burials (Folk and Hammatt 1993) and a burial treatment plan (Hammatt and Folk 1992). This site is approximately

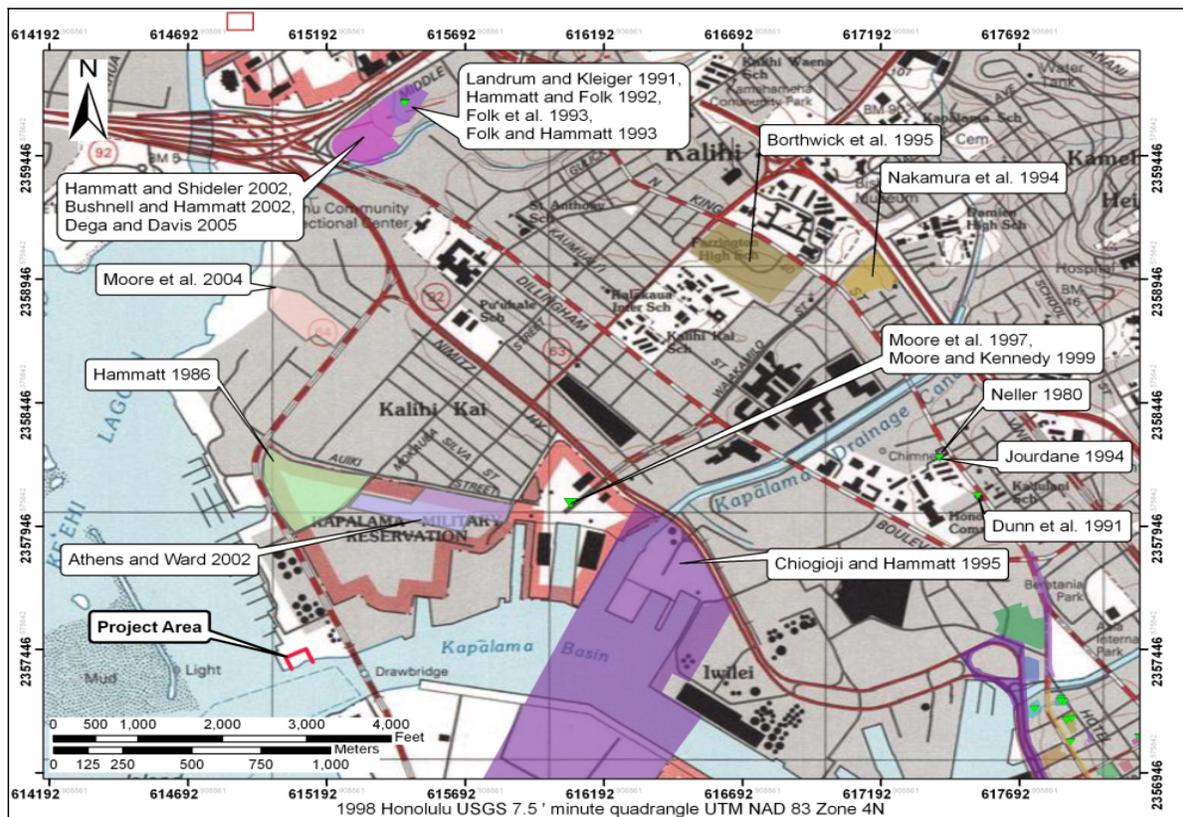


Figure 6. Portion of 1998 USGS Honolulu Quad showing locations of previous archaeological studies

1 ½ miles from the current project area. During the historical research, it was found that this site was used extensively from the Prehistoric period through the historical period and its proximity to a fishpond, Loko Weli may make it significant. It is indicated that despite its possible significance due to its location, the research did not identify any archaeological remains (Landrum and Klieger 1991:35). During the archaeological inventory survey, 19 trenches were excavated by backhoe. Three burials were exposed during testing including two coffin burials and one burial without coffin. In addition, a cultural layer was identified. The burials and cultural layer were assigned Site Number 50-80-14-4525 and given the National Register significance criteria code “D” (Folk et al. 199:28). Based on recommendations in these reports a mitigation plan and a burial treatment plan were written to address the human remains found during the test excavations (Folk and Hammatt 1993; Hammatt and Folk 1992).

In an adjacent locale, several studies were undertaken based on sites identified and information collected during the investigations for the Bus Repair Shop Facility. These studies include an archaeological assessment (Hammatt and Shideler 2002), a cultural impact assessment (Bushnell and Hammatt 2002) and a follow-up inventory survey and subsurface testing of a site identified during previous studies (Dega and Davis 2005). Like the adjacent Bus Repair Facility, this proposed Transit Center is located approximately 1½ miles from the current project area. The Archaeological Assessment uncovered no new data regarding the project area however it was recommended that a program of subsurface testing be implemented to provide paleo-environmental information, particularly in regards to Waikulu Fishpond underlying the site (Hammatt and Shideler 2002). For the Cultural Impact Assessment, concerns were expressed regarding the potential for more burials in the project area and also the potential contamination of the Kalihi Stream that feeds into the fishing grounds of Ke‘ehi Lagoon (Bushnell and Hammatt 2002:13). Scientific Consultant Services was contracted to perform subsurface testing on this site to mitigate the potential impacts to Waikulu Fishpond underlying the surface. Although many sediment samples were taken, it was impossible to distinguish between naturally deposited stream sediments and fishpond sediments in the project area. Evidence of prehistoric cultural activity was inconclusive, however evidence of historic industrial activity was abundant (Dega and Davis 2005:42).

A human burial was discovered during trenching activities on Austin Lane off of North King Street in Kapālama (Jourdane 1994). The remains of one individual were identified and the burial was determined to be historic based on associated historic artifacts in the soil matrix. The site was given State Historic Preservation Site Number 50-80-14-4929. No age or ethnicity could be determined at the time of the assessment (Jourdane 1994:2).

In Kalihi Waena, an archaeological assessment was conducted in 1994 (Nakamura et al. 1994). The corner of North King and Houghtailing Streets was surveyed for archaeological resources and assessed for potential archaeological and historical resources. Though no archaeological resources were found, several historic properties were identified based on their age including the storefront along King Street as well as several residences (Ibid: 21-22). Historical research as well as informal interviews of long-time residents suggest the parcel had a long history of agricultural use, beginning with pre-historic and historic wetland taro cultivation and most recently used by Chinese immigrants for truck farming. Nakamura et al. recommend

this site for further study as an example of the changing nature of a traditional ahupua'a in historic O'ahu.

An archaeological inventory survey was conducted of the Kamehameha Homes Project in Kapālama, Kona in 1995 (Borthwick 1995). This consisted of 16 test excavations in a 13.96-acre parcel between Kalihi and Houghtailing Streets off of King Street. Four distinct stratigraphic layers were recorded in the test trenches. No significant subsurface historic sites or features were identified during trenching activities. Historical research identifies this area was part of the Kapālama ridge dividing the well-watered plains of Kapālama and Kalihi. The Kamehameha Girls School was built on the site in 1893 where it stood until 1931. At this time, the Girl's School was demolished and the Kamehameha Homes Project was initiated. No further archaeological work was recommended (Borthwick 1995:33).

A 1995 archaeological assessment studying four alternative alignments for a wastewater pump station force main replacement encompassed a large portion of Honolulu Harbor (Chiogioji and Hammatt 1995). The area comprised of a corridor extending from the Hart Street pump station on the makai side of Nimitz Highway between piers 33 and 38, across the Kapalama Channel to piers 51 and 52 on Sand Island, and ending at the Sand Island waste water treatment plant. This corridor lies ½ mile east of the project area across the Kapalama Basin. This historical project found that the entire project area except for a small portion of the original Sand Island was once open water or tidal reef and was eventually filled or dredged during the construction and expansion of Honolulu Harbor and Sand Island, principally during the 1920s and 1930s (Chiogioji and Hammatt 1995: 23).

An inadvertent burial was discovered in 1997 at Pier 40 by Hawaiian Dredging (Moore 1997). Construction activities exposed the burial that required disinterment. Designated State Inventory of Historic Places (SIHP) Site 50-80-14-5581, the inadvertent burial was found approximately ¾ mile from the current project area. Further research of the area found that the burial was on the original coastline, within Land Commission Award 11019:2 awarded to Waolani (Moore and Kennedy 1999:5). Situated near the effluence of the Kapālama Stream, this burial was near many former fishponds, the nearest being Ananoho of Kalihi Kai. Site 5581 was determined to be a primary burial, probably post contact and was identified as significant for its potential to yield information of scientific value (criterion "D" of the National Register of Historic Places criteria) as well as being significant based upon its cultural value (criterion "E" of the Hawaii Register Review Board criteria) (Moore 1997:11).

A fishpond investigation was conducted in 2002 on the construction site for the proposed Department of Agriculture Plant Quarantine building and the Measurement Standards and Commodities (MS & C) building in Kalihi Kai approximately ½ mile N, N/E of the project area (Athens and Ward 2002). The current site consisted of fill overlaying traditional Hawaiian fishpond known as Auiki and Ananoho (SHPD Site 50-80-14-73). In an effort to mitigate anticipated negative impacts to the identified fishponds underlying the fill in this site, sediment cores were obtained to recover information regarding these fishponds (Criterion D). Based on four core samples taken from the two ponds, it was found that the sediments had been disturbed and thus further analysis was not possible (Athens and Ward 2002: 43).

A 2004 study of a property on the eastern coastline of Ke'ehi Lagoon, off of Sand Island Access Road, was conducted to meet requirements specified by the National Historic Preservation Act (NHPA) and the Department of Land and Natural Resources, State Historic Preservation Division (DLNR-SHPD) (Moore et al. 2004). The investigations included a pedestrian survey and subsurface testing consisting of six cores through old fill and into former fishponds which once ringed Kalihi Kai peninsula. Through historical research, it was found that the project area overlies two prehistoric/historic fishponds, Apili and Pahouiki. The results of the borings did not give definitive evidence of fishpond sediments and it was hypothesized based on this and previous fishpond studies that fishpond sediments form relatively thin layers 10cm+/- 5cm in thickness (Moore et al. 2004:25).

Section 4 Results of Fieldwork

4.1 Field Inspection

On December 17, 2006 a field inspection was conducted by Ms. Tina Bushnell, B.A. (see Figures 7 - 12). The entire project area was traversed. On the eastern boundary of the project area, a low-lying depression serves as a drainage or for seepage from tidal fluctuations. On the southern boundary is the ocean and approximately 35 feet of shallow reef. On the western boundary is ocean and a sea channel (Seaplane Channel). And on the northern boundary of the parcel is the parking lot of the Ke'ehi Small Boat Harbor. The parking lot is distinguished from the project area by its macadam pavement while the parcel is comprised of fill. Concrete blocks divide the parking lot from the parcel so that people can't drive their vehicles on the property. In the center of the property, the hull of an old barge, possibly a military barge has been abandoned. Other modern garbage is strewn throughout the property including white, pvc pipes and 50 gallon steel and plastic barrels. The parcel appeared as if it had been recently graded with bull-dozer tracks and freshly upturned soil

The soils on the property consist of fill. This description corroborates the 1972 assessment of soils of Hawai'i (Foote et al. 1972). On the shoreline, fragments of coral are strewn along the high tide mark. There is also fishbone midden suggesting that fish are being cleaned and consumed in this area.



Figure 7. General view of project area looking south toward Sand Island



Figure 8. General view of project area oriented north



Figure 9. General view, project area in foreground and Mokauea Islet in background. View to southwest.

In the drainage ditch at the eastern edge of the property, the vegetation is dominated by 'aki'aki (*Sporobolus virginicus*), an indigenous, coastal rush grass (see Figure 10). Other plants in the area include *kiawe* (*Prosopis spp.*) and false *kamane* (*Terminalia catappa*). *Kiawe*, which thrives in semi-arid, coastal areas like Kalihi Kai, is often found with 'aki'aki as an undergrowth (Wagner et al. 1990:62). All vegetation is concentrated along this drainage ditch and near the fence demarcating the edge of the property. During the field inspection, no archaeological or historic sites were observed.



Figure 10. Photo of project area with view of Bascule Bridge and Honolulu Harbor in background. View to east



Figure 11. Close up of native sedge 'aki'aki growing near the eastern border of the project area



Figure 12. Photo of project area facing northwest. Note 50 gallon drums and hull of abandoned ship on parcel.

Section 5 Traditional Cultural Practices

5.1 Fishing and Gathering of Marine Resources

5.1.1 Loko I'a (Fishponds)

Ke'ehi Lagoon and the Kalihi Kai promontory consisting of Pu'uhale were once flanked by fishponds that yielded great quantities of fish. Some of these fishponds were still in production into the early twentieth century. As expressed in a previous study in Kalihi Kai conducted in 2002, *kama'āina* growing up in the 1930s and 1940s remember abundant quantities of fish, shellfish and crabs everywhere (Bushnell and Hammatt 2002). They were in the streams, at the stream mouths, in the fishponds, in Ke'ehi Lagoon, the fisheries of Kaliawa and Mokauea and further out.

The Hawaiian traditional perspective of land use rights encompassed both diverse resource pockets on land and fishery rights. During the partition of land that began in the 1840s known as the Māhele, hundreds of Hawaiians claimed fishery rights as well as land in their respective *ahupua'a*. A total of 1,233 fishery claims were recorded in the Land Commission notes for all the islands (Maly & Maly 2003:252). On O'ahu alone, there were 646 claims. The extent of the richness and abundance of the Kalihi Kai area is reflected in the numerous and varied claims made for marine resources there. Table 2 relates fishery claims by residents of Kalihi Kai.

Table 2. Māhele Claimants for Fisheries in Kalihi Ahupua'a (information adapted from Maly and Maly 2003)

Claim Number	Name of Claimant	Place of Claim	Claim
818	Heirs of George Beckley	Kalihi, O'ahu	Fishing grounds called Kaliheawa (sic. Kaliawa)
851	Salai Hiwauli (w)	Kalihi, O'ahu	Land with four fish ponds
1189	Ewa	Kahauiki, Kalihi, O'ahu	A lot bounded on west by the island of Mokumoa and Kaihikapu Pond
1243	Kahoowaha	Kalihi, O'ahu	Lot bounded on side by <i>kuapā</i> for ponds Pahou and Apili
1257	Kahalekai	Kalihi, O'ahu	Three <i>pu'uone</i> (dune-bank ponds) and some salt beds
1521	Haula	Kalihi, O'ahu	A <i>pu'uone</i> (dune-banked pond) adjoining the west side of Weuweu Pond
1530	Weuweu	Niau, Kalihi, O'ahu	A <i>pu'uone</i> (dune-bank pond) and the pond Keuwuwi

Claim Number	Name of Claimant	Place of Claim	Claim
1537	Kauluhua	Kalihi, O'ahu	A <i>pu'uone</i> (dune bank pond)
1538	Kauiki	Kalihi, O'ahu	A <i>pu'uone</i> (dune bank pond) and <i>haha pa'akai</i> (salt bed) at Kaliawa
1677	Pao	Kaluaopalena, Kalihi, O'ahu	Lot bounded on south by pond named Weli
1800	Waianae	Kaluaopalena, Kalihi, O'ahu	A <i>pu'uone</i> (dune-banked pond)
2710	Haupu	Kalihi, O'ahu	A house lot in the 'ili of Haunapo and two " <i>Kio hooholo ia</i> " (small ponds in which to let fish go).
4452	C. Kanaina for Hazaleleponi Kalama	Kalihi, O'ahu	A house lot bounded on the Honolulu side by a fish pond belonging to Liholiho
7154	Kahookoikoi	Kalihi, O'ahu	One fish pond in the 'ili of Haunapo
7771	Kuhia	Kalihi, O'ahu	A <i>pu'uone</i> (dune bank pond) in the 'ili of Kahaukomo

Several fishponds were named, including several larger, well-known and established fishponds Weli, Pahou, Apili and Kaihikapu (See Figures 4 & 13). Other smaller ponds were also identified and these referred mainly to the *pu'uone*, the dune banked ponds or small ponds near the shore linked by ditch or stream to the ocean (definition from Pukui and Elbert 1986:359). Maly & Maly provide a description of how the *pu'uone* was developed:

Pu'uone ponds were close to shore ponds, *loko kuapā*, or to the seashore, and next to the mouths (*nuku*) of streams. The farmer cleared away the *mokae* sedges, 'aka'akai bulrushes, and the weeds, and deepened the pond, piling up the muck on the sides, until he had a clean pond. Then he stocked it with *awa* and fish fry, *pua i'a*—two or three gourds full—until the pond was full of fish. After two or three years the fish from the first gourd would have grown to a *ha'ilima* (18 inches) in length. The offering of sweet potatoes [made when the pond was first stocked] was a service to the 'aumakua (*he hana 'aumakua*). If there were no such service, the grubs of freshwater creatures, *mo'o* and dragonflies would take over, and there would be either no fish at all or else maimed and sickly fish that would soon die. He who assumes he is superior to the mana of his gods shall be smitten with thistles—as was Auwae, who assumed he had such mana himself. (Maly & Maly 2003:24)

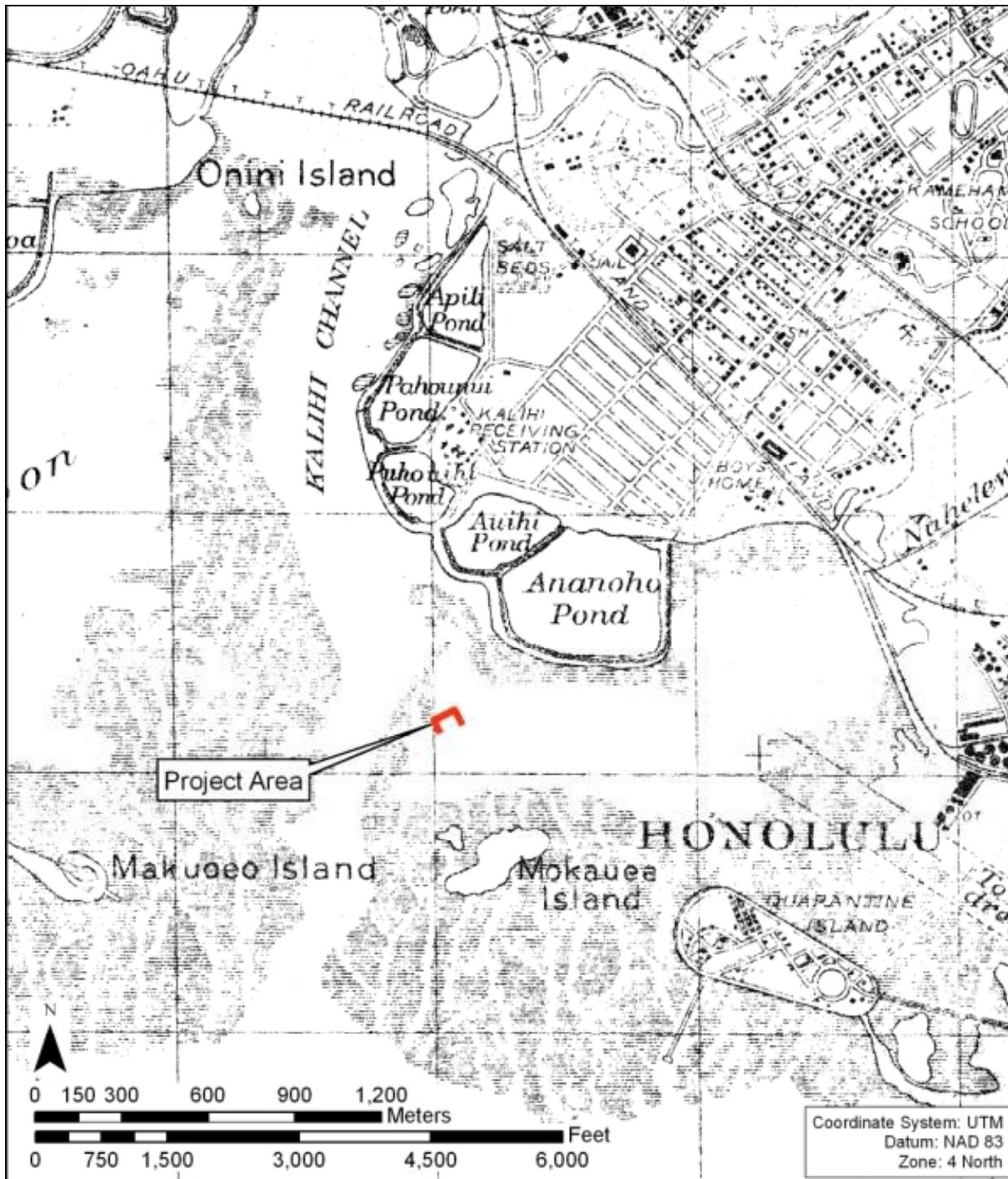


Figure 13. 1919 USGS Map showing project area, major fishponds in Kalihi Kai, salt beds, O&R Railroad and project area in red

These *pu'uone* identified in Kalihi Kai had names such as Keuwiiwi and Weuweu and were probably often named after the person who cared for the pond, as is the case for Weuweu. *Pu'uone* generally belonged to *maka'āinana* and were in great demand by farmers (Maly & Maly 2003:24). A different type of small fishpond that was claimed was the *ki'o ho'oholo i'a* which was a type of pond for spawn, a fish run or holding pond (definition of *ki'o* from Pukui and Elbert 1986:153).

5.1.2 Kai o Mokauea/ Kai o Kaliawa

In 1890, a petition came before the Board of Land Commissioners claiming the Kaliawa Fishery, the fishery adjacent to and 'Ewa of Mokauea Fishery. The Kai o Kaliawa fishery was claimed by Samuel Damon as a gift from Bernice Pauahi Bishop. Because the traditional use of an *ahupua'a* also included a fishery, the Boundary Commission was charged with setting the legal boundaries of fisheries such as holes in reefs, sand islets, walls, gates and corners of fishponds, rocks and rock piles, small inlets and drains. The following are the boundaries shared by Kai o Kalawa and Kai o Mokauea:

Ka Poo ka Mahina (Poomahina)—just inside breakers of reef

Waiololi—small ditch

Kahakaaulana—small island of Mokauea 'Ili

Kalaeunaoa—sand hill (islet)

Kaluapuhi—little hole in the edge of the reef (*hiwai*)

Kalaeone—sand hill (islet)

The shared boundary of the two fisheries more or less follows the eastern edge of the Kalihi Channel. The eastern boundary of Kai o Mokauea is unknown. The Ananoho Fishpond was one of the points that marked the boundary between Mokauea and Kapālama (Moehonua 1862). The pond probably also marked part of the boundary between Mokauea Fishery and the fishery to the east, Kaholaloa (aka Kahaolola, Kaholoa). Kai o Kaholaloa was owned by William Sumner, a mariner who came into the service of Kamehameha III and who was later granted this fishery along with the land fronting it, Kahaohao (in Renard 1975:A2).

It is unclear who owned Kai o Mokauea. Given the entire *'ili* of Mokauea was granted to Kaunuohua (LCA 6450), it is likely that she was also the owner of the fishery (See LCA 2038 to H. Kalama). Apparently Liholiho owned one of the ponds, probably Loko Auiki (in Maly & Maly 2003:285). This makes sense considering Kaunuohua was *kahu* to Liholiho. Kaunuohua was awarded Loko Ananoho (Royal Patent 8147 to Moehonua, husband of Kaunuohua). In 1849, Kaunuohua died leaving her estate to her second husband W. L. Moehonua (Barrère n.d.:290).

The *hoa'āina* and particularly the *lawai'a*, the fishermen of this area knew well the boundaries of the fisheries as is evident in the Boundary Commission Reports for the Fishery of Kaliawa. According to Keamahu, the native informant who identified Kaliawa Fishery boundaries, though the boundaries between fisheries were clear, there was flexibility in fishing beyond the boundaries. "Sometimes the Mokauea fishermen go over into Kaliawa, and

sometimes the Kaliawa men go over into Mokauea, but the boundaries are well understood.” (in Maly and Maly 2003:386).

5.1.3 Salt Beds

The estuarine environment marking the area between land and ocean at Kalihi Kai was a perfect area to develop small aquaculture features. Salt beds or *hāhāpa‘akai* were also noted at Kaliawa. These appear on a 1919 USGS map of Kalihi (Figure 13). Royal Patent 2388 to Meeks notes there were salt ponds adjacent to Apili Fishpond called “Punaula” (<waihona.com>). Salt was considered a necessity and used as a condiment for food and also in medicine. The processing of salt only took place in certain areas (Malo 1951:123). Salt beds were mentioned by several interviewees in a previous study of the area near the confluence of Kalihi Stream and Ke‘ehi Lagoon.

Mr. Ah Tou claims that Nahinu used to have salt ponds where white salt was made (pers. Communication, G. Ah Tou, 6/25/02)...George Kaeliwai, who grew up in Kalihi Kai, mentioned the Lee Family, who ran the salt flats down at Puuhale... (pers. Communication, G. Kaeliwai, 7/16/02 in Bushnell and Hammatt 2002:9).

Salt from different areas had particular characteristics unique to that area. The salt from neighboring Moanalua was noted for its gray tinge (Bushnell and Hammatt 2002:9).

5.1.4 The Reef

The project area today represents what used to be a reef platform previous to the beginning of dredging in the 1930s and 1940s. The natural channel leading from the mouth of the Kalihi and Kahauiki Streams through the reef and out beyond the reef is illustrated clearly in old maps (Figures 4 & 13). The earliest written record of fishing and gathering on the Ke‘ehi reef is described in 1825 during a survey made by British naval officer Charles Robert Malden. The reef is described as being dry in portions at low tide, particularly the seaward portions (in Renard 1975:A2). The reef here provided food for all the native tenants living in the surrounding areas. “The low orders of the natives get from it a considerable part of their daily subsistence, consisting of small fish, left in ponds, crabs, shell fish, etc.” (Malden in Renard 1975:A2). The interior portion was always submerged and during high tides was used as a passage for canoes between Honolulu and different areas of Pu‘uloa. Others without canoes would swim to avoid the walking detour around Moanalua (Sterling and Summers 1978:322). For residents of Mokauea Island, canoe transportation was a necessity.

Canoes were the primary means of transportation prior to WWII. Children would go to school in small 10-foot koa canoes and water would be gotten in larger canoes. Sometimes they measured 20 feet or more. Since there was no water on the islands nearby Puuhale was the source for hand carried water. This is still the practice today. Prior to the advent of motors, people either paddled, sailed or poled (since most of the area was shallow, poling was the most common) [Oppenheimer 1976:16].

One hundred fifty years later in the 1970s, despite the massive growth and industrialization experienced by this area, Native Hawaiians and other ethnic settler groups continue to fish from reef and waters in and around Ke'ehi Lagoon and Mokauea Island.

5.1.5 The Fish

Two studies in the 1970s, one a historical study of Mokauea Island and the other a biological survey of Sand Island both produced lists of fish species (Table 3). The historical study of Mokauea relies on oral interviews with residents or former residents of Mokauea Island to come up with a list of fish and marine resources collected and consumed within the Ke'ehi Lagoon region (Oppenheimer 1976). The biological survey of Sand Island utilizes the scientific transect survey method to estimate the general health of the reef ecosystem based on diversity and numbers (Bowers 1975).

Table 3. List of Fish in Mokauea Fishery (Adapted from Oppenheimer 1976 and Brock 1975)

Mokauea Historical Study	Sand Island Biological Survey
Fish	Fish
<i>manini</i> (<i>Acanthurs sandvicensis</i>)	<i>manini</i> (Surgeon Fish)
<i>'upāpalu</i> (<i>Aporgonidae</i>)	<i>palani</i> (Surgeon Fish)
<i>'anae</i> or mullet (<i>Mugil cephalus</i>)	<i>paku 'iku 'i</i> (Surgeon Fish)
<i>āholehole</i> (<i>Kuhlia sandvicensis</i>)	<i>maiko</i> (Surgeon Fish)
<i>hīnālea</i> or wrasse (Labridae)	<i>na 'ena 'e</i> (Surgeon Fish)
<i>'ō 'io</i> (<i>Albula vulpes</i>)	<i>kole</i> (Surgeon Fish)
<i>papi 'o</i> or young <i>ulua</i> fish (crevalle or jack fish)	<i>nunu/ nunu peke</i> (Stick Fish ssp.)
<i>'oama</i> or young <i>weke</i> (<i>Mullidae</i>)	<i>humunukunukuapua 'a</i> (Trigger Fish) <i>humuhumu umauma lei</i> (Trigger Fish)
<i>'ala 'ihi</i> or squirrel fish (<i>Holocentrus</i>)	<i>'o 'opu kawa/ 'o 'opu hue</i> (Puffer Fish ssp).
<i>paki 'i</i> or flounder (<i>Bothus pantherinus</i>)	<i>'omilu</i> (Jack)
<i>menpachi</i>	<i>kikakapu</i> (Butterfly Fish)
<i>kūmū</i> or goat fish (<i>Upeneus porphyreus</i>)	<i>lauwiliwili</i> (Butterfly Fish)
<i>ulupapa</i>	<i>pili ko 'a</i> (Hawk Fish)
<i>awa</i> (<i>Chanos chanos</i>)	<i>hinalea lauwili</i> (Saddle Wrasse)
<i>awa awa</i>	<i>hinalea lolo</i> (Clown Wrasse)
<i>'ōpelu</i> or mackerel (<i>Decapterus pinnulatus</i>)	<i>kumu</i> (Goat Fish)

Mokauea Historical Study	Sand Island Biological Survey
<i>akule (Trachurops crumenophthalmus)</i>	<i>munu</i> (Goat Fish)
<i>pūhi paka</i>	<i>moa</i> (Box Fish)
brown eel	<i>alo 'ilo 'i</i> (Damsel Fish)
white eel	<i>maomao</i> (Damsel Fish)
	Cleaner Wrasse
Limu	<i>uhu</i> (Parrot Fish)
<i>manauea (Grocilaria Coronopifalia)</i>	<i>kihikihi</i> (Moorish Fish)
<i>'o 'olu (Chondria tenuissima)</i>	<i>'o 'ili u wiwi</i> (File Fish)
<i>'ele 'ele (Enteromophora prolifera)</i>	<i>humuhumu 'ele 'ele</i> (Trigger Fish)
<i>lipēpe 'e (Laurencia Parvipapillata)</i>	<i>pu 'u u ola 'i</i> (Puffer Fish)
<i>kala (Sargassum echinocarpum)</i>	<i>lauhau</i> (Butterfly Fish)
<i>wawae 'iole (Codim edule)</i>	<i>kapuhili</i> (Butterfly Fish)
Shellfish	<i>'a 'awa</i> (Wrasse)
lobster	<i>weke 'a 'a</i> (Goat Fish)
<i>'ōpae</i> or shrimp	<i>paku</i> (Flat Fish)
<i>alamihi</i> or black crab (<i>Metopograpsus messor</i>)	<i>'ala 'ihi maoli</i> (Squirrel Fish)
red crab	<i>akule</i> (Jack)
white crab	<i>kapuhili</i> (Butterfly Fish)
	<i>lao</i> (Wrasse)
	<i>hinalea i 'iwi</i> (Wrasse)
	<i>moana</i> (Goat Fish)
	<i>pualu</i> (Surgeon Fish)
	<i>kala</i> (Surgeon Fish)
	<i>lau 'i pala</i> (Surgeon Fish)
	<i>lau wiliwili nukumuku 'oi oi</i> (Butterfly Fish)
	<i>hinalea luahine</i> (Wrasse)
	<i>menpachi</i> (Squirrel Fish)
	(Puffer Fish)

Mokauea Historical Study	Sand Island Biological Survey
	'upapalu (Cardinal Fish)
	Goby
	aweoweo
	puhi (Eel)
	hihimanu (Eagle Ray)
	Various species of algae, coral, sea urchins, chaetopterids, sea cucumbers, star fish and worm and shrimp holes

Many of the species found during the biological survey in 1976 are not consumed. The lists of fish give an idea of the diversity and variety of marine life near the project area in the 1970s.

5.1.6 'Ohana Style Fishing

Fish were plentiful in this area; There were approximately 885 acres of fishponds in the Ke'ehi area alone (Cobb 1905:429). Many fishing communities existed at the beginning of the 20th century, some on the small islands on either side of Kalihi Channel and others near the shoreline. *Hoa'āina* shared details about the way fishing worked within an 'ohana.

The fisherman of Keehi would usually fish with their 'ohana group. When fish were brought back to the island it would be shared with one's 'ohana first then with neighbors and finally the remaining fish were either sold or bartered. No one would go hungry because everyone watched out for their neighbor's welfare (Oppenheimer 1976:11).

Most of the families owned homes on land or in the *mauka* areas of Kalihi as well while maintaining a fishing house on one of the islands. Anyone from the 'ohana could go use the fishing house as this was where the fishing gear was kept. This lifestyle pattern is consistent with *kuleana* claims in Kalihi Kai, including the ones closest to the project area. Today, families continue to live on Mokauea and fish for subsistence.

5.1.7 Fishing Techniques

The historical study of Mokauea Island documents the struggle of the community on and around the island to maintain the fishing lifestyle of their ancestors (Oppenheimer 1976). The current project area, located in the traditional Mokauea fishery is part of the fishing grounds fished by the ancestors of many of the *kama'āina*. Within Mokauea fishery were two islands or groups of islands and islets, Kahakaaulana and Mokauea. Oppenheimer documents these islands as being continuously inhabited from 1853 (probably much earlier) until 1941 when it was dredged along with one of Mokauea islets (Oppenheimer 1976: 5). Following World War II in 1946, people returned to reside on Mokauea.

Several fishing techniques were documented as part of the Mokauea Island Historical Study. Some of the most common and popular fish in Mokauea were the *paki'i*, the flounder (*Bothus pantherinus*), squid and mullet (Oppenheimer 1976:13). The *paki'i* was found in sandy places and was caught by sticking it with a piece of metal wire. Squid was caught directly from the boat where a spear was used with a wire-ended barb (Oppenheimer 1976:13). Probably the most important fish, the mullet, was known to come in great numbers to these shores. One interviewee, Muriel Lupenui, speaks of the legendary *'anae holo*, the traveling mullet who made their runs from Pu'uloa all the way around to Ko'olauloa and back during the winter (Oppenheimer 1976:13; Thrum 1998:271). Though many of the fishponds were also stocked with mullet, it was noted that Mapunapuna was the primary one. Fishermen at Mokauea and in surrounding areas used nets to trap mullet and many other fish.

5.1.8 Traditional Beliefs about Fishing

The fishermen interviewed for the Mokauea study all spoke of the importance of fish breeding grounds, the *ko'a* and how every fisherman was familiar and respectful of the *ko'a* not taking more fish than was needed. Because *ko'a* were often difficult to locate, a system of triangulation was used to obtain bearings off of visible landmarks. Where the two bearings intersected identified the location of the *ko'a* (Malo 1951:211). *Ku'ula* were also emphasized during interviews with Mokauea fishermen. A *kū'ula* is “any stone god used to attract fish, whether tiny or enormous, carved or natural, named for the god of fishermen” (Pukui and Elbert 1986:187). *Kū'ula* offerings were observed on Mokauea Island by one of the fishermen in his youth. On the neighboring island of Kahaka'aulana was the *kū'ula* stone of Muriel Lupenui's *'ohana*.

On Kahaka'aulana Island they had a personal *kuula* god stone. This stone belonging to Muriel Lupenui was kept in a special house. This house was visited and described by Gertrude Damon and appears in her notebooks...It is remarkable that this practice existed up until the confiscation of the area in 1941 (*in* Oppenheimer 1976:14).

5.1.9 Changes to Traditional Fishing Lifestyle

It is difficult to imagine the massive change experienced by those who grew up in Kalihi Kai or Mokauea and neighboring areas. There is very little recognizable in the landscape from the childhoods of those who were born in the 1920s and 1930s. For the residents of Mokauea in the 1970s, the turning point was World War II. Following the war, the occupants of the Mokauea Fishery became more multiracial (Oppenheimer 1976:17).

Fishing practices were quickly adopted by immigrants. Informant Muriel Lupenui reported that the fleet of Japanese fishermen who docked their sampans at Puuhale, used her fishing *kuula* (stone god). They made offerings to the god and many of them spoke fluent Hawaiian. They would also leave fish at her house if they had a successful day (Oppenheimer 1976:16).

This transition was also noticed in the cultivation of the fishponds at Kalihi Kai. In a more recent cultural study of an area in Kalihi Kai, community members recall that the families operating the fishponds were largely Japanese.

A kama'āina born in Kalihi recalls fishponds in the vicinity of the former Apili Pond when he was a youngster in the 1930s. At that time, the Apili Pond was split into several ponds and was operated by the Hamada Family who would harvest the fish from tin boats (pers. Communication, G. Kaeliwai in Bushnell and Hammatt 2002:7).

The general condition of the Mokauea and Kaliawa fisheries has declined greatly since WWII as well. One of the major events which led to the decline of the fisheries was the dredging of Ke'ehi Lagoon in the 1940s. It was this dredging activity that created the seaplane runway and the current shape of the project area today.

Mr. Kaeliwai still remembers the day Pearl Harbor was attacked. At the time, the Ke'ehi Lagoon was being dredged to create Sand Island. The day of the attacks, young George was in the Ke'ehi Lagoon picking up shells, crabs and fish that were displaced from the dredging of the lagoon. He was talking story with the dredging workers and his sister called him from the bank to come home right away. Mr. Kaeliwai feels the dredging of the lagoon affected not only the form of the Lagoon, but the fish that lived in it (G. Kaeliwai in Bushnell and Hammatt 2002:12).

Others have pointed to the construction of the Nimitz Highway as the major development that wiped out the fishing grounds (Ibid). Still others focus on the negative impacts of non-point source pollution.

Mr. Akina still fishes in the Ke'ehi Lagoon and he has seen fishing conditions decline in the last few decades. He explained that Ke'ehi Lagoon was once a hammerhead shark breeding ground. Now, he sees very few sharks. Though he still goes crabbing for Samoan crab and pole fishing for mullet and *pāpio*, he feels the quantity and quality of the fish and crabs have been impacted negatively by all the pollutants coming into the Lagoon (E. Akina in Bushnell and Hammatt 2002:12).

It is difficult to pinpoint all the sources of pollution into the Ke'ehi Lagoon and neighboring Mokauea Fishery. The whole area has been heavily industrialized including the areas of Sand Island, Kalihi Kai and Mapunapuna. More specific sources of pollution were targeted in the 1970s when raw sewage effluent was rerouted as deep ocean outfall. However, this was not before much damage had been inflicted on the reef and waters of the fisheries. Between the 1920s and the 1970s, 62mgd (million gallons per day) of raw sewage was released into the near shore areas from one source point in the Honolulu Harbor (Brock 1997:28). The zones of "acute" impact extended 500m to 1000m from the source giving an idea of how far-reaching the pollutants had traveled. Industrial and urban runoff and storm water continue to pollute the waters of Mokauea and surrounding waters.

5.2 Burials

The project area is located in the former Mokauea Fishery. It is unlikely human burials will be encountered in the project area as it is entirely composed of fill. However, it is important to document the use of the islands, fishponds and coastlines as traditional burial sites utilized by Hawaiians. A burial was inadvertently discovered at Pier 40 during construction activities related to the pier (Moore 1997). This burial appears to have been buried in the original coastline near the mouth of the Kapālama Stream and also near the former Ananoho Fishpond. The burial is likely associated with the *kuleana* at the burial site. It was common practice for *kama'āina* to bury their family members within their *kuleana*.

Kamakau records the use of fishponds as burial sites. He describes the famous Kaloko Pond on Hawai'i Island. "Kaloko [pond] is another famous burial pit; it is at Kaloko, in Kekaha, Hawaii. {In a cave that opens into the side of the pond} were laid Kahekili, the ruler of Maui, his sister Kalola, and her daughter, Keku'iapoiwa Liliha, the grandmother of Kamehameha III" (Kamakau 1991:41). The name of one of the former fishponds at Kalihi Kai was Ananoho implying an inhabited "*ana*", cave. This does not suggest that Ananoho was a burial cave, but rather that fishponds often did contain caves which could have been used for burial.

The sand islets and islands in the Ke'ehi Lagoon are also known to contain burials. One of the *kama'āina*, Lama, charged with identifying the boundaries of the Kaliawa Fishery pointed out one of the "sand mounds", an islet in Kai o Kaliawa where some of her relatives were buried (in Maly and Maly 2003:386). The name of the islet was Makukaloo, referring possibly to "*kaloo*" the three sacred nights of the month belonging to the god Kanaloa. In a more recent study, many residents or former residents of Mokauea Islands were interviewed. Some of them discuss the burial of *'ohana* members on the islands (Oppenheimer 1976:14).

Section 6 Summary and Recommendations

Cultural Surveys Hawai'i, Inc. has conducted a cultural impact evaluation, an archaeological literature review and a field inspection for the proposed development of a small shipyard at Ke'ehi Lagoon Small Boat Harbor, Kalihi Kai, Kona, O'ahu [TMK 1-2-025:024]. The field inspection identified no historic or archaeological sites. There is a small drainage depression on the eastern boundary of the property in which '*aki'aki*, a native rush grass grows. Fish scales and bones found near the southern boundary of the property at the shore suggest this area is actively used for fishing and consuming fish. This was confirmed by fishermen fishing from the dock on the western boundary of the property. Based on their comments, it seems fishermen prefer this dock for fishing as it parallels the seaplane channel and the fish seem to congregate there.

A review of the archaeological literature found no archaeological properties in the vicinity of the project area. Several traditional fishponds once existed somewhat inland, but all of these were filled as "reclamation" land beginning in early twentieth century. Paleoenvironmental studies of the fishponds have been unable to determine any good dates for the fishponds at Kalihi Kai though tentative dates have been presented for the *ahupua'a* flanking Kalihi, Kūwili Fishpond in Kapālama (1500 AD) and Weli Fishpond in Kahauiki (1650 AD). Some human burials have been found in coastline or coastal estuarine environments in Kalihi Kai, however these are scattered and are not near the project area.

The project area once existed as an inter-tidal reef. With the growth and urbanization of Honolulu Harbor, the construction of the O.R. & L. Railroad in the late 19th century and the creation of Sand Island, the project area was included as part of the reclamation of hundreds of acres of inter-tidal reef. Like the majority of the modern coastline near the urban center of Honolulu, the project area is composed entirely of fill. Fill events most likely began in the first few decades of the twentieth century when large amounts of fill were dredged from the Honolulu Harbor and Kapālama Basin to enlarge Quarantine Island (now Sand Island). The channel on the southern boundary of the project area was dredged in 1925-26 and the current Bascule Bridge was built between 1959 and 1962. The channel on the western boundary of the project area was dredged during the creation of the seaplane channel beginning in 1941.

Based on historical and archival research, it is found that the Ke'ehi Lagoon Small Boat Harbor is located in the traditional fishery of Mokauea, an '*ili* or land division of Kalihi, O'ahu. The literature specific to Kalihi Kai indicates an area rich in marine resources and Hawaiian traditions related to these resources. Fishponds flanked the coast including Loko Ananoho, Auiki, Pahounui, Pahouiki and Apili. In addition, numerous Māhele claims were made for small, dune-banked fishponds - *pu'uone*, valued and cultivated by the *kama'āina* of Kalihi. Salt particular to Kalihi Kai was produced on the western side of Kalihi. The inter-tidal areas on the interior part of the reef were used as a passage way for canoes traveling between Honolulu and Pu'uloa and other parts of 'Ewa. The reef itself was utilized intensively for collecting small fish, crabs, *limu* and other shellfish.

A small fishing community continues to live on Mokauea Island and has fought for their way of life to remain on the island. Despite the massive changes the community has witnessed in the

urbanization of Honolulu and the depletion of their fishing grounds over the last four to eight decades, they continue to do their best to retain a fishing lifestyle. Others who grew up in Kalihi and the surrounding area continue to fish the Ke'ehi Lagoon and other areas including from the vicinity of the project area. Very limited community consultation was carried out for this project that consisted of talking story with a few fishermen on the project area. In addition, interviews with community members from previous cultural and historical studies suggest the community feels strongly about protecting the waters and fishing areas. Even the fishermen fishing from the project area feel strongly about their fishing spot. Many of them have lived in Kalihi all their lives and have fished from the project area all their lives.

Because the dry land portion of the project area is believed to be entirely 20th century fill land development of this land seems exceedingly unlikely to adversely impact any land resources. Although the immediate marine environment has been much impacted by dredge and fill operations, spanning many decades, the vicinity is still popular for subsistence fishing by Hawaiian and non-Hawaiian residents of Kalihi and elsewhere. The potential for adverse impact of the proposed project to near shore resources and fishing access is unclear to us at this time. Given the long-tradition of utilization of coastal resources in the vicinity and the expressed concerns associated with the struggle for access to and residence on Mokauea Island we recommend that the project attempt to minimize adverse impact to the coastal environment and minimize adverse impact to coastal access for purposes of fishing and accessing other coastal resources.

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Appendix G

Aqua Filter Manual



Aqua-Filter™ Stormwater Filtration System

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 - 💧 Step 2 - Filtration
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 - 💧 Buoyancy
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- 💧 Retrofit Applications
- 💧 Inspection and Maintenance
- 💧 Aqua-Filter™ Bypass Orientation
- 💧 Aqua-Site Worksheet
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- 💧 Aqua-Filter™ Sample Detail Drawing
- 💧 Aqua-Filter™ Specifications



Play in Clean water



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Aqua-Filter™ Stormwater Filtration Systems

The Aqua-Filter™ Stormwater Filtration System is designed for sites that require advanced treatment of runoff stormwater that may discharge into sensitive receiving waters.

Each Aqua-Filter™ system is custom engineered and utilizes a unique approach for pollutant removal. This patented configuration begins with the removal of gross pollutants by the Aqua-Swirl™ Stormwater Treatment System, followed by the removal of fine sediments and waterborne pollutants by the filtration chamber.



The Aqua-Filter™ is not only unique because of its modular design, and HDPE construction, but also because of the ease of installation. The system can be designed for new construction projects or be retrofit for existing storm drainage structures.

The Aqua-Filter™ system is engineered such that the filtration capacity complies with established "water quality treatment" requirements. This means that the system filters the initial movement of fine sediment pollutants that can be particularly harmful.

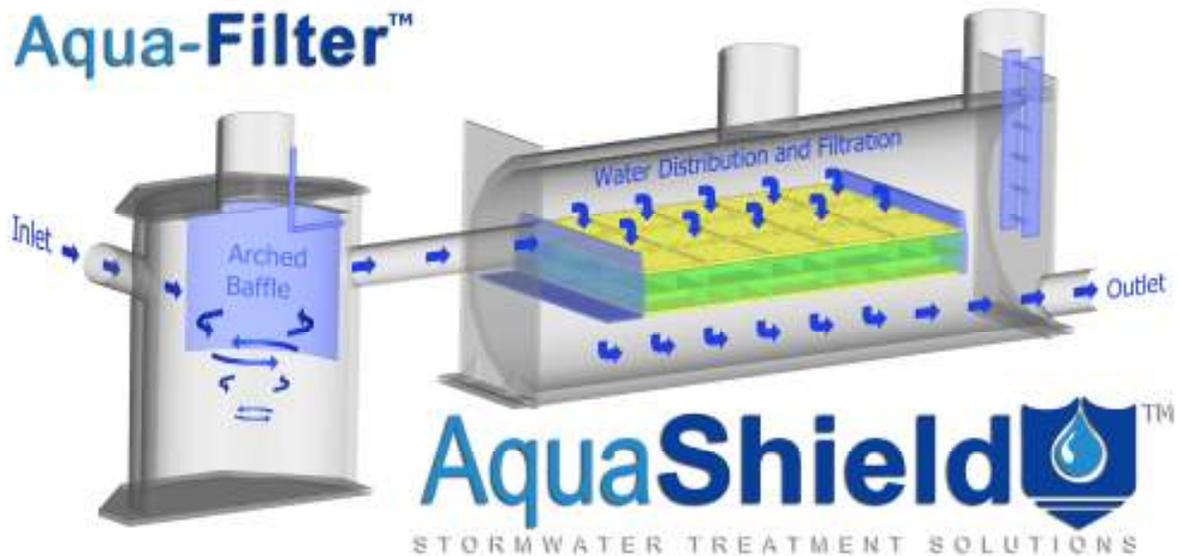
Performance testing is a normal part of our quality assurance program. Third party testing has demonstrated Total Suspended Solids (TSS) removals of greater than 80% and the effective removal of additional pollutants including hydrocarbons (i.e. light and heavy oils and grease), phosphorus, and various heavy metals (i.e. copper, zinc). See the "Performance and Testing" Section for details.



System Operation

The Aqua-Filter™ Stormwater Filtration System operates under gravitational and hydrodynamic forces with no moving parts or valves, which simplifies the treatment process. The Aqua-Filter™ system also normally operates in an off-line configuration as recommended by the Center for Watershed Protection and most municipalities; fully treating the more frequent 6-month to 1-year design storms (or roughly 90% - 95% of the annual rainfall on a given site). Larger, more intermittent storm events (i.e. 10-year or 25-year) are treated in the Aqua-Swirl™, and the peak over-flow is permitted to partially bypass the filter media internally beneath the filter bed, avoiding the need for external diversion chambers.

The unique Aqua-Filter™ treatment method is illustrated in the drawing shown below and described in the following steps.



Step 1: Pretreatment

Peripheral pre-treatment of stormwater is not necessary when using the Aqua-Filter™ Stormwater Filtration System. In fact, each Aqua-Filter™ is custom engineered to utilize a unique treatment sequence where both the coarse- and fine- grained pollutants are removed.

This sequence begins with the Aqua-Swirl™ Stormwater Treatment System designed to target the removal of TSS and free-floating oil and debris. The addition of the Aqua-Swirl™ allows larger debris to settle before filtration and increases filtration effectiveness.



Aqua-Swirl™ to be connected to the Aqua-Filter™ Stormwater Filtration System

Step 2: Filtration



Aqua-Filter™ system lowered into place

The filtration chamber in the Aqua-Filter™ is designed to refine and enhance the stormwater quality prior to discharge into sensitive receiving waters. The peak filtration flow rate is based on the calculated "water quality treatment" requirements desired for the site. The Sizing Chart provided later in this Section indicates the peak filtration flow rate for the specific Aqua-Filter™ model.

As the pre-treated water enters the filtration chamber, it is evenly distributed across the filter bed and allowed to permeate through the filter media. The filter media are contained in individual sections, which are layered in a pattern to avoid short-circuiting.

Aqua-Filter™ Filter Media

The natural filter media used for filtration are capable of removing the remaining waterborne pollutants such as oils, grease, fine silts and clays, nutrients (nitrogen, phosphorus), and heavy metals (copper, lead, zinc). The most commonly used media is medium-grained perlite. Other filter media, such as zeolite, granulated activated carbon, leaf compost, and various media blends are available. *Performance test reports are provided in the "Performance and Testing" Section of this manual.*



Installation

The Aqua-Filter™ Stormwater Filtration System has been designed and fabricated to facilitate easy installation of the system.

Due to the lightweight durable nature of HDPE, typically no special lifting equipment is required to off load the Aqua-Filter™. Lifting supports or cables are provided on each unit, and installation can typically be accomplished with an excavator or track-hoe. Compared to concrete systems, using an Aqua-Filter™ can significantly reduce installation costs.



The coupling between the Aqua-Swirl™ and Aqua-Filter™ system

In addition, stub-outs for the inlet and outlet are provided. AquaShield™ will furnish the coupling between the Aqua-Swirl™ and filter chamber. This requires the contractor to attach the pipes to the Aqua-Filter™ rubber couplings for the system to function properly. Typically, an AquaShield™ representative is present on-site to assist in the installation process.

Buoyancy

All Aqua-Filter™ systems are supplied with anchor feet at each end of the filter chamber. These anchor feet provide additional surface area to counter any buoyant force exerted on the system. If needed, concrete can be poured directly onto the anchors to provide additional surface area for resistive force. The AquaShield™ engineering staff can provide buoyancy calculations for your site-specific conditions.



Aqua-Filter™ system shown anchored to counteract buoyant force

Traffic Loading

When installed in traffic areas, the Aqua-Filter™ system is designed to withstand H-20 loading. In order to accomplish this, a reinforced concrete pad shall be poured in place above the system. *Further details can be found in the "Installation and Fabrication" Section of this manual.*



A concrete pad is required in traffic loading areas



Retrofit Applications

The Aqua-Filter™ system is designed so that it can be used for retrofit applications. The filtration system can be installed both above and below grade, and can be used for industrial applications to meet new, more stringent permit requirements.



Inspection and Maintenance



Workers use a vacuum truck to clean out an Aqua-Filter™ System

Maintenance of the Aqua-Filter™ Stormwater Filtration System is two-fold. First, inspect the Aqua-Swirl™ and then inspect the filtration chamber.

The first step is to inspect and cleanout the Aqua-Swirl™ pre-treatment chamber. Free-floating oil and floatable debris can be directly observed and

removed through the 32-inch service access provided. If cleanout is needed, a vacuum truck can be used to remove the accumulated sediment and debris. The second step is to inspect and cleanout the Aqua-Filter™ filtration chamber. Inspection of the filtration chamber can be performed from the surface by

observing the color change of the filter media from its original light color to dark brown. If the filter containers need replacing, entry into the system is required. The spent filter containers are lifted from the chamber as shown below.

Replacement filters are then lowered into the system and set into position. The filters are placed into two-foot by two-foot grates that should be overlapped such that the lower two containers are parallel to the length of the filtration chamber, and the upper two are perpendicular to the length of the chamber. Care must be taken to ensure that the containers are seated into position to promote good contact with the walls on all sides.



Spent filters removed from the Aqua-Filter™ System

Typically, the spent filters do not require any special treatment or handling for disposal. AquaShield™ recommends that all materials removed be handled and disposed of in accordance with local and state requirements.

An "Inspection and Maintenance Manual" is provided with the Aqua-Filter™ system for more detailed maintenance procedures.



Aqua-Filter™ Bypass Orientation

