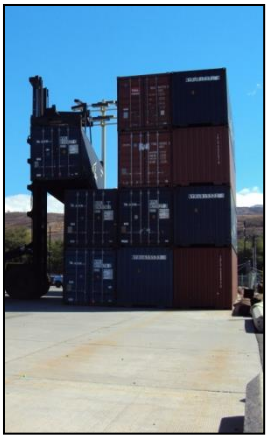
FINAL ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT

IMPROVEMENTS TO KAWAIHAE HARBOR








State of Hawai‘i
Department of Transportation
Harbors Division

October 2013

Project Summary and HRS 343-5(b) Agency Action Checklist Information

Project Name:	Improvements to Kawaihae Harbor Environmental Assessment
Island / Tax Map Key:	Hawai'i Island (3)6-1-03- various Kawaihae Road, South Kohala District
HRS Chapter 343 Proposing Agency and Accepting Authority:	State of Hawai'i, Department of Transportation 869 Punchbowl Street Honolulu, Hawai'i 96813 Glenn M. Okimoto, Ph.D., Director of Transportation (808) 587-2150
Statutory Trigger Conditions for Hawai'i Environmental Policy Act Under HRS Section 343-5(a)	• Use of State lands and use of State funds. • Use within a shoreline setback area. • Use of Conservation District Land (**See Section 9.2: State Land Use Districts** for more information)
Notice of Determination Letter from Proposing Agency	See cover letter attached to this FEA-FONSI requesting publication of notice of a finding of no significant impact (FONSI)
Written Comments and Responses to Comments During Public Review Period	A total of six comments were received during the public review period. Refer to **Section 11.2.2: Responses to Comments Received During Draft EA Comment Period** for these comments and official responses
Project Site Existing Use:	Industrial and Open Space. Ongoing commercial harbor activities.
Purpose and Need of the Proposed Action:	• Serve existing and future demand for harbor facilities through increased cargo capacity. • Add adequate berth length and yard space to accommodate multiple users with varying length and depth of vessels. • Improve safety of navigational and land operations. • Ensure Kawaihae Harbor meets current federal security requirements. • Improve safety for workers and recreational users at the Coral Flats. • Support Department of Agriculture efforts to implement biosecurity program by allocating space at a Department of Agriculture facility. • Protect the public and public resources by improving island resiliency and maintaining flexibility to respond when natural disasters occur. • Enhance security from adjacent recreational users.
Proposed Action	• Internal roadway circulation improvements. • Security fencing and dedication of land for Small Boat Harbor (South) and Perimeter Road (DLNR DOBOR). • Transfer of Pelekane Lands Buffer to DLNR. • Maintenance of Army Access • Grading of Coral Flats Area.

	• Relocation of the Hawai'i District Office and new comfort station. • New yard pavement, structural pavement strengthening and utility improvements. • Improve, replace, or add sheds, buildings, parking and fencing. • Improvements to Main Gate, South Gate and Kawaihae Road. • Security improvements. • Dredging for Pier 2A. • Reconstruction and extension of Pier 2A by 340 feet. • Pier 2C extension of 325 feet. • Demolition of small craft dock facilities. • New dredging at Pier 2C
Project Time Frame and Funding Source	Implementation is expected to be continuous over the coming decade. Funding will be from DOT-Harbors funding sources.
Individuals, Community Groups & Agencies Consulted:	**FEDERAL AGENCIES** • U.S. Department of Agriculture. • U.S. Department of Agriculture, Animal and Plant Health Inspection. • U.S. Army Engineer Division, Department of the Army. • U.S. Department of the Interior, Pacific Island Fish and Wildlife Office. • U.S. Department of the Interior, National Park Service, Pu'ukoholā Heiau National Historic Site. • U.S. Geological Survey, Pacific Islands Water Science Center Office. • U.S. Department of Transportation. • U.S. Environmental Protection Agency. • U.S. Department of Commerce, National Oceanic and Atmospheric Administration. • U.S. Department of Homeland Security, Customs and Border Protection, Kona International Airport. • U.S. Department of Homeland Security, Transportation Security Administration. • U.S. Coast Guard. **STATE OF HAWAI'I AGENCIES** • Department of Accounting and General Services. • Department of Agriculture, Plant Quarantine Branch. • Department of Agriculture, Animal Industry Division. • Department of Business, Economic Development and Tourism. • Department of Business, Economic Development and Tourism, Office of Planning. • Department of Defense. • Department of Education. • Department of Health, Office of Environmental Quality Control. • Department of Transportation, Highways Division. • Department of Land and Natural Resources, Division of Boating and Ocean Recreation. • Department of Land and Natural Resources, Office of Conservation and Coastal Lands.

	• Department of Land and Natural Resources, Historic Preservation Division. • Department of Hawaiian Home Lands. • Office of Hawaiian Affairs. • Department of Health, Clean Water Branch. • University of Hawai‘i, Environmental Center. **COUNTY OF HAWAI‘I AGENCIES** • County of Hawai‘i, Mayor Billy Kenoi. • Department of Environmental Management. • Hawai‘i Fire Department. • Department of Parks and Recreation. • Department of Water Supply. • Police Department. • Planning Department. • Department of Public Works. • Department of Research and Development. • Office of Housing and Community Development. **ORGANIZATIONS AND INDIVIDUALS** • Council District 9, Pete Hoffmann. • House District 7, Cindy Evans. • 3rd Senatorial District, Josh Green. • South Kohala Community Development Plan Action Committee. • Hawai‘i Harbor Users Group. • Young Brothers, Ltd. • Matson Navigation Co. • Mid-Pacific Petroleum. • Big Island Energy. • Hawai‘i Pilots Association. • Coordinating Group on Alien Pest Species. • Kawaihae Local Resource Council. **UTILITY COMPANIES** • Hawaiian Electric Light Company. • Hawaiian Telecom. • Hawai‘i Gas (formerly The Gas Company).
Affected Environment and Existing Land Use Designations:	The affected environment of the study area is described throughout **Chapters 4, 5, 6, 7, 8, and 9.** To summarize, Kawaihae Commercial Harbor (Kawaihae Harbor) is located on the northwest coast of Hawai’i Island. The harbor basin measures 1,450 by 1,500 feet and has a depth of 35 feet, with an entrance channel that is 3,270 feet long and 500 feet wide. A 2,650-foot long breakwater protects the harbor. The harbor is served by Queen Ka‘ahumanu Highway and is located 28 miles north of Kona International Airport at Keāhole. Kawaihae Harbor is located in the South Kohala District. Land use issues are discussed at length in **Chapter 9: Conformance with Plans**

	and Policies and summarized here. State Land Use: Urban (non-submerged lands), Conservation (submerged lands). Hawai'i County General Plan's Land Use Pattern Allocation Guide (LUPAG): *Open Area* nearest shoreline, with *Industrial* between Kawaihae Road and the shoreline, and some *Medium Density Urban*. South Kohala Community Development Plan (CDP): Alternatives considered in project are consistent with the CDP to varying degrees. Hawai'i County Zoning: MG-1a (General Industrial - one acre minimum lot size) with the exception of breakwaters, which are zoned *Open.* Special Management Area: Site is within Special Management Area (SMA). Portions of the site are located on ceded lands and are governed by a number of Executive Orders.
Project Alternatives:	Refer to **Chapter 3: Alternatives and Proposed Action** for more description. • Alternative 1- No Action: No actions other than ones previously committed. • Alternative 2 - Minimal Action: Internal Roadway, Fencing, and DLNR land transfer only. • Alternative 3 - Partial Action/Land-Side: All land-side improvements only. • Alternative 4 - Land-Side Plus Pier 2A Extension: All land-side improvements plus extending Pier 2A by 340 feet. • The Proposed Action is Alternative 5 – All land side improvements, extending Pier 2A by 340 feet, and extending Pier 2C by 235 feet, plus dredging. This alternative best meets the Purpose and Need of the project.
Anticipated Impacts:	A variety of impacts are anticipated under the various alternatives, but none are expected to be significant after mitigation. See **Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts** for a detailed breakdown of anticipated impacts and mitigation, including: • Traffic Circulation. • Water Quality and Marine Environment. • Marine and Terrestrial Wildlife. • Air Quality. • Noise. • Visual Quality. • Recreational Facilities.

Alternatives Not Considered in the EA Because They Did Not Meet Purpose and Need:	• Construct improvements at a new harbor in West Hawai‘i.
	• Redistribute cargo handling from Kawaihae Harbor to Hilo Harbor.
	• Caisson wharf design option for Piers 2A and 2C.
	• Several projects identified in the 2035 Master Plan, including:
	  o A new 865-foot Pier 3 with associated dredging.
	  o 22-acre paved cargo terminal to support new Pier 3.
	  o New ferry pier and passenger terminal.

Environmental Justice	The project team sought to engage low-income and minority populations in the planning and alternatives development for the Proposed Action. The anticipated effects of the project on low income and minority populations are discussed in **Section 5.4.1: Environmental Justice .**
Project Site Permits/Approvals Required:	• Section 404 Clean Water Act Permit. • Section 401 Certification. • National Pollutant Discharge Elimination System (NPDES). • Section 10 of the Rivers and Harbors Act (Nationwide Permit for maintenance dredging). • Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA) approval for ocean dumping of dredged materials. • State of Hawai‘i Department of Health (DOH) - Noise Permit/Variance. • Coastal Zone Management (CZM) Consistency Determination.
EA Preparers:	SSFM International 501 Sumner Street, Suite 620 Contact: Cheryl Soon, FAICP, Project Manager Honolulu, Hawai‘i 96817 Douglas Zang, AICP, Lead Writer (808) 531-1308

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CHAPTER 1: INTRODUCTION

1.1 Purpose of this Final Environmental Assessment

The purpose of this *Final Environmental Assessment and Finding of No Significant Impact* (FEA-FONSI) for Improvements to Kawaihae Harbor is to circulate comments on the Draft Environmental Assessment, to circulate responses to comments received, and to circulate the Finding of No Significant Impact (FONSI).

The *Draft Environmental Assessment and Anticipated Finding of No Significant Impact* (DEA-AFONSI) for Improvements to Kawaihae Harbor was published In the Office of Environmental Quality Control's (OEQC) *Environmental Notice* on July 23, 2013. A thirty day comment period ended August 22, 2013. Two newspaper articles highlighting the proposed improvements, the findings of the DEA-AFONSI, and the availability of the DEA-AFONSI for public review were published in the *West Hawai‘i Today* newspaper on July 28, 2013 and in the *Honolulu Star Advertiser* on August 2, 2013.

During the comment period a total of six comment letters were received. Two were from agencies, the National Marine Fisheries Service (NMFS) and State of Hawai‘i Department of Health Clean Water Branch. Four were from members of the general public. The letters and responses can be viewed in **Section 11.2.2: Responses to Comments Received During Draft EA Comment Period**.

The State of Hawai‘i, Department of Transportation, Harbors Division (DOT-H) is proposing infrastructure improvements to Kawaihae Harbor. Identification of needs, future demands, and alternative development was conducted in two planning efforts: The *Hawai‘i Island Commercial Harbors 2035 Master Plan Update* (2035 Master Plan), and the subsequent Kawaihae Development Studies, a collection of studies to identify actions required to implement the 2035 Master Plan. Both planning efforts included extensive participation by federal and state agencies, harbor users, adjacent property owners, and the public. The planning documents are available at http://www.hawaiiharborsplan.com.

This FEA-FONSI addresses the potential impacts on the surrounding environment resulting from the construction and use of these improvements at Kawaihae Harbor. This document was prepared in conformance with the regulatory and documentation requirements prescribed under Chapter 343, Environmental Impact Statements, Hawai‘i Revised Statutes (HRS), otherwise referred to as the "Hawai‘i Environmental Impact Statement Law," and Title 11, Chapter 200 (Environmental Impact Statement Rules) of the Hawai‘i Department of Health's (DOH) Administrative Rules (HAR).

Triggers for the Environmental Assessment of this project under Chapter 343 include:

- Use of State lands.
- Use of State funds.
- Use of Conservation District lands. (HDOT Harbors is exempted; see **Section 9.2: State Land Use Districts** for more information)

- Use of the shoreline area.

As the project would involve dredging in harbor waters, a Department of the Army permit will be required from the U.S. Army Corps of Engineers (USACE) for dredge activities to comply with Section 404 of the federal Clean Water Act (CWA) and Section 10 of the federal Rivers and Harbors Appropriation Act. Therefore, this EA has also been prepared to provide information to the USACE to facilitate review and processing of the Department of the Army permit application, including consultations to comply with applicable federal requirements such as Section 7 of the Endangered Species Act (ESA) and Executive Order 13089, Coral Reef Protection.

The mitigation that results from these consultations will serve to minimize impacts on specific regulated species and the overall environment.

1.2 Summary of Project Impacts and Mitigation Recommendations

A description of the Proposed Action is provided in **Section 3.8: Proposed Action: Alternative 5 – Full Action** below. The anticipated resources that may be impacted by the Proposed Action, and the recommendations to mitigate those impacts to ensure there are no significant impacts are described in **Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts**.

Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts

Potential Resource Impacted	Mitigation Recommendations
Grading/Soils	• Best Management Practices recommended including but not limited to: o Dust control plan. o Schedule construction to minimize the amount of unvegetated soils exposed at any given time. o Dust control measures such as wetting exposed areas, silt fences, and other measures. o Geotextile silt screens and absorbent "sausages" to capture sediment. o Drywells, drain trenches lined with geotextile. o Truck wash-down area with proper setback from ocean, with containment and proper disposal. o Road cleaning/tire washing program. o Early establishment of landscaping to control dust.
Natural Disasters	• Design of buildings should consider seismic conditions, hurricane requirements, tsunami, etc.
Sea Level Rise	• Future uses at Kawaihae Harbor consider sea level rise
Air Quality	• Fugitive dust and equipment emissions controls consistent with DOH Air Pollution rules and state/federal laws.

Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts

Potential Resource Impacted	Mitigation Recommendations
	• Dust control plan and BMPs as noted above for "Grading/Soils." • Ensure all vessels meet emission control standards. • Demolition of buildings following state/federal laws. • Wet cutting or dust-capture attachments for concrete cutting.
Noise and Vibration	• DOH Noise Permit to be obtained – restrictions on construction hours, days, and noise levels: o 7 AM – 6 PM weekdays, 9 AM – 6 PM Saturday, none on Sunday or holiday. o Pile drivers, hoe rams, jack hammers restricted to weekdays 9 AM – 5:30 PM. • Noise variance may be needed, application to be submitted if so. • Construction equipment should have mufflers and other controls • Generators should be low-noise and compressors should have sound-attenuating enclosures. • Where possible, use scheduling, substitution of methods/ equipment, mufflers, reduced size of equipment, quieter backup alarms and other measures to limit noise impact on community. • Underwater noise recommended to be mitigated through: o Timing of activities to avoid impacting marine life, through coordination with NMFS o Design-phase investigation of use of: ▪ air bubble curtains. ▪ temporary noise attenuation piles (TNAP). ▪ fabric barriers. ▪ cofferdams. o "Soft starts" for pile driving • Signage and enforcement of 35 mph speed limits, and traffic management to limit traffic noise
Visual Resources	• Avoid impacts to 22-acre Pelekāne Lands buffer to protect Pu'ukoholā Heiau National Historic Site from harbor property. • Fencing design should consider color and landscaping should minimize visual intrusion. • Lighting should meet county standards and should consider light pollution concerns. (See "Light Pollution" below) • If landscaping is pursued, native species should be considered.
Historic and Archaeological Resources	• Design and construction of Kawaihae Road should not encroach beyond existing mauka right of way limit to avoid burials. • On-call monitoring of archaeological resources recommended for any subsurface excavation along Kawaihae Road due to proximity of sensitive sites. • If subsurface features or artifacts are encountered during construction, activities should cease and State Historic Preservation Division (SHPD) will be contacted immediately.

Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts

Potential Resource Impacted	Mitigation Recommendations
Cultural Impacts	• Efforts will be made to ensure shoreline access is maintained to the highest degree possible. • It is recommended that DOT-Harbors provide community outreach as needed to address conflicts between increased activity in the harbor and recreational users. • Mitigate construction noise as described above under "Noise and Vibration." • DOT-Harbors will support DLNR-DOBOR efforts to complete Kawaihae Small Boat Harbor (South) • Avoid impacts to 22-acre Pelekāne Lands buffer to protect Pu'ukoholā Heiau National Historic Site from harbor property. • Provide new comfort stations with appropriate treatment prior to closure of existing comfort stations to protect marine quality
Hydrology/Marine Water Quality/Drainage/ Dredging Activity	• Best Management Practices recommended to include but not limited to: o Dust control plan. o Schedule construction to minimize the amount of unvegetated soils exposed at any given time. o Dust control measures such as wetting exposed areas, silt fences, and other measures. o Geotextile silt screens and absorbent "sausages" to capture sediment. o Drywells, drain trenches lined with geotextile. o Truck wash-down area with proper setback from ocean, with containment and proper disposal. o Road cleaning/tire washing program. o Early establishment of landscaping to control dust. • Follow DOH Antidegradation Policy (HAR Section 11-54-1.1). • Follow DOH Designated uses for a Class A embayment (HAR Section 11.54-3). • Follow DOH Water Quality Criteria (HAR Section 11-54-4 through 11-54-8). • National Pollution Discharge Elimination System (NPDES) permits will be obtained. • Section 404 Permit from USACE and Section 401 Water Quality Certification (WQC) from DOH will be obtained. • If required as conditions for Section 401 WQC and/or NPDES permits, monitor effluent discharge and/or receiving waters. • Obtain Section 10 Permit for Rivers and Harbors Act. • Obtain Section 103 Permit for Dredge Disposal under Marine Protection, Research and Sanctuaries Act (MPRSA). • Receive EPA Approval for Ocean Disposal of Dredge Materials. Dispose of dredge spoils as required by law depending on level of

Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts

Potential Resource Impacted	Mitigation Recommendations
	contamination. Any deep ocean disposal of dredge spoils will receive proper permits under the Clean Water Act and the MPRSA by USACE, using EPA's environmental criteria and subject to EPA's review and concurrence. • Follow recommended BMPs called for by NMFS: o Turbidity and siltation from project-related work should be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions. BMPs to avoid turbidity and siltation and erosion are outlined earlier in this section. o Any construction-related debris that may pose an entanglement hazard to marine protected species must be removed from the project site if not actively being used and/or at the conclusion of the construction work. o All project-related materials and equipment placed in the water should be free of pollutants. o No project-related materials (e.g., fill, revetment rock, pipe, etc.) should be stockpiled in the water (e.g., intertidal zones, reef flats, stream channels, etc.). o No contamination (e.g., trash or debris disposal, alien species introductions etc.) of marine (e.g., reef flats, lagoons, open ocean, etc.) environments adjacent to the project site should result from project-related activities. o Fueling of project-related vehicles and equipment should take place away from the water. A contingency plan to control the accidental spills of petroleum products at the construction site should be developed. Absorbent pads, containment booms and skimmers will be stored on-site to facilitate the cleanup of petroleum spills. o Underlayer fills will be protected from erosion with core-loc units (or boulders) as soon after placement as practicable. o The project team must prevent discharge of dredged material into the marine environment during the transporting and off-loading of dredged material. o Return flow of or run-off from dredged material stored at inland dewatering or storage sites must be prevented.
Wildlife	• If possible, time construction to minimize effects of construction on life cycles of humpback whales (October through May). • Work with NMFS to determine measures to minimize potential for collisions with humpback whales, green sea turtles, hawksbill turtles, monk seals, and spinner dolphins. • To protect marine species, the following are recommended: o A survey of the project area should be performed just prior

Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts

Potential Resource Impacted	Mitigation Recommendations
	to commencement or resumption of construction activity to ensure that no protected species are in the project area. If protected species are detected, construction activities must be postponed until the animals voluntarily leave the area. If any listed species enters the area during the conduct of construction activities, all activities must cease until the animals voluntarily depart the area. o All on-site project personnel must be apprised of the status of any listed species potentially present in the project area and the protections afforded to those species under Federal laws. o Any incidental take of marine mammals or injuries to sea turtles must be reported immediately to NMFS 24-hour hotline. Information reported must include the name and phone number of a point of contact, location of the incident, and nature of the take and/or injury. o BMPs recommended by NMFS (see Hydrology/Marine Water Quality/Drainage/Dredging Activity) o To avoid noise effects on humpback whales In the vicinity of the project area, prior to construction DOT-H is recommended to work with NOAA to determine the appropriate temporary threshold shift (TTS) distances of the protected species anticipated to be in the area. When the pile driving (or installation of sheet piling) effort commences, these efforts will be postponed or halted when the protected species are within the TTS range. o Consider the need for attenuating noise during underwater pile driving. See "Noise and Vibration" above. o Utilizing "soft starts" for the pile driving is recommended. See "Noise and Vibration" above. o Siltation curtains are recommended to minimize injury to or inadvertent taking of threatened marine wildlife and to minimize turbidity effects on coral reefs. A second siltation curtain may be erected as an extra safeguard. Use of silt curtains will include the following measures: ▪ In-water project construction activities will be managed during slack tide or during periods when tidal exchange within the harbor is modest to ensure silt curtains are effective in containing mobilized sediments. ▪ In-water project construction will be conducted at a slow, methodical pace, for the purpose of minimizing the disturbance of marine sediments during the installation of pilings, removal of existing pilings and

Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts

Potential Resource Impacted	Mitigation Recommendations
	removal of other debris. ▪ Double-layer silt curtains will be deployed when construction activities are conducted in close proximity to fish and wildlife resources, such as corals or other sessile organisms. • Lighting should be shielded and limited in height and power (per county ordinance) to protect seabirds as follows: o Limiting light poles to 46.5-foot heights already in use elsewhere in the harbor. o Use of lower-power (180 Watt) monochromatic and low-pressure sodium lighting (as opposed to the more common full-spectrum and high-pressure sodium lighting), which provides high contrast with sharply reduced brightness and glare, yet the yellow light does not attract insects and is not believed to be used for avian navigation. o Use of custom-designed light fixtures with "top-visor" shielding to minimize the potential for stray light up-scatter and side-scatter, so that the bulb is not visible at lamp height from the side. o Limiting light levels and hours of use to the minimum levels allowable under Occupational Safety and Health Administration (OSHA) worker safety and security. Union approval may also be required. • BMPs such as siltation curtains and other measures to mitigate impacts of siltation on marine habitats. See "Hydrology/Marine Water Quality/Drainage/Dredging Activity" above. • Underwater noise from pile driving recommended to be mitigated through timing of activities, air bubble curtains, and "soft starts." See "Noise and Vibration" above. • Section 7 Endangered Species Act consultation with resource agencies.
Coral Communities	• Consult with NMFS under Section 7 of the Endangered Species Act regarding the species *Montipora patula* which is a candidate for listing as "Threatened." • BMPs such as siltation curtains and other measures to mitigate impacts of siltation on marine habitats. "See Hydrology/Marine Water Quality/Drainage/Dredging Activity" above. • Water quality monitoring during dredging. "See Hydrology/Marine Water Quality/Drainage/Dredging Activity" above. • Consult with DLNR-DAR regarding coral mitigation measures. • Pursue compensatory mitigation for impacted coral, including potential transplantation or other strategies in compliance and coordination with 2008 USACE/EPA rules.

Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts

Potential Resource Impacted	Mitigation Recommendations
Invasive Species and Food Safety	• Provide one-acre space for DOA to build a future inspection facility, which will increase their capacity to intercept invasives from spreading. • All laws and regulations in place to target invasive species will be followed, including those governing ballast water discharges by US Coast Guard and USEPA. • Use of silt curtains recommended during construction to minimize spread of fragments of invasive coral species. • During the design phase of the project, a Hazard Analysis and Critical Control Point (HACCP) planning and implementation effort recommended to manage the risk of spreading invasives.
Hazardous Materials	• All demolition and site work should be managed according to DOH measures. • Phase II Environmental Site Assessment performed at all areas of known previous environmental incidents. • All fuel storage tanks, hazardous materials (including asbestos building material and lead-based paint), and transformers (potential sources for polychlorinated biphenyls (PCBs) present in structures planned for demolition), should be managed in accordance with measures agreed upon by DOH. These measures may include the removal, on-site stabilization, and if feasible, recycling of hazardous materials to avoid the potential for release into the environment. • A site-specific Health and Safety Plan should be prepared prior to any construction activities requiring earth movement, dredging, or building demolition. • Hazardous Waste will be generated during the demolition and construction activities. DOT-H should submit an EPA Form 8700-12, RCRA Subtitle C Site Identification Form to HDOH. • Disposal of materials should be consistent with state/federal regulations/permits. • The Contractor should be responsible for taking the safety, contamination management, and documentation actions required by the DOH's *Technical Guidance Manual for the Implementation of the Hawai'i State Contingency Plan.*
Light Pollution	• Lights should be shielded and mast heights should be limited to 46.5 feet high. • Low-pressure sodium light (180 watt) should minimize illumination levels. • Lighting should include lower security-level-illumination when higher levels are not needed. • All lighting should comply with the County's Lighting Code. • Light levels and hours of use should be limited to the minimum levels allowable under Occupational Safety and Health Administration

Table 1-1: Impacts of Proposed Action and Recommendations to Mitigate Those Impacts

Potential Resource Impacted	Mitigation Recommendations
	(OSHA) worker safety and security. Union approval may also be required.
Public Shoreline Access and Recreation Within Kawaihae Harbor	• Access should be maintained to all shoreline areas • It is recommended that DOT-Harbors provide community outreach as needed to address conflicts between increased activity in the harbor and recreational users.
Traffic	• Relocation of Gates and improvement to internal circulation • Coordination with DOT-Highways on pedestrian accommodations in areas of roadway improvements.
Utilities	• If utility infrastructure needs to be relocated, all necessary arrangements and agreements should be made with utilities prior to demolition of facilities.
Water Consumption and Wastewater	• New restrooms should be designed to consider the need to conserve water. • DOT-Harbors should coordinate with County of Hawai'i Department of Water Supply to ensure that all necessary permits/approvals obtained and that existing supplies are adequate to accommodate the Proposed Action.
Solid Waste	• Foreign wastes entering the US should be directed to a DOH-permitted foreign waste facility. • Hazardous wastes should be disposed of in compliance with all state and federal regulations. • Recycling and reuse measures should be encouraged during and after construction.
Educational Facilities (KANU Charter School)	• Access to the school area should be maintained. • Noise and construction impacts should be minimized through mitigation measures described above
Fire/EMS	• All structures and cargo handling activities should conform to existing fire codes. • Improvements in fire suppression at the harbor should be installed as warranted.
Pu'ukoholā Heiau National Historic Site	• The 22-acre Pelekāne Lands buffer should not be affected and will continue to buffer Pu'ukoholā Heiau National Historic Site from harbor property. • Fencing design should consider color and landscaping to minimize visual intrusion. • Lighting should meet county standards and should consider light pollution concerns. • If landscaping is pursued, native species should be considered.
Ala Kahakai National Historic Trail	• Design of Kawaihae Road should consider trail user needs.
Kawaihae Small Boat Harbor (South)	• Design of facilities to support and not preclude development of Small Boat Harbor (South)

1.3 Location

Kawaihae Commercial Harbor (Kawaihae Harbor) is located on the northwest coast of Hawai‘i Island, as shown in **Figure 1-1: Location of Kawaihae Harbor**. The harbor basin measures 1,450 by 1,500 feet and has a depth of 35 feet, with an entrance channel that is 3,270 feet long and 500 feet wide. A 2,650-foot long breakwater protects the harbor. The harbor is served by Queen Ka‘ahumanu Highway and is located 28 miles north of Kona International Airport at Keāhole. Kawaihae Harbor is located in the South Kohala District.

As shown in **Figure 1-2: Roads and Intersections Near Kawaihae Harbor**, Kawaihae Road (Highway 270) is the highway directly serving the entrances to the harbor. Some sources refer to this road by the name “Akoni Pule Highway,” which is the highway that continues northward to coastal North Kohala and Hāwī. For consistency, this report will exclusively use the name “Kawaihae Road.”

The Main Gate to Kawaihae Harbor is roughly 6,500 feet northwest of the juncture of Queen Ka‘ahumanu Highway (Highway 19) with Kawaihae Road. The harbor property runs from the north side of Pelekāne Bay at the south, to the Kawaihae Small Boat Harbor (North) at the northern end, just past the fork where Kawaihae Harbor Road begins to the left and Akoni Pule Highway (Route 270) begins to the right (mauka/northeast). The harbor occupies roughly 113 acres owned by the State of Hawai‘i. DOT-H Division records indicate portions of Kawaihae Harbor are located on “ceded lands” (see **Section 9.15.1: Ceded Lands**), including former Crown and Government lands and submerged lands (which are also considered part of the ceded lands trust). The two Kawaihae small boat harbors (North and South) are also State-owned, but under control of the Hawai‘i Department of Land and Natural Resources, Division of Boating and Ocean Recreation (DLNR DOBOR) (Helber, Hastert & Fee, 2009).

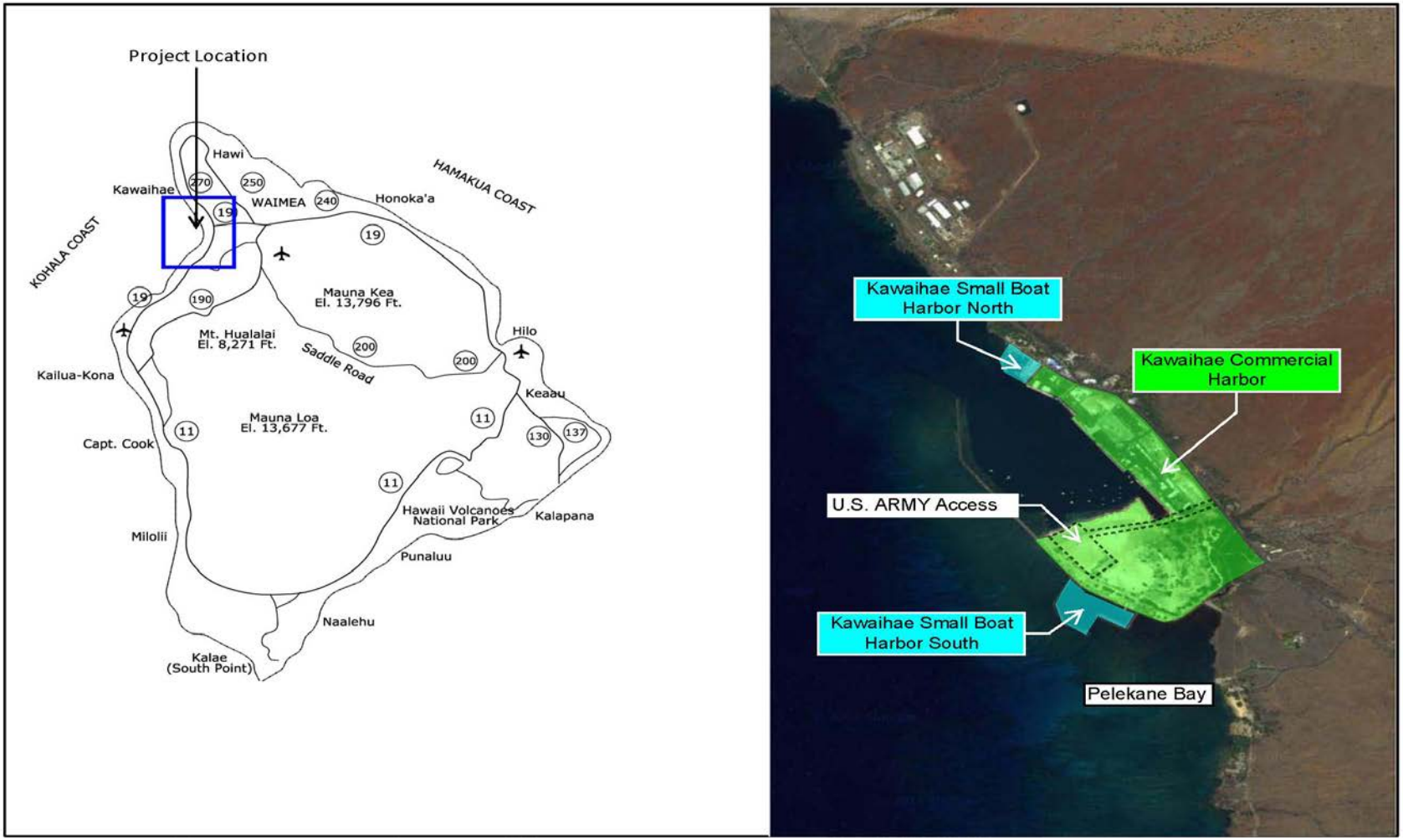
1.4 History

The State of Hawai‘i Department of Transportation (DOT) was established in 1959 to provide air, land, and water transportation facilities supporting commerce and the state’s economy by providing efficient and cost effective transportation systems. It is comprised of three modal divisions: Airports, Harbors and Highways. Together, these three divisions constitute an inter-modal system that contributes to the convenience and welfare of Hawai‘i’s community.

DOT, Harbors Division (DOT-H) is responsible for administering and managing the State-owned facilities used by commercial cargo, passenger and fishing operations. Chapter 266, Hawai‘i Revised Statues (HRS), delineates this responsibility as the control, management, use and regulation of commercial harbors and their improvements. Navigable waters (e.g., Kawaihae Harbor turning basin and entrance) and navigational features (e.g., breakwaters) are under the authority of the US Army Corps of Engineers (USACE).

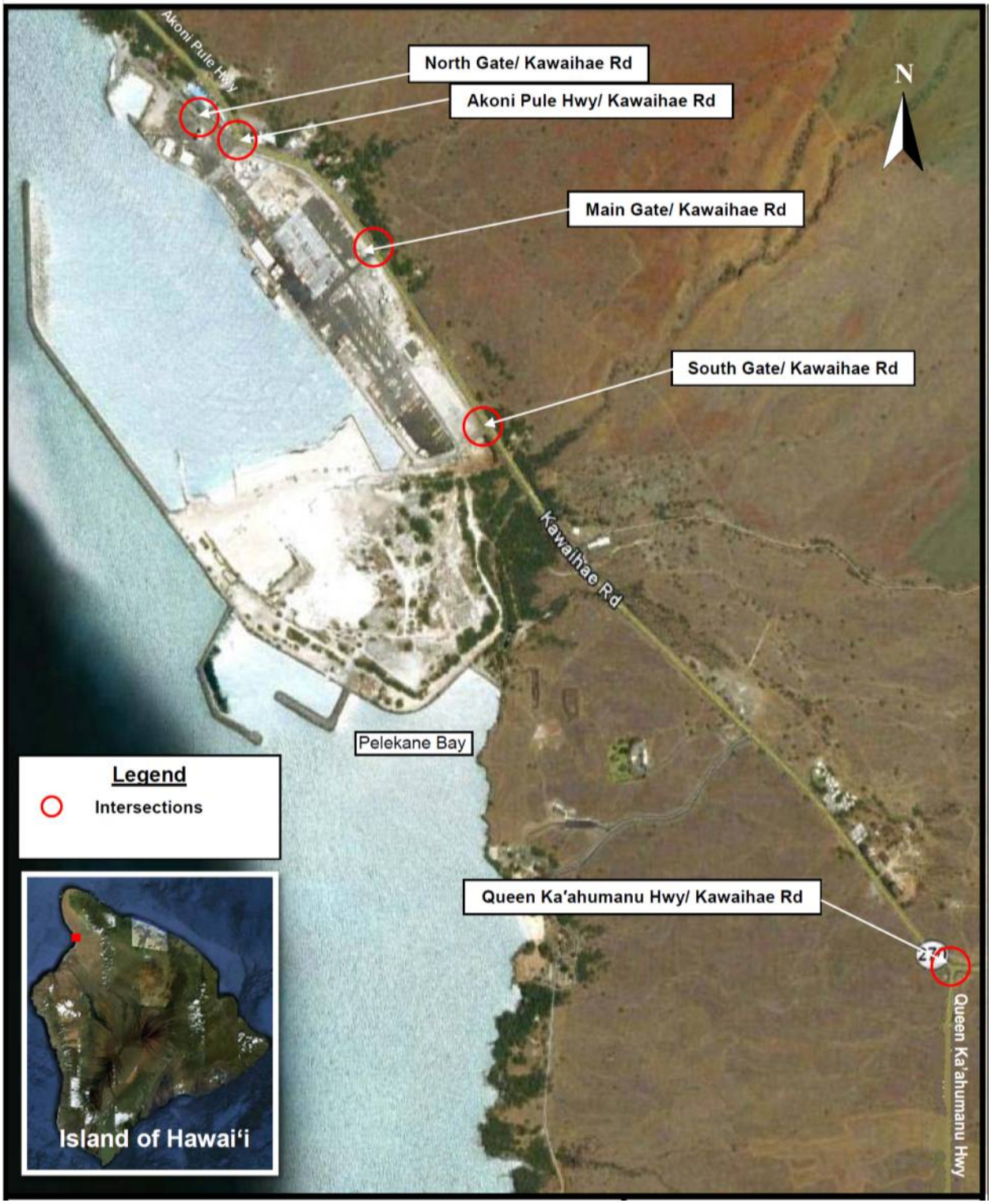
Hawai‘i Island is served by two commercial harbors: Hilo Harbor located on the northeast coast and Kawaihae Harbor on the northwest coast. Together these harbors work as an integrated system bringing all consumable goods, durables, building materials and fuel to the island. Cargo transported to Hawai‘i Island is integrally linked to Honolulu Harbor, where the majority

Figure 1-1: Location of Kawaihae Harbor



Source: SSFM International and Google Maps

Figure 1-2: Roads and Intersections Near Kawaihae Harbor



Map Base: Google Maps

of cargo first arrives into the state. Most cargo is then transferred to other vessels in Honolulu Harbor before it is transshipped to Hilo or Kawaihae.

Kawaihae was a major port throughout the 1800s. Large forests of sandalwood were harvested on the slopes of Mauna Kea and brought to Kawaihae for shipment. Thousands of heads of cattle were brought down from Parker Ranch to be shipped throughout the islands.

In 1946, the harbor experienced a 12-foot high tsunami, which brought much destruction. In 1957, the USACE began construction of a commercial harbor and main breakwater to allow use by larger barges. The dredge material consisted of cut and scraped corals that were used in part to create a landfill that would later be used to build the port facilities. The harbor was completed in 1959, the same year Hawai'i became a state. The harbor limits were widened and the breakwater was extended in the early 1960s.

In 1975, the Queen Ka'ahumanu Highway was completed connecting Kona International Airport at Keāhole to Kawaihae Harbor. This generated further growth, including a number of high-end resorts which used the harbor for bringing in construction materials. Akoni Pule Highway was dedicated in 1973, providing further access to the Kawaihae district and harbor. The harbor was expanded in the 1980s, and in 1992 a bridge connecting the terminals was added at Kawaihae, along with extensions of the overseas pier and marginal wharf. Smaller incremental improvements have since followed. Damage to Pier 1 and the north end of Pier 2 caused by the October 15, 2006, earthquake rendered them temporarily unusable. In 2009 pier repairs were completed, financed from the proceeds from the State's insurance policy.

1.5 Existing Facilities at Kawaihae Harbor

The existing layout of Kawaihae Harbor is shown in **Figure 1-3: Existing Conditions at Kawaihae Harbor**. Committed actions are limited to minor reconfiguration of some yard facilities as shown in the colored overlay in the figure.

1.5.1 Secured Areas

All commercial harbors are secured facilities. Traffic ingress and egress is limited by security regulations to those having a purpose for being on harbor property. All individuals accessing the harbor require a Transportation Worker Identification Credential (TWIC) and Maritime Security Awareness (MSA) training certification.

Within the security perimeter, Kawaihae Harbor currently has two piers that serve a range of different users.

Pier 1 has 412 feet of berthing space, 4.6 acres of yard space, 8,300 square feet of shed space and is primarily used by cement barges. Pier 2 has 1,150 feet of berthing space and 16 acres of improved area for cargo handling and storage operations. The majority of use Pier 2 is by interisland cargo and fuel barge operators. Pier 2 also serves other miscellaneous users as needed. Commercial harbor piers and yards are multi-use facilities that are flexible enough to serve a range of different users.

At Pier 1, Hawaiian Cement unloads bulk cement from barges through pneumatic pipelines to a nearby storage facility. The north shed at Pier 1 is leased by Liquid Robotics for marine research. The south shed is used by DOT-H for storage. In addition, cattle transfer operations occur at Pier 1.

Young Brothers, Limited (YB) operates interisland barge services from the north end of Pier 2 with barge calls typically twice a week. Matson Navigation Company, Inc. (Matson) operates barge services from Pier 2B with barge calls three times a week. Specifically, Matson's cargo barge Mauna Loa calls on Mondays and Fridays while the roll-on/roll-off (RO/RO) barge Waialeale calls on Wednesdays. Top-pick forklifts are used to load and unload containers from barges, although one of the Matson barges, Mauna Loa, has its own ship-board crane. The Mid-Pacific Petroleum fuel storage facility is located mauka of Pier 2 in the secured area.

1.5.2 Harbor Areas Outside of the Security Perimeter

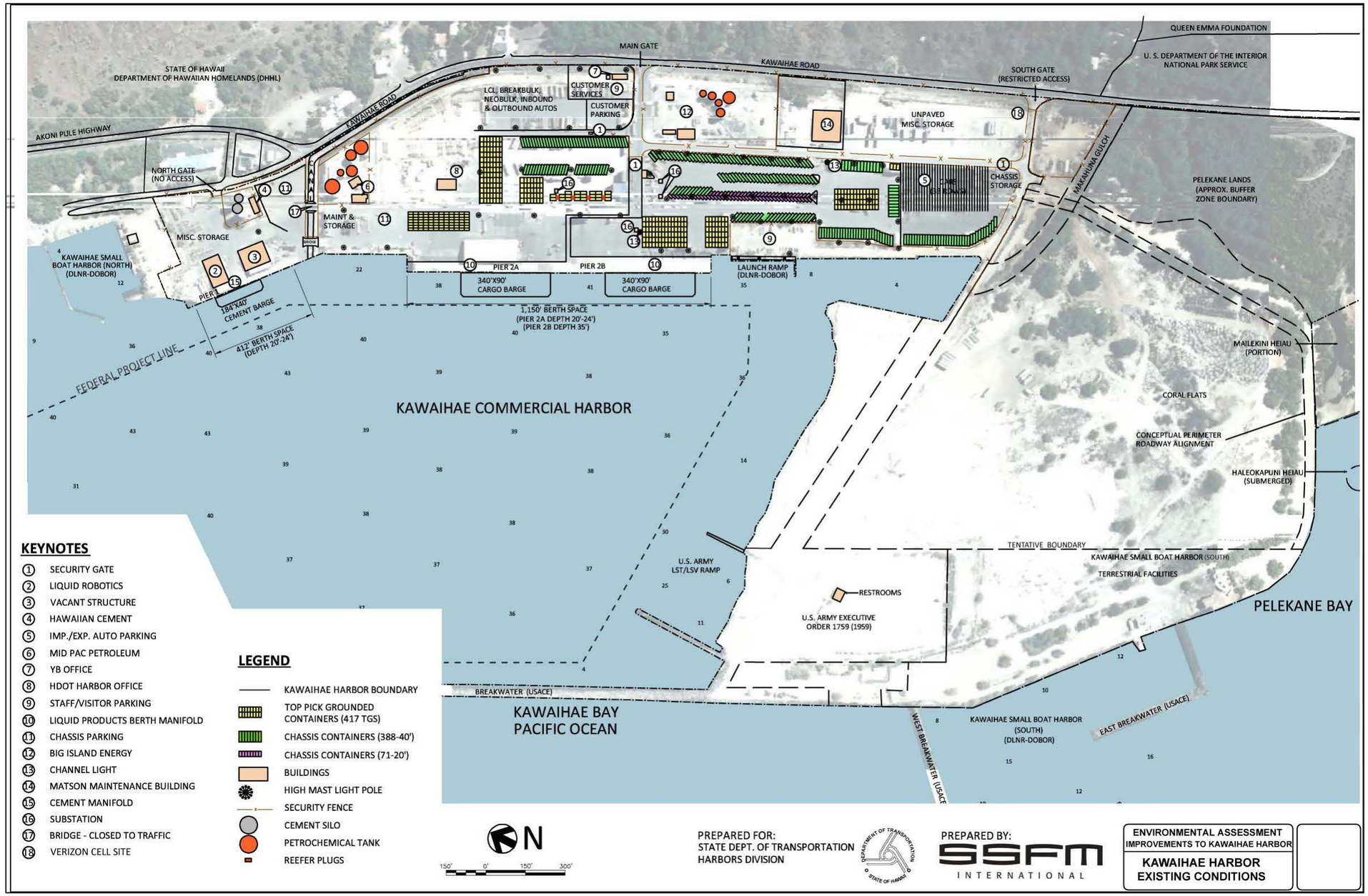
Outside of the secured area, uses include Big Island Energy Co. LLC (dba Akana Petroleum) facilities, A & B Fleet Services operations and various truck staging areas, as well as two recreational docks.

A recreational small craft loading dock (referred to as the dinghy dock) runs parallel to the revetment with an associated perpendicular finger pier (or boat dock). These facilities are located to the south of Pier 2B, outside of the security perimeter. Much of the existing timber-framed docks are severely rotted and deteriorated. Temporary off-shore moorings are also being utilized within the commercial harbor. Water access to the off-shore moorings and dinghy dock/finger pier require that recreational users cross through navigational areas also used by commercial harbor traffic.

The Coral Flats area is a peninsula of land outside the security perimeter created from coral spoils of the original dredging of the harbor in the 1950s. Coral Flats extends out from the southern end of the Kawaihae Harbor property and separates Kawaihae Commercial Harbor from Pelekāne Bay. It contains a number of recreational resources. The undeveloped Kawaihae Small Boat Harbor (South) is located at the western end of the Coral Flats area, and nearby facilities also serve canoe clubs, a surf club, and other users. Coral Flats also offers space for extraction of the coral spoils material.

At the Coral Flats area, the US Army owns and operates a landing ramp and an easement authorized by Governor's Executive Order (EO) No. 1759, which allows them to conduct military operations and transfer troops, vehicles, explosives and other goods. (Refer to **Section 9.15.2: Executive Orders** for more information on the Army's land status within Kawaihae Harbor). This area is used by the 45th Army Corps Support Group (Forward) to off-load Logistics Support Vehicles (LSV) to be taken to Pohakuloa Training Area (PTA). The off-loading generally occurs by dropping down a ramp from the shipping vessel after it beaches in the shallow landing area. At times, the Army also makes use of the state piers for this purpose. The use and need varies according to the status of deployment and scheduling of training exercises.

Figure 1-3: Existing Conditions at Kawaihae Harbor



Source: Adapted from *Hawai'i Commercial Harbors 2035 Master Plan Update*

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1.6 Planning Process for Hawai‘i Island Commercial Harbors 2035 Master Plan Update and Kawaihae Development Studies

1.6.1 Hawai‘i Island Commercial Harbors 2035 Master Plan

DOT-H considered the needs of the Hilo and Kawaihae harbors on Hawai‘i Island as an inter-connected system, since the two ports function interdependently as part of a single system providing the movement of goods to and from Hawai‘i Island. The 2035 Master Plan is a strategic planning guide for ensuring continuous and effective management and operations of the two harbors. The 2035 Master Plan sought to ensure that the needs of harbor users would be adequately met by accommodating current and future demand, addressing congestion, ensuring safe and secure operations, and avoiding or minimizing negative impacts on the environment and cultural sites. The 2035 Master Plan was completed in August 2011, and updated two earlier plans, the *Hawai‘i Commercial Harbors 2020 Master Plan* (1998) and the *Hilo and Kawaihae Harbors 2010 Master Plan* (1989).

The 2035 Master Plan included the following technical studies:

- Sea-Level Rise Vulnerability Study (2009).
- Cargo and Passenger Forecast (Sept, 2009).
- Wave and Surge Conditions Studies at Hilo and Kawaihae Harbors (March, 2010).
- Kawaihae Harbor 2006 Earthquake Damage and Repair Summary (March, 2010).
- Cost Estimates for Commercial Harbors 2035 Master Plan (March, 2010).
- Logistics Cost Analysis (Oct, 2009).
- Future Berth and Yard Requirements (2011).
- Economic Impact Study of Harbor Economies - Island of Hawai‘i (May, 2010).

The following issues and challenges specific to Kawaihae Harbor were identified in the 2035 Master Plan, and were considerations in identifying needs and formulating three alternatives to address those needs:

- Maritime space is finite and under competition from a wide variety of users.
- Because of limited space and competition, maritime-dependent uses compete for priority over other ancillary uses that are “maritime related”.
- State law requires the Hawai‘i Department of Agriculture (DOA) to have dedicated space for biosecurity and agricultural inspections, and the facility needs to be centrally-located convenient to the harbor and cargo handling operations.
- The state Farm Bureau and DOA are concerned about storage of perishables, and covered storage/refrigerated units are needed for exports and imports.
- Most fuel brought to Hawai‘i Island arrives in Hilo and must be trucked over to Kawaihae or West Hawai‘i destinations, but storage capacity at Kawaihae is limited. Challenges specific to Kawaihae include locating fuel storage: outside the tsunami inundation zone, outside the US Army safety arc, out of view of National Park Service

(NPS) property at Pu'ukoholā Heiau National Historic Site (NHS), and to improve Kawaihae Village's aesthetics.

- Kawaihae Road has limited capacity and truck traffic destined for the harbor also creates visual and vibration impacts to Pu'ukoholā Heiau NHS.
- Fencing should allow flexibility (secured, open/staffed for access control) depending on security needs, vessels in port, etc.
- Should Kawaihae Harbor ever start to receive direct foreign shipments, US Customs would need space with docks for removal, inspection, and return of shipments.
- Adequate space is needed for safe and secure storage of automobiles and to protect them from the elements and theft.
- Sea level rise from global climate change is expected to be one meter by the end of the 21st century. Kawaihae Harbor will have to adapt.
- Cargo volumes are forecast to grow, and expansion areas need to be identified that will allow safe cargo handling yards, increased berthing capacity, and staging areas for new products.
- Pu'ukoholā Heiau NHS is affected by visual intrusion, noise from cargo operations, and vibration impacts from construction.
- The military actively operates the Landing Ship, Tank (LST) ramp in the Coral Flats area, where military cargo is off-loaded from military ships, and eventually transported. Other vessels that may be used in the future may use existing harbor pier space. There is a "safety arc" that must be maintained from the military's operations. The challenge is to meet the military's needs while not hindering other civilian uses of the area.
- If ferry service is ever provided, potential locations for passenger service that are separate from cargo functions need to be identified.
- Suitable locations are needed within the harbor to accommodate a growing timber industry.
- Suitable locations are needed within the harbor to accommodate the aquaculture industry in the processing, storage, and transportation of products.
- Demand has been increasing for industrial lots at Kawaihae harbor for truck staging and staging of materials

The 2035 Master Plan considered three economic scenarios – the Low Case, the Base Case, and the High Case based on varying rates of growth in harbor activity to forecast harbor needs at both Hilo and Kawaihae Harbors in 2035. The Low Case essentially keeps the demand for harbor facilities at status quo, with no growth a scenario considered unlikely, and therefore no alternatives were developed for the Low Case. The Master Plan developed two alternatives for the middle or Base Case scenario of economic growth, which forecast economic growth based on existing trends. A third alternative was developed using the High Case, with a growth rate that had been experienced in the 1990s.

Based on the issues and challenges identified above, the 2035 Master Plan called for the improvements to address Kawaihae Harbor's needs as described in **Table 1-2: Needs and the Actions to Address Those Needs in 2035 Master Plan**.

Table 1-2: Needs and the Actions to Address Those Needs in 2035 Master Plan

Need Identified	Action in 2035 Master Plan
To accommodate future berthing demand	Extend Pier 2A by 340 feet and build a new 325-foot Pier 2C (Base and High Cases)
	Construct a new Pier 3 on the north side of the Coral Flats (High Case)
To accommodate storage needs within and near Kawaihae Harbor	Reorganize the container storage area inland of Pier 2 for greater efficiency.
	Construct a new container storage terminal at the Coral Flats in association with future Pier 3 (High Case)
	Facilitate off-harbor storage of liquid-bulk cargo
	Grade Coral Flats area for industrial lots for truck staging
To accommodate the location for a Department of Agriculture biosecurity, inspection, quarantine and treatment facility	Identify and reserve a one-acre site for such a facility
To address limited use of Pier 1 and area behind it because it is impacted by winter surge issues and cannot be used all year	Use a portion of the Coral Flats for dry-bulk cargo, which currently is stored behind Pier 1
	Extend Pier 2A by 340 feet and build a new 325-foot Pier 2C (Base and High Cases)
To accommodate ferry operations in an area west of the Coral Flats if future demand dictates need for such a facility	Construct a new Pier 3 on the north side of the Coral Flats (High Case)
To address traffic congestion at Kawaihae Harbor	Improve the harbor entrances and roadways at the main and south gates for efficient security clearance without creating stacking lanes that back up onto regional roadway
To ensure safe barge navigation	Provide dredging in front of Pier 2, and in the longer term, Pier 1 (Base Case) and future Pier 3 (Base and High Cases)
To avoid or minimize future impacts from Kawaihae Harbor on the NPS Pu'ukoholā Heiau NHS	Maintain the Pelekāne Buffer Zone
To enhance safety and security from adjacent users	Dedication of land for perimeter road leading to Kawaihae Small Boat Harbor (South)
	Provide fencing along perimeter road to separate cargo use from other users.

Source: SSFM International, Inc.

1.6.1.1 Public and Stakeholder Involvement for 2035 Master Plan

An extensive public outreach effort was conducted as part of the 2035 Master Plan. This outreach effort considered the need to reach out to environmental justice communities as part of compliance with Title VI of the Civil Rights Act and Executive Order 12898, as well as Hawai‘i Act 294. Public involvement for the 2035 Master Plan included the following:

- Three sets of public informational meetings held in May 2009, December 2009, and August 2011. All three sets included one meeting in Hilo and one meeting in Kawaihae.

- Two stakeholder meetings (one in Hilo, one in Kawaihae), May 2009. Stakeholders included a wide range of interests, including private citizens, educational/social institutions, major landholders, harbor users, utilities, and nearby businesses.

- Meetings with individual stakeholders, including:
    - Kawaihae Local Resource Council.
    - DNLR DOBOR.
    - Representative Cindy Evans.
    - Matson Navigation.
    - Young Brothers.
    - Indigo Seafood (aquaculture company).
    - Hawai‘i Pilots Association.
    - Amerigas.
    - National Park Service (Pu‘ukoholā Heiau NHS).
    - Department of Homeland Security, US Customs and Border Protection.
    - US Army Garrison Hawai‘i.
    - Hawai‘i Department of Agriculture.
    - Farm Bureau.
    - Pasha Hawai‘i Transport Lines.
    - Hawai‘i Harbors Users Group (two meetings).
    - South Kohala Community Development Plan Action Committee.
    - Horizon Lines.

1.6.2 Kawaihae Development Studies

The Kawaihae Development Studies were conducted after the completion of the 2035 Master Plan and considered issues needed to implement the recommendations from the plan at Kawaihae Harbor. The following technical studies were conducted.

1.6.2.1 Security Needs Plan

The *Kawaihae Harbor Security Needs Plan* (Security Needs Plan) (AECOM, 2011) was prepared to assist HDOT with conformance with Marine Transportation Security Act (MTSA) regulations, to identify ground-based terminal security requirements, and to recommend terminal security improvements for Kawaihae Harbor. Specific improvements were identified and compiled into

an action plan for implementation. The Security Needs Plan is incorporated by reference into this EA.

Projects to improve the security of Kawaihae Harbor recommended by the Security Needs Plan include:

- Upgrade all harbor entry gates (Main Gate Complex, South Gate and North Gate) in accordance with US Coast Guard (USCG) requirements.
- Install security infrastructure at the Coral Flats area.
- Install new or replacement fencing along the harbor's secure boundary.
- Prepare a port-wide parking study.
- Define a new secure labor parking area(s).
- Install new lighting and Closed Circuit Television (CCTV) cameras.
- Cover over an open channel in the northern portion of the harbor.
- Relocate the new Hawai'i District Office building outside the harbor's secure area, and locate a security center in the new building.

1.6.2.2 Drainage Study and Report

Makahuna Gulch crosses Kawaihae Harbor property dividing the existing harbor (fronting Piers 1 and 2) and the Coral Flats area. The drainage study and report (SSFM, 2011) recommended drainage improvements that will be necessary at Makahuna Gulch to ensure adequate flow capacity during flash flood storm events. Such drainage improvements would be necessary if DLNR DOBOR chooses to improve the perimeter roadway on the Coral Flats as described in greater detail in **Section 3.5.2: Security Fencing and Dedication of Land for Small Boat Harbor (South) and Perimeter Road**.

1.6.2.3 Traffic Analysis

A detailed traffic report was prepared to consider the implications of traffic needs at Kawaihae Harbor through the planning horizon of the 2035 Master Plan, and is provided in this EA as **Appendix H: Traffic Impact Assessment Report**. Improvements proposed by the traffic report are covered at length in **Chapter 6: Traffic**, and include improvements to Kawaihae Road near the South and Main Gates, specifically relocating the South Gate slightly to the north, and providing left turn storage lanes and deceleration areas. In addition, the traffic study presumes the Kawaihae Bypass Road is built by 2035, and considers the connection between the Main Gate and this bypass road.

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CHAPTER 2: PURPOSE AND NEED FOR ACTION

Eighty percent of all consumer goods used in Hawai‘i are imported. Hawai‘i’s commercial harbors receive and process 98.6 percent of these imported goods (Lee and Olive, 1994). Ocean transportation is thus Hawai‘i’s lifeline to the world, supporting every facet of the local economy: tourism, construction, national defense, agriculture and all other industries. Current prosperity and quality of life are highly reliant on the commercial harbors system. Ocean transportation provides the most cost effective and energy efficient method to transport cargo in and out of the state from the US mainland and foreign countries to residents and businesses.

Air transportation is substantially more costly than ocean shipping and is not an economical or practical alternative for most goods. If dependable and efficient ocean surface transportation were eliminated, Hawai‘i’s economy would experience substantially higher prices and shortages on all imported goods. Therefore, maintaining an efficient commercial harbors system is vital to the well-being of Hawai‘i’s economy.

A study performed for the Hawai‘i Harbor Users Group entitled *The Impact of Hawai‘i’s Harbors on the Local Economy* (Laney, 2007) documented just how critical the state’s harbors are to Hawai‘i’s economy, and the consequences of not addressing major problems in the commercial harbors system. According to Laney, if Hawai‘i's harbors are not upgraded to meet projected future demand, the loss of real gross domestic product (RGDP) could amount to more than $50 billion by 2030 (in 2007 dollars). Based on modest assumptions about overall impacts, the slightest reduction (0.1 percent) in the growth of Hawai‘i’s RGDP due to inadequate harbors will, by 2030, result in a reduction in RGDP that almost equals estimated RGDP for 2007 (Laney, 2007). The RGDP is defined as the gross domestic product adjusted for inflation.

Moreover, if harbor problems are ignored, by 2030, Hawai‘i’s standard of living will be reduced significantly and price levels will be substantially higher. The impact on everyday consumer goods will be pronounced. Inadequate harbor improvements will restrict shipping access and capacity and drive up the cost of food, household products, small appliances, and furniture by an average of 18 percent. In practical terms, this means that without harbor upgrades, the cost of a can of green beans in 2030 will go from $2.88 to $3.42, a case of cola from $9.83 to $11.67 and a queen-size mattress from $1,094.48 to $1,299.08 (Laney, 2007).

Laney considered harbor growth in 20-foot equivalent units (TEUs), a measure of the capacity of a 20-foot container. While Kawaihae Harbor only accounted for 4.2 percent of statewide TEU volume in 2005, it had the largest growth (245.2 percent) in TEUs at commercial harbors statewide over the 10 years from 1995 to 2004 (Mercator Transport Group, 2005, quoted in Laney, 2007).

The 2035 Master Plan also considered the economic effects of the commercial harbor system on Hawai‘i Island and the financial repercussions if the system were curtailed. Construction costs would rise due to a shortage of building materials, and retailers and wholesalers would need to transport materials by air, resulting in shortages of supplies and higher costs. (SMS, 2010)

While the State of Hawai‘i is making strides towards energy self-sufficiency, at the present time, the great majority of the state’s energy used for electrical generation and transportation comes from petroleum imported through the State’s harbors. The 2035 Master Plan notes that the State’s continuing growth has resulted in a need to increase the ability to bring more fuel in through Kawaihae Harbor; at present, most of the island's fuel is transported through Hilo Harbor.

2.1 Project Purposes

The purposes of the proposed actions are to:

- Serve existing and future demand for harbor facilities.
- Ensure adequate berth length and yard space to accommodate multiple users with varying length and depth of vessels.
- Ensure safety of navigational and land operations.
- Ensure Kawaihae Harbor meets current federal requirements for harbor security at gates.
- Ensure safety for workers and recreational users at the Coral Flats.
- Support Department of Agriculture efforts to protect biosecurity.
- Protect the public and public resources by improving island resiliency when natural disasters occur.

2.2 Need for the Action

The following project needs drive the purposes of the project. Each is discussed in detail below.

- To accommodate increased cargo volumes.
- To add berthing and yard spaces.
- To improve navigational safety .
- To improve harbor security and safety at access gates.
- To improve safety for workers and adjacent recreational users.
- To allocate space for Department of Agriculture facility to improve biosecurity and food security.
- To improve resiliency and maintain flexibility to respond to natural hazards.

2.2.1 Need to Accommodate Increased Cargo Volumes

Increasing the capacity of the harbor will be essential to meet future demands. **Table 2-1: 2008 and Projected 2035 Cargo Segment Volumes for Hawai‘i Island** lists the growth that is expected at Hilo and Kawaihae Harbors under the three scenarios studied in the 2035 Master Plan.

Table 2-1: 2008 and Projected 2035 Cargo Segment Volumes for Hawai'i Island

Cargo Segment	2008 Volumes	2035 Volumes Low Case	2035 Volumes Base Case	2035 Volumes High Case
Containers (TEUs)*	152,613	219,860 (45%)	330,847 (117%)	430,810 (182%)
General Break Bulk (tons) **	399,067	203,765 (-49%)	278,711 (-30%)	413,962 (3.7%)
Autos (each)	32,969	n/a	59,000 (79%)	n/a
Break Bulk Lumber (mbm)	20,457	n/a	32,000 (56%)	n/a
Cement (tons)	54,640	n/a	50,000 (-8%)	n/a
Petrochemicals (barrels)	4,903,416	5,200,000 (6%)	7,000,000 (43%)	9,200,000 (88%)
Cruise Passengers	381,884	200,000 (-48%)	375,000 (0%)	590,000 (54%)

*TEU = Twenty-foot equivalent unit (i.e., capacity of a 20-foot container)

** General Break Bulk is the amount in tons of cargo that must be broken out of or removed from containers before being shipped further. This occurs when a single container is used for more than one shipment. Lumber is also transported as break bulk (must be separated out into separate shipments).

Source: Moffatt and Nichol, 2011a

Increased cargo includes petrochemicals. At Kawaihae Harbor, there are two storage facilities located on Harbors property. However, the South Kohala Community Development Plan called for adding more fuel storage capacity outside of the commercial harbor for the following reasons:

- To locate new storage facilities outside the tsunami inundation zone.
- To locate new storage facilities outside the US Army safety arc for ammunition transport.
- To reduce the visual intrusion for the National Park Service.
- To improve the aesthetics of the village center at Kawaihae.

Fuel storage is the responsibility of the industry rather than the harbor. For these reasons, fuel storage capacity is not included in the proposed project.

2.2.2 Need for Additional Berthing and Yard Spaces

A berth capacity analysis was performed for Kawaihae Harbor as part of the 2035 Master Plan (Moffatt and Nichol, 2011a). Most of the existing barges using Kawaihae Harbor range from 295 to 350 feet in length; the one exception is a cement barge that is 184 feet long.

The 2035 Master Plan noted that cargo operators report they expect to replace their current barges with longer ones. New 400-foot barges will be about 50 to 105 feet larger than most barges currently in use. At the time the 2035 Master Plan was prepared, the expectation was that the current barges will be replaced within 15 to 20 years. With lengthier barges, there will not be enough berthing room, so the barges and tugs will be forced to wait off-shore until adequate space opens up, using additional fuel, generating added pollution, and delaying transport of goods.

As shown in **Table 2-2: Estimated Total and Additional Berth Length Recommended for Kawaihae Harbor**, there will be substantial shortages of berthing area within the Kawaihae

Harbor under the Base Case and High Case without additional capacity added by 2035. These additional pier lengths equate to two to five typical barge berths.

Table 2-2: Estimated Total and Additional Berth Length Recommended for Kawaihae Harbor

2035 Forecast Scenario Total Berth Length	Total Berth Length (Feet)	Additional Length Over Existing (Feet)
Existing	1440	-
2035 Low Case	1440	None
2035 Base Case	2355	793
2035 High Case	3022	1460

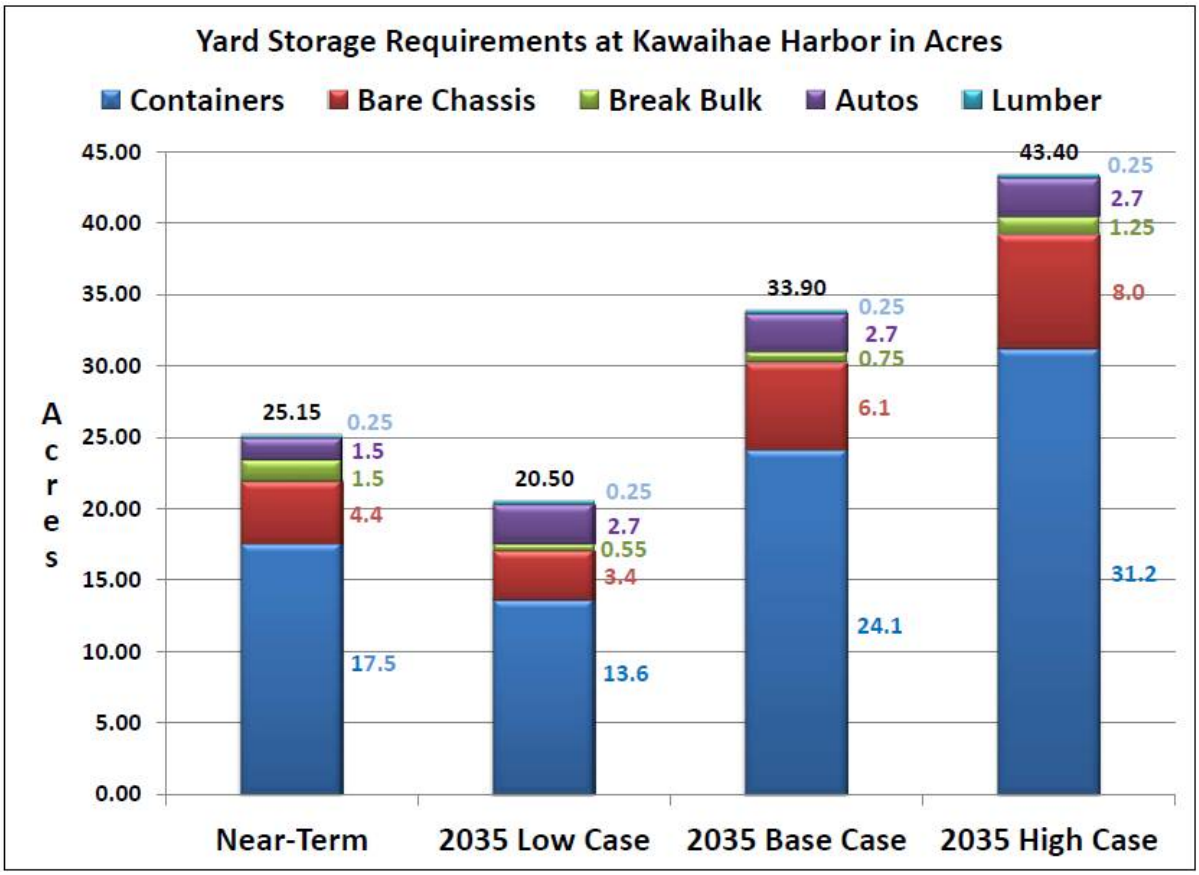
Source: Moffatt and Nichol, 2011a in *Hawai'i Island Commercial Harbors 2035 Master Plan Update*

The barges are typically pulled into the harbor by a tug boat, which also assists the barge in turning and docking. Currently the harbor has enough space to accommodate two 350-foot barges but only one of the two necessary 100-foot tugs. The barges must be directly adjacent to the pier as they are equipped with cranes that move cargo from the barge onto the cargo yard. When there are two barges at the harbor, one of the tug boats is required to tie up alongside the barge away from the pier due to the current lack of berthing space. In this situation, workers must be aboard the tug boat while the crane is moving cargo overhead, and tug workers must cross through the loading or unloading operations areas on the barge to access land. This situation is considered unsafe; for worker safety, tug boats and barges must tie up directly to the pier so that workers can disembark without having to traverse cargo operations.

For similar reasons, it would not be safe or practicable to tie up a second row of barges outside the two barges that can be tied up directly to the pier. Safety concerns for workers would be similar to those described above. In addition, the loading and unloading of cargo requires direct access to the pier, as it would be unsafe to hoist cargo over the inside barge. Finally, the navigation of the inside barge would be blocked by the outside barge.

Yard areas will also need to be expanded at Kawaihae Harbor by 2035 to meet future demands. Storage acreage for different commodities is shown under the different scenarios in **Figure 2-1: 2035 Yard Storage Requirements at Kawaihae Harbor**. In the figure, "near-term" reflects existing conditions. In all cases, the acreages shown assume Less than Container Load (LCL, a shipment not large enough to fill a standard cargo container, also called general break bulk commodities) are stored on-site, as is currently the case. This is consistent with the assumptions in the 2035 Master Plan. In all cases, projected needs will be greater than what is currently provided.

Figure 2-1: 2035 Yard Storage Requirements at Kawaihae Harbor



Source: Adapted from Moffatt and Nichol, 2011a

2.2.3 Need to Improve Navigational Safety

In order for barges and other vessels to access the piers safely, the water within the harbor needs to be at least 35 feet below mean lower low water level to ensure safe passage through the area. Existing shallow areas, which vary in depth but are as shallow as about 14 feet, are navigational hazards; these hazards were created by the deposition of sediments in areas that were dredged during previous harbor maintenance/improvement projects over past decades.

2.2.4 Need to Improve Harbor Security and Safety at Access Gates

Cargo truck traffic at Kawaihae Harbor is projected to increase from 2008 levels, which when combined with auto import/export trips, will result in an increase in gate traffic. **Table 2-3: Estimated Daily Vehicle Trip Counts for Kawaihae Harbor in 2008 and 2035** shows how much traffic will increase under the three different scenarios. Traffic backups will become an increasing problem if improvements are not made. Backups will be caused by increased truck and auto volumes as well as by security clearances during periods of high security threat levels. Longer queuing space will be needed to keep traffic from backing up into the travel lanes of Kawaihae Road.

Table 2-3: Estimated Daily Vehicle Trip Counts for Kawaihae Harbor in 2008 and 2035

Cargo Type	Time Period	2008	2035 Master Plan		
			Low Case	Base Case	High Case
Containers	Annual Ave. Daily Truck Trips	230	332	574	758
	Peak Monthly Daily Truck Trips	274	398	689	910
	Peak Hourly Truck Trips	51	74	128	169
Lumber	Annual Ave. Daily Truck Trips	1	n/a	1	n/a
	Peak Monthly Daily Truck Trips	1	n/a	1	n/a
	Peak Hourly Truck Trips	1	n/a	1	n/a
Cement	Annual Ave. Daily Truck Trips	4	n/a	4	n/a
	Peak Monthly Daily Truck Trips	5	n/a	5	n/a
	Peak Hourly Truck Trips	1	n/a	1	n/a
Petrochemicals	Annual Ave. Daily Truck Trips	1	2	2	3
	Peak Monthly Daily Truck Trips	1	2	2	3
	Peak Hourly Truck Trips	1	1	1	1
Truck Totals	Annual Ave. Daily Truck Trips	236	339	581	765
	Peak Monthly Daily Truck Trips	281	406	697	918
	Peak Hourly Truck Trips	54	77	131	172
Auto Import/Export	Annual Average Daily Trips	42	n/a	86	n/a
	Peak Monthly Daily Trips	77	n/a	155	n/a
Cruise Taxis, Bus, etc.	Daily Vehicle Trips	n/a	n/a	n/a	n/a

Source: Moffatt and Nichol, 2011a

Since the September 11, 2001 attacks, a greater emphasis has been placed on the security of the nation's harbors. The 2035 Master Plan documented a number of security needs for the harbor, focusing on improving fencing, guard stations, access-control gates, and surveillance systems. Kawaihae Harbor must comply with Department of Homeland Security regulations.

Improvements to the Main Gate are needed to improve on-site security in light of the anticipated increase in truck traffic as noted above. The South Gate also needs security improvements and to be relocated to separate recreational users from commercial harbor activities as described above.

2.2.5 Need to Improve Safety for Workers and Recreational Users at Coral Flats

Current recreational activities within Kawaihae Harbor are focused on the Coral Flats area and include beach/swimming activities, surfing, canoeing, and fishing within the harbor. Recreational activities include YMCA Facilities, the Pua Ka 'Ilima 'O Kawaihae Cultural Surf Park and the Na Kalai Wa'a Moku 'O Hawai'i educational program (voyaging). In addition, there are existing small boat crafts and fishing taking place in the area. Finally, DLNR DOBOR has proposed developing the Kawaihae Small Boat Harbor (South) on the Coral Flats. There is a

need to provide access to recreational activities while also separating recreational users from the harbor's security perimeter. In particular, separation provided by fencing will both enhance the security of the harbor and protect the public from accessing areas of the harbor that could endanger them.

At the present time, recreational boaters drive through the South Gate, but there is no fence or other measure to discourage public access into the secured portion of the Harbor lands.

The separation of small boat and recreational users from commercial harbor users, both on the land-side areas of the harbor and in the water itself, is needed to ensure public safety. As the volume of cargo handled by the harbor increases over time, there will be an increased potential for conflicts between recreational users and commercial vessels in the water, as well as between recreational users and commercial vehicles on land. Water access to the off-shore moorings and dinghy dock/finger pier area require that recreational users cross through navigational areas also used by commercial harbor traffic.

Limited berthing areas for tug boats creates safety concerns as the tug may be forced to tie up alongside a barge. This poses safety concerns because there are workers aboard the tug boat while the crane is moving cargo overhead, and tug operators must traverse an operating area to access land.

2.2.6 Need to Allocate Space for DOA Facility

Hawai‘i has a fragile ecosystem with native biota that is highly vulnerable to human disturbances and invasions from alien species from overseas. Invasive species threaten Hawai‘i's natural environment and local economy by damaging native forests; competing with and causing the extinction of native flora and fauna; and carrying disease that may affect native species, agricultural crops, and humans (Howarth, et al., 2008).

The following laws cover the protection of the state's agriculture and ecosystems from invasive species by giving the DOA authority to inspect, quarantine and deny entry to contaminated cargo:

- Hawai‘i Revised Statutes (HRS) Chapter 141 Section 1-(5) authorizes DOA to provide facilities to quarantine, fumigate, disinfect, destroy, or exclude commodities infested with pests or any article which is, in itself, a pest, which may be injurious to the agricultural industries and forest resources of the state.
- HRS Chapter 150A Sections 5 through 7, regulate the importation and disposition of animals, plants, and microorganisms into Hawai‘i.
- Hawai‘i Administrative Rules Chapter 4-72 Section 3, requires inspection and certification of plants, propagative plant parts, and non-domestic animals prior to shipping between O‘ahu and the neighbor islands.

Food security at Kawaihae Harbor is a particular concern. There is an increasing emphasis on preventing contamination rather than simply responding to it. Increased capacity and frequency of inspections, preventative controls, expanded administrative detention or

quarantine of foods that are not found to be in compliance with the laws cited above, and authority to deny entry of foreign foods into the US are needed to ensure the safety of the State's food supply. One acre of space is needed for inspection, quarantine and treatment activities. In addition, an increased amount of covered storage and more refrigeration units are needed to reduce the potential for spoilage and prevent food from being exposed to the sun and other elements.

The 2035 Master Plan process identified the need for DOT-H to allocate space for a one-acre DOA facility within the harbor for the inspection, quarantine and treatment of goods coming in and out of the harbor. Such a facility, which will be built by DOA under a separate action, will address the needs for biosecurity and food security by allowing DOA to improve their inspection, treatment and quarantine services of food and agricultural goods, both entering and exiting the harbor. This will better enable DOA to protect the island's food and natural communities from health concerns and invasive species.

2.2.7 Need to Improve Resiliency and Maintain Flexibility

Hawai'i Island is threatened by a number of natural hazards, including tsunami, earthquakes, lava flows, and hurricanes. Maintaining the ability of the island's harbors to move goods after a catastrophic event is an important need from a civil defense and public safety perspective. In the event of an emergency, supplies of food, fuel, and building materials will all be in high demand. Kawaihae Harbor sustained damage to buildings and piers during the 2006 Kiholo Bay Earthquake. Hilo town and its harbor have been affected by several crippling tsunami over the past century. Hilo also has a higher threat from lava flows. Kawaihae harbor may be needed to operate as the island's primary harbor if a possible disaster strikes Hilo. Increasing the capacity of berthing areas and storage yards at Kawaihae is needed to provide sufficient facilities to handle emergency demands in the event a natural disaster strikes Hilo or other parts of the island.

2.2.8 Other Project Objectives

In addition to the purpose and need for the project, the following objectives were considered during the planning for this project. The following issues were raised by members of the public, adjacent property owners, public agencies, and DOT-H:

- Avoid or minimize harm to the environment, including the marine environment, shoreline and floodplains.
- Address global climate change by reducing greenhouse gas emissions.
- Adapt to global climate change and sea level rise.
- Avoid direct and visual effects of the Proposed Action on the nearby Pu'ukoholā Heiau National Historic Site (NHS). Visual intrusion, noise from cargo operations, and vibration impacts from construction activities and truck traffic are all concerns that have been expressed by National Park Service (NPS) officials.

- Avoid encroachment into the Pelekāne Lands buffer zone between the NHS and Kawaihae Harbor.
- Support the military's continued use of Kawaihae Harbor.
- Avoid significant adverse impacts elsewhere besides Kawaihae Harbor.

The following considerations, while not central to the Purpose and Need, are important to DOT-H and the success of the project. These considerations supplement the other criteria listed above:

- Ensure the action can be phased to fit within the available annual funding levels of the Harbor Special Fund.
- Optimize use of the existing facility.

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CHAPTER 3: ALTERNATIVES AND PROPOSED ACTION

The alternatives described in this chapter were developed to meet the need for improvement to Kawaihae Harbor as identified by the 2035 Master Plan and the Kawaihae Development Studies. This chapter also discusses alternatives that were not carried forward into this EA because they do not reasonably address the purpose and need.

Comments on the DEA-AFONSI were received from members of the public urging forward thinking and readiness for an inter-island passenger ferry. That possibility is explored in the 2035 Plan as part of multi-use of a future Pier 3. Pier 3 construction is not included in the medium-term phase improvements covered in this FEA-FONSI.

3.1 2035 Master Plan Alternatives

The process for developing the range of alternatives in the 2035 Master Plan involved screening criteria tied to the 2035 Master Plan's Purpose and Need. The Master Plan quantified future asset needs using demand studies including forecasts of socio-economic variables and Gross State Product analyzed by sector. Supply studies looked at berthing, yard, and terminal needs within both Hilo and Kawaihae Harbors. In addition, a wave and surge analysis, a sea level rise analysis and security requirements were considered.

Cargo forecasts and economic activity at Kawaihae Harbor were projected using Low, Base, and High Case scenarios that took into account a range of projected changes in Gross County Product and population growth, both of which influence economic activity. The forecasts considered the "container concentration" of cargo passing through Hawai‘i Island, which is defined as the number of containers per person. A higher concentration means that a greater number of containers per person will pass through the island's harbors. This reflects a current trend that an increasingly higher percentage of goods and commodities are being transported in containers. The current container concentration is 474 TEU per 1,000 people.

"Less-than Container Load" (LCL), or "Break bulk cargo", describes goods that must be loaded individually (items on pallets, in wooden containers, in drums, automobiles, etc.) and are not bulk commodities like concrete or fuels. When the size of a cargo shipment is not large enough to fit a standard cargo container, it is combined with multiple consignments and shipped together in a container. The forecasts show that cargo will increasingly be carried in containers.

Hawai‘i Island imports more goods than it exports; therefore a relatively large number of empty containers leave the harbor. This factor of "empties" was also considered in formulating scenarios.

Alternatives were developed for each scenario and these were presented to stakeholders and the community for input.

The Low Case scenario, which expects lower economic activity than past trends, made the following assumptions:

- Container volumes grow yearly assuming a 2.0% Gross County Product and 1.6% de facto population growth rate from 2009 - 2025; volumes then gradually begin to slow to the rate of de facto population growth.
- Volumes grow from the 94,097 TEU in 2008 to approximately 145,000 in 2035, an average 1.6% per year.
- No further increases in container concentration (containers per Hawai‘i Island person) of the general and break bulk market are expected.

The Base Case scenario, which anticipates growth in economic activity at levels of the past decade, assumed the following:

- Container volumes increase by an average 3.1% per year to the 2035 forecast period. This reflects the continuing trend of actual average changes of Gross State Product and Gross County Product that occurred from 2002-2008.
- Volumes grow from 94,097 TEU in 2008 to 217,083 TEU in 2035. This reflects a 2.9% annual growth in imports and a 3.7% annual growth in exports.
- Containerization of general cargo and break bulk materials increases; average concentration of containers relative to the population of Hawai‘i Island grows from approximately 474 TEU per 1000 people in 2008 to 700 TEU per 1000 people in 2035.

The High Case scenario, which uses a higher level of economic growth assumed:

- TEU volumes grow by a factor of 3.0 based on a higher 2.8% Gross County Product forecast. This average multiplier is assumed over the next decade and then declines over the remainder of the forecast period. In other words, this scenario assumes that near-term growth exceeds past growth trends of Gross County Product, then equalizes over the longer term to reflect past trends so that by 2035, TEU volume growth is in line with Hawai'i Island’s long term Gross County Product growth. The rationale for this assumption comes from the fact that the historic growth rate at the harbor has repeatedly exceeded past forecasts.
- Containerization of traditional bulk and break bulk commodities increases at a rapid rate, such that the container concentration grows to approximately 913 TEU per 1000 people compared to the base case assumption of 700 TEU per 1000 people and 2008 levels of 474 TEU per 1000 people.

Three alternatives, two using the Base Case assumptions for growth and one using the High Case assumptions for growth were developed in the 2035 Master Plan. The 2035 Master Plan selected the alternative based on the High Case as the “Preferred Alternative” for planning purposes because Hawai‘i Island has historically exceeded growth expectations, with economic growth exceeding the rate of past forecasts. The Plan’s Preferred Alternative identified long-term needs at the harbor.

The 2035 Master Plan Preferred Alternative included the following elements in the near to mid-term (within the next 10 to 15 years):

- Extend Pier 2A by 340 feet and building a new 325-foot Pier 2C.
- Reorganize the container storage area inland of Pier 2 for greater efficiency.
- Facilitate storage of liquid-bulk (fuel) to an off-harbor location.
- Provide a one-acre space for a Department of Agriculture biosecurity, inspection, quarantine and treatment facility.
- Accommodate future demand for industrial lots for truck staging and holding within the Coral Flats.
- Improve the harbor entrances and roadways at the main and south gates.
- Provide dredging to ensure safe barge navigation in front of Pier 2.
- Maintain the Pelekāne Buffer Zone between Coral Flats and the National Park Service's Pu'ukoholā Heiau National Historic Site to minimize harbor impacts on park property.

The 2035 Master Plan Preferred Alternative included the following elements in the longer term (over 15 years, and possibly longer):

- Construct a new Pier 3 on the north side of the Coral Flats.
- Construct a new container storage terminal at the Coral Flats in association with future Pier 3.
- Provide dredging to ensure safe barge navigation at Pier 1 and a future Pier 3.
- Use a portion of the Coral Flats for dry-bulk cargo, which is currently served behind Pier 1 (which is impacted by surge issues during winter months).
- Accommodate ferry operations in an area west of the Coral Flats if future demand dictates need for such a facility.

3.2 Development of Screening Criteria for Alternatives

After the 2035 Master Plan was completed, planning continued through the preparation of Kawaihae Development Studies to consider security, drainage and traffic issues. With the findings of both the 2035 Master Plan and Kawaihae Development Studies in mind, candidate alternatives were formulated for study in this EA.

A number of screening criteria were considered. The initial screening was for addressing Purpose and Need. Other objectives were identified from agency and public input gathered at public meetings, from feedback through the project web site and from comment letters received.

The following criteria for assessing the suitability of alternatives were based on the Purpose and Needs analysis:

- Does it accommodate increased cargo volumes?
- Does it provide additional berthing and yard spaces needed for safe operations?
- Does it improve safe navigation in the harbor?
- Does it improve the harbor access gates and Kawaihae Road to adequately serve increased truck traffic?
- Does it improve safety for harbor workers and the general public by adequately separating recreational users from commercial harbor activities?

- Does it improve and enhance security?
- Does it provide space for a future DOA facility to improve biosecurity and food security?
- Does it improve Hawai'i Island's ability to respond to natural hazards?

The following criteria were identified based on agency and public input:

- Does it avoid or minimize harm to the environment, including the marine environment, shoreline and floodplains?
- Does it reduce generation of greenhouse gases from emissions?
- Does it offer the potential to adapt to global climate change and associated rising sea levels?
- Does it avoid or minimize direct or visual impacts on the nearby Pu'ukoholā Heiau NHS?
- Does it avoid encroachment into the Pelekāne Lands buffer zone between the NHS and Kawaihae Harbor?
- Does it support the military's continued use of their facility?
- Does it avoid significant adverse impacts elsewhere besides Kawaihae Harbor?

Finally, the following considerations, while not central to the Purpose and Need, are important to DOT-H and the success of the project. These considerations supplement the other criteria listed above:

- Can the action be phased to fit within the available annual funding levels of the Harbor Special Fund?
- Does it make optimal use of the existing facility?

3.3 Development of Project Alternatives Covered in this EA

The 2035 Master Plan's Preferred Alternative addresses Kawaihae Harbor's projected overall needs through a 2035 horizon date. To begin to address the needs of the harbor in the near-term (10 - 15 years), a range of alternatives were considered to avoid, minimize, and mitigate adverse impacts. The alternatives include a No-Action Alternative and four Build Alternatives. They cover a wide range of potential actions, and different actions are included in each alternative, as shown in **Table 3-1: Summary of Alternatives**. All the actions potentially included under any of the Build Alternatives are shown in **Figure 3-1: Improvements to Kawaihae Harbor Included in Part or in Total Under the Build Alternatives**. Alternative 5, the Proposed Action, reflects all of the near-term needs of the 2035 Master Plan's Preferred Alternative. Alternatives 2, 3, and 4 cover a portion of the needed improvements.

The Minimal Action, Partial Action, Pier 2A Extension, and Proposed Action alternatives all follow an incremental step-wise approach by including only those elements recommended in the 2035 Master Plan that are needed in the "near-term" (10 - 15 year timeframe). Therefore, they do not include other recommendations of the 2035 Master Plan's Preferred Alternative that will not be needed until warranted by growth at the harbor. In particular, none of these alternatives include development of Pier 3 in the Coral Flats area, which is anticipated to be a

Table 3-1: Summary of Alternatives

Alt. #	Alternative Name	Actions Included In Alternative	Overall Impacts and Options to Mitigate Impacts
1	**No Action**	None, other than shippers' previous commitments for making minor reconfigurations to yards.	• None.
2	**Minimal Action**	• Improve internal roadway circulation. • Open and upgrade South Gate Entry. • Dedicate land for Small Boat Harbor and Perimeter Road. • Add perimeter security fencing on Coral Flats. • Transfer Pelekane Lands Buffer to DNLR. • Maintain Military Access.	• No marine effects. • Minimal land-side effects.
3	**Partial Action/ Land-Side Only**	All of Alternative 2 plus: • Grading of Coral Flats Area. • Relocation of the Hawai'i District Office and New Comfort Station. • New Yard Pavement, Structural Pavement Strengthening and Utility Improvements. • Improve, Replace, or Add Sheds, Buildings, Parking and Fencing. • Improvements to Main Gate, South Gate and Kawaihae Road. • Security Improvements.	• Minor. • More impervious surface. • No marine effects.
4	**Land-Side Plus Pier 2A Extension**	All of Alternative 3 plus: • Extend Pier 2A by 340 feet. • Demolish and reconstruct Pier 2 superstructure. • Remove boulders (est. 15 tons) that are navigational hazards.	• Effects amenable to mitigation. • Options for construction. • Options for boulder removal.
5	**Proposed Action (Pier 2A & 2C Extensions)**	All of Alternative 4 plus: • Extend Pier 2C by 325 feet. • Demolition of small craft dock facilities. • New dredging (approx. 30,000 cubic yds.).	• Effects amenable to mitigation. • Marine effects. • Dredging options. • Dredge disposal options.

much later need. Refer to **Section 3.10.4: Future Master Plan Elements Not Carried Forward in EA** for more information.

In addition to the five alternatives shown in the table, two additional alternatives were considered that were not carried forward because they did not meet the purpose and need. Those alternatives, discussed in **Section 3.10: Alternatives That Did Not Meet Purpose and Need** are:

- Construct Improvements at a New Harbor in West Hawai'i.
- Redistribute Cargo Handling from Kawaihae Harbor to Hilo Harbor.

The screening criteria for alternatives were described above in **Section 3.2: Development of Screening Criteria for Alternatives.** The ability of the alternatives to address these screening criteria is outlined in **Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives**. A detailed description of each alternative follows the table.

3.3.1 Proposed Action

The Full Action Alternative 5 was selected as the Proposed Action. As shown in **Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives**, this alternative is most effective at addressing the purpose and need of the project compared to the other four alternatives. It would most effectively:

- Accommodate increased cargo volumes. Alternative 5 will extend both Pier 2A and 2C by a combined 665 feet of space, more than any other alternative. It would also improve yard operations through reconfiguration of the space.
- Add berthing and yard spaces. Alternative 5 provides the greatest increase in berthing spaces.
- Improve navigational safety. Alternative 5 will introduce new and maintenance dredging that would be address navigational needs.
- Improve harbor access gates and Kawaihae Road. Alternative 5 will improve harbor access.
- Improve public safety for workers/recreationalists. Alternative 5 will separate out industrial and recreational users.
- Improve and enhance security. Alternative 5 will provide security fencing to improve and enhance security.
- Allocate space for DOA facility to improve biosecurity and food security. Alternative 5 will offer DOA the space for a facility.
- Improve ability to respond to natural hazards. Under Alternative 5, the increased cargo capacity and berthing space will best enable Kawaihae Harbor to respond to natural hazards on the Island of Hawai'i, more so than any other alternative.

Since the Proposed Action, Alternative 5, includes other components of other alternatives, it is described after the descriptions of the other alternatives below, in **Section 3.8: Proposed Action: Alternative 5 – Full Action**.

Figure 3-1: Improvements to Kawaihae Harbor Included in Part or in Total Under the Build Alternatives

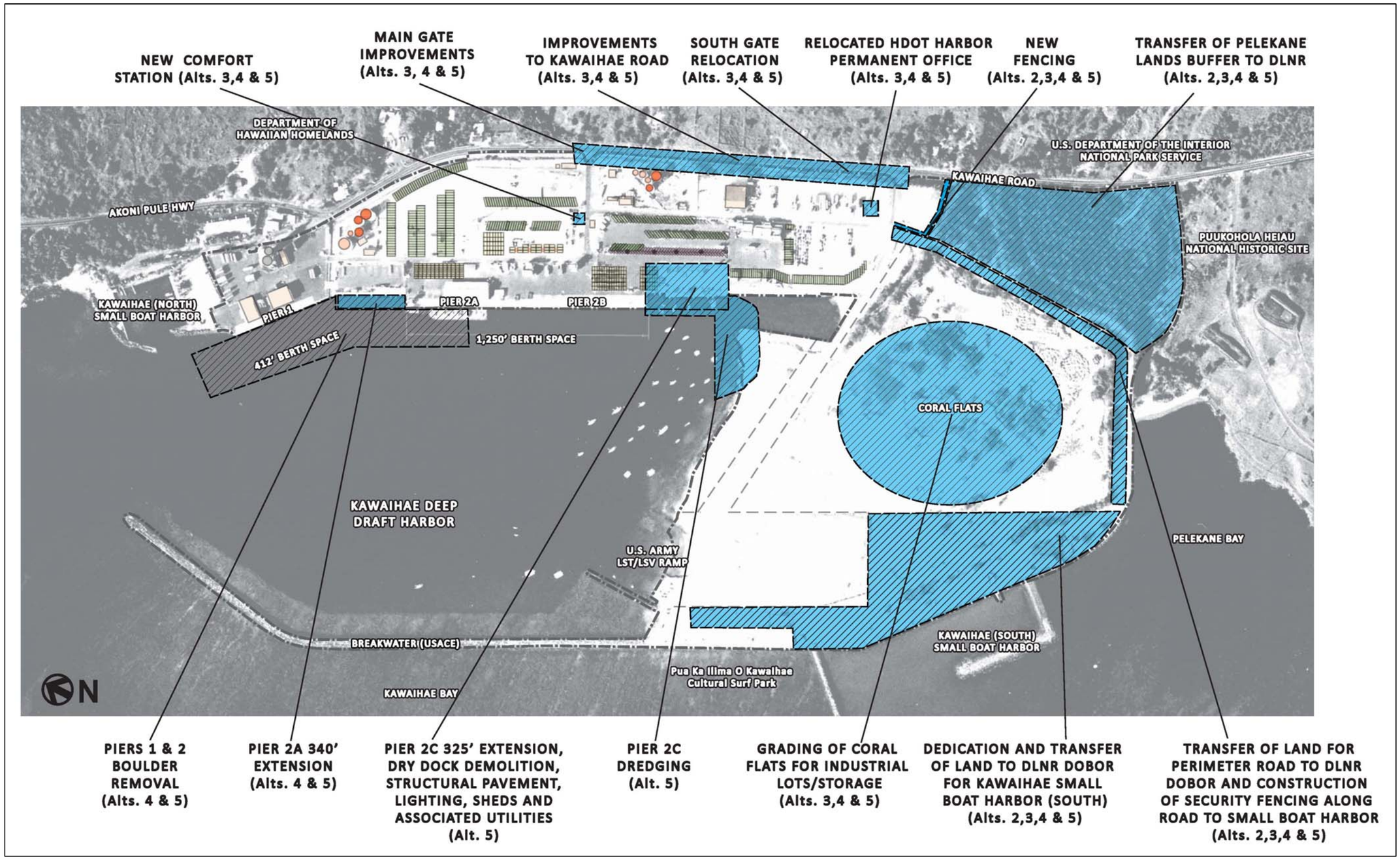

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Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives

Does Alternative Meet These Purposes, Needs, Objectives, or Considerations?	Alternatives Carried Forward for Further Study					Alternatives Not Considered Further	
	Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Act. Land-Side	Alt. 4: Pier 2A Extension	Alt. 5: Proposed Action - Full Action	Construct New Harbor	Redistribute Cargo to Hilo
Elements of Project's Purpose and Need							
Accommodate Increased Cargo Volumes	No	No	No	✓✓	✓✓✓	✓	✓
Add Berthing and Yard Spaces	No	No	No	✓	✓✓✓	✓	✓
Improve Navigational Safety	No	No	No	✓	✓✓✓	No	No
Improve Harbor Access Gates and Kawaihae Road	No	✓	✓✓✓	✓✓✓	✓✓✓	No	No
Improve Public Safety for Workers/Recreationalists	No	✓✓✓	✓✓✓	✓✓✓	✓✓✓	No	No
Improve and Enhance Security	No	No	✓✓✓	✓✓✓	✓✓✓	No	No
Allocate Space for DOA Facility to Improve Biosecurity and Food Security	No	No	✓✓✓	✓✓✓	✓✓✓	No	No
Improve Ability to Respond to Natural Hazards	No	No	✓	✓✓	✓✓✓	✓✓✓	No
Additional Criteria from Public and Agency Input							
Avoid or Minimize Harm to Environment, especially Marine, Shoreline, Floodplains	✓✓✓	✓✓✓	✓✓✓	✓✓	✓	No	No
Address Global Climate Change by Reducing Greenhouse Gas Emissions	No	No	✓	✓✓	✓✓✓	No	No
Adapt to Global Climate Change/Sea Level Rise	No	No	No	✓✓✓	✓✓✓	No	No
Minimize Direct/Visual Effects on Pu'ukoholā Heiau National Historic Site	✓✓✓	✓✓	✓	✓	✓	✓✓✓	✓✓✓
Avoid Encroachment into Pelekāne Lands Buffer Zone	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Support Military's Continued Use of Kawaihae Harbor	✓	✓✓	✓✓✓	✓✓✓	✓✓✓	No	No
Avoid significant adverse impacts elsewhere besides Kawaihae Harbor	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	No	No
Issues of Importance to DOT-H that are Independent of Purpose and Need							
Action phased within available levels of Harbor Special Fund?	n/a	✓✓✓	✓✓✓	✓✓✓	✓✓✓	No	No
Optimize usage of existing Kawaihae Harbor	No	No	✓	✓✓	✓✓✓	No	No

Key:
✓ =Addresses Purpose/Need/Objectives to Minor Degree at Kawaihae Harbor
✓✓ =Addresses Purpose/Need/Objectives to Moderate Degree at Kawaihae Harbor
✓✓✓ =Addresses Purpose/Need/Objectives to High Degree at Kawaihae Harbor
No = Does not address Purpose/Need/Objectives

3.4 Alternative 1 - No-Build

Alternative 1 - No-Build was not selected as the Proposed Action as it would not meet the Purpose and Need of the project.

Alternative 1 - No-Build will keep Kawaihae Harbor in its existing condition with none of the proposed improvements cited in the alternatives that follow. Only previously committed actions (minor improvements to yard areas planned by shipping companies independently of this project) will be pursued. This will limit the operational efficiency of future harbor activities, and compromise the ability of the harbor to adequately serve Hawai'i Island in movement of goods and economic development. It will also potentially compromise the supply of essential goods to the island if a natural disaster (such as an earthquake, tsunami, lava flow or other event) resulted in the closure of Hilo Harbor.

As shown in **Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives**, Alternative 1 - No-Build would not meet any of the Purpose and Need criteria and only some of the additional project objectives. While Alternative 1 - No-Build will not fulfill the Purpose and Need for the project, it is carried forward to provide a baseline condition for comparison to the other alternatives.

3.5 Alternative 2 - Minimal Action

Alternative 2 - Minimal Action was not selected as the Proposed Action as it would not meet the Purpose and Need of the project.

Alternative 2 - Minimal Action seeks to reconfigure existing resources at Kawaihae Harbor without incurring any major construction. Alternative 2 - Minimal Action reconfigures internal roadway circulation of the yards within the land-side areas of the harbor for greater operational efficiency, installs perimeter fencing and dedicates land to DLNR DOBOR for future development of the Kawaihae Small Boat Harbor (South). These improvements are shown in **Figure 3-1: Improvements to Kawaihae Harbor Included in Part or in Total Under the Build Alternatives**. Alternative 2 - Minimal Action will only address two out of eight of the purpose and need elements for the project.

Alternative 2 - Minimal Action will not construct new piers, incur dredging, build new offices, provide other security infrastructure, or grade the Coral Flats area. Alternative 2 - Minimal Action will not address the purpose and need for the project as shown in **Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives**. Only a minimal number of criteria will be met.

The actions included under Alternative 2 - Minimal Action are described below.

3.5.1 Internal Roadway Circulation

As discussed in greater detail in **Section 6.2.2.2: Internal Circulation** and shown in **Figure 6-3: Traffic Circulation**, the internal land circulation within Kawaihae Harbor will be improved by reconfiguring container storage areas, and shifting circulation on the site, reducing the number

of turns needed and improving sight lines. This action opens and upgrades the South Gate to serve users of the Kawaihae Small Boat Harbor (South), the military, and other users of Coral Flats, and separates them from the commercial harbor users, who will be served primarily by the Main Gate.

3.5.2 Security Fencing and Dedication of Land for Small Boat Harbor (South) and Perimeter Road

This action includes the dedication of land for a future perimeter access road and Small Boat Harbor (South) to the DLNR DOBOR and the construction of perimeter fencing to keep the public within the roadway area and outside of the secured harbor.

The future construction of the access road and the build-out of Small Boat Harbor (South) by DLNR DOBOR are not part of this project. Land will be dedicated for a new access road to the Small Boat Harbor (South) and an approximately 13 acre boat harbor yard. The road to the Small Boat Harbor (South) and its associated facilities will be built by DLNR DOBOR at a future time in a separate project for recreational users and the public, outside of the maritime secure area.

The perimeter fencing will be designed to separate the commercial harbor from the recreational boating facilities. DOT-H will construct the perimeter fencing as part of this action.

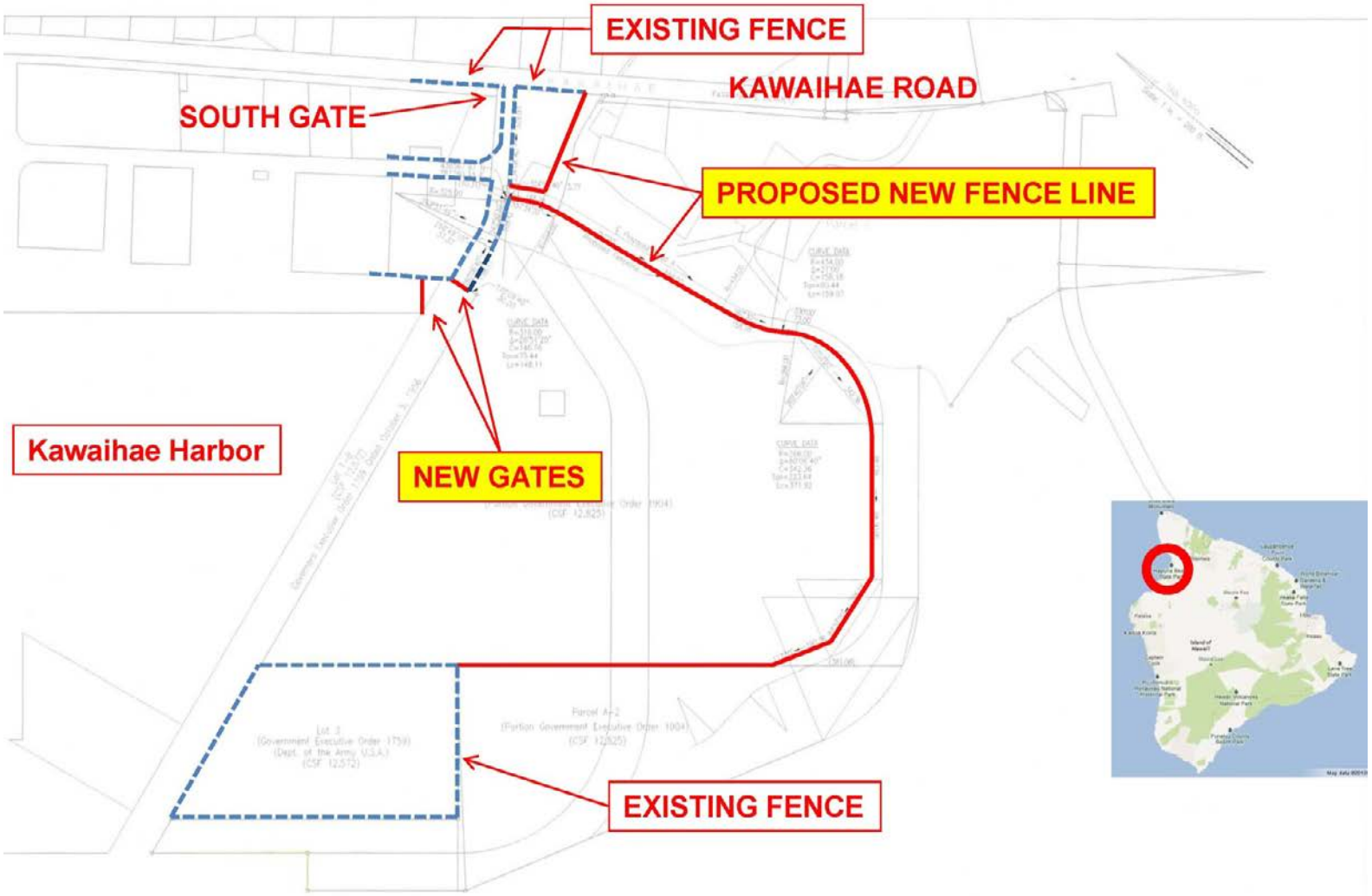
An image of the existing condition of the existing unimproved road on the Coral Flats is shown in **Figure 3-2: Location for Perimeter Roadway and Fencing at Coral Flats Area**.

Figure 3-2: Location for Perimeter Roadway and Fencing at Coral Flats Area



The conceptual design of fencing along this roadway is shown in **Figure 3-3: Proposed Fencing Improvements to Perimeter Road**. The edge of the perimeter road is located roughly between 20 and 130 feet from the shoreline (depending on location). The alignment was selected to avoid erosion, stormwater impacts, and other environmental effects from the roadway on the

Figure 3-3: Proposed Fencing Improvements to Perimeter Road



Source: HDOT, Harbors Division

marine environment and to prevent Small Boat Harbor (South) users from accessing areas used by the military or future harbor access locations.

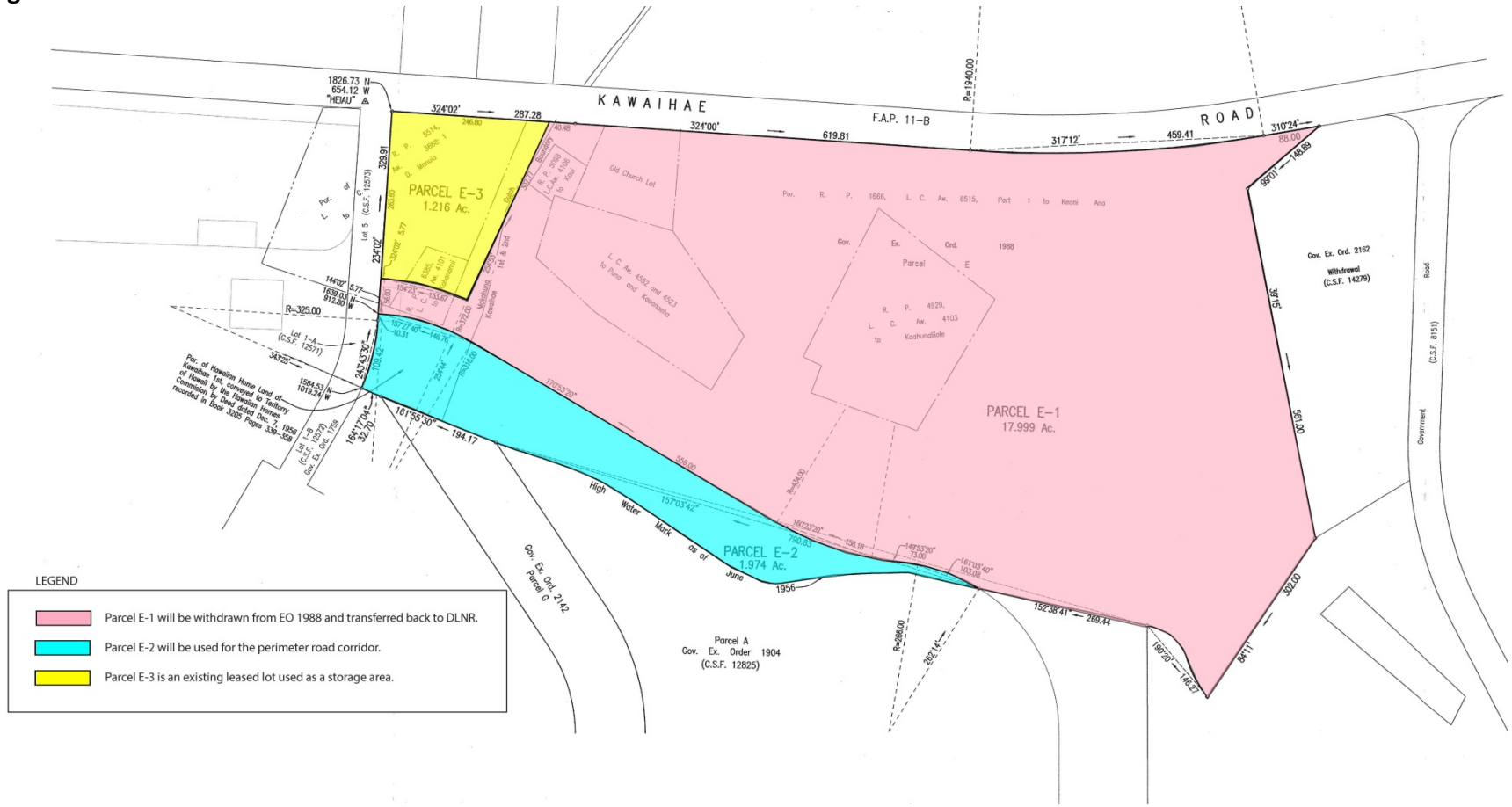
Fencing along the perimeter roadway will meet International Ship and Port Facility Security (ISPS) and/or contracting government standards. The fence shall define the appropriate locations where access restrictions could be applied (ISPS Part B, 16.11).

3.5.3 Transfer of Pelekane Lands Buffer to DLNR

The Pelekane Lands Buffer is located between Kawaihae Road, the commercial harbor, coral flats, and Pu'ukohola Heiau National Historic Site. In 1961, this site was set aside for State Department of Transportation use by way of Governors Executive Order (EO) No. 1988. The site is identified in the EO as Parcel E consisting of 23.66 acres. In 1964, a 2.92-acre portion of Parcel E was withdrawn from EO 1988 by way of EO 2162 because the parcel was no longer needed for Harbor uses.

Parcel E is proposed for subdivision to accommodate an existing storage area (Parcel E-3) and the future perimeter road (Parcel E-2) leading to the small boat harbor, See **Figure 3-4: Draft Subdivision Plan for Pelekane Lands Buffer** As part of the Minimal Action Alternative (as well as other alternatives that follow), the approximately 18-acre remainder of Parcel E, identified a Parcel E-1 on Figure 3-4, also referred to as the "Pelekane Lands Buffer," will be withdrawn from EO No. 1988 and transferred back to DLNR, thereby enabling DLNR to maintain its undeveloped state and removing it from future harbors development.

Figure 3-4: Draft Subdivision Plan for Pelekane Lands Buffer



Source: HDOT, Harbors Division

3.5.4 Maintenance of Military Access

The US Army owns and operates a landing ramp and an easement to conduct military operations and transfer troops, vehicles, explosives and other goods. (Refer to **Section 9.15.2: Executive Orders** for more information). This area is used by the 45th Army Corps Support Group (Forward) to off-load Logistics Support Vehicles (LSV) to be taken to Pohakuloa Training Area (PTA). The off-loading generally occurs by dropping down a ramp from the shipping vessel after it beaches in the shallow landing area. The Army follows an existing road on the north side of the Coral Flats from the ramp area up to the South Gate.

This road access will be maintained under the Minimal Action Alternative (as well as all other Build Alternatives described in subsequent sections). With the construction of the security fencing described in **Section 3.5.2: Security Fencing and Dedication of Land for Small Boat Harbor (South) and Perimeter Road**, the portion of the Coral Flats used by the Army during their loading and maneuvers will be fenced off from the general public and access for the Army to the Harbor's South Gate exit will be provided through a gate in the security fence.

3.6 Alternative 3 - Partial Action/Land-Side

Alternative 3 - Partial Action/Land-Side was not selected as the Proposed Action as it would not meet the Purpose and Need of the project in terms of increased berthing capacity.

Alternative 3 - Partial Action/Land-Side makes only the land-side improvements needed in the near term that are shown in **Figure 3-1: Improvements to Kawaihae Harbor Included in Part or in Total Under the Build Alternatives**. Alternative 3 - Partial Action/Land-Side provides a basic level of operational efficiency at Kawaihae Harbor by improving the efficient movement of goods within land-side areas of the harbor, enhancing the operation at the Main and South Gates, strengthening the harbor's security, and making basic infrastructural improvements to pavement, utilities, buildings, etc. However, this alternative also avoids the environmental impacts associated with marine improvements such as new piers or dredging.

As shown in **Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives**, Alternative 3 - Partial Action/Land-Side will address the purpose and need for the project as well as other criteria to a somewhat greater degree than Alternative 2 - Minimal Action. However, the primary capacity needs at Kawaihae Harbor will not be met as no increased berthing area will be provided.

Actions included under Alternative 3 - Partial Action/Land-Side are described below.

- Improvements to Internal roadway circulation improvements, described above for the Alternative 2 - Minimal Action in **Section 3.5.1: Internal Roadway Circulation**.
- The dedication of land for the Small Boat Harbor (South) and perimeter road to DLNR DOBOR and security fencing as described in **Section 3.5.2: Security Fencing and Dedication of Land for Small Boat Harbor (South) and Perimeter Road**
- Grading of Coral Flats Area.

- Relocation of the Hawai‘i District Office and New Comfort Station.
- New Yard Pavement, Structural Pavement Strengthening and Utility Improvements.
- Improve, Replace, or Add Sheds, Buildings, Parking and Fencing.
- Improvements to Main Gate, South Gate and Kawaihae Road.
- Security Improvements.

3.6.1 Grading of Coral Flats Area

There is a growing demand at Kawaihae Harbor for use of the Coral Flats area. This alternative will grade the Coral Flats to prepare it for future use. As demand for lots within Coral Flats increase, DOT-H will offer additional areas for industrial use and storage as needed. In the future (and beyond the timeline of the actions in this EA), a new Pier 3 and Cargo Terminal could be constructed in the Coral Flats area, and much of the area to be graded as part of this alternative could be used long-term for container storage and military access. In addition, a new Pier 4 and Ferry Terminal could be constructed in the future if there is a demand for such a facility. Therefore, grading as part of the Land-Side Alternative will serve longer-term needs as well as near-term. Earthwork activities include grading, grubbing, clearing and excavation.

3.6.2 Relocation of Hawai‘i District Office and New Comfort Station

The DOT-H Hawai‘i District Office and comfort station will be demolished and replaced by new and relocated permanent Hawai‘i District Office and new and relocated comfort stations. The existing office to be demolished is shown in **Figure 3-5: Existing Harbor Office to be Demolished and Relocated**. The new facilities will be designed to conserve water and be compliant with the Americans with Disabilities Act (ADA), and will be located outside the secure area, near the South Gate as shown in **Figure 3-1: Improvements to Kawaihae Harbor Included in Part or in Total Under the Build Alternatives**. Future visitors to the harbor will no longer be required to drive through the security check point and cargo operational area to visit the Hawai‘i District Office.

3.6.3 New Yard Pavement, Structural Pavement Strengthening and Utility Improvements

Improvements are proposed including paving of unimproved areas, strengthening of existing pavements to better bear the weight of cargo operations, and improvements to utilities, including lighting. Pavement markings and yard signage will be provided for better circulation and placement of containers.

Figure 3-5: Existing Harbor Office to be Demolished and Relocated



Areas that are currently unpaved behind Pier 2B will receive a paved surface, which will allow them to better serve harbor needs. The Pier 2B yard will be reconfigured to better organize and accommodate a much greater capacity of containers. The reorganization will result in one row of grounded exports adjacent the pier and uniform rows of wheeled chassis slots behind the grounded containers. Both actions will increase operational efficiency and offer greater efficiency and improve circulation.

This alternative will pave expansion areas with 16- to 17.5-inch thick Portland Cement Concrete (PCC) to support heavy loads. New pavement construction will include grading, removal of excess fill or import of fill material, and scarification and re-compacting of the top 12 inches. Pavement layering will consist of either 95 percent relative density placement of 8- to 12-inch cement treated base (CTB) paved with 8- to 10-inch asphalt concrete (AC) for parking areas, and 10- to 14-inch PCC over a 6-inch crushed miscellaneous base (CMB) for loading areas.

High-mast light poles are currently installed throughout the land-side parts of Kawaihae Harbor to provide safe illumination of the area, as seen in **Figure 3-6: Typical Light Fixture and Pole**.

With the reconfiguration of the yard areas described above, many of these light masts will need to be relocated as well. Container terminals typically employ 100- to 120-foot tall mast lights to provide recommended illumination, but at Kawaihae Harbor, 46.5-foot-high light poles are used in conjunction with 180-watt low-pressure sodium lights as required by Hawai'i County ordinances. These poles and lights minimize light pollution and spill-over of light, and mitigate effects of nighttime lighting on astronomical observatories and on migratory seabirds. See **Section 4.17: Light Pollution** for more information.

Figure 3-6: Typical Light Fixture and Pole



Fire hydrants will be placed adjacent to high-mast light poles. To accommodate Hawai‘i County Fire Department requirements, fire hydrants will be relocated adjacent to alternating light poles at distances of approximately 300 feet apart. This will satisfy the Hawai‘i Fire Department's distance requirement and allow for sufficient fire suppression coverage for the storage yard.

Three additional stations with reefer plugs (power outlets for refrigeration units) are proposed behind the extension of Pier 2A. These connections will provide continual electrical power to refrigerated containers containing perishable items.

The import/export auto storage yard will be expanded by about 3 acres. Auto imports and exports will be consolidated at the south end of the harbor where operators can share and better utilize parking space to more effectively accommodate high peak demands for auto storage.

In total, the Land-Side Alternative will provide for 814 twenty-foot ground slots for stacked containers, 756 forty-foot wheeled chassis slots and 113 twenty-foot wheeled chassis slots for a total area of roughly 31 acres for container storage. In addition, 1.5 acres of storage will be allocated for LCL cargo and roughly eight acres for bare chassis storage. Cement and petrochemical storage will remain at current sizes since their current facilities meet future throughput projections.

Consistent with Act 202, Session Laws of Hawai‘i 2011, which provides new requirements for biosecurity (see **Section 4.15: Invasive Species**), a one-acre space will be committed to support

biosecurity functions, including agricultural inspection, quarantine, and treatment to accommodate the Hawai'i DOA's operations. This area will be located next to the South Gate customer services area and will be convenient to the main cargo operations without interfering with the flow of cargo operations. Planning, design, and construction of this facility will be performed by DOA in the future.

3.6.4 Improve, Replace, or Add Sheds, Buildings, Parking and Fencing

As part of the improvements to Kawaihae Harbor, Alternative 3 - Partial/Land-Side will improve, replace or add sheds, buildings, parking areas and fencing as necessary, in support of the maritime function. New sheds or other buildings will be constructed to meet current County building standards. Design will consider the maritime environment as well as seismic activity, tsunamis, and other natural hazards.

If there is found to be a need to increase the supply of surface parking areas in the future, it could be desirable to add additional parking stalls. These may either be located in existing paved areas (restriping) or be located on new pavement, depending on the location of the facility they serve.

3.6.5 Improvements to Main Gate, South Gate, and Kawaihae Road

Traffic ingress and egress at Kawaihae Harbor is currently through the Main Gate, which is shown in **Figure 3-7: Main Gate**. Sufficient area is needed to accommodate internal circulation queues at security gates. The Main Gate will be improved to provide for separated truck in-gates and out-gates to handle the increase in truck traffic and separate inbound and outbound functions. After construction, at full buildout, there will be a total of three truck entrance lanes and three truck exit lanes.

Figure 3-7: Main Gate



Currently, the South Gate, shown in **Figure 3-8: South Gate**, is only opened on days with heavy barge traffic (currently Fridays). It will be opened regularly in the future to serve the recreational users at Coral Flats along with the relocated Hawai'i District Office, therefore the traffic at this gate will increase.

Figure 3-8: South Gate



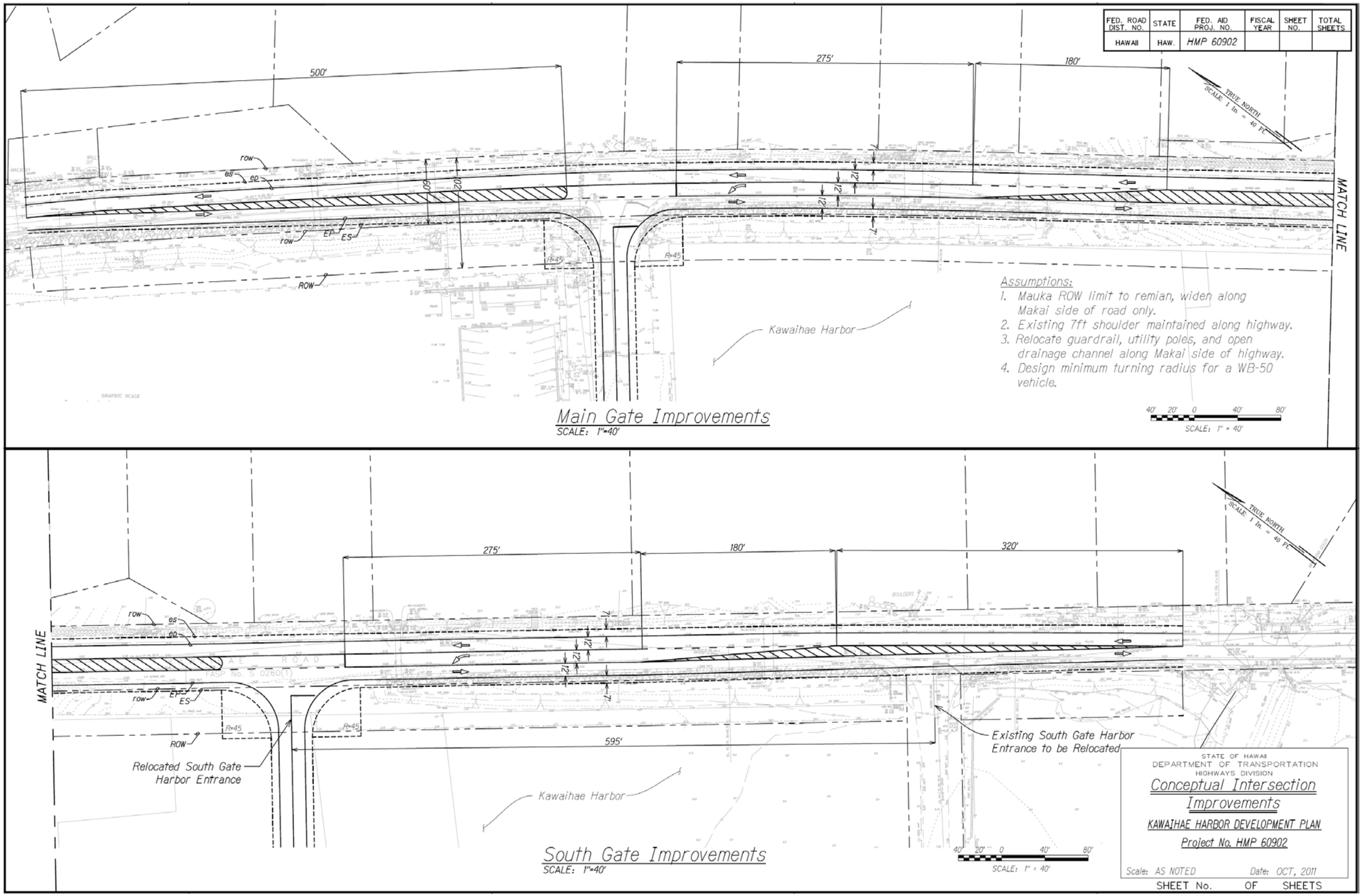
An improved access/egress point at the South Gate with security and truck gates will serve the import/export auto storage area and future Coral Flats development. A new customer service area for a second operator will be provided next to the South Gate as part of this alternative. The new gate will have a security booth west of the turnoff to the perimeter roadway that leads to the Kawaihae Small Boat Harbor (South). Improvements will be made to the intersection of the South Gate and Kawaihae Road to provide the needed turn lanes for traffic to enter this gate without backups. All gates will be designed made to meet applicable international standards, US Homeland Security, and US Coast Guard requirements.

Improvements at the gates' intersections with Kawaihae Road are recommended by the traffic study to ensure safe operations for turning vehicles. Increases in turning lane lengths and a slight relocation of the south gate are proposed in the discussion found in **Section 6.2: Impacts of the Project on Traffic** and shown below in **Figure 3-9: Intersection Improvements Along Kawaihae Road**.

3.6.6 Security Improvements

Improvements to the land-side perimeter of Kawaihae Harbor will include new fencing, guard stations, access-control gates, and surveillance systems. These will be made to meet applicable international standards, US Homeland Security, and US Coast Guard requirements. The fence and gate system will define where access is permitted and where it is limited. Design will consider moveable concrete barriers that could be relocated as necessary to accommodate future improvements.

Figure 3-9: Intersection Improvements Along Kawaihae Road



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The separated inbound and outbound traffic lanes at the Main Gate will allow appropriate security checking for both in- and outbound vehicles. This will serve to improve security on-site.

The improvements to the South Gate access/egress point will have similar security treatments.

3.7 Alternative 4 - Land-Side Plus Pier 2A Extension

Alternative 4 - Land-Side Plus Pier 2A Extension was not selected as the Proposed Action as it would not meet the Purpose and Need of the project to the extent of Alternative 5.

Alternative 4 - Land-Side Plus Pier 2A Extension includes all the land-side improvements needed at Kawaihae Harbor described in Alternative 3 - Partial Action/Land-Side and also reconstructs and extends Pier 2A by 340 feet, as shown in **Figure 3-1: Improvements to Kawaihae Harbor Included in Part or in Total Under the Build Alternatives**. The extension of Pier 2A to the north side allows greater berthing capacity. Alternative 4 - Land-Side Plus Pier 2A Extension does not include the extension of Pier 2C and its associated dredging thus avoiding the environmental impacts associated with constructing Pier 2C and dredging the area alongside that location.

Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives shows that Alternative 4 - Land-Side Plus Pier 2A Extension will address all the criteria of the purpose and need and other objectives to some degree. However, it will not meet the full berthing capacity needs as it will not enable two barges and associated tugs to simultaneously berth at Pier 2. Therefore, it will not meet the criteria to the same level as the Full Action Alternative.

Alternative 4 - Land-Side Plus Pier 2A Extension includes:

- All land-side improvements described above in **Section 3.6: Alternative 3 - Partial Action/Land-Side**.
- Reconstruction and Extension of Pier 2A by 340 feet.
- Dredging (Boulder Removal) for Pier 2A.

3.7.1 Reconstruction and Extension of Pier 2A by 340 Feet

As part of Alternative 4 - Land-Side Plus Pier 2A Extension, Pier 2A will be demolished, reconstructed, and extended 340 feet to accommodate future cargo demands and to increase berth capacity. All piers will be multi-use facilities that could accommodate a range of users and vessels of varying sizes and purposes. **Figure 3-10: Existing Pier 2 Showing Barge Tied Up to Pier** shows the Pier 2A area that will be enlarged to the left side of the image. A 340-foot extension will be the longest available distance for extending Pier 2A while maintaining adequate separation from Pier 1.

Pier 2 will be increased from 1,150 feet in length to 1,490 feet in length. With this change, the full length of Pier 2 will better accommodate space needs than current conditions, but it still will not accommodate the full total length of two future-length barges, two tug boats, and associated space needed for the tugs to maneuver.

Figure 3-10: Existing Pier 2 Showing Barge Tied Up to Pier



Pier 2A was completed in 1958; it sustained damage from earthquakes in 1973 and 2006. Consultants inspected Pier 2A during 2007 reconnaissance surveys for DOT-H's Waterfront Structural Inventory and also for the Pier 2A Shed Demolition project. The consultant's finding was the Pier 2A superstructure was in a "fair-to-poor" condition due to an advanced state of active corrosion resulting in spalling and cracking in the deck, beams and pile caps (Moffatt and Nichol, 2011b).

The pier has been repaired periodically – most recently in 2009 – to address both normal deterioration due to aging (i.e., concrete delamination and spalling; mechanical damage) as well as damage caused by seismic events (most notably, 1973 and 2006 earthquakes). Furthermore, the existing structure has a safe live load limit of 500 pounds per square foot, as determined by DOT-H. The replacement of Pier 2A is being proposed to address on-going deterioration and the need for continued periodic maintenance of the superstructure, and also to upgrade the operational live load limit to 1,000 pounds per square foot, which is a safe live load limit needed for the wharf to meet operational requirements.

The general concept for the demolition and reconstruction of the existing Pier 2 superstructure involves removing the existing concrete deck, concrete pile caps and beams, and the closure block capping the steel sheet pile bulkhead. The existing piles and the sheet pile bulkhead will

be salvaged and reused in the reconstructed configuration to the extent possible. After the demolition is complete, a row of precast, prestressed concrete batter piles will be installed between each existing bent of piles (40 to 50 new batter piles), as well as a row of precast, prestressed concrete vertical piles installed landward of the existing sheet pile bulkhead (40 to 50 new vertical piles). These two rows of piles, and the landside behind the cap will be backfilled and fitted with a reinforced concrete approach slab. The proposed improvements will be constructed to account for the increase in the seismic design loads since the original Pier 2 wharf was designed and constructed (Moffat and Nichol, 2011b).

Feasible alternative methods to construct the wharfs are illustrated in **Figure 3-11: Pile and Deck Wharf Typical Elevation** and **Figure 3-12: Tied Back Bulkhead Wharf Typical Elevation**. The design, demolition, and construction at Pier 2A has several options, described below. Pier design must meet the needs of cargo movement and oceanographic design criteria.

One method that was not considered to be reasonable, a caisson wharf design, is discussed later in the section of the EA discussing alternatives considered but not carried forward for analysis; see **Section 3.10.3: Caisson Wharf Design Option**.

Dolphins are structures that jut out of the water and could be used for either tying down vessels (i.e., mooring dolphin) or providing a structure where vessels could abut and dock alongside (i.e., breasting dolphin), and these could also be included as part of the design for any of the wharf alternatives.

The selection of a preferred design option in association with Alternative 4 - Land-Side Plus Pier 2A Extension will consider environmental impacts and design considerations and will be identified during the design phase.

3.7.1.1 Concrete Pile-and-Deck Construction Option

The concrete pile-and-deck option illustrated in **Figure 3-11: Pile and Deck Wharf Typical Elevation** allows water circulation beneath the footprint and hard strata. Because water circulation will be permitted below the pier, this design also will provide habitat for marine organisms in contrast to a bulkhead design, which will not permit the movement of water or organisms under the pier.

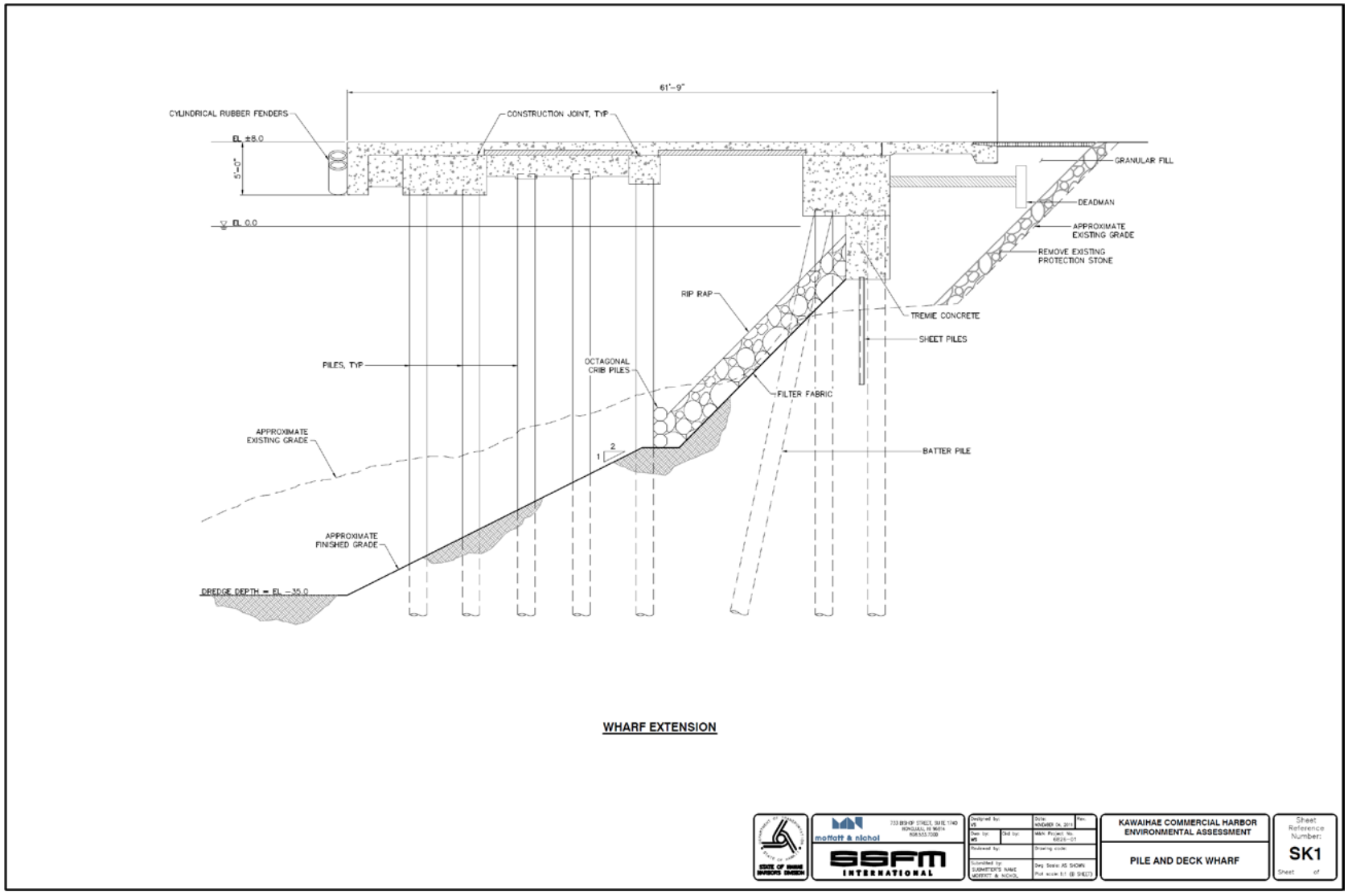
Pile and deck construction will require driving concrete piles to support a concrete deck. The structures will comprise precast, prestressed concrete piles supporting reinforced concrete pile caps, beams, and deck, with a cast-in-place concrete curtain wall and steel sheet pile bulkhead. It is estimated that the project will require approximately:

- 90 support piles for the Pier 2 repairs.
- 300 support piles for the extension of Pier 2A.

Assuming that three to four piles could be installed each day, the duration of pile driving will be approximately 25 to 30 days for the Pier 2 repairs, and 75 to 100 days for Pier 2A.

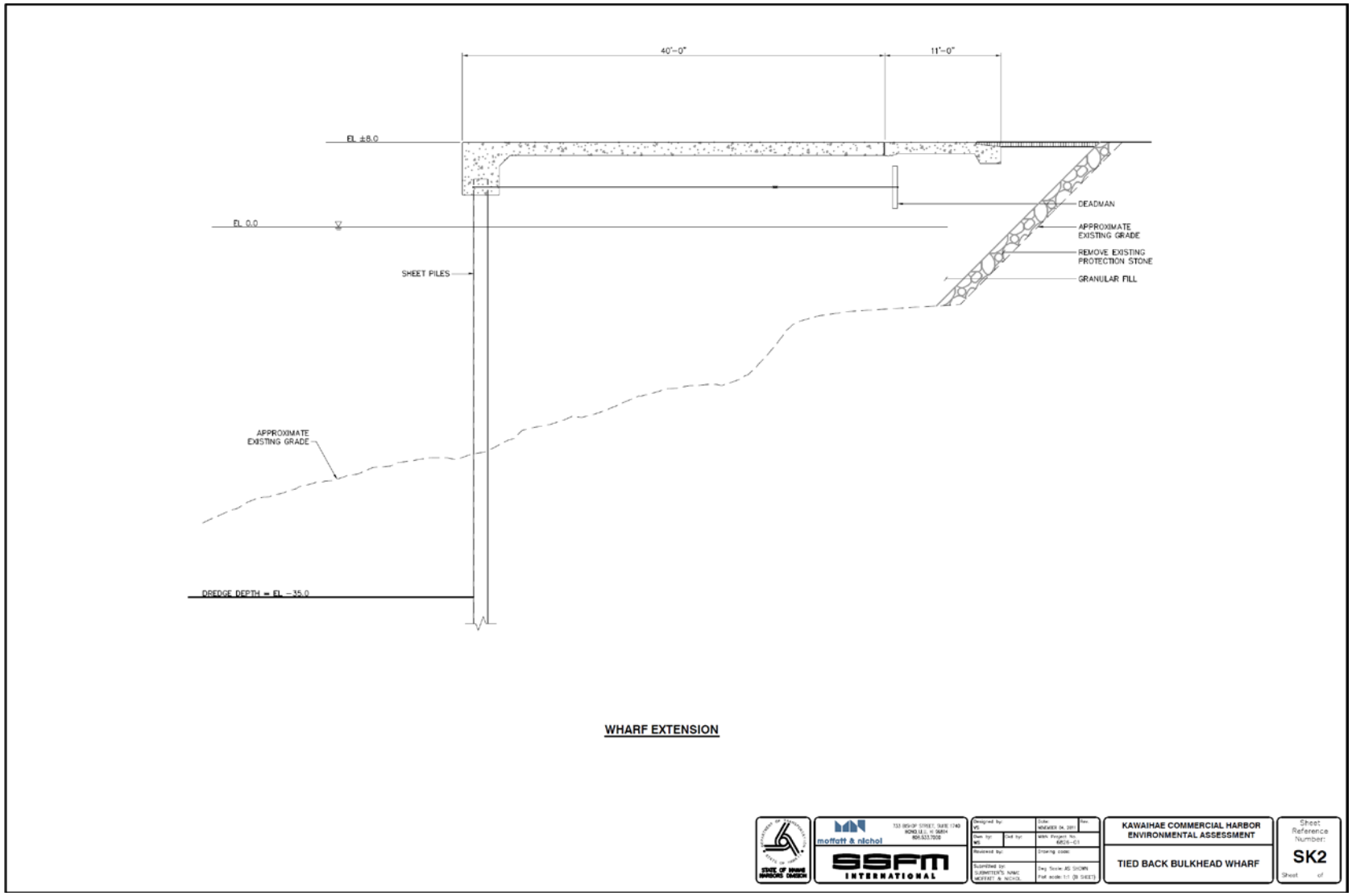
The vertical bulkhead will be approximately 340 feet long for the extension of Pier 2A, and assuming that 50 lineal feet of sheet piling can be installed every week, will take approximately

Figure 3-11: Pile and Deck Wharf Typical Elevation



Source: Moffatt and Nichol

Figure 3-12: Tied Back Bulkhead Wharf Typical Elevation



Source: Moffatt and Nichol

two months to construct. Pile driving within the harbor will be conducted using a barge-mounted diesel, hydraulic impact and/or vibratory hammer, depending on geotechnical conditions. The new piles will be in the same range of sizes and materials as the existing piles. (i.e., 20-inch octagonal pre-stressed concrete piles).

3.7.1.2 Bulkhead with Sheet Piles and Backfill Construction Option

In a tied-back bulkhead wharf design as illustrated in **Figure 3-12: Tied Back Bulkhead Wharf Typical Elevation**, interconnected steel sheet piling is commonly used to provide a solid, vertical wharf face to resist lateral pressures and seismic loads. Most often, the main bulkhead is tied back with steel rods to buried anchors to minimize stresses and deflections in the structure. The upland area behind the main bulkhead is backfilled to provide a contiguous yard area. This construction type requires driving sheet piles and backfilling with either dredge or other suitable material.

Since this design will produce a solid, vertical wharf face, it will not permit the movement of water or organisms under the pier and therefore offers less area for marine habitat than the previously-discussed concrete pile-and-deck design.

Steel sheet pile could be installed by using a barge-mounted diesel hammer, a hydraulic impact hammer and/or a vibratory hammer. There are two common driving options, depending on soil conditions:

1. "Pitch and Drive" is a method suitable for loose soils and short sheet piles, and will be conducted by carefully installing the first steel sheet pile, checking its alignment and verticality, and then threading the next sheet pile (also known as "pitching") through the interlock and driving it to its final depth. Driving of the bulkhead wall continues linearly.
2. "Panel Driving" is a method that involves the use of a driving template/frame comprising frame piles supporting upper and lower guide beams. The template helps ensure proper verticality and alignment of the bulkhead. A "panel" of sheet piles (common length will be about 40 feet) are initially pitched in the template, and the end sheets are partially driven to provide a good anchorage for the wall. The remaining piles are then driven either linearly from one end of the template to the other, or by staggering sheets to have the greatest control on verticality and alignment.

Since the panel driving method will use a driving template composed of additional piles temporarily installed in the sea bed to support the template, panel driving will result in a slightly greater impact on the sea bed compared to the pitch and drive method. Other than that primary difference, the overall impact on the marine environment will be comparable between the two methods.

The main front sheet pile bulkhead will typically be tied back to concrete deadman anchors, or to a sheet pile anchor wall. After the sheet piles are installed, the backfill will be installed and compacted in lifts, sequenced to prevent overloading the wall during construction. The tie rod anchors will be connected between the main wall and the anchor wall, and will be typically supported by temporary light duty piles to prevent them from sagging until the backfill will be

high enough and could support the tie rod weight. After the backfill is complete, the tie rods will be tightened. Pavement will be placed over the completed backfill.

The vertical bulkhead will be approximately 340 feet long for the extension of Pier 2A, and assuming that 50 lineal feet of sheet piling could be installed every week, will take approximately 2 months to construct.

3.7.1.3 Combination Pier Construction Option

A combination pier could include the two preceding construction types in conjunction with one another. In this case, sheet piles will be driven with backfilling behind them. Then the seaward side portion will include a concrete deck supported by piles.

3.7.2 Dredging (Boulder Removal) for Pier 2A

There are a number of underwater boulders adjacent to the sheet pile in the area between Pier 1 and the north end of Pier 2 that weigh as much as 15 tons. These boulders might need to be removed as they pose navigational hazards. They appear to be remnants from the initial dredging of the area. Several options are available for removing the boulders, which will enable adequate berth depth for barges of minus 35 feet mean lower low water (MLLW) level. The largest boulder is reported to be about the size of a small passenger car.

The selection of a preferred option for dredging at Pier 2A in association with Alternative 4 - Land-Side Plus Pier 2A Extension will consider environmental impacts and design considerations and will be identified during the design phase.

3.7.2.1 Options for Removing Large Obstructions

Boulders require unique means to break them up and remove them than usual dredging techniques. Typically, blasting will not be pursued unless there is no other viable alternative for mechanical removal. Four options for removing large obstructions will be as follows:

- A heavy-duty marine crane could be used to lift intact obstructions, and move them to an adjacent barge for transport off-site for disposal.
- An impact chisel could be used to demolish the obstruction by dropping a large spud- or chisel-shaped tool on the obstruction multiple times to break it into manageable sized pieces.
- Several holes could be drilled in the obstruction at pre-determined intervals and a hydraulic ram could be inserted into the holes to break the material into manageable sized pieces.
- An underwater hydraulic jackhammer, similar to equipment used in topside demolition activities, could break material into manageable sized pieces.

If any of the last three options is pursued, a large pit will be excavated on the seabed next to the obstruction, and the obstruction will be rolled into the pit.

3.8 Proposed Action: Alternative 5 – Full Action

As noted above in **Section 3.3.1: Proposed Action**, Alternative 5 has been selected as the Proposed Action, because it best serves the purpose and need for the project It provides the full level of berthing and navigational improvements to address Kawaihae Harbor's needs in the medium-term period .

Proposed Action - Alternative 5 includes all the improvements included under Alternative 4 - Land-Side Plus Pier 2A Extension described above and also includes an extension of Pier 2C and dredging associated with that improvement. By constructing Pier 2C and dredging the area alongside that location, the harbor will be able to accommodate the highest level of cargo capacity needed. By constructing the 325-foot Pier 2C in conjunction with an extension of Pier 2A, two barges and associated tugs will be able to berth simultaneously.

As demonstrated in **Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives**, Proposed Action - Alternative 5 fully meets the purpose and need elements for the project and it meets them to the highest level of all the alternatives under consideration. It also meets the additional criteria considered to a high level.

Actions included under Proposed Action - Alternative 5 are described below:

- All improvements cited above in **Section 3.7: Alternative 4 - Land-Side Plus Pier 2A Extension**.
- Pier 2C Extension of 325 Feet.
- Demolition of Small Craft Dock Facilities.
- New Dredging at Pier 2C.

3.8.1 Pier 2C Extension of 325 Feet

A new Pier 2C will be constructed, providing an additional 325 feet of berth space. In conjunction with Pier 2A, this improvement will provide berthing for up to four 400-foot long barges. The Pier 2C extension has a number of design options for the Pier, identical to those cited above for Pier 2A in **Section 3.7: Alternative 4 - Land-Side Plus Pier 2A Extension**. The selection of a preferred design option in association with Proposed Action - Alternative 5 will consider environmental impacts and design considerations and will be identified during the design phase.

3.8.1.1 Concrete Pile and Deck

For Proposed Action - Alternative 5, if a concrete pile and deck design is pursued, it will be constructed as described above for Pier 2A in **Section 3.7.1.1: Concrete Pile-and-Deck Construction Option**. It is estimated that the project will require approximately:

- 90 support piles for the Pier 2 repairs.
- 300 support piles for the extension of Pier 2A. and
- 275 support piles for the extension of Pier 2C.

Assuming that three to four piles could be installed each day, the duration of pile driving will be approximately 25 to 30 days for the Pier 2 repairs, 75 to 100 days for Pier 2A, and 70 to 90 days for Pier 2C.

The vertical bulkhead will be approximately 340 feet long for the extension of Pier 2A, and assuming that 50 lineal feet of sheet piling could be installed every week, will take approximately 2 months to construct. For Pier 2C, the bulkhead will be approximately 325 feet long and require approximately 1.5 months for construction. Pile driving within the harbor will follow the techniques suggested above for Pier 2A.

3.8.1.2 Bulkhead with Sheet Piles and Backfill Construction Option

A bulkhead design could be considered for Pier 2C, similar to the discussion provided above for Pier 2A in **Section 3.7: Alternative 4 - Land-Side Plus Pier 2A Extension**. As noted above, there will be two potential ways to drive the sheet pile, either the "pitch and drive" method, or the "panel driving" method. If a bulkhead design was pursued for the Full Action Alternative, the vertical bulkhead will be approximately 340 feet long for the extension of Pier 2A, and assuming that 50 lineal feet of sheet piling could be installed every week, will take approximately 2 months to construct. The bulkhead for Pier 2C will be approximately 325 feet long and require approximately 1.5 months to construct.

3.8.1.3 Combination Pier Construction Option

As noted above in **Section 3.7.1.3: Combination Pier Construction Option**, a combination pier design will be possible for Pier 2C as well as Pier 2A.

3.8.2 Demolition of Small Craft Dock Facilities

Small craft dock facilities are currently located south of Pier 2B where Pier 2C will be proposed for construction. A small craft "dinghy dock" (running parallel to the revetment) and a "finger pier" or "boat dock" (running perpendicular) are currently owned by DOT-H. To accommodate the Pier 2C Extension, under Proposed Action - Alternative 5, these docks will be demolished prior to pier construction. The current small craft dock facilities are in a substantial state of disrepair; much of the existing timber-framed dock is severely rotted and deteriorated.

Temporary off-shore small craft moorings are also being utilized within the commercial harbor, and these will be removed under Proposed Action - Alternative 5. DLNR DOBOR plans to complete the nearby Kawaihae Small Boat Harbor Facility (South) in the future. Environmental studies for that project are ongoing.

Figure 3-13: Small Craft Docks to be Demolished for Pier 2C shows some of the current dock facilities that will be demolished to accommodate Pier 2C.

Figure 3-13: Small Craft Docks to be Demolished for Pier 2C



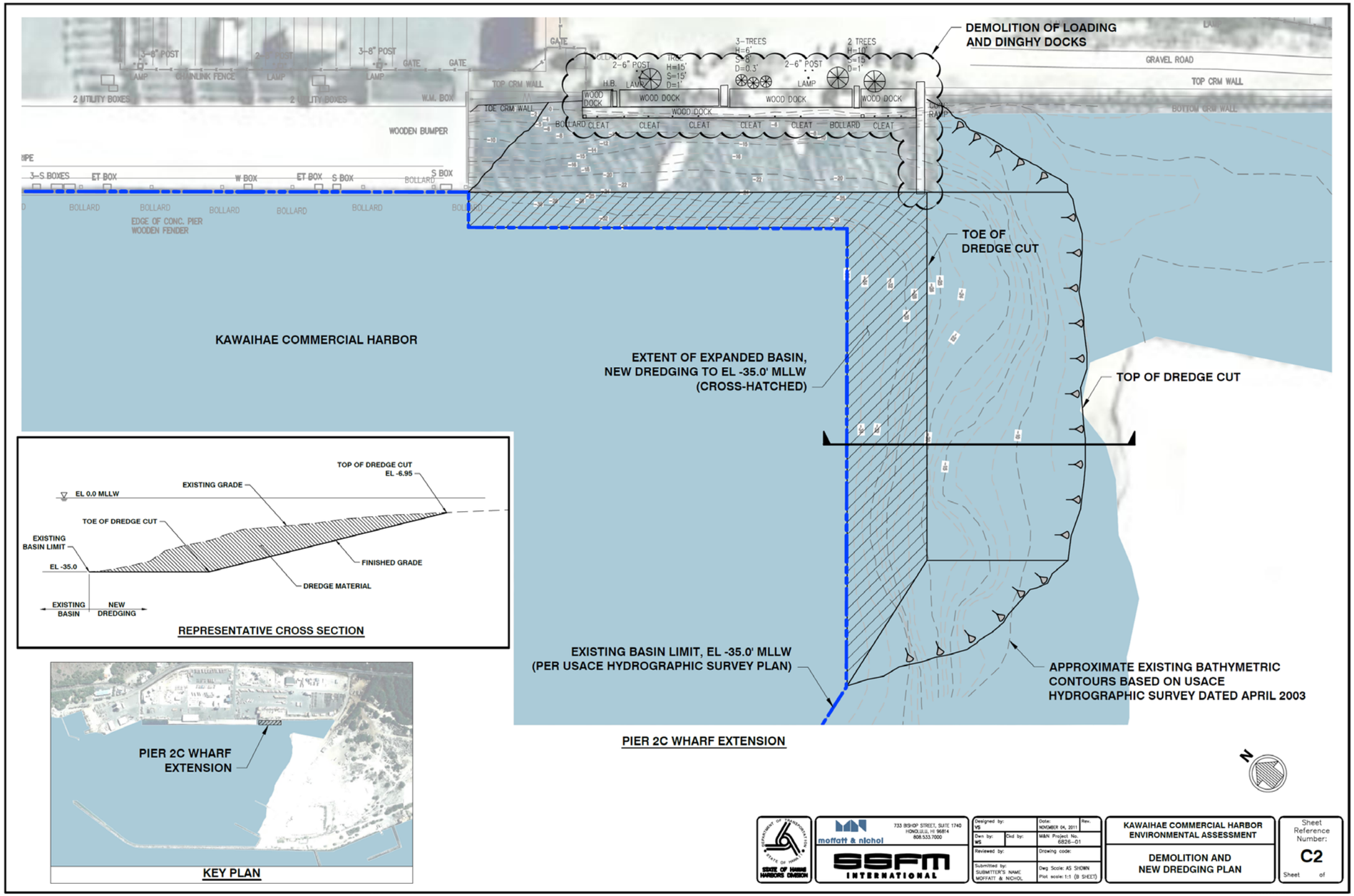
3.8.3 New Dredging at Pier 2C

Maintenance of existing water depths within the federal project area will be the responsibility of the US Army Corps of Engineers (USACE). USACE typically conducts maintenance dredging of this area every five to 10 years, which is separate from the proposed action. However, maintenance of water depths within the berthing area (typically between 50 and 100 feet from the pier face or bulkhead line up until the federal project line) will be the responsibility of DOT-H. This section focuses on new and maintenance dredging in the area under DOT-H's jurisdiction. Measures to remove boulders near Pier 2A under have already been discussed in **Section 3.7.2: Dredging (Boulder Removal) for Pier 2A** and will be pursued under Proposed Action - Alternative 5 as well.

New dredging is the dredging of areas never previously dredged in order to expand navigable areas. Maintenance dredging is the dredging of areas to remove sediment buildup and return the previously dredged area to designed water depths. The dredged material is known as dredgeate. Most of the harbor turning basin (i.e., the dredged maneuver area) was dredged to a minimum depth of minus 37.4 feet MLLW level during the original construction of the harbor in 1957 - 1959, but wave action, the 2006 Kiholo Bay earthquake, and reduced harbor circulation has contributed to sedimentation, which has reduced the depth in many areas, especially along the piers closest to the harbor entry. The necessary berth dredge depth will be minus 35 feet MLLW, however, a two to three-foot overdredge allowance (resulting in the minus 37.4 foot depth) offered some additional tolerance since it is not possible to dredge precisely to the exact 35 foot dredge depth.

New dredging will be required at the Pier 2C area to provide adequate water depth for barges, the same as the existing berth depth of at least minus 35 feet MLLW. The area that will be proposed for dredging for Pier 2C is shown in **Figure 3-14: Area of Dredging Proximate to Pier 2C Extension**. The limits of the existing dredge basin will be extended south approximately 100

Figure 3-14: Area of Dredging Proximate to Pier 2C Extension



Source: Moffatt and Nichol, 2011b

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feet beyond the end of the Pier 2C extension to provide room for maneuvering barges at the new berth. Based on the available hydrographic data reviewed for this project, it is estimated that 30,000 cubic yards of material will need to be dredged from the harbor bottom. Assuming that 500 cubic yards of material could be dredged each day, dredging will take about 60 days. The estimated duration of construction is based on the contractor's ability to work with minimal interruptions from existing commercial harbor operations.

The area of the proposed dredge footprint (the area to be dredged fully to a depth of 35 feet) is about 24,120 square feet (0.55 acres). The estimated total dredge area, including side slopes will cover about 81,360 square feet (1.87 acres), based on the type of dredge material.

Modern dredging operations include the use of electronic Global Positioning System instruments to provide accurate surveys of location. The most common and cost-effective dredging methods in Hawai‘i and in the United States in general, are discussed as options below. There are three options for the removal of dredge materials, and three options for the disposal of dredge materials.

The selection of a preferred option for dredging and disposal of dredgeate in association with Proposed Action - Alternative 5 will consider environmental impacts and design considerations and will be identified during the design phase based on the composition of the dredge materials and space availability.

3.8.3.1 Dredging Method Option 1 - Mechanical Dredging

Mechanical dredging will involve a clamshell dredge bucket operated from a barge-mounted crane accompanied by a material scow to receive the dredgeate. The material will be "scooped up" from the seabed and transferred to a material scow moored alongside the dredge barge. When the scow is filled, it will be taken to an authorized disposal site.

Mechanical dredges are well suited for work in confined areas and adjacent to existing piers and wharves. The dredged material for Kawaihae Harbor is likely to consist of sandy gravel and gravelly, calcareous sand with silt, as well as some cobbles and boulders. The presence of hazardous material in the area to be dredged will be assessed during detailed geotechnical analysis, engineering and design. Based on the estimated new dredging volumes, it has been assumed that mechanical dredging will be performed using a clamshell dredge bucket operated from a barge-mounted crane.

3.8.3.2 Dredging Method Option 2 - Hydraulic Dredging

Hydraulic dredging will use a mechanical dredge pump fitted on a marine barge to suck up the seabed material through a series of pipes. The intake end of the suction pipe is often fitted with a mechanical cutter to loosen the material that is being dredged. The dredge-water slurry will be hydraulically pumped either into a hopper contained within the dredging machine, or piped all the way to shore to a holding facility. Hydraulic dredging generates a large volume of wastewater that needs to be managed during the operation. Hydraulic dredging is best suited for dredging loose and sandy materials.

3.8.3.3 Options for Disposing of Dredgeate

To comply with Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA), EPA and the USACE must evaluate alternative disposal options and approve the correct placement of dredged material. These options include open-water disposal, confined (diked) disposal, and beneficial uses. (USACE and EPA, 2004). The selection of a preferred alternative for disposing of the dredgeate will be based on environmental acceptability, technical feasibility, costs, and other factors.

Some sediments identified in the water sampling contained barium, lead and polychlorinated biphenyls (PCBs) as noted in **Section 4.10.1.3: Marine Water Quality**. Dredge spoils containing heavy metals will have be to be disposed of at a landfill authorized to accept hazardous waste. In some cases, if the material is very contaminated, it is shipped to the US mainland for disposal there.

Dredgeate Disposal Option 1 - Deep Ocean Disposal

Any deep ocean disposal of dredge spoils will receive proper permits under the Clean Water Act and the Marine Protection, Research and Sanctuaries Act (MPRSA) by USACE, using EPA's environmental criteria and subject to EPA's review and concurrence.

There are five EPA-designated sites for disposal of dredge spoils in Hawaii; the closest one to Kawaihae is offshore of Hilo. USACE is required to use these sites unless an EPA-designated site is not feasible. Sites have been designated to minimize environmental impacts of dumping dredge spoils by localizing all the spoils from various projects at one disturbed site. They also consider such characteristics as currents, wave climate, water depth, bathymetry, benthic impacts, etc.

For ocean disposal, after removal from the dredge area, sealed and US Coast Guard-certified bottom-dump barges will be used to transport the material to an approved deep ocean-site. Permits for ocean disposal will be obtained as necessary. Barges will be positioned at the mandated coordinates and will then release the spoils directly into the water column by opening the bottom dump doors on the underside of the barge. Bottom-dump barges typically have a maximum capacity of between 1,000 and 2,000 cubic yards per load. As noted above, it is estimated that 30,000 cubic yards of material will need to be dredged from the harbor bottom, translating into between 15 and 30 estimated dumpings at the deep ocean site. Assuming that 500 cubic yards of material could be dredged each day, the duration of the dredging (and dumping) will take about 60 days.

Barges are designed with bottom doors or with a split-hull, and the contents may be emptied within seconds, essentially as an instantaneous discharge. Often sediments dredged by clamshell remain in fairly large consolidated clumps and reach the bottom in this form. Whatever its form, the dredged material descends rapidly through the water column to the bottom, and only a small amount of the material remains suspended. (USACE and EPA, 2004).

Possible impacts on the marine environment can come from suspension of sediments, and spread of contamination from sediments. Marine plants or animals could be affected from

turbidity, or take in contaminants. Contaminants could also volatize (evaporate). A testing program may be required as part of the permitting process.

Dredgeate Disposal Option 2 - Upland Landfill Disposal

For upland landfill disposal (also referred to as "confined disposal facilities"), the dredged material will be offloaded on-land to a designated containment area for dewatering (i.e., drying) by evaporation. The dredge material will be contained within an impermeable earthen berm during the dewatering process to prevent any flow back to coastal waters, and the containment area will be lined with an impervious bottom to prevent seepage into the soil and groundwater below. Following dewatering, the dredge material will be transported to its final location at an approved landfill. The spoils will be removed from haul barges by an excavator or clam-supported clamshell bucket, placed in the disposal area, and then graded within the area using standard earth-moving equipment.

Impacts of this option can primarily result from placement of contaminated sediments, and associated effluent, leachate, or runoff of contamination. Plants or animals could take in contaminants. Contaminants could also volatize (evaporate) or be attached to windborne particulates. A testing program may be required as part of the permitting process. At a contained upland landfill site that has already experienced past disturbance, it is assumed that there would be no significant alteration of habitat, vegetation, or impacts on cultural resources.

Dredgeate Disposal Option 3 - Disposal at Coral Flats

A third option for disposal will be to store the dredgeate at the Coral Flats area for reuse as part of the future development of the area. This use corresponds to a "beneficial use" (USACD and EPA, 2004) The method will be similar to the description above for upland landfill disposal except that spoils will be deposited instead within the Coral Flats area and then graded as needed. This will offer the opportunity to "build up" the Coral Flats area further (to offer higher ground) or to be used for other purposes.

As with the upland landfill, impacts of this option can primarily result from placement of contaminated sediments, and associated effluent, leachate, or runoff of contamination. Plants or animals could take in contaminants. Contaminants could also volatize (evaporate) or be attached to windborne particulates. A testing program may be required as part of the permitting process. Using the disturbed Coral Flats area that has experienced past disturbance, there will be no significant alteration of habitat, vegetation, or impacts on cultural resources.

3.9 Project Funding and Costs

The DOT-H funds their operating and capital improvement expenses through the Harbors Special Fund, which is derived from fees collected from the commercial harbor users. The project will be financed solely with State of Hawai'i funds, specifically through Harbor Special Funds (or in special cases, either from General Funds or from federal sources such as competitive grants). Cost estimates of the project elements described for the alternatives in this chapter are shown in **Table 3-3: Estimated Construction Cost of All Potential Project Actions**.

Table 3-3: Estimated Construction Cost of All Potential Project Actions

Improvement	Estimated Total Cost			
	Alt. 2 - Minimal Build	**Alt. 3 - Partial Action/ Land-side**	**Alt. 4 - Land-Side Plus Pier 2A Extension**	**Alt. 5 - Proposed Action (Pier 2A and 2C Extensions)**
Mobilization/Demobilization and Temporary Works			$ 0.8 million	**$4.6 million**
Dredging and Offsite Disposal of Dredge Material			$0.2 million	**$1.9 million**
Demolition and Reconstruction of Existing Pier 2 Superstructure			$15.8 million	**$15.8 million**
Demolition of Existing Loading, Dinghy Dock, and Finger Pier				**$0.8 million**
Pier 2A Extension			$13.3 million	**$13.3 million**
Pier 2C Extension				**$12.7 million**
Foreshore Fill			$1.1 million	**$2.2 million**
Slope and Scour Protection			$1.7 million	**$2.4 million**
Upland Yard Improvements (Fences, Pavements, Hydrants, etc.)	$0.1 million*	$38.1 million	$38.1 million	**$38.1 million**
Electrical (Poles, Lighting, Substation Modifications)		$3.9 million	$3.9 million	**$3.9 million**
Truck Gate Clerk Booths		$0.05 million	$0.05 million	**$0.05 million**
Main Gate Improvements and Associated Improvements to Kawaihae Road		$1.7 million	$1.7 million	**$1.7 million**
South Gate Improvements and Associated Improvements to Kawaihae Road	$1.3 million	$1.3 million	$ 1.3 million	**$ 1.3 million**
Subtotal Construction Estimate	**$1.4 million**	**$45.1 million**	**$78.0 million**	**$97.8 million**
35% Engineering/Contingency Allowance for Items Above	$0.5 million	$15.8 million	$27.3 million	**$34.2 million**
TOTAL	**$1.9 million**	**$60.9 million**	**$105.3 million**	**$133.0 million**

*Fencing for Perimeter Road only

Sources: Moffatt and Nichol, 2011b and SSFM International

3.10 Alternatives That Did Not Meet Purpose and Need

As was shown in **Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives**, several other alternatives were considered in the planning of this EA. None of these alternatives address the project's purpose and need or other screening criteria to a level commensurate with the alternatives carried forward for analysis in this EA. Two of the alternatives not carried forward for analysis in the EA would have substantial adverse effects off-site (either in Hilo or at a new harbor site) and therefore would transfer adverse impacts to a different location, and at a higher level of magnitude than making the improvements at Kawaihae Harbor itself.

3.10.1 Construct Improvements at a New Harbor in West Hawai‘i

There is no other existing commercial harbor on the west side of Hawai‘i Island. As such, there is no other existing facility on the west side of Hawai‘i Island that could currently provide the range of functions found in Kawaihae, or have infrastructure or harbor amenities added as a substitute to improvements at Kawaihae Harbor.

In addition, there are no known practical locations for a new commercial harbor on the west side of Hawai‘i Island containing piers, breakwaters, and other harbor amenities. Even if there was an appropriate location, the cost of constructing an entirely new harbor would be prohibitive and impractical as well, given that an existing harbor is already serving this side of the island. It is highly unlikely that funding could be raised for such an endeavor.

If a new harbor were built, the environmental impacts would be substantially greater than improving the existing Kawaihae Harbor. Kawaihae Harbor has been highly disturbed from its original ecological state since the modern construction of the harbor in the 1950s, and by decades of earlier harbor use before that. A new harbor would likely affect a relatively unaltered location and the environmental consequences would be substantial.

Since there are already pressing needs at Kawaihae Harbor that are independent of cargo and berthing capacity (such as safety for recreational users, security needs, etc.), a new harbor would do nothing to address those needs as shown in **Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives.**

For these reasons, the new harbor alternative is not carried forward for additional study.

3.10.2 Redistribute Cargo Handling from Kawaihae Harbor to Hilo Harbor

Re-distribution of cargo handling between Kawaihae and Hilo was considered during the 2035 Master Plan. However, Hilo Harbor is also facing a severe shortage of space, and expansion projects are underway at that harbor. The 2035 Master Plan proposes a number of improvements to Hilo Harbor in addition to improvements at Kawaihae Harbor. While Hilo Harbor already has needs for improvements of its own, there would have to be a dramatically greater investment in improvements in Hilo in order to compensate for the lack of

improvements at Kawaihae Harbor. These improvements would have environmental impacts and fiscal costs in Hilo (rather than Kawaihae), and therefore would not avoid impacts overall.

Furthermore, improving Hilo Harbor to a greater degree in place of the proposed improvements at Kawaihae Harbor would create adverse impacts of its own and not meet the Purpose and Need for the project for several reasons:

- Hilo Harbor is approximately 67 miles away from Kawaihae Harbor by road and therefore, it would result in increased environmental impacts (noise, air emissions, etc.) from increased trucking activity. It would also increase the cost of surface transportation of goods to and from West Hawai'i.
- Due to Hawai'i Island's location in the Pacific Ocean, Hilo Harbor and Kawaihae Harbor have historically been affected by tsunami and experience other natural disasters (earthquake, lava flows, etc.) By only improving Hilo Harbor and not improving Kawaihae Harbor, DOT-H would be compromising Hawai'i Island's capacity and flexibility for transporting essential goods in the event of a natural disaster.

As shown in shown in **Table 3-2: Assessment of EA Alternatives in Meeting Purpose and Need and Other Objectives**, improvements at Hilo Harbor in place of Kawaihae Harbor would not address the project's purpose and need and other criteria under consideration. Therefore, this alternative was not carried forward for further study.

3.10.3 Caisson Wharf Design Option

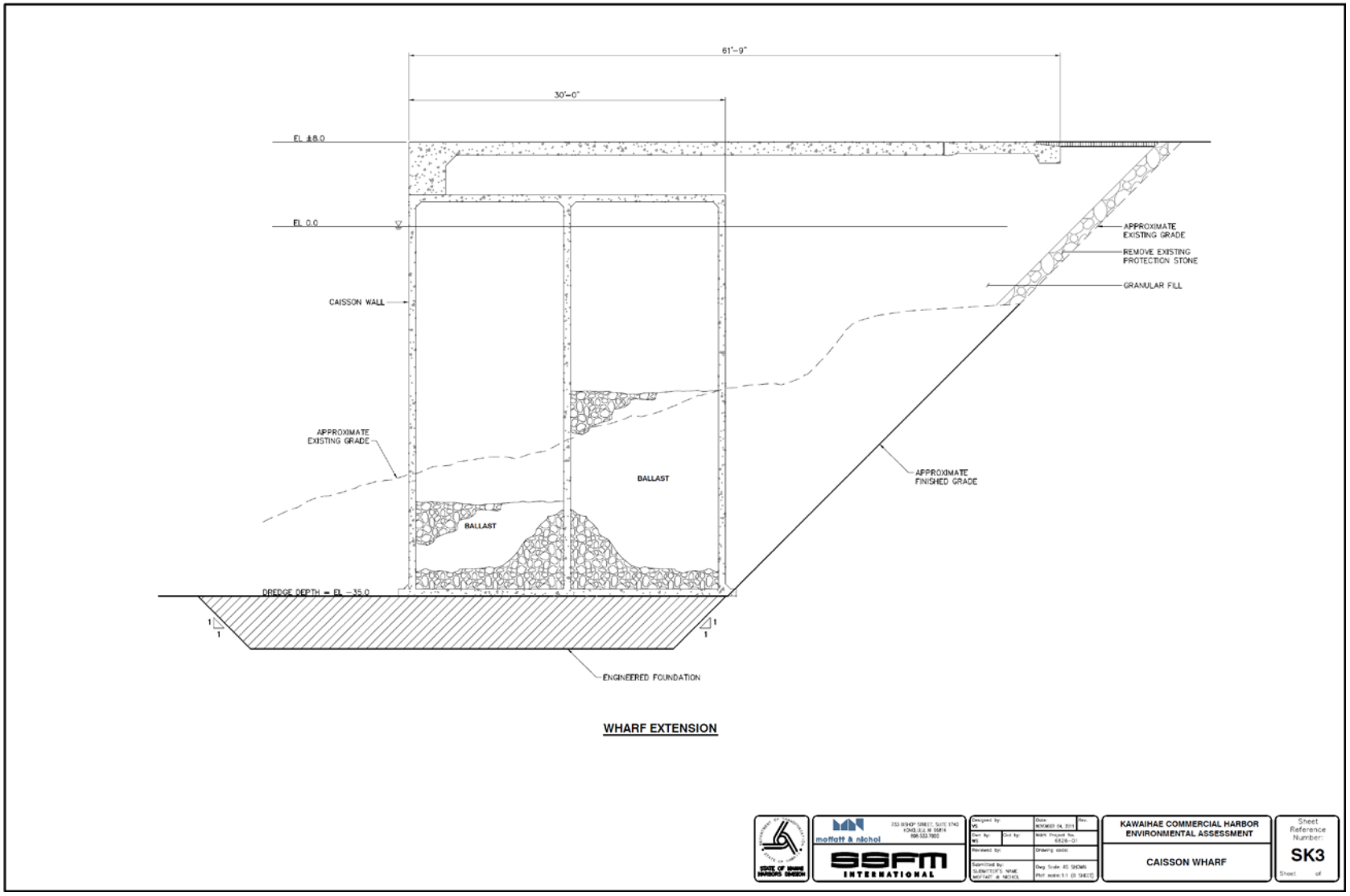
As part of the Proposed Action - Alternative 5 as well as Alternative 4 - Land-Side Plus Pier 2A Extension, several different design options are possible for Piers 2A and 2C. One option that is not considered practicable is a caisson wharf.

The caisson wharf design is shown in **Figure 3-15: Caisson Wharf Typical Elevation**. Caissons are concrete structures that are prefabricated off-site, floated into position, and seated on a prepared engineered foundation. The upland area behind the caisson is backfilled to provide a contiguous yard area. The system acts as a gravity-structure to resist lateral pressures and seismic loads. While a caisson wharf could be technically feasible, it would not be expected to be economically viable at Kawaihae Harbor because of the relatively short length of new wharf construction (i.e., relatively high unit costs), and the need to prepare a suitable foundation. A caisson wharf design would be more practical for lengthier pier installations because the unit cost of manufacturing and transporting the prefabricated caissons would be lower. The foundation preparation would also be an expensive component that would be more economically viable for a lengthier pier. Therefore, this design would be significantly more expensive than the other design options and is not considered to be reasonable.

3.10.4 Future Master Plan Elements Not Carried Forward in EA

This EA considers the direct, indirect, and cumulative impacts of those projects necessary within the near-term foreseeable future. While the 2035 Master Plan identifies a Preferred Alternative based on the High Case scenario as the preferred alternative, it recognizes improvements will occur in phases and that improvements to Piers 2A and 2C will be a

Figure 3-15: Caisson Wharf Typical Elevation



Source: Moffatt and Nichol

precursor to building Pier 3. The improvements to Piers 2A and 2C are considered in this EA because they will be expected to occur in the near-term future (10 to 15 years) and have independent utility. If Pier 3 is determined to be necessary, it will be constructed beyond 10-15 years and is therefore not evaluated in this EA.

DOT-H has determined that the following projects identified in the 2035 Master Plan are of a longer-term planning horizon and/or may not occur. Therefore, these improvements are not reasonably foreseeable. Conditions could change over time that delay or eliminate them. These elements that are not carried forward in the EA are:

- Construction of a new 865-foot long Pier 3 configured parallel to the shoreline of the Coral Flats area with associated dredging. As noted above, this action would only be needed if future berthing demands at Kawaihae Harbor could not be accommodated with the existing harbor (i.e., at Piers 1 and 2) due to increased barge traffic or because new uses warrant the need for more berths.
- Paving of 22 acres of new cargo terminal areas in the Coral Flats area to serve a possible future Pier 3, providing an additional 40 percent capacity of harbor container storage, including grounded blocks for exports, 40-foot chassis rows, 20-foot chassis rows, and reefer connections. The objective is to optimize the use of the existing harbor (i.e., areas behind Piers 1 and 2) before undertaking expansion outside of the existing harbor. Therefore, the timeline for such needed capacity at the Coral Flats is unknown at this time.
- Construction of a ferry pier configured perpendicular to Pier 3 with associated passenger terminal. This would only be pursued if ferry operations are proposed, and therefore a ferry pier is a long-term consideration of indeterminate need and schedule.

If and when the need for these long-range projects develops, DOT-H will conduct the appropriate environmental analysis in accordance with Chapter 343, HRS and with National Environmental Policy Act (NEPA) rules and regulations (if applicable).

3.11 Other Nearby Improvements Separate From the Alternatives Covered in this EA

The following improvements in the area proximate to Kawaihae Harbor are under consideration by proponents other than DOT-H. All of them have need and function independent from the improvements proposed in this EA and will operate on their own schedules and funding paths. All will have impacts evaluated in separate Chapter 343/NEPA documentation. They are all considered "reasonably foreseeable" from the standpoint of considering cumulative impacts (see **Section 10.2: Cumulative Impacts**.)

3.11.1 Road Improvements

DOT Highways Division is studying improvements to the roadway system in the region. One project will construct dedicated right turn lanes on south-bound Kawaihae Road and Kawaihae-bound Queen Ka'ahumanu Highway and an acceleration lane on Kawaihae Road for vehicles

making a left turn from Queen Ka‘ahumanu Highway. Related improvements will be installation of new guardrail, signs, and pavement markings (including new painted islands). These are needed to improve operations and safety at this intersection.

In the long-term, DOT Highways Division has plans to build a new Kawaihae Bypass Road which will provide additional roadway capacity to and from the harbor. A Draft Environmental Impact Statement for the Kawaihae Bypass Road is in preparation. Concept designs include one or more direct spur(s) into Kawaihae Harbor, subject to environmental and archaeological constraints.

The impacts of improvements at the Queen Ka‘ahumanu intersection and a Kawaihae Bypass Road will be considered in the separate Draft EIS. This EA considers only improvements to Kawaihae Harbor’s access gate intersections noted above in **Section 3.6.5: Improvements to Main Gate, South Gate, and Kawaihae Road** as part of the Proposed Action - Alternative 5 as well as Alternative 3 - Partial Action/Land-Side and Alternative 4 - Land-Side Plus Pier 2A Extension. The justification for and implementation of improvements to Kawaihae Harbor are independent of any of these separate improvements.

3.11.2 Fuel Storage

Fuel storage is the responsibility of the fuel industry; however, fuel discharge lines, pipelines and other connections to the final storage facilities are within the harbor boundaries.

Pier 2A will continue to serve as the fuel barge discharge berth, with transmission pipelines to landside fuel storage tanks. The 2035 Master Plan considered future improvements that will relocate liquid-bulk storage (i.e., fuel tanks and fuel pipelines) off of DOT-H’s property to the Hawai‘i Department of Hawaiian Homelands (DHHL) industrial lands across Kawaihae Road. Such actions will only be pursued in the future as demands warrant and their environmental effects will be evaluated in a separate review.

3.11.3 Small Boat Harbor (South) and Perimeter Road Development

While the Build Alternatives include the dedication of a future perimeter access road, and transfer of land ownership to the DLNR DOBOR to develop its Kawaihae Small Boat Harbor (South), the actual construction of the road and Kawaihae Small Boat Harbor (South) development is a separate action that will be permitted, funded, built, and operated by DLNR DOBOR. The Small Boat Harbor (South) will be built on approximately 13 acres. Refer to **Section 3.5.2: Security Fencing and Dedication of Land for Small Boat Harbor (South) and Perimeter Road** above for more information.

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CHAPTER 4: PHYSICAL AND BIOLOGICAL ENVIRONMENT

The chapter that follows covers the existing conditions, the anticipated impacts, and the proposed mitigation for effects on the physical and biological environment. Refer to **Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended** Mitigation for a brief summary of the rest of the chapter.

Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended Mitigation provides recommended mitigations. Actual mitigations will be determined by the appropriate permit/approval process.

Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
4.1	**Climate**	• None.	• Negligible - conversion of some unpaved areas to impervious surface.	• Negligible - conversion of some unpaved areas to impervious surface.	• Negligible - conversion of some unpaved areas to impervious surface.	• **Negligible - conversion of some unpaved areas to impervious surface.**	• No mitigation is warranted.
4.2	**Geology, Topography Bathymetry**	• None.	• Some grading.	• Some grading.	• Some grading, dredging (near Pier 2A). • Disposal of dredgeate either within Coral Flats or at approved sites.	• **Some grading, dredging at Piers 2A/2C (maintenance, expansion, new).** • **Disposal of dredgeate either within Coral Flats or at approved sites.**	• Best Management Practices (BMPs).
4.3	**Soils**	• None.	• Grading of areas mostly filled with coral spoils.	• Grading of areas mostly filled with coral spoils.	• Grading of areas mostly filled with coral spoils.	• **Grading of areas mostly filled with coral spoils.**	• Best Management Practices (BMPs) recommended.
4.4	**Earthquakes**	• No Benefits from Improvements.	• No Benefits from Improvements. • No increase in capacity if earthquakes affect island or Hilo Harbor.	• Minimal increase in capacity if earthquakes affect island or Hilo Harbor.	• Modest increase in capacity if earthquakes affect island or Hilo Harbor.	• **Highest increase in capacity if earthquakes affect island or Hilo Harbor.**	• Design should consider seismic conditions.
4.4	**Lava Flows**	• Low Risk Area for Lava Flows (Zone 9).	• Low Risk Area for Lava Flows (Zone 9).	• Low Risk Area for Lava Flows (Zone 9).	• Low Risk Area for Lava Flows (Zone 9).	• **Low Risk Area for Lava Flows (Zone 9).**	• No mitigation is warranted.
4.4	**Hurricanes**	• No Benefits from Improvements.	• No Benefits from Improvements • No increase in capacity if hurricanes affect island or Hilo Harbor.	• Minimal increase in capacity if hurricanes affect island or Hilo Harbor.	• Modest increase in capacity if hurricanes affect island or Hilo Harbor.	• **Highest increase in capacity if hurricanes affect island or Hilo Harbor.**	• Above-ground structures built to current codes.
4.4	**Tides/Sea Level Rise**	• Piers and Yard areas will be affected by sea level rise by 2035.	• Piers and Yard areas will be affected by sea level rise by 2035.	• Piers and Yard areas will be affected by sea level rise by 2035.	• Future uses at Kawaihae Harbor consider sea level rise.	• **Future uses at Kawaihae Harbor consider sea level rise.**	• Future uses at Kawaihae Harbor consider sea level rise.
4.4	**Tsunami**	• No Benefits from Improvements.	• No Benefits from Improvements • No increase in capacity if tsunami affect island or Hilo Harbor.	• Minimal increase in capacity if tsunami affect island or Hilo Harbor.	• Modest increase in capacity if tsunami affect island or Hilo Harbor.	• **Highest increase in capacity if tsunami affect island or Hilo Harbor.**	• Above-ground structures built to current codes.

Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	**Alt. 2: Minimal Action**	**Alt. 3: Partial Action/Land-Side**	**Alt. 4: Land-Side Plus Pier 2A Extension**	**Alt. 5: Proposed Action**	
4.5	**Air Quality**	• No direct effects. • Increased traffic and circulation congestion over time could increase emissions. • As barge traffic and ship lengths grow, more emissions as barges have to wait within the harbor for berthing area.	• Minor levels of fugitive dust during construction. • Increased traffic and circulation congestion over time could increase emissions. • As barge traffic and ship lengths grow, more emissions as barges have to wait within the harbor for berthing area.	• Fugitive dust emissions during construction. • Improved circulation and traffic. • Increased truck and barge traffic at harbor. • As barge traffic and ship lengths grow, more emissions as barges have to wait within the harbor for berthing area.	• Fugitive dust emissions during construction. • Improved circulation and traffic. • Increased truck and barge traffic at harbor. • As barge traffic and ship lengths grow, more emissions as barges have to wait within the harbor for berthing area.	• **Improved circulation.** • **Fugitive dust emissions during construction.** • **Increased truck and barge traffic at harbor.**	• BMPs recommended to mitigate fugitive dust and equipment emissions as part of DOH Air Pollution Rules. • All equipment and vehicle emissions regulated by state and federal laws.
4.6	**Noise**	• No direct effects. • Minimal traffic noise increase over time from general growth.	• Construction noise impacts from grading, etc. • Minimal increase in traffic noise on Kawaihae Road.	• Construction noise impacts from grading, etc. • Post-construction truck/ equipment noise from increased activity at harbor. • Minimal increase in traffic noise on Kawaihae Road.	• Construction noise impacts from grading, pile driving, etc. • Underwater noise during construction caused by pile driving could affect marine species. • Post-construction truck/ equipment noise from increased activity at harbor. • Minimal increase in traffic noise on Kawaihae Road.	• **Construction noise impacts from grading, pile driving, etc.** • **Underwater noise during construction caused by pile driving could affect marine species.** • **Post-construction truck/ equipment noise from increased activity at harbor.** • **Minimal increase in traffic noise on Kawaihae Road.**	• DOH Noise Permit should restrict hours of constructions. • Construction equipment should have mufflers and other required controls. • Underwater noise from pile driving recommended to be mitigated through timing of activates, air bubble curtains, and "soft starts." • Speed limits should limit traffic noise.

Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
4.7	**Visual Resources**	• None.	• Minor visual effects from fencing, removal of vegetation.	• Visual effects from fencing, grading, removal of vegetation, improved pavement, ancillary structures, and other effects of the project.	• Visual effects from fencing, grading, removal of vegetation, improved pavement, ancillary structures, and other effects of the project.	• **Visual effects from fencing, grading, removal of vegetation, improved pavement, ancillary structures, and other effects of the project.**	• The 22-acre Pelekāne Lands buffer will not be affected and will continue to protect Pu'ukoholā Heiau National Historic Site from harbor property. • Fencing design should consider color and landscaping to minimize visual intrusion. • Lighting should meet county standards and should consider light pollution concerns. • If landscaping is pursued, native species should be considered.
4.8	**Historic and Archaeo-logical**	• None.	• Limited potential for impacts on resources due to past disturbance of land in area.	• Limited potential for impacts on resources due to past disturbance of land in area. • Design of improvements to Kawaihae Road shifted makai to avoid impacts on burials.	• Limited potential for impacts on resources due to past disturbance of land in area. • Design of improvements to Kawaihae Road shifted makai to avoid impacts on burials.	• **Limited potential for impacts on resources due to past disturbance of land in area.** • **Design of improvements to Kawaihae Road shifted makai to avoid impacts on burials.**	• Design of improvements to Kawaihae Road should be shifted makai to avoid impacts on burials. • On-call monitoring of archaeological resources recommended for any subsurface excavation along Kawaihae Road due to proximity of sensitive sites. • If subsurface features or artifacts are encountered during construction, activities should cease and State Historic Preservation Division (SHPD) should be contacted immediately.

Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
4.9	**Cultural Impacts**	• No direct effects.	• Potential to disrupt some traditional practices such as canoeing, surfing, etc. • Access to shoreline could be affected if mitigation not ensured.	• Potential to disrupt some traditional practices such as canoeing, surfing, etc. • Access to shoreline could be affected if mitigation not ensured.	• Potential to disrupt some traditional practices such as canoeing, surfing, etc. • Increase in barge traffic could result in higher level of conflict with recreational users. • Access to shoreline could be affected if mitigation not ensured.	• **Potential to disrupt some traditional practices such as canoeing, surfing, etc.** • **Removal of small boat moorings will have effect.** • **Increase in barge traffic could result in higher level of conflict with recreational users.** • **Access to shoreline could be affected if mitigation not ensured.**	• Efforts should be made to ensure access is maintained to the highest degree possible. • Fencing along perimeter road should separate recreational users from security perimeter. • DOT-Harbors should support DLNR-DOBOR efforts to complete Kawaihae Small Boat Harbor (South), though that is DLNR-DOBOR's initiative. • The 22-acre Pelekāne Lands buffer will not be affected and will continue to protect Pu'ukoholā Heiau National Historic Site from harbor property.

Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
4.10	**Hydrology/ Marine Water Quality**	• None.	• Impacts from grading.	• Impacts from grading.	• Impacts from grading. • Impacts from dredging and pier construction.	• **Impacts from grading.** • **Impacts from dredging and pier construction.**	• BMPs recommended. • National Pollution Discharge Elimination System (NPDES) permits will be obtained. • Section 404 Permit from USACE and Section 401 Water Quality Certification will be obtained. • Section 10 Permit for Rivers and Harbors Act. • Section 103 Permit for Dredge Disposal under Marine Protection, Research and Sanctuaries Act (MPRSA). • EPA Approval for Ocean Disposal of Dredge Materials.
4.11	**Drainage**	• None.	• No perennial streams, ponds, lakes or wetlands directly affected by proposed action. • Makahuna Gulch not directly affected by the project; impacts will be evaluated if DLNR-DOBOR improves unpaved perimeter road.	• No perennial streams, ponds, lakes or wetlands directly affected by proposed action. • Makahuna Gulch not directly affected by the project; impacts will be evaluated if DLNR-DOBOR improves unpaved perimeter road.	• No perennial streams, ponds, lakes or wetlands directly affected by proposed action. • Makahuna Gulch not directly affected by the project; impacts will be evaluated if DLNR-DOBOR improves unpaved perimeter road.	• **No perennial streams, ponds, lakes or wetlands directly affected by proposed action.** • **Makahuna Gulch not directly affected by the project; impacts will be evaluated if DLNR-DOBOR improves unpaved perimeter road.**	• Stormwater BMPs recommended during and after construction. • National Pollution Discharge Elimination System (NPDES) permits will be obtained.
4.12	**Vegetation**	• None.	• Some highly-disturbed areas of Coral Flats where keawe have grown may be affected. • No high quality vegetative habitat affected.	• Some highly-disturbed areas of Coral Flats where keawe have grown may be affected. • No high quality vegetative habitat affected.	• Some highly-disturbed areas of Coral Flats where keawe have grown may be affected. • No high quality vegetative habitat affected.	• **Some highly-disturbed areas of Coral Flats where keawe have grown may be affected.** • **No high quality vegetative habitat affected.**	• None.

Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
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4.13	**Wildlife**	• None.	• Lighting could have an effect on seabirds. • No rare, endangered or threatened terrestrial mammals affected.	• Lighting could have an effect on seabirds. • No rare, endangered or threatened terrestrial mammals affected.	• Lighting could have an effect on seabirds. • No rare, endangered or threatened terrestrial mammals affected. • Potential impacts on marine wildlife from underwater noise, increased vessel traffic. • Impacts on coral.	• **Lighting could have an effect on seabirds.** • **No rare, endangered or threatened terrestrial mammals affected.** • **Potential impacts on marine wildlife from underwater noise, increased vessel traffic.** • **Impacts on coral.**	• Lighting should be shielded and limited in height and power to protect seabirds. • BMPs recommended such as siltation curtains and other measures to mitigate impacts of siltation on marine habitats. • Recommended that underwater noise from pile driving mitigated through timing of activities, air bubble curtains, and "soft starts." • Section 7 Endangered Species Act consultation with resource agencies
4.14	**Coral Communities**	• None.	• None.	• None.	• Coral colonies potentially affected near Piers 1 and 2 from new dredging, expansion dredging, and maintenance dredging.	• **Coral colonies potentially affected near Piers 1 and 2 from new dredging, expansion dredging, and maintenance dredging.**	• BMPs recommended such as siltation curtains and other measures to mitigate impacts of siltation on marine habitats. • Water quality monitoring during dredging. • Compensatory mitigation should be pursued for impacted coral, including potential transplantation or other strategies.

Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
4.15	**Invasive Species**	• No direct effects. • No space provided for future DOA inspection facility.	• No direct effects. • No space provided for future DOA inspection facility.	• One-acre space provided for DOA to build a future inspection facility, which will increase their capacity to intercept invasives from spreading.	• Increased barge and watercraft activity could pose greater risks for invasives to spread. • One-acre space provided for DOA to build a future inspection facility, which will increase their capacity to intercept invasives from spreading.	• **Increased barge and watercraft activity could pose greater risks for invasives to spread.** • **One-acre space provided for DOA to build a future inspection facility, which will increase their capacity to intercept invasives from spreading.**	• One-acre space provided for DOA to build a future inspection facility, which should increase their capacity to intercept invasives from spreading. • All laws and regulations in place to target invasive species will be followed, including those governing ballast water discharges.
4.16	**Hazardous Materials**	• No direct effects from exposure or release of existing hazardous materials.	• Potential adverse impacts from hazardous materials not previously documented during construction. • Normal operations should not expose public or workers to hazardous substances if standard procedures are followed.	• Potential for encountering hazardous materials previously documented (lead, asbestos, other potential materials) during construction. • Potential adverse impacts from hazardous materials not previously documented during construction. • Normal operations should not expose public or workers to hazardous substances if standard procedures are followed.	• Potential for encountering hazardous materials previously documented (lead, asbestos, other potential materials) during construction. • Potential adverse impacts from hazardous materials not previously documented during construction. • Normal operations should not expose public or workers to hazardous substances if standard procedures are followed.	• **Potential for encountering hazardous materials previously documented (lead, asbestos, other potential materials) during construction.** • **Potential adverse impacts from hazardous materials not previously documented during construction.** • **Normal operations should not expose public or workers to hazardous substances if standard procedures are followed.**	• All demolition and site work should be managed according to DOH measures. • All known potential sources of hazardous materials (utilities, pipelines, tanks, etc.) should be identified prior to demolition/construction. • Disposal of materials should be consistent with state/federal regulations/permits.

Table 4-1: Summary of Impacts on Physical and Biological Environment and Recommended Mitigation

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4.17	**Light Pollution**	• No direct effects on lighting.	• No direct effects on lighting.	• Increased lighting from new light poles.	• Increased lighting from new light poles.	• **Increased lighting from new light poles.**	• Lights should be shielded and mast heights should be limited to 46.5 feet high. • Low-pressure sodium light should minimize illumination levels. • Lighting should include lower security-level-illumination when higher levels are not needed. • All lighting should comply with the County's Lighting Code.

4.1 Climate

4.1.1 Existing Conditions

Hawai'i Island has a total land area of about 4,028 square miles, and is the largest island in the Hawaiian Islands chain. The climate is characterized as having low day-to-day and month-to-month temperature variability. The wide differences in the climate of various areas are generally attributed to the island's geologic formation and topography.

Kawaihae has the driest conditions anywhere on Hawai'i Island, experiencing less than 10 inches of rain annually. The Kawaihae area is on the leeward side of the island and is shielded from moisture-bearing trade winds by the slopes of Mauna Kea and Kohala mountains. Recent years have resulted in drought restrictions in arid leeward South Kohala areas.

Temperatures year-round for the general area range between mid- to upper-60s Fahrenheit (F) as low temperatures and mid-80s F as high temperatures with an average annual temperature of 76 degrees F. The low-variability temperatures are associated with the mid-ocean location of the island and to the small seasonal variation in the amount of energy received from the sun.

Climate change is a global concern, and is of particular importance in a coastal location. Refer to **Section 4.4.1.4: Tidal Effects and Sea Level Rise** for more information.

Winds are highly variable, but predominantly come from the common tradewind pattern from an easterly direction, and exceed 13 miles per hour (mph) about 35 percent of the time. Wind speeds normally remain below 30 mph, and rarely exceed 50 mph. However, winds are also significantly influenced by the heating of the upland area, which produces a pronounced diurnal wind pattern on Hawai'i Island, with afternoon sea breezes coming into shore, opposite the prevailing tradewinds, especially in summer when solar receipts are the strongest. Winds coming off the higher elevations and blowing toward the sea are common in the evening. The combination of these interacting factors, plus the highly unusual wind flow patterns caused by the temperature inversion and the channels in the terrain, results in an unusually diverse weather pattern (Helber, Hastert & Fee, 2009).

The common light and variable winds can also abruptly change to strong, unpredictable, and occasionally violent western winds which are funneled through the saddle between these two mountains and concentrated with significant force (referred to as "Waimea winds"). In the area of the Proposed Action, winds strong enough to blow over a 34-foot high stack of shipping containers, or containers mounted on a truck chassis have been experienced. The Hawai'i Pilots Association warns "Kawaihae Harbor is frequently subject to sudden, strong, gusty winds. ... Violent wind squalls can occur in as little as fifteen minutes, going from calm conditions to 30 knot gusts." These winds are even stronger offshore and have been known to reach 85 mph in the 'Alenuihaha Channel between Hawai'i and Maui. (Helber, Hastert & Fee, 2009).

During Kona wind periods, southerly and westerly winds may appear for short durations, and may bring overcast skies and Kona storms, but these winds are not channeled through the saddle, and so are normally not associated with damages unless associated with severe Kona

storms, which can bring sustained high winds for several days at a time, affecting navigation and creating disruptive wave action. (Helber, Hastert & Fee, 2009).

Hurricanes are rare, but can bring very heavy rains, and high and variable winds of around 75 to 115 mph posing dangerous sea and surf conditions.

4.1.2 Project Impacts on Climate

4.1.2.1 No-Build Alternative

The No-Build Alternative will have no direct impact on climate.

4.1.2.2 Build Alternatives

Alternatives 2 through 5 will all result in some conversion to impervious surface of areas that are not currently built as impervious or paved surfaces. This will have a negligible impact on the micro-climate in the immediate location of the improvements.

4.2 Geology, Topography, and Bathymetry

Hawai'i Island consists of flows from five separate volcanoes. Kawaihae lies at the base of Kohala Mountain, an inactive volcano that is the oldest of the five. As discussed in **Section 4.4.1.4: Tidal Effects and Sea Level Rise**, Hawai'i Island is subsiding under its own weight at a rate of approximately 1.5 millimeters (mm) per year.

4.2.1 Existing Conditions

Kawaihae Harbor is generally flat and exists at sea level to a few feet above sea level on the southwestern flank of the Kohala Mountains. The area is characterized by low-lying flatlands with a gentle slope to the ocean, against the saddle of the area where the Mauna Kea volcanic slopes overlap the older Kohala volcanic slopes. A large coral fringe reef surrounds the harbor area. Much of the coral reef was blasted and dredged between 1957 and 1959 to create the commercial harbor and to provide a sufficient turning basin and navigation space for the passage of larger vessels such as barges. The original ocean floor was primarily coralline reef rock, interspersed with scattered sand pockets and coral heads (Helber, Hastert & Fee, 2009).

The current bottom material is a mix of coral rubble, silty sand, coralline gravel, and remaining coralline rock. The harbor area was then extensively filled, recontoured, and leveled using the dense crushed coral dredge material on top of lagoonal deposits of silty sands and soft clayey deposits, coralline detritus deposits, and weathered basalt at greater depths (at around 47 feet). The fill material was used to more than triple the available land area and to provide straight-and-level piers and backland areas for cargo movement and storage (Helber, Hastert & Fee, 2009). Currently, most of the harbor shoreline area outside of the Coral Flats area is hardened with piers or revetments and the harbor has a breakwater to attenuate the wave action inside the harbor and against the shoreline.

Most of harbor turning basin (i.e., the dredged maneuver area) was dredged to a minimum depth of 37.4 feet below the Mean Lower Low Water (MLLW) level during construction, but wave action, the 2006 Kiholo bay earthquake, and reduced harbor circulation has reduced the

draft in many areas, especially along the piers closest to the harbor entry. The maximum allowable draft for the 1,150-foot long Pier 2 is 33 feet. (Helber, Hastert & Fee, 2009). The USACE has jurisdiction within their project area, which is demarcated by the "federal project line" and out. The area between the pier and the federal project line is the responsibility of HDOT Harbors Division.

The Kawaihae area was created by basalt flows of the Pololu Volcanic Series, which are part of the Kohala Volcano. The lower portion of the series is tholeiitic basalt, tholeiitic olivine, and oceanite, while the upper portion is alkalic olivine basalts (Macdonald et al. 1983 as cited in Reith and Morrison, 2010). Volcanic ash becomes more common in the upper layers of this series and is the parent material for the soils that developed in the area.

4.2.2 Project Impacts on Geology, Topography, and Bathymetry

4.2.2.1 No-Build Alternative

The No-Build Alternative will not create any impacts on geology or topography in the area.

4.2.2.2 Build Alternatives

Land-Side Impacts

Alternative 2 - Minimal Action will result in some minor earthwork in the Coral Flats area associated with the installation of fencing, including grading, grubbing, clearing and excavation activities.

Proposed Action - Alternative 5 along with Alternative 3 - Partial Action/Land-Side and Alternative 4 - Land-Side Plus Pier 2A Extension, will all have land side impacts to a larger magnitude, as all of Coral Flats will be graded for future uses.

Under all Build Alternatives, no significant adverse impacts are anticipated, and site grading will consider drainage patterns. Best Management Practices (BMPs) will be employed during construction to minimize fugitive dust emissions, and to reduce the potential for wind or water erosion and sedimentation.

Dredging Impacts

New dredging is the dredging of areas never previously dredged in order to expand navigable areas. Maintenance dredging is the dredging of areas to remove sediment buildup and return the previously dredged area to designed water depths.

Neither Alternative 2 - Minimal Action nor Alternative 3 - Partial Action/Land-Side will involve any dredging of either kind.

Alternative 4 - Land-Side Plus Pier 2A Extension will require maintenance dredging in the vicinity of Pier 2A. Proposed Action - Alternative 5 will require both types of dredging, with new dredging in the vicinity of Pier 2C and maintenance dredging in other areas of the harbor.

Under Proposed Action - Alternative 5, new dredging is required at the Pier 2C Extension area to provide adequate water depth for barges, which is the same as the existing berth depth of minus 35 feet below the Mean Lower Low Water (MLLW) level. The area that is proposed for

dredging is shown in **Figure 3-14: Area of Dredging Proximate to Pier 2C Extension**. The limits of the existing dredge basin will be extended south approximately 100 feet beyond the end of Pier 2C Extension to provide room for maneuvering barges at the new berth. It is estimated that the project will require dredging of approximately 30,000 cubic yards of material. Assuming that 500 cubic yards of material can be dredged each day, the total duration will be 60 days of dredging. The estimated construction durations are based on the contractor's ability to work with minimal interruptions from existing commercial harbor operations.

In addition, under Proposed Action - Alternative 5, dredging will be needed to remove a number of boulders between Pier 1 and Pier 2.

The most common and cost effective dredging methods in Hawai‘i, and in the United States (US) in general, include:

- Mechanical dredging using a clamshell dredge bucket operated from a barge-mounted crane accompanied by an anchored material scow to receive the dredgeate. The material is "scooped up" from the seabed and transferred to a material scow moored alongside the dredge barge. When the scow is filled, it is towed to an appropriate disposal site.
- Hydraulic dredging using a mechanical dredge pump fitted on a marine barge involves "sucking up" the seabed material through a series of pipes. The intake end of the suction pipe is often fitted with a mechanical cutter to loosen the material that is being dredged. The dredge-water slurry is hydraulically pumped either into a hopper contained within the dredging machine, or piped all the way to shore to a holding facility. Hydraulic dredging generates a large volume of waste water that needs to be managed during the operation. Hydraulic dredging is best suited for dredging loose and sandy materials.

A discussion of the type of disposal options and their potential impacts is provided in **Section 3.8.3.3: Options for Disposing of Dredgeate**.

The dredged material under the two alternatives that involve dredging is assumed to be sandy gravel and gravelly, calcareous sand with silt, as well as some cobbles and boulders. Sediment samples tested (see **Section 4.10.1.3: Marine Water Quality** and **Appendix F: Marine Environment and Water Quality Study**), identified some hazardous materials, specifically barium, a polychlorinated biphenyl compound, and semi-volatile compounds. Potential contamination should be further assessed during future stages of engineering and design, and handled as necessary under state and federal regulations

Under both Alternative 4 - Land-Side Plus Pier 2A Extension and Proposed Action - Alternative 5, the disposal options for the dredgeate, whether at an approved and permitted deep ocean disposal site, within the Coral Flats, or at an approved, upland landfill, will need to be determined at the time that the work is being planned, based on the composition of the dredge materials and space availability.

On other harbor projects, the US EPA has expressed concerns about sediment contamination in pier construction areas and has requested sampling. However, pier construction designs are very preliminary at this time and may not be known until much further in the design phase.

DOT-H will work with EPA to address the sediment testing, coring sampling and any other requirements when we are in design phase.

Dredging activities will require several permits/approvals. These include:

- Section 404 Permits under the Clean Water Act.
- Section 401 Water Quality Certification.
- Nationwide Permit for maintenance dredging under Section 10 of the Rivers and Harbors Act.
- Section 103 Dredge Disposal Permit under the Marine Protection, Research and Sanctuaries Act (MPRSA).
- EPA Approval for Ocean Disposal.

4.3 Soils

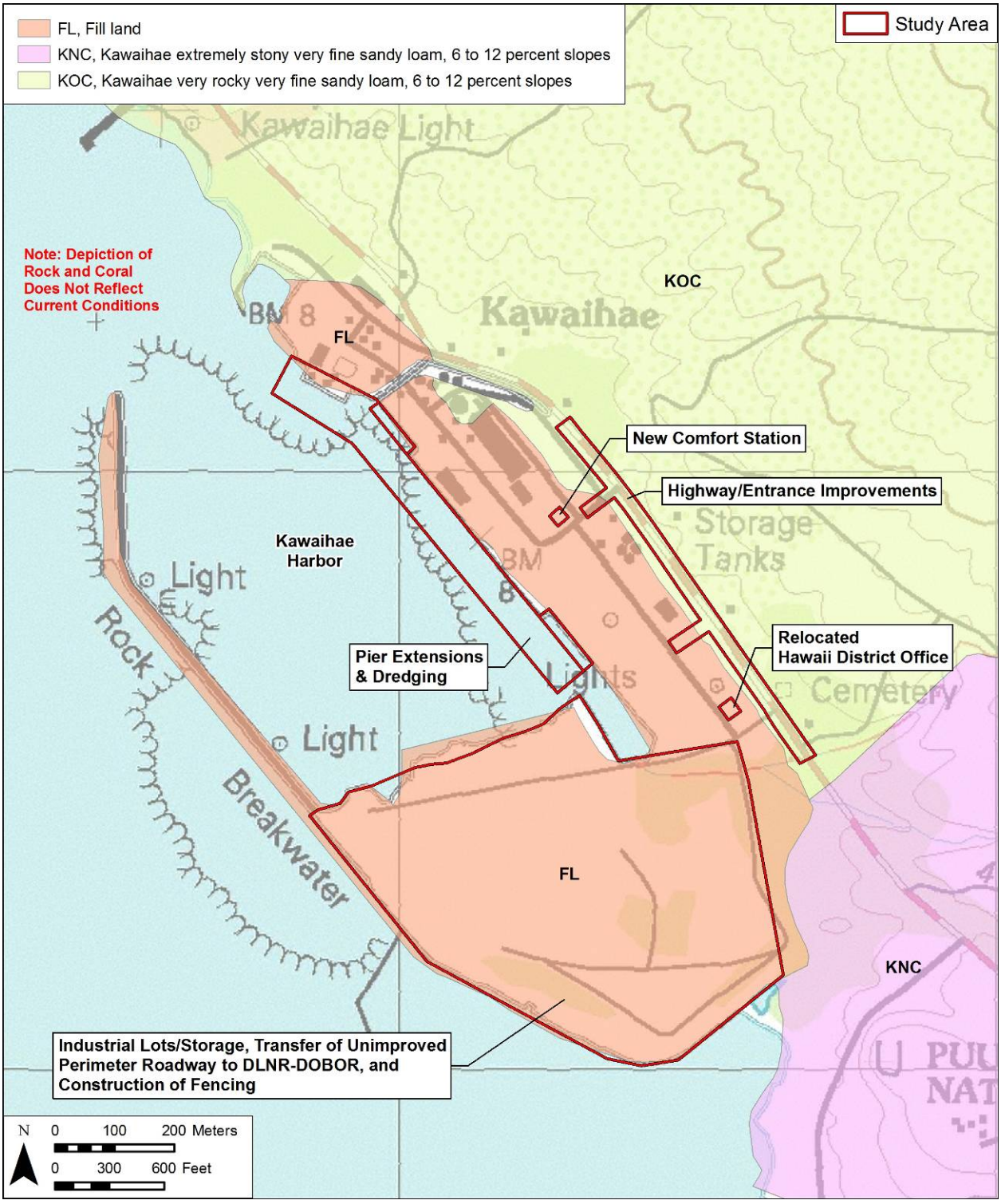
4.3.1 Existing Conditions

Most of Kawaihae Harbor is composed of crushed coral fill material removed from the harbor during dredging. The US Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Soil Map shows two types of soil in the project area, "Fill Land" and "Kawaihae very rocky very fine sandy loam." Soils are pictured in **Figure 4-1: Soils in Study Area**.

- The general descriptor of "fill" typically refers to soil that has been transported from a different location and is not indicative of coral spoil material from harbor dredging and used for the fill. The identified soil types and characteristics are: Fill Land (FL) - FL "soils" underlay the great majority of Kawaihae Harbor and Coral Flats with the exception of a narrow strip bordering Kawaihae Road. USDA NRCS describes Fill Land as typically "...well drained ... permeability is moderate, runoff is medium, and the erosion hazard is slight." This fill material has been reasonably stable since the late 1950s – more than 50 years – but several sinkholes developed as a result of settlement from the 2006 Kiholo Bay earthquake. Excavation of this material in the Coral Flats area is currently used to provide coral-based lime for farming as a soil amendment.
- Kawaihae very rocky very fine sandy loam (KOC), 6 to 12 percent slopes - are found in a narrow strip on the most inland portions of the project site bordering Kawaihae Road. The Kawaihae series is described as "... somewhat excessively drained extremely stony soils that formed in volcanic ash." These soils have a very thin surface layer of fine sandy loam over silt loam and loam. They are gently sloping to moderately sloping soils on coastal plains at an elevation ranging from near sea level to 1,500 feet.

Most of the areas slated for improvement under the Proposed Action are in the FL soil type; the segment of Kawaihae Road to be improved falls within the KOC soil type. A study of past subsurface investigations performed for the *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* (Helber, Hastert & Fee,

Figure 4-1: Soils in Study Area



Source: Cultural Surveys Hawai'i, 2011

2009) indicated that in many places, fill exceeds eight feet in depth above original soils and beach areas.

4.3.2 Project Impacts on Soils

4.3.2.1 No-Build Alternative

The No-Build Alternative will not create any impacts on soils.

4.3.2.2 Build Alternatives

All the Build Alternatives will result in some grading of the Coral Flats area. Alternative 2 - Minimal Action will only involve grading for new fencing along the perimeter road. The other Build Alternatives will involve greater areas of land side grading within the Coral Flats.

Earth movement anticipated with the project will include grubbing, clearing and excavation activities, virtually all of which is filled coral spoils. No adverse impacts are anticipated.

4.3.2.3 Recommended Mitigation of Impacts on Soils

Best Management Practices (BMPs) are recommended during construction to minimize fugitive dust emissions, and to reduce the potential for wind or water erosion and sedimentation. For dust containment, BMPs could include such measures as:

- A dust control plan as part of construction.
- Construction scheduling will enable the smallest amount of unvegetated soils to be exposed at any given time.
- Additional dust control measures such as applying water to exposed areas and use of silt fences will minimize air quality impacts such that the least number of surrounding properties are affected by work activities.

To address turbidity and siltation, BMPs could include measures such as:

- Water runoff: Geotextile silt screens anchored with absorbent sausages will be installed around the immediate work area to capture any potential water-borne sediment.
- Drain Inlets: All drywells and drain trenches will be lined with Geotextile fabric.
- Truck Wash Down Area: A plastic sheet lined and bermed wash down area will be constructed for truck wash down, with wash down water to be collected by tanker truck and disposed in an approved manner. Any wash down area will have sufficient containment and setback from the ocean and stormwater drainage features to assure there will be no contamination of the aquatic environment.

4.4 Natural Hazards

4.4.1 Existing Conditions

Kawaihae Harbor is currently served by Outdoor Emergency Warning Service by siren #HA407-Kawaihae Harbor. Kawaihae Harbor is compliant with Federal, State and County Emergency

Preparedness Plans, including the State of Hawai‘i *Plan for Emergency Preparedness* and the Federal and County *Emergency Procedure Guides*.

4.4.1.1 Earthquakes

The project site, as with the rest of Hawai‘i, is a seismically active region and has been affected by earthquakes. Most of Hawai‘i's earthquakes are directly related to volcanic activity caused by magma moving beneath the earth's surface. Other earthquakes less directly related to volcanism originate in zones of structural weakness deep within the earth beneath the island. The volcanic related earthquakes are concentrated primarily beneath the south flanks of Kīlauea and Mauna Loa; however, the effects of a large earthquake beneath Kīlauea or Mauna Loa are not limited to the localized overlying areas and may cause damage over much of the island.

Although difficult to predict, an earthquake of sufficient magnitude causing structural or other property damage may occur in the future.

The October 15, 2006 Kiholo Bay and Mahukona earthquakes (magnitude 6.7 and 6.0 respectively, occurring at 7:07 AM and 7:14 AM) included over 50 aftershocks. The stronger Kiholo Bay quake was centered roughly 15 miles south of Kawaihae close to the shore, whereas the Mahukona earthquake was centered offshore. Major damage was sustained from liquefaction and lateral spreading. Settling of the asphalt yard of up to six inches was observed. (County of Hawai‘i, 2010). The 1950s-era Pier 1 sustained substantial damage as sheet piles were moved and/or distressed.

4.4.1.2 Lava Flows

Kawaihae Harbor is in the lowest risk area for lava flows on Hawai‘i Island (Lava Zone 9). No eruptions have occurred from Kohala Mountain in the past 60,000 years. (USGS, 1997).

4.4.1.3 Hurricanes

The site of the Proposed Action could be potentially affected by hurricanes. The three major elements that make a hurricane hazardous are: (1) strong winds and gusts, (2) large waves and storm surges, and (3) heavy rainfall (FEMA, 1993). A hazard mitigation report prepared by the Federal Emergency Management Agency (FEMA) after Hurricane ‘Iniki in 1992 determined that nine hurricanes approached within 300 nautical miles (about one day’s travel time) of the Hawaiian Islands’ coastlines between 1970 and 1992 (FEMA, 1993). Most hurricanes affecting the Hawaiian Islands centered over Kaua'i. Based upon a tracking of hurricanes since 1950, there appears to be no geographical or meteorological reasons why hurricanes miss other islands and tend to steer toward Kaua‘i (FEMA, 1993).

4.4.1.4 Tidal Effects and Sea Level Rise

Kawaihae Harbor is exposed primarily to waves approaching from the west, and is shielded by more energetic waves from the north by the northern part of Hawai‘i Island. The harbor is protected by a 2,650-foot long breakwater, constructed in 1962.

Sea level rise caused by global climate change was considered in the *Hawai'i Island Commercial Harbors 2035 Master Plan Update*, and a special study was performed to consider these effects. (Fletcher, 2009). Global climate change has been attributed to increases in carbon dioxide and other greenhouse gases in the atmosphere. Over the past century, global mean air temperature has been increasing along with the oceans' heat content. Melting of glacier ice/snow and thermal expansion of ocean water, among other factors, have resulted in rising sea levels. Even if greenhouse gas concentrations were stabilized today, sea levels are still expected to rise for hundreds of years (Solomon et al., 2009). Refer to **Figure 4-2: Vertical and Perspective Views of Areas Estimated to be Inundated from Sea Level Rise in Kawaihae Harbor** for a view of the areas within Kawaihae Harbor that could be inundated under various scenarios.

The potential adverse effects of sea level rise will be most pronounced during high tide periods. Sea level rise leads to flooding by groundwater rise, overtopping of waves, a lack of drainage for surface runoff, and coastal erosion.

The long-term rate of rise as measured by tide gauges on Hawai'i Island is approximately 3 mm per year. This figure takes into account both subsidence of the island (approximately 1.5 mm per year) as well as global mean rise of approximately 1.5 mm per year through the 20th Century. As discussed in **Section 4.4.2.4: Tidal Effects and Sea Level Rise**, future levels of increase are anticipated to accelerate.

4.4.1.5 Tsunami

The site of the Proposed Action is at sea level and could be affected by tsunamis as it lies within the inundation zone. The most notable tsunamis within the past century occurred in 1896, 1946, 1957, 1960, and 1964. Most of Kawaihae Village was destroyed by the largest, a 14-foot-high wave, in 1946. (Helber, Hastert & Fee, 2009). A four-foot tsunami wave hit Kawaihae on March 11, 2011 associated with the earthquake off Sendai, Japan.

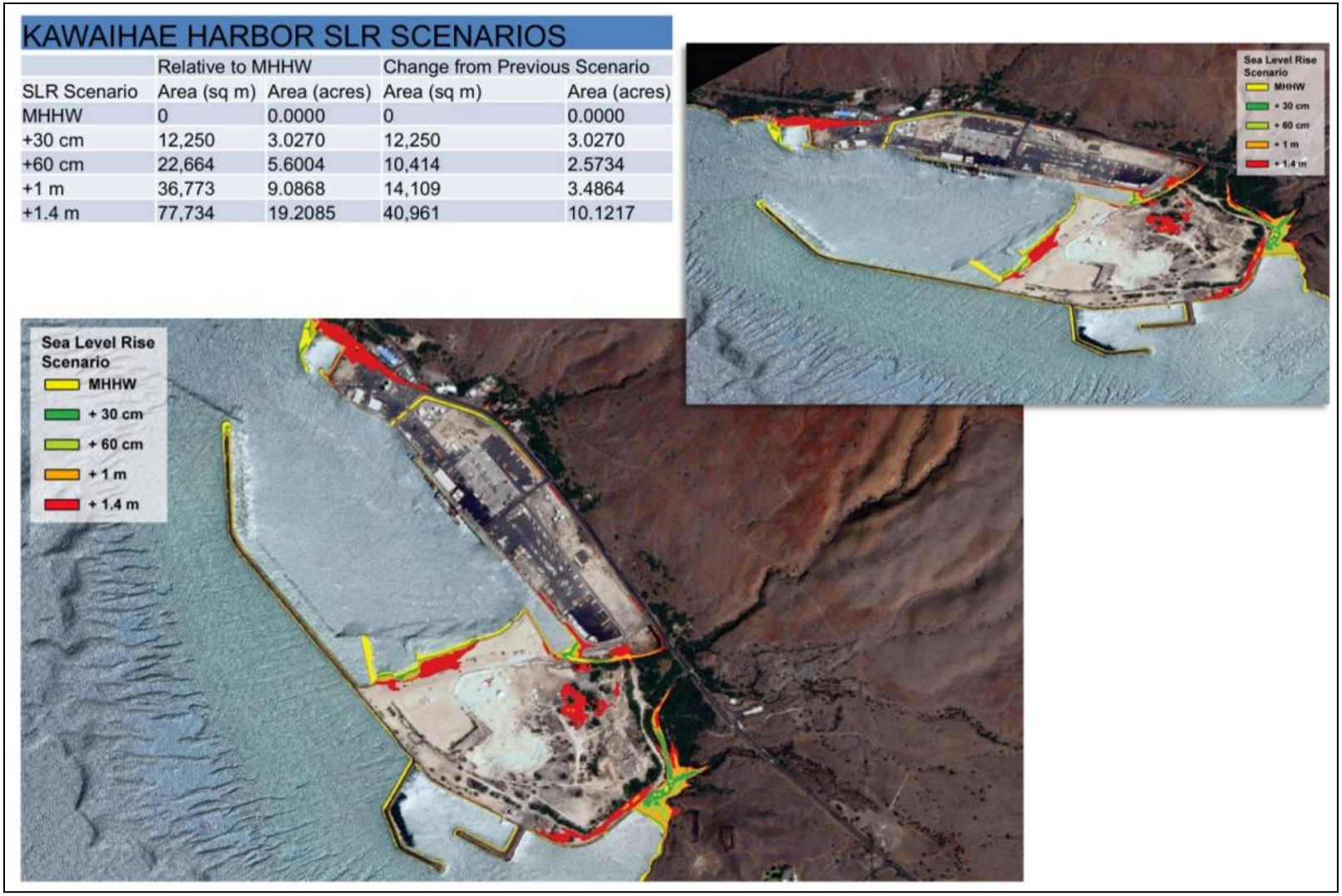
Hilo is the location within Hawai'i that historically has experienced the most extensive tsunami damage. Two crippling tsunami struck Hilo in 1946 and 1960. Tsunami damage to Hilo Harbor could greatly increase the demand on the use of Kawaihae Harbor.

4.4.2 Project Impacts from Natural Hazards

In general, if the Build Alternatives increase Kawaihae Harbor's capacity for transporting goods and commodities, they will strengthen Hawai'i Island's resilience in responding to natural disasters; improved capacity for transport of goods will be of greater importance, especially if Hilo Harbor is adversely effected. In contrast, the No-Build Alternative will offer no such benefit.

Alternative 2 - Minimal Action will not provide any measurable increase in capacity for transport of goods. Alternative 3 - Partial Action/Land-Side will offer a minimal increase in capacity, mainly from improved operations within the yard itself. Only Alternative 4 - Land-Side Plus Pier 2A Extension, and Proposed Action - Alternative 5 will offer substantial increases in

Figure 4-2: Vertical and Perspective Views of Areas Estimated to be Inundated from Sea Level Rise in Kawaihae Harbor



Note: Per **Table 4-2: Timing and Acreage of Areas Inundated from Sea Level Rise in Kawaihae Harbor**, a 30 cm rise is assumed to take 26 years, 60 cm rise assumed in 52 years, 1.0 meter in 87 years, and 1.4 m in 122 years. Source: Fletcher, 2009

capacity through increased berthing area, and the Proposed Action, Alternative 5 is expected to offer much a greater increase in capacity than Alternative 4.

Considerations specific to particular types of natural hazards are described below.

4.4.2.1 Earthquakes

Under all Alternatives, seismic events can damage piers, buildings, storage tanks, pipes, paved areas, etc. Given the seismic history of the area, it is likely that there will be future impacts from earthquakes. The maintenance and improvements of port infrastructure at Kawaihae under the Build Alternatives will be helpful in ensuring that Hawai‘i Island can respond to earthquakes and other natural disasters, particularly if Hilo Harbor is affected.

The US Geological Survey (USGS) has documented the earthquake hazard risk, but a geotechnical engineer and/or geologist will develop site-specific criteria during design that considers the harbor area’s tectonic conditions, fault lines, and soil conditions. These seismic parameters are used to develop the seismic design conditions for structural design.

Force-based engineering codes and guidelines will address seismic design of new building structures, to prevent collapse and protection of human life during and after a seismic event. Buildings constructed for the Build Alternatives will be built to force-based codes such as found in the International Building Code (IBC) and the American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) “Minimum Design Loads for Buildings and Other Structures” (ASCE/SEI 7).

Since waterfront structures like piers and wharves serve different uses, have different occupancy requirements, and behave differently from land-based structures, different codes are more appropriate for piers under Alternatives 4 and 5. The most common of these include:

- The California Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS), adopted in California and other states for marine oil terminals.
- Waterfront-structure-specific standards developed by the U.S. Navy, Ports of Los Angeles and Long Beach, and others.

These standards for piers and wharves use a performance-based approach to seismic design, rather than the force-based approach of conventional building codes. Performance-based design considers “permissible” levels of damage during different-magnitude seismic events, and attempts to balance the harbor’s tolerance for risk with the initial capital cost of the pier and estimated repair/rehabilitation costs after an earthquake. These performance criteria will be established during the design phase between DOT-H and designers.

4.4.2.2 Lava Flows

Kawaihae Harbor is in the lowest risk area for lava flows on Hawai‘i Island (Lava Zone 9) so no impacts are expected.

4.4.2.3 Hurricanes

A hurricane of significant strength and high winds passing close to the island could cause damage to Kawaihae Harbor. Under the Build Alternatives, any above-ground structures will be composed of suitable materials and designed to comply with Hawai'i County building code requirements minimizing its susceptibility to structural damage in the event of a hurricane.

4.4.2.4 Tidal Effects and Sea Level Rise

Sea level rise has been accelerating in the past century, and currently is approximately 3.4 mm rise per year. By the end of the century, the rise is estimated to reach 10 mm per year, for a total rise of approximately 1 meter (Fletcher, 2009). This inundation could potentially range from 0.75 meters to 1.9 meter based on different analysts' assumptions and on local conditions, so the 1-meter figure by the end of the century is considered appropriate for planning purposes.

The effects of sea level rise will be magnified by the fact that Hawai'i Island has been subsiding at a rate of approximately 1.5 mm per year, which was taken into consideration in the analysis.

Very detailed elevation data was analyzed both for submerged areas within the harbor as well as areas currently above high water levels, assuming the rates of sea level rise described above. **Table 4-2: Timing and Acreage of Areas Inundated from Sea Level Rise in Kawaihae Harbor** considers the length of time for subsidence as well as the acreage of Kawaihae Harbor that will be inundated under this scenario.

Table 4-2: Timing and Acreage of Areas Inundated from Sea Level Rise in Kawaihae Harbor

Elevation of Land Inundated at Kawaihae Harbor	Number of Years to Inundation Assuming Eventual 11.5 mm Rise Yearly*	Acreage of Land Inundated
30 cm	26 years	3.02 acres
60 cm	52 years	5.60 acres
1.0 m	87 years	9.08 acres
1.4 m	122 years	19.20 acres

* Assumes 10 mm global sea-level rise annually plus 1.5 mm subsidence of island
Source: Fletcher, 2009

Figure 4-2: Vertical and Perspective Views of Areas Estimated to be Inundated from Sea Level Rise in Kawaihae Harbor showed the current Median Higher High Water (MHHW) level and the additional areas that will be inundated by the rise in sea level documented in **Table 4-2: Timing and Acreage of Areas Inundated from Sea Level Rise in Kawaihae Harbor**.

The future uses of Kawaihae Harbor as proposed in the *Hawai'i Island Commercial Harbors 2035 Master Plan Update* and covered in all Build Alternatives have taken these changes into consideration.

4.4.2.5 Tsunami

Kawaihae Harbor and all areas that will be altered as part of all Build Alternatives are inside of the tsunami inundation zone. Evacuations of the tsunami zone by county and state authorities during a tsunami warning minimize the chance of loss of life.

The Build Alternatives, especially Alternative 4 - Land-Side Plus Pier 2A Extension and the Proposed Action - Alternative 5 will improve the capacity and efficiency of Kawaihae Harbor to facilitate disaster relief in the event of a tsunami. Alternative 2 - Minimal Action and Alternative 3 - Partial Action/Land-Side will only offer minimal increases in harbor capacity as no new berthing areas will be constructed; these alternatives will not substantially facilitate disaster relief.

4.5 Air Quality

National ambient air quality standards (NAAQS) have been established by the US Environmental Protection Agency (EPA) that set standards for six criteria pollutants: (1) carbon monoxide, (2) nitrogen dioxide, (3) sulfur dioxide, (4) lead, (5) ozone, and (6) concentrations of particulate matter less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$). Since 2003, the State of Hawai'i Department of Health began participating in the National $PM_{2.5}$ speciation monitoring program. In addition, a State standard has been established for hydrogen sulfide. State of Hawai'i ambient air quality standards (HAAQS) are more stringent than the comparable national limits (i.e., NAAQS) except for the standards for sulfur dioxide, particulate matter and lead, which are set at the same levels. A summary of both HAAQS and NAAQS is presented in **Table 4-3: State of Hawai'i and National Ambient Air Quality Standards**.

4.5.1 Existing Conditions

Air quality in Hawai'i is generally characterized as relatively clean and low in pollution. Northeast trade winds that are predominant throughout the year typically carry emissions and other air pollutants from inland areas out toward the ocean. However, naturally-produced volcanic gases from Kīlauea Volcano commonly cause air quality standards, specifically particulates and sulfur dioxide, to be exceeded in areas downwind of the volcanic activity from "vog" (volcanic smog). None of the five air quality monitoring stations on Hawai'i Island is in the Kawaihae area; the closest station is roughly 35 miles south-southeast in Kailua-Kona, which is far closer to Kīlauea.

On the Kawaihae Harbor site itself, some fugitive dust occurs during the movement of equipment and traffic in unpaved areas. In the *Final EA for the Pier 2A Shed Demolition and Container Yard Improvements* (Helber, Hastert & Fee, 2009), the Hawai'i District Manager is cited as indicating that increased container cargo traffic at the harbor has necessitated increased use of unpaved areas in recent years, which in turn has generated complaints by nearby residents and businesses, particularly when winds come from the west and southwest. The harbor-area residential community is small (about eight houses across from the harbor and between 12 and 14 across from the Pu'ukoholā Heiau). There are also concerns with the abrasive effects of the fine coral dust, particularly on mechanical equipment.

Table 4-3: State of Hawai'i and National Ambient Air Quality Standards

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawai'i
Particulate Matter <10 microns (PM_{10})	$\mu g/m^3$	Annual 24 Hours	- 150[a]	- 150[a]	50 150[b]
Particulate Matter <2.5 microns ($PM_{2.5}$)	$\mu g/m^3$	Annual 24 Hours	15[c] 35[d]	15[c] 35[d]	- -
Sulfur Dioxide	$\mu g/m^3$	Annual 24 Hours 3 Hours	80 365[b] -	- - 1300[b]	80 365[b] 1300[b]
Nitrogen Dioxide	$\mu g/m^3$	Annual 1 Hour	100 189[d]	100 -	70 -
Carbon Monoxide	mg/m^3	8 Hours 1 Hour	10[b] 40[b]	- -	5[b] 10[b]
Ozone	$\mu g/m^3$	8 Hours 1 Hour	157[e] 235[f]	157[e] 235[f]	157[e] -
Lead	$\mu g/m^3$	3 Months Quarter	0.15[g] 1.5[h]	0.15[g] 1.5[h]	- 1.5[h]
Hydrogen Sulfide	$\mu g/m^3$	1 Hour	-	-	35[b]

Notes:
[a] Not to be exceeded more than once per year on average over three years.
[b] Not to be exceeded more than once per year.
[c] Three-year average of the weighted annual arithmetic mean.
[d] 98th percentile value averaged over three years.
[e] Three-year average of fourth-highest daily 8-hour maximum.
[f] Standard is attained when the expected number of exceedances is less than or equal to 1.
[g] Rolling 3-month average.
[h] Quarterly average.

Particulate Matter (PM_{10} and $PM_{2.5}$) downwind of the site has not been measured, and impacts depend on wind direction and velocity, but have potential to exceed established standards when an unpaved yard is active and winds are blowing toward houses and businesses. There is a general prohibition against the use of this area under these conditions, although stored equipment like container chassis may still have to be moved, and there is increasing pressure to use the area for overflow cargo (Helber, Hastert & Fee, 2009).

4.5.2 Project Impacts on Air Quality

4.5.2.1 No-Build Alternative

The No-Build Alternative will have no direct impacts on air quality. However, increased congestion at the gates over time could result in greater vehicular emissions. Furthermore, with increased use of unpaved areas under the No-Build Alternative, there will be a likely increase in fugitive dust generated.

4.5.2.2 Build Alternatives

Potential air impacts associated with the Build Alternatives will mainly be associated with:

- Short-term construction activities.
- Increased motor vehicle traffic associated with increased activity at the harbor.
- Greenhouse Gas (GHG) emissions associated with vehicles, vessels, and harbor equipment.
- Air Toxics.

Short-Term Construction Impacts

Short-term and minor impacts on air quality from construction activities will predominantly be associated with fugitive dust emissions and exhaust emissions from on-site construction equipment. The greatest amount of land-side fugitive dust emissions will be associated with Alternative 3 - Partial Action/Land-Side, Alternative 4 -Land-Side Plus Pier 2A Extension, and Proposed Action - Alternative 5. Emissions from construction equipment will vary among the build alternatives commensurate with the amount of construction performed; Alternative 2 - Minimal Action will generate the least of these emissions and the Proposed Action - Alternative 5 will generate the most.

Fugitive dust emissions will generally arise from grading, grubbing and other dirt moving activities, and could affect both air quality and marine water quality if dust is deposited in the ocean. Impacts from such construction activities will be temporary. Dust impacts on the nearby community will primarily be an issue when winds from the southwest and west carry these emissions towards nearby homes. Most of the time, gentle trade and off-shore winds will blow dust away from the local populated areas, but could have effects on the marine environment.

Impacts associated with fugitive dust emissions will be mitigated through the implementation of a dust control plan as part of construction. Construction scheduling will enable the smallest amount of unvegetated soils to be exposed at any given time. Additional dust control measures such as applying water to exposed areas will minimize air quality impacts from work activities.

Any buildings that are demolished as part of the project will potentially create dust or other materials that could be entrained by winds.

None of the alternatives are anticipated to create a short-term exceedance of HAAQS or the NAAQS.

Increased Motor Vehicle Traffic

Emissions will be expected from increases in motor vehicle traffic, both trucks and light-duty motor vehicles, associated with increased activity at the harbor. Under all alternatives that improve Kawaihae Road and the main entrance/egress gates (Proposed Action - Alternative 5, along with Alternative 3 - Partial Action/Land-Side and Alternative 4 - Land-Side Plus Pier 2A Extension), the project should reduce vehicular delay to levels such that air impacts are not anticipated. Improvements to internal circulation under all Build Alternatives should also

reduce vehicular air emissions. The project is not anticipated to create a long-term exceedance of the HAAQS or the NAAQS.

Increased berthing capacity under Alternative 4 - Land-Side Plus Pier 2A Extension, and especially the Proposed Action - Alternative 5 will likely result in increased barge and tug activity over the long-term. Barges used may also be larger 400-foot-long barges compared to 286-foot and 340-foot barges that are used today. The tugs often tow two barges to the harbor (with separate maneuvers for docking) and this will likely continue in the future, even with the longer barges that could be used. Therefore, there may be incremental increases in emissions from towing larger barges, and from increased maneuvers within the harbor as individual barges are separated, joined, docked and undocked.

On-site activity associated with equipment for loading/unloading cargo and the barges themselves is anticipated to increase as use of the harbor increases over time under all build alternatives, but especially under Alternative 4 - Land-Side Plus Pier 2A Extension, and the Proposed Action - Alternative 5. Associated emissions will be expected to increase as well. Tow boats' emissions meet stringent standards (ISO-9000) and operators are actively working to ensure both boats and cargo-handling equipment are maintained to the high standards. Improved circulation patterns within container storage areas under all Build Alternatives should make movement of containers more direct and efficient and this may somewhat offset the increased emissions from larger volumes of cargo.

Greenhouse Gas Emissions

The Council on Environmental Quality (CEQ) has recently affirmed the applicability of the National Environmental Policy Act (NEPA) to consider Greenhouse Gas (GHGs) emissions, which are associated with global climate change, and, subsequently, sea-level rise. However, CEQ notes that "it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand"(CEQ, 2010). Therefore, the issue of GHGs can only be considered in a broad quantitative manner, in terms of the magnitude of change in GHG emissions.

GHGs are defined as including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6) in accordance with Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance. (USDOT-FAA, 2012). There are no federal standards for GHG emissions applicable to this project.

GHGs generated from activities in Kawaihae Harbor are primarily expected from the consumption of fuel, which will generate exhaust emissions of CO_2. Different fuels have different levels of equivalency for generating CO_2. However, in broad, general terms, the greater the quantity of fuel consumed, the higher the greater the quantity of GHG (mostly, CO_2) produced.

The Build Alternatives, especially Alternative 4 - Land-Side Plus Pier 2A Extension, and the Proposed Action - Alternative 5 will likely result in a net increase in the consumption of fuel

compared to the No-Build Alternative. Increases in fuel consumption will be associated with a larger number of barges and other vessels in the harbor, carrying higher quantities of goods into and out of the harbor than under the No-Build Alternative. This increased traffic in the harbor will also result in a commensurate increase in truck traffic and employee traffic to transport and process these goods on land.

These increases, however, may be somewhat offset by greater efficiencies with the use of larger vessels than currently dock at the harbor. It is also possible that reconfiguration of the harbor's container storage areas under all Build Alternatives will make movement by vehicles and equipment more efficient, thereby reducing fuel consumed on the site. If improvements to Kawaihae Harbor offset the need to ship some commodities to and from Hilo Harbor (thereby reducing distances traveled in some cases), this could also result in a reduction in fuel consumption.

It is difficult to quantify the exact amount of fuel consumed by all activities within and related to Kawaihae Harbor for the reasons cited above. Nonetheless, the No-Build Alternative and all Build Alternatives are anticipated to increase fuel consumption overall compared to existing levels, and thereby increase GHG emissions.

In the context of national or global emissions of GHG, the individual contribution from Kawaihae Harbor itself will be a miniscule percentage. Based on US EPA materials accessed at http://www.epa.gov/climatechange/emissions/downloads11/GHG-Fast-Facts-2009.pdf, in 2009 the United States emitted about 6.6 billion metric tons of CO_2 equivalent. The electric power industry was the greatest contributor, at about 2.2 billion metric tons; transportation was second at 1.8 billion metric tons, or about 27 percent of the total, and this includes all forms of transportation, including aviation, railroads, personal automobile travel, transit, etc. Kawaihae Harbor and the GHG that result from its operation will be a tiny, but still contributing part, of that total.

Air Toxics

Besides the criteria air pollutants for which there are National Ambient Air Quality Standards (NAAQS), the US EPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes and ships), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries). Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the Clean Air Act.

The Build Alternatives, especially Alternative 4 - Land-Side Plus Pier 2A Extension, and the Proposed Action - Alternative 5, will increase fuel consumption over No-Build conditions, as discussed in the preceding section. That increase will be expected to have a proportionate effect on generating MSATs. However, emissions of MSATs will likely be lower than present levels in the future as a result of EPA's national control programs that are projected to reduce transportation MSAT emissions by 57 to 87 percent from 2000 to 2020. The magnitude of the EPA-projected reductions is so great (even with growth of activity at the harbor) that MSAT emissions are likely to be lower in the future.

Emissions of Volatile Organic Compounds (VOCs), many of which are MSATs, are associated with the transfer and storage of fuel. Any increases in these activities at Kawaihae Harbor under the Build Alternatives will be expected to result in some increase in VOC emissions.

4.5.3 Recommended Mitigation of Air Quality Impacts

4.5.3.1 Short-Term Construction Impacts

State air pollution controls prescribed under the State of Hawai'i, Department of Health (DOH) rules (Chapter 11-59, Hawai'i Administrative Rules [HAR] "Ambient Air Quality Standards" and Chapter 11-60.1, HAR "Air Pollution Control") prohibit visible emissions of fugitive dust from construction activities at the property line. Therefore, a dust control plan will be prepared and implemented to have the contractor comply with these regulations. Adequate fugitive dust control can usually be accomplished by establishing a frequent watering program, using geotextile fabric barriers, or implementing other measures to address grading and grubbing activities.

Under all Build Alternatives, some measures that could be considered by the contractor may include:

1. Limiting the areas that are disturbed at any given time;
2. Applying chemical soil stabilizers, mulching, or using wind screens;
3. Spraying water as appropriate;
4. Use of geotextile fabric barriers;
5. Establishing a road cleaning or tire washing program to reduce fugitive dust emissions from trucks using paved roadways in or around the project site; and
6. Establishing landscaping early in the construction schedule to control dust.

Geotextile fabric dust barriers are recommended to be put up around construction areas to minimize the effects of fugitive dust emissions on surrounding properties. These dust barriers would be installed in conformance with DOH construction specifications to prevent dust from blowing away from the construction areas.

Demolition of buildings or structures will occur under Alternative 3 - Partial Action/Land-Side, Alternative 4 - Land-Side Plus Pier 2A Extension, and the Proposed Action - Alternative 5 and will require special consideration if the structure is found to contain asbestos-containing material, lead paint, or other hazardous materials. State and federal laws regarding the demolition and disposal of such materials will be followed if applicable to ensure there is no release of particulate matter to air or water.

Wet cutting or dust-capture attachments are recommended for any cutting of concrete or pavement under the Build Alternatives.

Under the Build Alternatives, temporary on-site mobile and stationary construction equipment will also emit air pollutants from engine exhausts. Minor nitrogen dioxide emissions from construction equipment should not violate stricter HAAQS standards since such emissions will

be short-term and the standards are set on an annual basis. Short-term carbon monoxide emissions from construction equipment will similarly be low and should be relatively insignificant.

Impacts from slow-moving construction vehicles are recommended to be mitigated by scheduling slow-moving vehicular travel during periods of low traffic volume on the affected roadways. Engine exhaust emissions from construction vehicles should be minimized via the proper operation and maintenance of all equipment to further limit potential air quality impacts. Fabric dust barriers installed around the construction area should further mitigate the short-term effects and nuisances associated with these other air pollutant emissions.

4.5.3.2 Post-Construction Activities

Use of equipment and ocean transport vessels (e.g., tow boats to pull cargo barges to their destination) will be likely to increase commensurate with increased activity in the harbor under Alternative 4 - Land-Side Plus Pier 2A Extension, and the Proposed Action - Alternative 5. Emissions from their engines will be mitigated through maintenance of emissions control equipment required under State and federal laws. Fuel storage activities may increase as well. As emissions control requirements are continually increasing over time, with replacement of equipment, it is possible that total future-year emissions from equipment, ocean vessels, and fuel storage could be lower than the present-day, even with increased activity at the harbor. No specific mitigation is necessary or warranted.

4.6 Noise

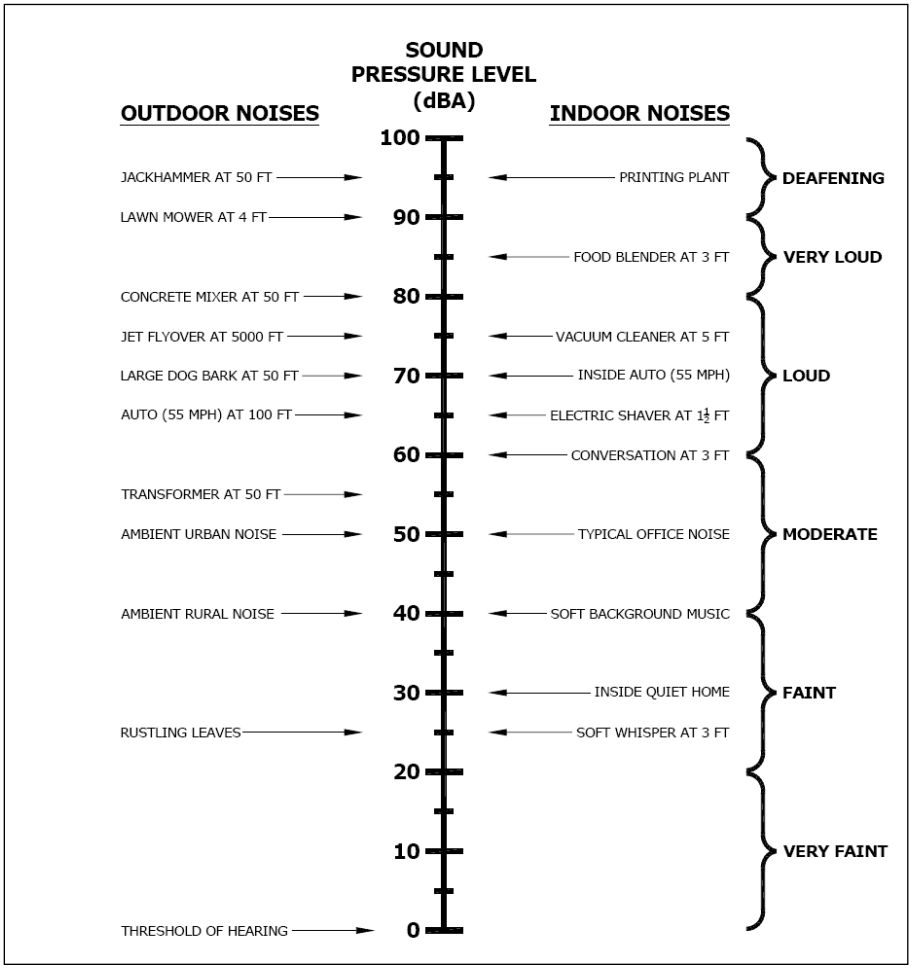
A study of land-based noise was performed for the *Improvements to Kawaihae Commercial Harbor* Environmental Assessment (EA). The full report can be found in **Appendix C: Noise Study**. The discussion that follows is summarized from that study. Underwater noise is discussed in **Section 4.6.5: Underwater Noise**. For the purposes of the noise analysis, the worst-case (highest impact) alternative, Proposed Action - Alternative 5, was assumed.

4.6.1 Noise Standards for Land-Based Noise

Noise is defined as excessive or unwanted sound. Sound intensity is measured in decibels (dB), based on a logarithmic scale. When sound is described in terms of the frequencies humans are capable of hearing, the term 'dBA' is used to reflect "A-weighted" decibels. **Figure 4-3: Common Outdoor and Indoor Sound Levels in dBA** provides an overview of decibel levels as perceived by human hearing.

Human sensitivity to changes in noise is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dBA in the level of sound is difficult for most people to detect. A 3 dBA change is commonly taken as the smallest perceptible change and a 6 dBA change corresponds to a noticeable change in increased loudness or noise reduction. A 10 dBA increase or decrease in sound level corresponds to a perceived approximate doubling or halving of loudness, respectively.

Figure 4-3: Common Outdoor and Indoor Sound Levels in dBA



Source: DL Adams Associates, 2011

Noise standards reflect the fact that noise is not constant, but rather varies continuously over time. Standards therefore use "metrics" such as "L_{eq}" or "L_{dn}." The L_{eq}, or Equivalent Sound Level, represents the low and high sound levels averaged over a given time period (such as one hour) equated to a single continuous sound level. The term $L_{eq(h)}$ or "hourly L_{eq}" is used to describe the L_{eq} in an hour's time and is the way some noise standards are measured. The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period with a 10 dB penalty between 10 PM and 7 AM to account for peoples' higher sensitivity to noise at night.

4.6.1.1 Hawai'i Department of Health (DOH) Noise Standards

In Title 11, Chapter 46 of the DOH Administrative Rules, the State of Hawai'i Community Noise Control Rule defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to stationary noise sources such as air-conditioning units, exhaust systems, generators, compressors, pumps, etc. The Community Noise Control Rule does not address most moving sources, such as vehicular traffic noise, aircraft noise, or rail transit noise.

However, the Community Noise Control Rule does regulate noise related to agricultural, construction, and industrial activities, which may not be stationary.

The maximum permissible noise levels for stationary mechanical equipment are enforced by DOH for any location at or beyond the property line and shall not be exceeded for more than 10 percent of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in **Table 4-4: DOH Standards for Stationary Noise**. With respect to mixed zoning districts, the rule specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level. In determining the maximum permissible sound level, the background noise level is taken into account by DOH.

Table 4-4: DOH Standards for Stationary Noise

Zoning District	Exterior Noise Standards, dBA	
	Daytime Hours (7 AM to 10 PM)	Nighttime Hours (10 AM to 7 AM)
Class A: Residential, Conservation, Preservation, Public Space, Open Space	55 dBA	45 dBA
Class B: Multi-Family Dwellings, Apartments, Business, Commercial, Hotel, Resort	60 dBA	50 dBA
Class C: Agriculture, Country, Industrial	70 dBA	70 dBA

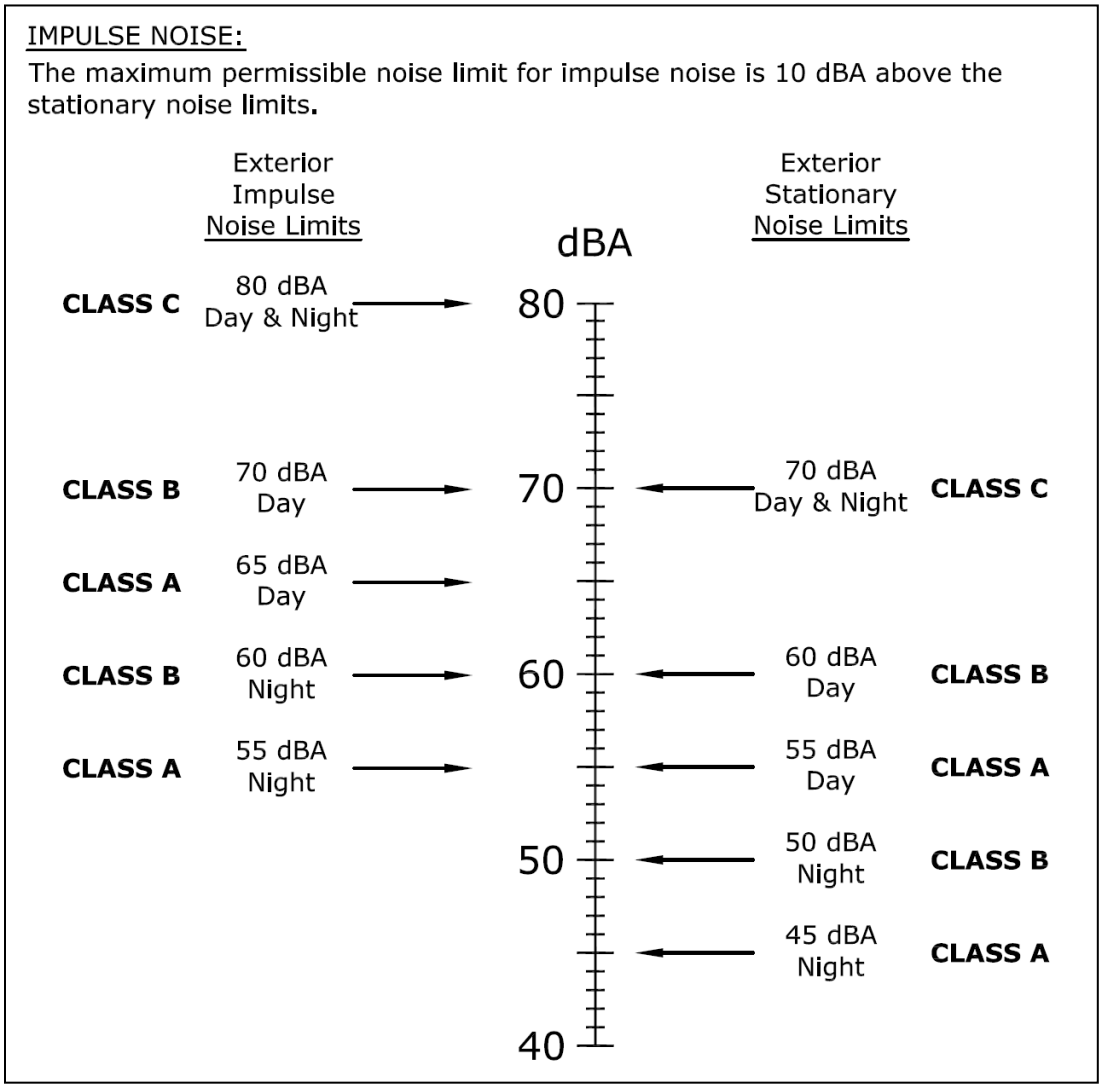
Source: DL Adams Associates, 2011

The criteria for impulse or impact noise are separate from stationary noise due to the nature of the sound. DOH defines impulsive noise as " any sound with a rapid rise and decay of sound pressure level, lasting less than one second, caused by sudden contact between two or more surfaces…". Noise from pile driving is considered impulse noise and the maximum permissible noise level is 10 dBA above the specified noise limits for stationary sources, as shown in **Figure 4-4: DOH Standards for Impulse Noise**.

4.6.1.2 Hawai'i Department of Transportation

DOT has adopted the US Department of Transportation (USDOT), Federal Highway Administration's (FHWA) design goals for traffic noise exposure in its Noise Analysis and Abatement Policy in its noise policy. According to the policy, a traffic noise impact occurs when the predicted traffic noise levels "approach" or exceed FHWA's noise abatement criteria (NAC) or when the predicted traffic noise levels "substantially exceed the existing noise levels." DOT has adopted FHWA's policies in their Highway Noise Policy and Abatement Guidelines dated April 25, 2011 (DOT, 2011b). DOT policy also states that "approach" means at least 1 dB less than FHWA's design goals and "substantially exceed the existing noise levels" means an increase of at least 15 dBA.

Figure 4-4: DOH Standards for Impulse Noise



Source: DL Adams Associates, 2011

The NAC are listed in **Table 4-5: FHWA and HDOT Noise Abatement Criteria**. For example, Category B, defined as picnic and recreation areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals, has a corresponding maximum exterior L_{eq} of 67 dBA. In this study, residences fall into land use category B and industrial properties category C. The Pu'ukoholā Heiau National Historic Site (NHS) is considered Category A because serenity and quiet are considered essential to the visitors to the site.

DOT has adopted the FHWA's NAC in its newest noise abatement policy dated April 25, 2011.

The NAC in **Table 4-5: FHWA and HDOT Noise Abatement Criteria** are intended to reflect impacts from traffic noise and do not provide a guideline for temporary impacts from construction.

Table 4-5: FHWA and HDOT Noise Abatement Criteria

Activity Category	Maximum L_{eq} (1 Hr period)	Description of Activity Category / Land Uses
A	57 dBA (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the lands are to continue to serve their intended purpose.
B	67 dBA (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.
C	72 dBA (Exterior)	Developed lands, properties or activities not included in Categories A or B above.
D	---	Undeveloped lands.
E	52 dBA (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.
F	n/a	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	n/a	Undeveloped lands that are not permitted

Source: Code of Federal Regulations, Title 23 Part 772, Revised April 2005 and DOT, *Highway Noise Policy and Abatement Guidelines* dated April 25, 2011

4.6.1.3 Federal Transit Administration Construction Noise Impact Threshold

In general, the DOH Community Noise Rule only assesses the impact of a construction project as it relates to nuisance and hours of allowed activity. While the Proposed Action is not a transit project, the Federal Transit Administration (FTA) has defined general guidelines for assessment of construction noise and the impacts it will create on nearby properties. According to the FTA, if the criteria shown in **Table 4-6: Federal Transit Administration Construction Noise Impact Thresholds** are exceeded, there may be adverse community reaction.

Table 4-6: Federal Transit Administration Construction Noise Impact Thresholds

Land Use	8- Hour L_{eq} (dBA)	
	Day (7am - 10pm)	Night (10pm - 7am)
Residential	80	70
Commercial	85	85
Industrial	90	90

Source: USDOT, 2006b

4.6.2 Existing Conditions for Land-Based Noise

Two types of noise measurements were conducted to assess the existing acoustical environment within the study area. Long-term measurements (taken continuously over the

course of multiple days) offer a baseline for establishing existing ambient noise levels in the area and are used for estimating future noise levels by adding the ambient levels to other noise generated from the Proposed Action. Short-term measurements (taken during peak traffic hours only) are used to validate the traffic noise model used for calculating future noise levels from traffic on Kawaihae Road.

4.6.2.1 Long-Term Noise Measurements

Continuous long-term ambient noise level measurements were taken at two locations from September 9, 2011 to September 19, 2011 to assess the existing acoustical environment on or near the project site. Measurements were taken for at least five days eat each location:

- Location L1 - Kawaihae Harbor: The sound level meter was located at Coral Flats near the South Gate security entrance between the harbor and Makahuna Gulch. The meter was approximately 550 feet southwest of Kawaihae Road. Dominant noise sources included heavy trucks along the harbor's access road and harbor activities. Secondary noise sources included vehicular traffic from Kawaihae Road, aircraft flyovers, birds, and wind.
- Location L2 - Pu'ukoholā Heiau NHS: The sound level meter was located east of Pu'ukoholā Heiau, approximately 600 feet from Kawaihae Road. Noise sources at this location included vehicular traffic from Kawaihae Road, harbor activities, birds, and aircraft flyovers.

The exact locations of these measurement sites are shown in **Figure 4-5: Long-Term and Short-Term Noise Measurement Locations**. The measured results of the noise measurements are shown in **Table 4-7: Summary of Long-Term Noise Measurements (dBA)**.

Table 4-7: Summary of Long-Term Noise Measurements (dBA)

Measurement Location	AM L_{eq}	PM L_{eq}	Average L_{dn}
L1 - Kawaihae Harbor	37 - 60	34 - 56	55
L2 - Pu'ukoholā Heiau NHS	43 - 55	32 - 52	53

Source: DL Adams Associates, 2011

The noise measurements indicate that while average noise levels over a period of time tend to be low, there are relatively brief periods of loud intermittent noises. These intermittent noises were observed on-site to be due to heavy trucks on Kawaihae Harbor's access road and vehicular traffic on Kawaihae Road. When the intermittent noises are not present, the ambient noise environment is very quiet.

4.6.2.2 Short-Term Noise Measurements

Short-term measurements were conducted during the peak PM and AM traffic hour on September 9, 2011 and September 14, 2011 respectively to validate the traffic noise model for noise from Kawaihae Road. An approximate one-hour equivalent sound level, L_{eq}, was measured 40 feet north-east of the centerline of Kawaihae Road. This location is documented as Location S1 in **Figure 4-5: Long-Term and Short-Term Noise Measurement Locations**.

4.6.3 Project Impacts from Land-Based Noise

4.6.3.1 No-Build Alternative

The No-Build Alternative will have no direct impact on noise in the study area.

4.6.3.2 Build Alternatives

Potential noise impacts associated with the Build Alternatives will mainly be associated with:

- Short-term construction activities.
- Post-construction operations within the harbor.
- Traffic noise on Kawaihae Road.

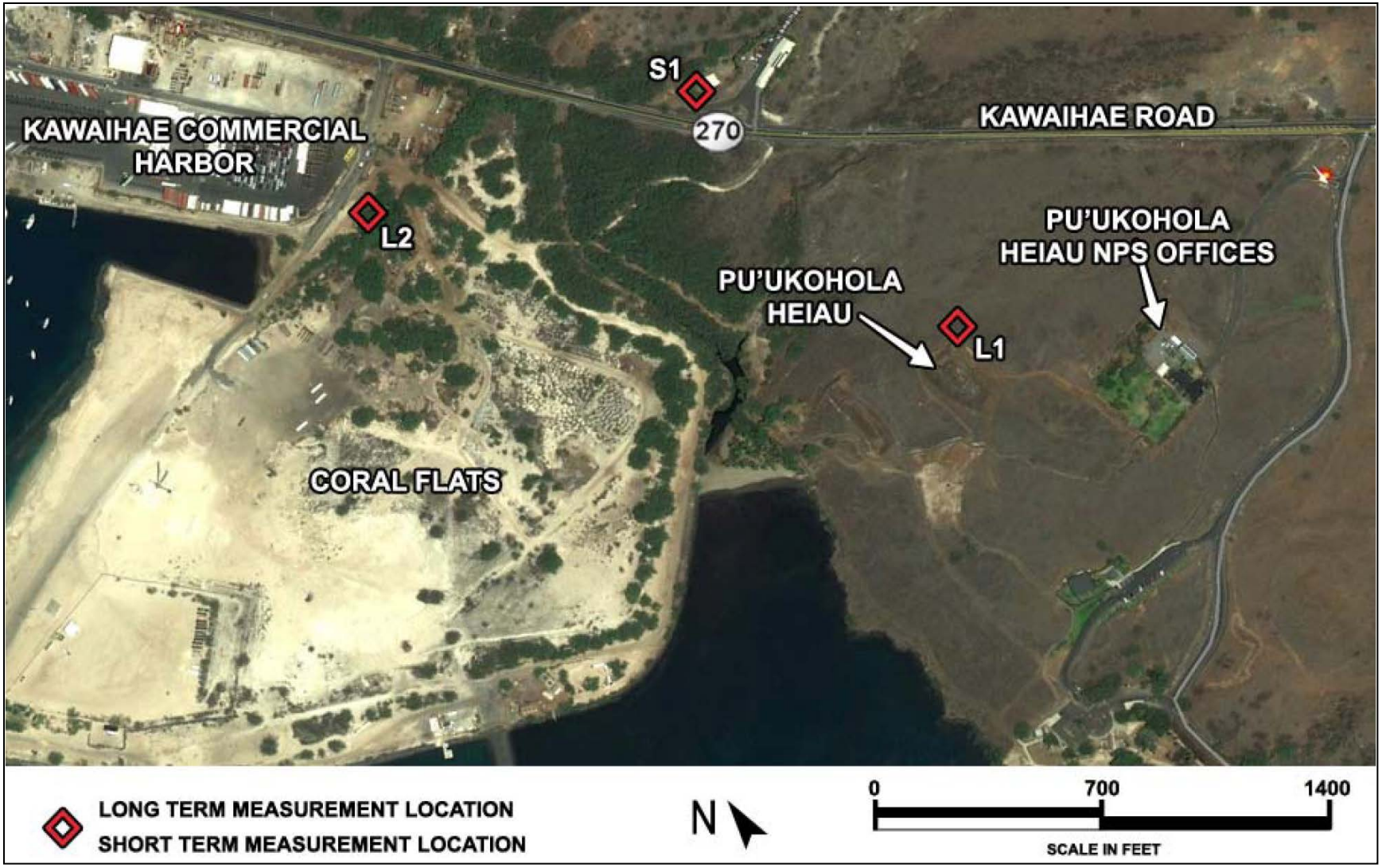
A discussion of underwater noise is considered separately in **Section 4.6.5: Underwater Noise**.

Land-Based Construction Noise

Noise from construction activities are regulated under Title 11, Chapter 46 (Community Noise Control) of the DOH's Administrative Rules. Under these regulations, the project site is situated within the Industrial zoning district (Class C). For areas zoned industrial, the noise limit at the property line is 70 dBA during the day and night.

The construction of Kawaihae Harbor improvements will involve several stages which utilize various types of construction equipment, as described in **Table 4-8: General Construction Stages and Equipment**. The estimated duration of each stage is included in the table, however, these estimations are based on the contractor's ability to work with minimal interruptions from existing commercial harbor operations. The actual noise levels produced during construction of the Build Alternatives will be a function of the methods employed during each stage of the construction process. Although specific equipment that will be used for this project has not been finalized, the equipment described below represents a reasonable approximation of the type of equipment that will be used.

Figure 4-5: Long-Term and Short-Term Noise Measurement Locations



Source: DL Adams Associates, 2011

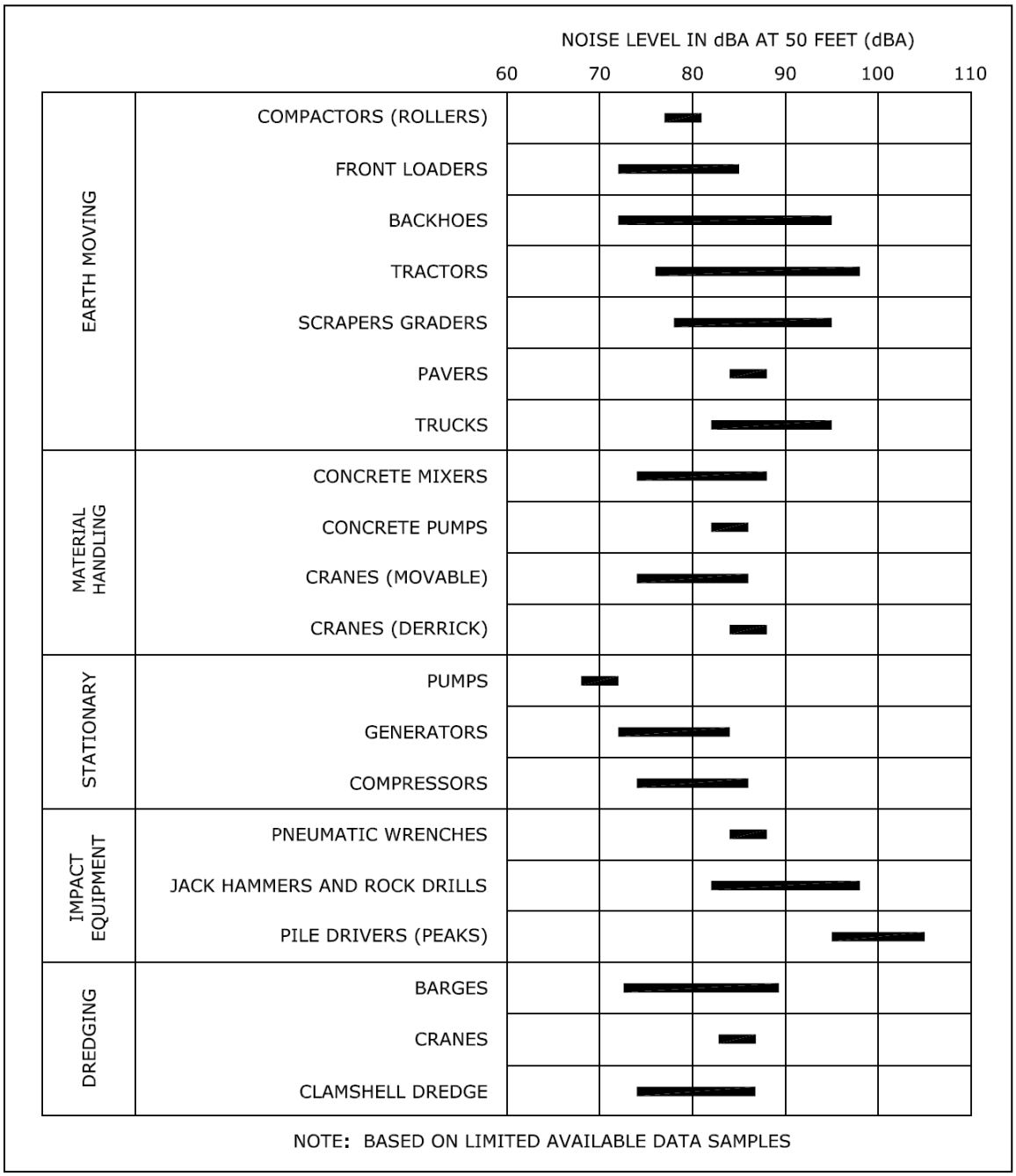
Table 4-8: General Construction Stages and Equipment

Construction Stage	Associated with Alternatives	Expected Equipment	L_{max} at 50 feet (dBA)	Impact Device?
Landside Construction (6 months)	2, 3, 4 and 5	Pavement Cutter	84	
		Excavator	85	
		Compacter	80	
		Concrete Pump	82	
		Scraper	85	
		Grader	85	
		Paver	85	
		Loaders	80	
		Roller	85	
		Trucks	55	
Pier Demolition (12-18 months)	4 and 5	Dump Trucks	84	
		Crane	85	
		Work Boat	72	
		Tug Boat	89	
		Hydraulic Breaker (Impact Hammer)	90	**yes**
Pier Construction (3-4 months):	4 and 5	Flat Bed Trucks	84	
		Crane	85	
		Work Boat	72	
		Tug Boat	89	
		Concrete Mixer	85	
		Mounted Impact Hammer	90	**yes**
		Hydra Break Ram	90	**yes**
		Impact Pile Driver	95	**yes**
Dredging (2 months)	4 and 5	Clamshell Dredge	85	
		Crane	84	
		Work Boat	72	
		Tug Boat	89	

Source: U.S. Department of Transportation - Federal Highway Administration. *Roadway Construction Noise Mode*l, FHWA-HEP-05-054, February 2006

Typical ranges of construction equipment noise are outlined in **Figure 4-6: Typical Sound Levels from Construction Equipment**. The hydraulic breaker used during the demolition stages and pile driver used during the installation stages will be the loudest equipment used during construction. However, the actual sound levels that will be experienced in the vicinity of the project site are a function of the distance from the noise source, the duration of the construction activities, and the number of pieces of equipment used.

Figure 4-6: Typical Sound Levels from Construction Equipment



Source: DL Adams Associates, 2011

The Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) was used to predict construction noise to receptor locations surrounding the project site under the Proposed Action - Alternative 5, since this alternative would be a "worst-case" (most conservative) representation of what could be constructed. Other Build Alternatives will have less noise generated from reduced levels of construction.

Receptor locations analyzed include the adjacent Pu'ukoholā Heiau NHS, nearby residences and businesses, and the Kawaihae Small Boat Harbor (North). The model was based on a summary of the construction methodology provided by Moffat & Nichol. **Table 4-9: Summary of Proposed Action - Alternative 5 Construction Noise Analysis Results** summarizes the results of the construction noise analysis.

Table 4-9: Summary of Proposed Action - Alternative 5 Construction Noise Analysis Results

ID	Noise Receptor	Distance (ft.)	Existing Ambient Noise (dBA)	Predicted Construction Noise per Stage (dBA)				Predicted Total Noise during Project Construction Stages [Ambient + Construction] (dBA)			
				A	B	C	D	A	B	C	D
R1	Pelekāne Beach (Pu'ukoholā Heiau NHS)	2,100	45-55	52	62	48	-	53-57	62-63	50-56	-
		100		-	-	-	80	-	-	-	80
R2	Nearest Residence	800	45-67	61	70	57	62	61-68	70-72	57-67	62-68
R3	Nearest Restaurant (in Stage A,B, C)	400	45-67	67	76	63	-	67-70	76-77	63-68	-
	Nearest Restaurant (in Stage D)	400	45-67	-	-	-	68	-	-	-	68-71
R4	Kawaihae Small Boat Harbor (North)	1,200	45-67	57	67	53	59	57-67	67-70	54-67	59-68

Source: DL Adams Associates, 2011

The results of the construction noise analysis show that construction noise levels at all noise receptor locations are generally expected to be below the Federal Transit Authority's (FTA) guideline noise impact thresholds of 80 dBA and 85 dBA for residential and commercial land uses, respectively. Since both stationary and impulse construction noise levels will exceed maximum permissible noise limits specified in the *Community Noise Rule,* a permit must be obtained from the DOH to allow the operation of construction equipment. Nevertheless, intermittent construction noises will still be audible in the vicinity of the project site.

Construction noise will be most audible for the noise receptors immediately surrounding the project site, i.e., the homes, restaurants, and businesses along Kawaihae Road. During the demolition and installation stages, specifically during percussive hydraulic breaker and pile

driving activities, ambient noise levels may increase by up to 31 dBA over existing levels. This will likely be disturbing to people who participate in activities that take place outdoors (such as at the small boat harbor or restaurants with outdoor seating). During pile driving or extraction activities, people will need to raise their voice or reduce the talker-to-listener distance in order to communicate effectively. The severity of the speech interference will depend on how close the park users are to the project site. However, in the break between driving or extraction activities, ambient noise levels are not expected to be significantly higher than existing ambient noise levels. Furthermore, construction noises are expected to be intermittent and short term. During the landside construction phase of the proposed project, the Coral Flats area will be graded and the existing perimeter roadway will be turned over to the Department of Land and Natural Resources (DLNR), Division of Boating and Ocean Recreation (DOBOR) for future construction to the Kawaihae Small Boat Harbor (South). Due to the proximity of Pu'ukoholā Heiau NHS to Coral Flats, ambient noise levels at Pelekāne Beach may increase by up to 35 dBA over existing levels. Again, construction noises are expected to be intermittent and short term.

Construction activities generate not only audible airborne sounds, but can also result in varying degrees of ground vibration depending on the equipment and methods employed. Pile driving and sheet piling installed by using impact hammers is likely the greatest source of vibration associated with the equipment used during construction of the various improvements to Kawaihae Harbor Improvements project.

Land-Based Post-Construction Harbor Noise

On completion of the Build Alternatives, harbor related activities such as truck traffic and cargo movement may increase, most prominently for Alternative 4 - Land-Side Plus Pier 2A Extension and the Proposed Action - Alternative 5. Noises associated with these activities include backup alarms and engine noise from cargo handling equipment, trucks and other heavy equipment, stationary mechanical equipment noise, and horns from the ships. In addition, under Alternative 3 - Partial Action/Land-Side, Alternative 4 - Land-Side Plus Pier 2A Extension, and Proposed Action - Alternative 5, the Coral Flats area will be graded and leased for truck staging, standby and storage purposes. Noise from these trucks will be closer in proximity to Pu'ukoholā Heiau NHS than the existing areas currently used in the harbor.

Existing noise levels measured at the southern edge of the harbor (at measurement location L1) indicate that current harbor activities generate noise levels well below the DOH maximum permissible noise limit. Future noise levels are also expected to be below the DOH noise limit. However, intermittent noises from commercial harbor related activities will still be audible in the area surrounding the harbor and at Pu'ukoholā Heiau NHS.

Land-Based Traffic Noise on Kawaihae Road

For Alternative 3 - Partial Action/Land-Side, Alternative 4 - Land-Side Plus Pier 2A Extension, and Proposed Action - Alternative 5, improvements will be made to Kawaihae Road and the harbors ingress/egress gates. Therefore, for these alternatives, a vehicular traffic noise analysis of Kawaihae Road was completed for the existing conditions (2010) and the expected year 2025 peak-hour traffic volumes using the FHWA Traffic Noise Model Look-up Tables Software Version

2.5. Vehicular mix data was collected during the site visit, and a speed limit of 45 MPH was assumed as a more conservative estimate than the posted 35 MPH speed limit. Vehicular traffic noise levels were calculated at the Pu‘ukoholā Heiau NHS and in the vicinity of the harbor north of the main gate. The results of the traffic noise analysis are described below and summarized **Table 4-10: Existing and Future Traffic Noise Projections for Kawaihae Road (dBA) Under Alternatives 3, 4 and 5**.

Table 4-10: Existing and Future Traffic Noise Projections for Kawaihae Road (dBA) Under Alternatives 3, 4 and 5

Scenario	Pu‘ukoholā Heiau NHS		Residences/Businesses North of Main Gate	
	dBA, 650 Feet from Roadway Centerline		dBA, 40 Feet from Roadway Centerline	
	AM	**PM**	**AM**	**PM**
Existing (2010)	55	55	65	67
Future (2025)	56	57	67	69
Future Change Due to Project	**1**	**2**	**2**	**2**

Source: DL Adams Associates, 2011

Based on the results of the traffic noise analysis, a slight traffic noise level increase of less than 2 dBA is expected under Alternatives 3, 4, and 5. Therefore, a significant noise impact on the surrounding community due to the increase traffic noise is not expected. Although this traffic noise increase will not likely be noticeable to the general public, future traffic noise levels at the Pu‘ukoholā Heiau NHS may exceed the 57 dBA noise abatement criteria (NAC) defined by the FHWA for Activity Category A, as shown in **Table 4-5: FHWA and HDOT Noise Abatement Criteria**. It should be noted that the traffic noise model was based on the observed vehicular speed of 45 MPH, a conservative factor, which is 10 MPH greater than the posted speed limit along Kawaihae Road. Higher vehicular speeds result in an increase in noise level, in this case by approximately 2 dBA.

4.6.4 Recommended Mitigation of Land-Based Noise Impacts

4.6.4.1 DOH Noise Permit

Title 11, Chapter 46 of the DOH Administrative Rules, the State of Hawai‘i Community Noise Control Rule, states that in cases where construction noise exceeds, or is expected to exceed the State’s "maximum permissible" property line noise levels, a permit must be obtained from DOH to allow the operation of vehicles, cranes, construction equipment, power tools, etc., which emit noise levels in excess of the "maximum permissible" levels.

In order for DOH to issue a construction noise permit, the contractor must submit a noise permit application to DOH, which describes the construction activities for the project. Prior to issuing the noise permit, DOH may require action by the contractor to incorporate noise mitigation into the construction plan. DOH may also require the contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. The contractor should use reasonable and standard practices to

mitigate noise, such as using mufflers on diesel and gasoline engines, using properly tuned and balanced machines, etc. However, DOH may require additional noise mitigation, such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

Specific permit restrictions for construction activities are:

- "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels ... before 7:00 AM and after 6:00 PM of the same day, Monday through Friday."
- "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels... before 9:00 AM and after 6:00 PM on Saturday."
- "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays."

The use of pile drivers, hoe rams and jack hammers 25 pounds (lbs.) or larger, high pressure sprayers, and chain saws are restricted to 9:00 AM to 5:30 PM, Monday through Friday. In addition, construction equipment and on-site vehicles or devices whose operations involve the exhausting of gas or air, excluding pile hammers and pneumatic hand tools weighing less than 15 lbs., must be equipped with mufflers.

The DOH noise permit does not limit the noise level generated at the construction site, but rather the times at which noisy construction can take place. Therefore, noise mitigation for construction activities should be addressed using project management, such that the time restrictions within the DOH permit are followed.

4.6.4.2 DOH Noise Variance

In cases where nighttime construction is expected, a variance must be obtained from DOH to allow the operation of a noise source which emits noise levels in excess of the maximum permissible levels and which operation does not conform to the requirements of the noise permit (i.e., nighttime construction activities which occur between 6:00 PM and 7:00 AM, Monday through Friday).

In order for DOH to issue a construction noise variance, the contractor must submit a noise variance application to DOH which describes the construction activities for the project. The contractor is required to prove that nighttime work is in the public interest, that it does not substantially endanger public health or safety, and that appropriate measures for the attenuation of excessive noise will be taken. Reasonable and standard practices to mitigate noise include the use of mufflers on diesel and gasoline engines, using properly tuned and balanced machines, and temporary noise barriers. In addition, property owners and residents along the construction route must be notified of the variance application through a public notice procedure. A public hearing may be requested where the neighboring residents and business owners can discuss construction noise. If a public meeting is required, a letter stating the purpose of the project and indicating the time and place of the public meeting must be delivered to all affected residences and property owners.

Noise mitigation for nighttime construction activities should be addressed using management of construction equipment uses. Construction activities which generate the most noise (e.g., pile driving, cutting of pavement, hoe ramming, etc.) should be limited to the daytime hours while the quieter activities should take place at night. Generators used during nighttime activities should be low-noise and compressors should employ sound attenuating enclosures.

4.6.4.3 Construction Noise Mitigation Techniques

Mitigating construction noise at the source is the most effective form of noise control. The source control methods listed in **Table 4-11: Construction Noise Source Control Methods** are recommended to be applied to most construction equipment.

Table 4-11: Construction Noise Source Control Methods

Scheduling	Limit activities that generate the most noise to less sensitive time periods (e.g. daytime hours).
Substitution	Use quieter methods/equipment when possible (e.g. low noise generators, smaller excavators, etc.).
Exhaust Mufflers	Install quality mufflers on equipment.
Reduced Power Options	Use smallest size and/or lowest power as required.
Quieter Backup Alarms	Install manual adjustable or ambient sensitive alarms. Do not use backup alarms during night work.

Source: DL Adams Associates, 2011

In general, a majority of the construction noise mitigation is in the form of scheduling, specifically, limiting the construction hours to the time frame specified by DOH. The pile and sheet pile driver is expected to be the most disruptive piece of equipment used during the construction process so the allowable hours of operation are even more restrictive, as described in **Section 4.6.4.1: DOH Noise Permit**.

When source control measures are not sufficient to avoid a noise impact, path control measures must be considered. Non-permanent noise barriers or curtains and equipment enclosures can be installed at the construction site to reduce construction noise in noise sensitive locations. However, mitigation of the noise path at Kawaihae Harbor may not be practical due to the intensity of the construction noise sources.

4.6.4.4 Recommended Mitigation of Vehicular Traffic Noise

Vehicular traffic noise levels are not expected to increase by a significant amount in the future. However, noise levels at the Pu'ukoholā Heiau NHS may exceed the FHWA's noise abatement criteria for Activity Category A by the year 2025. Traffic management measures are recommended to be implemented to ensure that vehicles, especially heavy trucks, driving past the site do not exceed the posted speed limit of 35 mph. This can include increased enforcement of speed limits and improved signage to notify drivers of the posted speed limit.

4.6.5 Underwater Noise

In addition to concerns posed by above-ground noise propagation, concerns have been raised by the US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) about underwater noise impacts from construction activities on marine life. The main concern is ambient background noise in the harbor combined with additional underwater noise created by pile driving and other construction activities.

Certain marine animals are known to depend on their hearing for everything from protection from prey to feeding, mating, and communicating. Essentially all cetaceans (whales and dolphins) are in this category, as are sirenians, some pinnipeds, and some sea turtles. It is widely believed that even temporary degradation in hearing ability may lead to injury or death. (Cavanagh, 2000).

Marine mammals such as monk seals, spinner dolphins, and humpback whales can suffer temporary hearing loss from man-made activities, called Temporary Threshold Shifts (TTS) or permanent hearing loss, called Permanent Threshold Shifts (PTS). While there has been extensive research into the issue of underwater noise levels and their effect on marine wildlife, there is a wide range of opinions as to the exact levels of noise that will adversely harass or injure these species, and the state of knowledge is continuously changing (Cavanagh, 2000).

Sound in water is typically measured in units of root mean square acoustic pressure in micropascals, or dB re 1 µPa. The in-water thresholds that NMFS has indicated are of concern in consultation with DOT-H are as follows:

1. Injury (permanent threshold shift, specifically permanent hearing loss) will result from exposure to:

    - 180 dB re 1 µPa (any sound) for cetaceans (whales and dolphins).
    - 190 dB re 1 µPa for pinnipeds (seals).

2. Behavioral impacts (temporary threshold shift and/or behavioral changes such as areal avoidance) will result from exposure to:

    - 160 dB re 1 µPa for impulsive sound (impact pile driver) for all marine mammals or
    - 120 dB re 1 µPa for non-impulsive (continuous sound) from vibratory drivers or drills for all marine mammals.

NMFS staff has indicated to DOT-H staff that these thresholds were derived for marine mammals, but are currently also used for sea turtles such as green sea turtles and hawksbill turtles.

4.6.5.1 No-Build Alternative

The No-Build Alternative will not create any additional impacts from pile driving or construction.

4.6.5.2 Build Alternatives

Alternative 2 - Minimal Action and Alternative 3 - Partial Action/Land-Side will not create any impacts from pile driving, though land-side construction will still occur.

Under Alternative 4 - Land-Side Plus Pier 2A Extension and the Proposed Action - Alternative 5, pile driving and other construction activities will be necessary as part of pier construction. Pier 2 will be reconstructed and increased by 340 feet in length under Alternative 4. Proposed Action - Alternative 5 will incur those same impacts, plus also extend Pier 2C an additional 325 feet. As noted above in Section **3.7.1: Reconstruction and Extension of Pier 2A by 340 Feet**, and Section **3.8.1: Pier 2C Extension of 325 Feet**, there are different methods constructing piers, either as a concrete pile-and-deck or a bulkhead with sheet piles and backfill, or a combination of these two methods.

If a concrete pile-and-deck was constructed, it would require:

- 90 support piles for the Pier 2 repairs (under Alternatives 4 and 5).
- 300 support piles for the extension of Pier 2A (under Alternatives 4 and 5).
- 275 support piles for the extension of Pier 2C (under Alternative 5 only).

Pile driving within the harbor will be conducted using a barge-mounted diesel, hydraulic impact and/or vibratory hammer, depending on geotechnical conditions. The new piles will be in the same range of sizes and materials as the existing piles. (i.e., 20-inch octagonal pre-stressed concrete piles).

If a Bulkhead with Sheet Pile method was pursued, there will be two potential ways to drive the sheet pile, either the "pitch and drive" method, or the "panel driving" method. If a bulkhead design was pursued, the vertical bulkhead will be:

- approximately 340 feet long for the extension of Pier 2A, (under Alternatives 4 and 5).
- approximately 325 feet long for Pier 2C (under Alternative 5 only).

Generally, sound pressures from marine pile driving depend upon the size of the pile and the size of the hammer. There are, however, other factors that can cause large variations in measured sound pressures at a particular project site or from project site to project site. These factors include water depth, tidal conditions or currents if sound attenuation systems are used, and geotechnical conditions that determine how difficult it is to drive the pile (Illinworth and Rodkin, 2007).

The impacts of underwater noise created by pile driving or installation of sheet piles will be influenced by the level of attenuation of the acoustic signal before it reaches marine mammals. In shallow near-shore waters, the attenuation is estimated based on the equation

$$RL = SL - 15 \log(R)$$

where RL= received level; SL = Source Level; R = range in meters from the source.

The 15 is used because it is between the theoretical "spherical spreading" (-20log(R)) and "cylindrical spreading" (-10log(R)).

With mitigative measures, the noise levels can be attenuated to lower the impacts on marine mammals.

Noise from sheet pile installation will vary based on the type of hammer as well (vibratory or diesel impact). During the start of driving a sheet pile, there tends to be a momentary peak in the noise level, and then the noise is reduced as the sheet is driven further into the ground. A vibratory hammer typically is not as loud as pile driving with an impact hammer (Paulus, Sokolowski and Sartor Engineering, 2006). However in order to verify the final stability, an impact pile driver is needed at least at the end of the pile installation process. (Matuschek and Betke, 2009).

No attenuation systems for underwater noise have been documented for sheet pile installation in available literature (Illinworth and Rodkin, 2007). Little information is known about the hammer or driving energies used to install sheet piles. (ICF Jones and Stokes, 2009).

4.6.5.3 Recommended Mitigation of Underwater Noise

Under Alternative 4 - Land-Side Plus Pier 2A Extension and Alternative 5-Full Action, to avoid noise effects on humpback whales in the vicinity of the project area, it may be advisable to avoid construction activities that will generate high levels of underwater noise during months when humpback whales are present. In comments received on the project, NMFS has indicated that Humpback whales typically arrive in the Hawaiian Islands as early as October and may stay as late as May or early June. If avoiding these months for construction is not possible, prior to construction, DOT-H will work with NMFS to determine the appropriate temporary threshold shift (TTS) distances of the protected species anticipated to be in the area. Pile driving will be postponed or halted when protected species are within the TTS range.

One possible measure for attenuating noise during underwater pile driving is through the use of an "air bubble curtain", which can be confined (within a separate outer containment shell) or unconfined (which exposes the bubbles, thereby driving away fish as well). Air provides an effective barrier to sound propagating through water, because of the difference in density between air and water. Air bubble curtain systems have been used to reduce underwater sound pressures from explosions or from other sources of high-amplitude sounds. Cylinders or rings are installed around piles and bubbles are produced to reduce sound levels (Reyff, 2009).

Other noise reduction strategies that have been considered in past research include temporary noise attenuation piles (TNAP), which consist of an inner and outer steel casing with an inner air chamber between the casings that is partially filled with foam. At the bottom on the inside of the inner casing is a bubble ring. (WSDOT, 2011). TNAPs were only found to attenuate noise approximately 10 dB because of unconstrained propagation of sound directly from sediment into water. (Reinhall and Dahl, 2011).

Fabric barriers have also been used to attenuate noise, using a similar theory to that of bubble curtains. Cofferdams can be used as well, either full of water or drained to the midline. The dewatered cofferdams have greater effectiveness than a full one. (WSDOT, 2011).

In addition to physical means to attenuate noise, "soft starts" for the pile driving are recommended. With this procedure, the pile installation begins with low impact, low-energy

velocities, and gradually builds up to full energy. The soft-start would allow marine species to leave the area before the full impact of the activity is attained.

Given that vibratory hammers generate lower levels of noise compared to pile driving, installation of sheet piles using vibratory hammers may be a way to reduce underwater noise impacts. However, as noted above, no other attenuation systems for underwater noise have been documented for sheet pile installation, and an impact pile driver is needed to verify final stability.

4.7 Visual Resources

Representative images of visual resources within Kawaihae Harbor and in surrounding areas are shown in **Figure 4-7** through **Figure 4-14**.

Figure 4-7: Pu'ukoholā Heiau, Pelekāne Beach & Pelekāne Bay Viewed from Coral Flats



Figure 4-8: Kawaihae Road & Kohala Mtn. Landscape as Viewed from Pu'ukoholā Heiau



Figure 4-9: Piers 1 & 2, Container Yards, & Pelekāne Lands Buffer as Viewed from Pu'ukoholā Heiau



Figure 4-10: Coral Flats as Viewed from Pu'ukoholā Heiau



Figure 4-11: Perimeter Roadway in Coral Flats Area



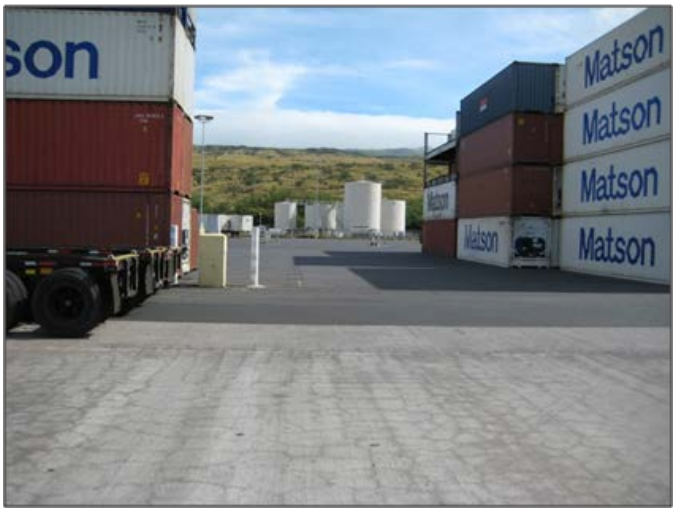
Figure 4-12: View of Harbor from Kawaihae Road



Figure 4-13: Overview Image of Matson and Young Brothers Yards



Figure 4-14: Fuel Storage and Containers in Matson Yard



4.7.1 Existing Conditions

The existing Kawaihae Harbor facilities present a man-made visual landscape that is expected of an industrial harbor facility. Stacked containers, barges and other vessels at berth, above-ground storage tanks, buildings, and other features dominate the land-side landscape. There is very little deliberately-planted landscaping or natural vegetation on the site. The harbor is zoned for industrial uses, and has been master-planned for its future development.

The Coral Flats area is composed of dredging spoils that were deposited there when the modern harbor was initially created in the 1950s and 1960s. Any exposed land in that area was covered with the spoils, and some of the area was "reclaimed" from the marine environment as

an upland area. Most of the vegetation that is present within the disturbed Coral Flats area consists primarily of keawe forest in the unused areas and ruderal or weedy species in the more disturbed areas of the interior of the Coral Flats (Towill, R.M., 2001). Naupaka shrubs were also observed colonizing areas along the perimeter of the Coral Flats. The one exception is the Pua Ka ‘Ilima O Kawaihae Cultural Surf Park, which offers a small landscaped area with grass, shade trees, and several picnic tables.

Outside of the harbor area, Kawaihae Road is a two-lane rural highway that runs between the harbor and more steep mauka hillsides leading up Kohala Mountain. As one of the driest locations on Hawai‘i Island, the area surrounding the harbor has few trees and is mostly covered in non-native grasses.

The most prominent visual resource in the area is the Pu‘ukoholā Heiau NHS. This 86-acre property maintained by the US Department of the Interior, National Park Service (NPS) contains several important man-made structures, including the main Pu'ukoholā Heiau, the smaller Mailekini Heiau and the John Young homestead on the mauka side of Kawaihae Road. Pelekāne Beach is located below Pu‘ukoholā Heiau. A smaller “shark heiau” called Hale o Kapuni, dedicated to the shark god Kauhuhu, is offshore from Pelekāne Beach. The landscape throughout the Pu‘ukoholā Heiau NHS offers steep hillsides with views of the ocean (including all of Kawaihae Harbor) below and Kohala Mountain above. Mauna Kea, Mauna Loa, and Hualalai can also be viewed in the area around the historic site under favorable conditions. The Pelekāne Buffer Zone of Kawaihae Harbor serves as a vegetated buffer separating the historic properties from the main working areas of the harbor and the Coral Flats area.

4.7.2 Project Impacts on Visual Resources

4.7.2.1 No-Build Alternative

The No-Build Alternative will have no direct effect on visual resources.

4.7.2.2 Build Alternatives

The Build Alternatives will have a number of impacts on the visual landscape. Visual impacts of the changes to Kawaihae Harbor from the Proposed Action will be experienced by a diverse group of viewers, with different opinions and visual perspectives. They include, but are not limited to, the following:

- Visitors and staff at the Pu‘ukoholā Heiau NHS.
- Residents, which include nearby homes as well as viewers that can see Kawaihae Harbor from distant vistas.
- Commercial properties near the harbor.
- Travelers on Kawaihae Road and Akoni Pule Highway, including motorists, bicyclists, and pedestrians.
- Recreational and commercial watercraft, which will get a view of the changes to the harbor from the water side.
- Users of the harbor facilities, either for activities associated with the movement of goods, military users, or recreational/educational users. The latter include those that

use the Coral Flats area for surfing, canoeing and other activities associated with the YMCA, Pua Ka ‘Ilima ‘O Kawaihae Cultural Surf Park, Na Kalaiwa ‘a Moku ‘O Hawai‘i, and the Kanu o ka ‘Āina New Century Public Charter School facilities.

The Build Alternatives will alter the viewscape of the area in a number of ways. However, all changes are consistent with those of an industrially-zoned harbor and in that context will not be considered an adverse impact. These improvements will result in some visual changes depending on the viewer's viewplane and perspective.

The visible changes associated with the project are summarized in **Table 4-12: Above-Water Visual Elements of Project Alternatives**.

Table 4-12: Above-Water Visual Elements of Project Alternatives

Visual Change	Alt 1 - No Build	Alt 2 - Minimal Action	Alt 3 - Partial Action/ Land-Side Only	Alt 4 - Land-Side Plus Pier 2A	**Alt 5 - Proposed Action**
Improve internal roadway circulation		X	X	X	**X**
Open and upgrade south gate entry		X	X	X	**X**
Dedicate land for Kawaihae Small Boat Harbor (South) & perimeter road		X	X	X	**X**
Add perimeter security fencing on Coral Flats		X	X	X	**X**
Transfer of Pelekane Lands Buffer to DLNR		X	X	X	**X**
Grade Coral Flats			X	X	**X**
Relocate Hawai‘i District Office and new comfort station			X	X	**X**
New yard pavement, structural pavement strengthening, & utility improvements			X	X	**X**
Improve, replace, or add sheds, buildings, parking, and fencing			X	X	**X**
Improvements to main gate, south gate, and Kawaihae Road			X	X	**X**
Security Improvements			X	X	**X**
Extend Pier 2A by 340 feet				X	**X**
Demolish and reconstruct Pier 2 superstructure				X	**X**
Extend Pier 2C by 325 feet					**X**
Demolish small craft dock facilities					**X**

4.7.3 Recommended Mitigation of Impacts on Visual Resources

As part of the efforts for planning future use of the harbor, DOT-H has coordinated with a number of interested stakeholders in the community. These outreach efforts have included the NPS, one stakeholder with notable visual sensitivity to the changes at the harbor. Several mitigative measures are recommended to minimize adverse effects of the Build Alternatives on visual resources.

- As part of the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update*, the 22-acre vegetated Pelekāne Buffer Zone between the Coral Flats area and the Pu‘ukoholā Heiau

NHS will remain unused for harbor uses under all Build Alternatives as open space through the planning horizon of 2035, to provide visual and physical separation between NPS property and the Coral Flats area. There are plans to turn over this buffer area to DLNR.

- One potential future action that could mitigate visual impact under any of the Build Alternatives is the relocation of fuel storage facilities across Kawaihae Road to Department of Hawaiian Homelands (DHHL) lands on the mauka (upland) side of the road. At the time of the *Hawai‘i Commercial Harbors 2020 Master Plan*, fuel storage was planned in the long term to be located within the Coral Flats area. As a way to mitigate the effects this facility will have on the NHS, the *Hawai‘i Island Commercial Harbors 2035 Master Plan* Update proposed instead to relocate the fuel storage outside of the harbor, and further from the NHS. The future fuel storage developer will have to do their own environmental review when this development is ready to be implemented.
- Security fencing will be constructed along the perimeter roadway in the Coral Flats under all Build Alternatives. The color and design of the fencing and associated landscaping could be designed to blend in with the existing environment in order to minimize the visual intrusion of these new elements. In addition, painting any structures a natural earth tone color to blend in with the surrounding environment could mitigate the effects of those structures on the visual landscape.
- Any new lighting provided on harbors property under the Build Alternatives will incorporate County of Hawai‘i lighting standards for shielding to ensure that light is directed to the ground only. Container terminals typically employ 100- to 120-foot tall mast lights to provide recommended illumination, but at Kawaihae Harbor, 46.5-foot-high light poles will be used in conjunction with 180-watt low-pressure sodium lights. This will minimize light pollution and spill-over of light and is also needed to mitigate effects of nighttime lighting on astronomical observatories and on seabirds (as discussed in **Section 4.17: Light Pollution**). The light level for the wharf area shall be 5 foot-candles average and 2 foot-candles minimum on the wharf.
- Landscaping is expected to be warranted in limited areas under all Build Alternatives. However, if any landscaping is to be provided for improvements to Kawaihae Road and within the harbors area itself, consideration could be given to the use native species appropriate to the local landscape for revegetating cleared areas.

4.8 Historic and Archaeological Resources

A literature review and field inspection (Cultural Surveys Hawai‘i, 2011) has been performed for this project and is found in **Appendix D: Archaeological Literature Review and Field Inspection** with a summary below. Past work recently done in the area includes an Archaeological Inventory Survey for the Kawaihae Road Bypass project (Reith and Morrison, 2010). The project area consists of the entire Kawaihae Harbor (approximately 113 acres), which is located in the ahupua‘a (traditional land divisions) of Kawaihae 1 and 2, South Kohala District, Hawai‘i Island.

4.8.1 Existing Conditions

During pre-contact times (prior to Captain Cook’s and other Europeans’ contact with Hawai‘i in 1778), the village at coastal Kawaihae was a major coastal settlement focused on marine resources. Its advantage was its deep channels and a safe landing place for canoes. Kawaihae played an important part in battles between warring chiefdoms, likely due to its strategic location. As the home of chiefs, Kawaihae became particularly important in the political career of Kamehameha I and is associated with his rise to power.

Integral to the history of Kawaihae are its two major heiau, Mailekini and Pu‘ukoholā that are adjacent to the southern portion of the present project area. Early descriptions of Kawaihae by western visitors present an arid landscape.

Subsequent to European contact, Kawaihae became a center for commerce, as it was the only harbor on the northwest side of Hawai‘i Island. The harbor offered entrepreneurial opportunities at the same time that Hawaiians’ lifestyles were evolving from traditional Hawaiian subsistence to a more western-influenced society. After contact, local business ventures included supplying ships with Waimea-grown fruits and vegetables, supplying cattle for beef, and exporting salt to places as far away as Russia.

During World War II, demand for Parker Ranch cattle increased, and Kawaihae’s role as the shipping outlet for Waimea products intensified. By the 1950s, the need for improved harbor facilities at Kawaihae was apparent. The old landing had been destroyed in the 1946 tsunami and the one built in 1937 had proven unsafe in high seas. The US Congress authorized the Kawaihae Harbor project in 1950 as a joint project of the Territory of Hawai‘i and USACE. The new harbor was officially dedicated on October 5, 1959.

The project area considered within the archaeological literature review and field inspection has been previously developed or disturbed by past development. USACE dredged the existing harbor from 1957 to 1959. To build new harbor facilities, the extracted coral was used as fill extending from the natural shoreline. Much of the former shoreline at Kawaihae Town was covered by up to thirteen feet of coral. At the same time, a breakwater was constructed to protect the main harbor piers.

Presently, Kawaihae Harbor includes a fuel depot, shipping terminal, and associated roadways and buildings. The shallower Kawaihae Small Boat Harbor (North), adjacent to the north of the commercial harbor, contains berths for smaller private and commercial vessels.

The Coral Flats area is a compacted area of coral fill located immediately south of the main harbor area and north of the Pu‘ukoholā Heiau NHS. Vehicles and people access Coral Flats to access a number of recreational facilities, including the Kawaihae Small Boat Harbor (South), constructed in 1970. The Coral Flats also include a landing for US Army vessels, and the Pua Ka‘Ilima ‘O Kawaihae Cultural Surf Park. A quarry is located in the Coral Flats area, at which excess coral fill material is crushed for use elsewhere.

On August 17, 1972 the US Congress authorized the designation of Pu‘ukoholā Heiau National Historic Site (NHS). This property includes:

- The main Pu'ukoholā Heiau (refer back to **Figure 4-7: Pu'ukoholā Heiau, Pelekāne Beach & Pelekāne Bay Viewed from Coral Flats**).
- The smaller Mailekini Heiau.
- The shark heiau of Hale-ō-ka-puni, which is the historic feature in closest proximity to the project area; its remains have been documented offshore under a layer of silt in Pelekāne Bay and they are visible at low tide.
- A stone post on the beach that, according to tradition, chief Alapa'i-kupalupalu-manō leaned against while watching sharks circling around offerings placed Hale-ō-ka-puni.
- Pelekāne, Kamehameha's Kawaihae residence.
- The site of the house of John Young, a close advisor to Kamehameha.

Ten historic sites have been documented within the Pelekāne Lands Buffer Zone, of which five are closer to the area of the Proposed Action, just east of the Coral Flats. This includes a purported homestead of John Young.

The Hawai'i Department of Hawaiian Homelands (DHHL) controls much of the area along the eastern or mauka side of Kawaihae Road directly across from the main harbor area.

Background research in the *Archaeological Literature Review and Field Inspection for the Kawaihae Harbor Project* (Cultural Surveys Hawai'i, 2011) indicated a general lack of historic properties in the bounds of the project area for the Proposed Action, due to the high level of disturbance within and along Kawaihae Bay over the last 50 or so years. The construction of the harbor, completed in 1959, likely obliterated the original shoreline and any historic properties that may have once been present there. While the harbor itself is more than 50 years old, it functions as an active commercial harbor and has undergone numerous subsequent improvements, and therefore is not of historic value.

Nevertheless, some potentially sensitive areas within the Area of Potential Effect (APE) were identified during the field inspection. Most importantly, the mauka or eastern shoulder and hillside along Kawaihae Road are of concern given the presence of several significant historic properties including burial sites, cemeteries and habitation sites. A modern memorial and buried fiber optic cable are also present along the mauka shoulder.

In addition, the following areas were identified as potentially sensitive (though unlikely), given their locations on coral landfill interface with the original shoreline: the project boundary with Pu'ukoholā Heiau NHS and the Pelekāne Lands Buffer Zone; the entire Kawaihae Road Highway corridor, including the western or makai (seaward) shoulder and the Main and South gates improvement areas; and the proposed comfort station locations.

4.8.2 Project Impacts on Historic and Archaeological Resources

4.8.2.1 No-Build Alternative

The No-Build Alternative will not create any direct impacts on historic or archaeological resources.

4.8.2.2 Build Alternatives

Kawaihae Harbor has undergone improvements since its construction in 1959 and is presently in active use as a harbor. Therefore, it is not recommended eligible to the State Inventory of Historic Places (SIHP).

No impacts to previously-recorded historic properties located along the eastern or mauka shoulder of Kawaihae Road and within the Pu'ukoholā Heiau NHS and Pelekāne Lands Buffer Zone are anticipated, given their locations outside of the proposed project's APE.

Furthermore, under all Build Alternatives, there is a potential (however unlikely) for construction-related disturbance of subsurface features or artifacts along the coral landfill interface with the original shoreline. The landfill was constructed over the heavily-used natural shoreline. The landfill depth along the interface is likely to be variable.

4.8.3 Recommended Mitigation of Impacts on Historic and Archaeological Resources

Under Proposed Action - Alternative 5 as well as Alternative 3 - Partial Action/Land-Side and Alternative 4 - Land-Side Plus Pier 2A, the improvements proposed to Kawaihae Road to improve shoulders and add turn lanes (see **Section 6.2.2.1: Near-Term (2015) Traffic Conditions**) have had their conceptual design modified to shift all construction towards the makai direction to avoid numerous known archaeological sites, including burials. The existing roadway right of way will remain as it is today on the mauka side.

Therefore, under these alternatives, the existing right-of-way along the mauka shoulder of Kawaihae Road, and the boundary between the Coral Flats and the Pelekāne Lands Buffer Zone and Pelekāne Bay should be strictly observed in order to avoid impacts to any of the sites located in the vicinity. Mitigation of construction-related vibration impacts is recommended to avoid adversely affecting the historic properties.

Given the close proximity of sensitive sites along the mauka shoulder of Kawaihae Road to the Main and South gates and Kawaihae Road corridor APE, a program of on-call monitoring by a qualified archaeologist is recommended to better ensure protection of the historic properties east of the shoulder, and is recommended for any subsurface excavation activities along the road APE, in order to mitigate the inadvertent discovery of subsurface features or artifacts that may be present there. While this area has been impacted by prior construction activities related to the road and its related infrastructure, the eastern limit of the coral landfill falls west of Kawaihae Road, and therefore undisturbed deposits may still exist. The presence of disturbed features or artifacts will be important to document as well, as they may provide further information about life at Kawaihae in the historic era. A monitoring program will require the preparation of a monitoring plan approved by DLNR, State Historic Preservation Division (SHPD).

There is a potential for construction-related disturbance of subsurface features or artifacts along the coral landfill interface with the original shoreline. In the unlikely event that subsurface features or artifacts are encountered during project-related excavation within the

APEs for the proposed construction activities, construction should cease and SHPD should be contacted immediately.

4.9 Cultural Impact Assessment

Act 50 (Session Laws Hawai‘i 2000) seeks to “promote and protect cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups” and requires project proposers under Chapter 343, Hawai‘i Revised Statutes (HRS) to consider cultural practices in a Cultural Impact Assessment (CIA). A CIA study (Fielder, 2008) was performed for then-proposed improvements to Kawaihae Harbor associated with the statewide large-capacity interisland ferry system that is no longer anticipated. That CIA was revised and updated by the same authors to cover the anticipated cultural impacts of the improvements to Kawaihae Harbor proposed in this EA. The updated CIA is provided in **Appendix E: Cultural Impact Assessment**. (Fielder and Mooney, 2011).

For the CIA, the project team contacted individuals and organizations knowledgeable about past and present cultural practices in the area, including oral interviews. Eleven contacts were initially consulted to obtain suggestions for interviewees. Detailed interviews were performed with eight local interviewees with strong connections to the community.

The project team conducted additional archival research, and together with the interviews, the CIA documented cultural practices and impacts of the project on those practices. The discussion that follows is greatly summarized from the full CIA.

4.9.1 Existing Conditions

Kawaihae has been a favored harbor since prehistoric times. It has a prominent place in the social, political, religious and economic history and culture of Hawai‘i. Besides being the seaport of chiefs, it was in the past as it is today an important fishing area and popular recreational venue. Kawaihae is recognized as the “makai” area for upland areas in Waimea.

The name Kawaihae literally means “water-of-wrath” because people are said to have fought for water from a pool in this arid area.

The original construction of Kawaihae Harbor altered the bay and the shoreline village with its construction. While it would seem likely that any traditional practices conducted in the area would have been lost as well, in fact traditional practices persist and the area is used in many traditional ways as the following discussion demonstrates.

The ocean or marine zones continue to be a significant subsistence resource. Local people still fish the area, using both modern and traditional methods. Traditional methods include the use of currents and landmarks. Traditional knowledge of fisheries (ko‘a) is used to locate fish and manage the establishment and development of those fisheries for future harvests.

Traditional uses of the shoreline, or ko kaha kai zone continue to this day and include gathering and shoreline or reef fishing. Kawaihae traditionally was a gathering and recreational spot from the times of the chiefs (ali‘i) to the present day. Picnicking, swimming, reef fishing, outrigger canoe paddling, and surfing are all traditional activities that continue to the present day.

People in Kawaihae retain a strong connection to the land, regardless of ownership. The original inhabitants strongly abided by the need for protection and conservation of subsistence resources (fish and limu or seaweed).

Pu'ukoholā Heiau is an integral part of Hawai'i's social, political and religious culture. Direct descendants of Kamehameha meet regularly at the heiau. This site, constructed during the time of Kamehameha I, includes several heiau structures, as well as an ahu (ceremonial rock structure), testifying to the significance and importance of the area to the Hawaiian people. The prominence and spiritual significance of the site is demonstrated by a much greater-than-usual number of religious structures at one location. These structures include Pu'ukoholā heiau, which Kamehameha built, the previously existing ahu attributed to Lonoikamakahiki, the Mailekini heiau, and the Hale 'O Kapuni (shark) heiau. Ongoing repairs of damage due to the October 15, 2006 earthquake incorporate traditional methods and techniques of heiau wall construction. This activity is being used to educate young Hawaiians on heiau, culture and traditional technology. More information on this site is found in **Section 8.2: Pu'ukoholā Heiau National Historic Site**.

The Ala Kahakai National Historic Trail follows the ancient fisherman's trail and Hawaiian Kingdom road around the island. This system includes the ancient Ala Loa land trail, which connected about 600 communities during the 15th through 18th centuries. Refer to **Section 8.3: Ala Kahakai National Historic Trail**.

SHPD Hilo Office indicates there are a significant number of people inquiring about burials and iwi (bones from grave sites) in Kawaihae. Historical grave sites are still being attended to by relatives. No burials have been inadvertently discovered in the Kawaihae Harbor area.

Specific traditional uses and practices within and near the harbor are shown in **Figure 4-15: Major Cultural Features of Kawaihae Harbor** and include:

- A recently-constructed "living" (actively used and maintained) ahu on the southwestern end of the harbor.
- Kanu o ka 'Āina New Century Public Charter School (KANU) maintains an outdoor-learning "makai" campus on the Coral Flats area called Hālau Kukui, which is a native Hawaiian learning center. See **Section 7.5: Education** for more information. There is no formal leasing arrangement with the school.
- The Pua Ka 'Ilima 'O Kawaihae Cultural Surf Park promotes traditional cultural activities such as hula, canoe building, etc. and is located on the Coral Flats between the Kawaihae Small Boat Harbor (South) and the main breakwater. The Pua Ka 'Ilima Long Board Classic competition is held every January or February. Pua Ka 'Ilima has a formal month-to-month revocable permit with DOT-H for use of the property.
- The YMCA's Aquatic Center programs teach traditional practices such as canoe paddling, surfing, crafts and hula. They also conduct marine ecology and science instruction. The YMCA has a formal month-to-month revocable permit with the DLNR DOBOR for use of the property.

Figure 4-15: Major Cultural Features of Kawaihae Harbor



Source: Fielder and Mooney, 2011, Adapted from Google Earth.

- The Na Kalai Wa‘a Moku ‘O Hawai‘i Hawaiian voyaging group built and maintains the Makali‘i voyaging canoe and provides educational programs. This group has a temporary dry storage permit with DLNR DOBOR. The group intends to complete a new storage facility at which time their equipment will be moved.
- Other recreation in the harbor includes swimming, picnicking, outrigger canoe paddling and boating. The inner harbor is used for canoe practices and regattas (races).

4.9.2 Project Impacts on Cultural Practices

4.9.2.1 No-Build Alternative

The No-Build Alternative is not anticipated to result in any direct effects on traditional native Hawaiian cultural practices or other traditional cultural practices.

4.9.2.2 Build Alternatives

Cultural activity areas on the southern corner of the Coral Flats, the Pelekāne Bay side of the Coral Flats, and the Pu‘ukoholā Heiau NHS may be temporarily impacted by construction of the proposed Perimeter Road fencing under all Build Alternatives. Impacts include visual disruptions, noise disruptions, ocean access, and/or ocean water quality deterioration.

The Kanu o ka ‘Āina New Century Public Charter School (KANU) has a makai campus, Hālau Pukui, on the Coral Flats just southeast of the Kawaihae Small Boat Harbor (South)’s East Breakwater. This makai curriculum component of KANU plays a vital role in the school’s goal in being a comprehensive Native Hawaiian learning center or kauhale. The makai campus allows KANU to continue traditional Hawaiian cultural practices associated with multiple marine resource areas. Furthermore, KANU also uses the area for physical educational and recreational water activities (swimming and diving), as it is considered a preferred location for its water depth and safety reasons. The Hālau Kukui complex is shared with the Waimea YMCA as their Aquatic Center, where recreational activities are scheduled twice a week during the summer. A modern ahu (traditional Hawaiian shrine) has also been erected in this area, which serves as a ceremonial and spiritual conduit between cultural practitioners of the area and the divine aspects of land and sea. Typical noises from the construction of roads and fencing under all Build Alternatives could distract children from their teachings and lessen their cultural experience. The noise could also be problematic to those paying their respects, leaving offerings, or wanting to pule (pray) at the modern ahu. Further, under all Build Alternatives, ocean water quality may be affected by unintentional run-off of disturbed sediment, which could obscure visibility during recreational and educational activities of both KANU and YMCA.

Currently, the non-profit organization, Na Kalai Wa‘a Moku ‘O Hawai‘i, conducts educational programs based on traditional knowledge and cultural practices for the community with Hawaiian voyaging and traditional navigation (non-instrument) as its foundation. The central focus of the organization is the double-hulled canoe, Makali‘i, which is stored in the far southwest corner of Coral Flats near the mouth of Pelekāne Bay. The Makali‘i has made numerous voyages throughout the Hawaiian Islands as well as the Marshall Islands, Micronesia, Guam and Saipan. This celebrated vessel also serves as the primary classroom for Na Kalai Wa‘a

Moku ‘O Hawai‘i‘s educational and cultural programs. Na Kalai Wa‘a Moku ‘O Hawai‘i has had a temporary dry storage permit issued to them for the Makali‘i by DLNR DOBOR since January, 2008. This temporary permit is intended to only be in place until a new storage facility is completed.

Pu‘ukoholā Heiau NHS is located immediately to the southeast of the proposed Perimeter Road. Cultural activities occurring at this prominent traditional Hawaiian cultural and religious center could be impacted from construction, including audible and visual disturbance. Construction noises and run-off could prevent sharks from frequenting the submerged heiau, Hale o Kapuni, which was created in ancient times out of reverence for sharks. While human sacrifices to the shark deity no longer occur, many cultural practitioners feel that there is a lasting connection between sharks and the heiau. These noises and runoff impacts will be most pronounced under Alternative 4 - Land-Side Plus Pier 2A and the Proposed Action - Alternative 5 although all Build Alternatives could create impacts.

Furthermore, on-shore fishing and marine resource collection is likely occurring along the southeast coast. These cultural practices could be affected if access to these spots is limited, or if and runoff impacts water quality. The Kawaihae Small Boat Harbor (South) is another potentially-impacted cultural activity area. This facility, which is to be completed, operated, and maintained by DLNR DOBOR continues to be used by cultural practitioners such as fishermen and marine resource gatherers, whose resources may be impacted by runoff related grading or fence construction.

Improvements to the Main and South gates under Alternatives 3, 4, and 5 are not anticipated to impact cultural activities so long as access is maintained to cultural activities in the Coral Flats area. As described in **Section 6.2.2.2: Internal Circulation**, all access to recreational and cultural sites within the Coral Flats area will be maintained, though security fencing may keep foot traffic out of the security perimeter. Construction of security elements of the South Gate will best be performed in tandem with the fencing improvements to serve as a complete entry way and access road to the outer areas of the Coral Flats, as this expanse of coastline provides numerous cultural activity and resource areas. After the South Gate and fencing are completed, improvements to the Main Gate will have little effect on cultural practices. Access will be improved for visitors to Coral Flats as they will be outside the security perimeter.

Cultural resource and activity areas have not been identified in the central Coral Flats area, yet many have been identified along its southern edges. Care should be taken under all Build Alternatives to avoid cutting off access to the Pua Ka ‘Ilima ‘O Kawaihae Cultural Surf Park that is located on the outer edge of the Coral Flats along the outside of the main breakwater. This area is already a popular surfing locale that holds the annual Tiger Long Board Classic surf competition and fund raisers to construct a cultural center and park for swimmers, divers, fishermen, sailors and/or surfers. Previously mentioned cultural activity areas potentially at risk are the KANU Hālau Pukui, the YMCA Aquatic Center, the Kawaihae Small Boat Harbor (South), and the Na Kalai Wa‘a Moku O Hawai‘i, Makali‘i.

Pier 2 is in a secured area, and while the public can get to this area, it is only used for harbors business. The proposed extension of Pier 2 towards the Kawaihae Small Boat Harbor (North)

and the “swale” area poses little to no threat to cultural practices. However, increases in the size and number of cargo barges under Alternative 4 - Land-Side Plus Pier 2A Extension and the Proposed Action - Alternative 5 may impact the use of the harbor by small boats that currently moor there. Many of these boats are used for recreation, yet, there are some who may depend on the ocean for traditional sustenance and/or business. Should the Pier 2A Extension component be initiated under these two alternatives, impact to cultural uses of the inner harbor may occur, as small boats will encounter the arrival and departure of more high-capacity barges berthing at the extended Pier 2A.

Under the Proposed Action - Alternative 5, the Pier 2C Extension is proposed for the current location of a small craft “dinghy dock” (running parallel to the revetment) and a “finger pier” or “boat dock” (running perpendicular) in the southeast corner of the inner harbor which is heavily used by fishermen and recreational boaters. Canoe clubs currently utilize the inner harbor during practices and regattas. If the inner harbor is no longer available, paddlers may need to utilize the open ocean. Further, as with the Pier 2A Extension, the addition of Pier 2C Extension will usher in more high-capacity barges, increasing the potential danger of conflicts with paddlers and boaters utilizing the inner harbor. Given the dangers that accompany these near-term improvements, the best way to mitigate the potential displacement of such a large number of small boat users is to encourage and support DLNR DOBOR in their efforts to complete the Kawaihae Small Boat Harbor (South) before these improvements are initiated, to ensure that enough space for safe traffic and affordable mooring is available for the displaced inner harbor boaters. While DOT-H has no direct control over the development of the Kawaihae Small Boat Harbor (South), DOT-H acknowledges that it is preferable to complete the Small Boat Harbor (South) facilities prior to the near-term improvements to avoid impacts to cultural practices currently occurring in the inner harbor. In conclusion, impacts to boating and/or fishing are likely if the Small Boat Harbor (South) is not completed prior to building the Pier 2C Extension as an alternate launching and berthing area. Furthermore, paddling activities will also be impacted with the increase of large vessel traffic.

Dredging occurring in front of Piers 1 and 2A-2C under Alternative 4 - Land-Side Plus Pier 2A Extension and the Proposed Action - Alternative 5 may result in similar impacts on fishing and small boats to those associated with pier construction. Under Proposed Action - Alternative 5, the area referred to as “the swale” by locals (shown in **Figure 4-15: Major Cultural Features of Kawaihae Harbor**), will be blocked from the interior harbor by the dredging area, hindering the movement of fish as well as boat traffic to and from the interior harbor to this locale. Fishing is a popular cultural activity in the swale area, especially when oama or juvenile weke (*Mullidae spp.*) and halalū or juvenile akule (*Trachurops crumenophthalmus*) are in season.

Furthermore, there may be an impact on Pu‘ukoholā Heiau from drilling and pile driving under Alternatives 4 and 5. Noise and vibration could affect the rock walls of the nearby heiau — Pu‘ukoholā, Mailekini, and Hale O Kapuni.

No cultural resources or activity areas were identified that will be impacted by the relocation of the Hawai‘i District Office and the construction of the comfort stations. Similarly, no cultural activity areas are anticipated to be impacted by operational yard improvements.

4.9.3 Recommended Mitigation of Impacts on Cultural Resources

In general, to mitigate potential impacts from the Build Alternatives, consultation with stakeholders and community leaders is recommended to serve as a “cultural compass” on issues regarding traditional use associated with the harbor to ensure that impacts and restrictions required by construction activities do not obstruct Native Hawaiians or other groups of their rights to traditional practices. Community outreach would be a good way to dispel misconceptions and begin a healthy discourse regarding the Proposed Action.

If access to the Coral Flats area is temporarily cut off, an alternate route should be provided during the construction phase to ensure access is maintained to the Pua Ka ‘Ilima ‘O Kawaihae Cultural Surf Park, KANU Hālau Pukui, the YMCA Aquatic Center, the Na Kalai Wa‘a Moku O Hawai‘i (Makali‘i) and Kawaihae Small Boat Harbor (South).

Noise and visual impacts from construction of the fencing along the Perimeter Road could be mitigated with a community relations program that offers information to the public about construction schedules. Construction schedules that enable planning to avoid major cultural events could also mitigate these effects. Access to the modern ahu or marine resource gathering and fishing areas should not be obstructed by the Proposed Action, but if access limitations are foreseen, this subject should also be discussed by the consultative body of stakeholders and community leaders. Public notices could also be provided to notify cultural practitioners of alternative marine resource areas while construction is active. To address the potential for water quality being impacted by runoff, which will impact a variety of aquatic activities and marine resources, Best Management Practices (BMPs) will include a comprehensive erosion and sediment control plan to minimize impacts from earth-moving activities.

Given the potential dangers to boaters, paddlers, and fishermen with increased barge activity in the harbor, the recommended way to mitigate the potential displacement of such a large number of small boat users is to support DLNR DOBOR in their efforts to complete the Kawaihae Small Boat Harbor (South) before these improvements are initiated. This will provide space for safe traffic and mooring for the displaced inner harbor boaters.

The *Hawai‘i Island Commercial Harbors 2035 Master Plan Update* recommends the continued use of the Pelekāne Buffer Zone between Kawaihae Harbor uses and Pu‘ukoholā Heiau NHS. The buffer zone shields the harbor activities from the heiau, and the increased distances help to mitigate noise and vibration. During the design of dredging and pier structures, it is recommended that technologies and methods to reduce the effects of vibration be identified. These may include cutterheads, drag line operations or roadcutters to dredge certain areas. For the piers, pre-drilling and expansion gels may be preferred to more vibration-inducing methods.

It is recommended that wastewater treatment from the new comfort stations be completed prior to the closure of existing comfort stations to protect marine water quality.

4.10 Hydrology and Water Quality

4.10.1 Existing Conditions

4.10.1.1 Aquifers and Water Service

The project area is on the leeward side of the Kohala range, and is on the extreme southern border of the Mahukona aquifer, unconfined flank type basal aquifer with an estimated sustainable yield of approximately 17 million gallons per day (MGD). Kawaihae Harbor is located just north of the north border of the West Mauna Kea/Waimea aquifer, with a sustainable yield of 24 MGD, but receives its domestic water supply from this aquifer (Helber, Hastert & Fee, 2009).

Groundwater depth was encountered at 5.8 to 12.8 feet below the existing ground surface in multiple soil borings, and was estimated at 5 feet below ground surface in the Environmental Site Assessment for the Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor (Helber, Hastert & Fee, 2009). These are not sole source aquifers, as there are no sole source aquifers on Hawai'i Island. Unlike the older islands, Hawai'i Island does not have a sedimentary coastal plain or cap-rock, so basal water levels are lower and more likely to suffer from the intrusion of seawater. However, there are no basal groundwater wells of drinking water quality in the Kawaihae area (Helber, Hastert & Fee, 2009).

Public water supplied by the Hawai'i County, Department of Water Supply is discussed in greater detail in **Section 7.2: Water Facilities**.

4.10.1.2 Hydrology and Marine Water Quality Inputs

Kawaihae Harbor lies in the very arid leeward side of the island, and receives relatively little rainfall or stream flow. However, it is situated at the toe of the saddle between the Kohala and Mauna Kea volcanic slopes, so ground and surface waters form an extensive watershed area which drains toward the sea under heavy rainfall conditions. Makeāhua and Pōhaukole gulches converge and convey stormwater and sediment into the sea at Pelekāne Bay, just southeast of the harbor's Coral Flats area. North of the other two gulches, Makahuna Gulch contributes stormflow into the southeast interior corner of the commercial harbor, but is blocked and stagnant or dry when no stormflow is available to overtop the concrete road bed at the south end of the Coral Flats fill area (Helber, Hastert & Fee, 2009).

The deforestation of the upland areas and the destruction of ground-cover in the early 1800s (stripped bare by sandalwood harvesting and the grazing of introduced cattle and feral pigs and goats) contributed to considerable soil loss and the heavy sedimentation, siltation, and nutrient load deposited to Pelekāne Bay. The combination of these elements smothered the coral reef, promoted algal growth, and damaged the reef ecosystem which was once abundant with limu (seaweed) and fish inhabiting the once-clear waters (Tissot 1998, as cited in Helber, Hastert & Fee, 2009). The dredging and addition of the harbor peninsula and breakwaters further reduced the natural circulation and sediment flushing of Pelekāne Bay. Available studies such as Tissot (1998) indicate decreased diversity in the Pelekāne Bay benthic community resulting

from these influences. In 2003, DOH found turbidity in the bay to be nearly 18 times the allowable water quality standard, and in 2004 listed the Pelekāne Bay Watershed as a Category I high priority watershed in need of restoration (Helber, Hastert & Fee, 2009).

4.10.1.3 Marine Water Quality Within Kawaihae Harbor

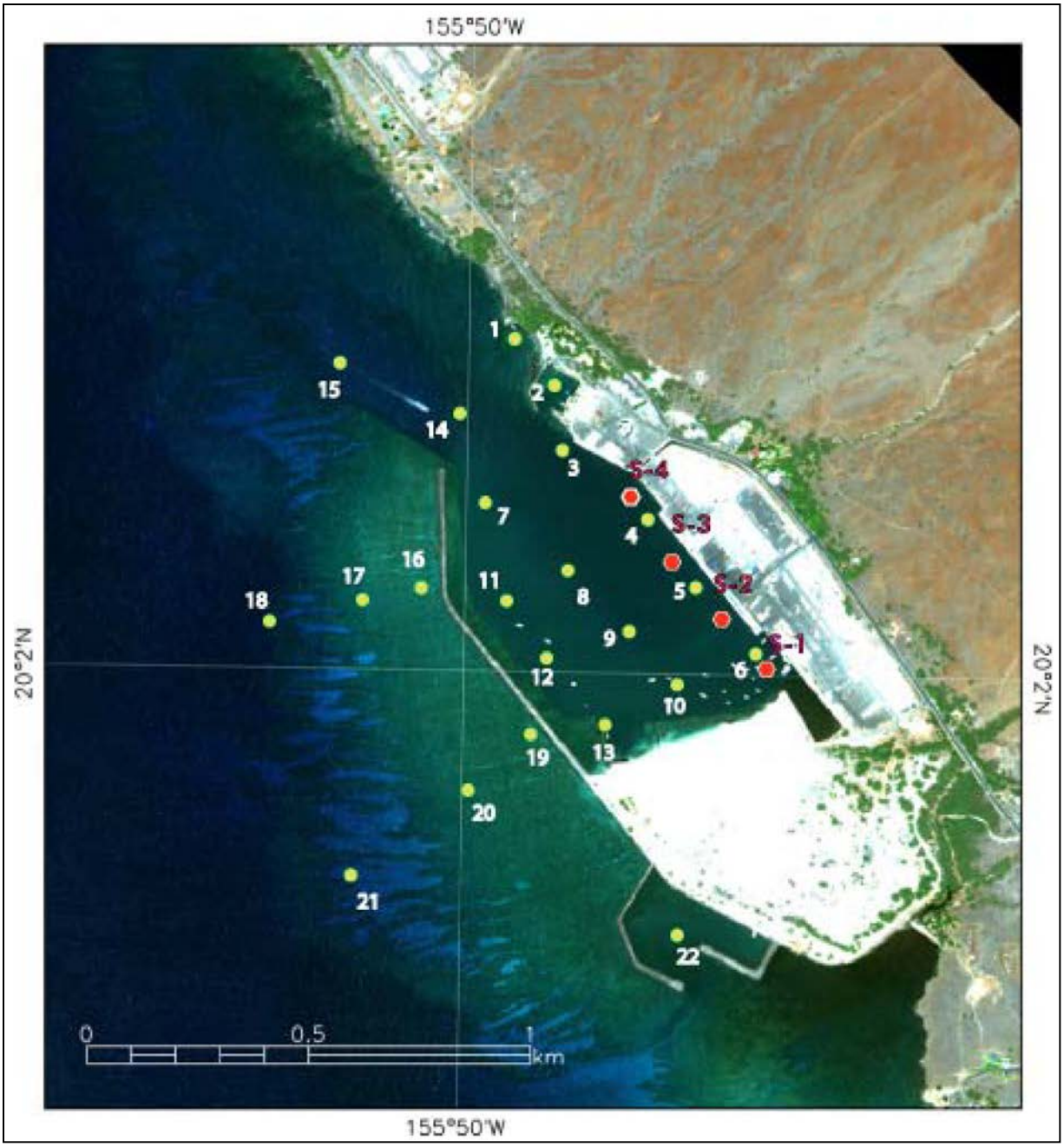
DOH classifies the waters of Kawaihae Harbor as a "Class A Embayment." (Title 11, Chapter 54, Water Quality Standards, DOH Administrative Rules). DOH intends Class A waters be protected for use for recreational purposes and aesthetic enjoyment. Other uses are permitted as long as they are compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. Class A Marine Waters are not to receive discharges that have not received the best degree of treatment or control compatible with the criteria established for this class. No new sewage discharges will be permitted within embayments. No new industrial discharges shall be permitted within embayments, with the exception of storm water discharges associated with industrial activities and discharges covered by a National Pollutant Discharge Elimination System (NPDES) general permit, approved by the US Environmental Protection Agency (EPA) and issued by DOH.

Kawaihae Harbor is currently listed on the State's 2004 Final List of Impaired Waters in Hawai'i. This list was prepared under the Clean Water Act as a §303(d) Listed Watershed, which identifies "waters which will not attain applicable water quality standards with technology-based controls alone (e.g., water quality limited)." Primary pollutants identified by DOH were suspended sediments.

To assess impacts for the Proposed Action's improvements at Kawaihae Harbor, a preliminary baseline assessment of water quality and sediment quality was conducted by Marine Research Consultants in 2011 (Marine Research Consultants, 2012. See also **Appendix F: Marine Environment and Water Quality Study**). Owing to the expected increased uses of Kawaihae Harbor, new dredging (i.e., dredging of areas never previously dredged) at the Pier 2C Extension will be necessary to provide adequate depth for safe navigational operations for that area. Maintenance dredging (dredging of areas to remove sediment buildup and return the previously dredged area to designed water depths) will be performed at the rest of the existing piers.

The assessment consisted of a general assessment of water quality including measurements of all constituents listed in the DOH Water Quality Standards for estuarine waters. Water samples collected from 22 stations (see **Figure 4-16: Water and Sediment Sampling Stations**) within the main harbor basin and outside the extending through the entrance channel to the open ocean surrounding the harbor revealed very little input of groundwater to the harbor basin or outer reef areas. Samples were collected at two depths at each sampling station; a surface sample was collected within approximately 10 centimeters (cm) of the sea surface, and a bottom sample was collected within 50 cm of the harbor floor. Water quality throughout the basin was similar to that of open coastal waters with the exception of clear patterns of vertical stratification of temperature.

Figure 4-16: Water and Sediment Sampling Stations



Note: Sites 1 through 22 are water sampling stations. Sites S-1 through S-4 are sediment sampling stations. Source: *Baseline Assessment of Water, Sediment, and Biotic Composition in Kawaihae Commercial Harbor, South Kohala, Hawai'i (2012)* (Marine Research Consultants, 2012)

Table 4-13: Summary of Water Quality Monitoring at 22 Sampling Stations summarizes the sampling and also shows the DOH standards for "open coastal" waters (outside the harbor) and embayments (inside the harbor). Shaded values exceed the DOH standard for geometric means of all samples within each zone.

The most evident characteristic of the sampling is that with two exceptions, there is an overall consistency in values of all constituents throughout the sampling regime. The two exceptions to the overall constancy of data are at sample stations 1 and 2, which are located respectively near the shoreline off the small beach north of the harbor, and in the small boat basin.

There is a distinctive surface layer of low salinity water at station 2. These patterns are likely a reflection of fresh groundwater that enters the nearshore ocean through discharge at the shoreline forming a buoyant surface lens. Data collected for this study indicates that groundwater efflux in the Kawaihae area is relatively small in magnitude compared to many other areas of West Hawai'i. These patterns suggest that while groundwater input to the area is small, there still is a detectable effect of input of low-salinity, high-nutrient groundwater throughout the Kawaihae area.

Turbidity data reveals substantial elevation at station 1, likely as a result of resuspension of fine-grained sediment from wave action. Turbidity at stations within the harbor basin were overall slightly elevated relative to stations outside the harbor, although there was no consistent pattern with respect to vertical stratification of turbidity. The lack of elevated turbidity in deep samples within the harbor, in which the bottom is composed of a fine-grained sediment, indicates very little resuspension of material from water movement.

Kawaihae Harbor is classified as an embayment within DOH Water Quality Standards. This classification includes three sets of specific criteria; values that are not to be exceeded 10 percent of the time; values not to be exceeded more than 2 percent of the time, and values that are not to be exceeded by the geometric means of samples. The only constituent that exceeded the specific 2 percent criteria within the harbor was nitrate in the surface sample of station 2 (no values exceeded the 10 percent standard). As station 2 is located within the Kawaihae Small Boat Harbor (North), no samples within the main commercial harbor basin exceeded any the specific standards for embayments.

The region of study outside of Kawaihae Harbor is considered "open coastal waters" according DOH classifications. Station 1 was the only sampling site to exceed the specific standards for open coastal waters. At this site, concentrations of nitrate, ammonium nitrogen, and turbidity all exceeded the 2 percent criteria in both the surface and deep samples. Again, this location is not within Kawaihae Harbor.

Sediment samples collected from four stations (see **Figure 4-16: Water and Sediment Sampling Stations**) were analyzed for a suite of constituents to evaluate the presence of contaminants. Sediment samples cored from the surface to a depth of approximately 8 inches into the sediment column were analyzed for the set of chemical constituents routinely analyzed for permitting decisions for allowable dredge spoils disposal.

Table 4-13: Summary of Water Quality Monitoring at 22 Sampling Stations

Sample Location	Depth	Statistic	Ortho-phosphate Phospho-rous	Nitrate & Nitrite	Ammo-nium Nitrogen	Silica	Total Organic Phos-phorous	Total Organic Nitro-gen	Total Phos-phorus	Total Nitrogen	Turbid-ity	Salin-ity	pH	Chloro-phyll A	Temper-ature	Dissolved Oxygen
			PO_4^{3-}	NO_3^-	NH_4^+	Si	TOP	TON	TP	TN				CHL a		O_2
		Units →	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**NTU**	**ppt**	**std. units**	**µg/L**	**°C**	**% Saturation**
Inside Harbor	**Deep**	Geometric Mean	3.34	1.43	1.14	107.50	10.02	107.62	13.44	111.60	0.33	35.08	8.24	0.10	25.98	101.65
		Standard Dev.	0.72	2.78	0.27	60.53	0.47	9.80	0.47	9.25	0.06	0.06	0.02	0.02	0.62	2.36
		Maximum	4.65	8.68	1.68	243.35	10.85	123.62	14.26	126.28	0.44	35.15	8.26	0.13	26.56	104.25
		Minimum	2.17	0.14	0.84	75.87	9.30	95.20	12.71	97.16	0.22	34.97	8.19	0.07	24.42	96.59
	Surface	Geometric Mean	3.96	0.97	1.13	55.04	9.53	104.42	13.60	106.68	0.35	35.14	8.25	0.15	25.55	104.26
		Standard Dev.	0.79	0.44	0.41	4.38	0.72	10.47	0.69	10.69	0.10	0.04	0.00	0.04	0.01	0.65
		Maximum	4.96	1.82	1.68	61.54	10.85	120.12	14.88	123.06	0.49	35.19	8.26	0.23	25.57	105.3
		Minimum	1.86	0.56	0.42	48.05	8.68	89.04	12.71	91.28	0.21	35.10	8.25	0.10	25.53	103.55
Outside Harbor	**Deep**	Geometric Mean	1.99	2.43	0.91	80.77	10.34	117.96	12.50	**122.42**	**0.15**	35.06	8.21	0.05	25.74	97.16
		Standard Dev.	0.87	2.80	0.84	29.59	1.23	23.55	1.04	23.67	0.15	0.04	0.06	0.02	0.81	6.09
		Maximum	3.72	7.84	2.66	140.50	12.71	154.56	13.95	160.02	0.55	35.11	8.27	0.07	26.43	104.77
		Minimum	1.24	0.28	0.14	47.49	8.99	91.00	10.85	92.96	0.06	35.00	8.11	0.02	23.67	87.74
	Surface	Geometric Mean	2.28	2.22	0.87	68.70	10.10	109.48	**12.69**	**114.34**	**0.15**	35.08	8.21	0.06	25.83	92.21
		Standard Dev.	1.23	2.95	1.46	17.58	1.53	24.89	1.68	23.89	0.10	0.02	0.06	0.02	0.33	12.93
		Maximum	4.03	7.70	5.04	106.50	12.40	146.44	16.43	147.84	0.42	35.11	8.27	0.08	26.53	107.45
		Minimum	0.93	0.42	0.14	51.42	8.68	68.32	10.54	74.62	0.10	35.06	8.10	0.02	25.52	72.36
DOH Standard	Embayments – Dry	Geometric Mean		5.00	3.50				20.00	150.00	0.40			0.5		
	Open Coastal - Dry	Geometric Mean	5.00	4.50	2.50				12.50	100.00	0.10			0.3		

Source: Marine Research Conultants, 2012.

Note: **Shaded and bolded** cells indicate samples exceeding DOH standards.

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For the samples collected for the present study within the harbor, no constituents had concentrations over DOH Water Quality Standards. Analyses of a variety of chemical constituents in sediment collected from four stations within the inner basin revealed no detectable concentrations of petroleum products. Toxicity characteristic leaching procedure (TCLP) metals (TCLP is an analytical method to evaluate metals leaching through a solid medium) were absent in all samples with the exception of barium, which occurred in at all four sampling sites, and lead which was detected at a single site. No volatile organic compounds tested were detected, while a single sample resulted in a detectable level of one Polychlorinated Biphenyl (PCB) compound. Semi-volatile compounds were detected at three of the four sites.

4.10.1.4 Marine Water Quality in Pelekāne Bay

Pelekāne Bay is outside of the Region of Influence (ROI) for the project alternatives, but is nearby. Pelekane Bay has experienced water quality deterioration. DOH classifies the waters of Pelekāne Bay as a "Class A Embayment." (Title 11, Chapter 54, Water Quality Standards, DOH Administrative Rules). Refer above to **Section 4.10.1.3: Marine Water Quality Within Kawaihae Harbor** for more description of how Class A waters are to be used and protected.

In an effort to improve water quality in Pelekāne Bay, DOT-H worked with the USACE in 2009 to analyze the impacts of a circulation channel through the coral stockpile, between Kawaihae Harbor and Pelekāne Bay (Li, et. al., 2009). This study determined that the hydrodynamics, wave and sediment transport study for Kawaihae Harbor and Pelekāne Bay indicates that construction of a circulation channel with different configurations would result in consistent flow from the bay to the commercial harbor under normal and storm conditions. The bay-to-harbor flows would produce net sediment transport into the channel and the harbor. Based on these findings, implementation of the circulation channel would not serve the purpose of harbor water renewal and bay water quality improvement and, therefore, was not recommended.

4.10.2 Project Impacts on Hydrology and Water Quality

Past impacts to the marine water quality environment in the region have resulted from a mix of historical deforestation, natural disasters (e.g., tsunami, storm events, and water heating resulting from lava flows), and the later harbor construction blocking the natural flushing of the bay (Helber, Hastert & Fee, 2009).

4.10.2.1 No-Build Alternative

The No-Build Alternative will not have any direct effect on marine resources as no construction will occur.

4.10.2.2 Build Alternatives

Alternative 2 - Minimal Action and Alternative 3 - Partial Action/Land-Side will not require any actions in the marine environment.

Alternative 4 - Land-Side Plus Pier 2A Extension will include the following marine works:

- Demolition and reconstruction of the existing Pier 2 superstructure.
- Construction of 340-foot Pier 2A extension.
- Shoreline bulkheads, revetments, and fills to stabilize the shoreline so there is continuous access between the new Pier 2A extension and the existing shoreline.
- Maintenance dredging in the previously dredged area in front of the piers under DOT-H jurisdiction.

The Proposed Action - Alternative 5 will include the following marine works:

- Demolition and reconstruction of the existing Pier 2 superstructure.
- Demolition of the existing Small Craft Facility at the future Pier 2C Extension location.
- Construction of the 340-foot Pier 2A extension.
- Construction of the 325-foot Pier 2C extension.
- Shoreline bulkheads, revetments, and fills to stabilize the shoreline so there is continuous access between the new wharf extensions (Pier 2A and Pier 2C) and the existing shoreline.
- New dredging at the future Pier 2C Extension location.
- Maintenance dredging in the previously dredged area in front of the piers under DOT-H jurisdiction.

The scale of the dredging anticipated as part of the Proposed Action is outlined in **Section 4.2.2: Project Impacts on Geology, Topography, and Bathymetry**. Under Proposed Action - Alternative 5, new dredging (in locations never previously dredged) will be required at the Pier 2C Extension area to ensure an adequate water depth for barges. It is estimated that the project will require dredging of approximately 30,000 cubic yards of material. Also, a number of boulders will be removed from offshore between the Piers 1 and 2.

Shoreline stabilization under Alternatives 4 and 5 may require construction of new shoreline bulkheads, rip rap revetments at the base of the bulkheads, placement of fill between the new sheet pile bulkheads and the existing shoreline, and seismic ground improvements if determined to be required during the future wharf design.

There are very few hydrological effects in the harbor presently and hydrology of the harbor and surrounding area are not anticipated to be impacted under the Build Alternatives. While Pelekāne Bay has been impacted in the past by upland erosion and sedimentation, these conditions in Pelekāne Bay are not anticipated to be affected by the proposed improvements.

Alternatives 4 and 5 will also involve extension of Pier 2A, which is in close proximity to the drainage canal that empties drainage from Kawaihae Road and the harbor. The Pier 2A Extension will be designed in a manner to not block flow from this canal.

Pier extensions and dredging may cause an increase in turbidity during construction and an increase in sedimentation. Marine monitoring will be needed to assess any changes in water chemistry, as these quantities cannot be projected. Mitigation may be necessary to address dredging impacts.

Different types of pier construction are possible alternative designs as described in **Section 3.7.1: Reconstruction and Extension of Pier 2A.** These include a concrete pile-and-deck, a bulkhead with sheet piles, a combination of these two designs, or a caisson wharf (which is not considered economically viable). The concrete pile-and-deck system will require the least fill and will offer new habitat for some forms of marine life. In contrast, with a sheet pile bulkhead system, the fill will go all the way to the front of the pier face, reducing the marine life footprint.

These differing pier designs will also have an effect on the attenuation of wave energy, and consequently, on vessels berthed at the pier. With a sheet pile bulkhead, wave energy will reflect off the pier face, whereas with a deck supported on piles, the piles will serve as "baffles" that absorb the wave energy.

Long term operation of Alternatives 4 and 5 will result in greater levels of navigational traffic. The potential for spills will increase slightly as the volume of navigational traffic increases, but this will be somewhat mitigated by improvements to navigation in the harbor (longer berths, removal of recreational users, etc.) that will help prevent accidents. Currently implemented BMPs for spill response will continue.

4.10.3 Recommended Mitigation of Impacts on Hydrology, Water Quality, and Coastal Resources

Several minor clarifications to the narrative that follows have been made since the Draft EA in response to comments on the Draft EA received from the DOH.

Mitigation will be necessary to address impacts from construction on land under Alternatives 2, 3, 4, and 5 as well as marine impacts under Alternatives 4 and 5. A Department of the Army (DA) permit is expected under Section 404 of the Clean Water Act for ocean construction. In addition, approval is necessary under Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA). The total extent of impacts and proposed mitigation will be better defined at the time the DA permit is pursued as design will be to a more refined level. The Least Environmentally Damaging Preferred Alternative (LEDPA) that meets the Purpose and Need of the project will be pursued. Consultation with other federal resource agencies (NMFS, USFWS) will be also pursued during the DA permit process.

DOH has policies that must be met to protect water quality. Any project and its potential impacts to State waters must meet the following criteria:

- Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.
- Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters. As Kawaihae Harbor is a "Class A embayment", all activities during and after construction will be consistent with the criteria established for that class.
- Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

Under all Build Alternatives, it is recommended that appropriate BMPs be developed during the project design, and implemented during construction activities to mitigate potential effects. For existing piers which will remain in place, BMPs to ensure minimal mortality of marine wildlife during dredging may include such features as silt containment devices to isolate the pier faces from effects of dredging operations. Activities that decrease the water quality during construction should be avoided by using BMPs designed to reduce or trap runoff. Because more than one acre is to be affected, a NPDES permit for construction activities would also be obtained in accordance with HAR, Chapter 11-55, and the necessary requirements will be implemented by the contractor. The application will be submitted to the DOH Clean Water Branch (DOH-CWB) at least 180 calendar days before the commencement of any discharge. In addition, an NPDES Notice of Intent (NOI) form will be submitted at least 30 calendar days prior to the start of construction.

Additional NPDES permits for potential impacts from chlorination of water lines or construction dewatering will not be required, as wastewater from these activities will be pumped to a tanker truck and disposed of in an approved manner, or other means consistent with applicable State and federal regulations, and no wastewater from these actions will be allowed to enter the water. Any discharges of wastewater into state surface waters may require additional general or individual NPDES permit coverage.

Because improvements to the harbor under Alternatives 4 and 5 include dredging, these will require several permits/approvals. These include:

- Section 404 DA Permits under the Clean Water Act.
- Section 401 Water Quality Certification (WQC).
- Nationwide Permit for maintenance dredging under Section 10 of the Rivers and Harbors Act.
- Section 103 Dredge Disposal Permit under the Marine Protection, Research and Sanctuaries Act (MPRSA). Refer above to **Section 3.8.3.3: Options for Disposing of Dredgeate**.
- EPA Approval for Ocean Disposal.

If required as conditions of the Section 401 WQC and/or the NPDES permits, effluent discharge and/or receiving water monitoring will be performed.

All discharges related to the project construction or operation activities, whether or not covered by an NPDES permit and/or Section 401 WQC, must comply with the State's Water Quality Standards

Some sediments identified in the sampling contained barium, lead and polychlorinated biphenyls (PCBs) as noted in **Section 4.10.1.3: Marine Water Quality**. Dredge spoils containing heavy metals will have be to be disposed of at a landfill authorized to accept hazardous waste. In some cases, if the material is very contaminated, it is shipped to the US mainland for disposal there.

In comments on the project, the NMFS has recommended a number of BMPs to minimize impacts on protected marine species. They are as follows:

- Turbidity and siltation from project-related work should be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions. BMPs to avoid turbidity and siltation and erosion are outlined in **Section 4.3.2.3: Recommended Mitigation of Impacts on** Soils.
- Any construction-related debris that may pose an entanglement hazard to marine protected species should be removed from the project site if not actively being used and/or at the conclusion of the construction work.
- All project-related materials and equipment placed in the water should be free of pollutants.
- No project-related materials (e.g., fill, revetment rock, pipe, etc.) should be stockpiled in the water (e.g., intertidal zones, reef flats, stream channels, etc.).
- No contamination (e.g., trash or debris disposal, alien species introductions etc.) of marine (e.g., reef flats, lagoons, open ocean, etc.) environments adjacent to the project site should result from project-related activities.
- Fueling of project-related vehicles and equipment should take place away from the water. A contingency plan to control the accidental spills of petroleum products at the construction site should be developed. Absorbent pads, containment booms and skimmers will be stored on-site to facilitate the cleanup of petroleum spills.
- Underlayer fills should be protected from erosion with core-Ioc units (or boulders) as soon after placement as practicable.
- The project team must prevent discharge of dredged material into the marine environment during the transporting and off-loading of dredged material.
- Return flow of or run-off from dredged material stored at inland dewatering or storage sites must be prevented.

4.10.3.1 Deep Ocean Disposal of Dredgeate

As noted above in **Section 3.8.3.3: Options for Disposing of Dredgeate**, one option for disposal of dredgeate is at a deep ocean site. To comply with Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA) act, EPA and the USACE must evaluate alternative disposal options and approve the correct placement of dredged material. These options include open-water disposal, confined (diked) disposal, and beneficial uses. (USACE and EPA, 2004). The selection of a preferred alternative for disposing of the dredgeate will be based on environmental acceptability, technical feasibility, costs, and other factors.

Any deep ocean disposal of dredge spoils will receive proper permits under the Clean Water Act and the MPRSA by USACE, using EPA's environmental criteria and subject to EPA's review and concurrence.

There are five EPA-designated sites for disposal of dredge spoils in Hawaii; the closest one to Kawaihae is offshore of Hilo. USACE is required to use these sites unless an EPA-designated site is not feasible. Sites have been designated to minimize environmental impacts of dumping dredge spoils by localizing all the spoils from various projects at one disturbed site. They also consider such characteristics as currents, wave climate, water depth, bathymetry, benthic impacts, etc.

4.11 Drainage

4.11.1 Existing Conditions

Currently, stormflow around Kawaihae Harbor is channelized by a seven-foot deep drainage canal which was constructed to surround the inland side of the commercial harbor property to intercept and convey high-volume flash flood or stormwater runoff to the sea. This channel runs along Kawaihae Road, turns makai near the intersection of Kawaihae Road and Akoni Pule Highway, and empties into the harbor between Piers 1 and 2. **Figure 4-17: Drainage Canal at Kawaihae Harbor** shows the path of the drainage canal.

There are no perennial streams, ponds, lakes, or wetlands within the area of, or capable of receiving downstream runoff, or otherwise being affected or influenced by the Proposed Action.

Makahuna Gulch crosses Kawaihae Harbor property and serves as a topographic division between the existing harbor (i.e., back area fronting Piers 1 and 2) and the Coral Flats area. Under the Proposed Action, DLNR DOBOR will be transferred the land for the perimeter roadway to serve the Kawaihae Small Boat Harbor (South) and will be responsible for future improvements. This roadway will cross Makahuna Gulch. The drainage implications of crossing designs were considered in a drainage report (SSFM International, 2011). The site of this crossing is located within the 100-year floodplain.

Runoff into the gulch is collected from uphill drainage areas along the side of Kohala Mountain. A total of 1,400 acres of watershed is drained by Makahuna Gulch. A combination of overland flow and flow into existing drainage channels carry the runoff down the mountainside towards the harbor.

Coral Flats is located on the south side of Kawaihae Harbor and is minimally developed. Mountainous terrain slopes up to the northeast with the harbor opening to the Pacific Ocean to the west. The topography of the mountainside consists of small rocky hills with 30 percent slopes.

Geologically the harbor consists of a wide range of material and is described as extremely stony, rocky and fine sand. Drainage down the mountainside consists of overland flow over a mixture of grass, shrubs and exposed soil. Coral Flats averages about a 3 percent slope, but also contains small hills over the general topography.

Figure 4-17: Drainage Canal at Kawaihae Harbor



Basemap Source: Google Maps

4.11.2 Project Impacts on Drainage

4.11.2.1 No-Build Alternative

The No-Build Alternative will have no effect on drainage in the area.

4.11.2.2 Build Alternatives and Recommended Mitigation

The existing seven-foot drainage canal running along the mauka side of the commercial harbor on the makai side of Kawaihae Road ensures that flash floods and stormwater from Kawaihae Road and upland areas do not cause drainage issues within the harbor itself. Since future grades are not expected to be substantially different than today, most of the improvements under the Build Alternatives will have minimal effects on drainage with the exception of areas that are converted from pervious surfaces (i.e., unpaved or vegetation) to impervious surface (i.e., paved areas or areas with roofed structures). There will be some additional surface flow directly towards the ocean in areas where such a conversion has been made. Drainage flows, volumes, velocities, and reception within the main harbor will be roughly comparable to the existing situation; therefore, no new drainage structures (drywells) are assumed to be necessary for any land side improvements under any of the Build Alternatives. Existing infrastructure for treating runoff will continue to be used and upgraded as necessary.

Stormwater BMPs are recommended during and after construction to ensure that water quality is maintained for stream and coastal areas. Because more than one acre is expected to be affected under all Build Alternatives, a NPDES permit for construction activities will also be obtained, and the necessary requirements will be implemented by the contractor.

BMPs will be documented in the construction documents, including (but not limited to) the following recommendations:

- There will be no intentional discharges to the waters, including drainage culverts or any ground discharges, which could be expected to be carried to or migrate to the aquatic environment via stormwater runoff or infiltration.
- Water runoff: Geotextile silt screens anchored with absorbent sausages should be installed around the immediate work area to capture any potential water-borne sediment.
- Drain Inlets: All drywells and drain trenches should be lined with Geotextile fabric.
- Truck Wash Down Area: A plastic sheet lined and bermed wash down area should be constructed for truck wash down, with wash down water to be collected by tanker truck and disposed in an approved manner. Any wash down area would have sufficient containment and setback from the ocean and stormwater drainage features to assure there will be no contamination of the aquatic environment.

Text that follows has been modified since the Draft EA in response to comments on the Draft EA received from the DOH:

Dredging activities proposed for the harbor will require a USACE Section 404 permit. A Section 401 Water Quality Certification will also be necessary from DOH. Refer to **Section 4.10.3: Recommended Mitigation of Impacts on Hydrology, Water Quality, and Coastal** Resources for more information. DOT-H will coordinate with USACE, Regulatory Branch and obtain a permit under Section 404 of the Clean Water Act. DOT-H will also undergo the Section 401 Water Quality Certification (WQC) process pursuant to Paragraph 401(a)(1).

4.12 Vegetation

The following discussions have been taken from the *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* (Helber, Hastert & Fee, 2009).

The project site is a highly disturbed area which has been in continuous harbors use for the past 50 years, and all future improvements are expected to be similar in disturbance to past actions. All exposed surface land is arid and generally barren fill material from the harbor dredging, and the existing surface contours are man-made. Crushed coral fill covers the first 8 to 13 feet of surface material. The region receives less than 10 inches of rain per year. Therefore, because of the highly disturbed nature of Kawaihae Harbor as a whole, the work performed for the Pier 2A EA is considered acceptable to document the status of Threatened and Endangered plant species throughout the harbor.

Information specifically on invasive species is provided in **Section 4.15: Invasive Species**.

4.12.1 Existing Conditions

Vegetation in the study area (including the Coral Flats area) is of limited diversity and consists predominantly of buffel grass (*Cenchrus ciliaris*), fingergrass (*Chloris Sw*.) and kiawe (*Prosopis pallida*), with scattered koa haole (*Leucaena leucocephala*), ‘ilima (*Sida fallax*) and ‘uhaloa (*Waltheria indica var. americana*). Pua kalaunu (*Calotropis gigantean*), or lavender crown flower, was observed in the vicinity of the historic properties along the mauka shoulder of Kawaihae Road. This flower was introduced to Hawai‘i toward the end of 19th century (Cultural Surveys Hawai‘i, 2011). Prior to human settlement, the native ecosystem of the project area consisted of lowland dry shrubland and grassland and rising to lowland dry and mesic forest, woodland and shrubland. Today, the ecosystem is characterized as “nonnative lands transformed by human activity” (Juvik et al., 1998).

The *Hawai‘i Commercial Harbors 2020 Master Plan EIS* (RM Towill, 2001) cited prior work for the *Environmental Assessment for Kawaihae Small Boat Harbor (South)* and the earlier *Final Environmental Impact Statement for Development of Kawaihae Boat Harbor, Kawaihae Hawai'i,* (Hawai‘i Department of Transportation Harbors Division, 1994 and 1985 respectively). Those two earlier documents found the vegetation in the southern part of the harbor, presumably the Coral Flats area, to have a few common native grasses (piligrass and fingergrass), weeds, hardy shrubs such as the haole koa and ‘ilima; and trees such as the kiawe, monkeypod, beach heliotrope, milo, kou, and coconut palms.

This information was updated for the *Hawai'i Commercial Harbors 2020 Master Plan EIS* (RM Towill, 2001), which included A *Botanical Survey for Kawaihae Harbor*, conducted in October 2000 by Winona Char. Vegetation was broken down into two types: "ruderal or weedy, wayside vegetation covering the disturbed portions of the property and kiawe forest occurring on the undisturbed areas" (e.g., Coral Flats and other filled harbor lands).

According to Char, the heavily disturbed (i.e., reclaimed submerged lands) area was covered by fill and stockpiles of coral material, boulders, soil, and concrete pilings. Char also noted that a "ruderal or weedy, wayside vegetation occurs on the disturbed area...composed of a weedy mixture of species, primarily the introduced buffel grass and Atriplex eardleyae with scattered patches of kiawe." Much of the harbor area was observed to be barren with vegetation cover of 5 to 20 percent in most places. Closer to the edges of the disturbed area where it adjoins patches of kiawe trees, the weedy cover is 40 to 50 percent (Char, 2000).

Char observed that the Pelekāne Lands area is a roughly triangular State property between the Coral Flats, the highway on the northeast, and the Pu'ukoholā Heiau National Historic Site (NHS) on the southeast. This area was noted as relatively undisturbed and supports a small kiawe forest, providing a natural area buffer between the commercial harbor and the NHS and highway. This area has a kiawe tree canopy cover that is closed in most places (i.e., the branches of the trees overlap and cover is 60 percent or more). Old stumps and cut branches scattered in the area suggest the trees are occasionally cut for firewood. No harbors development is planned for this area, and the Pelekāne Lands are intended to continue to serve as a buffer between the NHS and the active parts of the harbor site. (Char, 2000).

For the *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* (Helber, Hastert & Fee, 2009), an additional botanical survey was conducted in September, 2008 (Sweesy, 2008) to supplement the aforementioned 2000 survey by Char. No threatened and endangered (T&E) species, rare species, or listed species of concern were found in the study area for the Pier 2A Shed Demolition and Container Yard Improvements, consistent with prior surveys. The Hawai'i Biodiversity and Mapping Program (HBMP) database was consulted to review their records to see if any plant or animal species had ever been reported on the site in any historical reports, and the database manager confirmed: "There have been no recordings of rare species within your project site." A map was provided by HBMP to illustrate the locations of all reported Threatened and Endangered or rare species in the vicinity, and contained none in the Pier 2A Shed Demolition and Container Yard project area.

4.12.2 Project Impacts on Vegetation

4.12.2.1 No-Build Alternative

The No-Build Alternative will not create any direct impacts on vegetation.

4.12.2.2 Build Alternatives

Since there are no threatened, endangered, or rare species in the project area, and the entire Kawaihae Harbor property, including the Coral Flats has been highly disturbed and altered, none of the Build Alternatives will not have any adverse impact on vegetation.

4.12.3 Recommended Mitigation of Impacts on Vegetation

No mitigation is warranted as there will be no adverse impacts on vegetation associated with any of the Build Alternatives.

4.13 Wildlife

Several federal and state laws govern the protection of wildlife. In particular these include:

- The Fish and Wildlife Coordination Act of 1958, which requires that mandatory consultation occur with federal and state wildlife agencies to provide equal consideration of wildlife conservation with other features of a water resource development program. As such, early notification has been provided to federal and state resource agencies and consultation will be ongoing with them.
- The Endangered Species Act of 1973, which provides a legal means by which identified ecosystems that are determined to be essential to the sustainability of an endangered or threatened species can be conserved. Under this Act, the U.S. Fish and Wildlife Service under the Department of the Interior is responsible for all terrestrial and freshwater species, as well as migratory birds. Likewise, the National Marine Fisheries Service (NMFS) in the Department of Commerce is responsible for the protection of marine, estuarine, and anadromous species.
- The Marine Mammal Protection Act (MMPA) of 1972 (as amended in 1994), which was enacted to protect and manage population stocks of marine mammals that are, or may be, in danger of extinction or depletion as a result of human activity. The MMPA establishes a moratorium, with certain exceptions, on the taking of marine mammals and/or their products into the United States. As required, a biological assessment will be prepared to evaluate the potential effects of the project on an identified species. The scope of work for the planned species survey will be prepared in consultation and coordination with NMFS to determine the level of study detail required for the biological assessment.
- The Marine Protection Research and Sanctuaries Act of 1972 (MPRSA) requires that dredged material disposal must be evaluated under Section 103 of the Act, whereupon a permit is issued for transportation and disposal of dredged material meeting criteria established by the Environmental Protection Agency (EPA). Section 102 also directs the EPA Administrator to set criteria for the review of ocean dumping permits. To protect critical ocean areas, EPA may designate the sites and time periods at which ocean disposal can occur. EPA permits are needed to conduct ocean dumping under MPRSA.

- The Magnuson-Stevens Fishery Management and Conservation Act of 1956 seeks to conserve and manage the fishery resources found off of U.S. coastal waters as well as anadromous and continental shelf fishery resources. The act is intended to promote the protection of essential fish habitat (EFH) in the review of projects conducted under Federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. As such, consultation and coordination with NMFS must be conducted to identify specific actions that have the potential to adversely affect EFHs.

The following discussions have been taken in part from the *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* (Helber, Hastert & Fee, 2009). That project included informal consultation with the US Department of the Interior, US Fish and Wildlife Service (USFWS) as required under Section 7 of the Endangered Species Act of 1972. In addition, input on the current Proposed Action has been received from NMFS. The Section 7 consultation resulted in a finding of "Not Likely to Adversely Affect" listed seabirds.

The study area covered in the *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* contains no undisturbed land, natural areas, or known natural habitat for any known threatened, endangered, proposed, candidate, or rare species (Helber, Hastert and Fee, 2009). No listed threatened and endangered species, or any faunal species, was found to be present at that time. However, minor resources such as dripping hose bibs may be available for exploitation by opportunistic species.

The full harbor area was covered in a biological survey conducted for the *Final Environmental Impact Statement for the Hawai'i Commercial Harbors 2020 Master Plan, Island of Hawai'i* (RM Towill, 2001) to support the range of master-planned actions. While the Proposed Action will only affect portions of the harbor property, the 2001 survey is incorporated into this EA by reference as it specifically addresses the full range of harbor development and presents findings that are indicative of what species are present in the vicinity and could transit the site.

A Department of the Army (DA) permit is expected under Section 404 of the Clean Water Act for ocean construction. Consultation with other federal resource agencies (NMFS, USFWS) as required under Section 7 of the Endangered Species Act and the Fish and Wildlife Coordination Act will be pursued during the DA permit process to address concerns about endangered and threatened wildlife that may be found in the area. A quantitative marine study will be needed as part of the DA permit process. The design will be refined to a level at that stage of the project where specific impacts and appropriate mitigation can be determined. The studies will consider direct and direct impacts to fish and wildlife resources, develop plans to contain sediments within the project dredge site (if Alternatives 4 or 5 are pursued), and also consider compensatory mitigation measures to replace lost ecological functions from unavoidable impacts.

Information specifically on invasive species is provided in **Section 4.15: Invasive Species**.

For the current Proposed Action, a preliminary baseline assessment of the marine biotic community composition was conducted in 2011 and is discussed in **Section 4.13.1.3: Marine**

Habitat and Species and **Section 4.13.1.4: Benthic Community Composition**. The complete study is available in **Appendix F:: Marine Environment and Water Quality Study**.

4.13.1 Existing Conditions

4.13.1.1 Birds

In the *Final Environmental Impact Statement for the Hawai‘i Commercial Harbors 2020 Master Plan, Island of Hawai‘i* (R.M. Towill, 2001), DOT-H noted that doves and cardinals were observed by Winona Char when conducting the October, 2000 Botanical survey for the commercial harbor area. The 1985 *Final Environmental Impact Statement for Development of Kawaihae Boat Harbor, Kawaihae* (DLNR DOBOR, 1985) indicated that birds found in the surrounding area include the Ruddy Turnstone (*Arenaria interpres*), California Plover, Wandering Tattler (*Heteroscelus incanus*), Japanese White-eye (*Zosterops japonicus*), House Sparrow (*Passer domesticus*), American Golden Plovers (*PIuvialis dominica*), Cardinal, House Finch (*Carpodacus mexicanus*), Warbling, Silverbill (*Lonchura spp*.), Spotted Dove (*Streptopelia chinensis*), and Barred Dove. According to the 1994 EA for the Kawaihae Small Boat Harbor (South), the endangered Hawaiian Hawk (*Buteo solitarius*), and Hawaiian Owl (*Asio flammeus sandwicensis*) may also occasionally transit or forage in the area, but do not nest, breed, or roost in the area.

Field visits were performed for the *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* (Helber, Hastert & Fee, 2009). During those field visits, only pigeons were noted on the project area. Pigeons (*Patagioenas spp.*) and Common Myna (*Acridotheres tristis*) birds were observed on the wet sea-level portions of the coral flats area to the south of the commercial harbor, 2,000 feet (a quarter-mile) or more southeast of the project area. The project area contains no habitat area, and none of these birds nest, breed, or inhabit the project area, although birds may transit the site, or come in and land on the ground or structures from time to time.

Consultation with USFWS required under Section 7 of the Endangered Species Act of 1972 revealed that the federally threatened Newell’s shearwater (*Puffinus auricularis newelli*) or ‘a‘o, and the federally endangered Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), and a species of concern, the Band-rumped storm petrel (*Oceanodrama castro*) may fly over the project area. Other species which are not listed under the Endangered Species Act but are protected under the Migratory Bird Treaty Act may transit the area while traveling to or from their high-elevation nesting areas.

The threatened Newell’s Shearwater was formerly common on Hawai‘i Island, and is known to nest high in the mountains on the windward side under thick vegetation, such as the ‘uluhe fern. USFWS species data sheet states that shearwater nesting occurs in areas with 47 to 100 inches of annual rainfall, not the 10 to 20 inches above Kawaihae. The endangered Hawaiian petrel nests at high elevations and burrows or excavates four to six feet or more in lithosols characterized by boulders and erosional debris found in association with bedrock, and can be found under rocky outcrops, lava tubes, or other suitable burrows. Both birds feed, and are most commonly observed, far off-shore.

The study *Movement Patterns of Hawaiian Petrels and Newell's Shearwaters on the Island of Hawai'i* (Day, Cooper and Blaha, 2003) obtained radar contacts at night, which indicate birds, presumed to be petrels or shearwaters, overfly the Kawaihae area. These contacts did not include actual bird sightings or species confirmation. No radar contacts were recorded on the most recent (2008) observational attempts. (Personal contact with Megan Laut, USFWS, August 2008 as cited in Helber, Hastert & Fee, 2009).

The primary concern is that these seabirds (especially Newell's Shearwaters fledglings headed toward the sea in the fall) fly at night and may become disoriented or confused by bright lights. They may also become confused and circle bright lights until they become exhausted and "fall out". Night-flying seabirds also fly into things they cannot see, especially man-made structures like utility poles, wires, trees, or buildings, which can result in death. Either event increases vulnerability to predation and vehicles. However, this interference with navigation or blinding effect seems more of an issue with individual lights than with illuminated fields.

Numerous inquiries (USFWS, DOH, Hawai'i Biodiversity and Mapping Program Natural Diversity Database) have uncovered no reported instances of bird fallout or confusion due to light distraction, or any impact with wires or structures, during any portion of the history of this site, or anywhere in the surrounding area. There have been no dead birds found on site during the formal DOH reporting period for West Nile Virus, which has been in place roughly since the end of 2002.

This monitoring program requires that any dead or downed birds found on site be recovered and turned in for testing as potential carriers. There are no reports of any instances of bird fallout or disoriented birds flying in circles around the lights at any time in the past, despite the lighting of the site since the late 1950s, and the prior use of 45-foot light poles with poorly shielded 1,000 Watt high-pressure sodium floodlights in the 1970s (Helber, Hastert & Fee, 2009).

4.13.1.2 Terrestrial Mammals

As noted in the *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* (Helber, Hastert and Fee, 2009), much of the project area has been built up from crushed coral fill material with no original ground surface in the first 8 to 13 feet of surface material. The makai portions of the commercial harbor area consist of reclaimed submerged land and portions of the harbor site further inland have been covered or greatly modified. There is little or no original ground cover left on the site of the Proposed Action, with no remaining habitat, no known new habitat, and minimal plant growth. During the period when this area was used to support the sugar industry, there had been a problem with rats (*Rattus spp.*) which fed on the sugar, and feral cats (*Felis cattus*), which fed on the rats. There still may be populations of these species along the highway and/or at the south coral flats area.

The Hawai'i Biodiversity and Mapping Program database was consulted for the *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* (Helber, Hastert and Fee, 2009), and there have been no recordings of rare

species within the harbor area in more than a century. The *Environmental Assessment for Kawaihae Small Boat Harbor (South)* (Hawai‘i Department of Transportation, 1994) indicated the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) could transit the area, but this was not confirmed by other sources. Tall trees that will be desirable for use by bats are not present in the area.

4.13.1.3 Marine Habitat and Species

All the waters around Hawai‘i Island to the limit of the Exclusive Economic Zone from the surface to a depth of 200 meters have been designated as Coral Reef Essential Fish Habitat (EFH), and all near-shore areas around the northwest shore of the island of Hawai‘i , including the waters off Kawaihae, have been designated as EFH by the Western Pacific Regional Fishery Management Council (WPRFMC) for one or more species covered under the Fishery Management Plan (FMP) applicable to Hawai‘i (Helber, Hastert & Fee, 2009).

If it is found that there will be an adverse effect to EFH from this project action, a requirement of the EFH consultation (triggered at the time of the USACE permit application) is to provide NMFS an "EFH assessment". This EFH assessment must describe the impact to EFH and the mitigation measures proposed to avoid and minimize these EFH impacts.

Text has been deleted from the paragraph that follows in response to comments received by the NMFS to clarify the status of threatened/endangered species.

There is no critical habitat designated for any listed marine species within the waters of Kawaihae Harbor. However, because the harbor provides a broad open area easily accessible from open water, a listed species can easily enter and transit the area (Helber, Hastert & Fee, 2009).

During public comments received for the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update*, members of the public stated that there are whales found at the mouth of the harbor during the whale migration season, but commenters did not specify which species of whales were observed.

NOAA has proposed revisions to critical habitat designations of the Hawaiian monk seal under the Endangered Species Act. Biologists estimate that only about 1,100 Hawaiian monk seals exist, and are in danger of extinction because of their declining population in the Northwestern Hawaiian Islands, which have been a Hawaiian monk seal critical habitat since 1988. For this reason, NOAA is considering designating Critical Habitat for the Hawaiian monk seal on the main Hawaiian Islands, including Hawai‘i Island. The critical habitat would extend from 5 meters (16.5 feet) inland from the shoreline seaward to a depth of 500 meters (1,640 feet depth) around each island. The designated area would cover 4,787 square miles. While public access would still be allowed and non-federal activities such as recreational shoreline fishing could continue, many other activities would require additional permitting or may have to be relocated.

Comments on the critical habitat designation for monk seals were initially solicited in June, 2011 and extended through March 2013. A final revision to the rule is not expected until December, 2012. A draft Programmatic EIS on improving juvenile monk seal survival through relocation, vaccination, de-worming, behavioral modification, and transfer back to the Northwestern Hawaiian Islands was published by NOAA on August 19, 2011. A draft economic impact analysis of the critical habitat designation assessed impacts on harbors in Hawai'i, but was inconclusive on the economic effects of this ruling.

Kawaihae Harbor is not included within the proposed mapped boundaries of critical habitat. http://www.fpir.noaa.gov/Library/PRD/Critical%20Habitat/HMSCriticalHabitatFAQ-PUBLIC.pdf provides clarification that Kawaihae Harbor, along with other developed areas with hardened shorelines (seawalls, boat docks, fishponds, etc.) do not offer the essential features of critical habitat.

Pre-Assessment comments were received on this project from NMFS outlining that agency's concerns regarding protected species that frequent the area.

- The threatened Green sea turtle (*Chelonia mydas*) is frequently found in nearshore waters of Hawai'i and can reside within the harbor.
- The endangered Hawksbill sea turtle (*Eretmochelys imbricata*) may also be found near the harbor but is less commonly seen.
- The endangered Hawaiian monk seal (*Monachus schauinslandi*) is known to occur on Hawai'i Island and their numbers have recently been increasing within the Main Hawaiian Islands. Several pups have been born within the past few years on Hawai'i Island and it is likely this trend will continue. Monk seals may forage for food near the harbor or may haul out on shoreline areas.
- The endangered Humpback whale (*Megaptera novaeangliae*) breeds, gives birth, and nurtures their young in waters near the harbor. Humpback whales typically arrive in the Hawaiian Islands as early as October and may stay as late as May or early June. The Kohala coast (including Kawaihae Harbor) is included as part of the Humpback Whale National Marine Sanctuary.
- Hawaiian spinner dolphins (*Stenella longirostris*) are protected under the Marine Mammal Protection Act. According to NMFS, Hawaiian Spinner dolphins have been observed to use an area just north of Kawaihae Harbor as a daytime resting area, where groups of dolphins come after foraging during the night at offshore feeding grounds, to rest, socialize, and nurture their young.

Surveys were performed in January through May of 2005 to document population densities of marine turtles associated with a Section 7 Biological Assessment for improvements to Kawaihae Harbor. A total of 149 sightings of Green Sea Turtles (*Chelonia mydas*) were recorded over that January through May period. The overwhelming majority of these turtles were found either along the interior edge of the harbor breakwater wall or up to a kilometer outside the breakwater; few were observed near the interior harbor berthing areas. A very distinctive

characteristic of the turtle populations observed in the vicinity of the Kawaihae Deep Draft Harbor was that all individuals were within the same size range of 30-60 cm carapace length. The size for sexual differentiation of green sea turtles is generally considered to be about 82 cm (carapace length). Hence, none of the turtles observed at Kawaihae were of a size that could be unequivocally sexually differentiated. As a result, all turtles that were observed can be considered sub-adults (Marine Research Consultants, 2005).

All observed turtles were either resting on the reef surface or swimming above the reef surface. Many of the turtles were not especially wary of investigators, and could be approached to within one meter before swimming away.

During all surveys, the density of turtles was greatest near the southern end of the Kawaihae Harbor Breakwater in a region of well-defined sand channels that bisect the shallow reef flat. No turtles were observed on the northern side of the entrance channel. The great majority of these turtles were located outside the breakwater area (Marine Research Consultants, 2005).

4.13.1.4 Benthic Community Composition

The discussion that follows considers the general composition of benthic communities affected by the project. Specific details on coral reefs and their composition are also offered in greater detail in **Section 4.14: Coral Communities**.

The coral reefs within the Kawaihae Harbor and Pelekāne Bay area were heavily impacted by extensive runoff and siltation following the deforestation and denuding of the uplands in the early 1800s, with devastating effects on the corals and the aquatic ecosystem. Even more extensive damage was done when the harbor was constructed in the 1950s, with the first major use of explosive methods to cut a deep draft harbor into the coral shelf. These actions are long past, and the remaining impacts to the coral ecosystem are primarily due to the reduced circulation and flushing of the area caused by the blockage of the harbor peninsula (Helber, Hastert & Fee, 2009).

A study was performed to consider a channel across the Coral Flats area to improve water quality in Pelekāne Bay and Kawaihae Harbor (Li, et. al, 2009). Such a channel was determined to increase sedimentation in the harbor and bay and was not pursued. See **Section 4.10.3: Recommended Mitigation of Impacts on Hydrology, Water Quality, and Coastal** Resources for more information.

A detailed inventory of species that were identified as part of the marine studies for the current Proposed Action is found in **Appendix F: Marine Environment and Water Quality Study**.

The nearshore marine environment in and around Kawaihae Harbor consists of diverse assemblages of varied physical structures and biotic communities that represent a relatively unique Hawaiian coral reef habitat. Because of the status regarding mitigation of loss, the biotic evaluation concentrated on evaluating the status of reef coral communities in the areas potentially affected by the proposed activities.

To describe qualitatively and quantitatively the overall physical and biotic setting of these features of the marine environment, an approach that has become widely used in the field of

coral reef science was employed based on utilizing the optical properties of remote sensing imagery to generate habitat maps, as no detailed benthic habitat maps of the Kawaihae Harbor region (or most of West Hawai'i) presently exist. For more information on methodology, see **Appendix F: Marine Environment and Water Quality Study**.

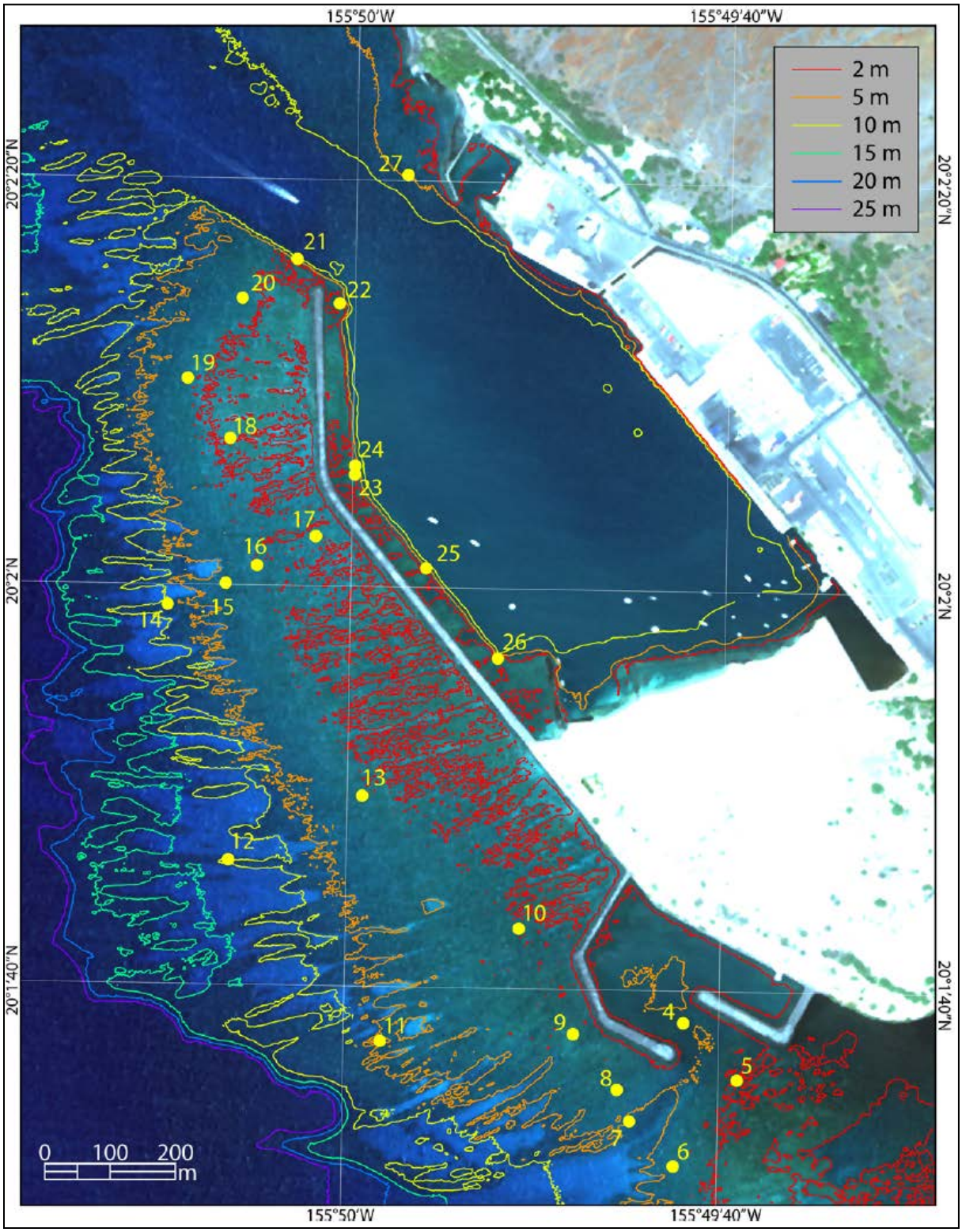
The survey area encompassed approximately 1.2 miles (or about 2 kilometers) of linear coastline and extended from the shoreline to a water depth of approximately 33 feet (or about 10 meters [m]), which encompasses an area of about 1,315,200 square meters (m^2), or 325 acres. Coral cover by species, as well as bottom cover of benthic algae, motile macro-benthos and non-living categories including sand, mud, bare limestone and rubble, were estimated by tabulating cover types within the segments. Qualitative evaluations of benthic composition were gathered on the vertical surfaces.

Figure 4-18: Sites Used to Qualify Coral Community Structure shows the area of Kawaihae Harbor surveyed, along with depth contours and locations of survey stations. The main structural component of the nearshore marine area is a wide shallow reef flat on which the harbor and entrance channel was dredged. A remnant strip of the original reef flat, approximately 60 feet wide extends from outside the channel entrance along the entire length of the submerged portion of the inner breakwater. The inner harbor reef remains essentially undamaged between the edge of the dredged basin and the boulder breakwater. Coral community structure on the outer edge of the dredge cut platform differs considerably from community structure on the inner harbor platform. Along the reef bench inside the harbor breakwater, composition of the coral community changes substantially from outside the breakwater.

As the entire floor of the dredged harbor basin is covered with a layer of fine-grained sand-mud sediment, corals do not occur on the harbor floor. However, the solid vertical surfaces of the working side of the harbor basin fronting the piers provides a habitat that has been extensively colonized by corals and other benthic invertebrates. Beyond the southern end of the pier structures, in the area of proposed Pier 2C expansion, the shoreline is comprised of a sloping wall of large basaltic boulders. Many of these boulders are colonized with numerous small corals. The entire span of the working piers within Kawaihae Harbor, including pilings, sheet pilings and concrete wharf fronts are colonized by a variety of corals and other invertebrates. The sheet piling forming the southern end of Pier 2B and the concrete piles of this pier are colonized by several species of coral. Also abundant on the pilings were a variety of other invertebrates typical of fouling communities within harbors including sponges, hydroids and algae. Submerged pilings on the outer face of Pier 2A also contain growth of isolated corals, while the interior pilings were barren of all coral growth. Areas of densest coral occurrence are located on the strip of undredged reef along the inner side of the breakwater, and along the outer edge of the reef flat fronting the outside of the breakwater.

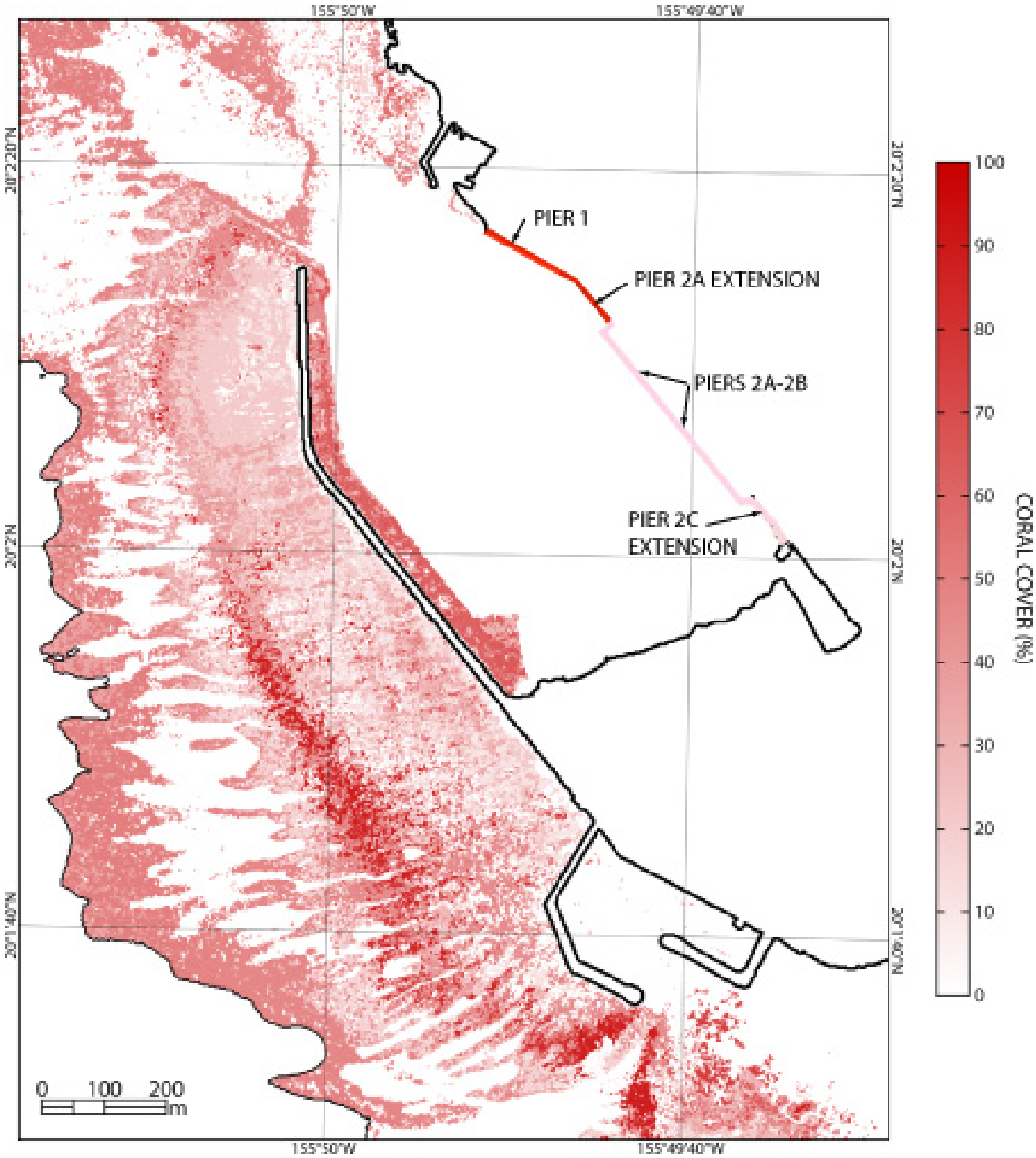
Figure 4-19: Coral Abundance by Percent Coverage displays coral abundance created by classifying community composition and ground-truthed data. It specifically shows percent of coral coverage in the vicinity of the proposed pier extensions and dredging areas. Within the

Figure 4-18: Sites Used to Qualify Coral Community Structure



Source: Marine Research Consultants, 2012

Figure 4-19: Coral Abundance by Percent Coverage



Source: Marine Research Consultants, 2012

region of study, one area stands out as being completely dissimilar. The anomalous area is located off the entrance channel to the Kawaihae Small Boat Harbor (South), which is outside of the commercial harbor. To ensure safe entrance to the small boat harbor, it appears that a channel was dredged from the small boat harbor mouth in a southwesterly direction. The floor of the channel is covered with rubble coated with a layer of fine-grained dark sediment. Small corals occur on the channel floor, but in far less abundance than in neighboring areas. Adjacent to the channel, the reef is covered with encrustations of crustose coralline algae that are gold, pink to dark burgundy in color. With further distance from the dredged channel area, crustose algae diminishes in abundance, while coral cover increases. Of note is that perhaps the richest area of coral cover encountered in the entire study area occurred adjacent to the southern edge of the small boat entrance channel. In summary, the interior of Kawaihae Harbor represents an area that has been created by human activities, but has become a suitable habitat for settlement and growth of reef corals. The existence of these communities indicates that water quality within the harbor is not a limiting factor for coral growth.

Benthic Community Composition - Motile Benthic Macrofauna, Algae and Reef Fish

The dominant group of motile macroinvertebrates observed on the outer reefs are the sea urchins. Sea urchins are generally found within interstitial spaces bored into basaltic and limestone substrata, in bored holes on the reef surface, or across the reef platform. Three species of sea cucumbers were observed during the survey. Individuals of these species were distributed sporadically across the mid-reef and deep reef zones.

The most common algae observed on the reef off Kawaihae Harbor were the encrusting red calcareous algae. These algae were abundant on bared limestone surfaces, and on the nonliving parts of coral colonies. As discussed above, crustose calcareous algae comprised a large percentage of bottom cover in the boundary zone between the small boat entrance channel and the outer reef areas. Similar zones of crustose calcareous algae have also been observed outside of Pelekāne Bay adjacent to Kawaihae in transition zones between mud-dominated areas and coral communities. While crustose algae were abundant, frondose algae were essentially absent from the reef surface in all zones.

Of the total of 1,498 fish observed, the two most numerous families were the damselfish and surgeonfish) which respectively comprised about 28 percent and 25 percent of the fish population. Wrasses and butterflyfish were the next most abundant families comprising about 13 percent and 15 percent of the fish respectively. Hence, these four families accounted for about 81 percent of the fish observed. The most common individual species was the blackfin chromis followed by the Saddle-back wrasse, and brown surgeonfish.

Distribution of reef fish community structure indicated that abundance was largely determined by the topography and composition of the benthos. With respect to fish abundance per sampling site, the number of species ranged from 2 (site 4) to 31 (site 22). The number of individuals per site ranged from 3 (site 4) to 149 (site 22). As shown in **Figure 4-18: Sites Used to Qualify Coral Community Structure**, Site 4 was located in the interior of the Kawaihae Small Boat Harbor (South), while site 22 was located at the corner of the dredged reef on the inner side of the Kawaihae breakwater.

Overall, fish community structure at Kawaihae Harbor is fairly typical of the assemblages found in undisturbed Hawaiian reef environments. However, the lack of fish species that are prized as food fish suggests that the area has been subjected to only significant amounts of fishing pressure.

Benthic Community Composition - Introduced and Regulated Species

It is stated that the greatest number of introduced marine invertebrates have probably arrived to Hawai'i through hull fouling, but many may have also arrived through solid ballast and in ballast water. Of the common introduced sponges, Cnidarians, Polycheates, Molluscs, Crustaceans, Bryozoans and Ascidians described in the publication, many are described as very common as fouling organisms in harbors throughout the main Islands. None are noted to exist only in Kawaihae Harbor.

DLNR, Division of Aquatic Resources (DAR) lists a variety of "regulated" marine fishes and invertebrates. Marine invertebrates include primarily species valued as food sources, including abalone, various clams and oysters, crabs, shrimp, lobsters, and sea urchins. The only species observed within the confines of Kawaihae Harbor on the list was the sea urchin (*Echinothrix diadema)*. It is possible that burrows noted within the sediment floor of the basin may be from shrimp (`opae), no individuals were observed.

4.13.2 Project Impacts on Wildlife

4.13.2.1 No-Build Alternative

The No-Build Alternative will have no direct effects on birds, terrestrial mammals, marine habitats/species, or biotic community as it will involve no new construction.

4.13.2.2 Build Alternatives

Birds

All Build Alternatives will result in some changes to a disturbed property, though Alternative 2 - Minimal Action will have a smaller impact than the other Build Alternatives, all of which will make all land side improvements. Much of Kawaihae Harbor has been altered from the construction of buildings, piers, and pavement. Coral Flats is a highly disturbed area that was created artificially when the harbor was dredged and the spoils were deposited there. While kiawe trees and weeds have colonized the Coral Flats, it still is highly disturbed and offers minimally-valuable habitat for wildlife use.

As noted in the *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* (Helber, Hastert & Fee, 2009), the current operational profile restricts full power lighting to the very limited hours of active operations, with "twilight" lighting levels used for inactive periods (using only one light per pole), so most lights are only switched on when the yard becomes active. The area is therefore only lit during periods when birds are returning, not during departing periods when fledglings are most vulnerable. The *Final Environmental Assessment for Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* also quotes USFWS, which confirmed that "A study conducted by Reed et al.

(1985) indicates that the majority of downed birds are detected during the first three hours after sunset, and decreases until six hours after sunset, when almost no new birds are found." The possibility of waterbird distraction is therefore considered remote.

The Section 7 consultation with USFWS on the *Pier 2A Shed Demolition and Container Yard Improvements at Kawaihae Harbor* project limited light poles to 46.5 feet in height.

Terrestrial Mammals

Given the lack of tall trees that serve Hawaiian Hoary Bats on Kawaihae Harbor property (including the Coral Flats area), there is no critical habitat for rare, endangered, or threatened species in the Project Area, and no such species are known to exist in the Project Area.

Marine Mammals and Sea Turtles

The effects of underwater noise on marine mammals and turtles are discussed in **Section 4.6.5: Underwater Noise**.

The NMFS has noted that the project could result in impacts. The text that follows has been supplemented since the Draft EA in response to comments received from NMFS on the Draft EA:

- Humpback Whales: Under Alternative 4 - Land-Side Plus Pier 2A Extension or Proposed Action - Alternative 5, construction of the Pier 2A and/or 2C extensions and the dredging of the harbor will occur. If these improvements are constructed during months when humpback whales are in residency (as early as October through as late as May or early June), impacts could occur to the whales as they breed, give birth, and nurture their young in waters near the harbor. Potential impacts could occur from the noise of construction such as pile-driving and vessel activity, and also from dredging of the harbor. NMFS has noted that increased vessel traffic resulting from the increased capacity of the harbor following improvements and expansion may also pose an increased risk of vessel collisions with whales. It is recommended that measures to minimize potential for collisions with whales be investigated.
- Green sea turtles: Impacts from noise are not usually a concern due to the turtles' limited hearing capabilities; however, they could be affected by siltation from dredging operations under Alternatives 4 and 5 which may affect foraging on algae within the harbor. Turbidity and siltation from project-related work should be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions. BMPs will be used to minimize the adverse effects of siltation from dredging. Refer to **Section 4.10.3: Recommended Mitigation of Impacts on Hydrology, Water Quality, and Coastal** Resources for more information. NMFS has also noted that increased traffic may also pose an increased risk of collision with sea turtles residing within the harbor. It is recommended that measures to minimize potential for collisions with turtles be investigated.

- Hawksbill turtles: These turtles may be found near the harbor, but are not as common as Green sea turtles. While the potential for collisions with these turtles is lower than Green sea turtles, even with increased vessel traffic, it is still a concern. Therefore, Alternatives 4 and 5 are of concern. It is recommended that measures to minimize potential for collisions with turtles be investigated.
- Hawaiian monk seals: Monk seals may forage for food near the harbor or may haul out on shoreline areas, and could be affected by the noise of construction and dredging as well as by vessel traffic increases under Alternatives 4 and 5.
- Hawaiian spinner dolphins: Hawaiian spinner dolphins can be affected by the noise of construction and increased vessel traffic under Alternatives 4 and 5 as it affects their ability to communicate, and they may temporarily abandon the area.

It is assumed that Kawaihae Harbor will not be designated as Critical Habitat for Hawaiian monk seals in future redesignations of Critical Habitat, as described above in **Section 4.13.1.3: Marine Habitat and Species**.

Benthic Communalities

A detailed discussion of coral communities is provided in a separate section, **Section 4.14: Coral Communities**, and the discussion that follows is a summary.

Ten coral species found in Hawai'i have been listed as candidates for endangered species status. These species are: *Cyphastrea agassizi, C. ocellina, Leptoseris incrustans, L. yabei, Montipora dilatata, M. flabellata, M. turgescens, M. patula, Porites pukoensis* and *Psammocora stellata*. The only one of these corals observed on the sheet piling, piles and boulders within the harbor was *Montipora patula*. This species was also observed on the reef outside the harbor during the present survey. AECOS (2000) also reported *M. patula* in the vicinity of Pier 1.

The areas planned for construction of Pier 2C under Proposed Action - Alternative 5 and extension of Pier 2A under Alternatives 4 and 5 presently contain extensive communities of reef corals that have likely been in place since the original construction of the harbor. Unless provisions are made to keep the existing sheet-piles and boulder shorelines in place during construction of new piers, these populations will unavoidably be eliminated under the proposed scenario of pier extension. Within these areas proposed for new piers, removal and transplantation of the existing corals would be the only way to ensure their survival, although such an action would be very difficult owing to the flat encrusting growth forms of many of the coral colonies. Alternate strategies to mitigate coral loss will likely be negotiated as part of permitting process. Refer to **Section 4.14.3: Recommended Mitigation of Impacts on Coral** Communities for more information.

For existing piers which will remain in place under Alternatives 4 and 5, BMPs to ensure minimal mortality during dredging may include such features as silt containment devices to isolate the pier faces from effects of dredging operations.

Different types of pier construction under Alternatives 4 and 5 are possible alternative designs as described in **Section 3.7.1: Reconstruction and Extension of Pier 2A.** These include a

concrete pile-and-deck, a bulkhead with sheet piles, a combination of these two designs, or a caisson wharf (which is not considered economically viable). The concrete pile-and-deck system will require the least fill and will offer new habitat for some forms of marine life. In contrast, with a sheet pile bulkhead system, the fill will go all the way to the front of the pier face, reducing the marine life footprint.

As noted above in **Section 3.7.2: Dredging (Boulder Removal) for Pier 2A** and **Section 3.8.3: New Dredging at Pier 2C**, the dredging under Alternative 4 is expected to be limited to removing a large 15-ton boulder, about the size of a small passenger car. Under Alternative 5, the boulder will be moved, plus new dredging will be performed near Pier 2C. The area to be dredged fully (to a depth of 35 feet) is about 24,120 square feet (0.55 acres). The estimated total dredge area, including side slopes will cover about 81,360 square feet (1.87 acres), based on the type of dredge material.

4.13.3 Recommended Mitigation of Impacts on Wildlife

In all cases, efforts to address the Build Alternatives' effects on wildlife will attempt to first avoid impacts outright, then minimize impacts as possible, and finally mitigate impacts that are unavoidable.

Birds

If nighttime construction work will be required under any of the Build Alternatives, it is recommended that lights be shielded to reduce the potential for interactions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Reed et. al. 1985, Telfer et. al. 1987).

It is also recommended that all exterior lighting associated with the operation of the proposed facility be shielded so as to reduce the potential for interactions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Reed et. al. 1985, Telfer et. al. 1987). Refer to **Section 4.17: Light Pollution** for more information. Mitigative measures that will be considered include the following:

- Limiting light poles to 46.5-foot heights already in use elsewhere in the harbor.
- Use of lower-power (180 Watt) monochromatic and low-pressure sodium lighting (as opposed to the more common full-spectrum and high-pressure sodium lighting), which provides high contrast with sharply reduced brightness and glare, yet the yellow light does not attract insects and is not believed to be used for avian navigation.
- Use of custom-designed light fixtures with "top-visor" shielding to minimize the potential for stray light up-scatter and side-scatter, so that the bulb is not visible at lamp height from the side.
- Limiting light levels and hours of use to the minimum levels allowable under Occupational Safety and Health Administration (OSHA) worker safety and security. Union approval may also be required.

Terrestrial Mammals

No mitigation is warranted for impacts on terrestrial mammals.

Marine Habitat and Species

Under Alternatives 4 and 5, to reduce the potential for impacts to protected marine species, the NMFS recommends the following mitigating measures be incorporated into the project:

- A survey of the project area be performed just prior to commencement or resumption of construction activity to ensure that no protected species are in the project area. If protected species are detected, construction activities must be postponed until the animals voluntarily leave the area. If any listed species enters the area during the conduct of construction activities, all activities must cease until the animals voluntarily depart the area.
- All on-site project personnel must be apprised of the status of any listed species potentially present in the project area and the protections afforded to those species under Federal laws.
- Any incidental take of marine mammals or injuries to sea turtles must be reported immediately to NMFS 24-hour hotline. Information reported must include the name and phone number of a point of contact, location of the incident, and nature of the take and/or injury.
- BMPs recommended by NMFS and other agencies such as noted in **Section 4.10.3: Recommended Mitigation of Impacts on Hydrology, Water Quality, and Coastal** Resources should be incorporated into the project to further reduce potential impacts to protected marine species from the construction of proposed harbor improvements.
- To avoid noise effects on humpback whales In the vicinity of the project area, prior to construction, it is recommended that DOT-H work with NOAA to determine the appropriate temporary threshold shift (TTS) distances of the protected species anticipated to be in the area. When the pile driving (or installation of sheet piling) effort commences, these efforts could be postponed or halted when the protected species are within the TTS range.
- Consider the need for attenuating noise during underwater pile driving through the use of an air bubble curtain. Air provides an effective barrier to sound propagating through water, because of the difference in density between air and water. Air bubble curtain systems have been used to reduce underwater sound pressures from explosions or from other sources of high-amplitude sounds. Cylinders or rings are installed around piles and bubbles are produced to reduce sound levels (Reyff, 2009).
- It is recommended that "soft starts" are utilized for the pile driving. With this procedure, the pile installation begins with low impact, low-energy velocities, and gradually builds up to full energy. The soft-start would allow marine species to leave the area before the full impact of the activity is attained.

- It is recommended that the contractors use siltation curtains to minimize injury to or inadvertent taking of threatened marine wildlife and to minimize turbidity effects on coral reefs. A second siltation curtain may be erected as an extra safeguard. Use of silt curtains would include the following measures:
    - In-water project construction activities would be managed during slack tide or during periods when tidal exchange within the harbor is modest to ensure silt curtains are effective in containing mobilized sediments.
    - In-water project construction would be conducted at a slow, methodical pace, for the purpose of minimizing the disturbance of marine sediments during the installation of pilings, removal of existing pilings and removal of other debris.
    - Double-layer silt curtains would be deployed when construction activities are conducted in close proximity to fish and wildlife resources, such as corals or other sessile organisms.
- General measures that the harbor can institute to minimize potential for collisions with marine wildlife will be investigated.

A Department of the Army (DA) permit is expected under Section 404 of the Clean Water Act for ocean construction. Consultation with other federal resource agencies (NMFS, USFWS) as required under Section 7 of the Endangered Species Act and the Fish and Wildlife Coordination Act will be pursued during the DA permit process to address concerns about endangered and threatened wildlife that may be found in the area. A quantitative marine study will be needed as part of the DA permit process. The design will be refined to a level at that stage of the project where specific impacts and appropriate mitigation can be determined. The studies will consider direct and direct impacts to fish and wildlife resources, develop plans to contain sediments within the project dredge site (if Alternatives 4 or 5 are pursued), and also consider compensatory mitigation measures to replace lost ecological functions from unavoidable impacts.

Benthic Communities

BMPs to ensure minimal mortality during dredging and pier extensions under Alternatives 4 and 5 may include such features as silt containment devices to isolate benthic communities from the effects of dredging and underwater construction. Use of silt curtains would have the considerations listed above.

4.14 Coral Communities

Executive Order 13089, signed by President Clinton on June 11, 1998 increases protection of US coral reef ecosystems. It requires Federal agencies whose actions may affect US coral reef ecosystems to identify their actions that may affect US coral reef ecosystems; utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and ensure that any actions will not degrade the conditions of such ecosystems. It also calls for federal agencies to research, monitor, manage, and restore affected ecosystems, including measures reducing impacts from pollution, sedimentation, and fishing. The federal Coral Reef

Task Force was formed as a result of this executive order, and includes twelve state departments, including the director of DLNR.

In 2000, Congress passed the Coral Reef Conservation Act of 2000, and NOAA created their Coral Reef Conservation Program.

On June 8, 2008, the new compensatory mitigation rules and regulations (as published in the Federal Register; April 10, 2008; Volume 73, No. 70) came into effect. The rule, which was instituted by USACE and EPA primarily addresses mitigation banking and In-lieu fee programs, and also accentuates the use of functional assessments and ecological performance standards to a much greater degree than prior regulations. The objective is to improve the quality and success of compensatory mitigation projects for activities authorized by USACE permits.

A recent public announcement from USACE on a project in Pohnpei, Micronesia that potentially affects coral reefs provides some background on the 2008 Mitigation Rule, stating that:

> This Mitigation Rule … includes requirements that prospective In-Lieu Fee (ILF) program sponsors meet substantially the same standards as mitigation banks and undergo the same interagency team review and approval process as mitigation banks. An ILF program involves the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for Department of the Army permits. Similar to a mitigation bank, an ILF program sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the ILF program sponsor. However, the rules governing the operation and use of ILF programs are somewhat different from the rules governing operation and use of mitigation banks." (USACE Announcement POH-2009-00315, June 15, 2011, p. 2.)

If required after consultation with state and federal authorities, a compensatory mitigation plan will be developed by DOT-H under the Proposed Action to mitigate impacts on coral.

4.14.1 Affected Environment

With regards to coral communities, the most important areas of the harbor potentially affected under Alternatives 4 and 5 are areas of the existing Piers 1 and 2, and the neighboring areas fronting them. Marine Research Consultants, Inc. visited areas that might be affected by dredging and extension of piers, as well as the reef habitats surrounding the harbor on August 17, 2011, and September 12-13, 2011. (Marine Research Consultants, 2012). Areas that were visited for this quantitative assessment were shown back in **Figure 4-18: Sites Used to Qualify Coral Community Structure**. **Figure 4-19: Coral Abundance by Percent Coverage** displayed coral abundance created by classifying community composition and ground-truthed data, including coral reefs in closer proximity to Piers 1 and 2.

Vertical surfaces composed of column piles supporting Piers 2 and 2B, and sheet-piling fronting Pier 1 and the area between Piers 1 and 2, as well as boulders forming the shoreline off the end of Pier 2B support substantial colonization of corals. The most prolific occurrence of corals

within the harbor occurs on the corrugated sheet-piling along the front margin of Pier 1 and between Piers 1 and the northern end of Pier 2. Typically, corals covered the sheet-piling from about one meter below the water surface to just above the juncture of the harbor floor. The cover of these vertical faces consists predominantly of merged and overlapping colonies that in places form a near continuous mass of living coral on the outer surfaces of the sheet-piling. Evaluation of coral colony size frequency distribution along the vertical surfaces of Piers 1 and 2, and the areas of proposed Piers 2A and Pier 2C extensions revealed a total of nine species of coral, with a total count of about 7,000 colonies. The most abundant coral was *Porites lobata*, accounting for about 50 percent of the colonies, followed by *Pocillopora meandrina* and *Montipora capitata*, each accounting for about 23 percent of the number of colonies. Hence, these three species comprised 96 percent of all colonies as shown in **Table 4-14: Size, Frequency and Distribution of Corals Observed in Kawaihae Harbor**.

Table 4-14: Size, Frequency and Distribution of Corals Observed in Kawaihae Harbor

Location	Species	Size Class (cm)					
		0-5	>5<10	>10<25	>25<50	>50	TOTAL
Pier 2C Extension Revetment	*Porites lobata*	173	145	168	77	60	623
	Pocillopora meandrina	16	26	32	4		78
	Montipora capitata	76	126	149	42	11	404
	Montipora patula		7	6			13
	Leptastrea purpurea		2	2			4
	Porites compressa			3			3
	Pavona duerdeni		1				1
	Pavona varians		1				1
	TOTAL	**265**	**308**	**360**	**123**	**71**	**1,127**
Pier 2A-2B	*Porites lobata*	92	132	96	28		348
	Pocillopora meandrina	16	40	32	4		92
	Montipora capitata	60	260	292	276	72	960
	Pocillopora eydouxi				2		2
	TOTAL	**168**	**432**	**420**	**310**	**72**	**1,402**
Pier 2A Extension Sheet Pile	*Porites lobata*	142	265	374	248	32	1061
	Pocillopora meandrina	396	330	222	18		966
	Montipora capitata	24	24	8	16		72
	Porites compressa		4				4
	TOTAL	**562**	**623**	**604**	**282**	**32**	**2,103**
Pier 1	*Porites lobata*	62	396	627	296	69	1450
	Pocillopora meandrina	34	210	225	13		482
	Montipora capitata	0	76	89	8	2	175
	Montipora patula	0	87	97	13		198
	Porites compressa	2	12	29	2		44
	Pocillopora eydouxi			1			1
	TOTAL	**97**	**781**	**1,068**	**333**	**71**	**2,350**
TOTAL		**1,092**	**2,144**	**2,452**	**1,048**	**246**	**6,982**

Source: Marine Research Consultants, 2012

With respect to size class, the overall most abundant class was the 10 to 25 cm group, accounting for 35 percent of the colonies, followed by the 5 to 10 cm class which accounted for about 30 percent of the colonies. The least abundant class was the largest size (>50 cm) accounting for about 3 percent of the colonies. The low number of large colonies is likely a result of the mostly vertical substratum, which limits the maximum size of colonies.

The area with the highest number of coral colonies was the corrugated sheet-piling fronting Pier 1 (approximately 2,350 colonies), followed by the sheet-piling fronting the area between Piers 1 and 2 (approximately 2,103 colonies). The lowest number of colonies occurred on the boulders in the area of proposed Pier 2C Extension. Considering the average number of colonies per meter of shoreline, the lowest value occurs on the column piles supporting Piers 2 and 2B, with 3.9 colonies per meter, while the highest colony counts per meter occurred on the sheet-piling between Piers 1 and 2, and along Pier 1 (20 and 16 colonies per meter, respectively).

In sum, the entire submerged region of the working area of inner Kawaihae Harbor, as well as the adjacent areas proposed for future development provide suitable surfaces for successful coral settlement and growth, resulting in dense coral communities that do not appear to be negatively affected by normal harbor operations.

4.14.2 Environmental Impacts on Coral Communities

Owing to the buildup of sediment in Kawaihae Harbor from stormwater runoff, dredging of the harbor floor fronting Piers 1 and 2 will be necessary under Alternative 4 - Land-Side Plus Pier 2A Extension and the Proposed Action - Alternative 5 to maintain adequate depth for safe navigational operations within the harbor. As noted above in **Section 3.7.2: Dredging (Boulder Removal) for Pier 2A** and **Section 3.8.3: New Dredging at Pier 2C**, As noted above in **Section 3.7.2: Dredging (Boulder Removal) for Pier 2A** and **Section 3.8.3: New Dredging at Pier 2C**, the dredging under Alternative 4 is expected to be limited to removing a large 15-ton boulder, about the size of a small passenger car. Under Alternative 5, the boulder will be moved, plus new dredging will be performed near Pier 2C. The area to be dredged fully (to a depth of 35 feet) is about 24,120 square feet (0.55 acres). The estimated total dredge area, including side slopes will cover about 81,360 square feet (1.87 acres), based on the type of dredge material.

The proposed dredging and pier improvements will have some unavoidable environmental impacts that will require mitigative actions. With regard to dredging, it is expected that turbidity and Total Suspended Solids (TSS) of the water column will be temporarily increased as a result of sediment resuspension and dredge leakage.

In correspondence on other harbor projects, USFWS has noted that suspended sediments from construction activities could have negative impacts on fertilization after coral spawning. (Richmond, 1993 and 1995). Furthermore, modest changes in water quality levels may significantly alter photosynthesis and respiration ratios (Telesnicki and Goldberg, 1995) and metabolic processes of corals and symbiotic algae (Muller-Parker and D'Elia, 1995).

The areas planned for construction of Pier 2C and extension of Pier 2A presently contain extensive communities of reef corals. Unless provisions are made to keep the existing sheet-

piles and boulder shorelines in place during construction of new piers, these populations will unavoidably be eliminated, as transplantation has not been very successful where it has been attempted. In that case, compensatory mitigation will be pursued as in the design phase as discussed below.

Under Alternatives 4 and 5, different types of pier construction are possible alternative designs as described in **Section 3.7.1: Reconstruction and Extension of Pier 2A**. These include a concrete pile-and-deck, a bulkhead with sheet piles, a combination of these two designs, or a caisson wharf (which is not considered economically viable). The concrete pile-and-deck system will require the least fill and will offer new habitat for corals and other marine life. In contrast, with a sheet pile bulkhead system, the fill will go all the way to the front of the pier face, reducing the marine life footprint.

4.14.3 Recommended Mitigation of Impacts on Coral Communities

A Department of the Army (DA) permit is expected under Section 404 of the Clean Water Act for ocean construction. Consultation with other federal resource agencies (NMFS, USFWS) as required under Section 7 of the Endangered Species Act and the Fish and Wildlife Coordination Act will be pursued during the DA permit process to address concerns about endangered and threatened wildlife that may be found in the area. A quantitative marine study will be needed as part of the DA permit process. The design will be refined to a level at that stage of the project where specific impacts and appropriate mitigation can be determined. The studies will consider direct and direct impacts to fish and wildlife resources, develop plans to contain sediments within the project dredge site (if Alternatives 4 or 5 are pursued), and also consider compensatory mitigation measures to replace lost ecological functions from unavoidable impacts.

The coral *Montipora patula* was designated as a candidate for listing as "threatened" on December 7, 2012. DOT-H will, with the assistance of the US Army Corps of Engineers initiate an interagency consultation process with NMFS regarding this proposed species under Section 7 of the Endangered Species Act.

Under Alternatives 4 and 5, because of the extensive coral colonization of the pilings that are adjacent to the maintenance dredging sites, recommended BMPs include requirements for silt containment devices to minimize and localize the potential negative effects of dredging. Measures to avoid abrading corals in areas not to be dredged are also recommended. Impacts from the resuspension of dredge materials may be minimized by placing silt barriers (curtains) between the dredge zone and the pilings as well as along the offshore boundary of dredging. Use of anchored barges for dredging, spuds, or shore-based dredging would be used as appropriate.

BMPs to avoid turbidity and siltation and erosion outlined in **Section 4.3.2.3: Recommended Mitigation of Impacts on** Soils will also serve to minimize effects of construction on coral communities.

A water quality monitoring program carried out during the dredging activity will likely set limits of exceedance which will trigger cessation of dredging until conditions return to acceptable levels.

As noted in **Section 3.10.3: Caisson Wharf Design Option**, it is unlikely that a caisson wharf design is economically reasonable. However, such a design, if found to be appropriate, would avoid the effects of pile driving.

In coordination with DLNR DAR, other possible suggested measures for mitigating impacts on coral under Alternatives 4 and 5 include sequestering affected coral and conducting reef transfer, similar to the artificial reef program which provides fish habitat and is supported by fishermen. “In-lieu” fees are often a mitigation measure. DLNR DAR will be looking for early consultation and best practice examples.

If required, a compensatory mitigation plan will be produced during the design phase that will provide mitigation to make up for the loss the ecological function of the resources. The compensatory mitigation plan will be in compliance with the 2008 USACE and EPA rules and regulations cited earlier.

4.15 Invasive Species

On February 3, 1999, President Clinton signed Executive Order 13112, which calls on federal Executive Branch agencies to work to prevent and control the introduction and spread of invasive species. The Executive Order defines an “invasive species” as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.”

DOA, Plant Quarantine Branch is responsible under Chapters 141 and 150A, Hawai‘i Revised Statutes (HRS) for the biosecurity program, which aims to protect the state from crop losses, extinction of native species, destruction of native forests, and spread of diseases. Inspection of exported agricultural crops allows them to be sold in markets outside of Hawai‘i. Hawai‘i’s agriculture industry can experience serious consequences if invasive species arrive and take hold. DOA has prioritized the pathways through which invasive species are transported and has created the biosecurity program, a statewide mitigation plan between government agencies and private entities to minimize the spread of invasive species.

The biosecurity program, as detailed in Act 236, Session Laws of Hawai‘i 2008 (SB 2850), targets potential invasive species, including those from overseas, from coming into the state by: (1) administering pre-entry measures (i.e., inspection at ports of departure or other point outside the state) to minimize the impact of invasive pests entering the state; (2) conducting port-of-entry inspections to detect and quarantine or destroy pests upon arrival; and (3) administering post-entry measures to mitigate the establishment of pests in the state. Reducing the number of invasive species entering the state should have a trickle-down effect, subsequently decreasing interisland dispersal of invasive species. In order to facilitate port-of-entry inspections, the biosecurity program will establish inspection facilities where multiple government agencies can inspect, quarantine, fumigate, disinfect, or destroy items that may harbor invasive species, while providing for the proper storage and handling of cargo (especially

agricultural and food commodities) awaiting inspection. Another objective of the biosecurity program is to promote the production of agricultural commodities in the state to reduce cargo shipments of imported high-risk commodities into the state (Howarth, et al., 2008).

Act 202, Hawai‘i Session Laws and effective July 1, 2011, provides new biosecurity regulations for the transportation and importation of agricultural commodities at harbors and airports. This legislation recognizes that inefficiencies in cargo transportation increase the cost of goods and raise the risk of spoilage and loss. Specifically, the act requires DOT-H to work cooperatively with DOA and to provide space at commercial harbors for biosecurity and inspection facilities. DOA will design and construct biosecurity and inspection facilities at the harbors.

Since 2000, the Department of Natural Resources, Division of Aquatic Resources (DLNR DAR) is the designated lead agency for preventing the introduction of alien aquatic organisms and for carrying out the destruction of these organisms through the regulation of ballast water discharges and hull fouling organisms. In 2007, rules were adopted to manage ballast water discharge from vessels operating in Hawaiian waters, found at 13 HAR 76. The rules are intended to minimize introduction and spread of non-indigenous aquatic organisms into waters surrounding the Hawaiian Islands. The rules require vessels that carry ballast water to follow the state administrative rules for ballast water, have a ballast water management plan specifically for that vessel, and file a ballast water reporting form with DLNR DAR no later than 24 hours prior to arrival.

HB 1568, signed by Governor Abercrombie in July, 2011 seeks to protect Hawai‘i's natural environment from the threat of invasive species and assist Hawai‘i's agricultural industry by authorizing the DOT to provide space for and work with the DOA to design and construct biosecurity and inspection facilities at Hawai‘i's airports and harbors. These facilities will provide safeguards and will also assist the agricultural industry in alleviating the delay experienced when shipping perishable items out-of-state. DOA and DOT are cooperating as required under HB 1568. No guidelines or standards have been issued yet for HB 1568.

An extensive assessment of invasive species was performed for in the *Alien Species Biological Assessment for the Statewide Large-Capacity Inter-Island Ferry Environmental Impact Statement* (EIS) (Howarth, et al., 2008), as one of the major concerns associated with the project were invasive species including those from overseas. The discussion that follows is adapted from that study.

Hawai‘i’s small physical size and geographic isolation from larger land masses results has resulted in a unique and diverse native flora and fauna. This isolated evolution has also resulted in a very fragile ecosystem with native biota that is highly vulnerable to human disturbances and invasions from alien species from overseas. “Alien species” refers to plants, animals, and microorganisms transported or established outside of their natural range due to the activities of humans, whether done so intentionally or not. Many alien species found in the Hawaiian Islands are confined to a single island or only a few of the islands. An apparently innocuous alien species may become “invasive” if it is moved to a new island or if a favorable change in its habitat occurs (Howarth, et al., 2008).

Alien invasive species, including those from overseas, can prolifically spread and disrupt ecosystems because there are no natural predators or controls present. Invasive species threaten Hawai‘i’s natural environment and local economy by damaging native forests; competing with and causing the extinction of native flora and fauna; and carrying disease that may affect native species, agricultural crops, and humans. (Howarth, et al., 2008). While this study raised concerns about transfer of invasive species between the Hawaiian Islands, Kawaihae Harbor and Hawai‘i Island are potentially affected by invasives that come from all over the world. Additionally, it is desirable to prevent invasive species that are present on Hawai‘i Island to gain a foothold on the other Hawaiian Islands, the mainland, or other international locations.

4.15.1 Existing Conditions

The DOA has provided DOT-H with their target list of current terrestrial species of concern. They are listed in **Table 4-15: Department of Agriculture's Top Eleven Overseas Pests of Concern**. The first five species have been found in Hawai‘i; the latter six have not but have a significant economic impact if they were, potentially wiping out entire species.

Table 4-15: Department of Agriculture's Top Eleven Overseas Pests of Concern

Number	Invasive Species Name	Found in Hawaiian Islands?
1	Brown Tree Snake (*Boiga irregularis*)	Yes
2	Mosquitoes (various spp.)	Yes
3	Biting Flies (various spp.)	Yes
4	Red Imported Fire Ants (*Solenopsis invicta*)	Yes
5	‘Ohia Rust (*Puccinia psidii)*	Yes
6	Coffee Leaf Rust (*Hemileia vastatrix*)	Not Yet
7	Sudden Oak Death pathogen (*Phytophthora ramorum*)	Not Yet
8	Red Palm Weevil (*Rhynchophorus ferrugineus*)	Not Yet
9	An Armored Scale (*Fiorinia phantasma*)	Not Yet
10	Naio Thrips (*Klambothrips myopori*)	Not Yet
11	Rough Sweet Potato Weevil (*Blosyrus asellus)*	Not Yet

Source: Personal Correspondence, DOA

The *Alien Species Biological Assessment for the Statewide Large-Capacity Inter-Island Ferry Environmental Impact Statement* (Howarth, et al., 2008) focused on invasive species that are not yet established on all the islands, with an emphasis on O‘ahu, Maui, Kaua‘i and Hawai‘i since those were the islands that would have been served. There are countless invasive species not yet established on Hawai‘i Island, so generalized distribution data was presented. Principal invasive species of concern identified were: bush beardgrass *(Schizachyrium condensatum),* fountain grass *(Pennisetum steaceum),* pampas grass *(Cortaderia* spp.), gorse *(Ulex europaeus),* fireweed *(Senecio madagascariensis),* miconia *(Miconia calvescens),* varroa mite *(Varroa destructor),* little fire ant (*Wasmannia auropunctata*), nettle caterpillar (*Darna pallivitta*), coqui frog (*Eleutherodactylus coqui*), veiled chameleon (*Chamaeleo calyptratus*), red-vented bulbul (*Pycnonotus cafer*), red-whiskered bulbul (*Pycnonotus jocosus*), small Indian mongoose (*Herpetes auropunctatus*), kariba weed (*Salvinia molesta*), suckermouth catfish (*Hypostomus* cf.

watwata), snowflake coral (*Carijoa riisei*), and the red algae gorilla ogo (*Gracilaria salicornia*) and hookweed (*Hypnea musciformis*). Numerous additional species pose similar or even more serious threats if spread to or from Hawai'i Island (Howarth, et al., 2008).

4.15.1.1 Alien Terrestrial and Freshwater Species

The analysis performed in that study noted that over 5,000 alien terrestrial and freshwater species have established wild populations in the Hawaiian Islands, including more than 1,308 plant species, 3,290 arthropod species, 50 mollusk species, 111 terrestrial vertebrate species (mammals, birds, reptiles, and amphibians), 46 freshwater fish species, and several hundreds of untallied invertebrates, fungi, and microorganisms. The island distribution of invasive terrestrial and freshwater species of greatest concern in 2008 (Howarth, et al., 2008) is included within **Table 4-16: Invasive Terrestrial and Freshwater Species of Concern**.

Table 4-16: Invasive Terrestrial and Freshwater Species of Concern

Invasive Species Name	O'ahu	Maui	Kaua'i	Hawai'i
Bush beardgrass (*Schizachyrium condensatum*)	Reported	Reported	Established	Established
Fountain grass (*Pennisetum setaceum*)	Reported	Reported	Reported	Established
Pampas grass (*Cortaderia spp*.)	Reported	Established	Reported	Reported
Gorse (*Ulex europaeus*)	Reported	Established	Reported	Reported
Fireweed (*Senecio madagascariensis)*	Reported	Established	Reported	Established
Miconia (*Miconia calvescens*)	Established	Established	Reported	Established
Varroa mite (*Varroa destructor*)	Established	Not Present	Not Present	Established*
Little fire ant (*Wasmannia auropunctata)*	Not Present	Not Present	Reported	Established
Nettle caterpillar (*Darna pallivitta*)	Reported	Reported	Not Present	Established
Coqui frog (*Eleutherodactylus coqui*)	Reported	Established	Reported	Established
Veiled chameleon (*Chamaeleo calyptratus*)	Not Present	Established	Reported	Not Present
Red-vented bulbul (*Pycnonotus cafer*)	Established	Not Present	Not Present	Reported
Red-whiskered bulbul (*Pycnonotus jocosus*)	Established	Not Present	Not Present	Not Present
Small Indian mongoose (*Herpestes auropunctatus*)	Established	Established	Reported	Established
Kariba weed (*Salvinia molesta*)	Established	Reported	Reported	Established
Suckermouth catfish (*Hypostomus* cf. *watwata*)	Established	Established	Not Present	Not Present
Coffee Berry Borer (*Hypothenemus hampei*)**	Not Present	Not Present	Not Present	Established**

*At the time this information was published in Howarth, et al. 2008, the varroa mite was "reported" on Hawai'i Island; it has since become established.

** The Coffee Berry Borer was not identified in Howarth, et. al, 2008 but has since been identified on Hawai'i Island and is added to this table for convenience.

Sources: Howarth, et al., 2008, based on based on information from Coordinating Group on Alien Pest Species (CGAPS) web site. http://www.hawaiiinvasivespecies.org/pests. Accessed November 10, 2008; Hawai'i DOA.

The primary connection between vessels entering Kawaihae Harbor will be Honolulu Harbor. As the principal port-of-entry for overseas arrivals by both air and sea, Honolulu serves as the main point of disembarkation and establishment of alien species arriving into the state. O'ahu has the most recorded occurrences of alien terrestrial and freshwater species, though this could be biased by the fact that most biologists live and work on O'ahu (Howarth, et al., 2008).

Kawaihae Harbor is designated as a limited port-of-entry for overseas cargo; therefore, only plants, produce, cut flowers, and seafood from domestic origins are allowed direct entry into Kawaihae Harbor. All other cargo must be inspected in Honolulu before loading onto interisland barges for transport to Kawaihae. Of the alien terrestrial and freshwater species known to be established statewide, 65 percent (n = 844) of plant species, 54 percent (n = 1,786) of arthropod species, 86 percent (n = 43) of mollusk species, 64 percent (n = 70) of vertebrate species, and 37 percent (n = 17) of freshwater fish species have been recorded on Hawai'i Island. Of the four islands studied, Hawai'i Island has the lowest number of recorded alien freshwater fish species (Howarth, et al., 2008).

The transportation of plants between the Hawaiian Islands is regulated by DOA. HAR Title 4, Subtitle 6, Chapter 72 "Plant and Non-Domestic Animal Quarantine Plant Intrastate Rules" details the relevant requirements and prohibitions. Living plants and propagative plant parts (e.g., roots and root stock) are not permitted to be transported between the islands without first being inspected at a DOA plant quarantine office. Plants infested with pests will not be allowed to travel unless the plants are treated with an approved quarantine treatment that can exterminate the pest. If the plant is approved, it is given a certificate of inspection. No plants are permitted to travel without this certificate. DOA maintains a list of plants that cannot be transported between the islands (Howarth, et al., 2008).

4.15.1.2 Alien Marine Species

A total of 343 alien or "cryptogenic" marine species are estimated to occur in Hawaiian marine or brackish waters, consisting of 287 invertebrate species, 24 algae species, 20 fish species, and flowering plant species (Howarth, et al., 2008). Cryptogenic species are of uncertain geographic origin but have either: (1) newly appeared in the region, (2) are associated with known dispersal mechanisms of alien species, or (3) have disjunct geographic distributions; they are considered alien species for the purposes of this study.

An intensive survey of alien marine species has been conducted in the four harbors (Howarth, et al., 2008). Sampling at 20 sites located throughout the four harbors identified a total of 108 alien species. The island distribution of invasive marine species of concern is shown in **Table 4-17: Invasive Marine Species of Concern Noted in Alien Species Biological Assessment.**

Table 4-17: Invasive Marine Species of Concern Noted in Alien Species Biological Assessment

Invasive Species Name	O'ahu	Maui	Kaua'i	Hawai'i
Snowflake coral (*Carijoa riisei*)	Established	Established	Limited Populations	Established
Gorilla ogo (*Gracilaria salicornia*)	Established	Not Present	Not Present	Established
Hookweed (*Hypnea musciformis*)	Established	Established	Limited Populations	Not Present

Source: Howarth, et al., 2008, based on based on information from Coordinating Group on Alien Pest Species (CGAPS) web site. http://www.hawaiiinvasivespecies.org/pests. Accessed November 10, 2008

Of four harbors in the study, Honolulu Harbor had the highest number of alien marine species, 77 in total. Kawaihae had the fewest alien marine species with 23 counted. The low number of

alien species within Kawaihae Harbor may be because Kawaihae Harbor is the most recently constructed harbor, allowing less time for the establishment of alien species and/or Kawaihae is more exposed to oceanic conditions than the other three more enclosed harbors, and is less likely to provide a suitable habitat and food supply for the fouling organisms that dominate alien marine species in the Hawaiian Islands (Howarth, et al., 2008).

4.15.2 Project Impacts from Invasive Species

The spread of invasive species from overseas into the State and between islands from where they are not yet established has the potential to impact multiple resource groups, including biological resources (e.g., threatened or endangered species and their habitats) and the socioeconomic environment (e.g., agriculture and tourism industries). Furthermore, construction activities could disperse resident invasive species.

4.15.2.1 No-Build Alternative

The No-Build Alternative will have no new direct influence on the occurrence or prevention of unintentional transferal of invasive species from overseas between Kawaihae and O'ahu, and by extension, the other Hawaiian Islands. Existing measures now in place to minimize this impact will continue under the status quo.

4.15.2.2 Build Alternatives

Alternative 2 - Minimal Action and Alternative 3 - Partial Action/Land-Side will not change the amount of berthing space and therefore will have a minimal effect on the amount of growth of harbor use.

Alternative 4 - Land-Side Plus Pier 2A Extension, and to a greater degree, Proposed Action - Alternative 5 could increase volumes of barges and other watercraft using the harbor. Therefore, there could be a greater potential risk for invasive species from overseas to arrive on or escape from Hawai'i Island's land and marine ecosystems if measures are not taken to prevent their spread. The species noted to be of greatest concern are listed above in **Table 4-16: Invasive Terrestrial and Freshwater Species of Concern** and **Table 4-17: Invasive Marine Species of Concern Noted in Alien Species Biological Assessment.**

Consistent with Act 202 and HB 1568 cited earlier, Alternatives 3, 4, and 5 will include providing space for a one-acre DOA facility within the harbor for the screening and inspection of goods coming in and out of the harbor. The space provided will be a substantial increase from the area currently allocated for this purpose. Once DOA has built this new facility, their capacity for inspections will be greatly increased and help to mitigate impacts from invasive species, as discussed in **Section 4.15.3: Recommended Mitigation of Impacts from Invasive** Species.

The *Alien Species Biological Assessment for the Statewide Large-Capacity Inter-Island Ferry Environmental Impact Statement* (Howarth, et al., 2008) focused on the unique circumstances that could spread invasive species with an island-to-island publicly-patronized ferry operation. Existing barge operations that arrive and depart from Kawaihae Harbor are already subject to DOA rules and regulations that are intended to control the spread of invasive species. Nonetheless, there are still ongoing pathways for inter-island transport of alien species.

Terrestrial and Freshwater Alien Species

Terrestrial alien species from overseas can be transported in soil and litter (containing seeds, microorganisms, and invertebrates) adhering to vehicles and construction equipment; stowaways boarding the vessel either actively or with contaminated cargo; contaminated produce; and symbiotic species traveling with their associated species. Alien freshwater species can be transported between aquatic freshwater environments on different islands unintentionally with contaminated containers, boats, and sporting equipment (Howarth, et al., 2008).

There are potential impacts associated with invasive terrestrial and freshwater species of concern. While barges that serve Kawaihae are primarily traveling between Hawai‘i Island and O‘ahu, the discussions that follow, taken from the *Alien Species Biological Assessment for the Statewide Large-Capacity Inter-Island Ferry Environmental Impact Statement* (Howarth, et al., 2008) consider the islands of Maui and Kaua‘i because invasives that originated on Hawai‘i Island could eventually make their way to these other islands via O‘ahu and vice versa.

- Bush beardgrass is not yet widespread on O‘ahu and Maui. If spread to these islands, its thick growth could displace native plants. Bush beardgrass is drought tolerant, yet able to flourish in wetter areas. It is also a fire hazard, as dry bush beardgrass promotes fires, after which it quickly re-grows.
- Fountain grass is not yet widespread on O‘ahu, Maui, and Kaua‘i but is widespread around Kawaihae. If spread to these islands, it could outcompete native plants. Fountain grass grows quickly, forming dense stands and can change the structure of dry forests from bushes and trees to grass savannah. It is a poor pasture grass, as it is unpalatable to cattle and can degrade the quality of pasture lands, particularly in dry areas. In addition, fountain grass is a fire hazard, as it is both fire-promoting and fire-adapted, fueling and surviving fires where native plants cannot.
- Pampas grass is not yet widespread on O‘ahu, Kaua‘i, and Hawai‘i Island. If spread to these islands, it could outcompete native plants. Pampas grass also creates a fire hazard in native forests.
- Gorse is not yet widespread on O‘ahu and Kaua‘i. If spread to these islands, it could outcompete native plants. Gorse forms dense, impenetrable thickets that allow nothing else to grow. It can render high pastures totally unproductive and impassable. Gorse is also an extreme fire hazard. Direct competition from gorse and indirect effects of increased fire hazard threaten high-elevation native forests and associated native birds.
- Fireweed is not yet widespread on O‘ahu and Kaua‘i. If spread to these islands, it could cause potential harm to livestock. Fireweed is toxic to livestock when eaten, causing slow growth, illness, liver-malfunction, and even death in severe cases. Although cattle and horses will not normally graze fireweed, it may become a problem in times of feed shortages, as fireweed displaces grasses and maintains toxins even after dying.

- Miconia is not yet widespread on Kaua‘i. If spread to this island, it could completely take over moist and wet forests, forming thick stands and shading out native plants. Miconia also creates an “umbrella” over the watershed, potentially reducing the amount of rainwater that seeps into the watershed. In addition, the shallow root system can promote erosion.
- Varroa mites have recently established themselves on Hawai‘i Island but are not yet well-established on Maui or Kaua‘i. If spread to these islands, there could be adverse impacts to queen bee breeders and honey producers. Varroa mites are one of the most destructive pests of honey bees. They kill the colonies they infest by feeding on the blood of larvae, pupae, and adult bees. The decline in bee population could also reduce plant pollination rates.
- Little fire ants are not yet well-established on O‘ahu or Maui. If spread to these islands, there could be adverse impacts to agriculture and public health, as little fire ants deliver a painful sting with welts that can last for weeks. They infest agricultural fields and farms, damaging crops and stinging workers. Infestations of houses, beds, furniture, and food can also diminish quality of life.
- Nettle caterpillars are not yet well-established on O‘ahu, Maui, and Kaua‘i. If spread to these islands, there could be adverse impacts to agriculture. Nettle caterpillars are primarily agricultural pests. Currently, they have been recorded to attack over 35 different plants in the Hilo area, including various palms and a couple of native plants. Nettle caterpillars can also be a public health concern, as they are covered with spines that produce a painful burning sensation when the spines touch the skin. Since 2010, DOA has been using a biocontrol (a tiny parasitic wasp) to slow the nettle caterpillar’s spread.
- Coqui frogs are not yet well-established on O‘ahu and Kaua‘i. If spread to these islands, they could become a threat to native ecosystems. Coqui frogs eat huge quantities of insects and spiders, competing with native birds for their food supply. In addition, their loud, incessant chirping from dusk to dawn is a major noise nuisance.
- Veiled chameleons are not yet well-established on O‘ahu, Kaua‘i, and Hawai‘i Island. If spread to these islands, they could become a threat to native ecosystems. Veiled chameleons prey primarily on insects but will also eat leaves, flowers, small mammals, and birds. Their high reproductive capacity (each female can lay 30 to 95 eggs, three times per year) coupled with their ability to prey on native insects and birds make them a serious threat.
- Red-vented and red-whiskered bulbuls are not yet well-established on Maui, Kaua‘i, and Hawai‘i Island. If spread to these islands, there could be adverse impacts to agriculture. Bulbuls are major agricultural pests, feeding on fruits, vegetables, flower buds, and insects, and spreading the seeds of invasive plants. Due to their aggressive behavior (chasing other birds and competing for food and space), there is also concern that bulbuls may compete with native birds.

- Small Indian mongooses are not yet well-established on Kaua'i. If spread to this island, they could become a threat to native birds and sea turtles. Mongooses are predators of birds, small mammals, reptiles, insects, fruits, and plants. Their appetites for eggs and hatchlings of ground-nesting species threaten native birds and sea turtles. In addition, mongooses can carry leptospirosis and contaminate water sources with this potentially lethal disease.
- Kariba weed is not yet widespread in aquatic freshwater environments on Maui and Kaua'i. If spread to aquatic freshwater bodies on these islands, there could be adverse impacts to native aquatic ecosystems. Kariba weed reproduces rapidly by fragmentation and is capable of doubling its volume in just a few days to form extensive mats. These dense mats prevent light from reaching aquatic plants, reduce the oxygen content of the water, and seriously degrade water quality. In addition, its aggressive growth can clog waterways and irrigation canals, block passage, and obstruct irrigation pumps.
- Suckermouth catfish are not yet well-established in aquatic freshwater environments on Kaua'i and Hawai'i Island. If spread to aquatic freshwater bodies on these islands, they could become a threat to native aquatic ecosystems. Suckermouth catfish feed mainly on algae and bottom-inhabiting invertebrates and can become very abundant. Males dig nesting tunnels along stream banks and water margins that can greatly increase siltation and erosion of stream banks and earth dams. These fish grow to more than a foot in length and their feeding and behavior severely impact native aquatic life.
- The Coffee Berry Borer was first spotted on Hawai'i Island in 2010. The coffee berry borer is a small beetle native to Central Africa but found in many coffee growing regions of the world, including Central and South America. The beetle bores into the coffee "cherry" to lay its eggs. The larvae feed on the coffee bean, reducing the yield and quality of the bean. Because the larvae are sheltered inside the bean, pesticides have limited effectiveness.

Alien Marine Species

The primary pathways for interisland transport of alien marine species from overseas that will be expected with increased use of Kawaihae Harbor include fouling organisms attached to the vessel; organisms in solid ballast sediment and ballast water discharges; intentional release associated with fisheries and aquaculture; parasites associated with other introductions; organisms associated with commercial oysters; and contaminated fishing, boating, and other marine equipment. Fouling can occur on hulls, seachests, and intakes where seawater is drawn into the vessel for propulsion or auxiliary purposes. Alien marine species that can survive dessication (drying) can also be transported on contaminated recreational and boating gear and nets (Howarth, et al., 2008).

As Hawai'i is primarily an import state, this minimizes somewhat the potential of introducing alien species through ballast water. As cargo is off-loaded from ships, ballast water is taken on rather than discharged. (DOT, 2000). As noted previously, DLNR DAR oversees regulation of ballast water discharges in Hawai'i, and any vessels that carry ballast must follow the state administrative rules for ballast water, have a ballast water management plan specifically for

that vessel, and file a ballast water reporting form with DLNR DAR no later than 24 hours prior to arrival.

The discussions that follow, taken from the *Alien Species Biological Assessment for the Statewide Large-Capacity Inter-Island Ferry EIS* (Howarth, et al., 2008) consider the islands of Maui and Kaua‘i because invasives that originated on Hawai‘i Island could eventually make their way to these other islands via O‘ahu and vice versa.

- Snowflake coral is not yet well-established in marine environments around Kaua‘i. If spread to these waters, it could overgrow corals and hard reef surfaces, preventing other species from growing. Snowflake coral colonies eat large amounts of zooplankton, diminishing the food supply for other species. Colonies growing in deep water could overgrow and kill black coral and large swaths of the bottom-dwelling community.
- Gorilla ogo is not yet well-established in marine environments around Maui and Kaua‘i. If spread to these waters, it could overgrow and kill coral and other seaweeds, as gorilla ogo grows quickly, forming large, thick mats over the reef. It can also prevent young, new corals and seaweeds from attaching to the bottom to grow. In addition, large amounts of gorilla ogo wash ashore on beaches, impacting beach use and potentially tourism.
- Hookweed is not yet established in marine environments around Kaua‘i and Hawai'i Island. If spread to these waters, it could alter the reef ecosystem, as hookweed grows quickly, shading out coral and other seaweeds. Large amounts of hookweed wash ashore and decompose on beaches, releasing a stench and attracting flies, impacting beach use and potentially tourism. Drifting rafts of hookweed can also deter ocean use.

Invasive marine species could be spread during construction as marine construction equipment is brought into and out of Kawaihae Harbor to build piers and other infrastructure. Inadvertent introduction of invasives could be minimized or avoided with inspection and cleaning of construction equipment, vehicles, and materials prior to entering the project area.

4.15.3 Recommended Mitigation of Impacts from Invasive Species

4.15.3.1 Future DOA Inspection Facility

Alternatives 3, 4, and 5 will benefit DOA’s Plant Quarantine Branch in its responsibilities under Chapters 141 and 150A, Hawai‘i Revised Statutes (HRS) for the biosecurity program, Act 236, Session Laws of Hawai‘i 2008 (SB 2850) governing potential invasive species coming into the state, Act 202 (biosecurity), and other relevant legislation discussed above under **Section 4.15: Invasive Species**.

DOA’s primary interests at Kawaihae Harbor are treatment, containment, and food safety.

The primary mitigative element of Alternatives 3, 4, and 5 for addressing biosecurity will include provision of space for a one-acre DOA facility within the harbor for the inspection, quarantine and treatment of goods coming in and out of the harbor. This site is located next to the South Gate customer services area and will provide easy access to Pier 2 and future berths to be built in the long term on the Coral Flats. This area is centrally located and close enough to the main

cargo operations without interfering with the flow of cargo operations. The precise configuration can be changed within the area designated depending on the specific needs of DOA. The space provided will be a substantial increase from the area currently allocated for this purpose. Once this new facility is built, DOA's capacity for inspections will be greatly increased and help to mitigate impacts from invasive species.

DOA's new facility will accommodate existing inspection needs and anticipated future requirements. DOA is considering new interisland inspection rules and regulations and discontinuing less-than-container-load (LCL) cargo inspections by Young Brothers, Ltd. Therefore, future HDOA facilities include areas for future expansion to inspect LCL cargo. LCL accommodations will supplement a larger facility or system of consolidation and deconsolidation facilities for agricultural commodities. The facility will be used for:

- Inspection of incoming containers which transport feed, fertilizer, media or propagative plant material.
- Treatment or holding of containers which have commodities infested with pests.
- Inspection of exported commodities for interisland and out-of-state transport; and
- Consolidation of inspected commodities into containers.

The facility will accommodate:

- A small office for the inspectors.
- Enclosed inspection bays for export and incoming inspection.
- Consolidation area for perishable commodities.
- Additional covered loading docks for overflow or inspection of larger commodities; and
- An area for containers held for treatment or for investigation.

4.15.3.2 Ballast Water Discharges

Under all alternatives, all federal laws or regulations governing ballast water discharges will be followed. Ballast water discharges are overseen by the following agencies:

- US Coast Guard (USCG). As of November, 2011, USCG is in the process of implementing a Ballast Water Discharge Standard (BWDS) rulemaking package intended to control foreign organisms that might hitch a ride to the United States in a ship's ballast water. The proposed standards would establish new procedures for approving onboard equipment to clean ballast water before discharge. For the first time, the regulation would set upper limits for the number of organisms per unit of ballast water. Current rules only require vessels to make mid-ocean ballast exchanges, a control technique that has frequently been attacked as inadequate to prevent the introduction of alien species into U.S. waters.

  The National Invasive Species Act of 1996 (NISA 96), required development of voluntary ballast management guidelines for all ships entering US Waters and required all vessels that enter US territorial waters (with certain exemptions) to manage ballast water according to prescribed measures. In 2004, voluntary guidelines were determined to be ineffective so USCG published regulations and compliance guidance for a national mandatory ballast water management program for all vessels equipped with ballast water tanks that enter or

operate within US waters. Vessels must maintain a ballast water management plan that is specific for that vessel and assigns responsibility to the master or appropriate official to understand and execute the ballast water management strategy for that vessel.

- US Environmental Protection Agency (EPA). In collaboration with USCG, EPA's Environmental Technology Verification (ETV) Program published a final protocol for verification of ballast water treatment systems in 2010.

  EPA also has a permit program dating from 2009 to reduce releases of 26 types of discharges from vessels operating in US waters. Beginning in February 2009, approximately 61,000 domestically flagged commercial vessels and 8,000 foreign flagged vessels have needed to comply with the Final Vessel General Permit. As a result of a court ruling, vessel owners and operators previously exempt from Clean Water Act requirements for 35 years now must obtain a permit. The permit covers non-recreational vessels 79 feet in length or longer, such as cruise ships or oil and cargo tankers, but excludes fishing vessels of any length, unless they discharge ballast water.

4.15.3.3 Construction-Phase Impacts from Invasives

It is recommended that spread of invasive marine species during construction be mitigated through the inspection and cleaning of construction equipment, vehicles, and materials prior to entering the project area. Use of silt curtains could also help to minimize spread of fragments of invasive coral species.

During the design phase of the project, a Hazard Analysis and Critical Control Point (HACCP) planning and implementation effort will manage the risk of spreading invasives.

4.16 Hazardous Materials

The discussion that follows considers potential impacts from hazardous materials, which could endanger construction workers during construction as well as cause contamination of subsurface soils, groundwater, and marine environments. General solid waste is discussed in **Section 7.4: Solid Waste**.

Hazardous materials have been primarily assessed only for previous site improvements, along with corrective actions associated with those improvements. Therefore, for portions of the site that has not been investigated under previous studies, it is unclear:

- What level of contamination is present.
- If soils, groundwater, or coastal waters have been affected.
- If construction workers could be affected upon contact with hazardous materials.
- What level of remediation will be needed to any contamination that is present.

Therefore, it is possible that portions of the site haven't been investigated. In such areas, it is not known if the following are present:

- Buildings with arsenic compounds.

- Fuels, solvents, lubricants, pesticides, and other chemicals that would be typically found in a harbor.
- Leaking electrical transformers (polychlorinated biphenyls).

Since Kawaihae Harbor has been used for many decades, it is possible that spills could have occurred before current protocols for handling hazardous materials were in place.

The discussions that follow document those studies that have been performed for portions of the harbor property.

4.16.1 Existing Conditions

Several studies have been performed in the past to assess the risk of hazardous materials at Kawaihae Harbor.

4.16.1.1 Asbestos and Lead Surveys (1997)

The *Asbestos Survey of Harbor Facilities* (Earth Tech Inc., 1997b) identified asbestos-containing building materials at all commercial harbors. **Table 4-18: Asbestos Survey at Kawaihae Harbor** shows the findings from that survey. As the table shows, some buildings on the harbor property do have asbestos-containing material.

Table 4-18: Asbestos Survey at Kawaihae Harbor

Building	Material Type	Percent Asbestos	Friable	Quantity
North Cargo Shed and Comfort Station	Asbestos-Cement Debris	30% Chrysotile	No	175 sq. ft.
	Corrugated Cementitious Panels	Unknown	No	Unknown
South Cargo Shed	Window Putty	<1% Chrysolite	No	300 sq. ft.

Source: *Asbestos Survey of Harbor Facilities* (Earth Tech Inc., 1997b)

The *Lead Paint Survey of Harbor Facilities* (Earth Tech Inc., 1997a) identified building materials with lead paint at all commercial harbors. **Table 4-19: Lead Paint Survey at Kawaihae Harbor** shows the findings from that survey. As the table shows, some buildings on the harbor property were found to have lead paint.

4.16.1.2 2020 Master Plan Phase I Environmental Site Assessment (2001)

A Phase I Environmental Site Assessment was performed for the *Final Environmental Impact Statement for Hawai'i Commercial Harbors 2020 Master Plan* (Towill, R.M. and Company, 2001). The site reconnaissance at Kawaihae Harbor found only one observable, adverse environmental condition connected with the property: the Big Island Energy Co. site (dba Akana Petroleum) has spilled petroleum product on the surface of the soils in their property. The site is bermed to prevent surface run-off of the product. No information on the presence of a liner to prevent ground water contamination was found at that time.

Records available at the time of the *Final Environmental Impact Statement for Hawai'i Commercial Harbors 2020 Master Plan* identified several operations within the harbor that may

have contributed to contamination on the site, though no conclusive proof could be provided. These operations include approximately 15 large, above ground petroleum storage tanks, dockside petroleum unloading facilities, and pipelines for transporting the petroleum product to the storage tanks.

Table 4-19: Lead Paint Survey at Kawaihae Harbor

Building	Room Equivalent	Component Type	Substrate	Condition	Quantity
North Cargo Shed and Comfort Station	Exterior, Room 1	Wall	Concrete	Good	500 sq. ft.
	Bath 2, Room 1	Support Columns	Wood	Good	3,500 linear ft.
	Room 1	Joist	Metal	Fair	3,000 linear ft.
	Exterior, Room 1	Window Casing	Metal	Fair	2,500 linear ft.
	Room 1 and 2	Pipes	Metal	Good	60 linear ft.
	Exterior, Room 1	Parking Lanes	Concrete	Fair	600 linear ft.
	Exterior	Door Jamb	Metal	Fair	250 linear ft.
	Exterior	Window Stool	Metal	Fair	100 linear ft.
	Exterior	Window Sash	Metal	Fair	500 linear ft.
	Exterior	Door	Metal	Fair	40 sq. ft.
	Exterior	Door Stop	Metal	Fair	30 linear ft.
South Cargo Shed	Exterior	Wall	Concrete	Fair	3,000 sq. ft.
	Exterior, Room 1	Wall	Metal	Good	18,000 sq. ft.
	Exterior	Door Jamb	Metal	Fair	500 linear ft.
	Exterior	Rain Gutter Downspout	Metal	Fair	100 linear ft.
	Exterior, Room 1	Parking Lanes	Concrete	Fair	1,500 linear ft.
	Exterior, Room 1	Support Columns	Metal	Good	5,000 linear ft.
	Exterior, Room 1	Joist	Metal	Good	5,000 linear ft.

Note: The Overseas Terminal Shed was originally included in this survey but is not listed here as it has since been demolished.
Source: *Lead Paint Survey of Harbor Facilities* (Earth Tech Inc., 1997a)

4.16.1.3 HTRW Assessment (2004)

A *Hazardous, Toxic and Radioactive Waste (HTRW) Assessment* was published in April, 2004 for Kawaihae Harbor (BEI Environmental Services, 2004), based on field visits performed in December, 2003. The objective of this Phase I assessment was to identify and assess the existence of or potential for HTRW conditions, which may be located within project boundaries or may affect or be affected by US Army Corps of Engineers (USACE) civil works projects. Specifically, the Corps defines HTRW as any material defined as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, commonly known as "Superfund"), with the exception of dredged material and sediments. Dredged material and sediments qualify as HTRW only if they are within the bounds of a site designated for a response action under CERCLA, or part of a National Priority List (NPL) site under CERCLA. This study did not consider lead paint, asbestos, radon, or methane concerns.

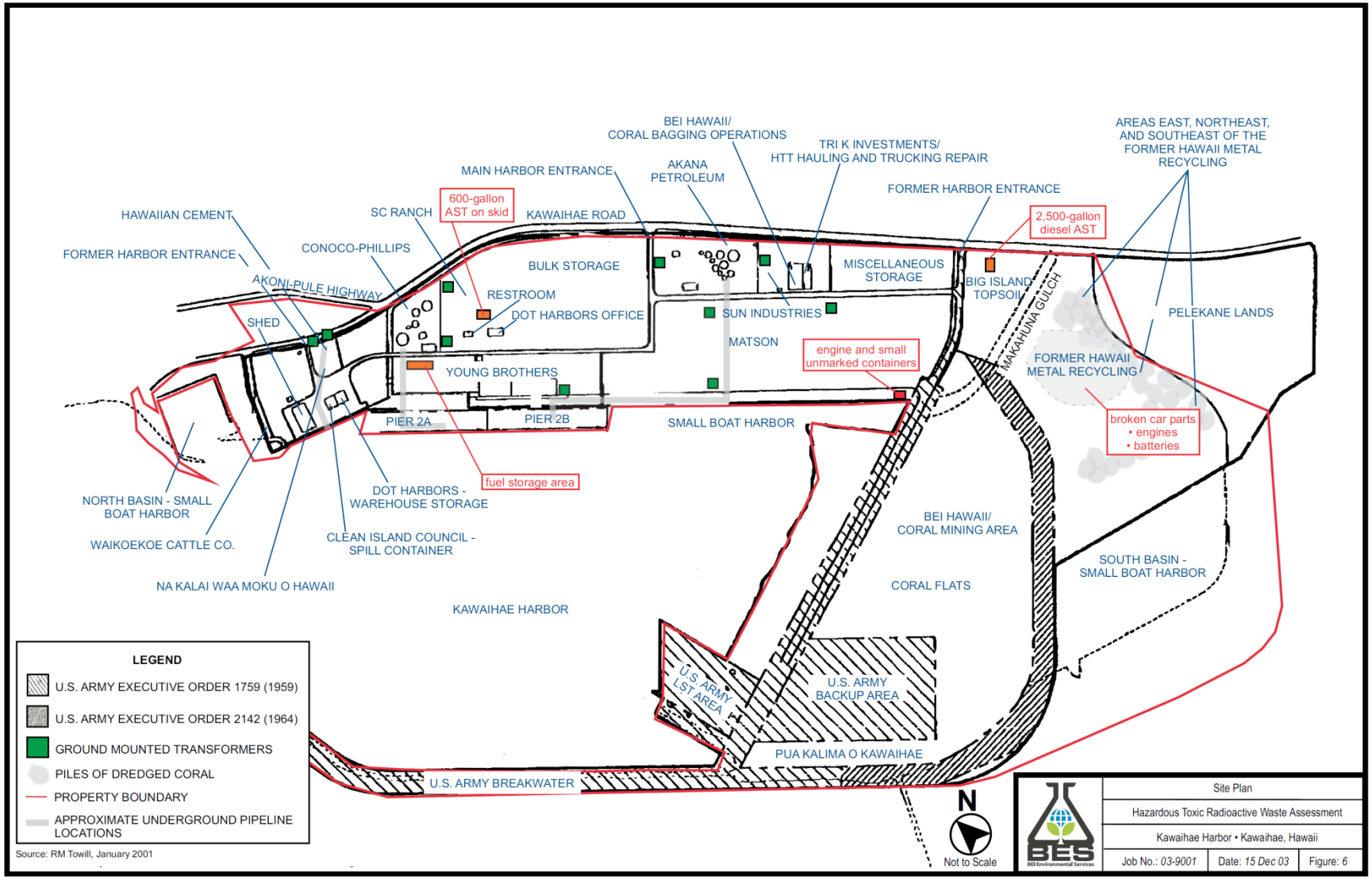
The *HTRW Assessment* identified several HTRW conditions. The properties as identified in the *HTRW Assessment* are shown in **Figure 4-20: Sites Identified in HTRW Phase I Assessment** and are described below:

- A former tenant, Hawai'i Metal Recycling, occupied an unpaved area in the Coral Flats area with broken car parts and abandoned vehicles mixed in with coral fill and had the potential for automotive fluids to have leaked into the soil.
- Areas east, northeast, and southeast of the Hawai'i Metal Recycling operation also contained broken car parts mixed in with coral fill, with potential for automotive fluids, solvents, and heavy metals.
- Sun Industries contained several improperly stored small quantity containers of paint. Brewer Environmental Industries had a former liquid fertilizer plant in this same area over a period of 20-plus years, with potential for fertilizer spills.

The HTRW Assessment also identified "Recognized Environmental Conditions", which were observed or documented in records. Recognized Environmental Conditions on the harbor property included:

- Akana Petroleum, with aboveground storage tanks (ASTs) ranging from 67,200 gallons to 760,200 gallons in size, plus numerous 55-gallon drums, and underground fuel lines. The site was unpaved and secondary containment was limited to a concrete masonry unit (CMU) wall.
- ConocoPhillips Company, contained an enclosed fuel farm with ASTs ranging between 74,750 and 255,000 gallons. The site was unpaved and secondary containment was limited to a concrete masonry unit (CMU) wall. A subsurface pipeline also originates at Pier 2 to convey fuels to the ASTs. A petroleum release was reported in January, 1999 at this site. Remediation had not been completed at the time of the report, so there was impacts to underlying soil and groundwater to an unknown extent.

Figure 4-20: Sites Identified in HTRW Phase I Assessment



Source: BEI Environmental Services, 2004

- Tri K Investments / HTT Hauling and Trucking Repair was a business using various small quantity solvents, paints and oils. A fuel AST, fuel truck, and pile of batteries was documented outside. Fuels and battery acids were identified as potential concerns. Sumps associated with the former Brewer Environmental Industries' liquid fertilizer plant also were identified at this site.
- The "North Basin" (Kawaihae Small Boat Harbor (North)) was identified as a potential concern because of boat wash water and potential crankcase oil drainage by boaters.
- Piers 2A and 2B were noted for fueling operations and potential for spills or leaks.
- Big Island Topsoil (also referred to as Island Topsoil), located in an unpaved area of Coral Flats, was observed with a 2,500 gallon AST. The tank did have secondary containment in a plastic-lined bermed area. (Refer to **Section 4.16.1.4: Island Topsoil Site** below for later investigations at this site.)
- Hawaiian Cement, at the north end of the harbor, contained two underground pipelines for transferring bulk cement pumped in from barges, with potential for cement spills.
- Take's Transportation was on the east end of the harbor in the area labeled "Miscellaneous Storage." There was an oil stain, indicating a past spill. An improperly-stored or abandoned battery was also observed.
- Young Brothers had a documented small (one quart) diesel fuel release from an AST in September, 2000. Fuel storage in drums was observed with secondary containment.

The HTRW Assessment identified "Recognized Environmental Conditions" on adjacent properties:

- A 10,000-gallon diesel fuel AST upgradient and southeast of the harbor.
- A 2,000-gallon underground storage tank at Kawaihae Service Station on Akoni Pule Highway north and upgradient of the site had a documented leak impacting soil and groundwater. At that time, remediation had not been performed to the extent requested by DOH.
- Yamada and Sons Trucking was listed on the Solid and Hazardous Waste Sites (SHWS) list maintained by DOH. The exact location of that site was not known.
- Pioneer Lumber, identified as 0.6 miles north of the harbor, was listed on the SHWS and CERCLIS-No Further Remedial Action Planned (NFRAP) lists. This site was identified as a historical HTRW condition and recognized environmental condition due to poor storage practices of wood treatment chemicals and small quantities of hazardous materials identified in the soil.

4.16.1.4 Island Topsoil Site (2009)

Island Topsoil (also referred to in other studies as "Big Island Topsoil", a company owned by the same owner) is a harbor tenant located immediately south of the south gate along Kawaihae Road. The location of this business (labeled as Big Island Topsoil) was shown in **Figure 4-20:**

Sites Identified in HTRW Phase I Assessment. Island Topsoil did not have a permit for storing diesel fuel on the site, and as a result, removed multiple above-ground tanks and 55-gallon drums of fuel in 2008 when directed by Harbors Staff.

The company subsequently requested a permit to park a mobile diesel fuel tanker on the site. The request was denied when harbors staff observed that the earlier tanks/drums leaked diesel fuel that had been tracked around the site. Ground staining also had been observed after the secondary containment liner was removed. The request would only be approved after adequate remediation was performed.

Testing of near-surface soils was performed in December, 2008. (North Shore Consultants LLC, 2009a). The testing found diesel-range organics (DROs), constituting diesel fuel and similar organic compounds at levels slightly higher than the DOH environmental action level (EAL) for DROs. Heavier residual-range organics (RROs) such as lubricating oils, residual fuels, asphalt, and other organic compounds were found at levels below the EAL. Therefore, cleanup and/or removal of the upper few inches of soil was recommended, with disposal at a permitted disposal facility such as Pu‘uanahulu landfill. Subsequent testing was recommended to ensure that DROs were no longer present in concentrations greater than the EAL.

In January 2009, approximately four cubic yards of soil was removed: an average depth of four inches in an area approximately 12 by 25 feet. (North Shore Consultants LLC, 2009b). Sampling was then performed of exposed near-surface soil only under the area of soil removal. The levels of DROs and RROs were below the respective EALs. However, DOT-H staff requested additional soil and water sampling, including groundwater sampling and soil sampling of areas outside the trailer’s bermed area to document whether there has been any migration of contamination.

No additional study or remediation has been pursued by Island Topsoil since 2009.

While past diesel contamination was partially remediated at the Island Topsoil site (North Shore Consultants LLC, 2009b), it is not clear if contamination has migrated. While no specific construction is proposed for this area under any project alternatives, the potential for migration of contamination is possible.

4.16.2 Project Impacts from Hazardous Materials

4.16.2.1 No-Build Alternative

The No-Build Alternative will not create any new impacts from exposure or release of Hazardous Materials.

4.16.2.2 Build Alternatives

Both asbestos and lead paint were identified in the North Cargo Shed/Comfort Station and in the South Cargo Shed. None of the Build Alternatives intend to demolish these buildings, both of which are located on Pier 1.

Based on the *Final Environmental Impact Statement for Hawai‘i Commercial Harbors 2020 Master Plan* (Towill, R.M. and Company, 2001), the Phase I Environmental Site Assessment

concluded that the only significant potential for environmental liability within the harbor was the presence of the underground storage tanks, above ground petroleum storage tanks, associated piping and loading facilities and surface contamination present at the Big Island Energy Company Co. property (dba Akana Petroleum) (Towill, R.M. and Company, 2001). None of the Build Alternatives intend to modify this portion of the harbor.

A *Hazardous, Toxic and Radioactive Waste (HTRW) Assessment* (BEI Environmental Services, 2004) identified a number of potential recognized environmental conditions and HTRW sites throughout the harbor property, and suggested additional study be performed. It also recommended testing of sediment or sludge in the harbor as well prior to dredging. Several of the areas identified, particularly the locations of HTT Hauling and Trucking Repair; the Hawai'i Metal Recycling Area; areas east, northeast and southeast of Hawai‘i Metal Recycling, and Sun Industries could all be affected by future construction under Alternatives 3, 4, and 5. Other sites of concern associated with petroleum storage are not likely to be directly affected by the Build Alternatives, but still could have had contamination that migrated into areas of construction.

Past diesel contamination was partially remediated at the Island Topsoil site (North Shore Consultants LLC, 2009b), though it is not clear if contamination has migrated. While no specific construction is proposed for this area under any project alternatives, the potential for migration of contamination is possible.

Beyond the footprints of buildings, past investigations noted above were generally limited to Phase I level studies, which involve background data review and visual inspections, but no testing. Therefore, construction could result in the release and spreading of unknown contaminants into the environment that were not identified in the Phase I surveys. Proper procedures for handling and disposing of unforeseen contamination are still essential. Excavation equipment could damage or rupture remnant underground storage tanks or fuel lines if these are not documented or avoided appropriately.

Potential adverse impacts to construction personnel include possible exposure to both known and unknown hazardous materials and wastes present in existing structures or the surrounding environment.

On other harbor projects, the US EPA has expressed concerns about sediment contamination in pier construction areas and has requested sampling. However, pier construction designs under Alternatives 4 and 5 are very preliminary at this time and may not be known until much further in the design phase. DOT-H will work with EPA to address the sediment testing, coring sampling and any other requirements when we are in design phase.

An increase in navigational marine traffic under Alternatives 4 and 5 will increase resuspension of contaminated sediments.

There are specific areas within the Harbor’s boundary where known environmental incidents previously occurred. One such area is currently being occupied by Big Island Topsoil near the proposed new District office. Selected areas, such as this, will have a Phase II Environmental

Site Assessment (ESA) to identify Chemicals of Potential Concern (COPC). Any contaminants present that exceed the regulatory limits will affect future decision-making during construction.

Hazardous Waste will be generated during the demolition and construction activities. DOT-H will need to submit an EPA Form 8700-12, RCRA Subtitle C Site Identification Form to HDOH.

4.16.3 Recommended Mitigation of Impacts from Hazardous Materials

All hazardous materials and substances will be managed in accordance with measures agreed upon by DOH, which may include removal, on-site stabilization, and, if feasible, recycling of hazardous materials to avoid the potential for release into the environment. All materials determined to be hazardous shall be packaged, labeled, marked, stored, transported, treated and disposed of in accordance with Title 40, Code of Federal Regulations (CFR) Parts 260 through 270, 49 CFR 171 through 178, and all other applicable Federal, State and local laws and regulations.

Under all Build Alternatives, areas of known previous environmental incidents will have a Phase II ESA to identify COPC. Any contaminants present that exceed the regulatory limits will affect future decision-making during construction.

Hazardous Waste will be generated during the demolition and construction activities. DOT-H will need to submit an EPA Form 8700-12, RCRA Subtitle C Site Identification Form to HDOH.

Deployment of silt curtains during dredging will contain suspended contaminated sediments.

Under all Build Alternatives, all known utilities and underground pipelines will be identified by the demolition and construction contractor and subsequently disconnected or removed prior to site work. All fuel storage tanks, hazardous materials (including asbestos building material and lead-based paint), and transformers (potential sources for polychlorinated biphenyls (PCBs) present in structures planned for demolition, will be managed in accordance with measures agreed upon by DOH. These measures may include the removal, on-site stabilization, and if feasible, recycling of hazardous materials to avoid the potential for release into the environment.

An inspection will be performed in the harbor buildings to determine if these contaminants are present on the property to assist future construction and demolition projects.

Construction of buried pipelines will be in accordance with established codes such as EPA regulations at 40 CFR 280.43 and DOH Solid and Hazardous Waste Branch Underground Storage Tank Permitting that call for double containment of pipelines carrying hydrocarbons. Corrosion-resistant materials and leak detection stations must be used. Design and construction of new in-ground or underground storage tanks will conform to current regulations concerning berms and liners.

Additional environmental investigation will be undertaken if excavation or earthwork is proposed for areas identified with hazardous materials on the Big Island Energy Co. (dba Akana

Petroleum) site. At the present time, no excavation or earthwork in this area is included as part of the Proposed Action.

A site-specific Health and Safety Plan will be prepared prior to any construction activities requiring earth movement, dredging, or building demolition. The plan will identify safe working conditions for construction in areas of known flammable products and/or vapor contamination. The contractor is required to comply with all conditions of the Health and Safety Plan, which will ensure that workers will not be exposed to unacceptable safety risks. Compliance with the site-specific Health and Safety Plan, DOH regulations, and other permit requirements, will assure that no significant impacts from hazardous materials or site contamination will occur during construction activities or facility operations. Safety measures will include proper techniques for monitoring the presence of flammable vapors in the air, response protocol, personal protective equipment, use of allowable tools, and mechanical measures, as appropriate.

Under the Build Alternatives, the potential for petroleum contamination will be addressed during the project design and construction phases and incorporated into contract and bid documents. Where appropriate, the design and construction phases will be completed in compliance with Guidance on Construction Activities Encountering Area-Wide Petroleum Contaminated Soils (DOH Guidance) and other applicable Federal and State laws and regulations.

The contractor shall be responsible for taking the safety, contamination management, and documentation actions required by the DOH's *Technical Guidance Manual for the Implementation of the Hawai'i State Contingency Plan* (HDOH, 2009). Compliance with the DOH Guidance involves the protection of workers and public health and safety; immediate notification of DOH; documentation of the locations of contaminated areas; and proper management of contaminated excavated materials.

Under the Build Alternatives, it is expected that most of the excavated materials will be returned to trenches and safely covered on-site. However, if some contaminated materials cannot remain on-site, they will be sampled, analyzed, and appropriately disposed of at DOH-approved facilities, which could also include out-of-state facilities if appropriate. Transport of the materials will also comply with State and Federal regulations regarding the transport of hazardous or petroleum contaminated materials. It is expected that a minimal amount of material will be removed from the property. Disposal of the materials will also comply with all State requirements and site-specific permits at the disposal site.

Normal operations at the proposed project sites will not expose the public or site workers to hazardous substances. Tenants on the site will be required to inform workers, through regular training sessions and use of operational manuals, about standard procedures for use of all equipment, especially equipment which may contain or use hazardous materials. Training will identify procedures to follow in the event of equipment malfunction or other emergency. Thus, no significant long-term impacts associated with exposure to hazardous materials are anticipated.

4.17 Light Pollution

Over the past century, use of artificial lighting in communities has been steadily increasing, and there have been physical, social, and biological effects from higher levels of illumination at night. Increasing artificial night sky brightness, or “light pollution” throughout the developed world has had pronounced effects. Light pollution obscures or reduces the visibility of stars and other celestial features and creates an orange haze or glare. Another effect has been on human sleep patterns, or circadian rhythms, with numerous documented human health effects caused by sleep disorders. Light pollution can also be a sign of wasted energy as well (mostly from fossil fuel sources in Hawai‘i) if lighting exceeds what is practicably needed.

Within the State of Hawai‘i, and particularly on the Island of Hawai‘i, light pollution has some additional specific impacts of concern. Seabirds (especially federally-Threatened Newell’s Shearwater fledglings headed toward the sea in the fall) fly at night and may become disoriented or confused by bright lights, as discussed in detail in **Section 4.13.1.1: Birds**. Astronomical observatories on Mauna Kea and Haleakalā can be affected by light pollution obscuring contrast between stars, galaxies and the sky itself. Sea turtle hatchlings on beaches can be attracted to artificial light, thereby disrupting their migration to the ocean.

Hawai‘i County has an Outdoor Lighting Ordinance No. 88-122 as amended in Ordinance No. 11-18 (Section 14-50 of the County Code) to address the design and placement of outdoor lighting fixtures to minimize the adverse effects of light pollution. In addition, Hawai‘i Act 287, (Session Laws of 2012), requires that beginning July 1, 2014, all new outdoor light fixtures installed by state agencies be fully shielded or directed to minimize upward glow.

4.17.1 Existing Conditions

Container terminals typically employ 100- to 120-foot tall mast lights to provide recommended illumination, but at Kawaihae Harbor, 46.5-foot-high light poles are used in conjunction with 180-watt low-pressure sodium lights in order to comply with the Hawai‘i County Outdoor Lighting Ordinance and minimize adverse effects. Light fixtures are shielded to ensure that light is directed to the ground only, avoiding “spill-over.”

The current operational profile at Kawaihae Harbor restricts full power lighting to the very limited hours of active operations, with “twilight” lighting levels used for inactive periods (using only one light per pole), so most lights are only switched on when the yard becomes active.

4.17.2 Impacts of Alternatives on Light Pollution

4.17.2.1 No-Build Alternative

The No-Build Alternative will have no effect on light pollution, but rather will keep the existing light infrastructure in place.

4.17.2.2 Build Alternatives

With the exception of Alternative 2 - Minimal Action, all Build Alternatives will increase in lighting at Kawaihae Harbor as new light poles are incorporated into the design of the yard

improvements. Mitigation will be actively pursued to minimize the adverse effects of additional lighting

Any new lighting provided on harbors property as a result of the Build Alternatives will incorporate County of Hawai‘i lighting standards for shielding to ensure that light is directed to the ground only. As noted above, light poles will be limited 46.5 feet-high light. Lighting used will be lower-power (180 Watt) monochromatic and low-pressure sodium luminaries (as opposed to the more common full-spectrum and high-pressure sodium lighting), which provides high contrast with sharply reduced brightness and glare, yet the yellow light does not attract insects and is not believed to be used for avian navigation.

The design will also consider use of custom-designed light fixtures with “top-visor” shielding to minimize the potential for stray light up-scatter and side-scatter, so that the bulb is not visible at lamp height from the side. This will minimize light pollution and spill-over of light and is also needed to mitigate effects of nighttime lighting on astronomical observatories and on seabirds.

The light level for the wharf area shall be 5 foot-candles average and 2 foot-candles minimum on the wharf. The lighting system will afford both automatic and manual control of lighting, both at full lighting and reduced “security light levels” (20 percent level).

4.17.3 Recommended Mitigation

As noted above, a number of design features will mitigate the effects of the project on light pollution. All designs will comply with Hawai‘i County’s Outdoor Lighting Ordinance No. 88-122, as amended in Ordinance No. 11-18 (Section 14-50 of the County Code). In addition, Hawai‘i Act 287, (Session Laws of 2012) requires that beginning July 1, 2014, all new outdoor light fixtures installed by state agencies be fully shielded or directed to minimize upward glow. Measures that will be considered include the following:

- Limiting light poles to 46.5-foot heights already in use elsewhere in the harbor.
- Use of lower-power (180 Watt) monochromatic and low-pressure sodium lighting.
- Use of custom-designed light shielded fixtures.
- Limiting light levels and hours of use to the minimum levels allowable under Occupational Safety and Health Administration (OSHA) worker safety and security. Union approval may also be required.

CHAPTER 5: ECONOMIC AND SOCIAL FACTORS

This chapter discusses the project's effects on the economies of the State of Hawai‘i and Hawai‘i County, as well as social factors such as demographics, housing, and character of community on Hawai‘i Island.

Economic growth in Hawai‘i County has been hindered by the financial crisis of 2008, rising energy prices and the resulting slowing of tourism. The State of Hawai‘i is also experiencing a fiscal crisis that will likely delay recovery for the local economy. Nonetheless, longer-term expectations are for economic growth to rebound, and the ability of Kawaihae Harbor to serve Hawai‘i Island's maritime needs in the future will remain of great importance.

The chapter that follows covers the existing conditions, the anticipated impacts, and the proposed mitigation for effects on the economic climate and social setting. Refer to **Table 5-1: Summary of Impacts on Economic and Social Factors and Recommended Mitigation** for a brief summary of the rest of the chapter.

Table 5-1: Summary of Impacts on Economic and Social Factors and Recommended Mitigation provides recommended mitigations. Actual mitigations will be determined by the appropriate permit/approval process.

5.1 Economic Factors

Hawai‘i County has transformed over time from a plantation-based economy to one that is diversified today. Tourism, diversified agriculture, construction, astronomy, export (e.g., deep-sea bottled water) and local small businesses have replaced sugar as the basis of the economy. Hawai‘i Island is serviced by the two commercial harbors: Hilo and Kawaihae. It is also serviced by modern airport facilities in Keāhole (near Kailua-Kona) and in Hilo. The island's population is located primarily on the west side in Kailua-Kona and on the east side in Hilo. Waimea, approximately 12 miles from Kawaihae Harbor, and Waikoloa Village, approximately 16 miles from the harbor, are the closest population centers, along with resort properties that parallel the South Kohala coast. Detailed information on the distribution of population in the study area is outlined in **Section 5.4: Demographics and Environmental Justice**.

The largest industries employing Hawai‘i County residents are in government, trade (both retail and wholesale) and leisure/hospitality services. County estimates for the year 2010 had 59,875 wage and salary jobs county-wide. The Trade/Transportation/Utilities sector was the highest employment sector with 12,763 jobs. Government was close behind as the second highest sector with 12,700 jobs, and Leisure/Hospitality was the third-largest employment sector with 12,467 job. The retail portion of the Trade/Transportation/Utilities sector accounted for approximately 8,658 jobs. (County of Hawai‘i, Department of Research and Development, 2010). The unemployment rate in 2010 was 9.7 percent; this has since grown to over 10 percent in subsequent monthly statistics (County of Hawai‘i, Department of Research and Development, 2011).

Table 5-1: Summary of Impacts on Economic and Social Factors and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
5.1	**Economic Factors**	• Minimal direct effect in the short term. • Longer-term, limitations caused by reduced efficiency at the harbor will have an adverse impact through higher costs for goods and lower productivity.	• Minimal direct effect in the short term. • Longer-term, limitations caused by reduced efficiency at the harbor will have an adverse impact through higher costs for goods and lower productivity.	• Minor effect on harbor efficiency as no measurable capacity added other than land-side improvements. • Lower-level benefit from direct, indirect and induced jobs created from construction. • Lower-level effect on general excise tax revenue • Minimal changes to tax revenues at County level. • Minimal benefit to local economy. • Modest benefit to serving statewide goals for greater energy independence.	• Moderate benefit to harbor efficiency as capacity added from Pier 2A extension improvements. • Moderate benefit from direct, indirect and induced jobs created from construction. • Moderate benefit from general excise tax revenue. • Minimal changes to tax revenues at County level. • Moderate benefit to local economy. • Moderate benefit to serving statewide goals for greater energy independence.	• **Greatest economic benefit from greater efficiency at the harbor.** • **Highest number of direct, indirect, and induced jobs created from construction activity at the harbor.** • **Highest Increase in general excise taxes from construction activity.** • **Minimal changes to tax revenues at County level.** • **Greatest positive effect on local economy.** • **Highest benefits to Hawai'i's Statewide goals for greater energy independence.**	• No mitigation is warranted.
5.2	**Social Factors**	• None.	• Limited impacts to community in immediate proximity to harbor. • No acquisition of land or relocation of residents or businesses.	• Limited impacts to community in immediate proximity to harbor. • No acquisition of land or relocation of residents or businesses.	• Limited impacts to community in immediate proximity to harbor. • Potential for increased development spurred by harbor improvements by DHHL and QEL, though their plans are limited by available water. • No acquisition of land or relocation of residents or businesses.	• **Limited impacts to community in immediate proximity to harbor.** • **Potential for increased development spurred by harbor improvements by DHHL and QEL, though their plans are limited by available water.** • **No acquisition of land or relocation of residents or businesses.**	• No mitigation is warranted.

Table 5-1: Summary of Impacts on Economic and Social Factors and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
5.3	**Public Shoreline Access**	• No changes from what is present.	• Access will be maintained to shoreline areas. • Fencing along the unimproved perimeter road will prevent access to security perimeter. • Future transfer of the perimeter road to DLNR-DOBOR will provide them the opportunity to improve the roadway to the Kawaihae Small Boat Harbor (South) in a separate action.	• Access will be maintained to shoreline areas. • Fencing along the unimproved perimeter road will prevent access to security perimeter. • Future transfer of the perimeter road to DLNR-DOBOR will provide them the opportunity to improve the roadway to the Kawaihae Small Boat Harbor (South) in a separate action.	• Access will be maintained to shoreline areas. • Fencing along the unimproved perimeter road will prevent access to security perimeter. • Future transfer of the perimeter road to DLNR-DOBOR will provide them the opportunity to improve the roadway to the Kawaihae Small Boat Harbor (South) in a separate action.	• **Access will be maintained to shoreline areas.** • **Fencing along the unimproved perimeter road will prevent access to security perimeter.** • **Future transfer of the perimeter road to DLNR-DOBOR will provide them the opportunity to improve the roadway to the Kawaihae Small Boat Harbor (South) in a separate action.**	• No mitigation is warranted.
5.4	**Demographics and Environmental Justice**	• None.	• Not expected to disproportionately impact low-income or minority communities. • Proposed Action complementary with DHHL plans for future development.	• Not expected to disproportionately impact low-income or minority communities. • Proposed Action complementary with DHHL plans for future development.	• Not expected to disproportionately impact low-income or minority communities. • Proposed Action complementary with DHHL plans for future development.	• **Not expected to disproportionately impact low-income or minority communities.** • **Proposed Action complementary with DHHL plans for future development.**	• No mitigation is warranted.
5.5	**Right of Way and Land Acquisition**	• None.	• None.	• Kawaihae Road improvements will result in widening of roadway right of way in the makai direction, all of which is in HDOT ownership. • Alignment designed to avoid property with burials.	• Kawaihae Road improvements will result in widening of roadway right of way in the makai direction, all of which is in HDOT ownership. • Alignment designed to avoid property with burials.	• **Kawaihae Road improvements will result in widening of roadway right of way in the makai direction, all of which is in HDOT ownership.** • **Alignment designed to avoid property with burials.**	• No mitigation is warranted.

The estimated median household income in 2009 was $55,645 in Hawai‘i County compared to $64,661 statewide. Hawai‘i County had an estimated 13.3 percent of its residents below the poverty line compared to 9.3 percent statewide (State of Hawai‘i DBEDT, 2011).

An economic impact study was performed for the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update.* That study, entitled *Economic Impact of Harbors on the Island of Hawai‘i* (SMS, 2010) considered the effects of improvements to both Hilo and Kawaihae harbors on Hawai‘i Island and also considered the 2035 timeline for the master plan improvements. While the Proposed Action only covers Kawaihae Harbor over a shorter timeline, many of the benefits of harbor improvements identified in the *Economic Impact of Harbors on the Island of Hawai‘i* (SMS, 2010) are still expected to accrue to some degree.

The role of commercial harbors system in the United States (US) is to promote the flow of waterborne commerce and to facilitate economic growth by maintaining a smooth flow of imports and exports. The US commercial harbors handle more than two billion tons of domestic and foreign cargo annually in this decade. By 2020, the total volume of cargo shipped by water is expected to be double that of the 2001 volume (SMS, 2010).

Hawai‘i, because of its geographic isolation, depends almost entirely on ocean shipping to transport its essential commodities (e.g., food, clothing, fuel, building materials, automobiles, etc.). More than 80 percent of all consumer goods sold in the state are imported. Of that total, over 98 percent enter through the commercial harbor system (Lee and Olive, 1994). The list of commodities and retail items imported from outside the state and consumed in Hawai‘i is extensive. An estimated 85 to 90 percent of the food consumed in the State of Hawai‘i is imported (SMS, 2010). The majority of cargo destined for Kawaihae arrives in Honolulu first and then is transshipped to Kawaihae.

Exports, while still a critical aspect of Hawai‘i’s economy, are limited to flowers, nursery products, tropical fruits, macadamia nuts, a few clothing items, and waste products. The majority of local products (e.g., pineapple, sugar, molasses, livestock, diversified agriculture, etc.) moves between the islands by vessels. Ensuring adequate, efficient, and safe harbor facilities is vital to the health and future of Hawai‘i’s economy. If its harbors are not upgraded, the loss of real gross domestic product (in 2007 dollars) could amount to more than $50 billion by 2030. (Laney, 2007)

An overall conservative estimate of the economic benefits provided by Hawai‘i Island’s harbors is shown in **Table 5-2: Economic Characteristics of Hawai‘i County's Maritime Industry,** 2005. In all, the maritime industry contributed more than $114 million in value added to the county’s Gross County Product (SMS, 2010).

Trends over the past two decades are shown in **Table 5-3: Economic Characteristics of Hawai‘i County's Harbor Industry,** 1992-2009. As the table shows, growth was fairly stable until 2002, followed by a period of relatively high growth through 2007, and then a recession-based slowdown (SMS, 2010).

Regardless of the time period, the industry’s value added grows faster than either its payroll or its imports. That is, for a given increase in demand, the maritime industry delivers a greater

Table 5-2: Economic Characteristics of Hawai'i County's Maritime Industry, 2005

Characteristic	Measures	Ocean Transport	Commercial Fishing	Support Activities	Total
Hawai'i-made Goods/Services Purchased from Maritime Industry	$ Millions (2005)	$57.8	$0.2	$20.6	$78.6
Goods/Services Purchased by Consumers	$ Millions (2005)	$139.5	$15.1	$110.8	$265.4
Total Industry Value	$ Millions (2005)	$197.3	$15.3	$131.4	$384
Maritime "Value Added" Countywide to Gross State Product	$ Millions (2005)	$32.2	$0.4	$81.8	$114.4
Labor Income	$ Millions (2005)	$14.2	$0	$51.5	$65.7
Imports	$ Millions (2005)	$30.6	$0.01	$8.4	$39.1
Jobs	People	346	15	1,625	1,986

Source; SMS, 2010

Table 5-3: Economic Characteristics of Hawai'i County's Harbor Industry, 1992-2009

Characteristic	Measures	1992	2002	2005	2009
Hawai'i-made Goods/Services Purchased from Maritime Industry	$ Millions (2010)	$29.2	$33.7	$107.2	$130.8
Goods/Services Purchased by Consumers	$ Millions (2010)	$27.6	$67.9	$178.5	$207.1
Total Industry Value	$ Millions (2010))	$56.8	$101.6	$285.7	$337.9
Maritime "Value Added" Countywide to Gross State Product	$ Millions (2010)	$19.3	$64.1	$114.5	$134
Labor Income	$ Millions (2010)	$13.3	$40.9	$65.7	$80.2
Imports	$ Millions (2010)	$18.5	$14.8	$39	$50.4
Jobs	People	1,500	1,929	1,986	2,423

Source; SMS, 2010

increase in contribution to the Gross County Product. This suggests a relatively efficient operation with a high capital to labor ratio (SMS, 2010).

5.1.1 Economic Impacts of No-Build Alternative

The No-Build Alternative is expected to have a minimal direct effect on the economy of Hawai‘i Island. It will not create any construction jobs. There will be no direct economic benefit to the larger community other than growth in cargo that will occur anyway, regardless of whether improvements are made to Kawaihae Harbor.

However, as noted in *Economic Impact of Harbors on the Island of Hawai‘i* (SMS, 2010), if the growth in the supply of commercial harbor services were curtailed, the first sector to be impacted would be local businesses. Construction costs would rise due to a shortage of building materials. Retailers and wholesalers would face the challenge of insufficient supply and dramatically higher costs associated with air transportation. Businesses of all types would experience inadequate supply, higher operating costs, and lower productivity. The cost of doing business would rise and the additional expenses would be passed along to the Hawai‘i consumer. If unchecked, the harbors slowdown could cause an economic recession.

Harbors throughput is expected to grow by an average of two percent per annum between 2010 and 2035. A calculation was made on the effects if the growth were held to one percent annually between 2005 and 2035. By 2015, Hawai‘i Island harbors’ output was calculated as losing $34 million annually in economic activity (SMS, 2010). Similar large losses would be expected from the Hawai‘i County Gross County Product and the Hawai'i Gross State Product.

5.1.2 Economic Impacts of Build Alternatives

The *Economic Impact of Harbors on the Island of Hawai‘i* report (SMS, 2010) determined that for every $10 million increase in the output of the harbors industry, it will produce an increase of $21.1 million in economic activity across Hawai‘i County. It will produce about 42 new jobs and increase the Gross County Product by $7.4 million dollars in one year. Therefore, increased efficiency in harbor output will return double the investment in economic activity.

Regarding jobs and income, three broad types are distinguished:

- Direct jobs are immediately involved with construction of a project or with its operations.
- Indirect jobs are created as businesses directly involved with a project purchase goods and services in the local community.
- Induced jobs are created as workers spend their income for goods and services.

Given the nature of the Build Alternatives, one economic effect of the project will be construction-related, such as new construction jobs and income. The specialized construction jobs would typically consist of tradesmen, mechanical operators, supervisors, etc. Any direct construction jobs created will also stimulate indirect and induced employment within other industries on the island such as retail, restaurants, material distributors, and other related businesses supporting the construction industry.

These new jobs will generate additional personal income for construction workers. Personal income is defined as the wages paid to the direct construction workers or operational employees associated with a development. It is anticipated that these construction jobs will likely be filled by residents from Hawai'i Island employed within the construction industry. Indirect and induced income will also be generated from the Build Alternatives.

While all the Build Alternatives will involve construction, there is a wide range of estimated costs. As shown in **Table 3-3: Estimated Construction Cost of All Potential Project Actions**, the estimated costs for construction could range from $45.1 million under Alternative 3 - Partial Action/Land-Side to $78.0 million for Alternative 4, and $97.8 million under Alternative 5 - Proposed Action. (The Minimal Build Alternative 2 will only require $1.3 million in construction). The economic benefits that will accrue from construction employment will be expected to be generally proportional to the overall cost.

Post-construction, it is likely that there will be increased activity at Kawaihae Harbor, particularly under Alternative 4 - Land-Side Plus Pier 2A Extension and Alternative 5 - Proposed Action, which will increase the capacity of the harbor's berthing areas and also increase the efficiency of harbor operations, potentially reducing rate of growth of new jobs that will be needed to be filled. Nonetheless, there are likely to be some additional jobs created, both within the harbor, and also indirectly from increased economic activity.

Fiscal Factors

Fiscal impacts associated with the Build Alternatives will primarily involve slightly increased tax revenue generated to the State of Hawai'i. Tax revenue sources for the State will be composed primarily of general excise taxes (GET) on development costs and construction materials, corporate income tax, and GET on construction income spent by workers. In addition, GET taxes on indirect and induced income spent stimulated by the spending of direct income will also contribute new revenues to the State. Fiscal effects based on construction cost would be expected to be generally proportional to the cost.

Since Hawai'i County revenues are primarily limited to property tax revenues, there should be minimal changes to the County revenues as no new land will be acquired.

None of the Build Alternatives will be expected to generate any new in-migrant residents to Hawai'i Island. Thus, there should be minimal, if any, effect on State and County operational expenditures for public services.

5.2 Social Factors

The Kawaihae Community Plan element of the *South Kohala Community Development Plan* (CDP) (County of Hawai'i, 2008) noted that the majority of people who work in the Kawaihae area do not live in the area. Instead, these people commute to work from neighboring communities such as Waimea or Waikoloa.

The Kawaihae population figures in the CDP were estimated by adding population totals for census block groups that were located around the Kawaihae Harbor area. The estimated population of Kawaihae and the nearby Mauna Kea Resort stated in the CDP was 321 people,

which was approximately 2.4 percent of the entire South Kohala population (County of Hawai‘i, 2008). The Census Tract that includes Kawaihae is 217.04, and has a 2010 census population of 8,087 persons. Census Tract 218 covers the North Kohala area, which is close proximity to Kawaihae. It has a 2010 census population of 6,322 persons.

Kawaihae Harbor is the main development feature of the area, with Pu'ukoholā Heiau National Historic Site (NHS) located immediately to the south. A small commercial center, containing a restaurant and several smaller stores is located on across Kawaihae Road from the commercial harbor. Small residential subdivisions are also located in the Kawaihae area to the south and east of the commercial center (County of Hawai‘i, 2008).

Up the road to the north of the harbor is the Kawaihae Industrial Park situated on Department of Hawaiian Home Lands (DHHL) property. The DHHL industrial park is connected to the Lālāmilo Water System. However, the industrial park was only allotted nine water meters by Hawai‘i County, greatly limiting future development (County of Hawai‘i, 2008).

DHHL’s long-term plans can be seen in **Section 9.10: Department of Hawaiian Home Lands Kawaihae Regional Plan**. Lands mauka of Kawaihae Harbor, the ahupua‘a known as Kawaihae I, are owned by the DHHL, a total of 10,000 acres. Of these, 356 acres are designated to be income producing, industrial, and commercial. The Kawaihae Industrial Park is being proposed as 141 acres and implemented in three phases spanning between 2009 and 2024. There are 221 residential lots on 214 acres in two areas, Kailapa and Na Pua Ka ‘Ilima. The majority of lands are designated General Agriculture, comprising 1,502 acres, mostly on lease to Kahua Ranch for cattle grazing as well as for ecotourism (e.g., recreational vehicle, horseback riding). That lease expires in 2011.

Water from the Lalamilo Water System poses a limitation on future development. At the mid-elevations of roughly 50 to 250 feet above sea level, there are many archeological and historical sites, which further limit the type and location of development. Nevertheless, there are important plans in place worth noting. In 1995, DHHL completed a ten-year master plan, but very little was implemented due to the lack of potable water. DHHL adopted its *Hawai‘i Island Plan* in 2002 and its *Kawaihae Regional Plan* in 2010 with a twenty year horizon. The *Kawaihae Regional Plan*’s focus is finding opportunities and facilitating partnerships to develop its Kawaihae lands.

Phase I of the draft DHHL Regional Plan focuses on constructing amenities for the existing residential communities, including mail delivery, day care, and a community park. Phase II will create 132 half acre residential lots and 54 acres of new industrial lots adjacent to the harbor. Phase III will construct an additional 300 residential lots, a school, park, church/community site, and a 39 acre town center. In addition, 55 acres of industrial lands will be developed. Phase IV completes the residential lots and adds 38 acres of town center commercial land.

Queen Emma Foundation (QEF), the investment arm of Queen Emma Trust, owns the entire 10,200 acre ahupua‘a of Kamehameha II, which is immediately adjacent to Kamehameha I, the ahupua‘a owned by DHHL. There is a diversity of habitat zones, and major features of the ahupua‘a include: Pu'ukoholā Heiau NHS; the historic residence of John Young; 118 acres of

coastal lands including Spencer Bay and Maumae Bay white sand beach; 88 acres of land classified as commercial/industrial; and Important Agriculture Lands and Forest Reserve.

The Queen Emma Foundation *Ahupua‘a Strategic Master Plan* described in **Section 9.11: Queen Emma Foundation Ahupua‘a Strategic Management Plan** was prepared as a guide for decision-making by the land trust. The Foundation’s stated mission is to “balance endowment income generation with the need for heritage preservation objectives.” Elements of the master plan include: Ahupua‘a Heritage Trail; for the makai lands, a Coastal Health & Wellness Center; for the Midland/Upland lands, cabins and lodges; for Kawaihae, a commercial/industrial village; residential communities in Kawaihae Village and/or Mauna Kea mauka.

5.2.1 Social Impacts of No-Build Alternative

The No-Build Alternative will not create any new direct social impacts.

5.2.2 Social Impacts of Build Alternatives

None of the Build Alternatives are expected to require additional workers to come to Hawai‘i Island to construct the facility; local employment will be able to serve construction needs. There will be no impacts to infrastructure that will prevent existing residents from continuing to receive services.

The Build Alternatives, particularly Alternatives 4 and 5, will have some limited impacts on the small Kawaihae community, though there are few residents in close proximity to the harbor. There could be additional development encouraged in the area by increased activity at the harbor with greater berthing capacity under Alternatives 4 and 5, but to a large degree, development will be constrained by limited amounts of available potable water as discussed in **Section 9.10: Department of Hawaiian Home Lands Kawaihae Regional Plan** and **Section 9.11: Queen Emma Foundation Ahupua‘a Strategic Management Plan**.

None of the Build Alternatives require the acquisition of any land or relocation of any residents.

5.3 Public Shoreline Access

Pre-assessment comments were received from the Hawai‘i County, Planning Department asking the preparers of this *Improvements to Kawaihae Commercial Harbor Environmental Assessment* (EA) to consider the issue of shoreline access and the potential impacts of the Proposed Action on access. While all beaches and shoreline areas are open to public access in Hawai‘i, the locations of public accesses are often limited. Chapter 34 of the *Hawai‘i County Code* outlines procedures for the provision of public access when lands are subdivided into six or more lots or parcels.

General public shoreline access is offered within both secured and unsecured portions of the harbor, and both recreational and commercial uses co-exist on the harbor property.

At Kawaihae Harbor, a number of recreational groups and individuals utilize shoreline areas associated with the Coral Flats, as described in greater detail in **Chapter 8: Public Recreational Facilities**. Currently, visitors looking to access shoreline areas within the Coral Flats must enter

either the harbor’s Main Gate or the South Gate (depending upon which is currently open for access) and use the internal access roadway, remaining outside the maritime secure area to access the Coral Flats area. Open unpaved pathways along the north side of Coral Flats, the western edge of Coral flats, and the perimeter roadway along the south side of Coral Flats are used to access different areas.

Current moorings for small boats are slated to be relocated in the future to the Kawaihae Small Boat Harbor (South). The State of Hawai‘i, Department of Transportation, Harbors Division (DOT-H) took over management of the temporary small craft mooring area located near Pier 2C from the Hawai‘i Department of Land and Natural Resources, Division of Boating and Ocean Recreation (DLNR DOBOR) at the beginning of 2011, and has issued 17 temporary month-to-month mooring permits to boaters who already had existing permits with DLNR DOBOR.

When military operations are taking place at the US Army’s LST/LSV ramp, public access to the loading docks and the Coral Flats area is managed by military soldiers stationed at strategic locations to maintain safety and to prevent unsupervised cross-traffic. Military operations occur up to four times per year. The LST/LSV ship lands at the ramp, then unloads and stages vehicles and equipment for transport to the Pohakuloa Training Area. After all of the vehicles and equipment are consolidated, they travel from the staging area in front of the LST/LSV ramp, down the easement that parallels the shoreline of the Coral Flats area and exit through the South Gate. The passage of military vehicles is metered appropriately to minimize traffic disruptions on public roadways. The whole process takes about six hours to complete. The process is reversed when vehicles and equipment are shipped back.

5.3.1 No-Build Alternative

The No-Build Alternative will not alter access from what is present today.

5.3.2 Build Alternatives

All Build Alternatives will retain access to the same locations that are afforded to the public today. DOT-H will transfer the unimproved perimeter road and the small boat harbor area in the Coral Flats to DLNR DOBOR. The permanent Hawai‘i District Office will be located outside of the maritime secure area, making it easier for the public to access this facility. In the future, DLNR DOBOR may improve the perimeter roadway in a separate project to better access the Kawaihae Small Boat Harbor (South) for recreational users and the public, outside of the maritime secure area. All Build Alternatives fencing along the perimeter road that will be designed to separate the commercial harbor activities from the recreational boating facilities.

5.4 Demographics and Environmental Justice

5.4.1 Environmental Justice

The State of Hawai‘i enacted Act 294 in 2006, calling for the Chapter 343 process to consider Environmental Justice in the context of Hawai‘i’s unique ethnic composition, where no group is a “majority.” The State Environmental Council subsequently prepared guidance to address this “no-majority” condition (Kahikikolo, 2008). The guidance recommended consideration of

project effects on “under-represented populations,” specifically Native Hawaiian, minority, and/or low-income persons.

The definition of Environmental Justice in Hawai‘i in this reference is as follows:

> Environmental justice is the right of every person in Hawai‘i to live in a clean and healthy environment, to be treated fairly, and to have meaningful involvement in decisions that affect their environment and health; with an emphasis on the responsibility of every person in Hawai‘i to uphold traditional and customary Native Hawaiian practices that preserve, protect, and restore the ‘aina for present and future generations. Environmental justice in Hawai‘i recognizes that no one segment of the population or geographic area should be disproportionately burdened with environmental and/or health impacts resulting from development, construction, operations and/or use of natural resources.

DOT-H’s Office of Civil Rights (OCR) *Title VI Plan* (January 18, 2009) outlines its departmental policies and procedures for compliance with federal and State Title VI/Environmental Justice requirements.

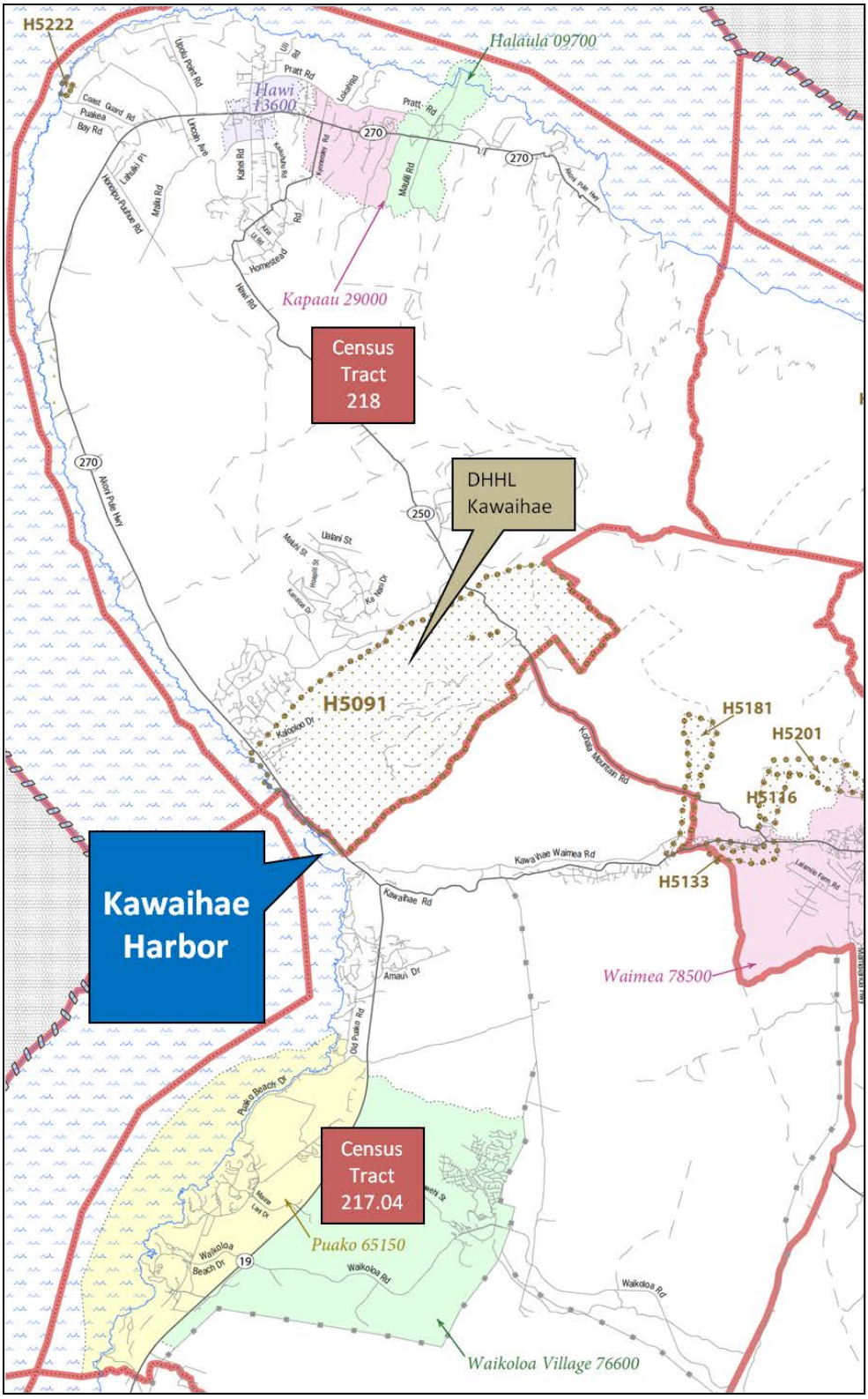
At public information meetings, the public is requested to complete voluntary Title VI forms requesting gender and ethnicity data. The purpose of the voluntary Title VI forms is to help DOT assess whether outreach strategies to engage a representative mix of community members are effective. Based on the data gathered, if appropriate, DOT may then develop different outreach strategies to better inform the community of upcoming public meetings.

Kawaihae Harbor is located within Census Tract 217.04 in the 2010 census. This census tract covers the immediate area around Kawaihae Harbor as well as the Puakō and Waikoloa areas. Census Tract 218 covers all of North Kohala, including the Hāwī and Kapa‘au areas and also includes the Department of Hawaiian Home Lands’ (DHHL) Kawaihae unit. Census Tracts are shown in **Figure 5-1: 2010 Census Tracts Near Kawaihae Harbor**.

The racial breakdown of the two census tracts as compared to the state and county is shown in **Table 5-4: Racial Breakdown of Census Tracts 217.04 and 218 Compared to State and County**. In general, both census tracts have a higher percentage of white residents than does the county or state, particularly tract 217.04, which is 61 percent white (for persons identifying only one race). Census tract 217.04 also has a much lower percentage of Asian residents than either the county or state. Census Tract 218, in contrast, has a similar percentage of Asian residents to the state level.

The percentage of Native Hawaiian and Other Pacific Islanders within both census tracts is roughly on par with the state and county, with a slightly lower percentage than the county for persons of one race but a slightly higher percentage than the state as a whole. The presence of DHHL’s population in Census Tract 218 does not result in a large percentage of Native Hawaiian residents as a whole for the census tract, because DHHL’s community is still small (103 homesteaders in 2010).

Figure 5-1: 2010 Census Tracts Near Kawaihae Harbor



Source: US Census Bureau, 2010 Census

Table 5-4: Racial Breakdown of Census Tracts 217.04 and 218 Compared to State and County

Racial Group	State of Hawai'i		Hawai'i County		Census Tract 217.04 Puakō, Waikoloa, Kawaihae		Census Tract 218 Hāwī, Kapa'au, DHHL Kawaihae	
	Persons	Percent	Persons	Percent	Persons	Percent	Persons	Percent
Total Persons:	**1,360,301**		**185,079**		**8,087**		**6,322**	
Population of one race:	1,039,672		130,544		6,413		4,102	
White alone	336,599	32.4%	62,348	47.8%	3,969	61.9%	2,110	51.4%
Black alone	21,424	2.1%	1,020	0.8%	52	0.8%	13	0.3%
American Indian & Alaska Native alone	4,164	0.4%	869	0.7%	53	0.8%	16	0.4%
Asian alone	525,078	50.5%	41,050	31.4%	1,186	18.5%	1,278	31.2%
Native Hawaiian & Other Pacific Islander alone	135,422	13.0%	22,389	17.2%	985	15.4%	593	14.5%
Some Other Race alone	16,985	1.6%	2,868	2.2%	168	2.6%	92	2.2%
Two or More Races:	320,629		54,535		1,674		2,220	
Population of two races:	206,989		34,223		1,096		1,340	
White; Black or African American	3,883	1.9%	509	1.5%	34	3.1%	10	0.7%
White; American Indian & Alaska Native	7,932	3.8%	2,147	6.3%	78	7.1%	47	3.5%
White; Asian	66,456	32.1%	8,918	26.1%	328	29.9%	305	22.8%
White; Native Hawaiian & Other Pacific Islander	37,904	18.3%	7,534	22.0%	239	21.8%	225	16.8%
White; Some Other Race	3,394	1.6%	474	1.4%	32	2.9%	15	1.1%
Black; American Indian & Alaska Native	834	0.4%	111	0.3%	4	0.4%	1	0.1%
Black or African American; Asian	2,694	1.3%	124	0.4%	5	0.5%	0	0.0%
Black; Native Hawaiian & Other Pacific Islander	1,809	0.9%	138	0.4%	5	0.5%	1	0.1%
Black or African American; Some Other Race	386	0.2%	30	0.1%	1	0.1%	0	0.0%
American Indian & Alaska Native; Asian	1,343	0.6%	221	0.6%	2	0.2%	3	0.2%
American Indian & Alaska Native; Native Hawaiian & Other Pacific Islander	1,233	0.6%	280	0.8%	9	0.8%	6	0.4%
American Indian & Alaska Native; Some Other Race	215	0.1%	31	0.1%	0	0.0%	1	0.1%
Asian; Native Hawaiian & Other Pacific Islander	72,607	35.1%	12,860	37.6%	323	29.5%	673	50.2%
Asian; Some Other Race	4,500	2.2%	515	1.5%	24	2.2%	39	2.9%
Native Hawaiian & Other Pacific Islander; Some Other Race	1,799	0.9%	331	1.0%	12	1.1%	14	1.0%
Population of three races	101,559		17,997		522		780	
Population of four races	11,167		2,160		50		92	
Population of five races	883		141		6		7	
Population of six races	31		14		0		1	

Source: U.S. Census Bureau, 2010 Census. Summary File 1, P8: Race

Census Data at the time of this writing does not offer detailed demographic data specific to the Hawaiian Home Lands property. The percentage of Native Hawaiian residents within this area is presumed to be much higher than state or county averages. The Hawaiian Homestead Association was invited to all public meetings and regularly attended and participated in public information meetings.

The conclusion that can be made that there is a small population in close proximity to Kawaihae Harbor of Native Hawaiian descent.

The US Census Bureau has not released poverty data for 2010, but instead has released data in three-year blocks as part of its American Community Survey (ACS). Poverty data is no longer collected as part of the decennial census. The ACS is only based on a small sample of the population every year. Therefore, the most recent data for detailed poverty information comparable to the discussion above for minority background has to go back to the year 2000 census and is shown in **Table 5-5: Poverty Breakdown in North and South Kohala Census Designated Places, 2000 Census**. As the table shows, most areas of North and South Kohala designated as Census Designated Places in 2000 had relatively low levels of poverty compared to the county as a whole. Halalaula is the only location in North Kohala that generally exceeds the county average, and this is some distance from Kawaihae, located east of Hāwī and Kapa‘au.

5.4.2 Impacts on Low Income and Minority Populations

None of the Build Alternatives are expected to disproportionately impact low-income or minority populations as demographically, these populations are not a disproportionately sizable portion of the North Kohala and South Kohala communities. While there is a small concentration of persons of Native Hawaiian descent on DHHL land near Kawaihae Harbor, this population has lived with the existing harbor present in their community for decades. While there will be some increase in activity at Kawaihae Harbor associated with Alternatives 4 and 5 (with increased berthing capacity), DHHL’s *Kawaihae Regional Plan* recognizes that the harbor improvements are complementary with the DHHL’s vision for additional economic development in the immediate vicinity of the harbor. The other alternatives will be expected to have minimal effects on economic activity in the area.

Increased capacity for goods and services that pass through the harbor will be important to Hawai‘i Island as a whole, and indirectly to the immediate community. DOT-H will work closely with DHHL to ensure that both agencies’ interests can be supported to the benefit of both, while avoiding adverse effects.

5.5 Right of Way and Land Acquisition

5.5.1 No-Build Alternative

The No-Build Alternative does not involve any construction or improvements and therefore will not require any property to be acquired.

Table 5-5: Poverty Breakdown in North and South Kohala Census Designated Places, 2000 Census

Census Designated Place in 2000	All Persons			18 and older			65 and older		
	Total	Below Poverty Level	Percent Below Poverty Level	Total	Below Poverty Level	Percent Below Poverty Level	Total	Below Poverty Level	Percent Below Poverty Level
Hawai'i County	**145,752**	**22,821**	**15.7%**	**107,929**	**14,619**	**13.5%**	**19,432**	**1,391**	**7.2%**
Halaula	506	85	16.8%	349	50	14.3%	66	1	1.5%
Hāwī	949	83	8.7%	685	57	8.3%	101	11	10.9%
Kapa'au	1,149	90	7.8%	832	58	7.0%	220	15	6.8%
Puakō	426	13	3.1%	381	11	2.9%	72	3	4.2%
Waikoloa Village	4,801	498	10.4%	3,378	281	8.3%	340	6	1.8%
Waimea	6,920	418	6.0%	4,950	247	5.0%	700	38	5.4%

Source: U.S. Census Bureau, Census 2000, "Table DP-3. Profile of Selected Economic Characteristics: 2000;" and "QT-P34. Poverty Status in 1999 of Individuals: 2000;" Figures for persons 18 years & over compiled and calculated by County of Hawai'i, Department of Research & Development

5.5.2 Build Alternatives

All of the improvements under the Build Alternatives will take place on DOT-H property with the exception of improvements to Kawaihae Road.

Improvements to Kawaihae Road under Alternatives 3, 4, and 5 are recommended in **Section 6.2.2.1: Near-Term (2015) Traffic Conditions** and shown specifically in **Figure 6-7: Intersection Improvements Along Kawaihae Road Under Alternatives 3, 4, and 5**. The improvements to Kawaihae Road are needed to provide deceleration tapers and left-turn lanes into two Kawaihae Harbor entrances - the Main Gate and a realigned South Gate. Because of the narrow bridge over Makahuna Gulch, the South Gate will be shifted slightly to the north to accommodate the needed length of the deceleration taper and left-turn lane approaching from the south.

Under Alternatives 3, 4, and 5, Kawaihae Road will be widened to the makai (i.e., away from the island's interior) side only and will have no widening performed on the mauka (i.e., towards the island's interior) side of the roadway (which is land owned by DHHL). Approximately 42 feet of additional roadway right-of-way beyond the existing makai right-of-way limits will be needed to replace part of the existing roadway shoulder, the existing open drainage channel, guardrail, and utility poles. A total of approximately 2.2 acres of property will be affected. Since DOT-H and DOT Highways Division are the two property owners, there will be no acquisition of land needed from other land-owners. The widening to the makai side of the highway is intended to avoid impacts upon burials located in the DHHL property.

CHAPTER 6: TRAFFIC

The chapter that follows covers the existing conditions, the anticipated impacts, and the proposed mitigation for effects on traffic and roadways. Refer to **Table 6-1: Summary of Impacts on Traffic and Recommended Mitigation** for a brief summary of the rest of the chapter. **Table 6-1: Summary of Impacts on Traffic and Recommended Mitigation** provides recommended mitigations. Actual mitigations will be determined by the appropriate permit/approval process.

Improvements to traffic circulation are needed to ensure the continued efficient movement of goods and vehicles in and out of the harbor while maintaining security at the harbor. An analysis of traffic operations is provided below. The full traffic study is available in **Appendix H: Traffic Impact Assessment Report**. The analysis that follows considers both existing conditions (year 2010), near-term conditions after the improvements under the Build Alternatives are made (year 2015), and mid-term conditions (year 2025).

The analyses that follow do not assume a Kawaihae Bypass Road. The bypass project is being evaluated separately in an Environmental Impact Statement under preparation by the State of Hawai'i, Department of Transportation (DOT), Highways Division. While that facility will likely eventually connect with Kawaihae Harbor's Main Gate, its completion is beyond the timeframe evaluated in the traffic studies below and is considered a separate longer-term action.

Kawaihae Harbor is located in the South Kohala region on the west side of Hawai'i island, 35 miles north of Kailua-Kona. The harbor is located off of Kawaihae Road (Route 270), just north of the intersection with Queen Ka'ahumanu Highway/Mamalahoa Highway (HI-19) and south of the intersection with Akoni Pule Highway, as seen in **Figure 6-1: Roadways and Accesses to Kawaihae Harbor**.

Kawaihae Road (Highway 270) is the highway directly serving the entrances to the harbor. Some sources refer to this road by the name "Akoni Pule Highway," which is the highway that continues northward to coastal North Kohala and Hāwī. For consistency, this report will exclusively use the name "Kawaihae Road."

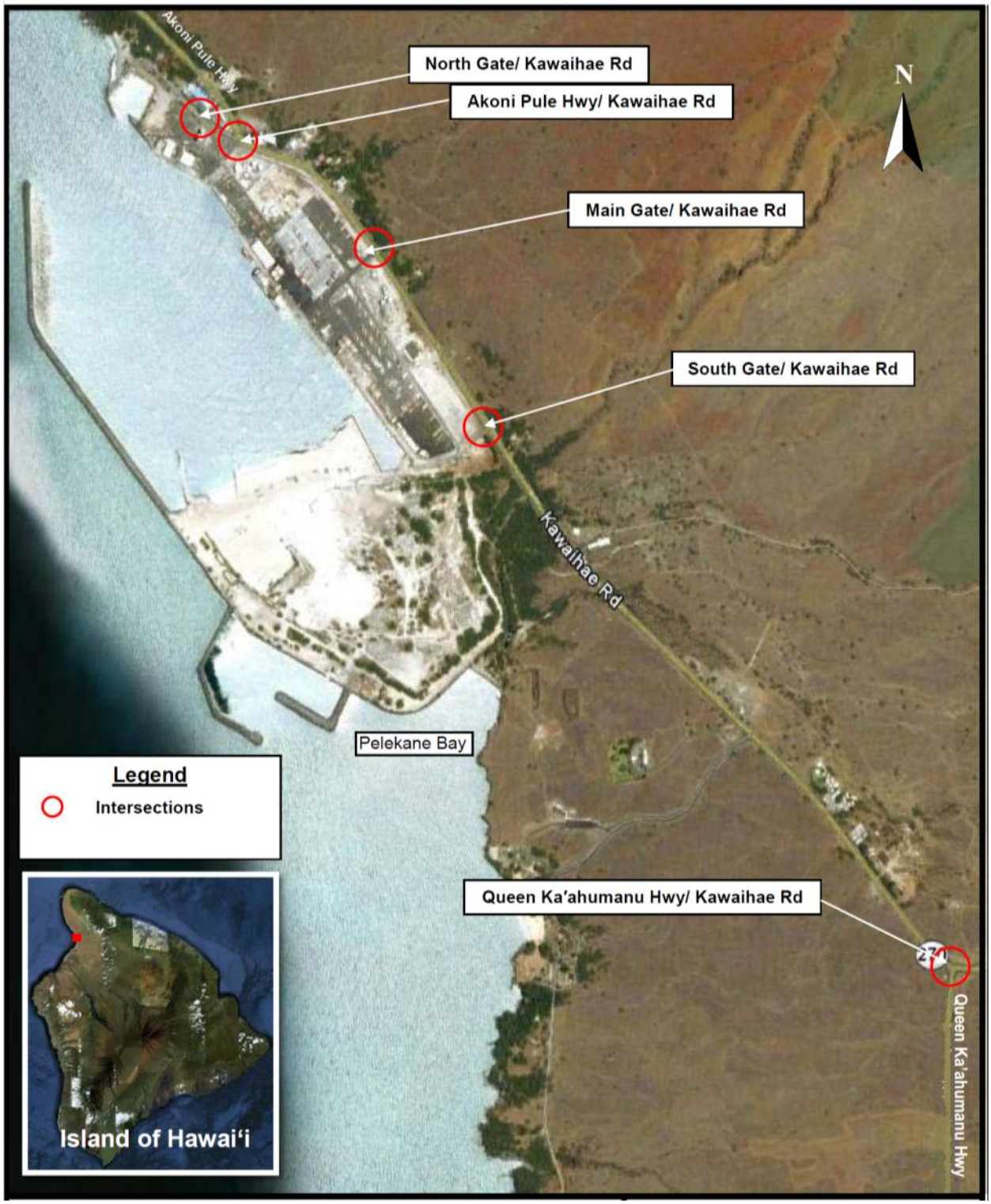
Adjacent to Kawaihae Harbor, Kawaihae Road is a two-lane, undivided highway oriented in the north-south direction with no turn lanes. According to the State Roadway Inventory, Kawaihae Road is classified as a rural principal arterial. Kawaihae Road intersects Akoni Pule Highway north of the Kawaihae Harbor Main Gate. The Main Gate access, also referred to as Pier 2 access, is centrally located on the harbor facilities. The South Gate access intersects Kawaihae Road approximately 250 feet north of the Makahuna Gulch crossing. The North Gate, located off of Kawaihae Road north of the intersection with Akoni Pule Highway, is currently locked.

Kawaihae Road has no turn lanes at the intersections with harbor access points and intersecting roads, as seen in **Figure 6-2: Existing (2010) Roadway Configurations**. Therefore, vehicles attempting to turn into the harbor often queue up into the travel lanes of Kawaihae Road, impeding the passage of through traffic. Prior to 2009, the security check point was located at the Main Gate opening, less than 100 feet from Kawaihae Road, creating queues of trucks and cars along Kawaihae Road waiting to enter the harbor, and blocking through movements. In

Table 6-1: Summary of Impacts on Traffic and Recommended Mitigation

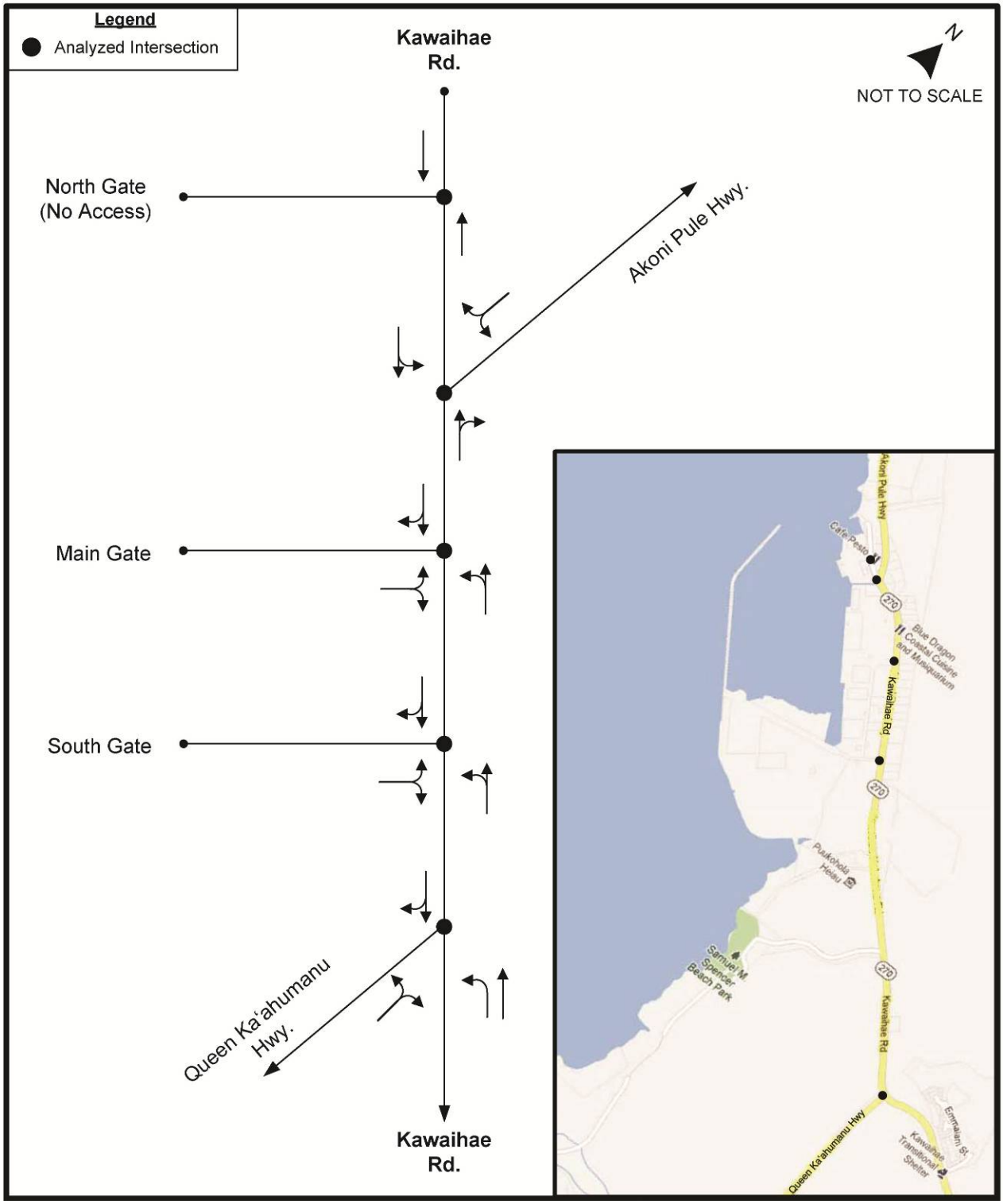
EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
Chapter 6:	**Traffic**	• No improvements for traffic, though traffic will increase over time.	• Only improvements with internal circulation. • Traffic will increase over time.	• Relocation of South Gate and provision of left-turn and deceleration lanes at Main and South Gates to improve traffic operations. • Improvements to internal traffic circulation.	• Relocation of South Gate and provision of left-turn and deceleration lanes at Main and South Gates to improve traffic operations. • Improvements to internal traffic circulation.	• **Relocation of South Gate and provision of left-turn and deceleration lanes at Main and South Gates to improve traffic operations.** • **Improvements to internal traffic circulation.**	• Traffic improvements will mitigate future effects from increased growth at harbor. • Coordination with DOT-Highways on pedestrian accommodations in areas of roadway improvements.

Figure 6-1: Roadways and Accesses to Kawaihae Harbor



Source: SSFM International, Inc.

Figure 6-2: Existing (2010) Roadway Configurations



Source: SSFM International, Inc.

2009, the security checkpoint was relocated further inside the harbor boundary to allow waiting room for additional trucks entering off of Kawaihae Road. Addition of a second security check point at the Main Gate entrance has relieved congestion further.

Access is primarily through the Main Gate which is open and manned by security guards 24-hours a day, 7 days a week. The South Gate is only open on Fridays between 7:00 AM and 5:00 PM. The typical circulation flow of vehicular access into the harbor as initially studied in September, 2010 is shown in **Figure 6-3: Traffic Circulation**. Since July 2011, early access into the harbor on Fridays changed to allow truck entrance into the harbor through the South Gate with an immediate turn and queuing along the access road awaiting the security check. A detailed discussion of internal circulation is provided in **Section 6.2.2.2: Internal Circulation**.

6.1 Existing (2010) Traffic Conditions

6.1.1 Motor Vehicles

Traffic counts were taken on Tuesday, May 25, 2010 to determine existing volumes. Twenty-four hour counts were taken, and show the Average Daily Traffic (ADT) volumes shown in **Table 6-2: Existing (2010) Average Daily Traffic (ADT)**.

Table 6-2: Existing (2010) Average Daily Traffic (ADT)

Road Segment	Average Daily Traffic (ADT)	
	Northbound	Southbound
Akoni Pule Highway	2,710	2,840
Kawaihae Road	3,610	3,490

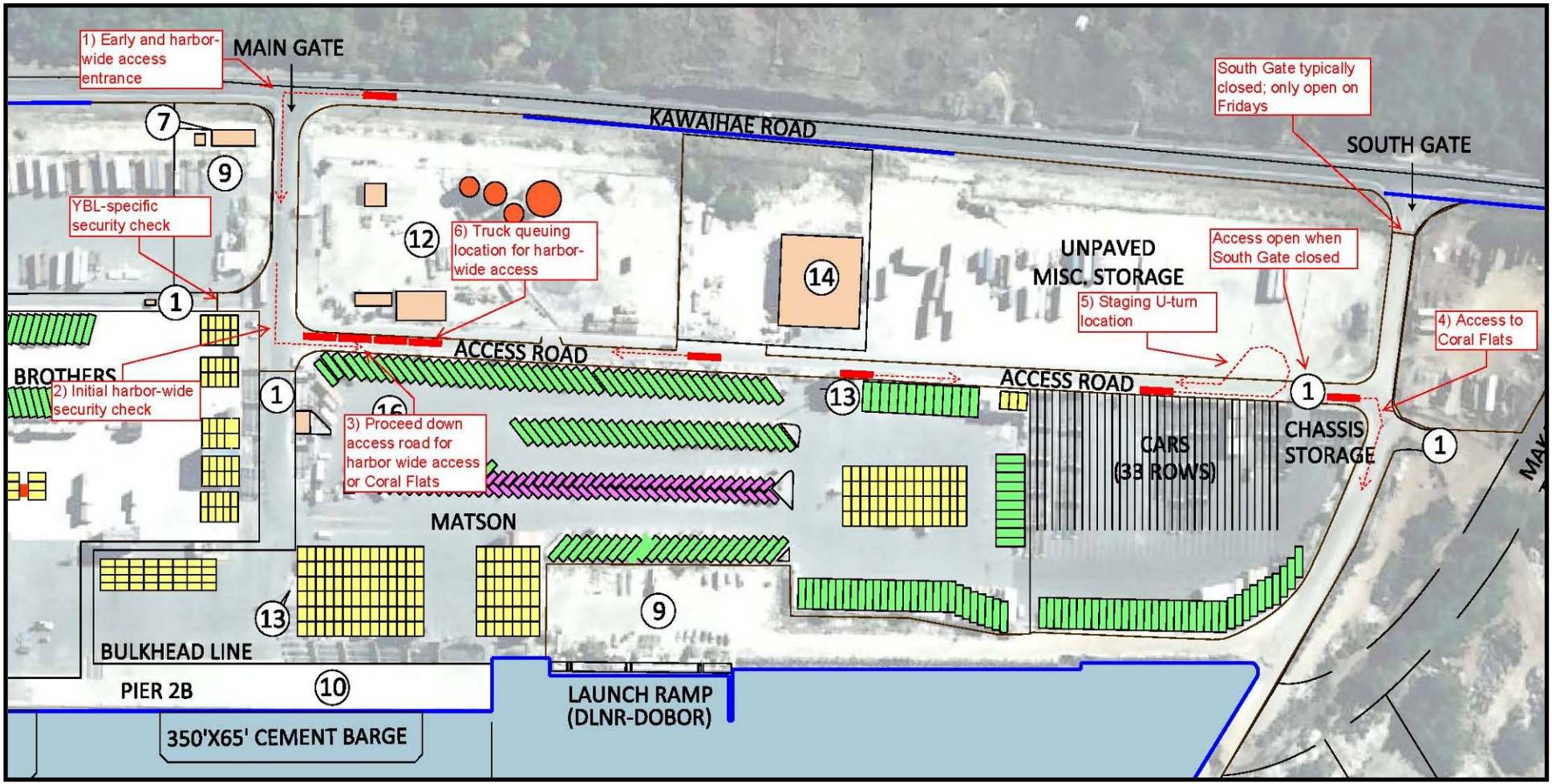
Source: SSFM International, Inc.

Traffic counts during peak traffic hours were taken during the periods 6:00 AM to 8:00 AM and 3:30 PM to 5:30 PM. The counts are shown in **Figure 6-4: Existing 2010 AM and (PM) Peak Hour Turning Movement Volumes**. Since counts were not taken on a Friday, the South Gate was not open and therefore no traffic movements were observed accessing the harbor there. Peak hours at the intersections were found to be from 7:00 AM to 8:00 AM and 3:15 PM to 4:15 PM. Volumes were shown at the South Gate for consideration of all access locations.

The assessment of traffic that follows looks at Levels of Service (LOS) for both roadways and intersections. LOS is an operational analysis rating system used in traffic engineering to measure the effectiveness of roadway operating conditions. There are six LOS ranging from A to F. LOS A is defined as being the least interrupted flow conditions with little or no delays, whereas LOS F is defined as conditions where extreme delays exist. Guidelines from the *Hawai'i Statewide Uniform Design Manual* state that an appropriate LOS for a rural State arterial is LOS C or better.

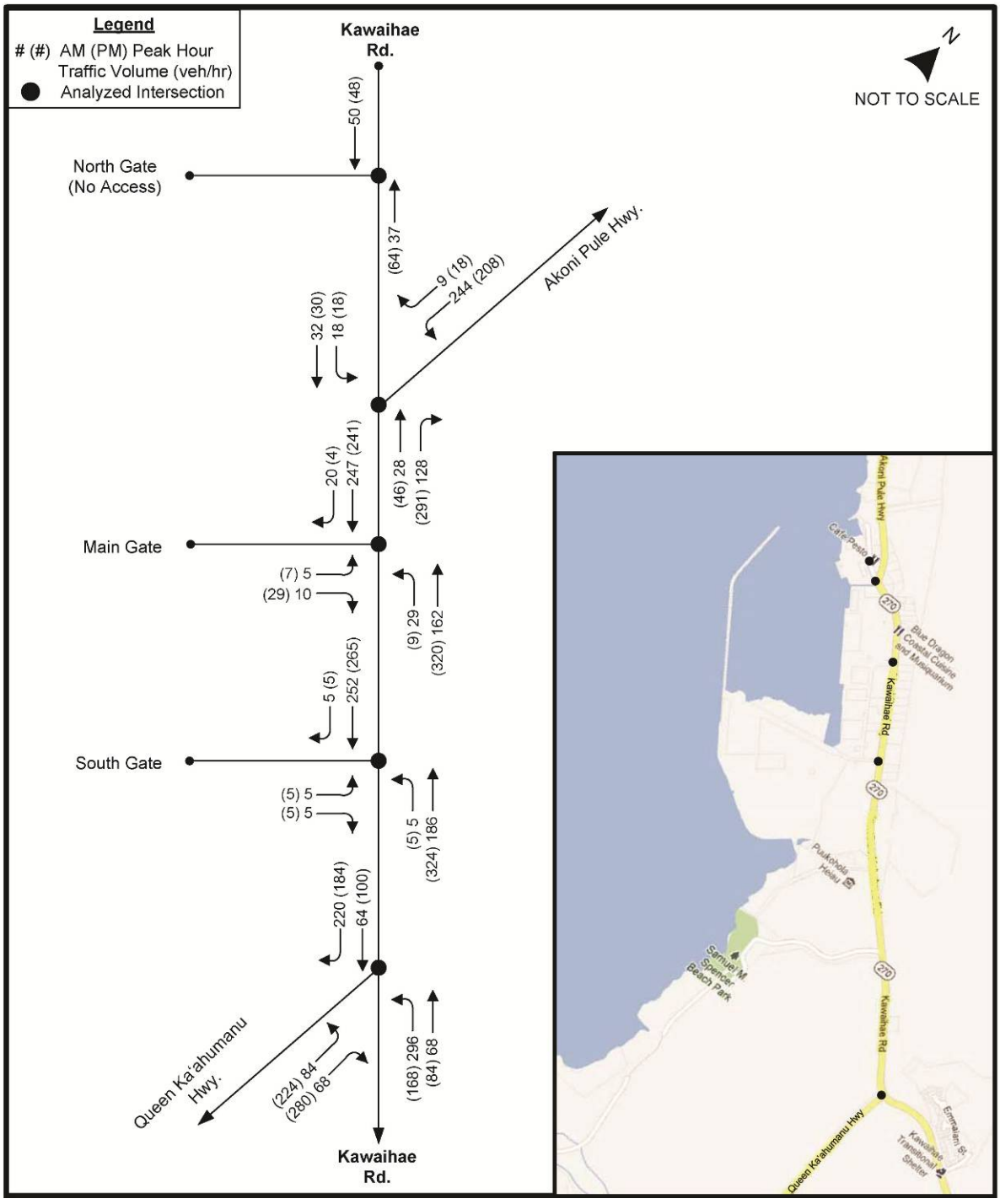
Existing LOS and associated ratios of volume to capacity and lengths of delay in seconds were assessed for left-turning movements at unsignalized project intersections (since through traffic

Figure 6-3: Traffic Circulation



Source: SSFM International, Inc.

Figure 6-4: Existing 2010 AM and (PM) Peak Hour Turning Movement Volumes



Source: SSFM International, Inc.

and right-turning movements experience minimal delays). The results of this assessment are shown in **Table 6-3: Existing Levels of Service at Area Intersections**.

Table 6-3: Existing Levels of Service at Area Intersections

Unsignalized Intersection	Approach-Movement	AM			PM		
		LOS	v/c	Delay	LOS	v/c	Delay
Kawaihae Road and Akoni Pule Highway	Southbound Left	A	0.02	7.7	A	0.02	8.1
	Westbound Left	B	0.37	12.4	B	0.37	13.4
Kawaihae Road and Main Gate access	Northbound Left	A	0.03	8.6	A	0.01	8.4
	Eastbound Left	B	0.05	12.8	B	0.06	11.4
Kawaihae Road and South Gate access	Northbound Left	A	0.00	8.5	A	0.00	8.5
	Eastbound Left	B	0.03	12.9	B	0.02	12.3
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound Left	F	1.12	143.4	F	1.14	112.1
	Westbound Left	A	0.35	9.6	A	0.16	8.5

Source: SSFM International, Inc.

Due to the poor LOS for the northbound left movement at Kawaihae Road and Queen Ka'ahumanu Highway, a traffic signal warrant was run for peak hour conditions. The Peak Hour signal warrant from the *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)* (USDOT, 2003) was used for analysis of Existing (2010) conditions and passed for the PM peak hour. Appendix C of the Traffic Impact Analysis Report (see **Appendix H: Traffic Impact Assessment Report**) provides the detailed traffic signal warrant analysis. It is noted in the *MUTCD* that the satisfaction of a traffic signal warrant or warrants does not in itself require the installation of a traffic signal.

The roadway segmental analysis evaluated this section of Kawaihae Road as an uninterrupted flow highway in a non-urbanized area with a population less than 5,000. Existing (2010) analysis for the road segment showed appropriate operations of LOS B.

There were no major problems observed in the internal traffic circulation within the harbor. Since vehicles can queue along the access road and there are two gates to enter the container yards, there was a consistent flow of vehicles entering and exiting the harbor, without delay caused by backup. It is also noted that there is sufficient storage along the access road to hold additional queues, if needed. There is also adequate space for trucks to make the U-turn in the staging area, which was necessary per the old internal circulation patterns.

6.1.2 Pedestrians

Several pedestrians and bicyclists were observed in the study area. No pedestrian pathways, crosswalks, designated bike lanes, or significant shoulder widths exist along Kawaihae Road in the vicinity of the harbor, which makes current pedestrian access and movement difficult.

Pedestrians desiring access to the harbor offices have to go through a security check prior to entering the harbor facilities. Additionally, no pathways or crosswalks exist for access to the commercial buildings located on the mauka (i.e., towards the interior of the island) side of the road at the north end of the harbor.

6.2 Impacts of the Project on Traffic

6.2.1 No-Build Alternative

The No-Build Alternative will have no direct effect on traffic volumes in the area.

6.2.2 Build Alternatives

Alternative 2 - Minimal Action will only result in internal reconfiguration of yards and minor construction. There will be no modifications to any of the gates or improvements to Kawaihae Road. Therefore, this alternative will have no direct effect on traffic volumes in the area.

The discussions that follow analyze the effects of traffic improvements along Kawaihae Road as discussed in **Section 3.6.5: Improvements to Main Gate, South Gate, and Kawaihae Road**. These improvements will be offered under Alternative 3 - Partial Action/Land-Side, Alternative 4 - Land-Side Plus Pier 2A Extension, and the Proposed Action - Alternative 5.

6.2.2.1 Near-Term (2015) Traffic Conditions

The traffic analysis considered future year growth assuming a 4.3 percent annual increase in container volumes through 2015, which is the highest of three scenarios that were examined for the *Hawai'i Island Commercial Harbors 2035 Master Plan Update*. Based on the probable expansion of the harbor and the regional growth in the area, traffic volumes at the study intersections were projected to 2015 to determine operations and necessary mitigation to improve the existing roadway configuration and harbor circulation.

For Alternatives 3, 4 and 5, by 2015, Kawaihae Road will be improved to provide left turn storage lanes at the Main and South gate entrances to minimize traffic congestion from queuing heavy vehicles. Alternatives 3, 4 and 5 will also retain existing internal traffic circulation operations but could include paving the staging area where trucks perform U-turns since it is highly used and thus more susceptible to erosion over time.

The turn lane configurations that will result from the Kawaihae Road improvements under the Proposed Action are seen in **Figure 6-5: Lane Configurations Along Kawaihae Road By 2015 Under Alternatives 3, 4, and 5**.

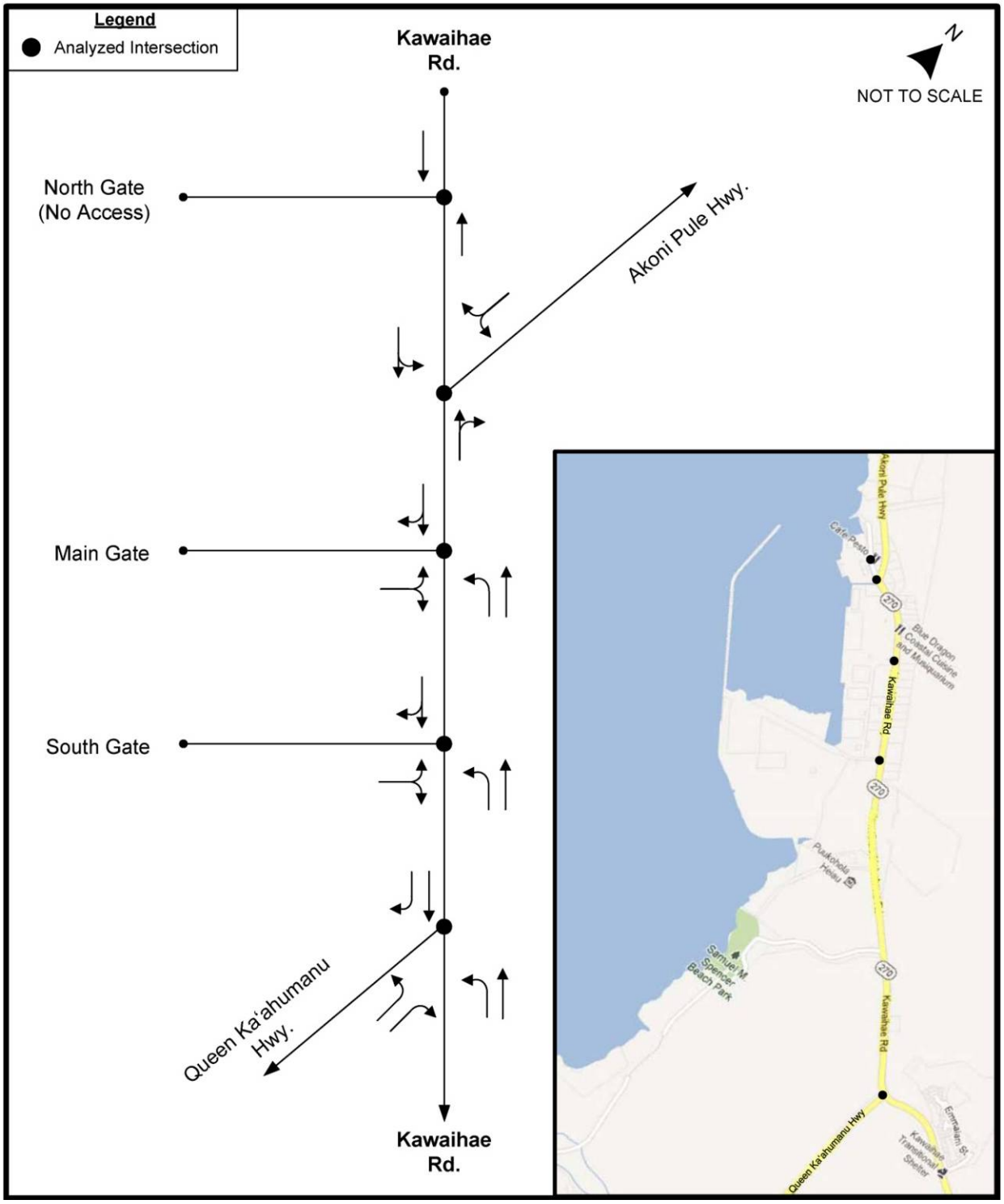
Average Daily Volumes in 2015 are expected to be as follows in **Table 6-4: Future (2015) Average Daily Traffic (ADT)**.

Table 6-4: Future (2015) Average Daily Traffic (ADT)

Road Segment	Average Daily Traffic (ADT)	
	Northbound	Southbound
Akoni Pule Highway	3,700	2,710
Kawaihae Road	4,520	3,690

Source: SSFM International, Inc.

Figure 6-5: Lane Configurations Along Kawaihae Road By 2015 Under Alternatives 3, 4, and 5



Source: SSFM International, Inc.

The resulting AM and PM Peak Hour turning movement volumes in the year 2015 are shown in **Figure 6-6: Future 2015 AM and (PM) Peak Hour Turning Movement Volumes Under Alternatives 3, 4, and 5**.

Year 2015 LOS and associated ratios of volume to capacity and lengths of delay in seconds under the Proposed Action are shown in **Table 6-5: 2015 Levels of Service at Area Intersections Under the Alternatives 3, 4, and 5**.

Table 6-5: 2015 Levels of Service at Area Intersections Under the Alternatives 3, 4, and 5

Unsignalized Intersection	Approach-Movement	AM			PM		
		LOS	v/c	Delay	LOS	v/c	Delay
Kawaihae Road and Akoni Pule Highway	Southbound Left	A	0.02	7.7	A	0.02	8.3
	Westbound Left	B	0.45	13.7	C	0.45	15.1
Kawaihae Road and Main Gate access	Northbound Left	A	0.04	8.8	A	0.02	8.6
	Eastbound Left	B	0.09	14.5	B	0.09	12.4
Kawaihae Road and South Gate access	Northbound Left	A	0.01	8.7	A	0.01	8.7
	Eastbound Left	B	0.03	13.9	B	0.02	13.3
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound Left	F	1.46	314.7	F	0.90	64.6
	Northbound Right	A	0.13	9.3	B	0.41	11.8
	Westbound Left	B	0.43	10.4	A	0.19	8.9

Source: SSFM International, Inc.

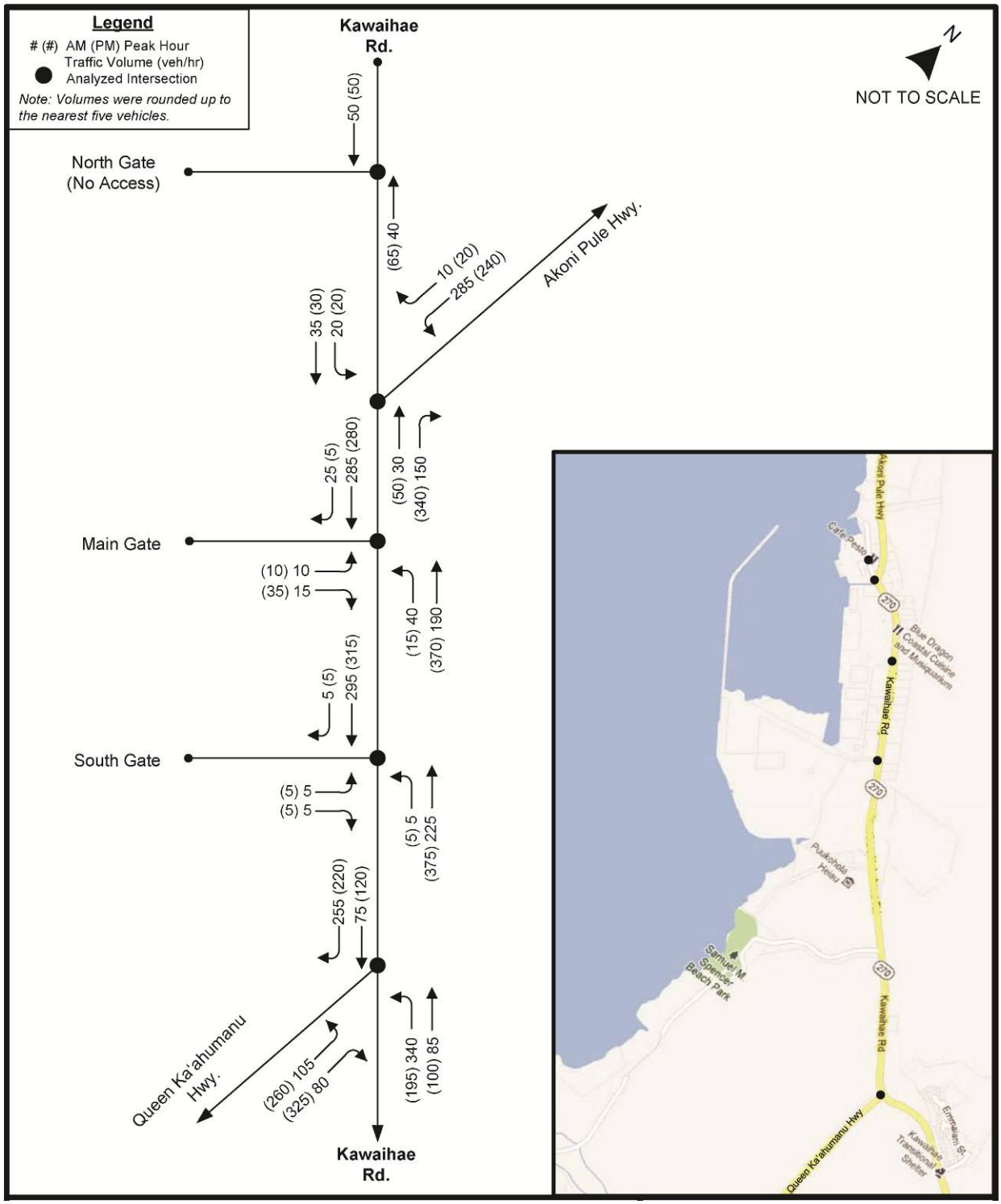
Due to the poor LOS for the northbound left movement at Kawaihae Road and Queen Ka'ahumanu Road, the Peak Hour signal warrant was used for analysis of Near-Term (2015) conditions. This included addition of dedicated turn lanes at the intersection which still resulting in passing for the PM peak hour. Appendix C of the Traffic Impact Analysis Report (see **Appendix H: Traffic Impact Assessment Report**) provides the detailed traffic signal warrant analysis.

Kawaihae Road itself is expected to continue operating at an appropriate LOS B under Alternatives 3, 4, and 5.

The length of the turn lanes at the Main and South gate entrances under the Proposed Action was analyzed for design stopping and minimum storage length. The design stopping distance is the necessary distance needed for a vehicle travelling at the design speed to safely stop. Storage length is based on the number of turning vehicles likely to arrive in an average two-minute period during the peak hour. A minimum requirement is storage for two passenger vehicles.

With the assumption that design vehicles are each 70 feet long, a minimum storage length of 95 feet is desired to consider both a truck and a motor vehicle. With 12-foot wide turn lanes and the roadways having a design speed of 45 miles per hour (MPH), a 180-foot taper length was determined to be needed. By including the deceleration needs in the taper length, total storage (275 feet) plus taper length (180 feet) is equal to 455 feet.

Figure 6-6: Future 2015 AM and (PM) Peak Hour Turning Movement Volumes Under Alternatives 3, 4, and 5



Source: SSFM International, Inc.

At its current location, approximately 250 feet south of the Makahuna Gulch bridge crossing, the section of Kawaihae Road is shorter than the necessary turn lane requirements. Therefore the Proposed Action will relocate where the South Gate access intersects with Kawaihae Road further north so as to account for a full 275 foot storage and 180-foot taper lane. Sufficient roadway exists to provide for the full storage and taper at Main Gate and therefore the Main Gate access will remain in its current location under the Proposed Action.

An analysis was performed to ensure there is adequate turning space for the design vehicle (i.e., a "WB-50" semi-trailer truck with a 50-foot wheelbase from front axle of tractor to rear axle of trailer) to enter and exit the harbor facilities with the suggested improvements at Main Gate and South Gate. At both entrances, no problems are anticipated.

A conceptual view of the improvements proposed along Kawaihae Road is shown in **Figure 6-7: Intersection Improvements Along Kawaihae Road Under Alternatives 3, 4, and 5**.

6.2.2.2 Internal Circulation

As shown above in **Figure 6-3: Traffic Circulation**, access to Kawaihae Harbor is primarily through the Main Gate which is open and manned by security guards 24 hours a day, seven days a week. Trucks typically start arriving at the harbor at approximately 6:00 AM. These are usually for cement or fuel pick-ups from Hawaiian Cement, Mid-Pac Petroleum or Big Island Energy (former-Akana Petroleum). Shortly thereafter, traffic for Matson Navigation (Matson) or Young Brothers, Limited (YB) begin to arrive for freight pick-ups. Prior to the opening of the Matson and YB checkpoints, trucks can enter the outside perimeter of the harbor at the Main Gate driveway.

The South Gate is currently only open on Fridays, which are busier "Double Barge Days" from 7:00 AM to 5:00 PM, providing direct access to the Coral Flats part of the harbor. The Main Gate is open on Fridays as well.

In accordance with federal regulations, all open access must be manned by properly trained and certified security personnel. Those wishing to access the beach park or Coral Flats must provide a valid driver's license, proof of no-fault insurance and current automobile registration. When the South Gate is closed, vehicles accessing Coral Flats enter through the Main Gate, proceeding through the security check and then driving down the access road which connects to the South Gate road.

On days that do not have two barges calling the harbor, the current circulation pattern is that vehicles enter the Main Gate, go through an initial security checkpoint, and drivers declare their destination and purpose. Trucks intending to enter the security perimeter also pass through security clearance. To do so, they travel down the access road, which runs parallel to the Matson fence, and make a U-turn at the staging area. The trucks then return towards the Matson and YB gates and queue along the access road, waiting to access the security checkpoint. People that seek to access recreational facilities on the Coral Flats follow the access road straight through to the South Gate road and Coral Flats.

Since July 2011, early access into the harbor on Fridays (busier double-barge days) changed to allow truck entrance into the harbor through the South Gate with an immediate right turn and queuing along the access road awaiting the security check. People that seek to access Coral Flats for recreational purposes must enter through the South Gate on these days and go through the security at the South Gate, because when the South Gate is open, the access road is intended for one-way northbound traffic use on those days.

There were no major problems observed in the internal traffic circulation within the harbor during the traffic analysis performed for this project. Since vehicles can queue along the access road and there are two gates (Matson and YB) to enter the container yards, there was a consistent flow of vehicles entering and exiting the harbor, without delay caused by backup. It is also noted that there is sufficient storage along the access road to hold additional queues, if needed. There is also adequate space for trucks to make the U-turn in the staging area, which was necessary per old internal circulation patterns.

The No-Build Alternative will have no effect on internal circulation. Alternative 2 - Minimal Action will only make minor reconfigurations to the circulation patterns.

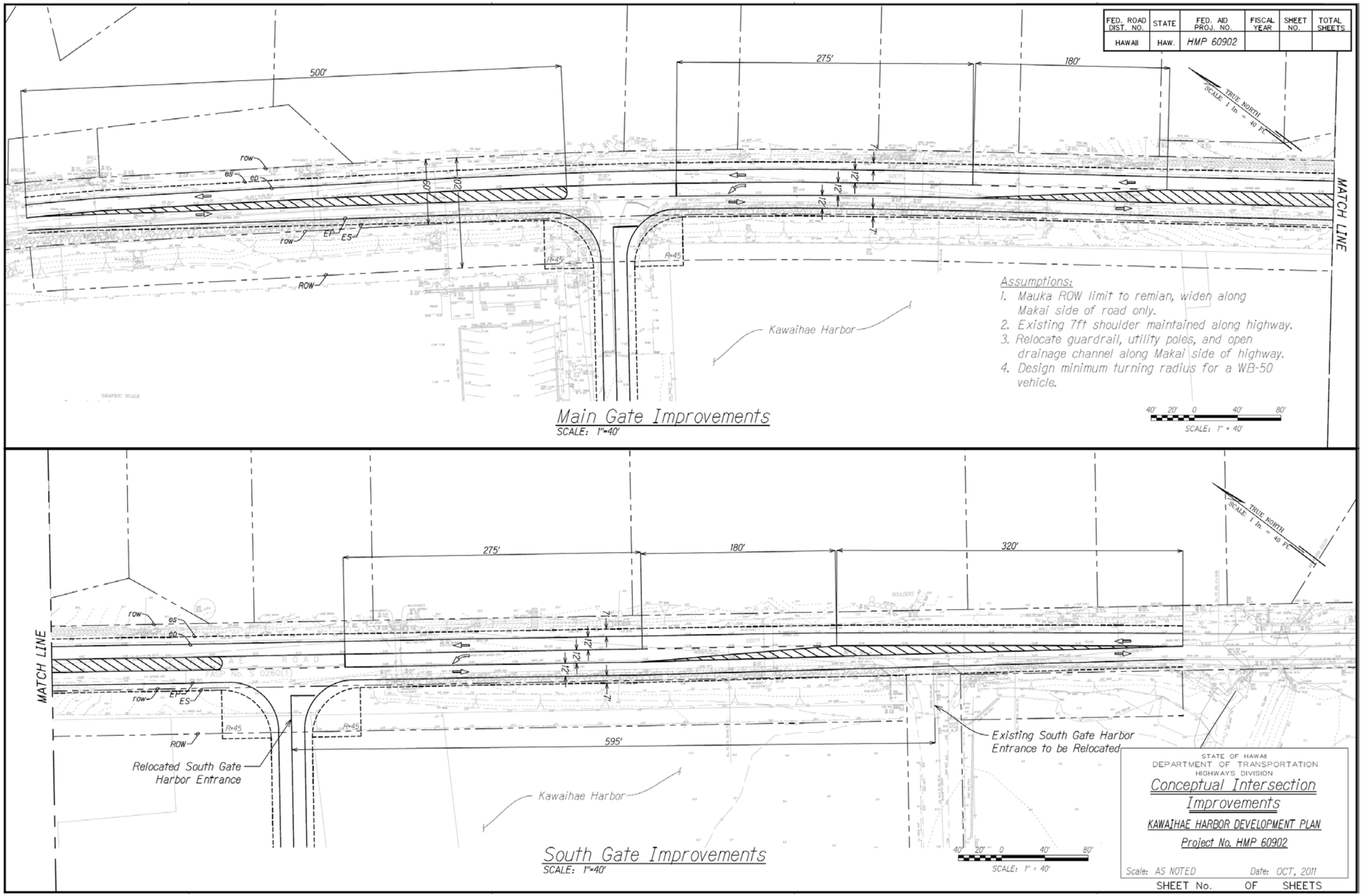
Alternatives 3, 4 and 5 intend to relocate the South Gate slightly to the north to ensure adequate traffic operations on Kawaihae Road. Alternatives 3, 4 and 5 will also open and upgrade this new South Gate to separate users of the small boat harbor, the military, and future improvements on the Coral Flats from the rest of the site, which will be served primarily by the Main Gate. All gates will be designed in accordance with US Coast Guard (USCG) requirements.

All internal circulation will be adequately and safely accommodated under this scenario.

Internal circulation for recreational users of the Coral Flats area will generally be improved from today's conditions under Alternatives 3, 4 and 5. As shown in **Figure 6-3: Traffic Circulation**, recreationists currently have to enter the main gate (except on Fridays), turn left, and follow the Access Road southbound to the south gate roadway. From there, they can either travel southward on the unimproved Coral Flats Perimeter Roadway or makai towards the outer breakwater area. In any case, this travel is circuitous. On Fridays, the South Gate is open and this route is somewhat simplified as recreationists have a more direct path to their destinations. Visitors to Coral Flats do not need to cross into the Maritime Security Area.

Under Alternatives 3, 4 and 5, all access for recreationists will be maintained, and improvements to the South Gate will reduce the amount of travel and enable recreationists to avoid the security perimeter entirely. Entry will be through the south gate, and security fencing around the inland side of the Perimeter Roadway will prevent foot traffic from crossing the Coral Flats, but will maintain all access to sites on the periphery of the Coral Flats that are used today by recreationists. As all Build Alternatives (including Alternative 2) will transfer the Perimeter Roadway land to DLNR-DOBOR, there may be additional improvements to access in the future if DLNR-DOBOR chooses to pave or otherwise improve the Perimeter Roadway in a separate project.

Figure 6-7: Intersection Improvements Along Kawaihae Road Under Alternatives 3, 4, and 5



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6.2.2.3 Pedestrian Impacts

The *Draft Statewide Pedestrian Master Plan* (HDOT, 2011c) has identified the Akoni Pule Highway at Kawaihae Road intersection proximate to the harbor a priority for improvements, and calls for investigating the feasibility of installing a marked crosswalk, pedestrian signage, and highway lighting.

The No-Build Alternative and Alternative 2 - Minimal Action will provide no change to the roadway system currently present, and therefore, no new accommodations will be made for pedestrians.

Under Alternatives 3, 4 and 5, DOT Highways Division will design Kawaihae Road improvements and decisions will be made during the final design process for that improvement as to what pedestrian accommodations will be provided. Pedestrian accommodations, if provided, could also facilitate future connections for the Ala Kahakai National Historic Trail, which is described in **Section 8.3: Ala Kahakai National Historic Trail**.

6.2.2.4 Year 2025 Conditions

Additional analysis was performed to determine if the improvements described previously for Alternatives 3, 4 and 5 will still permit satisfactory traffic operations in 2025.

The anticipated regional annual growth of 2.88 percent was applied to traffic along Kawaihae Road and Akoni Pule Highway. Container volumes were forecast to increase 4.7 percent per year through 2025, as projected in the High Case scenario of the *Hawai'i Commercial Harbors Cargo and Passenger Forecast Report* (Moffat and Nichol, 2009), and therefore applied to traffic volumes entering and exiting the harbor facilities at the Main Gate access. Average Daily Volumes in 2025 are expected to be as follows in **Table 6-6: Future (2025) Average Daily Traffic (ADT)**.

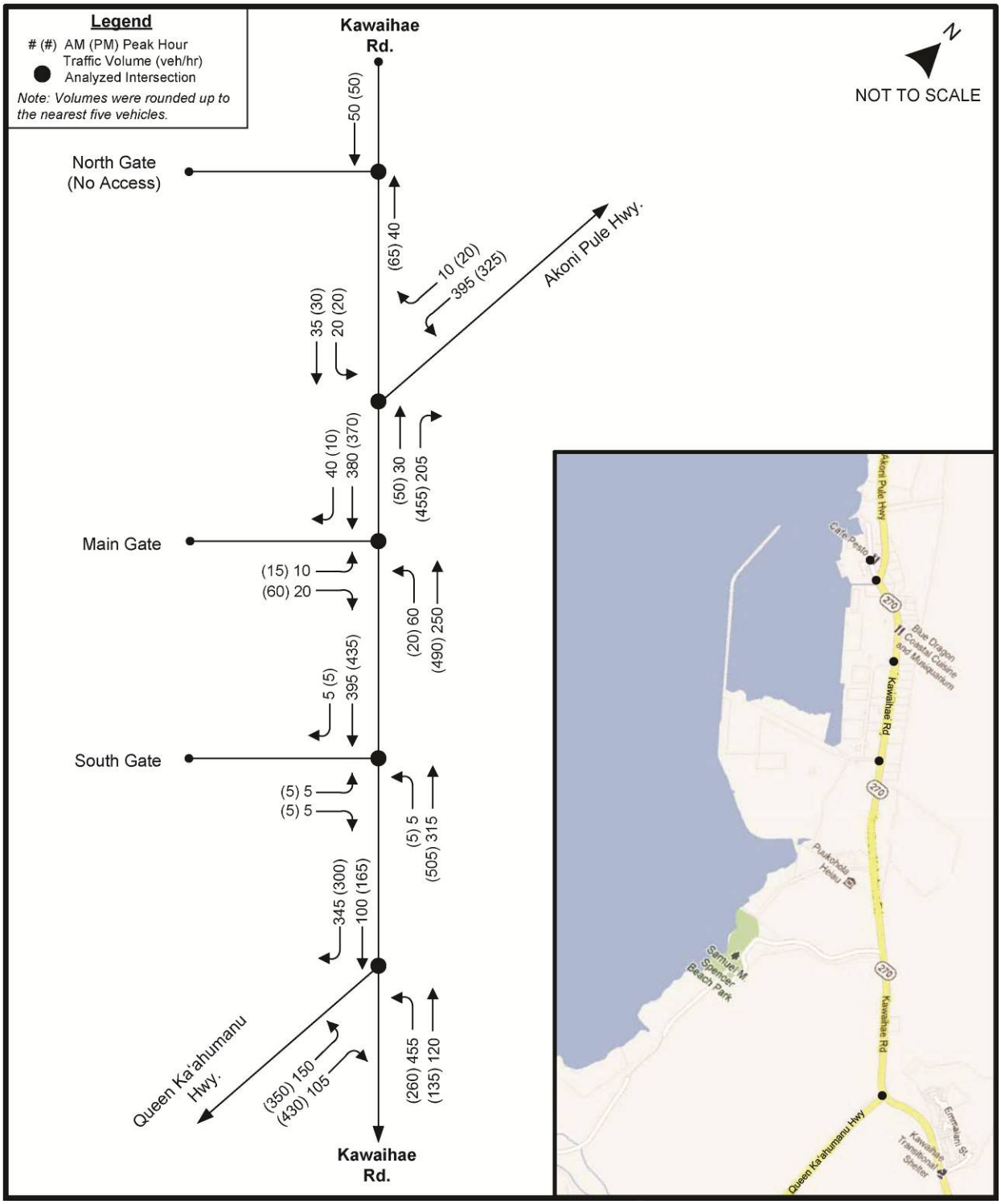
Table 6-6: Future (2025) Average Daily Traffic (ADT)

Road Segment	Average Daily Traffic (ADT)	
	Northbound	Southbound
Akoni Pule Highway	4,840	3,540
Kawaihae Road	6,070	5,120

Source: SSFM International, Inc.

The resulting AM and PM Peak Hour turning movement volumes in the year 2025 are shown in **Figure 6-8: Future 2025 AM and (PM) Peak Hour Turning Movement Volumes Under Proposed Action**.

Figure 6-8: Future 2025 AM and (PM) Peak Hour Turning Movement Volumes Under Proposed Action



Source: SSFM International, Inc.

Year 2025 LOS and associated lengths of delay in seconds under Alternatives 3, 4 and 5 are shown in **Table 6-7: 2025 Levels of Service at Area Intersections Under Alternatives 3, 4, and 5**. With the addition of project related traffic and inclusion of turn lanes at the entrances to the harbor, as proposed in Near-Term (2015) conditions, Mid-Term (2025) LOS at the study intersections are expected to remain appropriate at the majority of intersections as shown in the table. Conditions at the unsignalized intersection of Kawaihae Road and Queen Ka‘ahumanu Road remain poor. **Appendix H: Traffic Impact Assessment Report** provides a detailed discussion.

Table 6-7: 2025 Levels of Service at Area Intersections Under Alternatives 3, 4, and 5

Unsignalized Intersection	Approach-Movement	AM			PM		
		LOS	v/c	Delay	LOS	v/c	Delay
Kawaihae Road and Akoni Pule Highway	Southbound Left	A	0.02	7.9	A	0.02	8.7
	Westbound Left	C	0.64	18.7	C	0.66	22.2
Kawaihae Road and Main Gate access	Northbound Left	A	0.07	9.5	A	0.02	9.0
	Eastbound Left	C	0.14	17.7	B	0.19	15.0
Kawaihae Road and South Gate access	Northbound Left	A	0.01	9.1	A	0.01	9.2
	Eastbound Left	C	0.04	16.7	C	0.03	16.6
Kawaihae Road and Queen Ka‘ahumanu Highway	Northbound Left	F	5.88	2389	F	1.93	473.5
	Northbound Right	A	0.18	9.8	C	0.58	15.1
	Westbound Left	B	0.64	14.5	B	0.29	10.0

Source: SSFM International, Inc.

A review was made of the storage and turn lane operations for the year 2025. There will still be sufficient distance to contain the number of turning vehicles likely to arrive in an average two minute period within the peak hour.

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CHAPTER 7: PUBLIC FACILITIES AND UTILITIES

The chapter that follows considers the effects of the Proposed Action on public facilities and utilities in the area. Refer to **Table 7-1: Summary of of Impacts on Public Facilities/Utilities and Recommended Mitigation** for a brief summary of the rest of the chapter. **Table 7-1: Summary of of Impacts on Public Facilities/Utilities and Recommended** Mitigation provides recommended mitigations. Actual mitigations will be determined by the appropriate permit/approval process.

7.1 Electrical and Communication Facilities

7.1.1 Existing Conditions

Electrical service is provided on Hawai‘i Island by the Hawai‘i Electric Light Company (HELCO), a privately owned utility company regulated by the State Public Utilities Commission. The HELCO power plant in Waimea is the source of power locally.

Electrical Service is supplied to the South Kohala coast by existing 69 kilovolt (kV) and 12 kV overhead power transmission lines installed along an existing electrical utility easement adjacent to Kawaihae Road.

The terminal yard and wharf areas are presently lit by low pressure sodium lights mounted on high-mast light poles. The average light level across the yard and wharf is approximately 5 foot-candles.

Hawaiian Telcom lines share utility poles with HELCO and serve the harbor. Hawaiian Telcom also has an interisland cable landing site at Spencer Beach Park, on the far side of Pu'ukoholā Heiau from Kawaihae Harbor and about a third- to half-mile from the closest location in Coral Flats.

Verizon Wireless will construct and maintain a cellular communications tower on the Kawaihae Harbor property near the South Gate.

Oceanic Time Warner Cable has cables along Kawaihae Road.

Sandwich Isles Communications has buried fiber-optic cable approximately three feet deep along the mauka side of Kawaihae Road.

7.1.2 Impacts of Project on Electrical and Communication Facilities

7.1.2.1 No-Build Alternative

The No-Build Alternative will have no direct effect on any utilities in the area.

Table 7-1: Summary of of Impacts on Public Facilities/Utilities and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
7.1	**Electrical/ Communi-cation Utilities**	• None.	• Minimal change in electrical demand.	• New lighting will increase demand for electricity, though efficient fixtures will be used. • Electrical upgrades may be needed within harbor. • Improvements to Kawaihae Road could require relocation of utility poles, lines and cables.	• New lighting will increase demand for electricity, though efficient fixtures will be used. • Electrical upgrades may be needed within harbor. • Improvements to Kawaihae Road could require relocation of utility poles, lines and cables.	• **New lighting will increase demand for electricity, though efficient fixtures will be used.** • **Electrical upgrades may be needed within harbor.** • **Improvements to Kawaihae Road could require relocation of utility poles, lines and cables.**	• Increase in electrical/communicati on demand expected to be minor and not require major improvements from utilities. • If utility infrastructure needs to be relocated all necessary arrangements and agreements will be made with utilities prior to demolition of facilities.
7.2	**Water Comsump-tion**	• No direct effect though increase in cargo and harbor activities over time may result in proportionate increase in consumption.	• Consumption of water during construction for some BMPs (dust control, etc.).	• Consumption of water during construction for some BMPs (dust control, etc.). • Minimal increase in water consumption from increased harbor activity and new restrooms.	• Consumption of water during construction for some BMPs (dust control, etc.). • Minimal increase in water consumption from increased harbor activity and new restrooms.	• **Consumption of water during construction for some BMPs (dust control, etc.).** • **Minimal increase in water consumption from increased harbor activity and new restrooms.**	• New restrooms could be designed to consider the need to conserve water. • DOT-Harbors will coordinate with County of Hawai'i Department of Water Supply to ensure that all necessary permits/ approvals obtained and that existing supplies are adequate to accommodate Proposed Action.

Table 7-1: Summary of of Impacts on Public Facilities/Utilities and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
7.3	**Wastewater**	• No direct effect though increase in cargo and harbor activities over time may result in proportionate increase in wastewater generated.	• No direct effect though increase in cargo and harbor activities over time may result in proportionate increase in wastewater generated.	• Minimal increase in wastewater generated from increased harbor activity and new restrooms. • Restrooms will be compliant with the Americans with Disabilities Act (ADA). • New facilities will meet current standards for collecting and treating wastewater. • Demolition of old comfort station facilities will be in compliance with federal, state and county requirements.	• Minimal increase in wastewater generated from increased harbor activity and new restrooms. • Restrooms will be compliant with the Americans with Disabilities Act (ADA). • New facilities will meet current standards for collecting and treating wastewater. • Demolition of old comfort station facilities will be in compliance with federal, state and county requirements.	• **Minimal increase in wastewater generated from increased harbor activity and new restrooms.** • **Restrooms will be compliant with the Americans with Disabilities Act (ADA).** • **New facilities will meet current standards for collecting and treating wastewater.** • **Demolition of old comfort station facilities will be in compliance with federal, state and county requirements.**	• New restrooms could be designed to consider the need to conserve water. • DOT-Harbors will ensure that all necessary permits/ approvals obtained and that existing supplies are adequate to accommodate Proposed Action.

Table 7-1: Summary of of Impacts on Public Facilities/Utilities and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
7.4	**Solid Waste**	• No direct effect though increase in cargo and harbor activities over time may result in proportionate increase in waste generated.	• No direct effect though increase in cargo and harbor activities over time may result in proportionate increase in waste generated.	• Construction, demolition, and dredge material waste will be generated. • Disposal of construction/demolition waste will be done at an approved demolition sanitary landfill. • Minor increase in solid waste generated commensurate with increase in harbor activity. Pu'unaahulu landfill has ample capacity for these wastes.	• Construction, demolition, and dredge material waste will be generated. • Disposal of construction/demolition waste will be done at an approved demolition sanitary landfill. • Dredge materials will be disposed either at an approved ocean site, within Coral Flats, or at an approved landfill depending on the composition and space available. • Minor increase in solid waste generated commensurate with increase in harbor activity. Pu'unaahulu landfill has ample capacity for these wastes.	**• Construction, demolition, and dredge material waste will be generated.** **• Disposal of construction/demolition waste will be done at an approved demolition sanitary landfill.** **• Dredge materials will be disposed either at an approved ocean site, within Coral Flats, or at an approved landfill depending on the composition and space available.** **• Minor increase in solid waste generated commensurate with increase in harbor activity. Pu'unaahulu landfill has ample capacity for these wastes.**	• Foreign wastes entering the US will be directed to a DOH-permitted foreign waste facility. • Hazardous wastes will be disposed of in compliance with all state and federal regulations. • Recycling and reuse measures will be encouraged during and after construction.

Table 7-1: Summary of of Impacts on Public Facilities/Utilities and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
7.5	**Educational Facilities**	• None.	• Kanu o ka ʻĀina New Century Public Charter School (KANU), which operates a makai campus in the Coral Flats, could have some disruption from noises associated with construction and grading. • The unimproved perimeter roadway will be transferred to DOBOR, which may improve it in the future under a separate action. • Fencing will be installed along the unimproved perimeter road.	• Kanu o ka ʻĀina New Century Public Charter School (KANU), which operates a makai campus in the Coral Flats, could have some disruption from noises associated with construction and grading. • The unimproved perimeter roadway will be transferred to DOBOR, which may improve it in the future under a separate action. • Fencing will be installed along the unimproved perimeter road.	• Kanu o ka ʻĀina New Century Public Charter School (KANU), which operates a makai campus in the Coral Flats, could have some disruption from noises associated with construction and grading. • The unimproved perimeter roadway will be transferred to DOBOR, which may improve it in the future under a separate action. • Fencing will be installed along the unimproved perimeter road.	• **Kanu o ka ʻĀina New Century Public Charter School (KANU), which operates a makai campus in the Coral Flats, could have some disruption from noises associated with construction and grading.** • **The unimproved perimeter roadway will be transferred to DOBOR, which may improve it in the future under a separate action.** • **Fencing will be installed along the unimproved perimeter road.**	• Access to the school area will be maintained. • Noise and construction impacts will be minimized through mitigation measures described above.
7.6	**Police**	• None.	• None.	• Minimal changes in activity at the harbor most of which will generally be under jurisdiction of federal and state authorities.	• Increased activity at the harbor will generally be under jurisdiction of federal and state authorities, but there could be some increased need for county police assistance. • Any increase in police assistance is not expected to create an undue demand on police resources.	• **Increased activity at the harbor will generally be under jurisdiction of federal and state authorities, but there could be some increased need for county police assistance.** • **Any increase in police assistance is not expected to create an undue demand on police resources.**	• No mitigation is warranted.

Table 7-1: Summary of of Impacts on Public Facilities/Utilities and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
7.7	**Fire/EMS**	• No direct effect. • Some spacing of hydrants at harbor is more distant than current best practices, and this deficiency will not be addressed.	• No direct effect. • Some spacing of hydrants at harbor is more distant than current best practices, and this deficiency will not be addressed.	• Fire suppression generally handled on-site by harbor personnel, but there could be some increased need for county fire assistance. • Any increase in fire assistance is not expected to create an undue demand on fire department resources. • Improvements will need to ensure that fire suppression is up to current standards, and additional hydrants and sprinklers may be installed as warranted.	• Fire suppression generally handled on-site by harbor personnel, but there could be some increased need for county fire assistance. • Any increase in fire assistance is not expected to create an undue demand on fire department resources. • Improvements will need to ensure that fire suppression is up to current standards, and additional hydrants and sprinklers may be installed as warranted.	• **Fire suppression generally handled on-site by harbor personnel, but there could be some increased need for county fire assistance.** • **Any increase in fire assistance is not expected to create an undue demand on fire department resources.** • **Improvements will need to ensure that fire suppression is up to current standards, and additional hydrants and sprinklers may be installed as warranted.**	• All structures and cargo handling activities will conform to existing fire codes. • Improvements in fire suppression at the harbor will be installed as warranted.
7.8	**Medical Facilities**	• None.	• No measurable increase in demand for medical facilities.	• No measurable increase in demand for medical facilities.	• No measurable increase in demand for medical facilities.	• **No measurable increase in demand for medical facilities.**	• No mitigation is warranted.

7.1.2.2 Build Alternatives

Alternative 2 - Minimal Action is not expected to result in any measurable change in electrical demand.

To varying degrees, Alternatives 3, 4, and the Proposed Action - Alternative 5 will result in increased use of the harbor and will be expected to result in a minor increase in demand for electrical service and telecommunications. All these alternatives will result in new lighting systems (i.e., poles and light fixtures) that upgrade existing yard systems. In addition, new berthing areas (at Pier 2A under Alternatives 4 and 5, or at Pier 2C under Alternative 5) and newly graded yard areas will increase the demand for electricity on-site. Other sources of electrical consumption associated with the Alternatives 3, 4 and 5 include electrical power for the relocated offices, changes in inspection booths at the improved gates, and other similar improvements. A photovoltaic system is expected to generate power at the Hawai‘i District Office, but there will still be some consumption from the grid when the photovoltaic system is not generating power.

Under Alternatives 3, 4, and 5, a system of 180-watt low-pressure sodium luminaries are proposed. This system will provide automatic and manual control of lighting, with a range of full lighting during operations and reduced “security light levels” (i.e., 20 percent level).

Based on the additional and future load requirements at the terminal, including wharf outlets, high mast lighting, support buildings, reefer outlets and truck gates, electrical service to the terminal, and the site distribution system may require system upgrades (e.g., a new substation(s), rectifiers, transformers) under Alternatives 3, 4, and 5.

Electrical power will be required under Alternatives 3, 4, and 5 for additional site lighting for the terminal yard and wharf areas, reefer plug outlets, and buildings/auxiliary structures. A restructured underground power and communication ductbank system will be required to serve the new terminal layout and its support buildings, and, as a matter of good practice, spare power and communications conduits should be provided in the ductbank system for future equipment and development. Based on prior and similar terminal facility improvement projects, the electrical service and distribution system may require an upgrade to accommodate the added buildings and auxiliary structures, site lighting, reefer plug outlets, operations, and future development load requirements. The need for service upgrade should be assessed during future detailed engineering and design.

In order to maximize operational efficiency and flexibility, minimum above-grade utility infrastructure shall be placed in storage. Utility manholes and vaults shall be placed in planned travel aisles to facilitate access and minimize damage.

In pre-assessment comments received on the project, Hawaiian Telcom noted concerns about impact to their cable facilities along Kawaihae Road/Akoni Pule Highway as well as into the Kawaihae Harbor complex. Hawaiian Telcom also has an interisland cable landing site at Spencer Beach Park. Hawaiian Telcom raised concerns about dredging affecting their cable at Spencer Beach Park, however, that site is located south of Pu‘ukoholā Heiau, some distance from the harbor, and should not be affected by any dredging under Alternatives 4 or 5, which

will be limited to within Kawaihae Harbor. Refer to **Figure 8-6: Oblique View to North Showing Relative Location of Pu‘ukoholā Heiau National Historic Site and Harbor** in **Section 8.2: Pu‘ukoholā Heiau National Historic Site** to see the location of the park relative to Kawaihae Harbor. There are no Hawaiian Telcom cables within the commercial harbor itself, and therefore there will be no effects on Hawaiian Telcom interisland cables anywhere under any of the alternatives.

Improvements to Kawaihae Road under Alternatives 3, 4, and 5 could require the relocation of poles, lines, and cables, depending on the ultimate design and right-of-way needs. The relocation of utility poles or buried cable will require a utility agreement (UA) between the regulated utility companies (HELCO, Hawaiian Telcom, Oceanic Time Warner Cable, Sandwich Island Communications) and the State of Hawai‘i, Department of Transportation, Harbors Division (DOT-H). The UA will provide for cost-sharing for these relocations. Typically all relocations will be one-for-one (replace one utility pole with a similar utility pole at the new location). The Public Utilities Commission (PUC) will review the UA and the application for the relocation work, and provide a decision and order to the requesting utilities. The PUC may or may not require a public hearing.

7.1.3 Recommended Mitigation of Project on Electrical and Communication Facilities

If it is necessary to relocate utility infrastructure, DOT-H will coordinate with the utilities during the design phase of the project and make sure that all necessary arrangements and agreements have been fulfilled prior to construction and demolition of facilities to ensure there are no adverse effects on utility infrastructure.

Installation of a photovoltaic system on the Hawai‘i District Office will mitigate increased power consumption by partly or fully offsetting the office’s electricity use during hours of sunlight. No additional mitigation is necessary in terms of accommodating utility demand from the harbor.

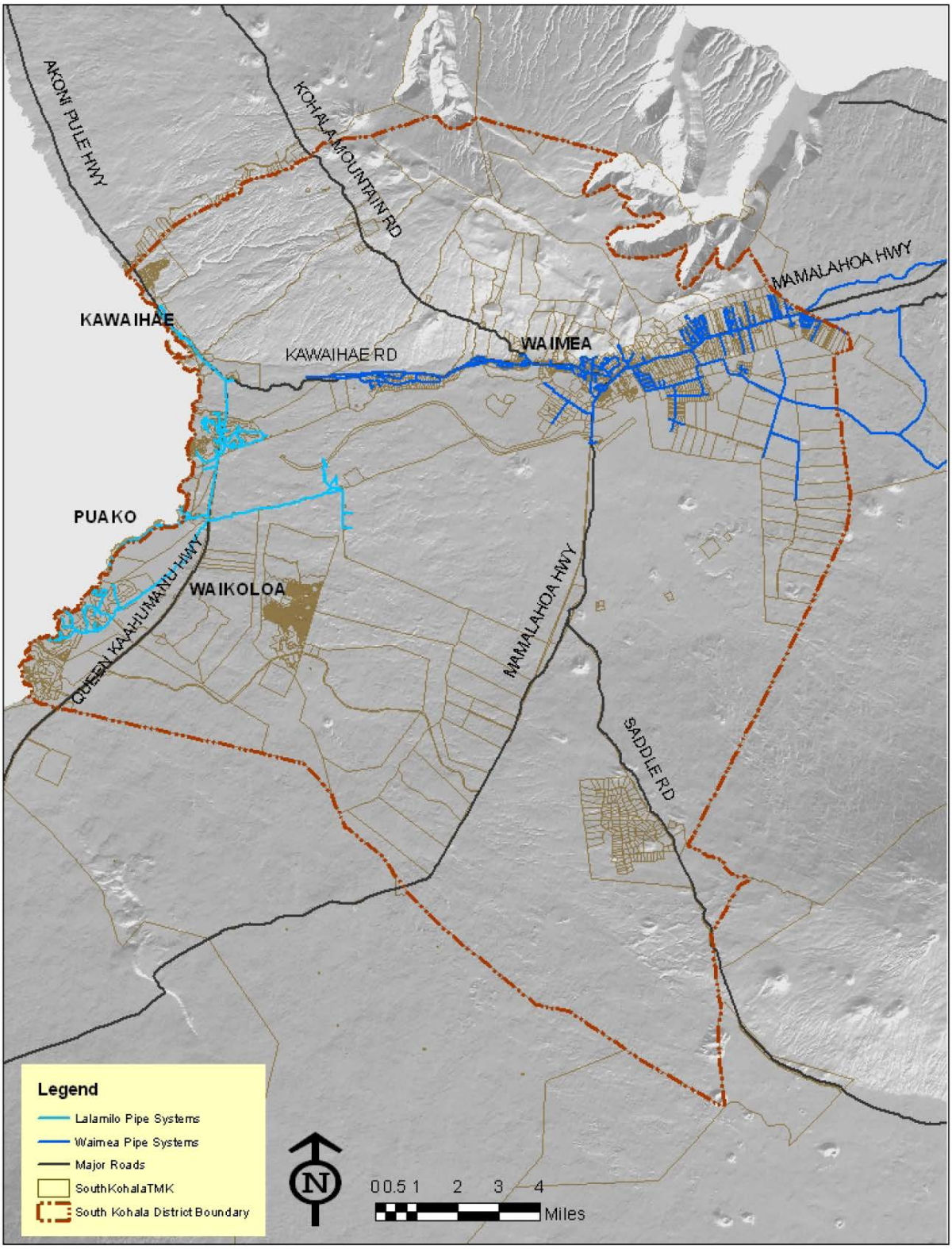
7.2 Water Facilities

7.2.1 Existing Facilities

Groundwater in the Kawaihae Area has been discussed in **Section 4.10: Hydrology and Water Quality**.

The existing Kawaihae Harbor obtains public potable water supplied by the County of Hawai‘i, Department of Water Supply’s (DWS) Lālāmilo Water System, which serves the Kawaihae and Puakō areas, and has an average consumption of 3 million gallons per day (MGD). This system is shown in **Figure 7-1: County Water Delivery Systems in South Kohala**.

Figure 7-1: County Water Delivery Systems in South Kohala



Source: County of Hawai'i, *South Kohala Community Development Plan,* 2008.

Originally, the Lālāmilo Water System was designed to service Kawaihae, but has since expanded to service other coastal areas including Puakō and the Mauna Kea and Mauna Lani Resorts. The system includes two booster pump stations and nine storage tanks. Water is transported via a six-inch pipeline from the Waimea Water System down to Kawaihae and more or less follows Kawaihae Road. As the Lālāmilo Water System expanded to accommodate the new coastal developments south of Kawaihae, high level exploratory deep wells were drilled along Kawaihae Road in order to supplement the limited supply of water from Waimea. The water was of marginal quality and had high chloride content. Water from these wells was blended with fresh mountain water to supply the coastal developments. In 1977, the State drilled exploratory wells on its Lālāmilo lands. These wells and subsequent additional wells were drilled with financing from the developer of Mauna Lani Resort. The water in these wells was of good quality and was also included as part of the system. Two Parker Ranch wells replaced the two Kawaihae wells that serviced the Lālāmilo Water System during the latter 1990s (County of Hawai‘i, Department of Water Supply, 2010).

A 12-inch water main is located within Kawaihae Road and continues down Akoni Pule Highway, serving Kawaihae Harbor and the surrounding area.

The Lālāmilo system obtains its water from six deep wells at the 1,200-foot elevation. The County of Hawai‘i has identified in its General Plan a need for alternative sources of water for the Lālāmilo system to meet future demand (County of Hawai‘i, 2005).

The *South Kohala Community Development Plan* (CDP) notes that while current water resources can accommodate existing demands through 2025, some of the future projected water demand will need infrastructure improvements, and increasing the amount of potable water for Kawaihae is a specific need (County of Hawai‘i, 2008). The CDP also notes that limitations on available water have prevented the Hawai‘i Department of Hawaiian Homelands (DHHL) from further developing land in Kawaihae for an industrial park and residential use.

The CDP suggests development of the ‘Oūli Well Field as part of the Bridge ‘Āina Le‘a project (County of Hawai‘i, 2008). According to the CDP, there are three wells in the ‘Oūli Well Field. Bridge ‘Āina Le‘a estimates the sustainable yield of the ‘Oūli well field at approximately 2.2 MGD. Each of the three wells is estimated to provide 1.1 MGD of water. However, one well will be used as a back-up well and will not be in regular use. 2.2 MGD of water will be enough to provide for the needs of about 9,000 people or 4,000 households (County of Hawai‘i, 2008).

The County negotiated a water development agreement with Bridge ‘Āina Le‘a in 2006. The agreement calls for Bridge ‘Āina Le‘a to develop the ‘Oūli Well Field and design and construct a transmission system to connect the water from the ‘Oūli Wells with the Lālāmilo Water System to service the Mauna Kea Resort and Kawaihae areas. Hawai‘i County will receive 20 percent of the water source while Bridge ‘Āina Le‘a will receive 80 percent. The Lālāmilo Water System will receive an estimated additional 0.8 MGD (2.2 MGD x 20 percent = 0.8 MGD), enough water to accommodate 3,200 people or 1,600 households (County of Hawai‘i, 2008).

In addition, Bridge ‘Āina Le‘a will also provide 2 million gallons of water storage capacity. More importantly, the DWS Lālāmilo Water System will become a dual source system, as the ‘Oūli wells will provide a back-up source of water to the system. In exchange for developing the ‘Oūli

Wells, Bridge ‘Āina Le‘a will be allowed to connect to the water system facilities in Lālāmilo (County of Hawai‘i, 2008).

Water use at Kawaihae Harbor currently consists of potable water at existing comfort stations as well as water used for current port operations and at fire hydrants. In the month of September, 2011, consumption at the harbor at four separate meters consisted of approximately 4,300 gallons per day. Two of the meters are for fire hydrants and have intermittent use, with no consumption in that particular month.

7.2.2 Project Impacts on Water Facilities

7.2.2.1 No-Build Alternative

The No-Build Alternative will have no direct effect on water facilities in the short term, though cargo and harbor activities are expected to grow over time, and water consumption may increase proportionately.

7.2.2.2 Build Alternatives

For the Build Alternatives, during the construction phase of the project, water usage will likely increase for the implementation of Best Management Practices (BMPs), e.g., dust control, concrete preparation, washing of equipment, etc. These uses will be short-term and temporary.

The Build Alternatives will have a minimal effect on water consumption from public water supplies at Kawaihae Harbor. Alternatives 3, 4, and 5 will increase the availability of restroom facilities on the property, and potable water usage for other harbor uses will likely increase proportionately to the increased activity at the harbor. However, these changes are not expected to have a significant effect on the public water supply.

The new comfort stations will be built to Americans with Disability Act (ADA) standards and will be designed in consideration of the need to conserve water. Measures to conserve water could include using water efficient fixtures, low-volume toilets, automatic faucets, appropriate xeriscaping if landscaping is pursued, etc.

Under Alternatives 3, 4, and 5, permanent relocation of the Hawai‘i District Office and comfort stations will require new water pipes to serve the new facilities, as well as capping of old pipes.

In pre-assessment comments on the project, DWS cited the 12-inch water main within Akoni Pule Highway/Kawaihae Road and noted that any additional water demand will require extensive improvements to the water system, which may include, but not be limited to, additional source, storage, booster pumps, and transmission facilities.

To bring fire suppression systems up to current standards, under Alternatives 3, 4, and 5, fire hydrants will be relocated adjacent to alternating light poles at distances approximately 300 feet apart. This will satisfy the fire department’s distance requirement and allow for sufficient fire suppression coverage for the storage yard.

In order to maximize operational efficiency and flexibility, minimum above-grade utility infrastructure shall be placed in storage areas and fire hydrants shall be placed adjacent to high-mast light poles. Utility manholes and vaults shall be placed in planned travel aisles to facilitate access and minimize damage.

7.2.3 Recommended Mitigation of Impacts on Water Facilities

It is recommended that DOT-H coordinate with DWS to ensure that the existing water supply is adequate to accommodate the Proposed Action.

7.3 Wastewater

7.3.1 Existing Wastewater Facilities

There are no public wastewater sewers in close proximity to the site of the Proposed Action. All wastewater from the harbor is treated on-site. Under the Pier 2A Yard improvements project that precedes the Proposed Action, the cesspool that services the Hawai‘i District Office will be closed and filled in. An additional cesspool and comfort station was previously closed with the Pier 2A Shed Demolition Project.

The only remaining cesspools on Kawaihae Harbor property are located at Pier 1, where four small-capacity cesspools and associated comfort stations are found. In addition, two small comfort stations with “cavitettes” for treatment (small aeration systems for injecting oxygen into waste which allows bacteria to reduce organic waste to carbon dioxide and water) are found in the former Akana Petroleum area. The US EPA has issued mandates that all large capacity cesspools are to be shut down.

7.3.2 Impacts on the Project from Wastewater

7.3.2.1 No-Build Alternative

The No-Build Alternative will not result in any increased generation of wastewater other than what will otherwise be expected with growth in harbor usage over time.

7.3.2.2 Build Alternatives

The Build Alternatives will likely result in a minor increase in generation of wastewater with increased use of Kawaihae Harbor. Under Alternatives 3, 4, and 5, the new comfort station near the main gate and the new Hawai‘i District Office by the south gate will have new septic systems installed to treat the waste created based on current Hawai‘i Department of Health (DOH) standards. The new restrooms will be built to meet ADA standards and consideration will be given to conserving water.

Under Alternatives 3, 4, and 5, the demolition of the old comfort station facilities will include removal of the restrooms, and the cesspool associated the old comfort station will be closed, pumped out, and filled in.

7.3.3 Recommended Mitigation of Impacts from Wastewater

Any cesspools that are closed as a result of this project will have the contents pumped out and will be completely filled in compliance with Federal, State and County requirements. All new facilities will be built to comply with ADA standards.

7.4 Solid Waste

7.4.1 Existing Profile of Solid Waste

Kawaihae Harbor is not a significant generator of solid waste. Currently, household-type waste and garbage (i.e., non-hazardous solid waste) is disposed of in trash-collection dumpsters. The solid waste is collected and disposed offsite by a private contractor, Pacific Waste, on a regular schedule.

Solid waste that is generated in West Hawai‘i is transported to the Pu‘uanahulu landfill, located south of the Waikoloa resort area and mauka of Queen Ka‘ahumanu Highway. Opened in 1992, this landfill is anticipated to have capacity for roughly 30 more years.

7.4.2 Impacts of the Project on Solid Waste

7.4.2.1 No-Build Alternative

Solid waste generated under the No-Build Alternative may increase from the present day if the volume of cargo handled by the harbor increases over time. However, the No-Build Alternative will not change the nature or composition of solid waste generated. No construction waste will be generated under the No-Build Alternative

7.4.2.2 Build Alternatives

Alternative 2 - Minimal Action is expected to generate little if any solid waste.

During the construction phase of Alternatives 3, 4, and 5, construction and demolition waste will be generated on a temporary basis by the demolition of buildings, piers and from general construction activities. Commercial contractors will dispose of non-hazardous construction and demolition waste off-site at an approved construction and demolition sanitary landfill in compliance with applicable federal and state regulations.

Dredge materials will be disposed at an approved deep ocean site, stored within the Coral Flats area for later reuse, or disposed at an approved, upland landfill depending on the composition of the dredge materials and space availability.

Hazardous wastes will require special handling and are discussed in **Section 4.16: Hazardous Materials.**

After construction is completed, the Build Alternatives, particularly Alternatives 4 and 5, may result in a minor increase in solid waste generation as activity at the harbor increases.

The Build Alternatives are not anticipated to compromise the long-term capacity of the Pu‘uanahulu landfill, which has capacity for roughly 30 years into the future.

Foreign solid waste generated by carriers, which left foreign ports and their first port of entry to the United States (US) is Hawai‘i, must comply with the US Department of Agriculture regulations. The Office of Solid Waste Management regulates facilities that process foreign wastes for disposal within the state. Therefore, all foreign waste removed from ships shall be directed to a DOH permitted foreign waste facility (Towill, R.M. and Company, 2001).

7.4.3 Recommended Mitigation of Impacts from Solid Waste

All disposal of construction and demolition waste will be performed in compliance with applicable Federal and State regulations, including Hawai‘i Administrative Rules 11-58.1 and the federal Resource Conservation and Recovery Act (RCRA). Recycling and reuse measures are encouraged to divert solid waste from the landfill and minimize waste from the Proposed Action, both during construction and after completion of construction.

7.5 Education

There are no public school buildings in close proximity to Kawaihae Harbor; the nearest public schools are found in Waikoloa and Waimea. Therefore, none of the alternatives should have any direct impact on any public educational facilities.

Kanu o ka ‘Āina Learning ‘Ohana (KALO) is a non-profit organization in Waimea promoting the progress of Hawai‘i’s indigenous people. One of KALO’s programs is Kanu o ka ‘Āina New Century Public Charter School (KANU). KANU has a makai campus, Hālau Pukui, on the Coral Flats just southeast of the East Breakwater. This makai curriculum component of KANU plays a vital role in the school‘s goal in being a comprehensive Native Hawaiian learning center or kauhale. The makai campus allows KANU to continue traditional Hawaiian cultural practices associated with multiple marine resource areas. Furthermore, KANU also uses the area for physical educational and recreational water activities (i.e., swimming and diving), as it is considered a preferred location for its water depth and safety reasons. The Hālau Kukui complex is shared with the Waimea YMCA as their Aquatic Center, where recreational activities are scheduled twice a week during the summer. A modern ahu (traditional Hawaiian shrine) has also been erected in this area, which serves as a ceremonial and spiritual conduit between cultural practitioners of the area and the divine aspects of land and sea (Fielder and Mooney, 2011).

Several recreational clubs that engage in traditional Hawaiian cultural practices (e.g., canoeing, surfing, voyaging) operate at Kawaihae Harbor as well. Consult **Section 8.1: Recreational Facilities within Kawaihae Harbor** for more information.

7.5.1 No-Build Alternative

The No-Build Alternative will have no direct effect on KANU or other educational facilities in the area.

7.5.2 Build Alternatives

Under the Build Alternatives, there may be some disruption in KANU activities with construction and grading in the Coral Flats area. Alternative 2 - Minimal Action will only involve security fencing in this area, whereas Alternatives 3, 4, and 5 will include grading throughout the coral flats. Noises and fugitive dust generated from grading and grubbing activities and the construction of the perimeter fence could distract children from their teachings and reduce their cultural experience. The noise will also be problematic to those paying their respects, leaving offerings, or wanting to pule (pray) at the modern ahu. Fugitive dust will be generated when winds spread dust from exposed soils or from vehicles using unpaved areas. Ocean water quality may be affected by unintentional run-off of disturbed sediment, which could obscure visibility during recreational and educational activities of both KANU and YMCA.

Under all Build Alternatives, the land for the unimproved perimeter road and Kawaihae Small Boat Harbor (South) area will be transferred to the Hawai‘i Department of Land and Natural Resources, Division of Boating and Ocean Recreation (DLNR DOBOR).

7.5.3 Recommended Mitigation of Impacts on Educational Facilities

If the current access route to the Coral Flats area is temporarily cut off during the construction phase, an alternate route should be provided to ensure continuous access to KANU.

One way to mitigate the noise and visual impacts from earthwork activities and the installation of the perimeter access roadway fencing could be to create a community relations program that could offer information to the public about construction schedules and create construction schedules that avoid major cultural events. Typical measures to conceal construction activities, such as temporary construction walls and fencing could help as well.

Best Management Practices (BMPs) have been recommended during construction to minimize fugitive dust emissions, and to reduce the potential for wind or water erosion and sedimentation. These would include such measures as a dust control plan, scheduling construction to minimize the amount of exposed soils at any given time, and applying water to exposed areas to minimize generation of fugitive dust.

7.6 Police Protection

Kawaihae Harbor has full-time on-site security and a guard shack at the Main Gate entry to provide security service, consistent with the United States Department of Homeland Security requirements. Police backup protection for the area of Hawai‘i County that includes Kawaihae Harbor is served by patrols from the Hawai‘i County, Police Department’s Waimea substation (South Kohala District), at the intersection of the Mamalahoa Highway and Kamamalu Street in Waimea town. This location is approximately twelve miles from Kawaihae Harbor, using Kawaihae Road and the Mamalahoa Highway. Other facilities are found in the Waikoloa area and in Kapa‘au in North Kohala.

7.6.1 No-Build Alternative

The No-Build Alternative will have no direct effect on police services in the area.

7.6.2 Build Alternatives

Alternatives 2 and 3 will not appreciably increase activity at the harbor and therefore should have a negligible, if any, effect on the demand for police services in the area.

Under Alternative 4 - Land-Side Plus Pier 2A Extension and to a greater degree, Alternative 5, there is expected to be increased activity at the harbor as more berthing capacity is offered. While the security at the harbor is generally under the jurisdiction of federal and state authorities and provided by private security providers, there could be some increased need for county police assistance at the harbor. This will not be expected to create an undue increase in police resources.

Kawaihae Harbor has a Facilities Security Plan (FSP) in place, which is administered by DOT-H. Matson Navigation, Young Brothers Ltd., and Mid Pacific Petroleum have their own FSPs (AECOM, 2011). Young Brothers has a Memorandum of Understanding granting passage for Mid Pacific through Young Brothers' backland areas. Existing security measures include:

- checking labor and trucker identity by TWIC card review.
- verifying dock receipts and bills of lading at the gate.
- perimeter security fencing defining the harbor's secure boundaries and secondary fencing for terminal tenants.
- high-mast lighting throughout most of the Harbor.

Two private security providers, Millennium Security and Securitas provide on-site security services. (AECOM, 2011). Additional security improvements proposed at Kawaihae Harbor are discussed in **Section 3.6.6: Security Improvements**.

7.7 Fire Protection and Emergency Medical Services

Fire protection and Emergency Medical Services (EMS) services are provided by Hawai'i County. The nearest Fire and EMS facilities to Kawaihae Harbor are on the South Kohala Coast (near the Mauna Lani Hotel) with a 12- to 15-minute response time, and in Waimea and Waikoloa Village, with about a 20- to 25-minute response time. A Volunteer Fire Station is found in Kohala Ranch in North Kohala.

According to the Hawai'i County, Fire Department, the space between hydrants should be no more than 300 feet. Currently, there is 700 feet of space between two of the hydrants serving Kawaihae Harbor.

7.7.1 No-Build Alternative

The No-Build Alternative will have no direct effect on fire services in the area.

7.7.2 Proposed Action

Alternatives 2 and 3 will not appreciably increase activity at the harbor and therefore should have a negligible, if any, effect on the demand for fire or EMS services in the area.

Under Alternative 4 - Land-Side Plus Pier 2A Extension and to a greater degree, the Proposed Action - Alternative 5, there is expected to be increased activity at Kawaihae Harbor. While fire protection activities at the harbor will often be handled by on-site resources, there could be some increased need for county fire assistance at the harbor. This will not be expected to create an undue increase in demand for fire protection.

Under Alternatives 3, 4, and 5, when the yard is reorganized as part of the improvements, DOT-H will work to ensure that the fire suppression system is up to current standards. To bring fire suppression systems up to current standards, fire hydrants will be relocated adjacent to alternating light poles at distances approximately 300 feet apart. This will satisfy the fire department’s distance requirement and allow for sufficient fire suppression coverage for the storage yard.

All future harbor structures and cargo handling activities will conform to existing fire codes. All on-site fire protection requirements and procedures will be closely coordinated with the County of Hawai'i, Fire Prevention Bureau.

7.8 Medical Facilities

The nearest major medical facility is the North Hawai‘i Community Hospital in Waimea.

7.8.1 No-Build Alternative

The No-Build Alternative will have no direct effect on medical facilities in the area.

7.8.2 Build Alternatives

None of the Build Alternatives are expected to have any measurable increase on the need for medical facilities in the area.

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CHAPTER 8: PUBLIC RECREATIONAL FACILITIES

The Kawaihae area, both within and near the commercial harbor is blessed with a wide variety of recreational facilities. Most of the facilities discussed in this chapter are identified in **Figure 4-15: Major Cultural Features of Kawaihae Harbor**. The chapter that follows covers the existing conditions, the anticipated impacts, and the proposed mitigation for effects on the physical and biological environment. Refer to **Table 8-1: Summary of Impacts on Public Recreational Facilities and Recommended Mitigation** for a brief summary of the rest of the chapter. **Table 8-1: Summary of Impacts on Public Recreational Facilities and Recommended Mitigation** provides recommended mitigations. Actual mitigations will be determined by the appropriate permit/approval process.

8.1 Recreational Facilities within Kawaihae Harbor

Current recreational activities within Kawaihae Harbor are focused on the Coral Flats area and include beach/swimming activities, surfing, canoeing, and fishing within the harbor. Some of the facilities have lease agreements with state agencies for use of the property, as will be discussed in the respective sections below.

Small boat facilities are discussed below as well. The small boat harbors are under the jurisdiction of the Hawai'i Department of Land and Natural Resources, Division of Boating and Ocean Recreation (DLNR DOBOR).

8.1.1 YMCA Facilities

The Waimea Family Young Men's Christian Association (YMCA) operates the Halau Kukui Aquatics Center located at Kawaihae Harbor in the Coral Flats area adjoining the Kawaihae Small Boat Harbor (South). The YMCA offers youth sailing camps and organized ocean recreation. A picture of those facilities is shown in **Figure 8-1: YMCA and Halau Kukui Facilities on Coral Flats**.

Figure 8-1: YMCA and Halau Kukui Facilities on Coral Flats



Table 8-1: Summary of Impacts on Public Recreational Facilities and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
8.1	**Recreational Facilities Within Kawaihae Harbor**	• None.	• The unimproved perimeter roadway within the Coral Flats area will be transferred to DOBOR, which may improve it in the future under a separate action to the benefit of recreational users.	• The unimproved perimeter roadway within the Coral Flats area will be transferred to DOBOR, which may improve it in the future under a separate action to the benefit of recreational users. • Grading and other construction impacts could temporarily impact recreational users.	• The unimproved perimeter roadway within the Coral Flats area will be transferred to DOBOR, which may improve it in the future under a separate action to the benefit of recreational users. • Increases in harbor activity could result in some additional conflicts between primary harbor users (barges, etc.) and surfers, canoeists, fishermen, small boats. • Temporary mooring area for small boats will be demolished to accommodate improvements at Piers 2B and 2C. • Dredging, grading, and other construction impacts could temporarily impact recreational users.	• **The unimproved perimeter roadway within the Coral Flats area will be transferred to DOBOR, which may improve it in the future under a separate action to the benefit of recreational users.** • **Increases in harbor activity could result in some additional conflicts between primary harbor users (barges, etc.) and surfers, canoeists, fishermen, small boats.** • **Temporary mooring area for small boats will be demolished to accommodate improvements at Piers 2B and 2C.** • **Dredging, grading, and other construction impacts could temporarily impact recreational users.**	• Access to recreational facilities will be maintained. Fencing along the unimproved perimeter road will limit access to secured areas. • It is recommended that DOT-Harbors provide community outreach to address conflicts between increased activity in the harbor and recreational users.
8.2	**Pu'ukoholā Heiau National Historic Site**	• None.	• Construction impacts from noise and aesthetic impacts on Pu'ukoholā Heiau National Historic Site associated with fencing.	• Construction impacts from noise and aesthetic impacts on Pu'ukoholā Heiau National Historic Site associated with fencing and grading of Coral Flats.	• Construction impacts from noise and aesthetic impacts on Pu'ukoholā Heiau National Historic Site associated with fencing and grading of Coral Flats.	• **Construction impacts from noise and aesthetic impacts on Pu'ukoholā Heiau National Historic Site associated with fencing and grading of Coral Flats.**	• BMPs will minimize impacts on Pu'ukoholā Heiau NHS.

Table 8-1: Summary of Impacts on Public Recreational Facilities and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
8.3	**Ala Kahakai National Historic Trail**	• None.	• None.	• Improvements to Kawaihae Road could offer a beneficial link for the Ala Kahakai National Historic Trail.	• Improvements to Kawaihae Road could offer a beneficial link for the Ala Kahakai National Historic Trail.	• **Improvements to Kawaihae Road could offer a beneficial link for the Ala Kahakai National Historic Trail.**	• Design of Kawaihae Road will consider trail user needs.
8.4	**Spencer Beach Park**	• None.	• None.	• None.	• None.	• **None.**	• None warranted.

8.1.1.1 No-Build Alternative

The No-Build Alternative will have no direct effect on the YMCA Aquatics Center Facilities.

8.1.1.2 Build Alternatives

All Build Alternatives will improve the access to the aquatics center by providing land for an improved perimeter access road on the south side of the Coral Flats. Increased activity in the harbor associated with growth may create some additional conflicts between the aquatics center users and vessels in the harbor. No mitigation is proposed.

8.1.2 Pua Ka 'Ilima 'O Kawaihae Cultural Surf Park

The Pua Ka 'Ilima Long Board Classic competition has been held every January or February since 1992, and this competition was the impetus for creating a surf park in Kawaihae. A 1997 Hawai'i Senate Resolution designated the site for the surf park and communities and foundations raised funds were to develop the park.

The Pua Ka 'Ilima O Kawaihae Cultural Surf Park, a non-profit organization, promotes traditional cultural activities such as hula, canoe building, etc. and is located on 1.5 acres of the Coral Flats between the Kawaihae Small Boat Harbor (South) and the main breakwater. The park offers stairs leading down into the water, plus a small landscaped area with picnic tables, grass, and shade trees. A sign at the site (which also shows the original shoreline) is shown in **Figure 8-2: Photo of the Pua Ka 'Ilima 'O Kawaihae Cultural Surf Park Information Sign**. The club was previously located near Pier 1 but was relocated when the Superferry was proposed to serve the area. Since 2008, they have had a revocable (month-to-month) permit with DOBOR, and now DOT-H.

8.1.2.1 No-Build Alternative

The No-Build Alternative will have no direct effect on the Pua Ka 'Ilima O Kawaihae Cultural Surf Park.

8.1.2.2 Build Alternatives

All Build Alternatives will result in the perimeter access road being transferred to DLNR DOBOR, which may choose in a separate project to improve the access to the surf park area with an improved perimeter access road on the south side of the Coral Flats.

The increase in activity in the harbor associated with growth, particularly under the Proposed Action – Alternative 4 as well as Alternative 4 may create some additional conflicts between surfers and other harbor users. To address the potential for water quality being impacted by run-off, which will in turn, impact a variety of aquatic activities and marine resources, Best Management Practices (BMPs) will include a comprehensive erosion and sediment control plan to minimize impacts from earth-moving activities.

Figure 8-2: Photo of the Pua Ka 'Ilima 'O Kawaihae Cultural Surf Park Information Sign



Source: Cultural Surveys Hawai'i, 2011

8.1.2.3 Recommended Mitigation of Impacts on the Pua Ka ‘Ilima O Kawaihae Cultural Surf Park

Should the current access route to the Coral Flats area be temporarily cut off, an alternate route will be provided during the construction phase to ensure access to the surf park. It is recommended that community outreach and timely communication with recreational harbor users help to find solutions to concerns about conflicts between increased activity in the harbor and surfers. To mitigate the effects of the improvements on the Coral Flats users, DOT-H could coordinate with the community about construction schedules and create construction schedules that avoid major cultural events. Typical measures to conceal construction activities, such as temporary construction walls and fencing are also recommended as well.

8.1.3 Na Kalai Wa‘a Moku ‘O Hawai‘i

Na Kalai Wa‘a Moku ‘O Hawai‘i is a non-profit organization that conducts community educational programs utilizing Hawaiian voyaging and non-instrument navigation as its foundation. The focal point and primary classroom for the programs is the double-hulled canoe Makali‘i, which has sailed extensively through the Hawaiian Islands and has also sailed to the Marshall Islands, Micronesia, Guam and Saipan. Educational programs are based on traditional knowledge and cultural practices. Na Kalai Wa‘a Moku ‘O Hawai‘i is located in the far southwest corner of Coral Flats near the mouth of Pelekāne Bay.

Na Kalai Wa‘a Moku ‘O Hawai‘i has had a temporary dry storage permit issued to them by DLNR DOBOR since January, 2008. This temporary permit is intended to only be in place until a new storage facility is completed.

8.1.3.1 No-Build Alternative

The No-Build Alternative will have no direct effect on Na Kalai Wa‘a Moku ‘O Hawai‘i.

8.1.3.2 Build Alternatives

All Build Alternatives will result in the perimeter access road being transferred to DLNR DOBOR, which may choose in a separate project to improve the access to Na Kalai Wa‘a’s launch area with an improved perimeter access road on the south side of the Coral Flats.

8.1.4 Kawaihae Canoe Club

The Kawaihae Canoe Club was formed in 1972 as part of a revival of the ancient Hawaiian sport of outrigger canoe racing. The club, a non-profit organization, currently launches from the DLNR DOBOR’s Kawaihae Small Boat Harbor (North) facility (see **Section 8.1.5: Kawaihae Small Boat Harbor (North)** for more information.) A view of the canoe club’s launch area and the Kawaihae Small Boat Harbor (North) and breakwalls is shown in **Figure 8-3: Small Boat Harbor (North) and Canoe Launch**.

8.1.4.1 No-Build Alternative

The No-Build Alternative will have no direct effect on the Kawaihae Canoe Club.

Figure 8-3: Small Boat Harbor (North) and Canoe Launch



8.1.4.2 Build Alternatives

The increase in activity in the harbor associated with growth, particularly under the Proposed Action, Alternative 5 and Alternative 4, may create some additional conflicts between canoeists and other harbor users. To address the potential for water quality being impacted by run-off, which will in turn, impact a variety of aquatic activities and marine resources, Best Management Practices (BMPs) will include a comprehensive erosion and sediment control plan to minimize impacts from earth-moving activities.

8.1.4.3 Recommended Mitigation of Impacts on Kawaihae Canoe Club

It is recommended that community outreach with recreational harbor users work to find solutions to concerns about conflicts between increased activity in the harbor and paddlers. To address the potential for water quality being impacted by run-off, which will in turn, impact a variety of aquatic activities and marine resources, recommended BMPs include a comprehensive erosion and sediment control plan to minimize impacts from earth-moving activities.

8.1.5 Kawaihae Small Boat Harbor (North)

DLNR DOBOR has jurisdiction over the Kawaihae Small Boat Harbor (North), located immediately north of the northern limit of Kawaihae Harbor. This harbor is located north of the north entrance to the Port of Kawaihae on 4.01 acres of land and was shown above in **Figure 8-3: Small Boat Harbor (North) and Canoe** Launch.

The Small Boat Harbor (North) contains a trailer boat launch ramp and limited berthing for small boats. The basin is shallow with a maximum depth of about 10 feet and contains very little maneuvering room; thus, the use of the basin is limited to manually-propelled water

vessels (such as, sailboats and canoes) and small power boats. Local canoe clubs often launch their canoes from the Small Boat Harbor (North).

The development of the Kawaihae Small Boat Harbor (South), described in **Section 8.1.6: Kawaihae Small Boat Harbor (South) and Temporary Mooring Area** is necessary to accommodate all types of light-draft watercraft.

8.1.5.1 No-Build Alternative

The No-Build Alternative will have no direct effect on the Small Boat Harbor (North).

8.1.5.2 Build Alternatives

The Build Alternatives will have no direct effect on the Small Boat Harbor (North) but there will be increased activity in the harbor under the Proposed Action, Alternative 5 and Alternative 4 which may create some additional conflicts between canoes and vessels in the harbor.

8.1.5.3 Recommended Mitigation of Impacts on Small Boat Harbor (North)

To address the potential for water quality being impacted by run-off, which will in turn, impact a variety of aquatic activities and marine resources, recommended BMPs include a comprehensive erosion and sediment control plan to minimize impacts from earth-moving activities.

8.1.6 Kawaihae Small Boat Harbor (South) and Temporary Mooring Area

Small boats have been anchoring at the temporary small craft mooring area inside Kawaihae Harbor since the harbor was constructed. A small wharf was constructed in the 1970s to accommodate the limited "Tahiti" style berthing-tying the bow to the wharf and using a stern anchor. A small craft mooring "dinghy dock" (running parallel to the revetment) and a "finger pier" or "boat dock" (running perpendicular) are currently owned and managed by DOT-H, after having formerly been managed by DLNR DOBOR. There is no other infrastructure except for underwater anchor blocks to tie down boats in place. Only small powerboats and manually-propelled vessels (e.g., sailboats, canoes) are capable of using the Kawaihae Small Boat Harbor (North) and therefore there are no provisions for other small boats at DLNR DOBOR's facilities in Kawaihae (M&E Pacific, Inc., 2003).

DOT-H took over management of the temporary small craft mooring area from DLNR DOBOR at the beginning of 2011, and has issued 17 temporary month-to-month mooring permits to boaters who already had existing permits with DLNR DOBOR. Under the Proposed Action, increased usage of the commercial harbor and construction of Piers 2A and 2C extensions will require eventual relocation of the small, light-draft vessels for safety and operational needs.

The long-term goal has been to relocate the small boats from the commercial harbor to the Kawaihae Small Boat Harbor (South) facility, located off the Coral Flats, which currently has no boating facilities. This will alleviate conflicts between small boats and other users of the

harbor. The small craft docks, which are in disrepair (see **Figure 8-4: Small Craft Docks to be Demolished**), will be demolished to make room for the Pier 2C Extension.

Figure 8-4: Small Craft Docks to be Demolished



Figure 8-5: Small Boat Harbor (South) seen from Pu'ukoholā Heiau



DLNR DOBOR has jurisdiction over the Kawaihae Small Boat Harbor (South) facility, which is seen in **Figure 8-5: Small Boat Harbor (South) seen from Pu'ukoholā Heiau**. In 1970 construction of this facility was initiated under the name of Project Tugboat. It was designed as a test of the use of high explosives to create harbors in hard substrate and as a proof of the concept that small nuclear charges could be used for civil works projects. Over 100 tons of conventional explosives (roughly equivalent to the smallest nuclear charge that could be built at that time) were buried in the Kawaihae reef and detonated to clear the basin and the entrance.

DLNR DOBOR and the US Army Corps of Engineers (USACE) completed the *Master Plan for the Small Boat Harbor (South), Kawaihae, Island of Hawai'i, Hawai'i* in 2003 (M&E Pacific, Inc., 2003). This plan has since been superseded by a scaling-back of the project. See **Section 9.12: Kawaihae Small Boat Harbor (South) Master Plan** for more information on future plans at this site. **Figure 9-11: Current Concept for Kawaihae Small Boat Harbor (South)** shows the eventual planned facilities as currently proposed. A Final Environmental Assessment was prepared in 2008 (M&E Pacific, 2008).

Most of the land-side facilities were erected by the YMCA for activities with the knowledge that these facilities should be demolished when further development of the Small Boat Harbor (South) is undertaken (M&E Pacific, 2008). See **Section 8.1.1: YMCA Facilities** for more information.

8.1.6.1 No-Build Alternative

The No-Build Alternative will have no direct effect on the small craft docks. However, until the Kawaihae Small Boat Harbor (South) facility is open, conflicts between small boats and larger barge operations are anticipated to increase.

8.1.6.2 Build Alternatives

None of the Build Alternatives will affect the small craft docks with the exception of the Proposed Action - Alternative 5. Until the Kawaihae Small Boat Harbor (South) facility is open, conflicts between small boats and larger barge operations are anticipated to increase.

Under the Proposed Action - Alternative 5, the construction of the Pier 2C Extension will require the demolition of the underwater anchor blocks and removal of the 17 temporary small craft mooring spots. There will not be comparable mooring facilities available within the immediate vicinity of Kawaihae Harbor until the Kawaihae Small Boat Harbor (South) is completed, which will be a separate project initiated by DLNR DOBOR. It is not known if the Small Boat Harbor (South) mooring spots will be completed prior to the demolition of the small craft mooring spots.

All Build Alternatives will transfer the land for the perimeter roadway and the Kawaihae Small Boat Harbor (South) from DOT-H to DLNR DOBOR. The Build Alternatives also include fencing to separate users of the Small Boat Harbor (South) from secured areas within harbor property. DLNR DOBOR has proposed paving the roadway in its *Master Plan for the Small Boat Harbor (South), Kawaihae, Island of Hawai'i, Hawai'i* in 2003 (M&E Pacific, Inc., 2003). Improvements to the perimeter roadway will not be included as part of any Build Alternatives, but will be a separate action initiated by DLNR DOBOR.

8.1.6.3 Recommended Mitigation of Impacts on Temporary Small Craft Mooring Area

It is recommended that DOT-H reach out to the community to address concerns about conflicts between increased activity in the harbor and recreational users. To address the potential for water quality being impacted by run-off, which will in turn, impact a variety of aquatic activities

and marine resources, recommended BMPs include a comprehensive erosion and sediment control plan to minimize impacts from earth-moving activities. BMP measures could include use of geotextile silt screens, covering of drain inlets, washing down trucks, and watering exposed areas to reduce the effects of wind erosion. Refer to **Section 4.3.2.3: Recommended Mitigation of Impacts on** Soils for more information.

8.2 Pu‘ukoholā Heiau National Historic Site

The US Department of the Interior, National Park Service (NPS) maintains and operates the 86-acre Pu‘ukoholā Heiau National Historic Site (NHS), south of the Coral Flats area. A portion of the NPS’ property also spans across Kawaihae Road to the mauka side of the highway. The archaeological and cultural importance of this facility is discussed in detail in **Section 4.8: Historic and Archaeological Resources** and **Section 4.9: Cultural Impact Assessment**. An oblique view to the north showing the relationship between the harbor and the Pu‘ukoholā Heiau NHS is shown in **Figure 8-6: Oblique View to North Showing Relative Location of Pu‘ukoholā Heiau National Historic Site and Harbor**.

The Pu‘ukoholā Heiau NHS is open to the public daily year-round from 7:45 AM to 5:00 PM, including all federal holidays. In addition to interpretive programs, there are also cultural demonstrations. A visitor center offers movies, exhibits, a museum and a bookstore. Visitors can take guided or audio tours of the trails within the site.

The Pu‘ukoholā Heiau NHS is separated from the Coral Flats area by the 22-acre “Pelekāne Lands Buffer,” an area vegetated primarily by kiawe trees. The Pelekāne Lands Buffer, which is part of the Kawaihae Harbor property, has been under lease to the NPS as a way of minimizing harbor impacts by providing a buffer zone of no development between these two entities. In addition, the buffer zone purportedly contains a number of historic sites. As part of the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update*, the Pelekāne Lands buffer area between the Coral Flats area and the Pu‘ukoholā Heiau NHS will remain unused as open space through the planning horizon of 2035, to provide visual and physical separation between NPS property and the Coral Flats.

Refer back to **Figure 4-7: Pu‘ukoholā Heiau, Pelekāne Beach & Pelekāne Bay Viewed from Coral Flats** for an image of the heiau and **Figure 4-9: Piers 1 & 2, Container Yards, & Pelekāne Lands Buffer as Viewed from Pu‘ukoholā Heiau** to see the Pelekāne Lands Buffer area.

Kawaihae Harbor and the activities taking place there are prominently visible below much of the Pu‘ukoholā Heiau NHS. NPS staff have been coordinating with the project team to ensure that adverse effects on the Pu‘ukoholā Heiau NHS are minimized to the greatest degree possible.

Pelekāne Beach is located below Pu'ukoholā Heiau. No swimming, picnicking, camping, or sunbathing is allowed at this location in reverence to the sacred sites above.

8.2.1 No-Build Alternative

The No-Build Alternative will have no direct effect on the Pu‘ukoholā Heiau NHS.

Figure 8-6: Oblique View to North Showing Relative Location of Pu'ukoholā Heiau National Historic Site and Harbor



Source: Google Earth

8.2.2 Build Alternatives

All Build Alternatives will have some effects on the Pu'ukoholā Heiau NHS during construction resulting from noise and aesthetic impacts within the Coral Flats Area. All Build Alternatives propose to construct new security fencing along the perimeter road that will be visible from the NHS. Furthermore, the Proposed Action – Alternative 5 as well as Alternatives 3 and 4 will result in much greater levels of disturbance from grading within Coral Flats itself.

Alternatives 4 and 5 will also result in increased activity at the harbor with the increased availability of berthing. NPS officials have also expressed concerns about the effects of vibration from trucks that are traveling to and from the harbor along Kawaihae Road.

Adverse effects will be mitigated during construction through BMPs and other recommended mitigative measures such as:

- Dust control and sedimentation control such as use of geotextile silt screens, covering of drain inlets, washing down trucks, and watering exposed areas to reduce the effects of wind erosion as described in **Section 4.3.2.3: Recommended Mitigation of Impacts on** Soils.
- Protection of marine water quality from turbidity, siltation and other effects of dredging noted in **Section 4.10.3: Recommended Mitigation of Impacts on Hydrology, Water Quality, and Coastal** Resources.
- Construction noise mitigation methods to control the scheduling and level of noise as described in **Section 4.6.4.3: Construction Noise Mitigation Techniques**.
- Mitigation of vehicular traffic noise by controlling speeds such as outlined in **Section 4.6.4.4: Recommended Mitigation of Vehicular Traffic Noise**.
- Mitigation of visual effects by controlling lighting, selecting fencing colors/designs that blend into the landscape, providing landscaping where appropriate and retaining the Pelekāne Lands Buffer, as noted in **Section 4.7.3: Recommended Mitigation of Impacts on Visual** Resources.
- Mitigating impacts on cultural practices through community outreach as described in **Section 4.9.3: Recommended Mitigation of Impacts on Cultural** Resources.

Coordination with NPS staff will be ongoing to ensure that adverse effects on the Pu'ukoholā Heiau NHS are minimized to the greatest degree possible.

Improvements to Kawaihae Road associated with Alternatives 3, 4, and 5 will take the needs of users of the Pu'ukoholā Heiau NHS into consideration, particularly users who use bicycles or walk to the property.

8.3 Ala Kahakai National Historic Trail

The Ala Kahakai National Historic Trail was established in 2000 for the preservation, protection and interpretation of traditional Native Hawaiian culture and natural resources. It is a 175-mile trail corridor in various states of completion that is administered by the NPS. The full corridor traverses numerous sites of cultural and historical significance, stretching between the Hawai'i Volcanoes National Park in the Puna District, around South Point, and up the Kona Coast, ending at 'Upolu Point on the northern tip of the island in North Kohala. The trail, being a remnant of ancient infrastructure that is still used to access cultural resource areas, plays a major role in preserving cultural practices taking place along the coast. The system also contains a segment of the ancient Ala Loa Trail, which was a major land trail connecting about

600 communities during the 15th through 18th centuries. The *Ala Kahakai National Historic Trail Comprehensive Management Plan* was produced in May, 2009 (National Park Service, 2009).

The portion of the Ala Kahakai Trail in the immediate vicinity of Kawaihae is under the jurisdiction of DLNR, Division of Forestry and Wildlife's Nā Ala Hele trail system. As **Figure 8-7: Ala Kahakai National Historic Trail in North and South Kohala** and **Figure 8-8: Proposed Elements of Ala Kahakai Trail North and South of Kawaihae Harbor** show, a segment of the trail runs for 15.4 miles from Pu'ukoholā Heiau southward to 'Anaeho'omalu Bay and can be accessed from Spencer Beach Park, Hapuna Beach Park, the Mauna Lani Resort, Waikoloa Resort, Mauna Kea Beach Hotel, or Puakō Boat Ramp. The trail follows the coastline over ancient fishermen's trails and Hawaiian Kingdom roads and offers users access to shoreline, protected anchialine ponds, and petroglyph fields.

North of Kawaihae Harbor, the NPS' *Ala Kahakai National Historic Trail Comprehensive Management Plan* proposes potential trails ("possible lateral trail", shown in purple dotted line on the map). The Ala Kahakai corridor will terminate up at 'Upolu Point, but most of the corridor is not formally served by trails presently.

In the *Ala Kahakai National Historic Trail Comprehensive Management Plan*, Kawaihae Harbor is noted as having security, but permits public access during certain hours.

8.3.1 No-Build Alternative

The No-Build Alternative will not have any direct effect the Ala Kahakai National Historic Trail.

8.3.2 Build Alternatives

The improvements to Kawaihae Road associated with the Proposed Action – Alternative 5 as well as Alternatives 3 and 4 could offer a beneficial link for the Ala Kahakai National Historic Trail by increasing safety for pedestrians and bicyclists along the roadway, outside of the security perimeter.

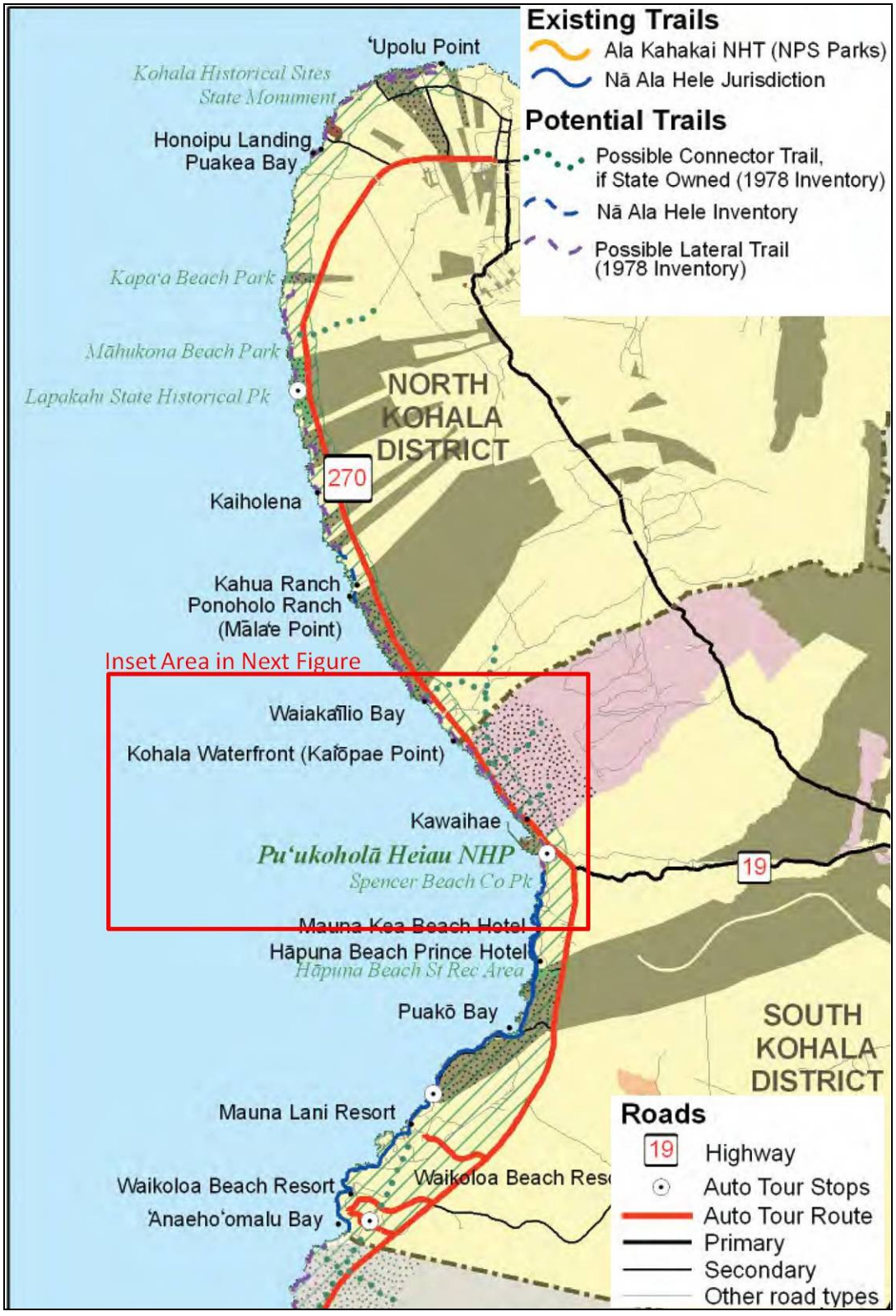
8.4 Spencer Beach Park

Samuel M. Spencer Beach Park is owned and maintained by Hawai'i County, Department of Parks and Recreation, and has an area of 13.4 acres and a sandy coastline of approximately 1,200 feet. Spencer Beach Park shares a common entrance roadway off Kawaihae Road with the Pu'ukoholā Heiau NHS and is located to the south of NPS property. Lifeguards are present at Spencer Beach Park from 9:30 AM to 4:45 PM on weekends, holidays, and daily during the summer. The park offers places for fishing. Facilities include a pavilion, picnic areas, basketball courts, restrooms, showers, and potable water. Camping is allowed with a permit. The location of Spencer Beach Park relative to Kawaihae Harbor was shown previously in **Figure 8-6: Oblique View to North Showing Relative Location of Pu'ukoholā Heiau National Historic Site and Harbor**.

8.4.1 No-Build Alternative

The No-Build Alternative will have no direct effect on Spencer Beach Park.

Figure 8-7: Ala Kahakai National Historic Trail in North and South Kohala



Source: Excerpted from NPS, *Ala Kahakai National Historic Trail Comprehensive Management Plan*

Figure 8-8: Proposed Elements of Ala Kahakai Trail North and South of Kawaihae Harbor



Source: Excerpted from NPS, *Ala Kahakai National Historic Trail Comprehensive Management Plan*

8.4.2 Build Alternatives

None of the Build Alternatives are anticipated to create any direct effects on Spencer Beach Park although increased activity at the harbor under the Proposed Action – Alternative 5 and Alternative 4 may increase traffic along Kawaihae Road. Improvements to Kawaihae Road associated with harbor improvements will take the needs of users of Spencer Beach Park into consideration, particularly users who use bicycles or walk to the property.

CHAPTER 9: CONFORMANCE WITH PLANS AND POLICIES

The sections that follow establish the level of consistency of the Proposed Action with State and county plans and policies. Refer to **Table 9-1: Summary of Conformity with Plans** for a brief summary of the rest of the chapter.

Table 9-1: Summary of Conformity with Plans

EA Sec.	Plan/Land Designation	Consistency or Supportiveness of Alternatives with Plan/Land Designation:				
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action
9.1	**Hawai'i State Plan**	• Not consistent.	• Generally not consistent.	• Somewhat Consistent.	• Consistent.	• **Most Consistent.**
9.2	**State Land Use**	• No change.	• No change.	• No change.	• Consistent.	• **Consistent.**
9.3	**Chapter 344, State Environmental Policy**	• No change.	• Consistent.	• Consistent.	• Consistent.	• **Consistent.**
9.4	**Coastal Zone Management (CZM)**	• No change.	• Not Consistent in Some Economic Aspects and Coastal Hazards.	• Not Consistent in Some Economic Aspects and Coastal Hazards.	• Generally Consistent with mitigative measures.	• **Generally Consistent with mitigative measures.**
9.5	**County of Hawai'i General Plan**	• Not consistent.	• Not consistent.	• Somewhat consistent.	• Consistent.	• **Most Consistent.**
9.6	**Zoning**	• No change.	• Consistent.	• Consistent.	• Consistent.	• **Consistent.**
9.7.1	**South Kohala CDP**	• Not Consistent.	• Somewhat Consistent.	• Consistent.	• Consistent.	• **Consistent.**
9.7.2	**Kawaihae Community Plan**	• Not Consistent.	• Somewhat Consistent.	• Consistent.	• Consistent.	• **Consistent.**
9.8	**Special Management Area**	• No permit required from County.	• No permit required from County.	• No permit required from County.	• No permit required from County.	• **No permit required from County.**
9.9	**Shoreline Setback Area**	• No variance required from County.	• No variance required from County.	• No variance required from County.	• No variance required from County.	• **No variance required from County.**
9.10	**DHHL Kawaihae Regional Plan**	• Not Supportive.	• Generally Not Supportive.	• Supportive.	• Most Supportive.	• **Most Supportive.**
9.11	**Queen Emma Foundation Plan**	• Not Supportive.	• Generally Not Supportive.	• Supportive.	• Most Supportive.	• **Most Supportive.**

Table 9-1: Summary of Conformity with Plans

EA Sec.	Plan/Land Designation	Consistency or Supportiveness of Alternatives with Plan/Land Designation:				
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action
9.12	**Kawaihae Small Boat Harbor (South) Master Plan**	• Not Supportive.	• Supportive.	• Supportive.	• Supportive.	• **Supportive.**
9.13	**Pelekāne Bay Watershed Restoration**	• Supportive.	• Supportive.	• Supportive.	• Supportive.	• **Supportive.**
9.16	**Food Safety Modernization Act**	• Not Supportive.	• Supportive.	• Supportive.	• Supportive.	• **Supportive.**

9.1 Hawai‘i State Plan

Chapter 226, Hawai‘i State Planning Act, Hawai‘i Revised Statutes (HRS), also known as the *Hawai‘i State Plan*; serves as a comprehensive guide for the future long-range development of the State. It sets forth the overall theme, goals, objective, policies, and priorities for the State. Additionally it sets forth a statewide planning system to coordinate State and county activities as well as to implement the *Hawai‘i State Plan*.

The discussions that follow demonstrate the myriad ways that the improvements to Kawaihae Harbor will support the *Hawai‘i State Plan*.

The primary goals of the *Hawai‘i State Plan*:

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

Kawaihae Harbor is of essential importance to Hawai‘i Island and the State of Hawai‘i as a whole in ensuring a stable, growing economic climate. Alternatives 4 and 5 generally will ensure the harbor can fulfill the needs and expectations of Hawai‘i’s present and future generations by improving the harbor and ensuring it operates efficiently and effectively. Neither the No-Build Alternative, Alternative 2 - Minimal Action nor Alternative 3 - Partial Action/Land-Side will support economic needs.

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

Kawaihae Harbor is a fixture of the shoreline with spectacular physical surroundings. It is of great importance that improvements to the harbor do not detract from the natural environment as a whole. All of the Build Alternatives will protect sensitive resources.

3. *Physical, social, and economic well-being, for individuals and families in Hawai‘i , that nourishes a sense of community responsibility, of caring, and of participation in community life.*

A number of important commodities are transported into and out of Kawaihae Harbor, and this provides direct and indirect employment for many workers on Hawai‘i Island. As noted above, the community is greatly dependent upon transport of essential goods for its economic and social well-being. Therefore, Alternatives 4 and 5 will ensure the harbor’s continued contribution to the community by providing needed berthing capacity. None of the other alternatives will appreciably benefit the community in this fashion

Objectives and Policies for Facility Systems - Transportation

Objectives:

- *An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods.*

- *A statewide transportation system that is consistent with and will accommodate planned growth objectives throughout the State.*

Policies:

- *Design, program, and develop a multi-modal system in conformance with desired growth and physical development.*
- *Provide for improved accessibility to shipping, docking, and storage facilities.*
- *Encourage transportation systems that serve to accommodate present and future development needs of communities.*
- *Encourage a variety of carriers to offer increased opportunities and advantages to interisland movement of people and goods.*
- *Increase the capacities of airport and harbor systems and support facilities to effectively accommodate transshipment and storage needs.*
- *Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification.*

Alternatives 4 and 5 are consistent with these objectives and policies. Alternative 3 - Partial Action/Land-Side begins to address these objectives and policies but not to the level of Alternatives 4 and 5. Alternative 2 - Minimal Action does not address these needs.

Harbor improvements will be of critical importance in supporting shipping, docking, storage that will accommodate future communities on Hawai‘i Island and support economic development. Alternatives 4 and 5, and to a lesser degree, Alternative 3 - Partial Action/Land-Side will increase the harbor’s capacity to accommodate transshipment and storage of essential commodities.

Objectives and Policies for Population

Objective:

- *Guide population growth consistent with achievement of physical, economic and social objectives.*

Policies:

- *Encourage an increase in economic activities and employment opportunities on the neighbor islands consistent with community needs and desires.*
- *Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area.*

Alternatives 4 and 5 will help sustain increased economic activity, employment and population growth on Hawai‘i Island, and is using land and water resources in a master-planned manner. The other alternatives will have little effect.

Objectives and Policies for Economy - General

Objectives:

- *Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawai‘i's people.*
- *A steadily growing and diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands.*

Policies:

- *Expand existing markets and penetrate new markets for Hawai‘i's products and services.*

Alternatives 4 and 5 will help sustain increased capacity for transporting products from Hawai‘i Island to new markets. The other alternatives will have little effect in this regard.

Objectives and Policies for Economy - Agriculture

Objectives:

- *Growth and development of diversified agriculture throughout the State.*
- *An agriculture industry that continues to constitute a dynamic and essential component of Hawai‘i's strategic, economic, and social well-being.*

Policies:

- *Strengthen diversified agriculture by developing an effective promotion, marketing, and distribution system between Hawai‘i’s producers and consumer markets locally, on the continental United States, and internationally.*

Alternatives 4 and 5 will help sustain increased capacity for transporting agricultural products from Hawai‘i Island to consumer markets on the mainland and internationally. The other alternatives will have little effect in this regard.

Objectives and Policies for Economy - Federal Expenditures

Objective:

- *Achievement of the objective of a stable federal investment base as an integral component of Hawai‘i’s economy.*

Policies:

- *Promote Hawai‘i’s supportive role in national defense.*

Alternatives 3, 4, and 5 will help separate military use of the harbor from other uses and be supportive of movement of goods to Pohakuloa Training Area. The other alternatives will have little effect in this regard.

Objectives and Policies for Economy - Potential Growth Activities

Objective:

- *Achievement of the objective of development and expansion of potential growth activities that serve to increase and diversify Hawai'i's economic base.*

Policies:

- *Facilitate investment and employment in economic activities that have the potential for growth such as diversified agriculture, aquaculture, apparel and textile manufacturing, film and television production, and energy and marine-related industries.*
- *Enhance and promote Hawai'i's role as a center for international relations, trade, finance, services, technology, education, culture, and the arts.*
- *Promote Hawai'i's geographic, environmental, social, and technological advantages to attract new economic activities into the State.*
- *Provide public incentives and encourage private initiative to attract new industries that best support Hawai'i's social, economic, physical, and environmental objectives.*

Alternatives 4 and 5 will encourage business investments that are dependent on movement of goods and commodities. Alternatives 3, 4 and 5 will all offer space for economic opportunities by grading the Coral Flats area.

Objectives and Policies for the Physical Environment - Land-based, Shoreline, and Marine Resources

Objectives:

- *Prudent use of Hawai'i's land-based, shoreline, and marine resources.*
- *Effective protection of Hawai'i's unique and fragile environmental resources.*

Policies:

- *Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.*
- *Take into account the physical attributes of areas when planning and designing activities and facilities*
- *Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.*
- *Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai'i.*
- *Pursue compatible relationships among activities, facilities, and natural resources.*
- *Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.*

Alternatives to improve Kawaihae Harbor are being considered in this Environmental Assessment process under Chapter 343, HRS, to ensure the continued protection of important environmental resources. Kawaihae Harbor serves a wide range of users for commercial and recreational purposes.

All alternatives will have adverse environmental impacts mitigated to address these objectives and policies

Objectives and Policies for the Physical Environment - Scenic, Natural Beauty, Historic Resources

Objective:

- *Enhancement of Hawai‘i’s scenic assets, natural beauty, and multi-cultural/historical resources.*

Policies:

- *Promote the preservation and restoration of significant natural and historic resources.*
- *Protect those special areas, structures, and elements that are an integral and functional part of Hawai‘i’s ethnic and cultural heritage.*

All Build Alternatives seek to minimize adverse effects on the Pu‘ukoholā Heiau National Historic Site (NHS) through coordination with National Park Service (NPS). A number of mitigative measures have been proposed to ensure the continued protection of this important element of Hawai‘i’s cultural heritage.

Objectives and Policies for the Physical Environment - Land, Air, and Water Quality

Objectives:

- *Maintenance and pursuit of improved quality in Hawai‘i’s land, air, and water resources.*
- *Greater public awareness and appreciation of Hawai‘i’s environmental resources.*

Policies:

- *Foster educational activities that promote a better understanding of Hawai‘i’s limited environmental resources.*
- *Promote the proper management of Hawai‘i’s land and water resources.*
- *Promote effective measures to achieve desired quality in Hawai‘i’s surface, ground, and coastal waters.*
- *Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.*

All alternatives will support continued educational and cultural users of harbor properties. The project has promoted stewardship of coastal waters through Best Management Practices (BMPs) outlined in the *Improvements to Kawaihae Commercial Harbor Environmental*

Assessment (EA). The harbor's capacity to serve Hawai‘i Island will be of critical importance in the event of natural disasters, particularly if Hilo Harbor is adversely affected.

Objectives and Policies for Socio-Cultural Advancement - Leisure

Objectives:

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

Policies:

- *Ensure opportunities for everyone to use and enjoy Hawai‘i's recreational resources.*
- *Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.*

Alternatives 3, 4, and 5 will provide a better separation between existing recreational users and other harbor activities. The eventual relocation of boats to the Kawaihae Small Boat Harbor (South) and the continued provision of other recreational activities within the harbor property will support these objectives and policies.

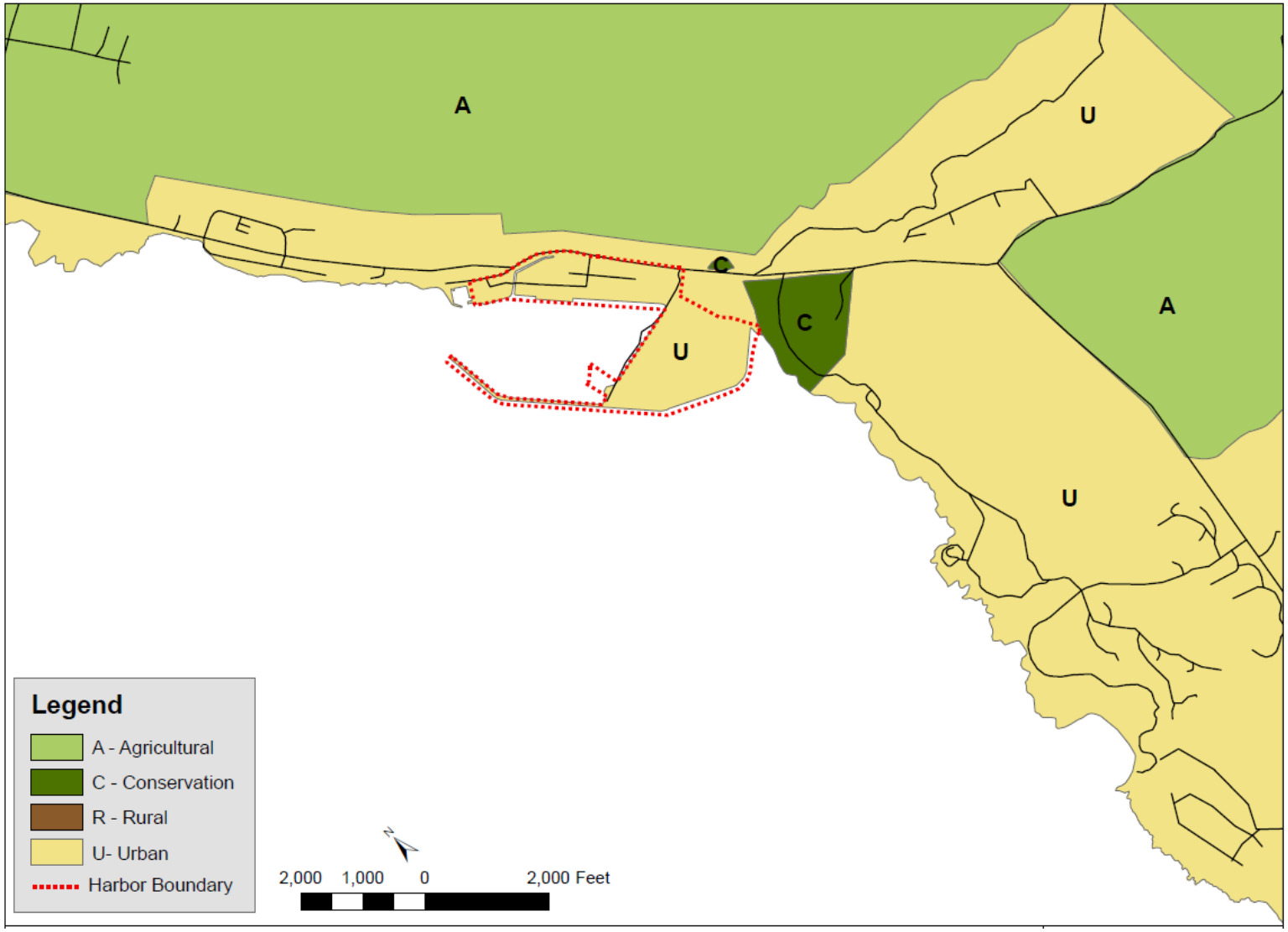
9.2 State Land Use Districts

Chapter 205, HRS, also known as the State Land Use Law, designates all lands within the State of Hawai‘i into one of four categories: Agricultural, Conservation, Rural, and Urban. Permissible uses and standards are identified for each district. Refer to **Figure 9-1: State Land Use Districts for Kawaihae Area**.

The land-side areas of Kawaihae Harbor are located within the state Urban District. Submerged lands within the harbor are located within the Conservation District.

In 2013, the Hawai‘i State legislature passed a bill (SB 1207 HD2CD1, HB976) for Act 086, which amends HRS Chapter 266 to exempt H-DOT from any permitting and site plan approval requirements for work within submerged lands within the Conservation District that are used for state commercial harbor purposes. Consequently, a Conservation District Use Permit is not required for any of the alternatives under consideration.

Figure 9-1: State Land Use Districts for Kawaihae Area



Source: State Land Use Commission

9.3 Chapter 344, State Environmental Policy

Chapter 344, Environmental Policy, HRS sets forth the State's policy and guidelines to conserve natural resources and enhance the quality of life. All Build Alternatives are consistent with the following policy:

Environmental Policy

1. *Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resource, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawai‘i.*
2. *Enhance the quality of life by:*
    a. *Setting population limits so that the interaction between the natural and artificial environments and population is mutually beneficial.*
    b. *Creating opportunities for the residents of Hawai‘i to improve their quality of life through diverse economic activities which are stable and in balance with the physical and social environments.*
    c. *Establishing communities which provide a sense of identity, wise use of land, efficient transportation, and aesthetic and social satisfaction in harmony with the natural environment which is uniquely Hawaiian; and*
    d. *Establishing a commitment on the part of each person to protects and enhance Hawai‘i's environment and reduce the drain of nonrenewable resources.*

All Build Alternatives are consistent with state environmental policy. They seek to minimize adverse effects on natural resources through BMPs that will mitigate impacts on water, air and other natural resources. The Build Alternatives sensitive to cultural resources near the project site. The Proposed Action will also help sustain the Hawai‘i Island and State economies through efficient transportation of goods onto and off of the island.

9.4 Coastal Zone Management (CZM)

The Coastal Zone Management Act (CZMA) of 1972 (16 USC 1451 et seq.) provides guidelines for development regulations within the coastal zone to provide recreational opportunities, protect historic resources, protect scenic and open space resources, protect coastal ecosystems, provide facilities for economic development, reduce hazards and manage development. The entire state of Hawai‘i is in the coastal zone. HRS Chapter 205A implements the Coastal Zone Management (CZM) program at the state level.

DOT-H projects are not subject to a CZM review by the County as part of the SMA process, described in **Section 9.8: Special Management Area**. However, because the Proposed Action will require federal permits (including a Section 404 permit from the US Army Corps of

Engineers [USACE]), it does still need to obtain federal CZM consistency approval as administered by the Hawai‘i Coastal Zone Management Program, a unit of the Department of Business, Economic Development and Tourism, Office of Planning (DBEDT OP).

The CZM Federal Consistency review application will be filed when the USACE permit application is accepted to demonstrate that the federal permitting requirements are underway. Once the USACE Section 404 application has been accepted, the CZM review will begin.

The CZM Objectives and Policies Applicable to the Project involve:

- Recreational Resources.
- Historic Resources.
- Scenic and Open Space Resources.
- Historic Resources.
- Coastal Ecosystems.
- Economic Uses.
- Coastal Hazards.
- Managing Development.
- Public Participation.
- Beach Protection.
- Marine Resources.

The following discussions outline how these CZM resources are addressed.

9.4.1 Recreational Resources

The improvements to Kawaihae Harbor under all Build Alternatives seek to minimize adverse effects on recreational uses in and around the harbor. A wide range of recreational uses are both within and near harbor property as noted in **Chapter 8: Public Recreational Facilities**. The Build Alternatives will seek a delicate balance of maintaining access to recreational opportunities for the public while at the same time ensuring security to protect from unauthorized access. The Build Alternatives also seek to minimize adverse effects on recreational visitors to the Pu‘ukoholā Heiau NHS.

Use of BMPs will help protect water quality during construction.

9.4.2 Historic Resources

The project team has actively coordinated with the staff of the Pu‘ukoholā Heiau NHS to ensure that adverse impacts on NPS property under any Build Alternative has been minimized to the greatest degree possible.

An archaeological literature review and field visit was performed to build upon previous archaeological impact assessments performed for the harbor and surrounding areas. While the likelihood of encountering archaeological resources is relatively low, a monitoring program during construction has been proposed. In the unlikely event that subsurface features or artifacts are encountered during project-related excavation within the Areas of Potential Effect

for the grading or fencing, construction activities should cease and the State Historic Preservation Division (SHPD) should be contacted immediately.

A Cultural Impacts Assessment (CIA) has also been performed on this project, as described in **Section 4.9: Cultural Impact Assessment** in the effort to ensure that there are no adverse effects on cultural practices or resources.

9.4.3 Scenic and Open Space Resources

The discussion in **Section 4.7: Visual Resources** assesses the visual landscape.

The Build Alternatives will have a generally neutral effect on the visual environment, although the greatest level of visual change will occur under Alternative 5, then Alternative 4 - Land-Side Plus Pier 2A Extension and Alternative 3. Most of the land-side portions of the harbor are already either built-up or disturbed areas, and while the project alternatives modify portions of the harbor, these modifications will be of minimal effect from a visual quality standpoint in areas that currently are developed. There will be some improvements to Kawaihae Road for safety purposes under Alternatives 3, 4, and 5, and these will have a localized visual effect. There will also be a localized visual effect within those portions of the Coral Flats area where grading occurs and vegetation (mostly kiawe trees) is removed.

The 22-acre Pelekāne Lands buffer area of Kawaihae Harbor serves as a vegetated buffer separating the Pu‘ukoholā Heiau NHS property from the main working areas of the harbor and Coral Flats. This buffer will remain untouched to maintain this separation through the 2035 planning horizon of the *Hawai‘i Island 2035 Commercial Harbors Master Plan Update*.

9.4.4 Coastal Ecosystems

This EA has had analyses performed of coastal ecosystems to ensure that there adverse impacts on these areas are adequately mitigated under various alternatives. Alternatives 4 and 5 will have the greatest effect on the coastal environment. Nonetheless, none of the alternatives are anticipated to significantly affect threatened or endangered species.

During project construction, to mitigate impacts on aquatic resources, a BMPs plan will be developed and implemented. In addition, a National Pollution Discharge Elimination System (NPDES) permit will be required to minimize impacts on aquatic resources.

9.4.5 Economic Uses

None of the Build Alternatives are not expected to have a substantial direct effect on coastal development, as they only include essential improvements mostly limited to the harbor site itself, and therefore should not have a direct economic impact on use of coastal areas. Improvements to Kawaihae Road associated with Alternatives 3, 4, and 5 are not of the nature that will induce increased growth or traffic. Economic benefits associated with construction will come from temporary construction employment.

The Proposed Action, Alternative 5 as well as Alternative 4 will provide a lifeline for goods and services to and from Hawai‘i Island and will be of statewide importance in supporting a growing

Hawai‘i economy. This dependency on Kawaihae Harbor could become even more pronounced in the event of a natural disaster, particularly if Hilo Harbor is adversely affected.

The No-Build Alternative, Alternative 2, and to a degree, Alternative 3 - Partial Action/Land-Side will have a detrimental effect on the island and state from an economic standpoint. As demands for shipping of goods and commodities grow in the future, Hawai‘i Island can be economically harmed if Kawaihae Harbor is unequipped to meet the island’s and state’s needs.

9.4.6 Coastal Hazards

None of the Build Alternatives will have a direct effect on coastal development, as it will be mostly limited to existing harbor properties.

All Build Alternatives have considered natural hazards, including sea level rise, and development at Kawaihae Harbor is taking into account these potential threats.

Kawaihae Harbor’s ability to serve Hawai‘i Island’s needs for movement of goods will be of even greater critical importance in the event of a natural hazard, particularly if Hilo Harbor is affected. Alternatives 4 and 5 will serve the island best in this regard.

9.4.7 Managing Development

None of the Build Alternatives will have a direct effect on coastal development, as improvements will be mostly limited to the existing harbor area. Improvements to Kawaihae Road associated with Alternatives 3, 4, and 5 will not be of a nature that could encourage greater development. Development by adjacent landowners, specifically the Hawai‘i Department of Hawaiian Home Lands (DHHL) and Queen Emma Land Company will be managed by master plans and approval processes and are considered compatible with and complementary to the harbor.

9.4.8 Public Participation

A number of efforts have been and will continue to be made on this project to ensure public concerns are considered. Much outreach with the local community and resource agencies has taken place as a result of the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update* and this outreach has continued into the planning for this Environmental Assessment

A pre-assessment consultation letter was sent out to Federal, State and County government agencies and nearby property owners to obtain their comments and concerns associated with the project as part of the environmental assessment process. See **Chapter 11: Agency and Public Consultation** for more information.

The EA process includes a public comment process to ensure community concerns have been addressed. Comments that were received after issuance of the Draft EA are addressed in the Final EA.

The Cultural Impact Assessment (CIA) described above in **Section 4.9: Cultural Impact Assessment** included efforts to get input from cultural practitioners and kūpūna from the community. Eleven contacts were initially consulted to obtain suggestions for interviewees.

Detailed interviews were performed with eight local interviewees with strong connections to the community. While that effort was for an earlier project, the concerns raised about changes to the harbor were relevant to the current Proposed Action as well.

Outreach on this project has included a public information meeting in Kawaihae on August 29, 2011 at the Hāmākua Macadamia Nut Factory. The public has also been offered the chance to comment on the project at the website for the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update*, found at http://www.hawaiiharborsplan.com/.

9.4.9 Beach Protection

Marine improvements under Alternatives 4 and 5 will be built to current standards, and erosion protection measures, including BMPs will be used as necessary. All necessary permits will be obtained as needed.

9.4.10 Marine Resources

Adverse impacts from Alternatives 4 and 5 on marine resources will be mitigated. To minimize effects on marine resources, a BMPs plan will be developed and implemented along with a NPDES permit. Also, if required upon further consultation with federal and state agencies during the design of the pier extensions and other in water work, a compensatory mitigation plan will be developed to address impacts on coral caused by pier construction and dredging.

9.5 County of Hawai‘i General Plan

The *County of Hawai‘i General Plan* (February 2005, as amended) dictates the County’s goals and policies for future development. It includes Land Use Pattern Allocation Guide (LUPAG) maps. The LUPAG map estimates the future acreage allocation for a particular land use and is meant to serve as a land use guide for the County. Generally, future developments must be consistent with the LUPAG map. The County LUPAG map designates Kawaihae Harbor as “Open Area” closest to the shoreline, with industrial areas further inland. An area of Medium Density Urban land is also shown in the more inland area of the Coral Flats closest to Pelekāne Bay. Refer to **Figure 9-2: Hawai‘i County Land Use Pattern Allocation Guide Map for Kawaihae Area**.

The *County of Hawai‘i General Plan* outlines a number of goals and policies, some of which are relevant to the project alternatives. Alternatives 4 and 5, and to a lesser degree, Alternatives 3 are consistent with the following goals and policies:

Transportation Terminals: Airports and Harbors Goals and Policies

Specifically mentioning Kawaihae Harbor, the Hawai‘i County General Plan notes the shortage of sufficient parallel docking space and cargo yard space and calls on DOT-H to improve harbor facilities at Kawaihae to meet increased shipping activities and cruise ship passenger arrivals. (cruise ships currently do not use Kawaihae Harbor). The county also supported the DLNR in its plans to develop a small boat harbor at Kawaihae.

Goals:

- *Provide transportation terminals and related facilities for the safe, efficient and comfortable movement of people and goods.*

Policies:

- *Encourage the programmed improvement of existing terminals, including adequate provisions for control of pollution and appropriate and adequate covered storage facilities for agricultural products.*
- *The State Department of Transportation should continue to implement its plans for transportation terminals and related facilities to promote and influence desired land use policies.*
- *Transportation terminals should be developed in conjunction with the different elements of the overall transportation system.*
- *Encourage maximum use of the island's airport and harbor facilities.*
- *Encourage the development, maintenance, and enhancement of Hilo and Kawaihae Harbors as detailed within the State's Hawai‘i Commercial Harbors 2020 Master Plan.* [The current master plan at the time of the writing of the *Hawai‘i County General Plan*].

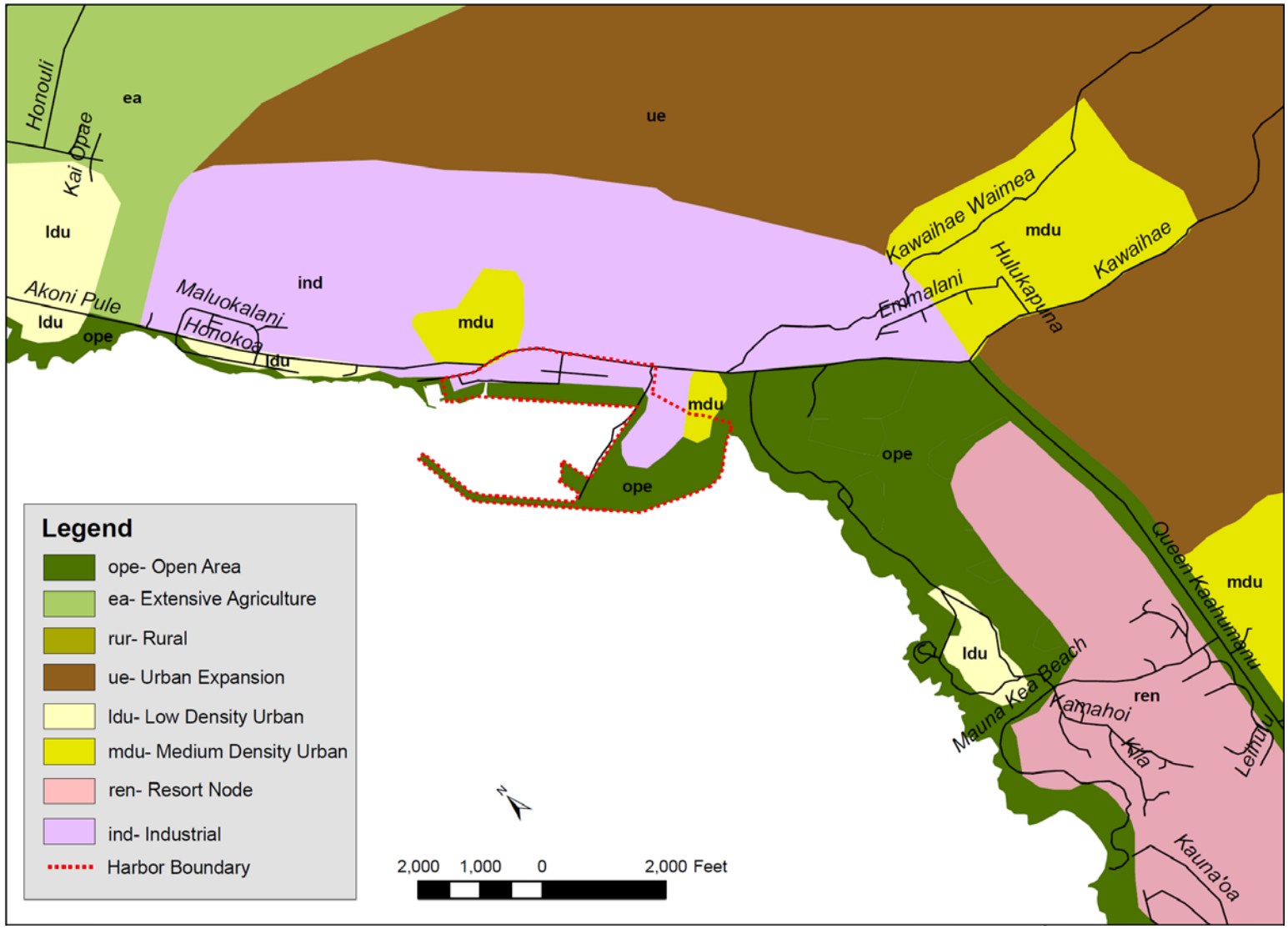
Proposed Action - Alternative 5 is fully consistent with these goals and policies, and Alternative 4 - Land-Side Plus Pier 2A Extension is also consistent to a somewhat lesser degree. Alternative 3 - Partial Action/Land-Side addresses these needs, but only from a land-side perspective.

The *Hawai‘i Island Commercial Harbors 2035 Master Plan Update* has built off of the earlier master plan cited above. Harbor improvements under this project will be of critical importance in supporting shipping, docking, storage that will accommodate future communities on Hawai‘i Island and support economic development. Alternative 4 - Land-Side Plus Pier 2A Extension and especially Proposed Action - Alternative 5 will increase the harbor's capacity to maximize transshipment and storage of essential commodities. All Build Alternatives will also be complementary with future goals to develop the Kawaihae Small Boat Harbor (South).

Land Use - Industrial Goals and Policies

Specifically mentioning Kawaihae Harbor, the *Hawai‘i County General Plan* notes the industrial use of the property and suggests development of a regional industrial park at Kawaihae.

Figure 9-2: Hawai'i County Land Use Pattern Allocation Guide Map for Kawaihae Area



Source: County of Hawai'i General Plan (February 2005, as amended)

Goals:

- *Designate and allocate industrial areas in appropriate proportions and in keeping with the social, cultural, and physical environments of the County.*

Policies:

- *Locate industrial areas convenient to transportation facilities, and provide a variety of industrial zoned districts and lot sizes, depending on the needs of the industries and the communities.*
- *Improve the aesthetic quality of industrial sites and protect amenities of adjacent areas by requiring landscaping, open spaces, buffer zones, and design guidelines.*

Alternatives 3, 4, and 5 seek to support industrial activities in a location that has been in industrial use for decades. These alternatives will also maintain the Pelekāne Lands Buffer Zone between the harbor and Pu‘ukoholā Heiau NHS to minimize the aesthetic impacts on that property through the 2035 planning horizon of the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update*.

Economic Goals and Policies

Goals:

- *Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County's cultural, natural and social environment.*

Policies:

- *Capital improvements program shall improve the quality of existing commercial and industrial areas.*

Alternatives 3, 4, and 5 will improve Kawaihae Harbor will help sustain increased economic activity, on Hawai‘i Island through improvements to this industrial area.

Flooding and Other Natural Hazards Goals and Policies

Goals:

- *Protect human life, prevent damage to man-made improvements, control pollution, prevent damage from inundation, reduce surface water and sediment runoff, maximize soil and water conservation.*

Policies:

- *Enact restrictive land use and building structure regulations in areas vulnerable to severe damage due to the impact of wave action. Only uses that cannot be located elsewhere due to public necessity and character, such as maritime activities and the necessary public facilities and utilities, shall be allowed in these areas.*

Kawaihae Harbor necessarily must be in an area vulnerable to wave action, although the harbor’s breakwater helps to mitigate this threat. Design of the features in all Build

Alternatives will take into account natural hazards. The harbor's capacity to serve Hawai‘i Island will be of critical importance in the event of natural disasters, particularly if Hilo Harbor is adversely affected, which means that Alternative 4 - Land-Side Plus Pier 2A Extension and especially Proposed Action - Alternative 5 will be best for increasing needed capacity.

Historic Sites Goals and Policies

Goals:

- *Protect, restore, and enhance the sites, buildings, and objects of significant historical and cultural importance to Hawai‘i.*

Policies:

- *Require both public and private developers of land to provide historical and archaeological surveys and cultural assessments, where appropriate, prior to the clearing or development of land when there are indications that the land under consideration has historical significance.*

This EIS has included assessment of archaeological resources as well as a CIA. The project team has actively coordinated with the staff of the Pu‘ukoholā Heiau NHS to ensure that adverse impacts on NPS property has been minimized to the greatest degree possible, regardless of which alternative is selected

Natural Resources and Shoreline Goals and Policies

Goals:

- *Provide opportunities for recreational, economic, and educational needs without despoiling or endangering natural resources.*
- *Protect and effectively manage Hawai‘i's open space, watersheds, shoreline, and natural areas.*
- *Ensure that alterations to existing land forms, vegetation, and construction of structures 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.*

Policies:

- *Require users of natural resources to conduct their activities in a manner that avoids or minimizes adverse effects on the environment.*
- *Maintain the shoreline for recreational, cultural, educational, and/or scientific uses in a manner that is protective of resources and is of the maximum benefit to the general public.*
- *Promote sound management and development of Hawai‘i's land and marine resources for potential economic benefit.*

- *Ensure public access is provided to the shoreline, public trails and hunting areas, including free public parking where appropriate.*

Alternatives 4 and 5 will have the greatest impact as they involve dredging and other marine works. Nonetheless, all Build Alternatives will include numerous mitigative measures, including BMPs, to ensure that adverse impacts on shoreline resources have been minimized to the greatest degree possible. All Build Alternatives will accommodate future access by the public to shoreline areas. The improvements under Alternatives 4 and 5 will also help sustain increased economic activity on Hawai‘i Island.

Recreation Goals and Policies

Goals:

- *Provide a wide variety of recreational opportunities for the residents and visitors of the County.*

Policies:

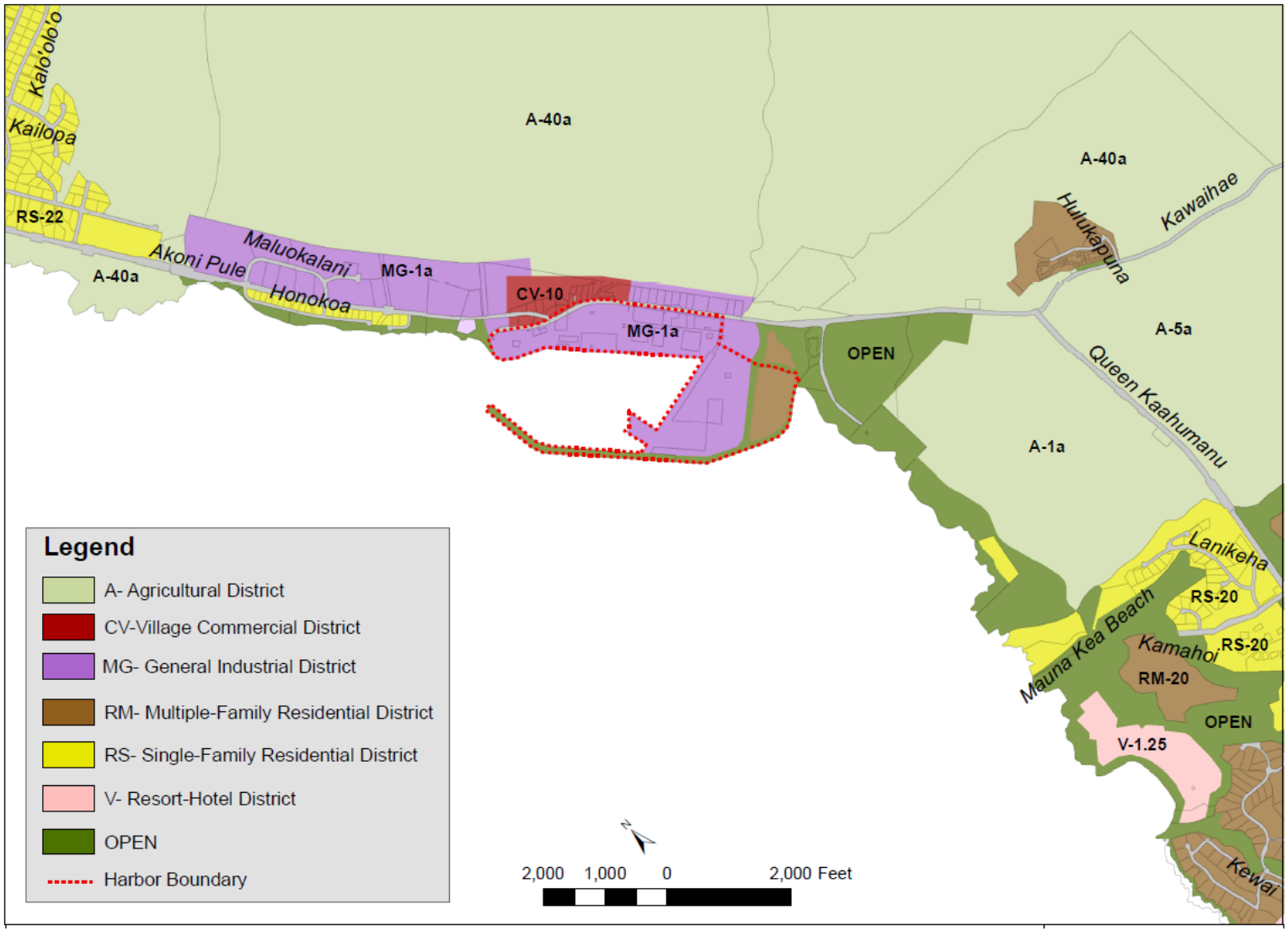
- *Public access to the shoreline shall be provided in accordance with an adopted program of the County of Hawai‘i.*

All Build Alternatives seek to minimize adverse effects on recreational uses in and around the harbor. A wide range of recreational uses are both within and near harbor property as noted in **Chapter 8: Public Recreational Facilities**. All Build Alternatives will seek a delicate balance of maintaining access to recreational opportunities for the public while at the same time ensuring security to protect from unauthorized access. The project also seeks to minimize adverse effects on recreational visitors to the Pu‘ukoholā Heiau NHS.

9.6 County of Hawai‘i Zoning

The majority of Kawaihae Harbor is zoned MG-1a (General Industrial - one acre minimum lot size). The only exception is the breakwater which is zoned as O (“Open District”) by the County of Hawai'i. All Build Alternatives are consistent with the General Industrial zoning on the site. Refer to **Figure 9-3: Hawai‘i County Zoning for Kawaihae Area** for zoning districts.

Figure 9-3: Hawai'i County Zoning for Kawaihae Area



Source: County of Hawai'i

9.7 South Kohala Community Development Plan

One of the most important planning efforts is the *South Kohala Community Development Plan* (CDP) (Hawai'i County, 2008), which was signed into law in November 2008. The CDP offers a vision for future development within the South Kohala district and notes that there have been development pressures from population growth. The South Kohala resort area is the largest source of employment within the district, and the source of some of the largest employment within the County as a whole. Pelekāne Bay is noted as an impaired body of water that is in urgent need of restoration.

9.7.1 General Policies of South Kohala CDP

The CDP included several policy issues of relevance to the project alternatives. Alternatives 3, 4, and 5 are consistent with these general policies:

Preserve Cultural and Historic Sites

The project team has actively coordinated with the staff of the Pu'ukoholā Heiau NHS to ensure that adverse impacts on NPS property under the all Build Alternatives have been minimized to the greatest degree possible.

A CIA has also been performed on this project, in the effort to ensure that there are no adverse effects on cultural practices or resources.

Establish Bicycle, Pedestrian, and Equestrian Travel Ways to Link up the Communities within the District

Under Alternatives 3, 4 and 5, design improvements to Kawaihae Road located mauka (towards the interior of the island) of the harbor will consider means to accommodate other travel modes. The No-Build Alternative and Alternative 2 - Minimal Action will not offer this benefit.

Evaluate Proposed Uses of Natural Resources to Ensure That Each Such Use Is Consistent With the Sustainable Long-Term Health of the Eco-System, Including the Direct and Indirect Impact on Coastal Waters.

This EIS has had analyses performed of coastal ecosystems to ensure that there adverse impacts on these areas are adequately mitigated under all alternatives. The project is not anticipated to adversely affect threatened or endangered species.

During project construction, to mitigate impacts on aquatic resources, a BMPs plan will be developed and implemented. In addition, a NPDES permit will be required to minimize impacts on aquatic resources.

Require Water Conservation Measures and Plans for New Large Scale Development Projects (i.e. Residential and Agricultural Subdivisions, Resorts, Commercial and Industrial Centers, etc.) In South Kohala.

All Build Alternatives will increase demand for water, but new facilities will be designed with water conservation in mind.

Ensure the Quality of South Kohala's Ground Water Resources and Marine Resources

The CDP notes that no cesspools or seepage pits should be installed in South Kohala upon issuance of the plan. Groundwater and marine resources will be protected as all design for treatment of wastewater on-site will meet current Hawai‘i Department of Health (DOH) Standards. Refer to **Section 7.3: Wastewater** for more information.

Increase Enforcement of the County Lighting Code and modify the existing code as necessary.

All Build Alternatives will be consistent with the county's lighting code to prevent light pollution and protect shorebird species. See **Section 4.17: Light Pollution**.

9.7.2 Kawaihae Community Plan

The CDP includes a sub-section, the *Kawaihae Community Plan*, which focuses on issues specific to this area. The *Kawaihae Community Plan* calls for a balance of recreational, commercial, residential, and industrial uses around the harbor area and the restoration of marine waters of Pelekāne Bay. A map called the "Kawaihae Area Conceptual Plan" (part of the Kawaihae Community Plan sub-section of the South Kohala CDP) is shown in **Figure 9-4: South Kohala CDP Kawaihae Area Conceptual Plan**.

The South Kohala CDP has four suggested overall goals for land use in the Kawaihae Community:

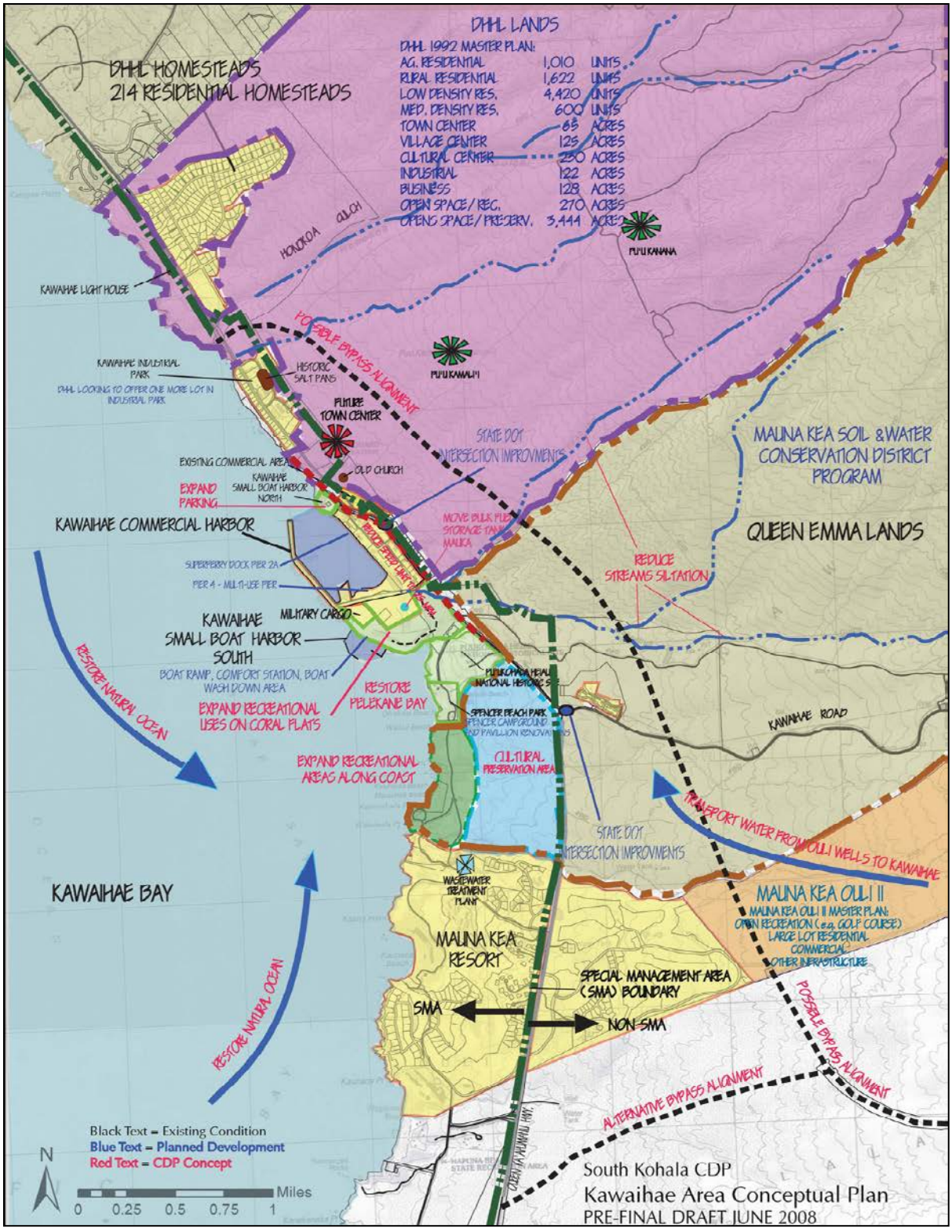
1. The Hawai'i County and State governments shall work closely with the Kawaihae Community to create a balance of recreational, commercial, and industrial uses around the harbor area while preserving the cultural and historic importance of the area.
2. The Hawai'i County, Water Department shall seek new sources of potable water for the Kawaihae area.
3. The Hawai'i County shall work with the Kawaihae Community and other State and Federal agencies to improve the ocean water quality along the Kawaihae coast.
4. The Hawai'i County and State governments shall work closely with the Kawaihae Community to improve traffic safety for both vehicular and non-vehicular transportation along Akoni Pule Highway.

Specific strategies within those policies that are relevant to and consistent with the Proposed Action are as follows:

Support DOT Commercial Harbor Expansion Mauka of Akoni Pule Highway [Kawaihae Road] and,
Expand Commercial Activities Around the Harbor Area

None of the Build alternatives will preclude future harbor expansion mauka of the existing roadway, or preclude additional commercial development.

Figure 9-4: South Kohala CDP Kawaihae Area Conceptual Plan



Source: *South Kohala Community Development Plan* (County of Hawai'i, 2008)

Expand Recreational Activities Around the Harbor Area and Encourage Canoe Club Activities

All Build Alternatives will be supportive of DLNR DOBOR efforts to improve its Kawaihae Small Boat Harbor (South) facilities and will also continue to allow other recreational users of harbor property to continue to visit the site, while also providing a secure area for harbor activities that require security.

Mitigate the Effects of Industrial Sprawl Around the Harbor and Industrial Areas

The CDP recommends addressing visual impacts by placing future utility lines underground, and notes that future expansion of the harbor and industrial uses should mitigate impacts on viewplanes and scenic beauty. All Build Alternatives are supportive of this strategy. Decisions on undergrounding utilities will be made by the utilities, but none of the alternatives will preclude burial of utilities. Several measures for mitigating visual impacts of the Proposed Action itself are outlined in **Section 4.7.3: Recommended Mitigation of Impacts on Visual** Resources**.**

Construct Pedestrian Paths and Bikeways along Akoni Pule Highway through the Kawaihae Corridor and add Appropriate Signage to Increase Safety.

Portions of Kawaihae Road that will be improved under Alternatives 3, 4, and 5 will contain pedestrian amenities to improve pedestrian travel in the area. Alternative 2 - Minimal Action will not offer this benefit.

Move Forward With Feasibility Studies to Examine Different Alternative Strategies to Improve Marine Water Quality Along the Coast.

The CDP recommends investigating a circulation channel between Pelekāne Bay and Kawaihae Harbor to mitigate siltation that takes place in the bay, in part because the Coral Flats area blocks the washing out of sediments from the bay. DOT-H has worked with USACE in 2009 to perform this study (see **Section 4.10.1.3: Marine Water Quality**). Construction of a circulation channel would produce net sediment transport into the channel and the harbor and, therefore, was not recommended as it would not improve water quality in the bay.

Reduce the Speed Limit from 35 mph to 25 mph along Akoni Pule Highway [Kawaihae Road] in the vicinity of Kawaihae Harbor as indicated on the Conceptual Plan Map.

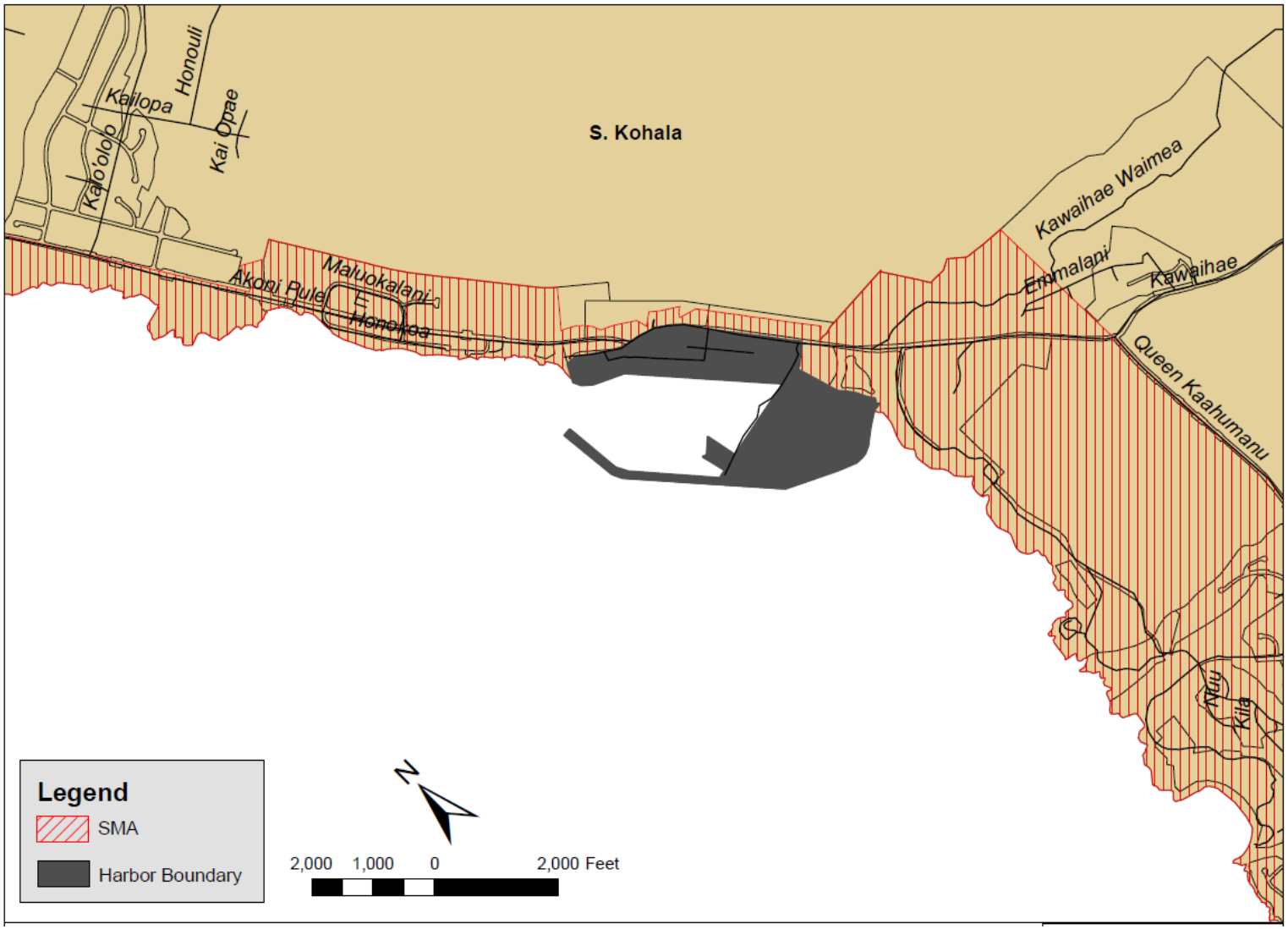
Alternatives 3, 4, and 5 include improvements to the immediate area of Kawaihae Road in the vicinity of Kawaihae Harbor. The appropriate design speed, and ultimate posted speed limit, will be determined during final design of this facility.

9.8 Special Management Area

Under Chapter 205A (Coastal Zone Management Act), HRS, the County is given authority to regulate land uses located within the established Special Management Area (SMA) for the island. The Proposed Action is located within the SMA, shown in **Figure 9-5: Special Management Area (SMA)**. New developments within the SMA ordinarily require additional permitting from the county. However, pursuant to HRS 266-2 (b), DOT-H is authorized to plan,

construct, and maintain any commercial harbor facility in the State, without the approval of county agencies. Therefore, no SMA permit is required.

Figure 9-5: Special Management Area (SMA)



Source: County of Hawai'i

9.9 Shoreline Setback Area

As no SMA permit is needed as noted above in **Section 9.8: Special Management Area**, no shoreline setback variance is required.

9.10 Department of Hawaiian Home Lands Kawaihae Regional Plan

The Hawai'i Department of Hawaiian Home Lands (DHHL) produced its *Kawaihae Regional Plan* in September, 2010 (DHHL, 2010). DHHL's land holdings in this area stretches approximately 10,153 acres from the ocean to the base of the Kohala Mountain Range, and are shown in **Figure 9-6: DHHL Kawaihae Area Lands**. The discussion that follows has been adapted from its *Kawaihae Regional Plan.*

DHHL has designated 7,502 acres of the most mauka (i.e., towards the interior of the island) areas for agricultural use, and 2,223 acres for eventual residential development. Closer to the coastline, 72 acres have been designated for community use and 356 acres for industrial/commercial uses. Rainfall in the area varies greatly. Along the coastline, average rainfall is approximately ten inches per year. Lack of rainfall is a major issue for further development in the low-elevation areas of Kawaihae.

Agricultural. In the highest elevation areas, proposed for agricultural use, average annual rainfall increases significantly to more than 150 inches per year, but the more makai portions of the agricultural-designated area may not receive enough rain. (DHHL, 2010). Archaeological and historic sites pose another constraint throughout the DHHL's lands.

Residential. Kawaihae's largest residential subdivision (Kailapa Community Association) is located mauka of Akoni Pule Highway. The 199 lots encompass a total of 180 acres. Average lot size is approximately 32,000 square feet (0.73 acres). The community's water is supplied from the Kohala Ranch's private water system. A second, smaller subdivision (Nā Pua Ka 'Ilima) is located makai of Akoni Pule Highway and consists of 22 house lots. Average lot size is approximately 15,000 square feet (0.34 acres). Total acreage for the second Kawaihae makai (i.e., away from the interior of the island) subdivision is approximately thirty-four (34) acres. The remaining 2,009 acres designated for residential usage is currently not developed and awaiting further infrastructure improvements. At the time of the writing of the *Kawaihae Regional Plan*, a total of 103 homesteaders were living on 40 parcels.

DHHL noted that the improvements called for in the *Hawai'i Island Commercial Harbors 2035 Master Plan Update* will undoubtedly create an increase in demand for services and shopping opportunities in the Kawaihae area. DHHL's *Hawai'i Island Plan* (2002) also proposed to increase the amount of land available for commercial and industrial businesses mauka of the existing development. However, archaeological surveys indicate a large number of burial sites mauka of Akoni Pule Highway.

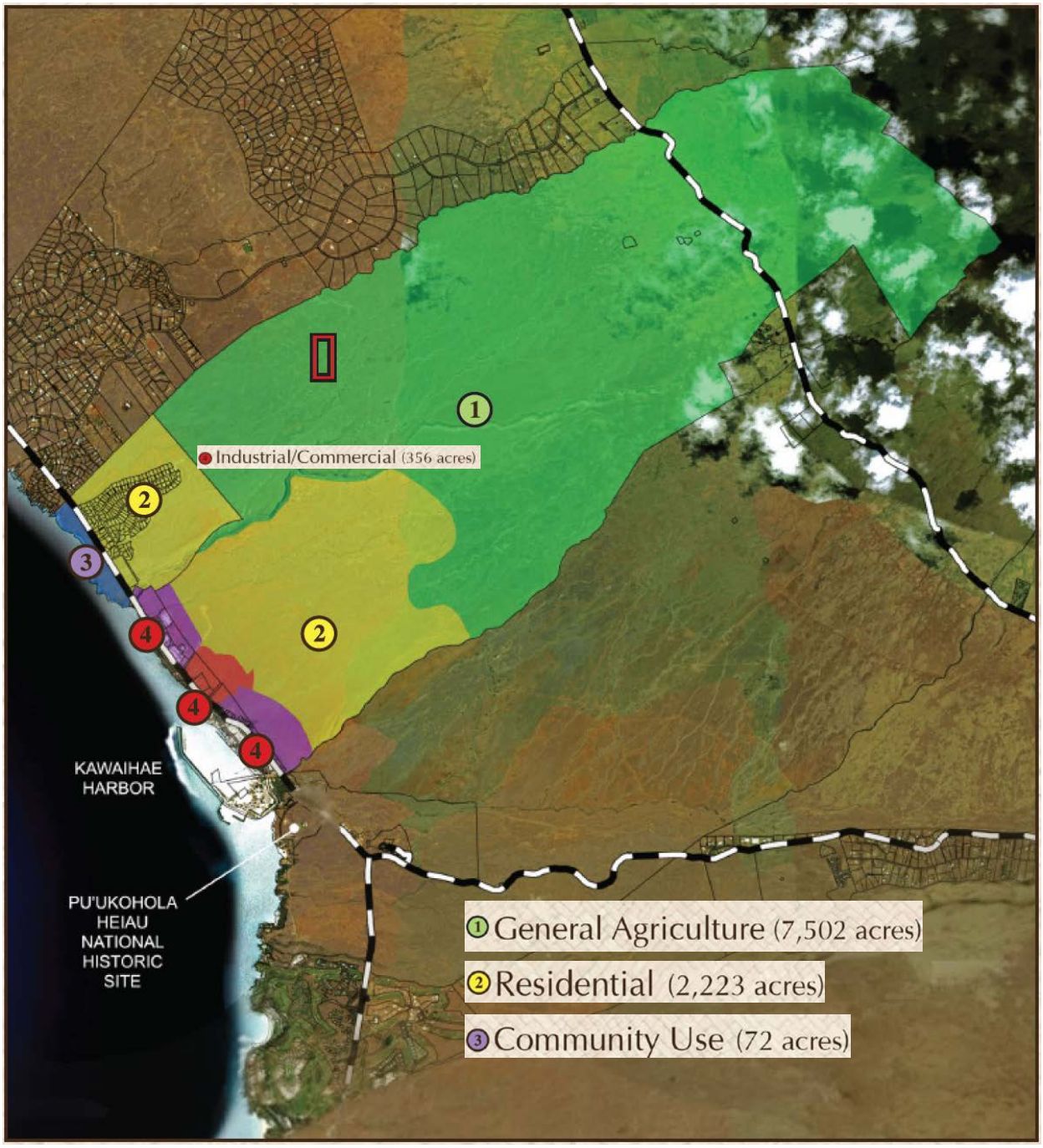


Figure 9-6: DHHL Kawaihae Area Lands
Source: Adapted from *Kawaihae Regional Plan*, Department of Hawaiian Home Lands, 2010

Community Use. A 72-acre parcel is designated for community use makai of Akoni Pule Highway and across from the mauka homestead residential tracts. Community members have begun generating ideas on how to develop the parcel, such as a walking/jogging trail, native plant revegetation, community gathering area, and other ocean-related activities. A “Kailapa Resource Center” is envisioned to provide park areas, a mailbox facility, and community facilities, which will be needed with the much larger residential base in the DHHL plan.

Industrial/Commercial. DHHL lands along Kawaihae Road and Akoni Pule Highway adjacent to Kawaihae Harbor are currently being used by a variety of different commercial and industrial tenants. Current tenants include: fish market, restaurants, and other light industrial and commercial operations. DHHL designated 356 acres for industrial use overall. DHHL hopes that increasing commercial opportunities will reduce the need for homesteaders to have to commute to Kailua-Kona or Hilo.

Kawaihae’s existing commercial and industrial parcels. An area mauka within the Kawaihae ahupua‘a (shown in a red box on DHHL’s map in **Figure 9-6: DHHL Kawaihae Area Lands**) is currently utilized as a permanent reinterment site for iwi.

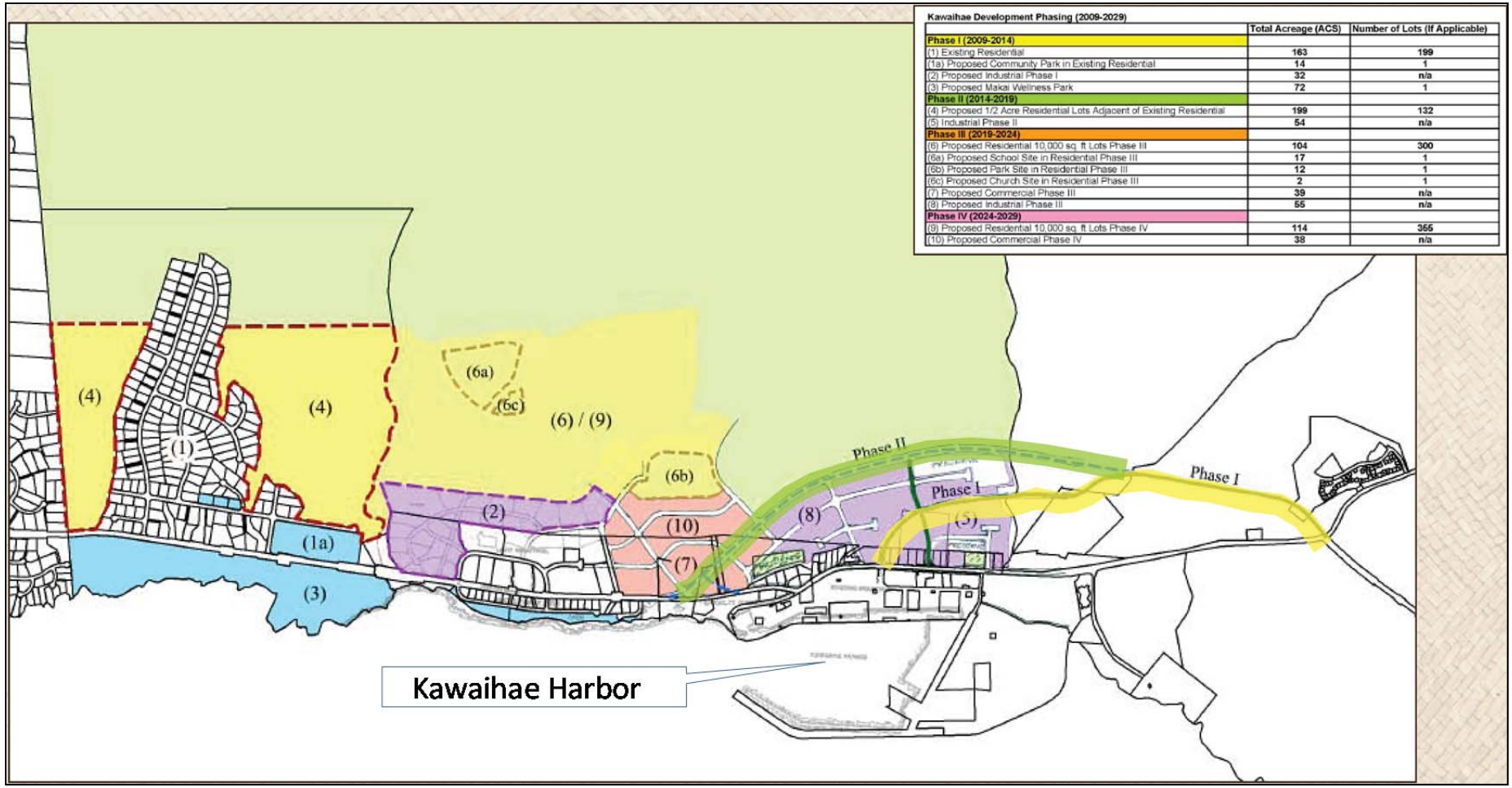
The *Kawaihae Regional Plan* covers the future plans that DHHL has for their holdings. Once completed, the subdivisions will add another 787 residential units, 218 acres of industrial and commercial land, land for a new school, and additional space for other community facilities. The DHHL’s plan is outlined in **Figure 9-7: DHHL Kawaihae Area Plan**. The plan assumes a Kawaihae Bypass road is built, between Waimea and Kawaihae Harbor and improvements are made to the intersection of Kawaihae Road and Queen Ka‘ahumanu Highway.

The plan notes that the water needs for the first two phases of the *Kawaihae Regional Plan* will require 1.23 million gallons per day (MPD) and suggests drilling a well at the 600-foot elevation, though the water will most likely be brackish. In order to make the water suitable for potable usage, a desalinization treatment plant at the 310 foot level will be constructed. The proposed desalinization plant will be able to produce approximately 1.23 MGD of potable water.

The second phase of the water development plan will require 1.17 MGD for the third and fourth phases of subdivision development in Kawaihae. Water development requires defining alternative water sources to meet this demand. The ‘Oūli Well Fields and Kehena Ditch were seen as potential long-term water sources. However, the ‘Oūli Well Field will require a significant investment in transmission infrastructure while consistent rainfall and storage are serious issues associated with the Kehena Ditch. See **Section 7.2: Water Facilities** for more information on the ‘Oūli Well Field.

Improvements to utilities such as electricity, gas, cable, telephones, etc. are also called for to accommodate DHHL plans. Renewable energy generation within DHHL lands is also suggested.

Figure 9-7: DHHL Kawaihae Area Plan



Source: Adapted from *Kawaihae Regional Plan*, Department of Hawaiian Home Lands, 2010

The *Kawaihae Regional Plan* calls for a number of improvements for residential development, economic development, and resource management. One priority project cited by DHHL is further study for ways to improve the problem of siltation that has degraded Pelekāne Bay. USACE has studied this issue, as noted in **Section 9.14: Potential Channel Between Kawaihae Harbor and Pelekāne Bay**. While that study did not result in a finding that will improve water quality, future efforts will likely continue to address this problem.

All Build Alternatives, particularly Alternatives 4 and 5, are complementary with the DHHL's vision. Improvements to Kawaihae Harbor will be supportive of additional economic development in the immediate vicinity of the harbor. Increased capacity for goods and services that pass through the harbor will be important to Hawai‘i Island as a whole, and indirectly to the immediate community. DOT-H will work closely with DHHL to ensure that both agencies' interests can be supported to the benefit of both, while avoiding adverse effects.

9.11 Queen Emma Foundation Ahupua‘a Strategic Management Plan

The Queen Emma Land Company (QEL) is the real estate arm of the Queen Emma Foundation, which operates the Queen's Health Systems. QEL owns and manages approximately 10,200 acres in South Kohala near Kawaihae Harbor, across from the Coral Flats area. (**Figure 9-4: South Kohala CDP Kawaihae Area Conceptual Plan** showed the location of Queen Emma Lands relative to the harbor). QEL was the original owner of the land on which Pu‘ukoholā Heiau NHS sits, and donated that land to the NPS because of its cultural importance. Approximately 80 percent of QEL Kawaihae lands are leased to Parker Ranch for grazing. Reforestation efforts with native species are also underway in the upper regions of QEL parcels.

A 24-bed Transitional Housing Program operated by the Catholic Charities of Hawai'i was on the QEL property but was recently closed due to not having an approved cesspool system. The County of Hawai‘i is in the process of dismantling the facility. The Queen Emma Foundation is considering building a Kawaihae historic museum next to the former location of the Kawaihae Transitional Housing.

Tradewinds Forest Products LLC has been storing harvested eucalyptus trees on the portion of QEL property immediately across Kawaihae Road from the harbor. The trees are grown on the Hāmākua coast and are stored until a full shipload is available for shipping to Asia.

QEL produced a draft of the *Kawaihae Ahupua‘a Management Plan - Strategic Master Plan* in December, 2009 (PBR Hawai‘i, 2009). The discussion that follows is taken from that document, which is still current. The *Kawaihae Ahupua‘a Management Plan - Strategic Master Plan* notes that there are a number of constraints and opportunities within and near QEL property in the ahupua‘a, including water, roadways, the Pu‘ukoholā Heiau NHS, a Kawaihae Bypass roadway, and the Kawaihae Small Boat Harbor, among others.

With specific regard to Kawaihae Harbor and proposed improvements, the *Kawaihae Ahupua‘a Management Plan - Strategic Master Plan* notes that Kawaihae Harbor is being master planned for improvements and expansion. Kawaihae Road, which provides access to the Harbor, may

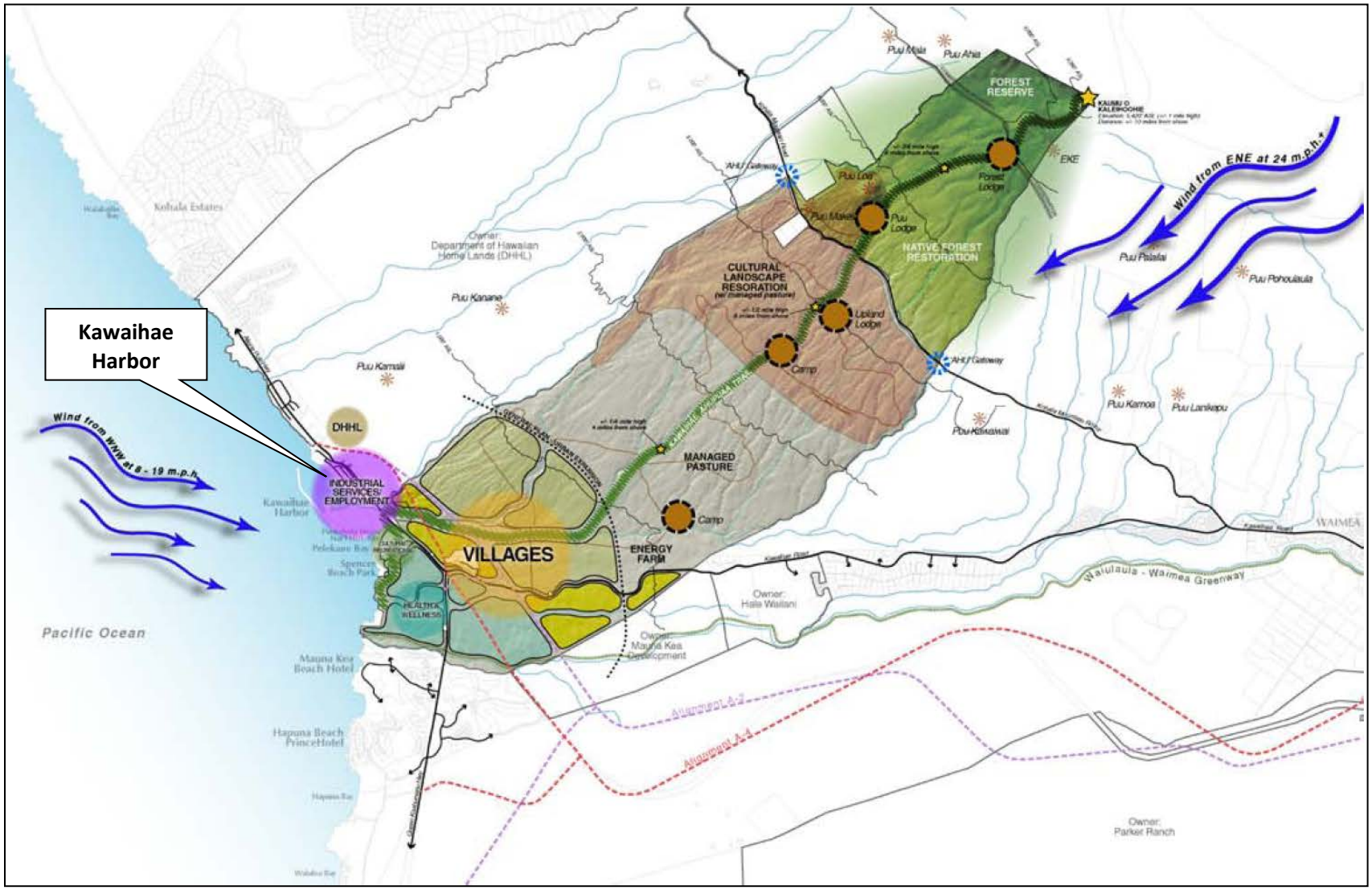
be relocated to mitigate vibration impacts to Pu‘ukoholā Heiau. A relocated access that is as close as possible or traversing QEL from the proposed Kawaihae Road Bypass could create industrial-commercial opportunities. DHHL land has the best proximity to the harbor. QEL could distinguish its potential commercial-industrial lands with master planning (e.g., more aesthetic streetscapes, landscaping guidelines and covenants), fee simple options, and available infrastructure (PBR Hawai‘i, 2009).

The *Kawaihae Ahupua‘a Management Plan - Strategic Master Plan* proposes a range of improvements. The proposed components of the master plan are shown in **Figure 9-8: Queen Emma Lands Kawaihae Ahupua‘a Strategic Master Plan**. From the standpoint of the improvements at Kawaihae Harbor, the most relevant improvement is a Kawaihae Commercial-Industrial Village shown in **Figure 9-9: Queen Emma Land Proposed Kawaihae Commercial - Industrial Village**. The elements of the *Kawaihae Ahupua‘a Management Plan - Strategic Master Plan* are as follows:

- **Ahupua‘a Trail.** The heritage trail from the shoreline to the mountains will reinforce the ahupua‘a concept and integrate the various components of the Strategic Master Plan. It will provide economic value to supplement the intrinsic value to restore the dryland and wet forest native ecosystems, as well as interpret archaeological sites along the trail route.
- **Kawaihae Commercial-Industrial Village**. To be positioned to take full advantage of the proximity to Kawaihae Harbor and the proposed Kawaihae Bypass Highway, the Strategic Master Plan proposes an industrial-commercial area in the vicinity of the harbor, shown as “villages” in **Figure 9-9: Queen Emma Land Proposed Kawaihae Commercial - Industrial Village**.

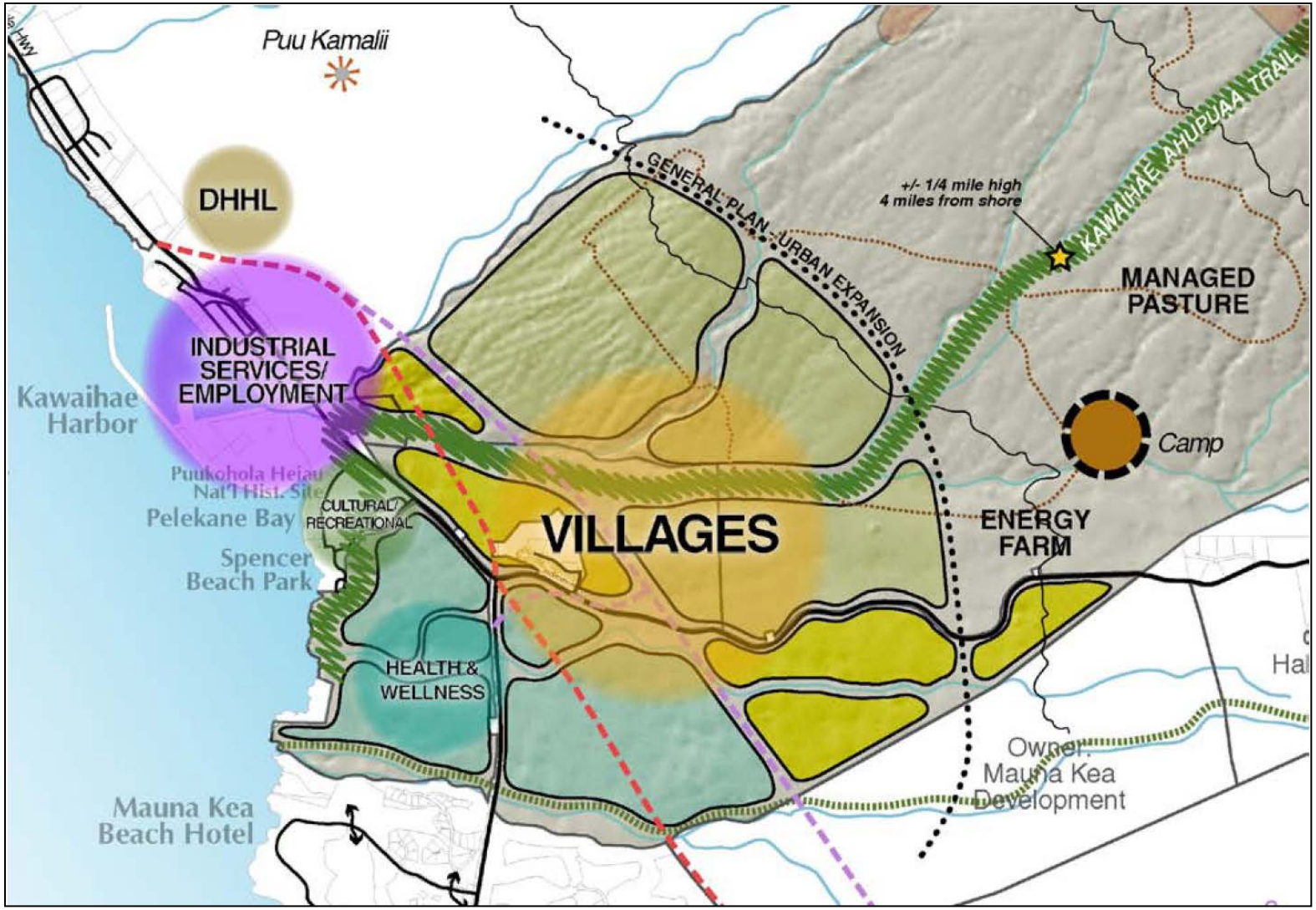
  The Strategic Master Plan recognizes that DHHL has better proximity to the harbor compared to the QEL property and therefore several ways to distinguish itself for commercial-lease opportunities will be to offer Hawai‘i County, Department of Water Supply water credits, offer fee-simple sales of land, lobby for the Kawaihae Road Bypass as a direct link to the harbor, and offer a more attractive industrial environment through elements such as a master-planned, visually attractive setting, integrate renewable energy sources, and try to encourage an “eco-industrial” concept with synergy of interrelated firms, to see if there is a potential to attract key catalyst businesses that will induce other businesses to co-locate to the area. The *Kawaihae Ahupua‘a Management Plan - Strategic Master Plan* suggests a future master plan be performed for the Kawaihae Commercial-Industrial village.
- **Makai.**
  - Coastal Health and Wellness Center. In the high-value but sensitive coastal area, the master plan suggests an upscale health and wellness center to complement the healthcare mission of Queen’s Hospital.

Figure 9-8: Queen Emma Lands Kawaihae Ahupua'a Strategic Master Plan



Source: Adapted from *Kawaihae Ahupua'a Management Plan - Strategic Master Plan* (PBR Hawai'i, 2009)

Figure 9-9: Queen Emma Land Proposed Kawaihae Commercial - Industrial Village



Source: *Kawaihae Ahupua'a Management Plan - Strategic Master Plan* (PBR Hawai'i, 2009)

- Coastal Preserve/Campgrounds. To balance the exclusivity of an upscale health and wellness facility, the master plan proposes campgrounds in the coastal areas to provide a diversity of outdoor accommodation choices for the local or more adventurous visitor market.

- **Midland/Upland Cabins and Lodges.** Resting areas along the trail will be economic opportunities for cabin sites or lodge. Archaeological and cultural sites will be preserved and interpreted to enhance the unique characteristics of the site.

- **Residential Communities** (Kawaihae Village and/or Mauna Kea Mauka)**.** A major unresolved land asset management policy question is the extent to incorporate residential development, which raises a related question as to whether and where QEL should sell land in fee simple. To this day, much of the original ahupua'a inherited by Queen Emma remains intact. Any land sold in fee simple removes the land from this legacy. On the other hand, controlled sales in strategic locations could provide income.

All Build Alternatives are complementary with QEL's vision, and its *Kawaihae Ahupua'a Management Plan - Strategic Master Plan* recognizes improvements to the harbor as a unique opportunity, especially if the Kawaihae Bypass Road provides a direct connection to the harbor from QEL's Commercial-Industrial Village. Improvements to Kawaihae Harbor, particularly under Alternatives 4 and 5 will be supportive of additional economic development in the immediate vicinity of the harbor. Increased capacity for goods and services that pass through the harbor will be important to Hawai'i Island as a whole, and indirectly to the immediate community. DOT-H will work closely with QEL to ensure that both entities' interests can be supported to the benefit of both, while avoiding adverse effects.

9.12 Kawaihae Small Boat Harbor (South) Master Plan

DLNR DOBOR has jurisdiction over the Kawaihae Small Boat Harbor (South) facility, located off the Coral Flats. As noted above in **Section 8.1.6:Kawaihae Small Boat Harbor (South) and Temporary Mooring Area**, there is currently conflict between small boats moored in the commercial harbor (near where Alternative 5's Pier 2C will be located) and larger vessels because of their inherent incompatibilities. The long-term goal is for the Small Boat Harbor (South) to be completed, and for small boats to be relocated to this harbor. This will alleviate conflicts between small boats and larger vessels that constitute the primary commercial users of the harbor.

The existing structures at the Kawaihae Small Boat Harbor (South) include an unpaved, white coral and gravel vehicular path and clearing, a fenced off area for equipment and boat storage, a pair of open pavilions, a stone and rock-lined coastline, a small lookout with handrails, a small boat launch ramp, two breakwaters and a small floating dock (M&E Pacific, Inc., 2003). Most of the land-side facilities were erected by the YMCA for activities with the knowledge that these facilities should be demolished when further development of the Small Boat Harbor (South) is undertaken (M&E Pacific, Inc., 2008). See **Section 8.1.1: YMCA Facilities** for more information.

DLNR DOBOR and USACE completed the *Master Plan for the Small Boat Harbor (South), Kawaihae, Island of Hawai'i, Hawai'i* in 2003 (M&E Pacific, Inc., 2003). Three alternative

scenarios were considered, and Alternative 2 - Minimal Action was pursued as the preferred alternative. However, the *Master Plan for the Small Boat Harbor (South), Kawaihae, Island of Hawai'i, Hawai'i* is now obsolete. Because DLNR DOBOR justified the need for about 13 acres, a recent agreement between DOT-H and DOBOR will result in the transfer of this area. The discussion that follows notes both the original plan, as well as the 13-acre project as now being pursued.

As originally planned, the master plan for the Kawaihae Small Boat Harbor (South) was to include construction of a 24-foot wide paved access road, charter and cruise facilities, 16,000 square feet of retail shops, an 800 square-foot restaurant, a boat club, an administration building with meeting rooms, public restrooms, a boat and trailer washdown area, a boat storage and maintenance area, a paved parking lot (with parking for boat trailers), perimeter fencing, boat launch ramps, an ice and fish storage dock, a fuel service dock, and floating docks with 88 slips and access ramps that are compliant with the Americans with Disabilities Act (ADA) guidelines. Approximately 318 parking spaces were to be provided. These harbor improvements were planned for implementation through several phases.

The *Master Plan for the Small Boat Harbor (South), Kawaihae, Island of Hawai'i, Hawai'i* called for buildings to be constructed with an aesthetic sensibility that reflected local values, and that were made of materials compatible with a marine environment. All utilities were found to be needed at the property. The master plan also showed an alternative access into the site from Kawaihae Road, separated from the harbor gates.

The current conceptual project being pursued on 13 acres is shown in **Figure 9-10: General Project Site Plan for Kawaihae Small Boat Harbor (South)** and **Figure 9-11: Current Concept for Kawaihae Small Boat Harbor (South)**. An issue confronting DLNR DOBOR is the presence of roughly 200 square feet of coral within the inner basin, along the west breakwater, which is holding up permitting from USACE. For this reason, DLNR DOBOR can construct only about 25 moorings, much less than the 90 moorings originally envisioned when the Small Boat Harbor (South) was first created. The boat ramp cannot be installed until the coral issues have been resolved. The 13 acres being transferred is sufficient to support this facility.

The Hawai'i County Planning Commission approved constructing the harbor within the SMA and Shoreline Setback in 2008.

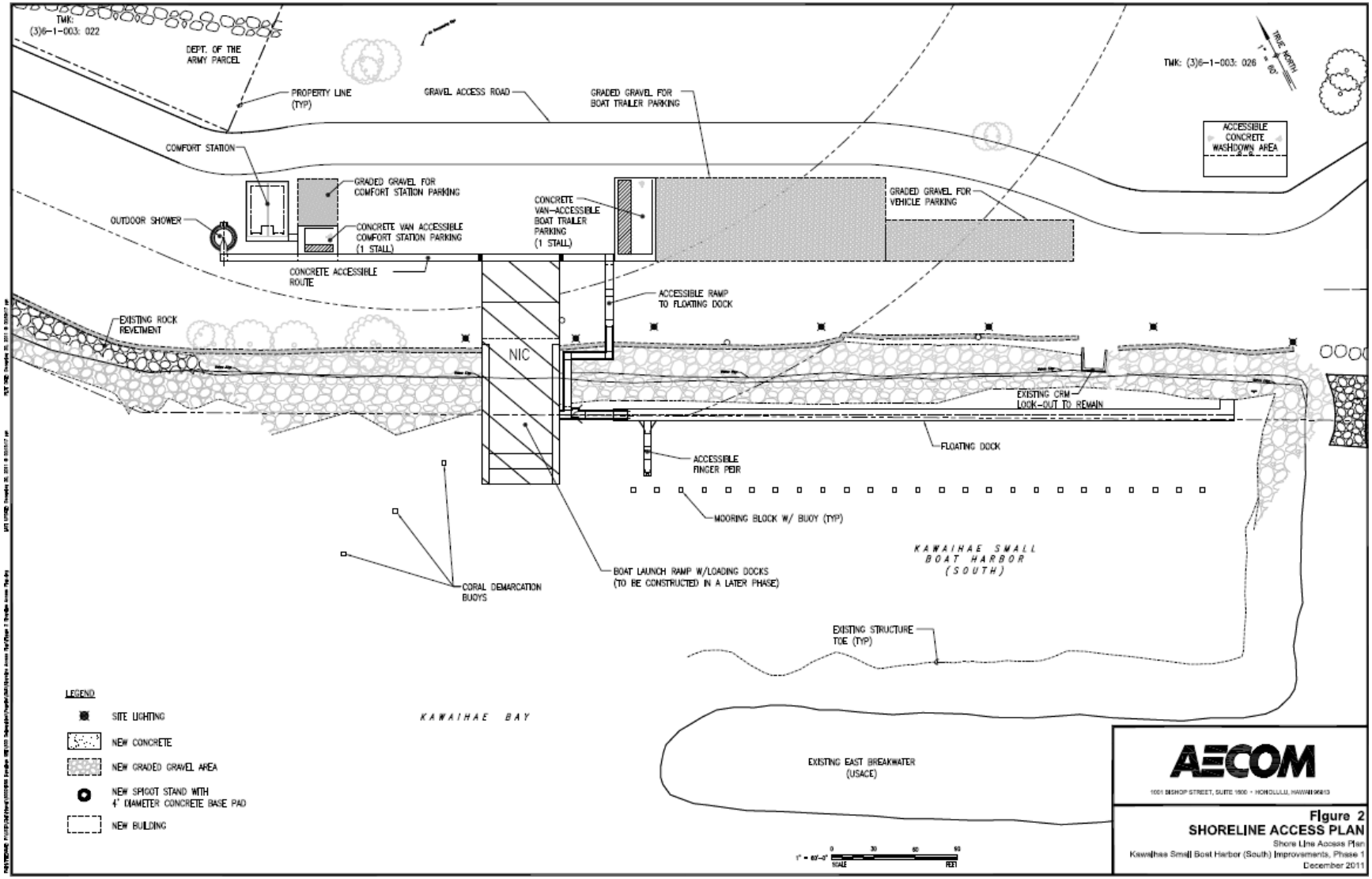
All Build Alternatives are supportive of the DNLR DOBOR goals to construct the Small Boat Harbor (South).

Figure 9-10: General Project Site Plan for Kawaihae Small Boat Harbor (South)



Source: DLNR DOBOR

Figure 9-11: Current Concept for Kawaihae Small Boat Harbor (South)

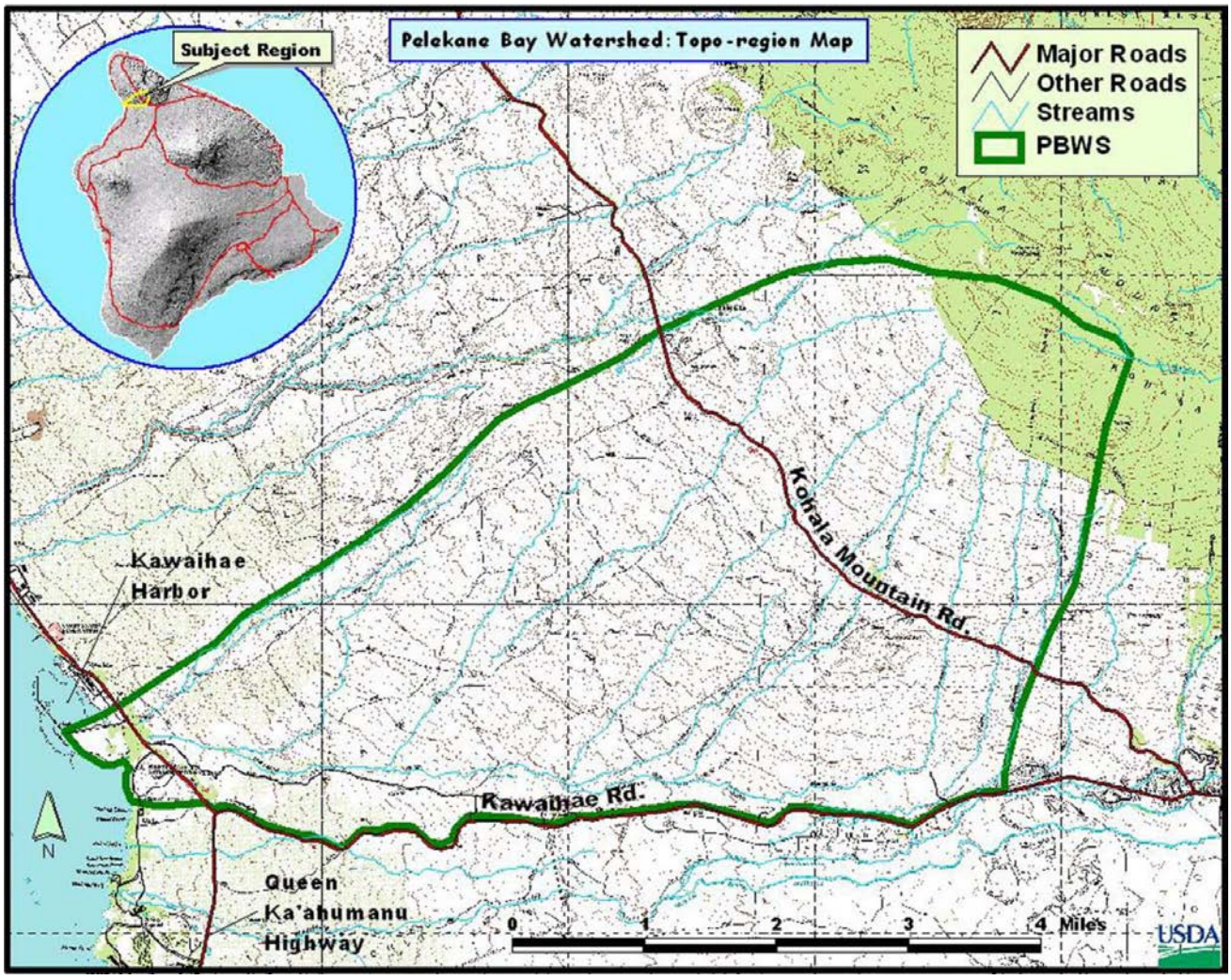


Source: DLNR DOBOR

9.13 Pelekāne Bay Watershed Restoration Project

Pelekāne Bay is located immediately south of the Coral Flats area and Kawaihae Harbor. Pelekāne Bay's watershed is located on the slopes of Kohala Mountain, extending from the Kohala Forest Reserve at the top of the mountain down to Pelekāne Bay. It is approximately 12,225 acres in size and falls from 5,300 feet to sea-level in a distance of approximately eight miles. The terrain is rugged, bisected by deep, normally dry gulches (Mauna Kea Soil and Water Conservation District, 2005). The Pelekāne Bay watershed is shown in **Figure 9-12: Pelekāne Bay Watershed**.

Figure 9-12: Pelekāne Bay Watershed



Source: *Pelekane Bay Watershed Management Plan - 2005* (Mauna Kea Soil and Water Conservation District, 2005

The water quality of Pelekāne Bay is impaired almost exclusively by erosion, sediment and the resulting turbidity. The Pelekāne Bay watershed was identified in Hawai'i's Unified Watershed Assessment as a Category I watershed, (i.e., one of the State's watersheds in most urgent need of restoration). Pelekāne Bay is also on the DOH's 2004 Section 303(d) List of Impaired Waters. To address this problem, the Mauna Kea Soil and Water Conservation District (MKSWCD) developed the *Pelekāne Bay Watershed Management Plan - 2005* with the cooperation of landowners and other interested stakeholders (MKSWCD, 2005). MKSWCD and its partners funded the installation of BMPs to reduce polluted runoff potential in the watershed.

Makahuna Gulch is the watershed boundary to the northwest and Kawaihae Road to the southeast. While there are six named gulches within the watershed — Makahuna, Palihae, Luahine, Waiakamali, Makeahua, and Pauahi — there are no perennial streams, other than within the Kohala Forest Reserve. Streamflow is limited to flows in the gulches and overland during rainfall events in all but the highest parts of the watershed. Under normal conditions, there is a berm at the artificial mouth of the watershed, and no regular streamflow enters into the ocean (MKSWCD, 2005)

Pelekāne Bay, the current mouth of the watershed, lies between Pu'ukoholā Heiau to the south and the coral flats adjacent to Kawaihae Harbor to the north. The Coral Flats was created during the construction of Kawaihae Harbor in the late 1950s, when material (sand and coral) dredged from the nearshore waters was deposited to create a filled area. The original outlets of the watershed have been blocked by the creation of Kawaihae Harbor and channelization of the flows around the harbor facility and Coral Flats (MKSWCD, 2005). The presence of the Coral Flats and Kawaihae Harbor have eliminated the littoral drift current carrying sediment out of Pelekāne Bay and this is considered the major reason for the present siltation of the bay. (MKSWCD, 1998).

The primary purpose of the Pelekāne Bay Watershed Management Project is to reduce soil erosion in the watershed by improving land management practices and restoring vegetative ground cover. The goals of the project are:

- To increase groundcover density and quality in the watershed.
- To minimize the number of fires within and adjacent to the watershed.
- To restore damaged groundcover and areas of bare soil in the watershed, as practicable;
- To reduce sediment deposits into Pelekāne Bay from upland watershed areas.
- To measure the success and effectiveness of watershed restoration and protection activities.

Several recommendations were made specifically to the goal of reducing sediment deposits in Pelekāne Bay:

- Request Congressional funding for continued feasibility studies.
- Explore feasibility/cost effectiveness of a catchment and/or sediment basin in the old quarry or on the Coral Flats.
- Explore feasibility/cost effectiveness of dredging the bay to preserve the Shark Heiau.

- Explore feasibility/cost effectiveness of a channel between Pelekāne Bay and the harbor to flush out Pelekāne Bay.

The last recommendation was pursued as described in **Section 9.14: Potential Channel Between Kawaihae Harbor and Pelekāne Bay**. It was found not to be feasible.

All Build Alternatives will use BMPs to minimize additional sedimentation in Pelekāne Bay. The DOT-H will work with MKSWCD to investigate additional ways that the project can minimize adverse effects on the bay.

9.14 Potential Channel Between Kawaihae Harbor and Pelekāne Bay

In an effort to improve water quality in Pelekāne Bay, DOT-H worked with the USACE in 2009 to analyze the impacts of a circulation channel through the coral stockpile, between Kawaihae Harbor and Pelekāne Bay (Li, et.al, 2009). This study determined that the hydrodynamics, wave and sediment transport study for Kawaihae Harbor and Pelekāne Bay indicates that construction of a circulation channel with different configurations would result in consistent flow from the bay to the harbor under normal and storm conditions. The bay-to-harbor flows would produce net sediment transport into the channel and the harbor. Based on these findings, implementation of the circulation channel would not serve the purpose of harbor water renewal and bay water quality improvement and, therefore, was not recommended.

9.15 Land Tenure

9.15.1 Ceded Lands

Much of Kawaihae Harbor is located on "ceded lands", including former Crown and Government lands and submerged lands (which are also considered part of the ceded lands trust).

Ceded lands are lands that had been in the ownership of the Hawaiian Monarch prior to the 1893 overthrow of the Hawaiian Kingdom, then owned by the Hawaiian Provisional Government and Republic of Hawai'i. Upon annexation by the US, these lands were "ceded" to the Federal Government. Upon statehood, these lands were transferred to the state. The true "ownership" of these lands is disputed, with Native Hawaiian groups asserting that they are owned by the Hawaiian People, and any use of the properties without compensation is illegal.

The Admission Act (Public Law 86-3, signed in 1959, admitting Hawai'i as the fiftieth state of the Union) Section 5 transferred title to 1.4 million acres of ceded lands in the State, to be held as a public trust for five purposes:

- Support of public education.
- Betterment of the conditions of native Hawaiians as defined in the Hawaiian Homes Commission Act of 1920.
- Development of farm and home ownership.
- Public improvements.

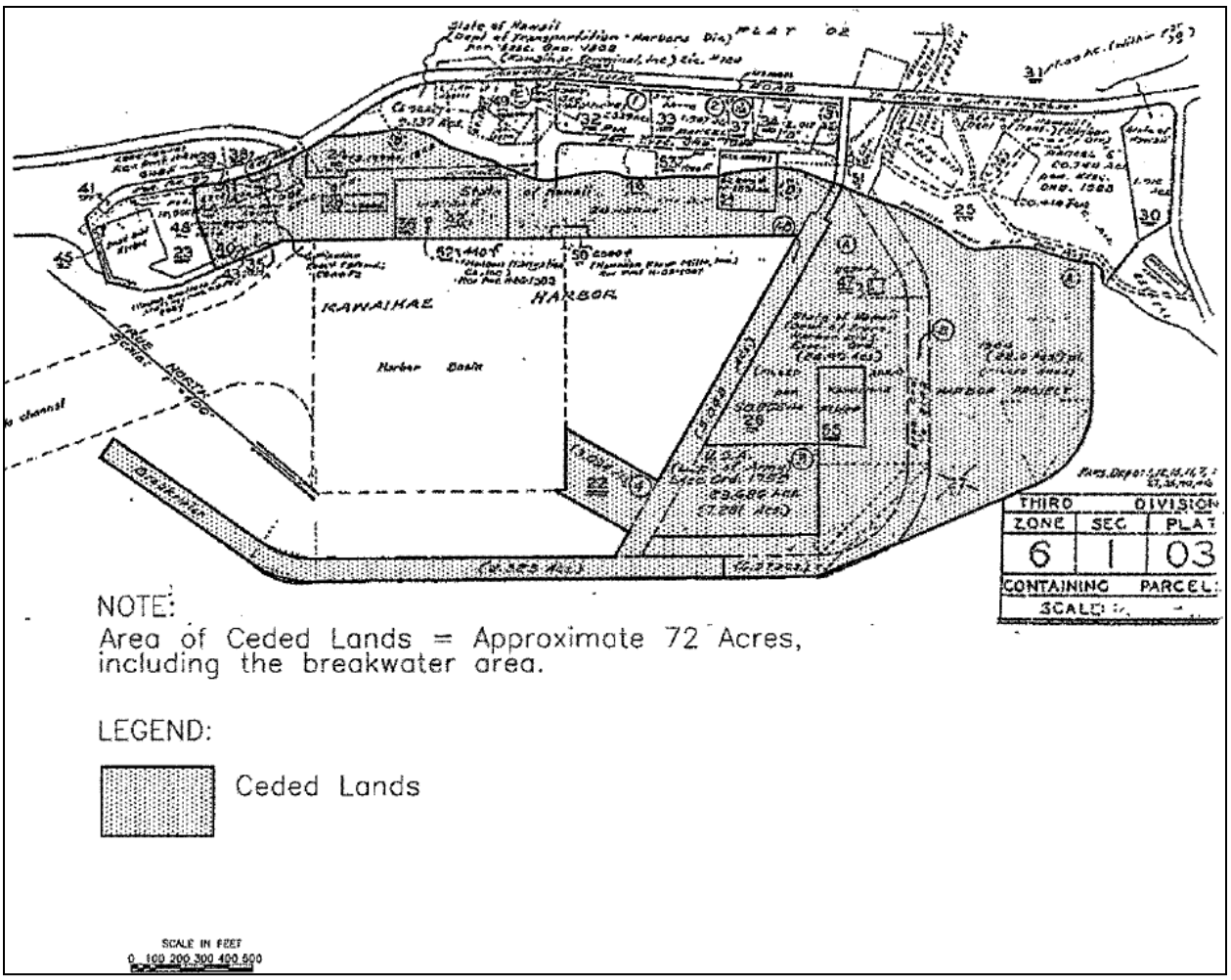
- Provision of lands for public use.

Section 5(f) of the Admission Act provides that these lands and the income and proceeds derived from them are to be held in trust by the State of Hawai'i.

Ceded lands within Kawaihae Harbor are shown in **Figure 9-13: Ceded Lands within Kawaihae Harbor**. The proposed improvements under all Build Alternatives will result in further development of ceded lands that are currently unimproved.

The improvements associated with any of the Build Alternatives are clearly to the benefit of the general public and are for public use. Therefore, the use of these ceded lands under the Build Alternatives is consistent with their intended use under the Admission Act.

Figure 9-13: Ceded Lands within Kawaihae Harbor



Source: R.M. Towill, 2001

9.15.2 Executive Orders

Several Executive Orders have had an influence on the use of property within Kawaihae Harbor, either in the past or currently. The discussions that follow describe and show the locations of the land controlled by the Executive Orders.

9.15.2.1 Executive Order 1759

In October, 1956, Governor King of the Territory of Hawai'i signed Executive Order Number 1759 (EO 1759). EO 1759 was intended to set aside public land for the Kawaihae Harbor Project to be under the control and management of the US Army. There were four separate lots provided to the Army, as illustrated in **Figure 9-14: Executive Order 1759**.

In the area covered by EO 1759, the US Army owns and operates a landing ramp, which allows them to conduct military operations and transfer troops, vehicles, explosives and other goods. This area is used by the 45th Army Corps Support Group (Forward) to off-load Logistics Support Vehicles (LSV) to be taken to Pohakuloa Training Area (PTA). The off-loading generally occurs by dropping down a ramp from the shipping vessel after it "beaches" itself in the shallow landing area. At times, they also make use of the state piers for this purpose. The use and need varies according to the status of deployment and scheduling of training exercises.

The four lots in EO 1759, covering approximately 30.2 acres, are as follows:

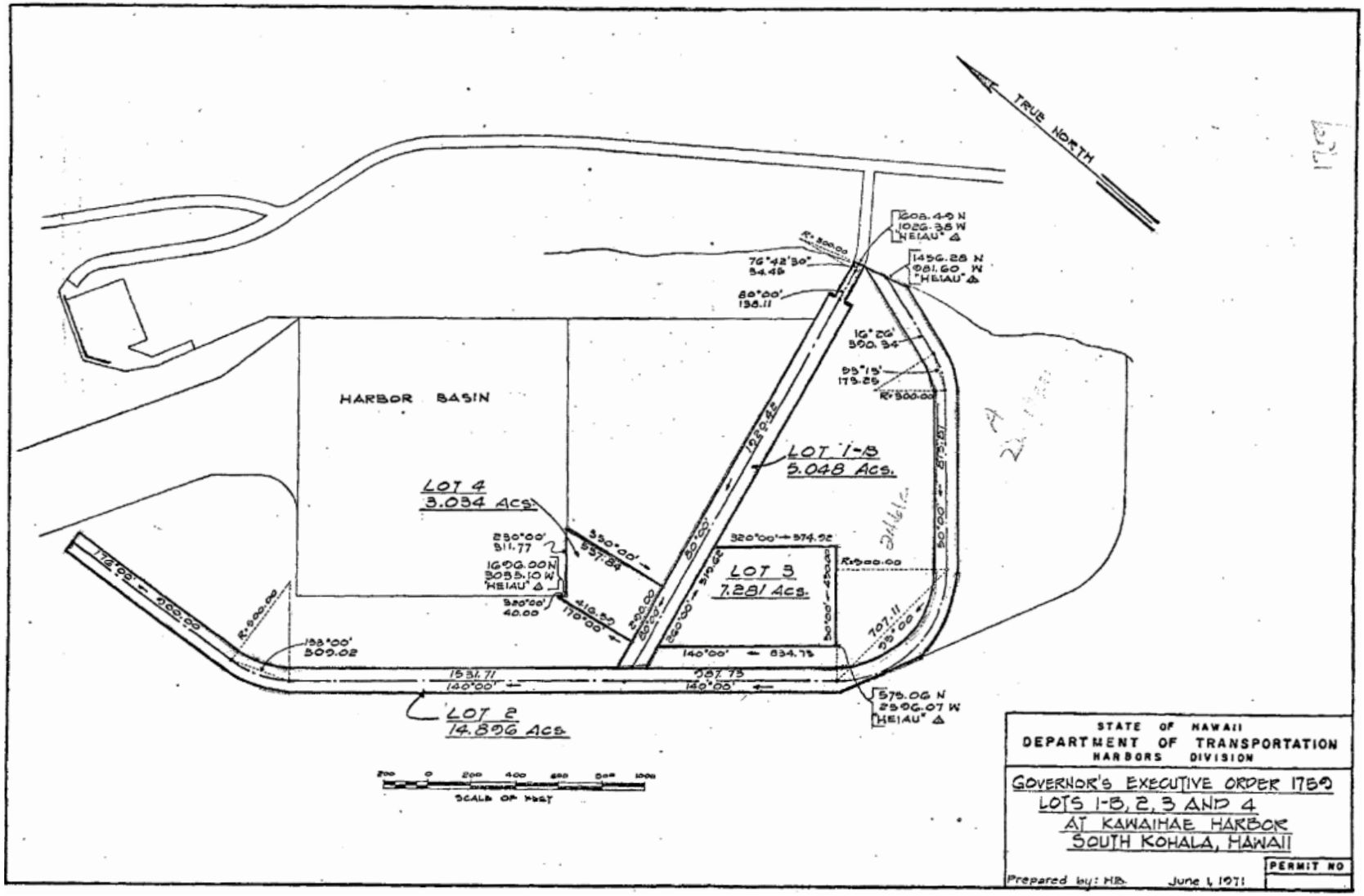
- Lot 1, approximately 5.0 acres in size, which constitutes the unpaved roadway leading in from the South Gate towards the Army's LST/LSV ramp.
- Lot 2, approximately 14.9 acres in size, which bisects the middle of the Coral Flats and continues to the breakwater that extends north from the Coral Flats. This lot's ownership was later changed in part as part of Executive Order Number 2142, described below in **Section 9.15.2.3: Executive Order 2142**.
- Lot 3, approximately 7.3 acres in size, which contains an unpaved staging area within the Coral Flats that lies across the unpaved roadway in Lot 1 from the Army's LST/LSV ramp.
- Lot 4, approximately 3.0 acres in size, which includes the Army's LST/LSV ramp.

9.15.2.2 Executive Order 1904

Executive Order Number 1904 (EO 1904) was signed in March 1960 by the State of Hawai'i's Governor William F. Quinn and was intended to set aside public land for the purpose of "receiving or discharging passengers and for the loading and landing of merchandise with warehouse or warehouse space, office or office space, storage for wares and merchandise…" to be under the control and management of the Board of Harbor Commissioners (which has since been superseded by the Commission on Transportation, COT).

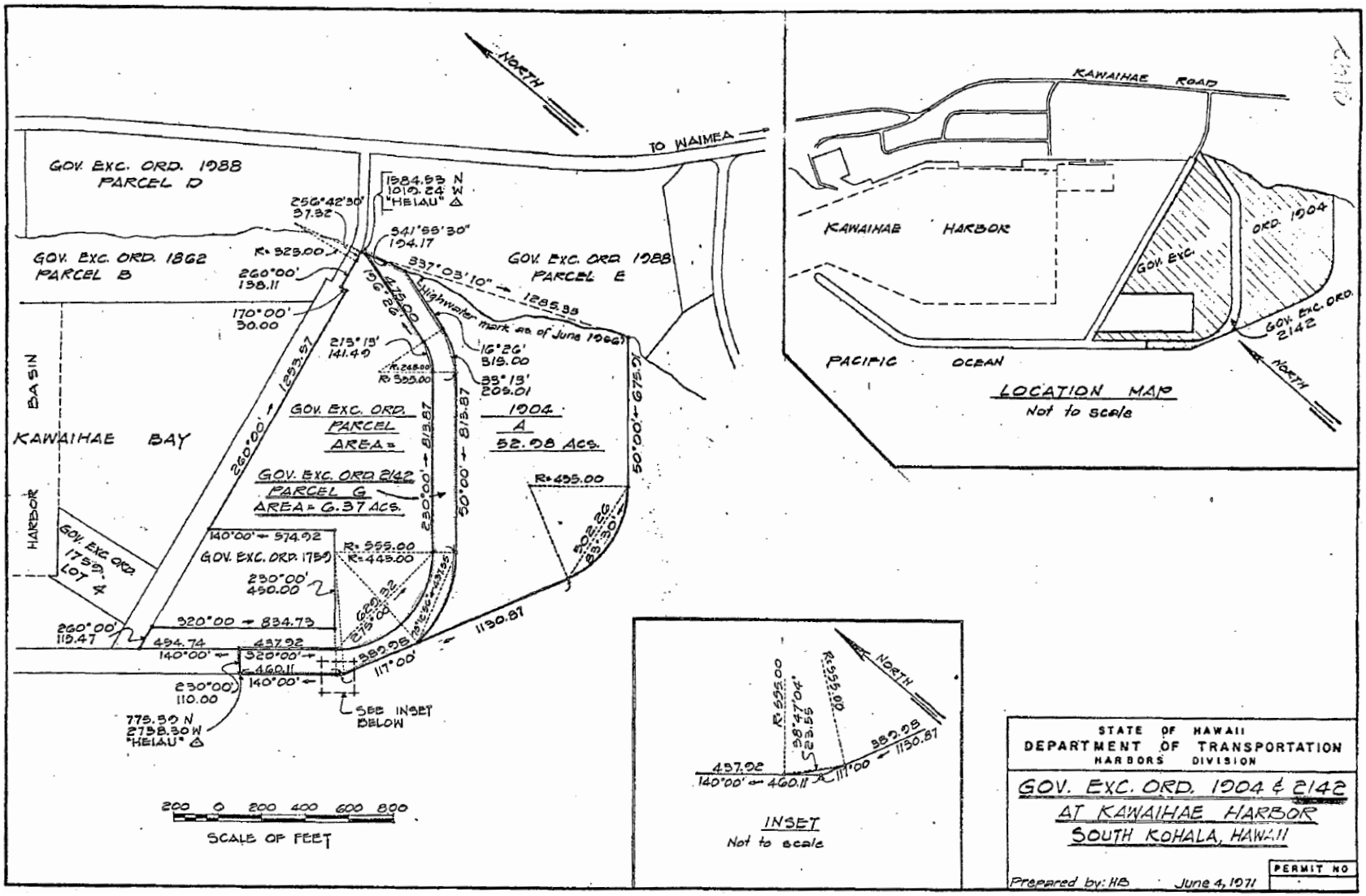
EO 1904 covered essentially the remainder of the Coral Flats that was not previously included within EO 1759, a total of approximately 53.0 acres. The area covered by EO 1904 is found in **Figure 9-15: Executive Orders 1904 and 2142**.

Figure 9-14: Executive Order 1759



Source: Hawai'i Department of Transportation

Figure 9-15: Executive Orders 1904 and 2142



Source: Hawai'i Department of Transportation

9.15.2.3 Executive Order 2142

Executive Order Number 2142 (EO 2142) was signed in June 1964 by the State of Hawai‘i’s Lieutenant Governor William S. Richardson (acting as Governor on behalf of Governor John A. Burns) and turned approximately 6.4 acres of the land that constituted Lot 2 from EO 1759 previously given to the US Army back to the Hawai‘i Department of Transportation. Approximately 8.3 acres from EO 1759’s Lot 2 constituting the breakwater was still retained by the US Army. The area covered by EO 2142 is shown in **Figure 9-15: Executive Orders 1904 and 2142.**

9.16 FDA Food Safety Modernization Act (FSMA)

On January 4, 2011, President Obama signed into law the “FDA Food Safety Modernization Act,” (FSMA) which amends the Federal Food, Drug and Cosmetic Act (21 USC 301 et seq.) with respect to the safety of the food supply. The FSMA is the most sweeping reform of national food safety laws in more than 70 years. The law aims to ensure the US food supply is safe by shifting the focus to preventing contamination rather than responding to it. Recent high-profile outbreaks related to various foods have underscored the need to make continuous improvements in food safety. The law seeks to improve the safety of the nation’s food supply by improving the systems for producing, processing, transporting, and preparing foods.

From the standpoint of Kawaihae Harbor and transportation of food, the law calls for increased capacity and frequency of inspections, preventative controls, expanded administrative detention of foods violating the law, authority to deny entry of foreign foods into the US, and enhanced partnerships/capacity building for state inspection agencies like DOA.

Most of the rules and guidelines associated with the FSMA are still being written. Nonetheless, this legislation will greatly influence DOA’s efforts to ensure safety of foods entering and leaving Kawaihae Harbor, and DOA intends to comply with appropriate regulations when they are instituted. Furthermore, during public meetings held for the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update*, several comments were made about food safety, specifically the accommodations for perishable or refrigerated goods as a public health concern. Increased food self-sufficiency is a goal, and agriculture also helps support many rural communities.

At the state level, HB 1568, signed by Governor Abercrombie in July, 2011 seeks to protect Hawai‘i’s natural environment from the threat of invasive species and assist Hawai‘i’s agricultural industry by authorizing the DOT to provide space for and work with the DOA to design and construct biosecurity and inspection facilities at Hawai‘i’s airports and harbors. These facilities will provide safeguards and will also assist the agricultural industry in alleviating the delay experienced when shipping perishable items out-of-state. DOA and DOT are cooperating as required under HB 1568. No guidelines or standards have been issued yet for HB 1568.

In addition to food safety, DOA’s other primary interests at Kawaihae Harbor are treatment and containment of invasive species, which are discussed in **Section 4.15: Invasive Species**.

9.16.1 Existing Conditions

The State Farm Bureau and the Hawai'i Department of Agriculture (DOA) want to ensure that food waiting to be loaded into refrigerated containers be covered to avoid spoilage. Covered storage and additional refrigerated units will improve the situation and prevent food from being exposed to the sun and other elements. The farming and agriculture communities' desire climate controlled shed space at both harbors where perishables can be handled and stored while waiting for shipping (exports) or transfer (imports). A long term option is to build a consolidation facility away from the harbor.

Young Brothers Ltd. (YB) handles two types of refrigerated cargo: containerized and less-than-container load (LCL) cargo. Containerized cargo is tendered to YB already packed in a refrigerated ("reefer") shipping container. In contrast, LCL cargo is tendered to YB by customers either as individual pallets or non-palletized packages. YB transfers and combines these individual LCL pieces into a refrigerated container. In the case of both containerized cargo and LCL cargo placed into a container, a YB power source provides electricity to the container's cooling system from the port of origin to the destination port. At the destination port, YB removes LCL cargo from the refrigerated container and places it in a holding area to await customer pick-up. YB notifies customers of proper cargo drop-off and pick-up times to keep items off the open dock.

Fruit flies are a major problem for farmers because they render the fruit unsuitable for export; they are currently treated at a private irradiation facility.

9.16.2 No-Build Alternative

The No-Build Alternative will not provide improvements to the harbor and as a result, the operations will be less efficient as increasing volumes of freight pass through the facility. It is likely that there could be increased delays in the movement of refrigerated or perishable goods between the docks and storage facilities, which could pose a public health concern.

9.16.3 Build Alternatives

Under all Build Alternatives, space will be provided for a future one-acre DOA inspection facility as called for in the *Hawai'i Island Commercial Harbors 2035 Master Plan Update.* DOA will have jurisdiction over the construction of this facility under a separate project. Such a facility will allow DOA to improve their inspection, treatment and quarantine services of food and agricultural goods, both entering and exiting the harbor. This will better enable DOA to protect the island's food and natural communities from health concerns and invasive species. DOA anticipates the need for one inspector at this inspection facility.

Alternatives 3, 4, and 5 will also increase the efficiency of movement of freight within the harbor site, especially between the docks and storage facilities, which should help towards reducing the time perishable or refrigerated goods sit idle in unfavorable conditions.

DOA has expressed an interest in developing common facilities with DOT-H to share infrastructure costs, such as common comfort station, utilities, paving, etc. Efforts will be made during the design of the Proposed Action to find ways to economize in this manner.

Longer-term improvements outlined in the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update* will improve the number and placement of electrical plugs for reefer containers to improve food safety. DOA has supported future installation of additional reefer plugs as well to improve food safety. Reefer plugs are installed, owned, and operated by the shipping companies themselves, with space for the plugs leased to the companies from DOT-H.

In the *Statewide Comprehensive Economic Development Strategy (CEDS)* (DBEDT, 2005), Hawai‘i County and the Farm Bureau propose an Agricultural Products Marketing Facility which will conduct irradiation, vacuum cooling, packing, distribution, and ice facilities. Consolidation, warehousing, storage, refrigeration, packing, and high tech telecommunications marketing will be important functions for such this facility. While the inspection facility will be built by others, the Proposed Action will facilitate future efforts to build inspection and/or consolidation facilities by providing land at the harbor.

9.17 Emergency Preparedness

Kawaihae Harbor is compliant with Federal, State and County Emergency Preparedness Plans, including the State of Hawai‘i *Plan for Emergency Preparedness* and the Federal and County *Emergency Procedure Guides*.

CHAPTER 10: SECONDARY AND CUMULATIVE IMPACTS

The discussions that follow consider both secondary and cumulative impacts. Refer to **Table 10-1: Summary of Secondary and Cumulative Impacts and Recommended Mitigation** for a brief summary of the rest of the chapter. **Table 10-1: Summary of Secondary and Cumulative Impacts and Recommended Mitigation** provides recommended mitigations. Actual mitigations will be determined by the appropriate permit/approval process.

10.1 Secondary Impacts

Secondary impacts, also called indirect impacts, are those which are caused by an action and are later in time or farther removed in distance, but are still reasonably foreseeable. Such effects may include changes in land use patterns, population density or growth rate, and related effects on air, water, and other natural systems.

10.1.1.1 No-Build Alternative

The No-Build Alternative does not involve any construction or modification of Kawaihae Harbor and therefore, no direct impacts resulting from the No-Build Alternative are anticipated. However, adverse secondary effects are possible if the Proposed Action is not pursued at Kawaihae Harbor, such as traffic impacts associated with growth without improvements, lower efficiency at the harbor, offices not being adequate for Hawai‘i District needs, etc. Other secondary effects are listed below.

Economic Effects

The No-Build Alternative could result in long-term operational deficiencies at Kawaihae Harbor, which could compromise Hawai‘i Island’s ability to import needed commodities and consumer goods. It will also potentially impact economic growth in the area, with resultant multiplier effects on employment, wages, and community quality of life. Refer back to **Chapter 2: Purpose and Need for Action** for detail on the economic effects caused by avoiding improvements to the harbor.

The Hawai‘i Department of Hawaiian Homelands (DHHL) and the Queen Emma Land Company (QEL) have both proposed economic development opportunities on their respective land holdings that will not be viable without improvements at Kawaihae Harbor.

Construction on the $1.2 billion Thirty Meter Telescope (TMT) project is scheduled to begin in 2012 with completion by 2018. Sensitive instruments, mirrors, and large volumes of construction materials must be shipped through the commercial harbors, staged near the harbors, and then moved to the project site. TMT will create hundreds of construction jobs, along with 140 permanent jobs with wages exceeding $10.6 million annually. By 2023, the number of jobs associated with the project could grow to 500. In addition, firms specializing in adaptive optics are developing a local technology sector, which translates to more employment opportunities for local residents. While these improvements bode well for Hawai‘i island, the No-Build Alternative will not provide for increased operational capacity and could limit

Table 10-1: Summary of Secondary and Cumulative Impacts and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
10.1	**Secondary Impacts**	• Adverse secondary impacts associated with growth at the harbor not being addressed by improvements. • No secondary effect on mitigating spread of invasive species • Other plans proposed by DHHL and QEL may not be viable if improvements not made at harbor.	• Adverse secondary impacts associated with growth at the harbor not being addressed by improvements. • Will facilitate DLNR-DOBOR efforts to finally develop Kawaihae Small Boat Harbor (South). • No secondary effect on mitigating spread of invasive species • Other plans proposed by DHHL and QEL may not be viable if improvements not made at harbor.	• Minor effect as catalyst for additional employment, business activity and development near harbor in Kawaihae. • Will facilitate DLNR-DOBOR efforts to finally develop Kawaihae Small Boat Harbor (South). • Will offer space for future DOA initiative to construct a facility for inspecting agricultural products, prevent spreading invasive species, and address food safety/security. • Additional development in the area may be limited by water supply.	• Greater effect as catalyst for additional employment, business activity and development near harbor in Kawaihae. • Will facilitate DLNR-DOBOR efforts to finally develop Kawaihae Small Boat Harbor (South). • Will offer space for future DOA initiative to construct a facility for inspecting agricultural products, prevent spreading invasive species, and address food safety/security. • Additional development in the area may be limited by water supply.	• **Highest effect as catalyst for additional employment, business activity and development near harbor in Kawaihae.** • **Will facilitate DLNR-DOBOR efforts to finally develop Kawaihae Small Boat Harbor (South).** • **Will offer space for future DOA initiative to construct a facility for inspecting agricultural products, prevent spreading invasive species, and address food safety/security.** • **Additional development in the area may be limited by water supply.**	• DOT-Harbors will coordinate with County of Hawai'i Department of Water Supply to ensure that all necessary permits/ approvals obtained and that existing supplies are adequate to accommodate Proposed Action.

Table 10-1: Summary of Secondary and Cumulative Impacts and Recommended Mitigation

EA Sec.	Resource/ Issue	Impacts of Alternatives:					Recommended Mitigation Measures
		Alt. 1: No-Build	Alt. 2: Minimal Action	Alt. 3: Partial Action/Land-Side	Alt. 4: Land-Side Plus Pier 2A Extension	Alt. 5: Proposed Action	
10.2	**Cumulative Impacts**	• None, as project will not have impacts and therefore not cumulatively contribute to any impacts.. • No cumulative benefit in mitigating spread of invasive species.	• Project will not have minimal impacts and therefore have a minimal cumulative contribution to any impacts.. • No cumulative benefit in mitigating spread of invasive species	• While vegetation and natural terrestrial habitats have been highly disturbed, Alternative 3 will contribute further to this • Will offer DOA space for a facility to counteract the cumulative effects of other actions in spreading invasive species. • Noise has been created by development in the area and Alternative 3 will contribute to noise. • Air quality has been affected in the past by fugitive dust, and Alternative 3 will contribute. • Developments have changed the visual landscape and cultural surroundings of area, particularly with regards to Pu'ukoholā National Historic Site • Traffic has been increasing over time and Alternative 3 will have a minor effect on increasing it further.	• While vegetation and natural terrestrial habitats have been highly disturbed, Alternative 4 will contribute further to this • Will offer DOA space for a facility to counteract the cumulative effects of other actions in spreading invasive species. • Noise has been created by development in the area and Alternative 4 will contribute to noise. • Air quality has been affected in the past by fugitive dust, and Alternative 4 will contribute. • Developments have changed the visual landscape and cultural surroundings of area, particularly with regards to Pu'ukoholā National Historic Site • Traffic has been increasing over time and Alternative 4 will have an effect on increasing it further.	**• While vegetation and natural terrestrial habitats have been highly disturbed, Alternative 5 will contribute further to this** **• Will offer DOA space for a facility to counteract the cumulative effects of other actions in spreading invasive species.** **• Noise has been created by development in the area and Alternative 5 will contribute to noise.** **• Air quality has been affected in the past by fugitive dust, and Alternative 5 will contribute.** **• Developments have changed the visual landscape and cultural surroundings of area, particularly with regards to Pu'ukoholā National Historic Site** **• Traffic has been increasing over time and Alternative 5 will have an effect on increasing it further.**	• BMPs will minimize impacts on Marine habitats, noise, air quality, vegetation. • The Pelekāne Lands Buffer will be maintained to minimize effects on the National Historic Site. • Kawaihae Road is only being widened in the makai direction to avoid known burial sites. • Improvements to Kawaihae Road will address traffic impacts.

Kawaihae Harbor's support for the Hawai'i Island astronomy industry, the construction industry and its ability to import materials.

The US government is already investing in improvements to Saddle Road near the base of Mauna Kea. Limitations to the cargo yards under the No-Build Alternative will not provide assurance that the island can support its leading technology sector.

Harbor Operations

The operational deficiencies cited above under the No-Build Alternative will create problems as cargo and traffic increase at the harbor over time.

Traffic

Under the No-Build Alternative, increasing traffic volumes over time will limit the ability of Kawaihae Road to efficiently and safely accommodate traffic, particularly trucks.

Emergency Response

In the event of a natural disaster that damages Hilo Harbor or a portion of Kawaihae Harbor, the lack of capacity to efficiently process cargo at Kawaihae could hamper the recovery efforts and slow the revival of the local economy.

Recreational Facilities

The No-Build Alternative will not transfer land over to DLNR DOBOR and therefore, they will be unable to pursue separate future improvements on their part that will improve access and usage of the area for recreational purposes.

Invasive Species and Food Safety

The No-Build Alternative will have no direct effect on invasive species, but will not offer space for a future Hawai'i Department of Agriculture (DOA) facility to better protect Hawai'i Island and the rest of the state by preventing the spread of invasive species, and supporting food safety and food security.

10.1.1.2 Proposed Action

The Proposed Action will have the following secondary impacts:

Social Impacts

The Proposed Action could serve as a catalyst for additional employment, business activity and development in and around the Kawaihae area. As noted above, DHHL and QEL have both proposed economic development opportunities on their respective land holdings that will be driven by improvements at Kawaihae Harbor. These plans are to some degree constrained by water supply limits as described below. In addition, the astronomy industry will benefit from the project's support of the construction industry and its ability to import materials needed to build the TMT.

The Proposed Action is not expected to directly encourage population growth as it does not involve any residential development, and most construction jobs are likely to originate from

Hawai‘i Island. The Proposed Action is really more a response to previous population growth, which has increased demand for consumer items and commodities to be transported into the harbor. However, while population growth in the immediate area will likely be constrained by water limitations, there could be secondary growth island-wide caused by economic benefits noted above, some of which could attract migration due to new jobs.

Recreational Facilities

The Proposed Action will facilitate the Hawai‘i Department of Land and Natural Resources, Division of Boating and Ocean Recreation (DLNR DOBOR) efforts to finally develop the Kawaihae Small Boat Harbor (South). Other recreational users such as the Pua Ka ‘Ilima O Kawaihae Cultural Surf Park, YMCA, and Na Kalai Wa‘a Moku ‘O Hawai'i, and the Kawaihae Canoe Club may choose to capitalize on the opportunities offered by the improvements proposed to Coral Flats.

Invasive Species

The Proposed Action will have no direct effect on invasive species, but will offer the space for a future DOA facility. DOA will construct this facility to better protect Hawai‘i Island and the rest of the state by preventing the spread of invasive species, and supporting food safety and food security.

Water Supply

The County of Hawai‘i, Department of Water Supply (DWS) cited the 12-inch water main within Akoni Pule Highway/Kawaihae Road and noted that any additional water demand will require extensive improvements to the water system, which may include, but not be limited to, additional source, storage, booster pumps, and transmission facilities. Therefore, increased consumption of water at the harbor could have a secondary effect on limiting other proposed developments from being built in the area without substantial improvements.

10.2 Cumulative Impacts

In considering the improvements necessary within the short-term, this EA considers the cumulative impacts of Proposed Action. "Cumulative impacts" are defined in HAR 11-200-2 as environmental impacts resulting from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Therefore, the cumulative impacts associated with the Proposed Action are assessed by considering the implementation of the Proposed Action along with other past or known future planned improvements within the study area that would affect or be affected by the project.

10.2.1 Other Actions Considered for Cumulative Impacts

There are other actions or planning efforts beyond the limits of harbor improvements that could also contribute to cumulative impacts.

- Kawaihae Small Boat Harbor (South) Master Plan.

- Kawaihae Road Bypass EIS, Improvements at Queen Ka‘ahumanu Highway and other planned highway improvements.
- Plans for expansion of residential and commercial subdivisions in and around Kawaihae (DHHL, Queen Emma Lands, etc.).
- Plans for Pohakuloa Training Area.
- South Kohala Community Development Plan.

In addition, proposals have been made in the past to lease about 12 acres in the center of the Coral Flats for timber storage, and construct two access roads from the north side of the Coral Flats to the area. It has not been pursued further at this time. The cut timber would originate from eucalyptus forest land in the Hāmākua District of Hawai‘i Island, and be hauled to Kawaihae Harbor for export to Asia. If such a project is reconsidered in the future, an Environmental Assessment will be produced to consider impacts and mitigation from this action.

10.2.2 Cumulative Impacts of Project Alternatives

10.2.2.1 Cumulative Impacts of No-Build Alternative

The No-Build Alternative does not involve any construction or modification of Kawaihae Harbor and therefore will not have a cumulative effect in association with the other actions that have taken place at Kawaihae Harbor in the past or are anticipated to take place in the future. The No-Build Alternative will not offer DOA the space for a new inspection facility and therefore will have no benefit in counteracting the cumulative effects of other actions that have spread invasive species

10.2.2.2 Cumulative Impacts of Build Alternatives

Impacts associated with the Build Alternatives are mainly associated with construction activities, with some additional impacts occurring from the ongoing post-construction operation of the harbor itself.

In determining what is reasonably foreseeable, the State of Hawai'i, Department of Transportation, Harbors Division (DOT-H) has determined that the following intermediate- and long-range projects identified in the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update* are of a longer-term planning horizon than is found in this report. Therefore, they are not reasonably foreseeable, as conditions could change over time that delay them indefinitely or even negate their need. These elements not covered in the EA are described in **Section 3.10.4: Future Master Plan Elements Not Carried Forward in EA.**

If and when these intermediate- and long-range projects become ripe for decision-making, an environmental analysis will be completed to determine if any environmental documentation will be needed in accordance with State of Hawai‘i Chapter 343 and (if applicable) National Environmental Policy Act (NEPA) rules and regulations.

Cumulative effects on resources are described below.

Natural Habitats

Kawaihae Harbor has been used as a harbor for centuries, but actions dating from the 1950s through 1970s, particularly dredging and fill, irreparably altered the landscape, vegetation, and natural resources of the area. The Coral Flats area does offer some vegetation, primarily keawe trees, but this is not a natural ecosystem that will offer much to native species. Therefore, none of the Build Alternatives are anticipated to create a substantial additional impact on natural resources in the area like vegetation or terrestrial wildlife because of past disturbance, but the project will incorporate mitigative measures in the form of Best Management Practices (BMPs) and natural landscaping where appropriate to avoid further effects.

Invasive Species

The Build Alternatives will all offer DOA space for an inspection facility. This will counteract the cumulative effects of other actions that have increased the spread of invasive species.

Water Quality and Marine Environments

Actions to build the original harbor have irreparably altered the underwater relief of the area through dredging, fill, and general alteration of the shoreline. The Proposed Action will require additional dredging to ensure adequate clearance for vessels. There will also be impacts on marine environments caused by other land-side construction actions that could pose water quality concerns.

Pelekāne Bay has been adversely affected by siltation. This situation is the cumulative effect of a number of separate causes. Long-term changes to the natural plant community started with clear-cutting of sandalwood almost two hundred years ago and subsequent colonization of dry areas with fire-prone grasses like fountain grass have prevented regeneration of native plant landscapes. Ranching compounded these problems by releasing dry soils as particulates to be dispersed by air and water, increasing erosion and siltation in stream beds. Dredging for the Kawaihae Harbor and the filling of coral materials in the Coral Flats limited currents from dispersing waterborne silt out of the bay. Increased use of unpaved surfaces on harbor property has also contributed to siltation. All of these factors have resulted in the current poor water quality in Pelekāne Bay.

Impacts associated with Alternatives 4 and 5, which will involve work in the marine environment, will contribute to these ongoing cumulative impacts to the environment, but with the mitigative measures proposed in this EA, the project will not result in impacts of significance. Best Management Practices (BMPs) covering erosion control and other mitigative measures will be implemented by the contractor during construction activities. This includes compliance with all applicable permits and regulations.

Other measures that will have a cumulatively beneficial impact on water quality and marine environments are associated with the Kohala Watershed Partnership, the Mauna Kea Soil and Water Conservation District and the Pelekāne Bay Watershed restoration project, described in **Section 9.13; Pelekāne Bay Watershed Restoration Project**. To reduce erosion and resultant marine sedimentation, efforts are being made to improve the watershed at higher elevations.

Improvements include restoring native forests, controlling feral goats, and installing sediment check dams and erosion-control fabric.

Noise and Air Quality

Industrialization of the Kawaihae area has increased noise levels in the immediate area. Construction noise and vibration are ongoing concerns. Pu‘ukoholā Heiau is affected to some degree by noise and vibration from Kawaihae Road. There will be minor increases in noise from traffic along Kawaihae Road, though this was not modeled as being significant in magnitude.

Air quality has been affected in the past by fugitive dust created from particulates stirred up by vehicles traveling on unpaved areas.

The cumulative impact of the Build Alternatives on the global climate when added to other past, present, and reasonably foreseeable future actions is not currently scientifically predictable. Actions are underway within the U.S. and by other nations to reduce transportation’s contribution of greenhouse gases (GHGs) through such measures as new technologies to reduce emissions and improve fuel efficiency, renewable alternative fuels with lower carbon footprints, market-based measures and environmental regulations.

BMPs, which will also include compliance with all applicable permits and regulations such as those concerning noise control and air quality to limit adverse impacts. Paving and re-vegetation of some areas that currently are currently unpaved will help to minimize the project’s contribution to these problems.

Cultural and Visual Impacts

Ongoing changes to the visual landscape have changed the context of the surroundings near Pu‘ukoholā Heiau National Historic Site (NHS). The heiaus and other features of this property existed long before nearby roads, residences and harbor were built. Whereas the NHS was originally surrounded by a rural, undeveloped area, the construction of Kawaihae Harbor added a very different type of industrial land use in close proximity to the cultural and natural landscape of the NHS.

One potential future action that could cumulatively contribute to a reduction in visual impact is the relocation of fuel storage facilities across Kawaihae Road to Department of Hawaiian Homelands (DHHL) lands on the mauka (upland) side of the road. At the time of the *Hawai‘i Commercial Harbors 2020 Master Plan*, fuel storage was planned in the long term to be located within the Coral Flats area. As a way to mitigate the effects this facility will have on the NHS, the *Hawai‘i Island Commercial Harbors 2035 Master Plan* Update proposed instead to relocate the fuel storage outside of the harbor, and further from the NHS. The future fuel storage developer will have to do their own environmental review when this development is ready to go.

All of the Build Alternatives will need to take the sensitive nature of the NHS into account to ensure that there are not ongoing changes that will adversely affect the area. DOT-H staff has worked with staff from the NHS to find ways to mitigate the effects of the landside improvements of the Build Alternatives on an important and cultural resource like the heiau.

Possible measures include choosing a design and color of fencing in the Coral Flats area that blends into the landscape and preserving the Pelekāne Buffer Zone as an intact block of land between the NHS and the harbor through the 2035 planning horizon of the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update*.

Past actions have affected archaeological resources in the area. DHHL has re-interred ‘iwi (burials) that were encountered during the limited development on their property located makai (i.e., towards the exterior of the island) of Kawaihae Harbor. Other archaeological resources were affected during the original construction of the harbor, nearby roadways, etc. The Proposed Action is making efforts to minimize further impacts on archaeological resources by widening Kawaihae Road towards the makai direction, away from known burial sites that exist on the mauka (i.e., towards the interior of the island) side.

Traffic and Roadways

Traffic has been increasing over time, and improvements to Kawaihae Harbor under Alternatives 3, 4, and 5 propose improvements to Kawaihae Road to ensure safe turning movements by trucks entering the harbor. As traffic levels have increased, with minimal accommodations for pedestrians and bicyclists, conditions have become less favorable for these alternative modes. There have also been circulation problems within the harbor itself. All of these issues either have been recently addressed or will be improved under the Proposed Action.

A number of additional traffic concerns exist on roads leading to the harbor. The intersection of Queen Ka‘ahumanu Highway and Kawaihae Road is due for improvements over the long-term. Queen Ka‘ahumanu Highway is eventually planned to be four lanes in width between Kawaihae and Kailua-Kona. The segment of Kawaihae Road between Waimea Town and Queen Ka‘ahumanu Highway is a concern because of steep grades, numerous curves, and high traffic volumes bypass roadway is being planned.

Increased activity at Kawaihae Harbor under the Build Alternatives, particularly Alternatives 4 and 5, may increase traffic demand on associated roadways, though other factors such as community development will also contribute to traffic. It is difficult to foresee exactly how much community development is likely in the area within the planning horizon of this project; while both DHHL and QEL have proposed increased development on their lands as noted in **Section 9.10: Department of Hawaiian Home Lands Kawaihae Regional Plan** and **Section 9.11: Queen Emma Foundation Ahupua‘a Strategic Management Plan**, both plans note that a lack of water in the area greatly constrains additional development. Therefore, there could be cumulative effects on traffic from nearby development, but the extent of these effects is highly speculative.

Proposals have been made in the past to store timber at the Coral Flats, but this has not been pursued further at this time. If such a facility was constructed, it would have impacts on traffic in the area, and could introduce up to 20 timber hauling trucks a day during peak demand carrying timber from the Hāmākua Coast to Kawaihae Harbor. Under such a scenario, there would be increased circulation of traffic within the site when timber is hauled from the Coral Flats area to Pier 1 for shipping to Asia.

Tradewinds Forest Products LLC has been storing harvested eucalyptus trees on the portion of QEL property immediately across Kawaihae Road from the harbor. The trees are grown on the Hāmākua coast and are stored until a full shipload is available for shipping to Asia. They are expected to generate traffic in a similar manner.

Regardless of the effects on traffic from harbor improvements and other developments, long-range planning of the region's transportation needs will address such challenges.

Internal roadway improvements at Kawaihae Harbor and future development of the Perimeter Road by DLNR DOBOR to serve the Kawaihae Small Boat Harbor (South) should not have a substantial cumulative effect on regional roadways or traffic.

Conclusion

While all Build Alternatives will cumulatively contribute to the effects of other past and future effects on the environment, mitigation of adverse impacts will be provided as cited above. Therefore, none of the Build Alternatives will significantly contribute to adverse cumulative effects on the environment.

10.3 Relationship Between Short Term Uses and Long Term Productivity

All alternatives, including the No-Build Alternative, will involve short- and long-term tradeoffs. Financial resources, labor, and construction materials used to construct the Proposed Action will be substantial. Based on all of the improvements included in the project, the ultimate benefits should justify the initial costs. These costs and benefits are not limited to the spending of public dollars, but also include qualitative items such as safety, people's time, economic development benefits, opportunities to facilitate regional planning efforts, etc. For this discussion, "short-term" refers to the immediate direct consequences of the project while "long-term" refers to its direct or indirect effects on future generations.

Short-term consequences to the environment resulting from project alternatives have been discussed throughout this EA**.** In the case of the No-Build Alternative, there will be no changed short-term uses of the human environment above and beyond existing uses of the harbor. No construction will occur. Over the long term, the harbor will be unable to efficiently accommodate increasing demand for goods and services as outlined in **Section Chapter 2:: Purpose and Need for Action**.

In the case of the Build Alternatives, short term uses of the environment will include:

- Temporary air, noise, and visual effects caused by construction activities.
- Minor disruption to harbor users and travelers on Kawaihae Road caused by construction activities.
- Limited disturbance to adjoining land uses because of construction activities.

Most of the long-term benefits from making the improvements Kawaihae Harbor are addressed in **Section Chapter 2:: Purpose and Need for Action.** The No-Build Alternative will not provide

any long-term benefits, and instead, the harbor will be less-equipped to meet future needs. In contrast, long-term benefits associated with the Purpose and Need for the project include:

- Increased capacity for essential harbor operations to accommodate continued growth safely and efficiently through improvements to piers, yards, gates, and other infrastructure. This increased capacity will be mainly realized with Alternatives 4 and 5, and to a lesser degree, Alternative 3.
- Increased depths in the harbor through dredging to safely accommodate navigation of barges and other craft using the harbor under Alternatives 4 or 5.
- Improved security through improved facilities for security inspections and agricultural inspections under Alternatives 3, 4, and 5.
- Support for the military's continued use of the site for transport of equipment essential for national security through provision of improvements to separate military facilities from general harbor use under all Build Alternatives.
- Improved safety between small boats/recreational uses and commercial harbor uses through relocation of facilities for small boats under Alternative 5.
- Accommodating future ferry operations if proposals for such service were made in the future. All project alternatives meet this objective.

Improvements at Kawaihae Harbor are associated with a long-range planning effort, the *Hawai'i Island Commercial Harbors 2035 Master Plan Update*, but also the *Kawaihae Harbor Development Plan* studies and are also consistent with other long-range planning efforts cited in **Chapter 9: Conformance with Plans and Policies**.

10.4 Irreversible & Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources are the funds, materials, and labor put into a project.

Irretrievable commitments of the No-Build Alternative include the economic effects, lost time, wasted energy from inefficient operations, and other resources that will be lost or expended as Kawaihae Harbor fails to accommodate the need for the movement of goods and materials in the future. The effects of delaying improvements or not improving the harbor will increase operational inefficiencies that will potentially compromise the ability of Hawai'i Island to receive essential goods and materials, particularly if a natural disaster such as a tsunami affected Hilo Harbor.

The Build Alternatives (in increasing levels of intensity between Alternatives 2, 3, 4 and 5) will permanently commit, acquire, or modify various resources for construction and operation:

- Funding from tax dollars and port users.
- Land that is now vacant.

- Fossil fuels and construction materials such as cement, stone, concrete, asphalt, and building materials.
- Labor.

Such uses of resources will be generally irreversible, although it could be possible to retrieve and reuse some resources to a limited extent. For example, building or construction materials could conceivably be dismantled and reused for another purpose, though the likelihood of that occurring is remote.

The essential need for Hawai‘i Island to address the increasing demand to transport goods and raw materials far outweighs the irreversible commitment of the resources described above.

CHAPTER 11: AGENCY AND PUBLIC CONSULTATION

Consultation with various Federal, State and County government agencies was conducted to obtain their comments and concerns associated with the project as part of the environmental assessment process. The public has also been given a number of ways to provide input on the project, as described below.

11.1 Project Website

A project website, www.hawaiiharborsplan.com provides:

- An overview of the project and related projects at Kawaihae Harbor.
- Notices and summaries about public information meetings.
- An opportunity for the public to comment or make inquiries about issues related to the project.

11.2 Draft EA Comments

11.2.1 Draft EA Comment Period

The Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFONSI) for this project was submitted to the Office of Environmental Quality Control (OEQC) in July, 2013 and published in the OEQC's *Environmental Notice* on July 23, 2013. Agency stakeholders and the general public were afforded the opportunity to submit comments through August 22, 2013. Two newspaper articles highlighting the proposed improvements, the findings of the DEA-AFONSI, and the availability of the DEA-AFONSI for public review were published in the *West Hawai'i Today* newspaper on July 28, 2013 and in the *Honolulu Star-Advertiser* on August 2, 2013.

11.2.2 Responses to Comments Received During Draft EA Comment Period

A total of six pieces of correspondence with comments on the project, shown in **Appendix B3: Public Input Received in Draft EA Comment Period** were received from the following entities:

FEDERAL AGENCIES

- U.S. Department of Commerce, National Oceanic and Atmospheric Administration – National Marine Fisheries Service. (NMFS)

STATE OF HAWAI'I AGENCIES

- Department of Health, Clean Water Branch (DOH-CWB)

INDIVIDUALS

- Ms. Joyce O'Connor, resident of area
- Ms. Joani Duncan and Mr. Ray Duncan, resident of Kailua-Kona

- Ms. Francis Harman and Mr. Robert Harman, resident of Waikoloa
- Ms. Alice Hughes, resident of area

In general, both NMFS and DOH-CWB raised concerns about water quality in the harbor from construction and dredging activities. The responses noted that these impacts will generally be addressed with the use of Best Management Practices (BMPs) and all required permits will be obtained from resource agencies.

NMFS cited a number of concerns associated with protection of marine wildlife and coral. The responses noted that consultation as required under Section 7 of the Endangered Species Act will be conducted, and a number of mitigative measures will be pursued to minimize adverse impacts on wildlife, particularly protected species.

The four letters from individuals focused on one specific issue: a desire to see accommodations made for inter-island ferry service through a ferry pier. The responses noted that a ferry pier would be accommodated on Pier 3. Pier 3 construction is not included in the medium-term phase improvements covered in this FEA-FONSI.

The correspondence received during the comment period and responses provided follow.

SSFM INTERNATIONAL, INC.
RECEIVED
JUL 31 2013
dkz

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
EMD/CWB

07069PKP.13

July 25, 2013

FILE

TO: The Honorable Glen Okimoto, Ph.D.
Director
Department of Transportation

FROM: Alec Wong, P.E., Chief
Clean Water Branch

**SUBJECT: Comments on the Draft Environmental Assessment (DEA) for the Kawaihae Harbor Improvements
South Kohala, Island of Hawaii, Hawaii**

The Department of Health (DOH), Clean Water Branch (CWB) has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at:
http://health.hawaii.gov/epo/files/2013/05/CWB-standardcomment.pdf

1. Any project and its potential impacts to State waters must meet the following criteria:
   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.
   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.
   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).
2. As stated in your DEA, you will be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, dewatering effluent, and/or hydrotesting water, into State surface waters (HAR, Chapter 11-55). An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. To request NPDES permit coverage, you must submit the CWB Individual NPDES Form through the e-Permitting Portal and the hard copy certification statement with $1,000 filing fee. Please open the e-Permitting Portal website at: https://eha-cloud.doh.hawaii.gov/epermit/View/home.aspx. You will be asked to do a one-time registration to obtain your login and password. After you register, click on the Application Finder tool and locate the "CWB Individual NPDES Form." Follow the instructions to complete and submit this form.
3. If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.
4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb/, or contact the Engineering Section, CWB, at 586-4309.

KP:rh

c: DOH-EPO [via email only]
✓Mr. Douglas Zang, SSFM International, Inc.

FILE COPY

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

13 OCT -4 A9:51

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
HAR-EP
4035.14
R/S: 14.0137

September 26, 2013

TO: THE HONORABLE LORETTA J. FUDDY, DIRECTOR
DEPARTMENT OF HEALTH

ATTENTION: CHIEF ALEC WONG, P.E.
ENVIRONMENTAL MANAGEMENT DIVISION
CLEAN WATER BRANCH

FROM: GLENN M. OKIMOTO, PH.D.
DIRECTOR OF TRANSPORTATION

SUBJECT: KAWAIHAE HARBOR IMPROVEMENTS DRAFT ENVIRONMENTAL ASSESSMENT, SOUTH KOHALA, ISLAND OF HAWAI'I

Thank you for your memorandum dated July 25, 2013, commenting on the *Kawaihae Harbor Improvements Draft Environmental Assessment* (DEA). The following are the Department of Transportation, Harbors Division's (DOT-H) responses to your comments:

1. In response to your concerns about potential impacts to State Waters, appropriate Best Management Practices (BMPs) will be developed during the project design, and implemented during construction activities to mitigate potential effects. All required state and federal permits will be obtained.

   Regarding the State criteria cited:

   a. Any use of Kawaihae Harbor, during and after construction of improvements at Kawaihae Harbor outlined in the DEA, will comply with the Department of Health (DOH) Clean Water Branch (CWB) antidegradation policy per Hawai'i Administrative Rules (HAR) Section 11-54-1.1. BMPs will ensure compliance as noted in the DEA.

   b. Any use of Kawaihae Harbor, during and after construction of improvements at Kawaihae Harbor outlined in the DEA, will be consistent with the CWB designation of Kawaihae Harbor as a "Class A Embayment" per HAR Section 11-54-3. As Class A Marine Water, Kawaihae Harbor will not receive discharges unless they have received the best degree of treatment or control compatible with the criteria established for this class. No new sewage discharges will be permitted within Kawaihae Harbor. No new industrial discharges will be permitted within Kawaihae Harbor, with the exception of storm water discharges associated with industrial activities and discharges covered by a National Pollutant Discharge Elimination System (NPDES) general permit, approved by the US Environmental Protection Agency (EPA) and issued by DOH.

   c. Any use of Kawaihae Harbor, during and after construction of the improvements as outlined in the DEA, will comply with CWB's Water Quality Criteria, per HAR Sections 11-54-4 through 11-54-8.

2. In response to your comment regarding an NPDES permit for discharges of wastewater, DOT-H will apply for the permit in accordance with HAR Chapter 11-55 and the directions you provided. The application will be submitted at least 180 calendar days before the commencement of the discharge. The CWB Individual NPDES Form will be submitted through the e-Permitting Portal and the hard copy certification will be submitted with the $1,000 filing fee.

3. In response to your comment about work in, over, or under Waters of the United States, DOT-H will coordinate with the US Army Corps of Engineers (USACE), Regulatory Branch and obtain a permit under Section 404 of the Clean Water Act. DOT-H will also undergo the Section 401 Water Quality Certification (WQC) process pursuant to paragraph 401(a)(1).

4. In response to your comment that discharges related to construction or operations must comply with the State's Water Quality Standards in HAR Chapter 11-54 and with permitting requirements specified in HAR Chapter 11-55, DOT-H and/or its contractors will comply with all DOH requirements. This compliance will occur irrespective of whether NPDES permits and/or Section 401 WQC are required.

We have followed your recommendation to review DOH-CWB's standard comments, dated April 22, 2012, posted at http://health.hawaii.gov/epo/files/2013/05/CWB-standardcomment.pdf. Per those standard comments:

- We will comply with all requirements under "Permit Issuance", including the state's antidegradation policy, Class A designation requirements for Kawaihae Harbor, water quality criteria, USACE permits, and NPDES permits, consistent with what has already been stated above.
- An NPDES Notice of Intent (NOI) form will be submitted at least 30 calendar days prior to the start of construction.
- All discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC is required, will comply with the State's Water Quality Standards.
- If required as conditions of the Section 401 WQC and NPDES permit, effluent discharge and/or receiving water monitoring will be performed.

Alec Wong, P.E.
September 26, 2013
Page 3

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- DOT-H acknowledges that noncompliance with water quality requirements contained in HAR Chapter 11-54 and/or permitting requirements specified in HAR Chapter 11-55 may be subject to penalties of $25,000 per day per violation.

We appreciate your participation in the EA review process and look forward to your continued involvement in this very important State project.

cc: SSFM International Inc.

bc: DEP-P, DEP-H, HAR, -E, -H

SR/DW:va

Douglas Zang

From: Joyce oconnor <joyce_oconnor@yahoo.com>
Sent: Thursday, August 22, 2013 8:35 PM
To: Douglas Zang
Cc: Jared Chang; Cheryl Soon; Sandra Rossetter (Sandra.C.Rossetter@hawaii.gov); Dean Watase (Dean.Watase@hawaii.gov)
Subject: comment on Kawaihae Harbor Environmental Assessment

To: Douglas Zang.
Re: Kawaihae Harbor Public Comment

Mr. Zang,

Thank you for your comprehensive response to my concerns.

I have read the 2035 Master Harbor Plan and I am enclosing a copy of one of the recommendations that is in the plan.

Potential Ferry Facilities
A safe location for ferry service should be provided in the event a service is proposed. The safety issue applies to both loading/embarking away from wave surge areas, and it applies to the transport of passengers on and off harbor property.
The challenge is to identify potential locations for passenger service that are separated from cargo functions and that provide safe passageway to areas outside the harbor.

Please consider including a ferry port in your plan. Our economy is strongly based on tourism. I recently toured the San Juan Islands and invested at least $ 1500 in their economy during my 4 day stay. We need to provide the opportunity for this service for our residents and our visitors.

Also, we cannot use state and federal tax dollars to only support the barge companies.

From: Douglas Zang <dzang@ssfm.com>
To: "joyce_oconnor@yahoo.com" <joyce_oconnor@yahoo.com>
Cc: Jared Chang <jchang@ssfm.com>; Cheryl Soon <csoon@ssfm.com>; "Sandra Rossetter

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(Sandra.C.Rossetter@hawaii.gov)" <Sandra.C.Rossetter@hawaii.gov>; "Dean Watase (Dean.Watase@hawaii.gov)" <Dean.Watase@hawaii.gov>
Sent: Friday, August 9, 2013 10:13 AM
Subject: How to comment on Kawaihae Harbor Environmental Assessment

Aloha, Ms. O'Connor.

Thank you for calling us this morning with regards to the Kawaihae Harbor Environmental Assessment that you read about in the newspaper. Per your request, I am providing information to your questions about how to comment in writing. I understand you are concerned about the project only serving large commercial interests (not the general public) and a desire for ferry service in Kawaihae. I encourage you and others to comment on these and other issues of concern to you.

If you wish to send me an email prior to the close of the comment period on August 23, 2013, you may respond directly to me at this email address and it will get submitted into the public administrative record for this project. You may also send me a hard copy letter postmarked before August 23, 2013 at the address below, or at the Sumner Street address in Honolulu you cited; both will reach me.

Per our discussion, here is more information for you:

- The Hawai'i Island Commercial Harbors 2035 Master Plan was completed about 2 years ago and can be reviewed on the project website http://www.hawaiiharborsplan.com/ . That plan suggested a range of improvements for both Hilo and Kawaihae Harbors through the year 2035. The plan itself can be read at http://www.hawaiiharborsplan.com/docs/HI%20COM%20HAR%202035%20MP%20Final.pdf

- The new Draft Environmental Assessment that you wish to comment on covers a medium-term period, the beginning of implementing what is proposed in the 2035 plan for Kawaihae only, so it does not cover every potential improvement in the 2035 plan. The Draft Environmental Assessment can be viewed from the Hawai'i Office of Environmental Quality Control (OEQC) website at http://oeqc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Hawaii/2010s/2013-07-23-HA-5B-DEA-Kawaihae-Harbor.pdf . When a Final Environmental Assessment is issued, it will include all correspondence from the administrative record, submitted during the comment period, including your comments.

Thank you very much for your interest in this project, and please feel free to contact me again with additional questions.

Mahalo,

--Doug

Douglas K. Zang, AICP
Planner IV
Direct Line: 808-356-1249 (Honolulu)

SSFM INTERNATIONAL

99 Aupuni Street, Suite 202
Hilo, HI 96720

Office Line: 808-933-2727
Fax Line: 855-329-7736
www.ssfm.com

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GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
HAR-EP
4039.14

September 26, 2013

Ms. Joyce O'Connor
64-804 Uikeoni Street
Kamuela, HI 96473

Dear Ms. O'Connor:

Subject: Kawaihae Harbor Improvements Draft Environmental Assessment, South Kohala, Island of Hawai'i

Thank you for your email dated August 22, 2013, commenting on the *Kawaihae Harbor Improvements Draft Environmental Assessment* (DEA).

We understand that you reviewed both the DEA and *Hawai'i Island Commercial Harbors 2035 Master Plan* (2035 Master Plan). Your comments have been noted and our responses are shown below:

Your first comment states:

> I have read the 2035 Master Harbor Plan and I am enclosing a copy of one of the recommendations that is in the plan:
>
> > *Potential Ferry Facilities- A safe location for ferry service should be provided in the event a service is proposed. The safety issue applies to both loading/embarking away from wave surge areas, and it applies to the transport of passengers on and off harbor property.*
> >
> > *The challenge is to identify potential locations for passenger service that are separated from cargo functions and that provide safe passageway to areas outside the harbor.*
>
> Please consider including a ferry port in your plan. Our economy is strongly based on tourism. I recently toured the San Juan Islands and invested at least $ 1500 in their economy during my 4 day stay. We need to provide the opportunity for this service for our residents and our visitors.

We acknowledge the benefits that a ferry service would provide to the people of Hawai'i. We also recognize that tourism is of great importance to the economy of Hawai'i Island. As you noted, the 2035 Master Plan calls for a ferry berth and recommends that it be located on the western area of the Coral Flats area of the harbor because of the relatively calm water conditions there. There are no existing proposals from an operator for a ferry service at Kawaihae Harbor. While DOT-H provides the infrastructure to support such operations, it does not operate a ferry service directly.

The long-term plan is to develop Pier 3 in the Coral Flats area, which considers a ferry service and other uses. An environmental assessment will be prepared for the development of Pier 3 at the appropriate time. The DEA that you are commenting on covers a range of improvements over the medium-term period.

Your second comment states:

> Also, we cannot use state and federal tax dollars to only support the barge companies.

The proposed improvements to Kawaihae Harbor proposed will be of benefit to all of Hawai'i Island, not just the barge companies. Every resident of Hawai'i Island is dependent on goods that arrive through the island's harbors, so improved harbor operations will benefit local businesses and residents. Additional benefits to everyone, not just the barge companies, include the following:

1. Security will be greatly improved through the use of security fencing that separates the secured areas from elsewhere on the Coral Flats.
2. Recreational users in the Coral Flats area will be separated from harbor uses, increasing navigational safety for both workers and recreational users. The plan supports the Department of Land and Natural Resources' efforts towards developing the Kawaihae Small Boat Harbor (South).
3. Traffic on Kawaihae Road in immediate proximity to the harbor will be improved as the turn lanes and entrance gates are improved. All users of this road will benefit.
4. New office space will enhance harbor management's ability to serve the public at large.
5. The Department of Agriculture will be offered space for a facility to inspect agricultural products and prevent the spread of invasive species, increasing biosecurity and food security for all of Hawai'i Island.
6. All of Hawai'i Island will be better equipped to respond to and recover from a natural or man-made emergency with increased harbor capacity.

Ms. Joyce O'Connor
September 26, 2013
Page 3

HAR-EP
4039.14

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

cc: SSFM International Inc.

bc: DEP-P, DEP-H, HAR, -E, -H

SR/DW:va

13 OCT -4 A9:50

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, Hawaii 96814-4700
(808) 944-2200 • Fax (808) 973-2941

AUG 2 2 2013

Mr. Glen Okimoto
Director
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

Dear Mr. Okimoto:

The National Marine Fisheries Service (NMFS) Pacific Islands Region's Protected Resources Division provides the following comments on the Draft EIS for the Improvements to Kawaihae Harbor project on the Big Island of Hawai'i.

NMFS is responsible for the conservation and management of marine species protected under the Endangered Species Act (ESA) that frequent the area in question: the endangered humpback whale (*Megaptera novaeangliae*), the threatened green sea turtle (*Chelonia mydas*), the endangered hawksbill sea turtle (*Eretmochelys imbricata*), and the endangered Hawaiian monk seal (*Monachus schauinslandi*); and the Hawaiian spinner dolphin (*Stenella longirostris*) that is protected under the Marine Mammal Protection Act.

On December 7, 2012, NMFS proposed the listing of several species of coral found in Hawaiian waters under the ESA. One of these corals, *Montipora patula*, has been documented in the DEIS as being present in the areas of Pier 2C and Pier 1 (Table 4-14, pg. 4-94). This species has been designated as a candidate for listing as "threatened" under the ESA, thus we recommend that you consider conducting an ESA Section 7 conference. The conference process is described on our website http://www.fpir.noaa.gov/PRD/prd_esa_section_7.html.

Should the construction of the Pier 2A extension, the new Pier 3, and the dredging of the harbor and occur during months when humpback whales are in residency, impacts could occur to the whales as they breed, give birth, and nurture their young in waters near the harbor. Humpback whales typically arrive in the Hawaiian Islands as early as October and may stay as late as May or early June. Potential impacts could occur from the noise of construction such as pile-driving and vessel activity, and also from dredging of the harbor. Increased vessel traffic resulting from the increased capacity of the harbor following improvements and expansion may also pose an increased risk of vessel collisions with whales.

Green sea turtles are frequently found in nearshore waters of Hawai'i and can reside within the harbor. Impacts from noise are not usually a concern due to the turtles' limited hearing capabilities; however, they could be affected by siltation from dredging operations which may affect foraging on algae within the harbor. Increased vessel traffic may also pose an increased risk of collision with sea turtles residing within the harbor.

The DEIS incorrectly states on pg. 4-80, par. 2 that "There are no resident threatened or endangered marine species in the harbor area." This statement is later contradicted in the document on pg. 4-81, par. 5 in the survey results that documented 149 sightings of green sea turtles recorded from January to May 2005 within the harbor area.

Hawksbill turtles may also be found near the harbor, however they are not as common. The potential for increased vessel traffic to pose a risk of collision with hawksbill turtles is not as much of a concern as it is for green turtles, but should also be addressed in the EIS.

The Hawaiian monk seal is known to occur on the Big Island of Hawai'i and their numbers have recently been increasing within the Main Hawaiian Islands. Several pups have been born within the past few years on Hawai'i Island and it is likely this trend will continue. Monk seals may forage for food near the harbor or may haul out on shoreline areas, and could be affected by the noise of construction and dredging as well as by vessel traffic.

Hawaiian spinner dolphins have been observed to use an area just north of Kawaihae Harbor as a daytime resting area, where groups of dolphins come after foraging during the night at offshore feeding grounds, to rest, socialize, and nurture their young. Dolphins can be affected by the noise of construction and increased vessel traffic as it affects their ability to communicate, and they may temporarily abandon the area.

To reduce the potential for impacts to protected marine species, we recommend the following mitigating measures be incorporated into the project:

- A survey of the project area must be performed just prior to commencement or resumption of construction activity to ensure that no protected spec(ies) are in the project area. If protected spec(ies) are detected, construction activities must be postponed until the animal(s) voluntarily leave the area.
- If any listed spec(ies) enters the area during the conduct of construction activities, all activities must cease until the animal(s) voluntarily depart the area.
- All on-site project personnel must be apprised of the status of any listed spec(ies) potentially present in the project area and the protections afforded to those species under Federal laws. A brochure explaining the laws and guidelines for listed species in Hawai'i, American Samoa, and Guam may be downloaded from http://www.nmfs.noaa.gov/prot_res/MMWatch/hawaii.htm.
- Any incidental take of marine mammals must be reported immediately to NOAA Fisheries' 24-hour hotline at 1-888-256-9840. For Hawai'i only, any injuries to sea turtles must be reported immediately to NOAA Fisheries at 1-808-983-5730. Information reported must include the name and phone number of a point of contact, location of the incident, and nature of the take and/or injury.

We also recommend using the attached Best Management Practices to further reduce potential impacts to protected marine species from the construction of proposed harbor improvements. If you have any questions about this comment letter, please contact Jayne LeFors of my staff at (858) 546-5653 or at jayne.lefors@noaa.gov.

Sincerely,

for Alecia Van Atta
Assistant Regional Administrator
for Protected Resources

cc: Douglas Zang, SSFM International, Inc.

Attachment: Best Management Practices

Best Management Practices
National Oceanic and Atmospheric Administration, National Marine Fisheries Service
Pacific Islands Regional Office, Protected Resources Division

The National Marine Fisheries Service, Pacific Islands Regional Office recommends that the following measures, as appropriate and germane to specific projects, be incorporated into projects to minimize impacts on protected resources:

a. Turbidity and siltation from project-related work should be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.

b. Any construction-related debris that may pose an entanglement hazard to marine protected species must be removed from the project site if not actively being used and/or at the conclusion of the construction work.

c. All project-related materials and equipment placed in the water should be free of pollutants.

d. No project-related materials (fill, revetment rock, pipe, etc.) should be stockpiled in the water (intertidal zones, reef flats, stream channels, etc.)

e. No contamination (trash or debris disposal, alien species introductions etc.) of marine (reef flats, lagoons, open ocean, etc.) environments adjacent to the project site should result from project-related activities.

f. Fueling of project-related vehicles and equipment should take place away from the water. A contingency plan to control the accidental spills of petroleum products at the construction site should be developed. Absorbent pads, containment booms and skimmers will be stored on-site to facilitate the cleanup of petroleum spills.

g. Underlayer fills will be protected from erosion with core-loc units (or stones) as soon after placement as practicable.

h. Attempts must be made to prevent discharge of dredged material into the marine environment during the transporting and off-loading of dredged material.

i. Return flow of or run-off from dredged material stored at inland dewatering or storage sites must be prevented.

4

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

13 OCT -4 A9:5

HARBORS

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
HAR-EP
4034.14
R/S: 14.0184

September 27, 2013

Ms. Alecia Van Atta
Assistant Regional Administrator
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Pacific Islands Regional Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawai'i 96814

Dear Ms. Van Atta:

Subject: Kawaihae Harbor Improvements Draft Environmental Assessment, South Kohala, Island of Hawai'i

Thank you for your letter dated August 22, 2013, commenting on the *Kawaihae Harbor Improvements Draft Environmental Assessment* (DEA). The following are the Department of Transportation, Harbors Division's (DOT-H) responses to your comments:

1. Your comment on *Montipora patula* near Piers 1 and 2C has been noted. This coral was proposed as a candidate for listing as "threatened" on December 7, 2012. The US Army Corps of Engineers will initiate an interagency consultation process with National Marine Fisheries Service (NMFS) regarding this proposed species under Section 7 of the Endangered Species Act. A quantitative marine assessment will be completed as part of the Department of Army permit process at the appropriate time.

2. The months that humpback whales are present in the area and your concerns about the impacts of construction noise from pile driving, construction vessels, and dredging have been noted. The potential for increased risk of vessel collisions with whales resulting from increased vessel traffic and capacity is also noted.

   Section 4.6.5.3 of the DEA advises avoidance of construction during the months that humpback whales are present. If these periods cannot be avoided, the DEA notes several noise reduction strategies such as contained bubble curtains, temporary noise attenuation piles, fabric barriers, cofferdams, and "soft starts" that will be considered to mitigate

underwater noise impacts, depending upon the alternative selected and construction technique to be utilized. The DEA states DOT-H will work with NMFS prior to construction to determine the appropriate temporary threshold shift (TTS) distances, and ensure that pile driving will be postponed or halted when protected species are within the TTS range.

Regarding the potential impact of increased collisions with whales resulting from increased vessel traffic, DOT-H will add this issue to the *Kawaihae Harbor Improvements Final Environmental Assessment* (FEA), and welcomes additional guidance from NMFS on ways to mitigate this effect.

3. Your comments on Green Sea Turtles, the potential effects of siltation from dredging operations on their foraging for algae, and the potential for increased vessel traffic to increase the risk of collision with sea turtles in the harbor have been noted.

   Section 4.10.3 of the DEA states that turbidity and siltation from project-related work will be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions. Best Management Practices (BMPs) will be used to minimize the adverse effects of siltation from dredging. DOT-H will add the issue of increased vessel traffic and collisions to the FEA and welcomes additional guidance from NMFS on ways to mitigate the effects of increased vessel traffic on collisions with the turtles.

4. Your comments note an inconsistency between text on page 4-80, paragraph 2 that "There are no resident threatened or endangered marine species in the harbor area" and page 4-81, paragraph 5 that a 2005 survey documented 149 sightings of green sea turtles within the harbor area.

   Paragraph 2 on page 4-80 is citing a 2009 environmental assessment for the Pier 2A shed demolition that only looked at the portion of the interior harbor in close proximity to Pier 2A. The citation from page 4-81 was an unrelated 2005 turtle survey which covered both areas within the breakwater and up to a kilometer outside the breakwater. The overwhelming majority of the turtles identified were located outside the breakwater during that survey.

   In the FEA, we will remove the first mention of the issue on what was page 4-80 in the DEA and clarify the locations of the turtles on what was page 4-81 of the DEA.

5. Your comments about the potential effects of the project on hawksbill turtles have been noted. DOT-H will add the issue of increased vessel traffic and collisions to the FEA.

6. Your concerns about the effects of construction noise, dredging and vessel traffic on Hawaiian monk seals have been noted. It is our understanding that while the larger region is considered critical habitat, due to national security concerns, Kawaihae Harbor

itself is not located within the proposed mapped boundaries of critical habitat for the monk seal. The mitigation measures cited earlier for other species to minimize impacts from dredging, construction noise, siltation, and vessel collisions will also serve to address concerns about the monk seals.

7. Your concerns about the project effects on Hawaiian spinner dolphins have been noted. The mitigation measures cited earlier for other species to minimize impacts from dredging, construction noise, siltation, and vessel collisions will also serve to address concerns about the spinner dolphins.

8. You suggest several other general mitigation measures to reduce the potential for impacts on protected marine species, including:

   - Pre-construction surveys of protected marine species just prior to commencement/resumption of construction.
   - Cessation of construction if a listed species enters the area until they depart.
   - Education of work crews about the status of listed species via a brochure.
   - Reporting of any incidental take to National Oceanic and Atmospheric Administration Fisheries' 24-hour hotline.
   - Institution of all applicable BMPs on the attachment sheet provided by NMFS.

   DOT-H will note the above for consideration within the FEA.

We appreciate your participation in the review process and look forward to your continued involvement in this very important State project.

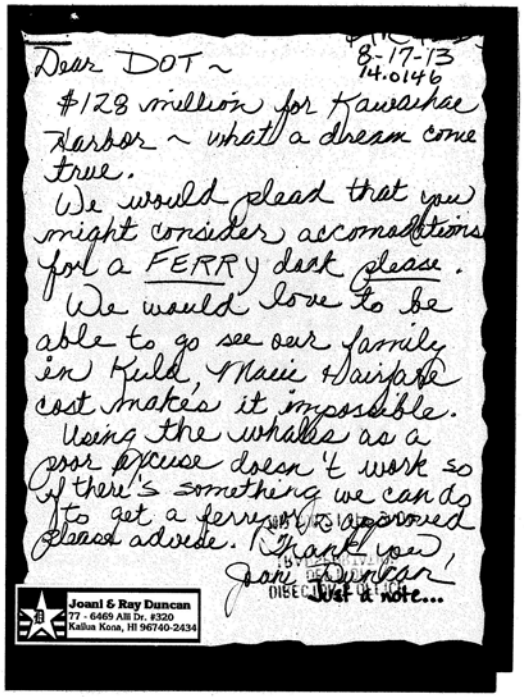
Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

cc: SSFM International

bc: DEP-P, DEP-H, HAR, -E, -EP, -H

SR/DW:va



8-17-13
14.0146

Dear DOT ~

$128 million for Kawaihae Harbor ~ what a dream come true.

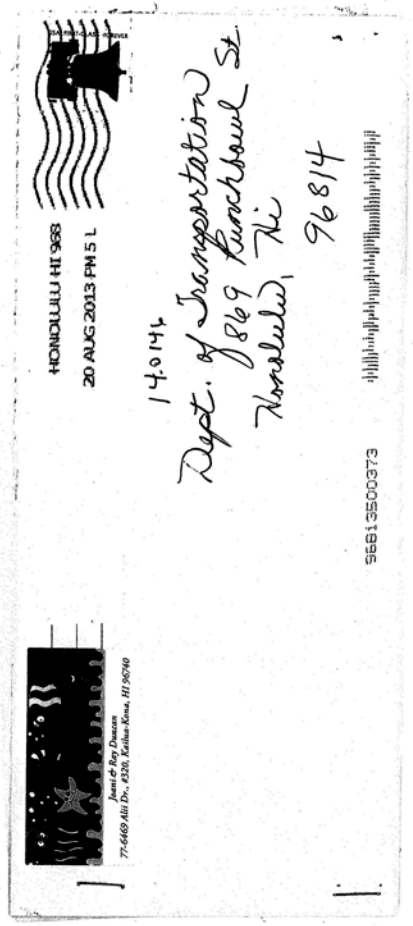
We would plead that you might consider accomodations for a FERRY dock please.

We would love to be able to go see our family in Kula, Maui + Hairpate cost makes it impossible.

Using the whales as a poor excuse doesn't work so if there's something we can do to get a ferry approved please advise. Thank you,

Joan Duncan

Joani & Ray Duncan
77 - 6469 Alii Dr. #320
Kailua Kona, HI 96740-2434



HONOLULU HI 968
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14.0146
Dept. of Transportation
869 Punchbowl St
Honolulu, Hi
96814

5581350373

Joani & Ray Duncan
77-6469 Alii Dr., #320, Kailua-Kona, HI 96740

NEIL ABERCROMBIE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

13 OCT -4 A9:51

HARBORS

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

IN REPLY REFER TO:
HAR-EP
4037.14
R/S: 14.0146

September 27, 2013

Mrs. and Mr. Joani and Ray Duncan
77-6469 Ali'i Drive #320
Kailua-Kona, Hawai'i 96740-2434

Dear Mrs. and Mr. Duncan:

Subject: Kawaihae Harbor Improvements Draft Environmental Assessment, South Kohala, Island of Hawai'i

Thank you for your letter dated August 17, 2013, commenting on the *Kawaihae Harbor Improvements Draft Environmental Assessment* (DEA). Below are the Department of Transportation, Harbors Division's (DOT-H) responses to your comments.

You stated: "We would plead that you might consider accommodations for a FERRY dock please. We would love to be able to go see our family in Kula, Maui and airfare cost makes it impossible. Using the whales as a poor excuse doesn't work, so if there's something we can do to get a ferry approved, please advise."

We acknowledge the benefits that a ferry service would provide to the people of Hawai'i. There are no existing proposals from an operator for a ferry service at Kawaihae Harbor. While DOT-H provides the infrastructure to support such operations, it does not operate a ferry service directly. In 2011, DOT-H completed the *Hawai'i Island Commercial Harbors 2035 Master Plan,* which recommends a range of improvements for both Hilo and Kawaihae Harbors. The DEA that you are commenting on covers a range of improvements over the medium-term period for Kawaihae only. The long-term plan includes developing Pier 3 in the Coral Flats area, which considers a ferry service and other uses. An environmental assessment will be prepared for the development of Pier 3 at the appropriate time.

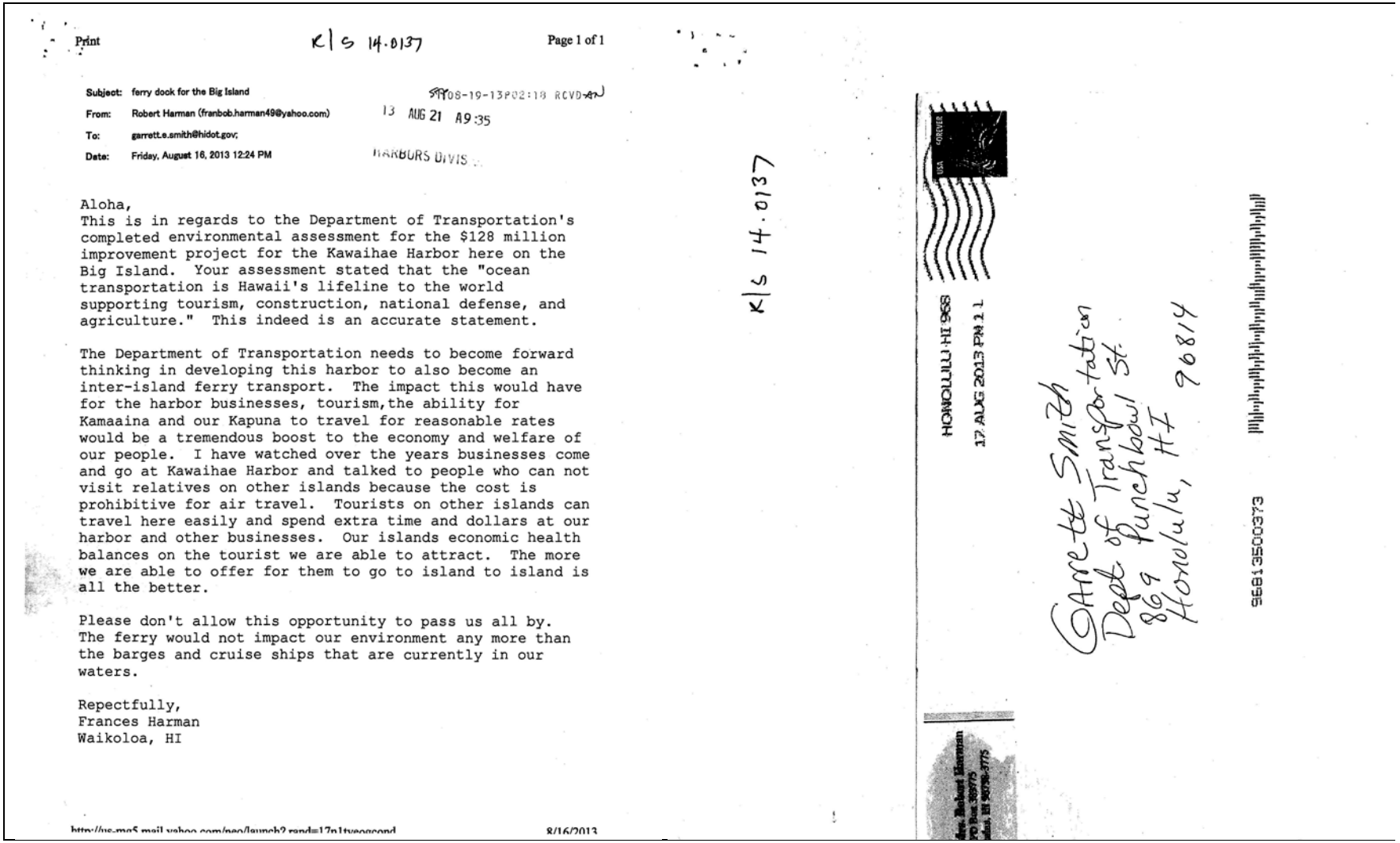
We appreciate your participation in the review process and look forward to your continued involvement in this very important State project.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

bc: DEP-P, DEP-H, HAR, -E, -H
SSFM International Inc.

DW/SR:va



Print

K|S 14.0137

Page 1 of 1

Subject: ferry dock for the Big Island

From: Robert Harman (franbob.harman49@yahoo.com)

To: garrett.e.smith@hidot.gov;

Date: Friday, August 16, 2013 12:24 PM

13 AUG 21 A9:35

HARBORS DIVIS

Aloha,
This is in regards to the Department of Transportation's completed environmental assessment for the $128 million improvement project for the Kawaihae Harbor here on the Big Island. Your assessment stated that the "ocean transportation is Hawaii's lifeline to the world supporting tourism, construction, national defense, and agriculture." This indeed is an accurate statement.

The Department of Transportation needs to become forward thinking in developing this harbor to also become an inter-island ferry transport. The impact this would have for the harbor businesses, tourism,the ability for Kamaaina and our Kapuna to travel for reasonable rates would be a tremendous boost to the economy and welfare of our people. I have watched over the years businesses come and go at Kawaihae Harbor and talked to people who can not visit relatives on other islands because the cost is prohibitive for air travel. Tourists on other islands can travel here easily and spend extra time and dollars at our harbor and other businesses. Our islands economic health balances on the tourist we are able to attract. The more we are able to offer for them to go to island to island is all the better.

Please don't allow this opportunity to pass us all by. The ferry would not impact our environment any more than the barges and cruise ships that are currently in our waters.

Repectfully,
Frances Harman
Waikoloa, HI

http://us-mg5.mail.yahoo.com/neo/launch?.rand=12n1tveqqcond

8/16/2013

K|S 14.0137

HONOLULU HI 968

17 AUG 2013 PM 2 L

Garrett Smith
Dept of Transportation
869 Punchbowl St.
Honolulu, HI 96814

96813500373

NEIL ABERCROMBIE
GOVERNOR

13 OCT -4 A9:51

HARBORS DIVIS

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

IN REPLY REFER TO:
HAR-EP
4036.14
R/S:14:0137

September 26, 2013

Mr. and Mrs. Robert and Frances Harman
P.O. Box 383775
Waikoloa, Hawai'i 96738-3775

Dear Mrs. and Mr. Harman:

Subject: Kawaihae Harbor Improvements Draft Environmental Assessment, South Kohala, Island of Hawai'i

Thank you for your email dated August 16, 2013, commenting on the *Kawaihae Harbor Improvements Draft Environmental Assessment* (DEA). The Department of Transportation, Harbors Division has the following responses to your comments.

You stated: "The Department of Transportation needs to become forward thinking in developing this harbor to also become an inter-island ferry transport. The impact this would have for the harbor businesses, tourism, the ability for Kamaaina and our Kapuna to travel for reasonable rates would be a tremendous boost to the economy and welfare of our people. I have watched over the years businesses come and go at Kawaihae Harbor and talked to people who can not visit relatives on other islands because the cost is prohibitive for air travel. Tourists on other islands can travel here easily and spend extra time and dollars at our harbor and other businesses. Our islands economic health balances on the tourist we are able to attract. The more we are able to offer for them to go to island to island is all the better.

Please don't allow this opportunity to pass us all by. The ferry would not impact our environment any more than the barges and cruise ships that are currently in our waters."

Your comments as stated above have been noted. We acknowledge the benefits that a ferry service would provide to the people of Hawai'i. There are no existing proposals from an operator for a ferry service at Kawaihae Harbor. While DOT-H provides the infrastructure to support such operations, it does not operate a ferry services directly. In 2011, DOT-H completed the *Hawai'i Island Commercial Harbors 2035 Master Plan,* which recommends a range of improvements for both Hilo and Kawaihae Harbors. The DEA that you are commenting on covers a range of improvements over the medium-term period for Kawaihae only. The long-term plan includes developing Pier 3 in the Coral Flats area, which considers a ferry service and other uses. An environmental assessment will be prepared for the development of Pier 3 at the appropriate time.

We appreciate your participation in the review process and look forward to your continued involvement in this very important State project.

Sincerely,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

bc: DEP-P, DEP-H, HAR, -E, -H
cc: SSFM International Inc.

DW/SR:va

Date: 09/03/2013

State of Hawaii
DEPARTMENT OF TRANSPORTATION

Log No: DIR 1276

Suspense: 09/17/2013

FROM: DIRECTOR

TO: STP

- ☐ DIR
- ☐ AIR
- ☐ DEP-S
- ☐ HAR
- ☐ DEP-A
- ☐ HWY
- ☐ DEP-H
- ☐ BUS
- ☐ DEP-P
- ☐ BUS-F
- ☐ DIR-GZ
- ☐ BUS-O
- ☐ DIR-P
- ☐ CON
- ☐ OCR
- ☐ CSS
- ☐ PER
- ☐ LEG
- ☐ PMN
- ☐ PFB
- ☒ STP ~M
- ☐ _

FOR: APPROPRIATE ATTENTION & ACTION

- ☒ Appropriate Attention & Action
- ☐ Arrange Meeting
- ☐ Investigate & Report Back
- ☐ Comments & Recommendations
- ☐ Draft Reply
- ☐ Final Reply for Gov's Sig
- ☐ Direct Action/Reply
- ☐ Information
- ☐ See Me
- ☐ Signature
- ☐ Submit Copy of Response
- ☐ File
- ☐ Review
- ☐ Return
- ☐ Phone Call _____
- ☐ Follow-up Interim Reply

Subject: PLANNING COMMISSION FOR THE EXPANSION AND MODERNIZATION OF KAWAIHAE HRBOR, KAWAIHAE, HAWAII ISLAND, HAWAII

09-04-13P02:20 RCVD

DO NOT REMOVE FROM CORRESPONDENCE

DIR 1276

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION

2013 SEP -3 A 9:42

09-04-13P02:20 RCVD

Department of Transportation

869 Punchbowl Street

Honolulu, Hi 96814

Planning commission for the expansion and modernization of Kawaihae Harbor , Kawaihae, Hawaii Island , Hawaii

My letter is to address the need and planning for a ferry dock on the Big Island.

As a forty plus year resident of Hawaii Island I have witness the geographic restriction we have here because of the cost of travel. Here is the basic cost for two people to travel to Maui or Oahu from the Big Island.

Airfare – $240.00 . Rental Car $50.00 a day, accommodations $100 to $200 daily. So the cost of going to Maui or Oahu for a couple for a weekend is about $600.00 plus food and gas. That works out to be about $800 for 2 days. Not a small amount for most people . Compound this for a family and it become impossible to do , except for the most well to do individuals.

We all pay state taxes every day and there are many many parks , services and events that happen on Oahu that we on the Big Island simply can not experience because of the cost to attend. If the government could take the "middle man" out of the equation there would be much for enjoyment, commerce, education and free flow of people from island to island.

There are so so many ferry systems in other places on the mainland and throughout the world. They are convenient, inexpensive and work really well. Why cant we have such a system?

Some young people have many social ills here on the Big Island. Basically , in many communities there is not much to do. Many

keiki here have never traveled to the other islands and having a ferry would allow more fun for our families. They could bring a car, get a camping permit and enjoy some of the other islands. Our Big lsland could use more commerce. People shopping and using our restaurants and stores.

The airlines and rental car companies are in control of how much this costs. Why not give our people some more choices. The visitors would still use the airlines and so would we but why not do something good and make it easier for our people who pay your salaries and support the government here. Your loyalty should be to the people.

I know , the last time we had an opportunity to have a ferry happen there were some protestors on Kauai that were against it. So be it. They may have a point and if they don't want it on that island, that's okay. But many people on the Big Island and Maui would welcome this way to travel.

Please include a ferry dock area in your planning.

Thanks,

Sincerely and with Aloha

Alice Hughes

Alice Hughes

alice@alicehughes.com
808-989-1905

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

13 OCT -4 A9:51

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
HAR-EP
4038.14
R/S: 14.0195

September 27, 2013

Ms. Alice Hughes
68-1956 Linapoepoe Street
Waikoloa, HI 96738

Dear Ms. Hughes:

Subject: Kawaihae Harbor Improvements Draft Environmental Assessment, South Kohala, Island of Hawai'i

Thank you for your letter received September 3, 2013, commenting on the *Kawaihae Harbor Improvements Draft Environmental Assessment* (DEA).

Your comments and our responses are below. You stated:

"As a forty plus year resident of Hawaii Island I have witness the geographic restriction we have here because of the cost of travel. Here is the basic cost for two people to travel to Maui or O'ahu from the Big Island.

Airfare - $240.00. Rental Car $50.00 a day, accommodations $100 to $200 daily. So the cost of going to Maui or Oahu for a couple for a weekend is about $600.00 plus food and gas. That works out to be about $800 for 2 days. Not a small amount for most people. Compound this for a family and it become impossible to do, except for the most well to do individuals.

We all pay state taxes every day and there are many many parks, services and events that happen on Oahu that we on the Big Island simply can not experience because of the cost to attend. If the government could take the "middle man" out of the equation there would be much for enjoyment, commerce, education and free flow of people from island to island.

There are so many ferry systems in other places on the mainland and throughout the world. They are convenient, inexpensive and work really well. Why can't we have such a system?

Some young people have many social ills here on the Big Island. Basically, in many communities there is not much to do. Many keiki here have never traveled to the other islands and having a ferry would allow more fun for our families. They could bring a car, get a camping permit and enjoy some of the other islands. Our Big Island could use more commerce. People shopping and using our restaurants and stores.

The airlines and rental car companies are in control of how much this costs. Why not give our people some more choices. The visitors would still use the airlines and so would we but why not do something good and make it easier for our people who pay your salaries and support the government here. Your loyalty should be to the people.

I know, the last time we had an opportunity to have a ferry happen there were some protestors on Kauai that were against it. So be it. They may have a point and if they don't want it on that island, that's okay. But many people on the Big Island and Maui would welcome this way to travel.

Please include a ferry dock area in your planning..."

Your comments about the cost of travel between islands, the provision of ferry services elsewhere, and the need for a ferry system in Hawai'i have been noted. We acknowledge the benefits that a ferry service would provide to the people of Hawai'i. There are no existing proposals from an operator for a ferry service at Kawaihae Harbor. While DOT-H provides the infrastructure to support such operations, it does not operate a ferry service directly.
In 2011, DOT-H completed the *Hawai'i Island Commercial Harbors 2035 Master Plan,* which recommends a range of improvements for both Hilo and Kawaihae Harbors. The DEA that you are commenting on covers a range of improvements over the medium-term period for Kawaihae only. The long-term plan includes developing Pier 3 in the Coral Flats area, which considers a ferry service and other uses. An environmental assessment will be prepared for the development of Pier 3 at the appropriate time.

We appreciate your participation in the EA review process and look forward to your continued involvement in this very important State project.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

cc: SSFM International Inc.

bc: DEP-P, DEP-H, HAR, -E, -H
DW/SR:va

11.3 Outreach Performed Prior to Issuance of Draft EA

11.3.1 Public Informational Meetings

A public informational meeting was held on August 29, 2011 at the Hamakua Macadamia Nut Factory. The purpose of this meeting was to update the community of the status of the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update* and *Kawaihae Harbor Development Plan* studies. In addition, the *Improvements to Kawaihae Commercial Harbor Environmental Assessment* (EA) approach was presented and elements of the proposed alternative were described.

Issues raised by participants at the public informational meeting and in correspondence in response to the meeting were as follows:

- Relationship between this EA, later EA documents, and the Hawai‘i Commercial Harbors 2035 Master Plan Update.
- Location of fuel tanks within the commercial harbor.
- Availability of “mined” coral sand from Coral Flats for agricultural use.
- Concerns about water quality in Pelekāne Bay.
- Elimination of temporary moorings in the commercial harbor for recreational crafts, and the need to finish the Kawaihae Small Boat Harbor (South) to relocate the recreational crafts.
- Deterioration of water quality from sedimentation caused by upstream activities.
- Transportation improvements on Kawaihae Road, internal harbor traffic circulation (including gate access), and the relationship to a future Kawaihae Bypass Road to Kawaihae Commercial.
- Pedestrian issues along Kawaihae Road.
- Navigational impacts and effects on whales.
- Socioeconomic impacts of the project and emergency preparedness.
- Geologic conditions to be considered in EA.
- Concerns about surge in the harbor.
- Potable water use by the harbor.
- “Backwash” of debris from the drainage canal that runs between Piers 1 and 2A and along Kawaihae Road.
- Impacts on cemeteries and burials mauka (i.e., towards the interior of the island) of Kawaihae Road.

Prior to the meeting in August 2011, two additional public informational meetings were held for the Hawai'i Island Commercial Harbors 2035 Master Plan Update in May 2009 and December 2009.

11.3.2 Draft EA Pre-Assessment Consultation Efforts

Consultation with various Federal, State and County government agencies was conducted to obtain their comments and concerns associated with the project as part of the EA process.

Letters providing project information along with a preliminary site plan were sent to 53 consulted parties dated August 5, 2011 to solicit their initial comments and concerns associated with the project as part of the preparation of the Draft EA.

A listing of agencies and organizations for which consultation letters were sent is provided below. Those providing written response are identified **in bold text**. Copies of written comments received along with written responses are included in **Appendix B: Public and Agency Consultation Efforts**. Comments received have been addressed in the appropriate sections of the Draft and Final EA documents.

FEDERAL AGENCIES

- U.S. Department of Agriculture.
- U.S. Department of Agriculture, Animal and Plant Health Inspection.
- U.S. Army Engineer Division, Department of the Army.
- U.S. Department of the Interior, Pacific Island Fish and Wildlife Office.
- U.S. Department of the Interior, National Park Service, Pu'ukoholā Heiau National Historic Site.
- **U.S. Geological Survey, Pacific Islands Water Science Center Office.**
- U.S. Department of Transportation.
- U.S. Environmental Protection Agency.
- **U.S. Department of Commerce, National Oceanic and Atmospheric Administration .**
- U.S. Department of Homeland Security, Customs and Border Protection, Kona International Airport.
- U.S. Department of Homeland Security, Transportation Security Administration.
- U.S. Coast Guard.

STATE OF HAWAI'I AGENCIES

- **Department of Accounting and General Services.**
- Department of Agriculture, Plant Quarantine Branch.
- Department of Agriculture, Animal Industry Division.
- Department of Business, Economic Development and Tourism.
- Department of Business, Economic Development and Tourism, Office of Planning.
- **Department of Defense.**

- **Department of Education.**
- Department of Health, Office of Environmental Quality Control.
- Department of Transportation, Highways Division.
- Department of Land and Natural Resources, Division of Boating and Ocean Recreation.
- **Department of Land and Natural Resources, Office of Conservation and Coastal Lands.**
- Department of Land and Natural Resources, Historic Preservation Division.
- Department of Hawaiian Home Lands.
- **Office of Hawaiian Affairs.**
- Department of Health, Clean Water Branch.
- University of Hawai'i, Environmental Center.

COUNTY OF HAWAI'I AGENCIES

- County of Hawai'i, Mayor Billy Kenoi.
- **Department of Environmental Management.**
- **Hawai'i Fire Department.**
- Department of Parks and Recreation.
- **Department of Water Supply.**
- **Police Department.**
- **Planning Department.**
- Department of Public Works.
- Department of Research and Development.
- Office of Housing and Community Development.

ORGANIZATIONS AND INDIVIDUALS

- Council District 9, Pete Hoffmann.
- House District 7, Cindy Evans.
- 3rd Senatorial District, Josh Green.
- South Kohala Community Development Plan Action Committee .
- Hawai'i Harbor Users Group.
- **Young Brothers, Ltd.**
- Matson Navigation Co.
- Mid-Pacific Petroleum.
- Big Island Energy.
- Hawai'i Pilots Association.
- Coordinating Group on Alien Pest Species.
- Kawaihae Local Resource Council.

UTILITY COMPANIES

- Hawaiian Electric Light Company.
- **Hawaiian Telecom.**
- The Gas Company. (Now Hawai'i Gas)

CHAPTER 12: FINDINGS AND DETERMINATION

To determine whether a proposed action may have a significant effect on the environment, the Approving Agency needs to consider every phase of the action, the expected primary and secondary consequences, cumulative effect, and the short- and long-term effects. The Approving Agency's review and evaluation of the proposed action's effect on the environment will result in a determination whether: (1) the action will have a significant effect on the environment, and the Final EA/Environmental Impact Statement Preparation Notice should be issued, or (2) the action will not have a significant effect warranting a Finding of No Significant Impact (FONSI).

This chapter discusses the results of the *Improvements to Kawaihae Commercial Harbor Environmental Assessment* (EA) conducted of the improvements to Kawaihae Harbor covered in **Section 3.8: Proposed Action: Alternative 5 – Full Action** in relation to the 13 Significance Criteria prescribed under the DOH's Administrative Rules Title 11, Chapter 200. The purpose of this EA was to consider the "significance" of potential environmental effects which includes the sum of effects on the quality of the environment along with the overall and cumulative effects. The resulting findings are discussed below for each criterion. The discussions that follow consider all Build Alternatives, including the Proposed Action.

12.1 Findings

As noted below in **Section** Error! Reference source not found.**: Finding of No Significant Impact (FONSI)**Error! Reference source not found., a FONSI is expected as none of the following 13 Significance Criteria are expected to be met.

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

All Build Alternatives, including the Proposed Action will be limited to improvements, both land-side and in submerged areas, within highly-disturbed environments. Use of the area as a harbor has taken place for centuries, and actions dating from the 1950s through 1970s, particularly dredging and fill irreparably altered the landscape, vegetation, and underwater relief of the area. Any Build Alternative will contribute to these ongoing cumulative impacts to the environment, but with the mitigative measures proposed in this EA, the project will not result in the irrevocable loss or destruction of natural or cultural resources that are of significance. This significance criterion is not met.

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

The site of this project is currently in use as a harbor, which as noted above, is a highly disturbed environment. Thus, the Build Alternatives, including the Proposed Action will not limit or significantly impact existing uses or the surrounding environment. The project will permit and enhance ongoing recreational uses of the harbor and surrounding area by making improvements to the Coral Flats area. Best Management Practices (BMPs) are proposed as measures to minimize adverse impacts on water quality in the coastal environment. For all

these reasons, none of the Build Alternatives will curtail the range of beneficial uses of the surrounding environment. This significance criterion is not met.

3. Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.

The improvements under the Build Alternatives, including the Proposed Action will not conflict with the State's long-term environmental policies or goals and guidelines expressed in Chapter 344, Hawai'i Revised Statutes (HRS). This EA has addressed the probable environmental impacts associated with the project, both short-term construction activities and long-term effects after construction is completed, through mitigative measures. These mitigative measures will ensure that the state's long term policies and goals for environmental protection have been addressed. This significance criterion is not met.

4. Substantially affects the economic, social welfare, or cultural practices of the community or State.

As discussed under **Chapter 5: Economic and Social Factors**, the Build Alternatives, including the Proposed Action, will not have any significant negative impacts on the economic or the social welfare of the community. The objective of the Proposed Action is to address pressing needs at Kawaihae Harbor, which is of great economic and social importance to maintaining the quality of life for Hawai'i Island. Without improvements at Kawaihae, the movement of goods to Hawai'i Island could be hindered, particularly in the event of a natural disaster that compromises the use of Hilo Harbor. Construction of improvements at Kawaihae Harbor will also offer short-term, minor economic benefits by generating some construction jobs and associated personal income and spending. Efforts are being made through mitigative measures proposed in this EA to minimize negative impact or change to the overall character of the community.

In terms of cultural practices, a Cultural Impact Assessment has considered the effects of the Proposed Action on traditional practices in the area, as noted in **Section 4.9: Cultural Impact Assessment**. Active coordination has taken place with staff at the Pu'ukoholā Heiau National Historic Site and other groups with an interest in cultural practices in the region. Both the *Hawai'i Island Commercial Harbors 2035 Master Plan Update* effort and this EA have considered the interests of these stakeholders.

For all the reasons cited above, none of the Build Alternatives, including the Proposed Action are expected to have negative impacts upon cultural resources or the social and economic welfare of the community or State of Hawai'i. This significance criterion is not met.

5. Substantially affects public health.

The Build Alternatives, including the Proposed Action are not expected to substantially affect public health, either during construction or after construction. The natural and physical environment in the area around Kawaihae is generally very good, and with mitigation, new impacts from the project on air quality, noise, water quality, hazardous materials, etc. will be mitigated to a level that is not significant. As a result, none of the Build Alternatives, including

the Proposed Action are expected to have any adverse effect on public health. This significance criterion is not met.

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

The Build Alternatives, including the Proposed Action will have negligible secondary impacts on the social environment or infrastructure and public facilities. All Build Alternatives, including the Proposed Action strictly involve improvements at Kawaihae Harbor and will not entail any residential development. Therefore, there will not be any elements of the project contributing to in-migration of residents or additional visitors to the Island. The project will also not significantly impact other existing infrastructure facilities or public facilities in the immediate area due to the type of improvements being proposed as discussed in **Chapter 7: Public Facilities and Utilities**. Public access to portions of the Coral Flats area used by the public, especially for recreational use, will be maintained. This significance criterion is not met.

7. Involves a substantial degradation of environmental quality.

The Build Alternatives, including the Proposed Action will not involve a substantial degradation to the quality of the surrounding environment. As noted above, the Build Alternatives, including the Proposed Action will be limited to improvements within highly-disturbed environments, and will not substantially degrade pristine resources. BMPs will be implemented during construction and post-construction to minimize erosion and other adverse effects, and ensure no degradation of environmental quality. This significance criterion is not met.

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

Impacts associated with the Build Alternatives, including the Proposed Action were addressed in this document, and are mainly associated with construction activities, with some additional impacts occurring from the ongoing post-construction operation of the harbor itself. In considering the projects necessary within the short-term, this EA considers the cumulative impacts of those projects. "Cumulative impacts" are defined in HAR 11-200-2 as environmental impacts resulting from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions.

In determining what is reasonably foreseeable, the State of Hawai'i, Department of Transportation, Harbors Division (DOT-H) has determined that the intermediate- and long-range projects identified in the *Hawai'i Island Commercial Harbors 2035 Master Plan Update* are of a longer-term planning horizon than is found in this report. Therefore, they are not reasonably foreseeable, as conditions could change over time that delay them indefinitely or even negate their need. These elements not covered in the EA are described in **Section 3.10.4: Future Master Plan Elements Not Carried Forward in EA**.

If and when these intermediate- and long-range projects become ripe for decision-making, an environmental analysis will be completed to determine if any environmental documentation

will be needed in accordance with State of Hawai'i Chapter 343 regulations and (if applicable) National Environmental Policy Act (NEPA) rules.

There could also be other actions beyond the limits of harbor improvements that could also contribute to cumulative impacts, but the cumulative effect would not be considerable.

As previously noted, Kawaihae Harbor has been used as a harbor for centuries, and actions dating from the 1950s through 1970s, particularly dredging and fill, irreparably altered the landscape, vegetation, and underwater relief of the area. Impacts associated with the Proposed Action will unavoidably continue these ongoing cumulative impacts to the environment, but with the mitigative measures proposed in this EA, the project will not result in impacts of significance.

For all the reasons cited above, the cumulative impacts of the Build Alternatives were assessed in **Section 10.2: Cumulative Impacts**, and it was determined that the Build Alternatives will not have a significant effect on the environment from a cumulative impacts standpoint. This significance criterion is not met.

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

As noted in **Section 4.13.2: Project Impacts on Wildlife**, there are both terrestrial and marine wildlife species with rare, threatened or endangered status that could be found in the vicinity of the project area. No rare, threatened, or endangered plants are known to exist within the harbor area, and little favorable habitat is offered for terrestrial wildlife.

To protect rare, threatened or endangered species, a number of BMPs are proposed in Section **4.13.3: Recommended Mitigation of Impacts on** Wildlife. State and Federal authorities will be contacted if any are encountered for further instruction. With these actions, the adverse effects of the Build Alternatives, including the Proposed Action on rare, threatened species, endangered species, or critical habitat are expected to be less than significant. This significance criterion is not met.

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

The Build Alternatives, including the Proposed Action will not have a detrimentally significant impact on air, water quality, or ambient noise levels. Analyses of all these issues have been considered respectively in **Section 4.5.2: Project Impacts on Air Quality**, **Section 4.10.2: Project Impacts on Hydrology and Water Quality**, and **Section 4.6.3: Project Impacts from Land-Based Noise**. Mitigation in the form of BMPs will be provided in the case of water quality to ensure that there will not be an adverse deterioration in water quality. Mitigative measures will be provided to ensure that there are no adverse effects from windborne dust. Noise has been studied in the context of this project to ensure that there are no significant adverse effects to Pu'ukoholā Heiau or other nearby receivers. This significance criterion is not met.

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

As expected with a harbor, all Build Alternatives, including the Proposed Action are located within a tsunami inundation zone and also contains floodplain, beach areas, and coastal waters. Kawaihae Harbor is in the lowest risk area for lava flows on Hawai'i Island (Lava Zone 9).

BMPs have been proposed in **Section 4.10.3 Recommended Mitigation of Impacts on Hydrology, Water Quality, and Coastal** Resources . These measures will minimize adverse impacts on environmentally sensitive coastal locations.

Kawaihae Harbor is of essential importance for Hawai'i Island to respond to tsunami threats. Hilo is the location within Hawai'i that has experienced the most extensive tsunami damage historically. Two devastating tsunami struck Hilo in 1946 and 1960. Tsunami or volcanic damage to Hilo Harbor could greatly increase the demand on the use of Kawaihae Harbor. Alternatives 4 and 5 will best serve this increased demand. This significance criterion is not met.

12. Substantially affects scenic vistas and view planes identified in county or state plans or studies.

As discussed in **Section 4.7: Visual Resources**, the Build Alternatives, including the Proposed Action will alter the viewscape of the area with a number of changes. However, these changes are consistent with those of an industrially-zoned harbor and in that context will not be considered a substantial adverse impact. These improvements will result in some visual changes depending on the viewer's viewplane and perspective. As part of the efforts for planning future use of the harbor, DOT-H has coordinated with a number of interested stakeholders and several mitigative measures are proposed to minimize adverse effects of the Build Alternatives, including the Proposed Action on visual resources. This significance criterion is not met.

13. Requires substantial energy consumption.

The Build Alternatives, including the Proposed Action will require some expenditure of energy to construct the improvements as noted above in **Section 10.4: Irreversible & Irretrievable Commitments of Resources**. However, this expenditure of energy is not substantial when considering the much greater future operational efficiencies that the Proposed Action will offer. The Build Alternatives, including the Proposed Action will result in a net reduction in energy consumed resulting from improved circulation within the site, improved traffic operations on Kawaihae Road and at harbor gates, and improved capacity to accommodate more barges and larger container volumes. In addition, use of photovoltaic collectors on the offices will further offset energy consumption. This significance criterion is not met.

12.2 Finding of No Significant Impact (FONSI)

Based upon the result of the environmental assessment documented in this Final EA, a Negative Declaration also referred to as a Finding of No Significant Impact (FONSI) determination is warranted for the improvements to Kawaihae Harbor under the Proposed Action. The findings supporting this determination are based upon the previous discussion of the project's effect on the environment in relation to the 13 Significance Criteria.

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CHAPTER 13: REFERENCES

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Appendix A: Project Plans

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State of Hawai'i, Department of Transportation,
Harbors Division

Kawaihae Commercial Harbor
Environmental Assessment

Conceptual Level Design (10%) Engineering Report

November 4, 2011

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Appendix B – Itemized Order of Magnitude Cost Estimate

I. INTRODUCTION

The Hawaii Department of Transportation, Harbors Division, (HDOT) is moving forward with the preparation of an environmental assessment (EA) for proposed improvements and upgrades for the Kawaihae Commercial Harbor that are likely to be implemented in the near-term (6 – 10 years). The improvements include the construction of the Pier 2A and Pier 2C extensions, the reconfiguration of the Pier 2 container yard, and improvements to the Main Gate and South Gate. The scope of improvements is referred to in this Report as the "EA Plan".

A. Existing Development

Construction of the modern Kawaihae Commercial Harbor began in the late 1950s when the U.S. Army Corps of Engineers dredged the harbor and built a breakwater to protect it. The dredge material consisted of cut and scraped corals which were used in part to create a landfill that would used to build the port facilities. The harbor limits were widened and the breakwater was extended in the early 1960s.

Pier 1 caters to conventional cargo and cement. The facility has berthing space of 412 feet with alongside depth of 20-24 feet mean low water (MLW). The tenants at Pier 1 include:

- Liquid Robotics (high-tech research and development)
- Hawaiian Cement Corporation (cement importer), has two storage tanks with capacity for 3,200 tons of cement. A cement manifold near the mid-length of the pier facilitates off-loading of cement from barges.

Pier 1 also provides for overflow berthing when Pier 2 / 2B is occupied. There are no improvements or upgrades proposed for Pier 1 under the EA Plan.

Pier 2 / 2B, also referred to as the Overseas Terminal, is used to ship and receive conventional (break bulk, lumber, agriculture, perishable foods, live cattle) and containerized (both 20-foot and 40-foot containers) cargo and automobiles, and also receives petroleum products and loads aggregate materials. The original 602 ft long Pier 2 was constructed in 1958, and a 550 ft extension (Pier 2B) was built to the south in 1990. Piers 2 and 2B have a combined berthing space of 1,152 feet with alongside depth of 35 feet (MLW) based on the latest available U.S. Army Corps of Engineers hydrographic survey data (dated 2003). Two liquid products manifolds are available – one along Pier 2, and one along Pier 2B. The tenants at Pier 2 / 2B include:

- Young Brothers Ltd., which operates an approximately 8-acre partly-paved storage area at the rear of Pier 2 that contains refrigerated container positions
- Matson Navigation Company, which operates an approximately 9 acre open storage yard at the rear of Pier 2B
- Mid-Pac Petroleum (fuel importer) has five fuel storage tanks at the rear of Pier 2
- Big Island Energy (fuel distributor) has five storage tanks at the rear of the Pier 2B

A Department of Transportation temporary small craft (dinghy) mooring area, with a loading dock, is located immediately south of Pier 2B. Much of the existing timber-framed dock is severely rotted and deteriorated. Off-shore moorings are also being utilized within the commercial harbor.

In addition to the existing infrastructure, there are various repair and modernization projects underway or fiscally committed to by HDOT at Kawaihae Commercial Harbor. As the baseline case for this Report, the existing development is defined as the infrastructure and harbor operations that will be present after HDOT's Committed Projects are completed, estimated to be in within 1 – 2 years. The

"Existing Plan Plus Committed Projects" plan identifying the existing site plan and committed projects that define the baseline development conditions for this Report is presented in *Appendix A*.

B. Proposed Development

The EA Plan is based on development through completion of the High Case Phase 3 forecast developed during the Hawai'i Commercial Harbors 2035 Master Plan project, as shown on *Sheet MP1* in *Appendix A*. For a comprehensive review of the study, the reader is referred to the Hawai'i Commercial Harbors 2035 Master Plan prepared by SSFM International (SSFM) and Moffatt &Nichol (M&N) in 2010.

As described in the plan, Kawaihae Commercial Harbor will require substantial increases in berth length and yard area to meet the forecast volumes. Key features of the EA Plan include:

1. A 340 foot extension is added to the north end of Pier 2 (designated Pier 2A extension), and a 325 foot extension is added to the south end of Pier 2B (designated Pier 2C extension). This lengthens the Pier to provide four in line berths for 400 foot barges.

2. New dredging is required at the south end of Pier 2B, for the new Pier 2C extension, to provide adequate water depth for barges. Also, a submerged boulder – an existing navigation hazard – will be removed from offshore between the Kawaihae Small Boat Harbor (North) and Pier 1.

3. The customer services and LCL break bulk areas adjacent the Main Gate remain as per the existing site plan. The container storage area inland of Pier 2 / 2B is reorganized to provide for container and chassis storage. The yard layout consists of one row of grounded exports adjacent to the pier and uniform rows of wheeled chassis slots behind.

4. The entire 2.7 acres of recommended auto import and export storage is provided south of the Pier 2C extension where it is easily accessible from the Pier 2 / 2B berths.

5. A second entrance is opened to the commercial harbor at the realigned South Gate entrance road with security and truck gates that will serve the auto storage area, and provide future access to the Coral Flats area if it becomes developed in the future. Next to the South Gate is a new customer service area for a second operator. The new gate will have a security booth west of the turnoff to a new perimeter roadway to the Kawaihae Small Boat Harbor (South).

6. At the Main Gate a separated truck in-gate and out-gate is provided to handle the increase in truck traffic and separate inbound and outbound functions.

7. A one acre State DOA inspection and quarantine area will be located next to the South Gate customer services area with easy access to Pier 2.

In total, the alternative provides for 814 twenty-foot ground slots for stacked containers, 756 forty-foot wheeled chassis slots and 113 twenty-foot wheeled chassis slots for a total area of roughly 31 acres for container storage. In addition, 1.5 acres of storage is allocated for LCL cargo, 2.7 acres for automobile imports and exports and roughly 8 acres for bare chassis storage. Cement and petrochemical storage remain as they are currently since their current facilities can meet future throughput projections.

In consideration of harbor surge issues, particularly during the winter months, the distance from the main harbor working area, and the restricted apron width due to adjacent buildings, Pier 1 remains as is and will primarily be used by cement barges. As well, cargo barges can use the berth when Pier 2 / 2B are fully occupied since there is access to the main yard area pending bridge upgrades over the harbor canal. Bulk commodities operators Hawaiian Cement, Mid Pac Petroleum and Big Island Energy all remain in their current configurations. The US Army LST/LSV ramp remains in its present configuration.

Hawaii Department of Transportation Harbors Division
Kawaihae Commercial Harbor EA
Conceptual Level Design (10%) Engineering Report

II. PROJECT DESCRIPTION

The purpose of this work is to facilitate the determination of potential types of construction for the proposed terminal improvements, as well as potential construction methods and equipment that may be used during the construction of the EA Plan, based on M&N knowledge and research of the potential participating contractors and locally available equipment.

Scope of Work for Conceptual Level Design (10%)

The current project includes completion of a conceptual level design (10%) of the EA Plan elements, as follows:

1. Replacement of the existing Pier 2 superstructure.

2. Demolition of the existing loading and dinghy dock at the south end of Pier 2B and construction of a 325-foot pier extension at the south end of the existing pier (the Pier 2C extension).

3. Addition of a 340-foot extension to the north end of Pier 2 (designated the Pier 2A extension). With the Pier 2C extension, the Pier is lengthened to provide in-line berths for four (4) 400 foot long barges.

4. Dredging at the south end of Pier 2B to provide adequate water depth for barges along the new Pier 2C wharf extension. Removal of a large, underwater boulder between Kawaihae Small Boat Harbor (North) and Pier 1.

5. Reorganization of the container storage area inland of Pier 2 / 2B to provide one row of grounded exports adjacent the pier and uniform rows of wheeled chassis slots behind the grounded containers.

6. Expansion of the import / export auto storage yard to 2.7 acre.

7. Creation of a one-acre inspection and quarantine area located next to the South Gate customer services area to provide space for the State Department of Agriculture (DOA) to screen cargo and protect Hawai'i Island's natural environment from the threat of invasive species. The location provides easy access to Pier 2 and the future Coral Flats berths.

8. Reconfiguration of the Main Gate to provide for separated truck in-gates and out-gates to handle the increase in truck traffic and separate inbound and outbound functions. In total, there are 3 truck in-lanes and 3 truck out-lanes.

9. Opening of a second access / egress point at the South Gate with security and truck gates that will serve the import / export auto storage area and a potential future Coral Flats development. The T-intersection of the South Gate road and Kawaihae Road will be relocated approximately 120 feet to the north and the road will be realigned. A new customer service area for a second operator has been provided next to the South Gate. The new gate will have a security booth west of the turnoff to a new perimeter roadway to the Kawaihae Small Boat Harbor (South).

The effort included a review of available Kawaihae Commercial Harbor site records including record drawings, geotechnical reports, dredging and reclamation plans, topographic survey data, hydrographic survey data, and interviews with HDOT. Where site-specific information was not readily available, assumptions were made regarding the existing conditions based on engineering judgment and experience.

III. STORAGE YARD

A. Project Elements

- Container yard site grading, fills, excavation, cuts, pre-loading to accommodate the Pier 2 expansion.
- Pier 2 yard area pavements.
- Identification of the type of utilities that will be needed for the Pier 2 / 2B extensions and Pier 2 yard area improvements. Detailed design of the utilities, to identify specific pipe and conduit sizes, one-line diagrams, site service tie-ins and upgrades, etc., was not performed.
- Pier 2 site security fencing.

B. Standards and References

Design of the civil site improvements and utilities work should be in accordance with the following standards and references:

Table III.1 – Container Yard and Support Areas Codes and References

Codes and Standards	Description/Use
U.S. Army Corps of Engineers and Asphalt Institute Portland Cement Association (PCA)	Pavement
International Plumbing Code (IPC) International Fire Code International Mechanical Code (IMC) NFPA 24 - Fire mains and appurtenances NFPA 11 and 16 - Aqueous fire fighting foam NFPA 307 - international shore connection	Potable water fire water suppression system
U.S. Coast Guard Regulations International Ship and Port Facility Security (ISPS)	Port Security
Uniform Plumbing Code International Plumbing Code (IPC)	Sewerage System
AASHTO-Roadways	Terminal Roadways
Federal Clean Water Act Statewide Storm Water Management Program	Stormwater System

C. Design Criteria

Pavement

The objective of the pavement design process is to select the most economical pavement sections that can meet the unique loading demands of a marine terminal. The combination of very high wheel loads and channelized traffic patterns over often poor sub-grade conditions requires robust pavement sections. Factors that must be considered in the pavement design process include:

- Subgrade

  Geotechnical investigation and assessment shall be performed to determine the subgrade properties. The top 12 inches of the subgrade shall be scarified and compacted @ 95% compaction.

- Pavement Material Properties

  The characteristics of the components of the various structural pavement alternatives that shall be considered are presented in Table III.2 below, and exhibited in Figures III.C.1 and III.C.2:

Table III.2 – Pavement Options

Pavement Areas	Pavement Alternatives	
	8" to 10" AC on 8" to 12" CTB (16" to 22" thickness) *Except for Auto Parking Area	10" to 14" PCC on 6" CMB (16" to 17.5" thickness)
Container Storage Areas	√	√
Empty Container Storage Areas	√	√
Entrance & Exit Gate	X	√
Break Bulk Traffic Area	√	√
Auto Parking Area (*4" AC on 6" CMB)	√	X

√ : Should be considered X : Should not be considered
Abbreviations: *AC: Asphalt Concrete, PCC: Portland Cement Concrete, CTB: Cement Treated Base, CMB: Crushed Miscellaneous Base*



Figure III.C.1 – Asphalt Concrete (AC)



Figure III.C.2 – Portland Cement Concrete (PCC)

- Traffic Repetitions

  From a pavement design perspective, the terminal can be separated into the different operational areas according to the type of container equipment utilized, how the equipment operates, and the number of moves.

- Container Equipment Wheel Loads

  Characteristics of the various types of container handling equipment typically used for pavement design purposes are presented in Table III.3 below:

Table III.3 – Typical Container Equipment Characteristics

Equipment Type	Model	Stacking Height	Gear Configuration	Tire Inflation Pressure (psi)	Maximum Front Axle Load (pounds)
Empty Handler	Kalmar DCE90-45E8	8 High	4 Tires Front 2 Tires Rear	145	84,000
Container Handler	Hyster 1150HD	6 High	4 Tires Front 2 Tires Rear	145	88,185
RTG	Kalmar 6+Lane Wide	6 High (1 over 5)	8 Tires (4 Ea Side)	165	62,200 (single wheel)
RTG	Kone 6+Lane Wide	5 High (1 over 5)	16 Tires (4 per Corner)	130	31,600 (single wheel)
Straddle Carrier	Kalmar CSC-440	4 High (1 over 3)	8 Tires (4 Ea Side)	145	29,200 (single wheel)
Reach Stacker	Kalmar DRD450-80S4X	5 High	4 Tires Front 2 Tires Rear	145	126,100
Top Loader	Taylor TEC-950L	5 High	4 Tires Front 2 Tires Rear	120	219,500

- Static Loads

  In addition to loading from container handling equipment, port pavements are typically subjected to static loading from corner castings. Corner castings measure 7" by 6.4" and project approximately 0.5" below the container base. While containers may be stacked in a block arrangement up to six high, it is unlikely that all containers in the stack will be fully loaded. Four high container stacks exert an average load of approximately 287,700 lbs.

- Design Procedures

  The asphalt concrete alternatives shall be designed using multi-layer elastic pavement design software. Failure criteria for multi-layer elastic theory is based on horizontal tensile strain (fatigue) at the bottom of a specified layer (usually the asphalt base) and vertical compressive strains (rutting) at the top of subgrade. Failure by rutting and fatigue is based on US Army Corps of Engineers and Asphalt Institute criteria.

  Rigid pavements alternatives designed using the following Portland Cement Association (PCA) publications will be based on the theory of fatigue consumption:

  - PCC: Design of Heavy Industrial Concrete Pavements
  - CTB: Thickness Design of Soil-Cement Pavements for Heavy Industrial Vehicles

- Pavement Performance Factors

  In addition to direct economic considerations, there are other non-quantifiable engineering considerations that must be evaluated in the selection of a pavement alternative. Several of these important considerations are described below:

  a) Ease of Localized Repairs and Maintenance

     Need for localized pavement repairs are an unavoidable problem that will occur regardless of the selected alternative. These repairs can result from the need to repair damaged utilities, localized pavement failures, and other events common to regular marine terminal operations. While these events are unavoidable, ease of pavement repair and maintenance should be considered in the evaluation of a preferred pavement alternative. For example, asphalt pavement is easier to repair than concrete or roller compacted concrete (RCC).

  b) Resistance to Fuel / Oil Spills

     Given the high level of vehicle movement across a marine terminal, spillage and leakage of fuel, oil, and lubricants will undoubtedly occur. Resistance to petroleum products is higher for concrete pavement than for an asphalt pavement.

  c) Resistance to Channelized Traffic

     Equipment operating over a repetitive wheel path tends to cause pavement rutting. This type of damage is typically the result of "shoving" of the pavement surface or lateral spreading of the base course. Two measures can be taken to counteract this phenomenon. First, a stiff or rigid material can be used for the pavement surface. Secondly, a bound base course may be utilized to prevent aggregate spreading. While asphalt stability has been greatly improved with the advent of asphalt modifiers, rigid concrete surfaces provide a higher resistance to rutting.

  d) Resistance to Static Point Loads

     Static point loads from container corner castings and truck trailer dollies and sand shoes create concentrated vertical stresses on the pavement surface. The rigidity of concrete provides greater resistance to this type of stress. Localized surface indentation will occur in asphaltic surfaces. Concrete, interlocking paver block (IPB), and RCC pavements are more resistant to high concentrated stresses.

  e) Shearing Resistance Due to Tire Rotation

     During normal port vehicular operations, tire rotation may occur while the vehicle is at or near a stopped condition. This tire movement (i.e., locked wheel turning) may cause significant horizontal shear stresses in the pavement surface. The rigidity of concrete provides greater resistance to this type of stress than an asphaltic surface.

  f) Excessive Wear on Equipment Tires

     Rough pavement surfaces may result in excessive tire abrasion for terminal operating equipment that requires repeated tire rotation. Roller compacted concrete without a layer of asphalt wearing surface typically has a rough surface that could result in excessive wear for terminal equipment, such as top loaders and rubber tyred gantry cranes.

  g) Subgrade Settlement or Heave

     Even after necessary deep ground improvements are performed, it is anticipated some settlement will occur. Excessive settlement can result in deformation of the pavement surface. Rigid concrete surfaces tend to form abrupt faults when subjected to settlement or heave, while deformations in flexible pavements are less pronounced. Repairs to rigid pavements typically consist of complete removal and replacement of affected areas. Flexible pavement repairs are generally localized and are often corrected by milling and placement of variable depth overlays.

Pavement Markings and Yard Signage

Pavement markings shall be provided for management of traffic flow (see *Sheet C1* in *Appendix A*), separation of functional areas, and related purposes. Directional and informational signs, supported in movable concrete blocks, will be provided for the storage yard.

Grading

The grading for the facility shall be developed to minimize the number of structures, facilitate proper drainage, and promote efficient operations. All areas, including the container stack areas, shall be designed to minimize ponding of surface runoff water. Support areas including the Empty Container Storage, chassis storage, and general cargo storage areas shall be designed for the operation of heavy, rubber-tired container handling equipment and stacking of empty containers. For the general terminal spaces, the range of acceptable slopes is 0.8% to 1.5%.

Utilities

In order to maximize operational efficiency and flexibility, minimum above-grade infrastructure shall be placed in storage areas and fire hydrants shall be placed adjacent to high-mast light poles. Utility manholes and vaults shall be placed in planned travel aisles to facilitate access and minimize damage.

Fencing

The terminal perimeter, with the exception of the vessel berthing face, shall be secured with International Ship and Port Facility Security (ISPS) and / or contracting government-approved fencing and access controlled gates. The fence and gate system shall define the appropriate locations where access restrictions could be applied (ISPS Part B, 16.11). The terminal may change due to project phasing. Concrete "K-Rail" barriers that can be relocated

as required by changes in the Terminal perimeter shall be considered. The final design of the fencing shall be incorporated into each design phase of the container terminal.

Striping

Striping patterns for wheeled containers and grounded containers are outlined in the figures below. Chassied containers will be stored in 40 foot striping areas (Figure III.C.3) or 20 foot striping areas. Grounded containers will be stored in 20 foot striping areas (Figure III.C.4) each stacked four containers high.

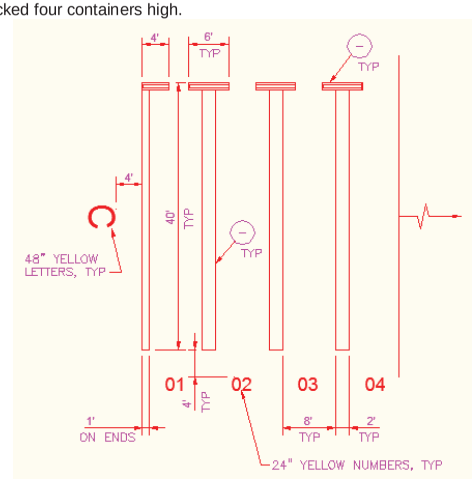

Figure III.C.3 – 40 Foot Wheeled Striping Detail.

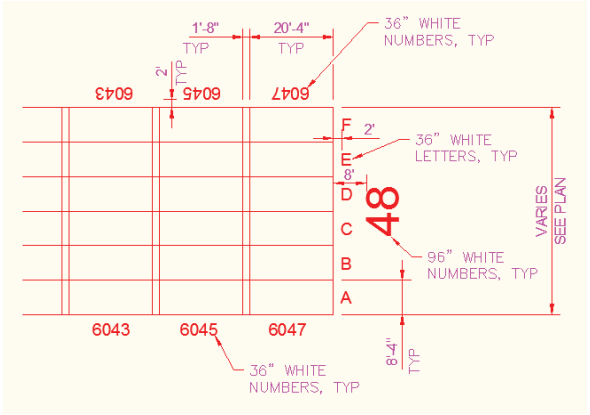

Figure III.C.4 – Grounded Top Pick Striping Detail.

D. Existing Storage Yard Conditions

Pavement

- Majority of paved storage yard consists of 16" to 17.5" thick Portland cement concrete (PCC).
- Other areas of the harbor either consists of concrete (AC) or are unpaved.
- Three major cargo service companies that operate at Kawaihae Commercial Harbor: Young Brothers, Horizon Lines, and Matson.
- Young Brothers and Matson designated areas are paved with a combination of PCC and AC paving.
- Horizon Lines' designated area is paved with AC.

Container Handling Equipment

- The Hyster 1150HD is the largest container handler currently used at Kawaihae Harbor.

Grading and Drainage

- Drywells are used for stormwater drainage in the storage yard.
- The site is currently graded to allow storm water drainage to trench drains that are connected to the drywells.

Fire Suppression

- As noted in the Hawaii 2020 Master Plan Environmental Impact Statement, the County of Hawaii Fire Department requires that the distance between fire hydrants be no greater than 300 feet. At least one set of fire hydrants is currently approximately 700 feet apart.

Fencing

- Fencing design around the harbor is 8 feet high with an additional 3-strand, 1-foot high razor or barbed wire.
- Fences conform to U.S. Coast Guard requirements.

E. Storage Yard Improvements

Pavement

It is recommended that expansion areas be paved with 16" to 17.5" thick Portland cement concrete (PCC). With the exception of parking areas, PCC is preferred over asphalt concrete (AC) because asphalt concrete has a tendency to soften in warm climates. Heavy channelized wheel loads from container handling equipment and high contact pressures from landing gears will cause significant damage to AC pavement.

New pavement construction will include grading, removal of excess fill or import of fill material, and scarification and re-compacting of the top 12 inches. Pavement layering will consist of 95% relative density placement of 8" to 12" cement treated base (CTB) paved with 8" to 10" asphalt concrete (AC). Alternatively, 10" to 14" Portland cement concrete (PCC) will be paved on 6 inch crushed miscellaneous base (CMB).

The timeline for completion of newly paved areas can vary based on what areas of the harbor can be worked on at a given time. Assuming the paving work will be split into two phases, the newly paved areas could be completed in approximately 6 months (24 weeks) broken down in Table III.4.

Table III.4 – Construction Timeline.

Paving Layer	Timeline	Equipment Needed
Rough Grading	8 weeks	Trucks, scrapers, rollers, excavators, loaders
CTB or CMB	8 weeks	Rollers, graders, loaders
AC or PCC	8 weeks	Paving machine, rollers, concrete pumping machine

Sheet C1 in Appendix A shows the areas to be paved with PCC or AC. The customer services and customer parking areas near the South Gate can be paved with AC since the wheel loads in that area will be significantly less than in other areas of the harbor. Other newly paved areas include the maintenance building, chassis parking, LCL cargo, and container storage areas. These should all be paved with PCC due to the possibility of heavy channelized wheel loads and high contact pressures.

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Container Handling Equipment

The Hyster 1150 HD Container Handler causes the greatest pavement contact loads of any equipment used at the terminal. Portland Cement Concrete (PCC) is suggested as paving material for most of the storage yard to account for these maximum contact loads.

Grading and Drainage

The current storage yard drainage system allows storm water drainage to trench drains that are connected to the drywells. No changes are recommended because this system does not have any major issues.

The construction of the Pier 2A extension is not expected to have any effect on the existing drainage channel that opens to the harbor approximately 30 feet to the north of the end of the proposed pier extension. The new pier extension is proposed to be pile-supported, allowing water to flow freely beneath the structure, and the channel drains far enough from the end of the extension so that the channel's functionality is not expected to be impaired.

Fire Suppression

To accommodate this requirement, fire hydrants will be relocated adjacent to alternating light poles at approximately 300 feet apart. This will satisfy the fire department's distance requirement and allow for sufficient fire suppression coverage for the storage yard. These changes are reflected in *Sheet E2 of Appendix A*.

Fencing

The current fencing design around the harbor that is 8 feet high with an additional 3-strand, 1-foot high razor or barbed wire will be used for the expansion areas, including along the perimeter road, and any other areas in disrepair. A fencing detail is shown in Figure III.E.1.

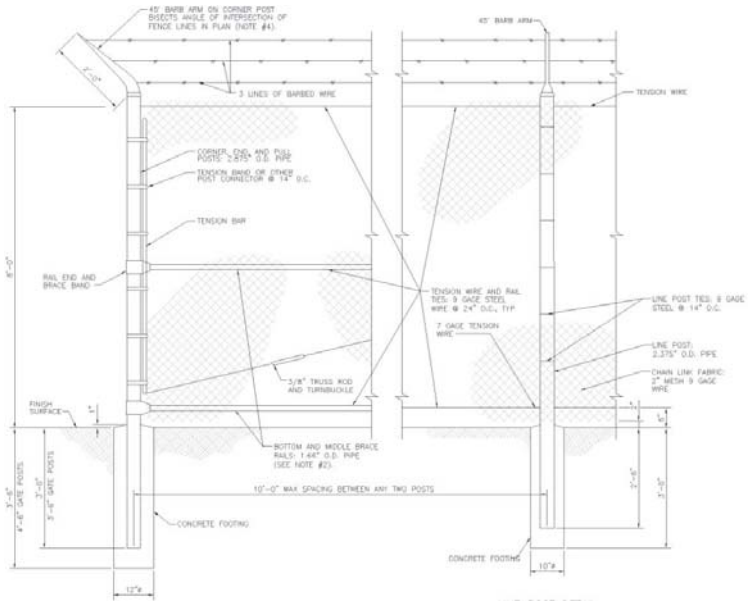

Figure III.E.1 – Typical 8 foot fencing detail.

IV. YARD LIGHTING

A. Project Elements

- Pier 2 Terminal area lighting

B. Standards and References

Design of the yard lighting improvements will be in accordance with the following:

- Hawaii County Code (HCC), Chapter 14 – General Welfare, Article 9 Outdoor Lighting.
- National Electrical Code (NEC) – Applicable Code Edition

C. Lighting Design Criteria

Light Poles

Container terminals typically employ 100 to 120-foot tall mast lights to provide recommended levels of illumination at pavement level of port facilities. However, special outdoor lighting regulations, as outlined in the Hawaii County Code, Chapter 14, require special consideration at Kawaihae Commercial Harbor to reduce the potential impact of new yard lights on migratory birds and to minimize light pollution that could affect the Mauna Kea Observatory.

To account for these considerations, 39-foot high, galvanized steel high-mast light poles, with eight, 180-watt low pressure sodium luminaires, are recommended, as shown on *Sheet E1 of Appendix A*. Maximum height of light poles, from finish grade to top of pole cap, is 46'-6", including the concrete pedestal (4'-11"), lamp pole base (30-3/4"), and 39'-0" pole. Low pressure sodium floodlights shall be used to light the wharf and yard areas, which are the type of fixtures currently used at the site. The fixtures should be fitted with light shields / housing to reduce variant light scatter. The elevated profile of the pole and light fixtures should be kept minimized to reduce the potential for bird strikes.

Light poles and foundations shall be designed to meet the specific soils, seismic and wind load conditions for the area in which they are to be installed. Poles shall be located so as not to interfere with the operation and travel of the yard equipment.

Lighting Levels

The light level for the wharf area shall be 5 footcandles average and 2 foot-candles minimum on the wharf.

A lighting uniformity max / avg ratio of 5:1 (or better) shall be maintained throughout the terminal. Care in design shall be taken to minimize glare and light spill at the end of the wharf and on the water so as not to obstruct the view of vessel pilots.

Control System

Control of the lighting system shall be designed using hard-wired control of contactors with automatic (time-switch and photo-cell) and manual options. A reduced "security light level" option shall also be provided to reduce the lighting to one-fifth of the normal.

D. Existing Yard Lighting Conditions

The terminal yard and wharf areas are presently lit by low pressure sodium lights mounted on the high mast light poles. The average light level across the yard and wharf is approximately 5 foot-candles.

E. Yard Lighting Improvements

The improvements to the terminal will include an extension to the north of the existing Pier 2 wharf and to the south of the existing Pier 2B wharf (i.e., the Pier 2A and Pier 2C extensions, respectively) and expansion of the upland container yard. High mast light poles will be added as shown on *Sheet E2 of Appendix A* in order to illuminate these areas. The new light poles will be as described above – 39-foot, high mast poles with low pressure sodium light fixtures (maximum height above finish grade is 46'-6"). The newly paved areas and the extended wharf areas should be lit at a level of 5 footcandles average. The results of a preliminary photometric analysis to evaluate illumination levels of the EA Plan improvements are presented on *Sheet E3 of Appendix A*.

F. Yard Power Improvements

Electric Service

Based on the additional and future load requirements at the terminal, including wharf outlets, high mast lighting, support buildings, reefer outlets and truck gates, it is recommended that the electrical service to the terminal, and the site distribution system, be reviewed as possible system upgrades (e.g., a new substation(s), rectifiers, transformers) may be necessary to support the planned development.

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V. MARINE WORKS

A. Project Elements

- Demolition of the existing loading and dinghy docks at the south end of Pier 2B.
- Dredging requirements to accommodate the new Pier 2C extension.
- Pier 2A and Pier 2C extensions, including pile size, layout and basic deck configuration.
- Demolition and reconstruction of the existing Pier 2 superstructure.
- Shoreline bulkheads, revetments, fills and seismic ground improvements based on geotechnical information provided.

B. Review of Background Data

The Design Team completed a review of available reference documentation, including Record Drawings, Surveys and other Technical Studies, including the following:

Reference Drawings

1. H.C. 916A, Dredging and Other Improvements, Kawaihae Harbor, Hawai'i, March 1954.
2. H.C. 1031C, Overseas Terminal, Kawaihae Harbor, Hawai'i, January 1958.
3. H.C. 1303A, Kawaihae Harbor Improvements, Kawaihae Harbor, Hawai'i, January 1967.
4. H.C. 5064, Earthquake Repairs, Kawaihae Harbor, Hawai'i, September 1973.
5. H.C. 5219, Dredging and Overseas Pier Extension, Kawaihae Harbor, Hawai'i, May 1990.
6. H.C. 5248, Maintenance Dredging at Overseas Terminal, Kawaihae Harbor, Hawai'i, February 1992.
7. H.C. 5337, Repair Fender System at Overseas Terminal (Phase 4), Kawaihae Harbor, Hawai'i, May 2001.
8. H.C. 50022, Repair Substructure at Pier 2, (Phase 1), Kawaihae Harbor, Hawai'i, May 2006.
9. H.C. 50040, Approach Slab Repairs at Pier 2, Kawaihae Harbor, Hawai'i, 2009.
10. H.C. 50044, Repairs at Pier 2B, Kawaihae Harbor, Hawai'i, August 2007.
11. H.C. 50066, Substructure Repairs at Pier 2A, Kawaihae Harbor, Hawai'i, April 2009.

Technical Studies

1. Port Hawaii Waterfront Structural Inventory, Hawaii Statewide, prepared for the Hawaii Department of Transportation, Harbors Division, by Moffatt & Nichol. September 2008.
2. Geotechnical Engineering Exploration, Pave Additional Barge Terminal Area, Kawaihae Harbor, Job H.C. 5313, Kawaihae, South Kohala, Hawaii, by Geolabs, Inc. October 1999.

3. Geotechnical Engineering Exploration, Pier 2a Shed Demolition, Kawaihae Harbor, H.C. 50038, Kawaihae, South Kohala, Hawaii, by Geolabs, Inc. January 2009.
4. Bathymetric Survey for Kawaihae and Boat Basin, Hawaii, by US Army Corps of Engineers. June 2003.
5. Kawaihae Harbor 2006 Earthquake Damage and Repair Summary Memorandum, by M&N. March 2010.
6. Robertson, I., Nicholson, P. and Brandes, H. (2006, October 26). "Reconnaissance Following the October 15th, 2006 Earthquakes on the Island of Hawai'i - Research Report UHM/CEE/06-07". Retrieved December 9, 2009 from www.cee.hawaii.edu

C. Existing Marine Structures and Condition

Description of Existing Marine Facilities

The northern half of the Pier (Pier 2) was completed in 1958, and comprises 18 inch square reinforced concrete piles supporting 2-1/2 feet wide by 3 feet deep reinforced concrete pile caps and a 12 inch thick reinforced concrete deck. The arrangement of the wharf includes a series of 44 bents spaced at 14 feet centers each supported by 7 vertical piles. A reinforced curtain wall and a steel sheet pile seawall abut the shoreline and provide lateral support to the backland fill. The existing structure has a safe live load limit of 500 psf, as determined by HDOT Harbors Division. The structures are described in the Record Drawings for reference Project H.C. 1031C.

The southern half of the Pier (Pier 2B) was added as a 550 foot long extension to the existing pier and was constructed in 1990. It comprises 20 inch diameter precast, prestressed octagonal concrete piles supporting 4 feet deep by 8 feet wide and 3 feet wide reinforced concrete pile caps, variable size transverse reinforced concrete beams at 25 foot centers, 10 inch thick precast concrete deck panels, and an 8 inch thick reinforced concrete deck topping. The arrangement of the wharf includes 3 rows of vertical piles spaced at approximately 7 foot centers and transverse batter piles spaced at 50 feet centers. A reinforced concrete cap supported by vertical and batter piles and steel sheet pile bulkhead system abut the shoreline and provide lateral support to the backland fill. The existing structure has a specified safe live load limit of 1000 psf. The structures are described in the Record Drawings for reference Project H.C. 5219.

To the south of Pier 2B, there is a dinghy and boat dry storage facility, marginal wharf, and loading pier. The facility is also operated by the Department of Transportation and comprises a 200 foot long by 8 foot wide marginal wharf with a timber superstructure supported by concrete pile caps and piles. The facility also includes a 70 foot long x 6 foot wide concrete loading pier. The existing structure has a specified safe live load limit of 500 psf. The structures are described in the Record Drawings for reference Project H.C. 5219.

The water lot in front of Pier 2 / 2B was dredged to a depth of 35 feet below MLLW. The dredged areas is enclosed by the piers to the east, the coral flats area to the south, the breakwater to the west, and the harbor entrance to the north. The total dredged area enclosed within the harbor limits is approximately 65 acres. The existing dredge limits are shown on the USACE Hydrographic Survey Plan prepared in April 2003.

Condition of Existing Marine Facilities

The Pier 2 wharf structures have been repaired at various times to address both normal deterioration due to aging (i.e., concrete delamination and spalling; mechanical damage) as well as damage caused by seismic activity (1973 and 2006 earthquakes). Also, M&N's recent

experience at the facility during the Pier 2A Shed Demolition project and the 2007 Reconnaissance Surveys completed for the HDOT Waterfront Structural Inventory projects provide insight into the existing conditions of the structures.

- The superstructure of the northern half of Pier 2 (completed in 1958) is in a "fair to poor" condition due to an advanced state of active corrosion resulting in spalling and cracking in the deck, beams and pile caps. The piles, however, are generally in "fair to good" condition.
- The southern half of the Pier 2 wharf (Pier 2B, completed in 1990) is in a "fair to good" condition, with regular maintenance required to address existing cracks and on-going concrete delamination and spalling.
- The existing loading and dinghy docks is generally in a state of disrepair, and recent images viewed on Google Maps show that the northern half of the marginal wharf is missing its superstructure (Figure V.C.1). Regardless of its condition, this facility is scheduled for demolition to make room for the Pier 2C wharf extension.

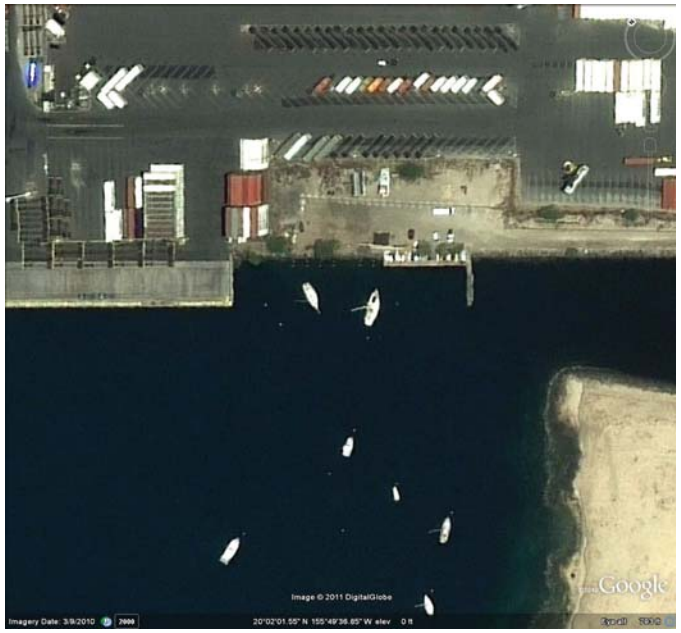

Figure V.C.1 – Existing Loading and Dinghy Docks, Northern Half of Superstructure Demolished (photo from Google Earth, Image Date March 2010, accessed September 2011).

Damage to Kawaihae Commercial Harbor due to October 15, 2006 Earthquake

On Sunday, October 15, 2006 at 7:07:48 a.m. HST, a 6.7 magnitude earthquake, as reported by the U.S. Geological Survey, Hawaiian Volcano Observatory, Hawai'i, struck 7 miles (11 km) NNW (348°) off Kalaoa, Hawai'i. This event was followed by a powerful 6.0 magnitude aftershock, as well as many smaller magnitude aftershocks.

As a result of the earthquakes, lateral movements of bulkheads, cracks and differential settlement of pavement and other structural damage were reported within Kawaihae Commercial Harbor, located less than 15 miles from the earthquake's epicenter. The damage was primarily a result of liquefaction and lateral spreading of the reclaimed fill used to construct the waterfront areas of Kawaihae Commercial Harbor, known to contain significant depths of unconsolidated gravelly calcareous sand from adjacent dredging operations (Robertson 2006).

Localized cracks and spalls were observed in the reinforced concrete substructure of Pier 2. The cracks and spalls were repaired by chipping and removing the deteriorated concrete and repairing with cementitious mortar (Job No. H.C. 50048 / 50066). (Note that the repair drawings were not available so no differentiation was made between damage that may have been caused solely by the earthquake and existing damage that may have been present prior to the earthquake.)

Total and differential settlement, as well as lateral displacements and associated separations, within the Pier 2 container yard created an immediate, though temporary, problem for container operations and also created serious concern for the fuel offloading pipelines which traversed the damaged area.

The Pier 2 fills experienced liquefaction and settlement of the fill material below the approach slabs. This consolidation resulted in large voids beneath the slabs. To repair the condition, the voids beneath a 11'± x 112'± section of the Pier 2 approach slab were filled by coring holes through the existing reinforced concrete slab at approximately 4'-0" on centers and pumping controlled low-strength material (CLSM) through the holes to fill the voids beneath the slabs. Where the voids extended beneath existing asphalt pavement (approx. 6' wide), existing pavement was removed to enable the CLSM to be placed, then new asphalt pavement was placed over the CLSM (Job No. H.C. 50040).

The projects HDOT Harbors Division implemented to address the earthquake damage to the harbor facilities were completed in 2009. As such, the damages sustained from the 2006 earthquake do not affect current commercial operations or future planning of Kawaihae Commercial Harbor.

Based on the review of available geotechnical data and discussions with local geotechnical engineers familiar with the site, ground improvements behind the existing and the new wharves are not being proposed because the available ground improvement technologies are not very effective at mitigating liquefaction potential in the unconsolidated gravelly calcareous sand that is prevalent at the site. Following a seismic event, settlement of the backland fills and damage to the pavement structures similar to that experienced in 2006 may be expected. The cost to mitigate this risk by instituting an extensive backland ground improvement / soil modification program for existing areas and to incorporate these measures into new construction is expected to be economically infeasible and may prove marginally effective with current technology. It is therefore reasonable to expect that such extensive ground improvements will not be instituted and repair of future earthquake-related damage to waterfront structures and pavements will be performed if / when such an event occurs in the future.

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The northern and southern extensions to Pier 2 / 2B should be designed to account for the high seismicity of the site and the liquefaction potential of the *in-situ* soils.

D. Standards and References

The conceptual engineering design of the marine works elements has been prepared drawing upon the Design Team's knowledge of the applicable design references and criteria. While the following list of design references and criteria is not exhaustive nor all inclusive, it does capture the major items for consideration that will have an impact on construction costs.

Unified Facilities Design (UFC) Criteria

- UFC 3-220-01N — Geotechnical Engineering Procedures for Foundation Design of Buildings and Structures
- UFC 3-310-01 — Structural Load Data, 25 May 2005, including change 2, 5 Dec 2007
- UFC 4-151-10 — General Criteria for Waterfront Construction
- UFC 4-152-01 — Design: Piers and Wharves
- UFC 4-159-03 — Design: Moorings

Other Documents, Codes and Criteria

- IBC — International Code Council "International Building Code", 2006 Edition
- ASCE 7-05 — American Society of Civil Engineers, "Minimum Design Loads for Buildings and Other Structures"
- ACI 318-08/318R-08 — American Concrete Institute "Building Code Requirements for Reinforced Concrete and Commentary"
- PCI — "PCI Design Handbook, Precast and Prestressed Concrete"
- MOTEMS — Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS)

E. Design Criteria

The conceptual engineering design was based on the following design criteria:

Vessel Parameters

Type:	Fuel and Cargo Barges
LOA:	400 ft
Beam:	100 ft
Draft:	30 ft

Seismic Design Parameters

S_s = 1.3g
S_1 = 0.45g
Site Class E (assumed, soft soil profile)

Wharf Operational Live Loads

AASHTO HS20-44 Truck Live Load
Uniform Live Load: 1000 psf

Vehicle Parameters

Type:	Hyster 1150-HD container handler lift trucks
Outrigger Load:	1,032 kN (232 kips) maximum (use of cribbing will not be allowed)
Maximum Container Load:	88,000 pounds
Max. Front Axle Load:	232,995 pounds
Design Axle Load:	302,894 pounds
Tire Pressure:	145 psi
Dual Wheel Separation:	25 inches

F. New Marine Structures and Improvements

Demolition of the Existing Loading and Dinghy Docks

In order to accommodate the southern Pier 2C extension, the marginal wharf, dinghy and boat storage platforms, and the loading pier will be demolished (*Sheet C2* of *Appendix A)*. The demolition will include removal and off-site disposal of approximately 4,200 sf of timber superstructure at the marginal wharf and dinghy storage areas, 480 sf of concrete superstructure at the loading pier, and approximately 76 vertical piles. The demolition will include vibro-extraction of the piles where possible.

Dredging

Additional dredging is required at the south end of Pier 2B, for the new Pier 2C extension, to provide adequate water depth for barges, which is the same as the existing berth depth of 35 feet below MLLW. The limits of the existing dredge basin will be extended south approximately 100 feet beyond the end of the new pier extension to provide room for maneuvering barges at the new berth. The proposed dredge limits for the EA Plan are presented on *Sheet C2 of Appendix A*.

In addition, there is reportedly a “car-size” boulder between the Kawaihae Small Boat Harbor (North) and Pier 1 that presents a navigational obstruction and will need to be removed (dredged). Possible methods of removal of the large obstruction include:

1. Heavy duty marine crane to lift intact obstruction (assumed to weigh 15 tons), if such equipment is available locally during the heavy marine construction phase of the proposed work. Off-site disposal is required.
2. Impact chisel demolition involves dropping a large spud or chisel shaped tool on obstruction multiple times to break into manageable sized pieces.

3. Drill several holes in obstruction at pre-determined intervals and then inserting a hydraulic ram into the holes to break rock into manageable sized pieces.
4. Underwater hydraulic jackhammer, similar to equipment used in topside demolition activities, used to break rock into manageable sized pieces.
5. Dig a large pit next to the obstruction it and roll it into pit.

Based on the available hydrographic data reviewed for this project, it is estimated that 30,000 cy of material will need to be dredged from the harbor bottom. Disposal options for the dredgeate, whether at an approved deep ocean disposal site or at an approved, upland landfill, will need to be determined at the time that the work is being planned, based on the composition of the dredge materials and space availability.

Pier 2A and Pier 2C Extensions

The general concept for the new pier extensions is to construct a pile-and-deck structure similar to the structural arrangement of the existing Pier 2. The structures comprise precast, prestressed concrete piles supporting reinforced concrete pile caps, beams, and deck, with a cast-in-place concrete curtain wall and steel sheet pile bulkhead.

The existing shoreline is protected by a primary earth-filled dike that is dressed with protection rock on its offshore face extending approximately 5 feet below MLLW. The existing protection rock will be removed to provide a well compacted fill behind the new pier extensions.

Based on the conceptual engineering completed to date, the elements will include three longitudinal rows of 20 inch to 24 inch diameter octagonal precast, prestressed concrete piles, supporting reinforced concrete pile caps, with transverse concrete beams spaced at approximately 25’ centers. The deck could be constructed of precast concrete panels and a reinforced concrete topping, or entirely of cast-in-place concrete.

The tied-back concrete capping beam will include vertical and battered precast, prestressed concrete piles and a steel sheet pile wall, supporting a reinforced concrete cap beam. The landside behind the cap will be backfilled and fitted with a reinforced concrete approach slab.

The proposed Pier 2A and Pier 2C extensions concept is illustrated on *Sheets S1 and S2* of *Appendix A*.

Pier 2 Repairs / Reconstruction

The general concept for the demolition and reconstruction of the existing Pier 2 superstructure involves removing the existing concrete deck, concrete pile caps and beams, and the closure block capping the steel sheet pile bulkhead. The existing piles and the sheet pile bulkhead will be salvaged and reused in the reconstructed configuration to the extent possible.

After the demolition is complete, a row of precast, prestressed concrete batter piles will be installed along Bayline G between each existing bent of piles (42 new batter piles), as well as a row of precast, prestressed concrete vertical piles installed inshore of the existing sheet pile bulkhead that will be designated as Bayline H (43 new vertical piles).

A new tied-back concrete capping beam will encapsulate the piles and the bulkhead between Baylines G and H, and the landside behind the cap will be backfilled and fitted with a reinforced concrete approach slab.

The conceptual recommendations account for the increase in the seismic design loads since the original Pier 2 wharf was designed and constructed.

The proposed Pier 2 demolition and reconstruction concept is illustrated on *Sheet S3* in *Appendix A*.

G. Construction Methods and Equipment

Demolition

Demolition of the loading and dinghy docks will take approximately two weeks, and demolition of the Pier 2 concrete deck (600' x 40' approx) will be completed over a total period of approximately 12-to-18 months (assuming demolition of 3 bays every 4-to-6 weeks and a total of 43 bays). The estimated construction durations are based on the Contractor's ability to work with minimal interruptions from existing commercial harbor operations.

Demolition of the existing Pier 2 deck and the loading / dinghy docks will likely be conducted from the topside/landside, with marine support from a barge to receive demolition materials (the demolition debris on the barge would be transferred to land). The topside decks would likely be cut and lifted onto the barge, and the concrete pile caps and beams will likely be demolished in place using a hydraulic breaker. Demolition materials would not be permitted to enter the harbor, and would be disposed of off-site at an approved disposal facility.

The demolition debris would be hauled from the site using dump trucks or via a barge overwater, and disposed of in an appropriate landfill.

Pier Construction

It is estimated that the project will require approximately 300 to 350 support piles for the north and south pier extensions. Assuming that 3 to 4 piles can be installed each day, the total duration will be 75 to 120 days of pile driving.

The vertical bulkhead will be approximately 665 to 700 feet in length. Assuming that 50 lineal feet of sheet piling can be installed every week, the total duration will be 3-to-4 months.

Pile driving within the harbor is conducted using a barge-mounted diesel, hydraulic impact and / or vibratory hammer, depending on geotechnical conditions. The new piles are assumed to be in the same range of sizes and materials as the existing piles (i.e., 20-in octagonal pre-stressed concrete piles).

Dredging

Dredging for the new Pier 2C extension will be required to achieve the required minimum operational water depth. The most common and cost effective dredging methods in Hawaii, and in the United States in general, include:

1. Mechanical dredging using a clamshell dredge bucket operated from a barge-mounted crane accompanied by a material scow to receive the dredgeate. The material is "scooped up" from the seabed and transferred to a material scow moored alongside the dredge barge. When the scow is filled, it is towed to an appropriate disposal site.

2. Hydraulic dredging using a mechanical dredge pump fitted on a marine barge involves "sucking up" the seabed material through a series of pipes. The intake end of the suction pipe is often fitted with a mechanical cutter to loosen the material that is being dredged. The dredge-water slurry is hydraulically pumped either into a hopper contained within the dredging machine, or piped all the way to shore to a holding facility. Hydraulic dredging generates a large volume of waste water that needs to be managed during the operation. Hydraulic dredging is best suited for dredging loose and sandy materials.

Modern dredging operations include the use of electronic Global Positioning System instruments to provide accurate surveys of their location.

Mechanical dredges are well suited for work in confined areas and adjacent to existing piers and wharves. Based on the estimated dredging volumes, it is anticipated that dredging at Kawaihae Commercial Harbor will be completed by means of mechanical dredging.

It is estimated that the project will require dredging of approximately 30,000 cy of material. Assuming that 500 cubic yards of material can be dredged each day, the total duration will be 60 days of dredging. The estimated construction durations are based on the Contractor's ability to work with minimal interruptions from existing commercial harbor operations.

It has not yet been determined what options are available at the Kawaihae Commercial Harbor facility for disposal of the dredgeate. Options may include deep ocean disposal if an established offshore site and permits are available, disposal at an appropriate upland facility, or disposal at the Coral Flats area of the port (note that earthen containment berms may be necessary if disposing of the dredge material on-site to prevent runoff from re-entering the harbor waters).

Off-Site Fabrication

Prefabrication of a number of project elements may be possible to streamline the construction process. Typical elements that can be prefabricated at an off-site Contractor's yard / facility include concrete deck panels and support piles. Prefabricated items are transported to the site in modular form by either towing on barges over water or trucking over land.

Construction Equipment

The following construction and mechanical equipment are anticipated to be used in the project's construction.

- Landside cranes for loading / offloading.
- Dump trucks to haul demolition debris from site.
- Occasional flat bed trucks for deliveries.
- Concrete delivery trucks to fabricate cast-in-place concrete elements.
- Marine derricks fitted with 1-2 cranes, and lay-by barges for material handling.
- Pile extracting / driving equipment may include diesel, hydraulic impact and / or vibratory hammer, depending on geotechnical conditions.

- Dredging equipment could include a clamshell dredge bucket operated from a barge-mounted crane, or a mechanical dredge pump with dredge cutter fitted on a marine barge.
- Equipment such as pavement cutters, trenchers, compacters, pavers, etc. for limited shoreside trenching to extend existing utility lines to new piers. This work is expected to be minor, so use of this equipment would be for brief durations.
- Hydraulic jackhammers for concrete demolition.

VI. TRUCK GATES AND SITE ACCESS

A. Project Elements

- Gate improvements to Main Gate and South Gate to accommodate processing, inspection, queuing and security.

B. Standards and References

Design of the truck gate improvements will be in accordance with the U.S. Coast Guard requirements.

C. Design Criteria

Entrance Gate

The entrance gate serves two key functions: (1) maintaining and controlling all incoming and outgoing truck cargoes and (2) providing a security checkpoint for all incoming and outgoing vehicular traffic. Accordingly, two systems should be deployed: (1) a Gate Management System (GMS) for processing containers in and out of the terminal, and (2) an Access Control System (ACS) for security. In addition to interfacing with each other, the GMS must interface with the terminal container control system, such as NAVIS. The technology and degree of automation to be implemented will depend on throughput, operator preferences, forthcoming federal security regulations, and Union Labor work agreements.

Security

Entering trucks should first pass a security guard booth where driver identification and credentials will be checked, followed by an entry inspection gate for truck cargo inspection (Figure VI.C.1).



Figure VI.C.1 – Typical Entry Inspection Gate

Clerk Station

After passing through the security checkpoint, trucks proceed to the inspection and processing stage staffed by clerks with handheld data entry devices (Figure VI.C.2).

Typically, three hand held devices are used at each terminal (the cost of each hand held device is approximately $3,000).



Figure VI.C.2 – Typical hand held device used by clerks

Exit Clerk Pedestals and Inspection Gate

The exit inspection gate should be located adjacent to the entry inspection gate (Figure VI.C.3). As the truck pulls into the inspection lane, the clerk validates that the transaction was completed successfully. The driver signs his name on the handheld device and a receipt of the transaction is printed at the pedestal.



Figure VI.C.3 – Typical Exit Inspection Gate

D. Existing Truck Gates and Site Access

- Security checkpoint at the Main Gate consists of verifying appropriate credentials (i.e., Transportation Worker Identification Credential (TWIC) and Maritime Security (MARSEC)) by security personnel, as required by the U.S. Coast Guard.
- Clerks on site direct Young Brothers, Horizon Line, or Matson pickups and deliveries to designated areas.
- Drivers check out with clerks before exiting the yard through the Main Gate.

- Use of the South Gate is currently limited to days when two barges are operating at the Pier 2 / 2B berth. On those "double barge days", security procedures at the South Gate follow those typically employed at the Main Gate.

E. Truck Gates and Site Access Improvements

Though the criteria outlined in the Design Criteria section may be currently beyond the scope of operations at the Kawaihae Commercial Harbor, minor, incremental upgrades should still be considered. A security booth could be built to provide a housing station for security guards to operate. Additionally, the use of electronic hand held devices by the clerks to organize information such as: verifying empties are clean, checking seal numbers, checking hazardous materials paperwork, reefer temperature, and securing any information about the container the truck will be picking up from the terminal.

As is currently done when two barges are operating at the Pier 2 / 2B berth, ingress and egress via the South Gate of the harbor could be provided to increase the efficiency of traffic flow into and out of the port. Access via the South Gate also eliminates one (1) turn drivers need to negotiate within the harbor and facilitates straight line queuing of trucks waiting to pick up containers at Pier 2. The South Gate will provide direct and convenient access to the HDOT Harbor Office, Customer Services, and Customer Parking areas by visitors to the port. It could also be used by POV traffic related to the operator operating at the south end of the terminal, for auto imports and exports, and could also serve as either a normal access truck gate or limited to an overflow truck gate during peak cargo periods only.

The proposed new location of the HDOT Harbor Office and Customer Services areas near the South Gate will be convenient for visitors and will also enable the Port to maintain a higher level of security since visitor activities are restricted to the perimeter directly adjacent to the South Gate. Visitors to the Port would no longer be required to drive through the operating port to visit the Port offices.

VII. OPERATIONAL ISSUES

A. Project Elements and Increases in Operations Activity

The 2035 High Case "Phase Three" plan of the Hawaii Commercial Harbors 2035 Master Plan (M&N Drawing No. 8826-205) is an interim step towards developing the full potential of Kawaihae Commercial Harbor required to accommodate projected volumes in 2035. Based upon future cargo forecasts, the primary need at Kawaihae Commercial Harbor by 2035 is additional berth and yard capacity to accommodate growing container volumes. This is not to say that break bulk, lumber, cement and petrochemical volumes will not grow, just not to the extent that container traffic is projected to.

At present, the berths at the Kawaihae Commercial Harbor have a capacity of roughly 2.4 million foot-hours per annum. Current vessel traffic includes roughly 5 to 6 calls per week of barges carrying mixed and dedicated volumes of containers, break bulk cargo (LCL) and autos. Cement barges call roughly every 3 weeks and barges with gas, diesel and other petrochemicals approximately every 5 weeks. The current occupancy of the Kawaihae Commercial Harbor berths at these traffic levels is approximately 1.2 million foot-hours. Based on projections for 2035, Kawaihae Commercial Harbor will need to increase berth capacity to 4.3 million foot-hours. This is an almost doubling of current capacity.

The "Phase Three" plan will increase berth capacity to roughly 3.4 million foot-hours. At this level of berth capacity, vessel traffic volumes have the ability to increase almost threefold. However, the addition of the 340-foot and 325-foot berth extensions to Pier 2 / 2B as part of the "Phase Three" plan is not solely about adding berth capacity, put to allow for less reliance on the exposed Pier 1 berth, permit a reconstruction of the existing Pier 2, and allow for the simultaneous berthing of three cargo barges and one fuel barge along the Pier 2A, 2, 2B, and 2C berth.

The "Phase Three" plan essentially adds little additional working land or storage area to Kawaihae Commercial Harbor from what is available at present. The primary area added is to the current loading and dinghy dock area south of Pier 2B. More so, the plan calls for a rationalization of current assets and streamlining of current operations. Current cement, break bulk cargo, lumber and petrochemical storage can accommodate projected 2035 volumes. Additional storage is therefore essentially required for auto imports and exports plus container traffic.

The auto import/export area as part the "Phase Three" plan provides the full acreage necessary to accommodate 2035 traffic projections and is located in its final preferred full build out location.

The reconfigured container yard comprising of chassis and grounded storage is ultimately intended for one operator where the second operator will move over and occupy new facilities at the Coral Flats area in order to meet 2035 container projections.

The near term estimated container throughput capacity of the current Kawaihae Commercial Harbor is 175,000 TEUs per annum. The "Phase Three" plan will roughly increase that capacity to 225,000 TEUs per annum. This capacity will permit an approximate doubling of current container volumes.

The "Phase Three" plan can therefore accommodate the following growth estimates from present levels at Kawaihae Commercial Harbor:

- 100%+/- growth in cement volumes.
- 300%+/- growth in gas/diesel/petrochemical volumes
- 100%+/- growth in auto import and exports

- 125%+/- growth in container volumes

To accommodate such cargo increases, vessel traffic will have to double current levels, including utilizing larger barges that are already being introduced. Truck traffic, and POV traffic, to and from the terminal will likely more than double from current levels.

B. Discussion of Potential Impacts and Benefits from Improvements

The potential doubling of activity at Kawaihae Commercial Harbor under the 2035 High Case "Phase Three" plan will have operational considerations and impacts on the facility, and on the surrounding areas.

The increase in barge activity will necessitate the removal of recreational craft that presently anchor in the harbor near the Coral Flats. This will require development of alternative moorage.

With increased barge activity, additional tugs will be required by operators and also additional barges, most likely larger 400 ft. barges that are apparently being proposed by operators. Additional tugs and calls may lead to increased emissions. With a doubling of vessel calls, greater marine traffic may require enhanced navigational aids and marine vessel traffic coordination and safety review by the US Coast Guard and other agencies.

Terminal operations must be enhanced to accommodate a doubling of potential volumes. This will necessitate additional work shifts that could require the retention of additional labor along with more support staff. Depending on vessel schedules, additional cargo handling equipment may, and will likely, be required. At the very least, there will be a roughly doubling of equipment operating hours. This will result in increased emissions and likely increased wear on equipment and pavements resulting in enhanced maintenance of both.

Of equal importance is the new ability to accommodate 5 barges simultaneously and, as a result, the harbor can experience high peak demands on harbor resources including labor and equipment. Peak demands can often cause distress in operational systems, and are best avoided through effective coordination and scheduling. Regardless, if 4 or 5 barges do call simultaneously the need for more labor and equipment will be very apparent.

Fortunately, the streamlining and separation of primary harbor activities through the "Phase Three" plan will make operations smoother. The dedication of Pier 1 to cement and the 340 foot Pier 2A extension to petrochemicals will provide the ability to dedicate and separate cement and fuel unloading from container and general cargo operations. This removes conflicts that even occur presently. The rationalization of the container yard, and distribution of the yard amongst chassis import and grounded export that better reflects traditional splits, will assist with operations. The systematic container storage blocks and aligned aisles will improve internal traffic flows to assist with the increase in volumes and possible peaking demands.

However, until the Coral Flats area is developed, which will allow for a clear separation of operator areas, the shared use of the Pier 2 container yard will require coordination and cooperation of the operators. Fortunately, the streamlined blocks can be easily re-assigned and re-designated as market demands dictate.

Auto imports and exports will now be consolidated at the south end of the harbor where operators can share and better utilize parking space to more effectively accommodate the high peak demands for auto storage.

A key feature of the "Phase Three" plan that will improve operations – along with safety and security – is the location of HDOT and operator administration functions, plus associated POV parking, and the inspection and quarantine area, to the periphery of the harbor. This will enable cargo operations to be conducted without interference of non-essential traffic, personnel and visitors, and will allow the State DOA to screen cargo for invasive species in its own,

secure area. This will also greatly enhance the ability to accommodate increasing cargo volumes within essentially the same area that exists currently.

With more cargo will come more trucks although with closer coordination, scheduling and more double transactions, the amount of truck traffic can be mitigated. The processing procedure for trucks entering and departing the harbor will remain essentially manual with face-to-face interaction with clerks. This was requested by operators. The Main Gate, although intended to serve a single Pier 2 operator once the Coral Flats is developed for the second operator, can accommodate multiple operators through proper signage. As a result of its increased queuing capacity, all cargo traffic, with the exception of auto imports and exports, is expected to use the Main Gate, although the South Gate may be used to accommodate overflow as it currently does. At both the Main Gate and South Gate, all traffic must pass through a single security checkpoint first. Cargo trucks will then proceed for processing at a secondary station – at the Main Gate, 6 lanes with queuing space is provided; at the South Gate, trucks queue in a straight line. Once in the terminal, the streamlined and systematic container yard will improve traffic flows and truck turnaround times. The South Gate will be used by POV traffic related to the second operator, HDOT personnel and inspection personnel such as DOA. Auto imports and exports will use the South Gate which can also serve as potential overflow gate during peak cargo periods, as it presently does. The use of the South Gate, and the resultant reduction of traffic from the Main Gate, will improve capacity at the Main Gate/Kawaihae Road intersection.

Hawaii Department of Transportation Harbors Division
Kawaihae Commercial Harbor EA
Conceptual Level Design (10%) Engineering Report

VIII. ORDER OF MAGNITUDE COST ESTIMATE

The total Order-of-Magnitude cost estimate for the Kawaihae Commercial Harbor elements identified in the EA Plan is $128-million. The detailed line item estimate is presented in *Appendix B*.

In the absence of preliminary or detailed engineering design and analysis, estimates for the scope of work and quantity take-offs are based on the general arrangement alternatives drawings. As a result, a contingency allowance of 35% is included in the total cost to account for the undefined or indeterminate items. It must be emphasized that these estimates are approximate at this stage and will be subject to revision as HDOT Harbors Division moves forward and more detailed planning and engineering analysis is performed.

The unit rates are based on mid-2011 cost levels and do not allow for future escalation. The individual unit rates have been developed based on recent cost estimates and contract pricing data for similar project in Hawaii, Guam, California, Washington State and British Columbia, Canada, discussions with manufacturers and suppliers, and *RSMeans* "Heavy Construction Handbook" cost data (*RSMeans* is commercially-available, annually-updated construction cost data published by Reed Construction Data, Inc.). All costs exclude all applicable taxes and duties.

Pricing shall be considered "order-of-magnitude" due to the level of engineering analysis and design completed to date. Also, the future construction market and commodity prices, which cannot be more accurately determined at this time, may add variability to the costs at the time of bid and construction.

The following descriptions provide additional information regarding the assumptions made in formulating the quantities and unit costs.

Mobilization / Demobilization

This item includes the cost of mobilizing marine and land based equipment and personnel for the specified work and includes incidental contractor project costs such as providing site offices, personnel and overhead costs, as well as project insurance and bonding. The lump sum allowance for this item is estimated to be approximately 5% of the construction cost.

Temporary Works

This item includes a lump sum allowance for providing temporary works during construction, such as site access, security measures, barriers, fencing, traffic control, dust control, works to protect existing facilities, power, and other miscellaneous temporary works.

Dredging

The dredged material for the Kawaihae site has been assumed to be sandy gravel and gravelly, calcareous sand with silt, as well as some cobbles and boulders. It has been assumed that the dredge material does not contain hazardous materials though this should be assessed during future detailed engineering and design. It has been assumed that mechanical dredging will be performed using a clamshell dredge bucket operated from a barge-mounted crane. It is noted that the cost of the dredging program can vary significantly depending on the specific characteristics of the dredge materials, dredge method used, and the method of dredge material disposal.

Wharf Structures

The unit cost for the wharf structures are assumed to include miscellaneous wharf elements such as mooring bollards, fender units, and navigation lights. The unit cost for the barge vessel wharves is based on similar wharf structures designed or constructed on the west coast of North America, adjusted for Hawaii. It is noted that the cost of the berth structures can vary significantly depending

on the characteristics of the existing soils, seismic design criteria and ground improvement program, if deemed necessary during future design.

Foreshore Fill

This item includes the infill required within the wharf areas. The quantities were estimated based on the imported fill required to extend the existing shoreline to the proposed foreshore slope (2H:1V) located underneath the various wharf structures, with the toe of the slope to match the berth face alignment. This cost is based on placing imported granular fill materials to ensure proper compaction is achieved in the wharf area using land-based equipment.

Slope and Scour Protection

This item includes the quarried riprap stone and filter stone (under layer) that is required for the new wharf structures for Kawaihae. The costs of the slope protection are based on providing a nominal 7.5 ft thick layer of imported rip rap and filter stone. The costs of the scour protection are based on providing a nominal 3 ft thick layer of imported rip rap and filter stone.

Miscellaneous Demolition

A lump sum allowance is included to account for small miscellaneous items that are not explicitly shown on the drawings, including fencing, barriers, curbs, small pavement areas, signage, etc.

Clear and Grub

This item includes the site clearing and grubbing of surface vegetation and miscellaneous organics / trash for the new cargo upland areas.

Upland Infill

This item includes the fill that is required to raise the grade for the new cargo barge upland area for Kawaihae Commercial Harbor. The existing sand from surrounding area is expected to be available in sufficient quantities with no imported materials needed. It is assumed that the new cargo upland area will need on average to be raised 5 ft. The unit rate is based on using large earth moving equipment such as a CAT D8.

Bulk Excavation

This item includes the excavation to sub-grade that is required to install a new pavement structure for the areas identified on the drawings. This includes removal of the existing pavements, base gravels, and in some localized high areas where excavation of the subgrade is needed to match the existing grades. The cost is based on off-site disposal of all excavated materials (no reuse of materials is assumed; material assumed to be free of hazardous materials).

Heavy Duty Pavement

This item includes the entire Portland cement concrete pavement structure for the wharf areas, including the cast-in-place concrete, dowels, reinforcement and underlying aggregate base courses for the heavy duty pavement areas identified for primarily the top-pick grounded container storage and chassis areas. The unit costs are based on a pavement structure up to 2.1 feet thick (16”-17.5”” of PCC over 8” of aggregate base stone) suitable for the container handling equipment (top picks) within the wharf and container handling areas.

Medium / Light Duty Pavement

This item includes the entire asphalt pavement structure for the upland areas and access roads, including the asphalt cement course and underlying aggregate base courses for the remaining new pavement areas identified. The unit costs are based on a pavement structure up to 1.5 ft thick (8” asphalt over 10” aggregate base stone) is assumed adequate for the parking areas, access roads and general upland area infill pavements.

Fencing

This item includes a typical 8’-0” high chainlink fence, topped with three-strand, 1-foot high, razor or barbed wire, including gates, foundations and electrical grounding.

Barriers

This item includes a standard Jersey type precast concrete barrier for the access to the new cargo barge area for Kawaihae Commercial Harbor.

Pavement Markings

This item includes all required pavement markings for the top pick and chassis container areas, auto parking areas, and POV parking lots. The lump sum allowance also includes miscellaneous signage not indicated on the drawings.

Fire Hydrants

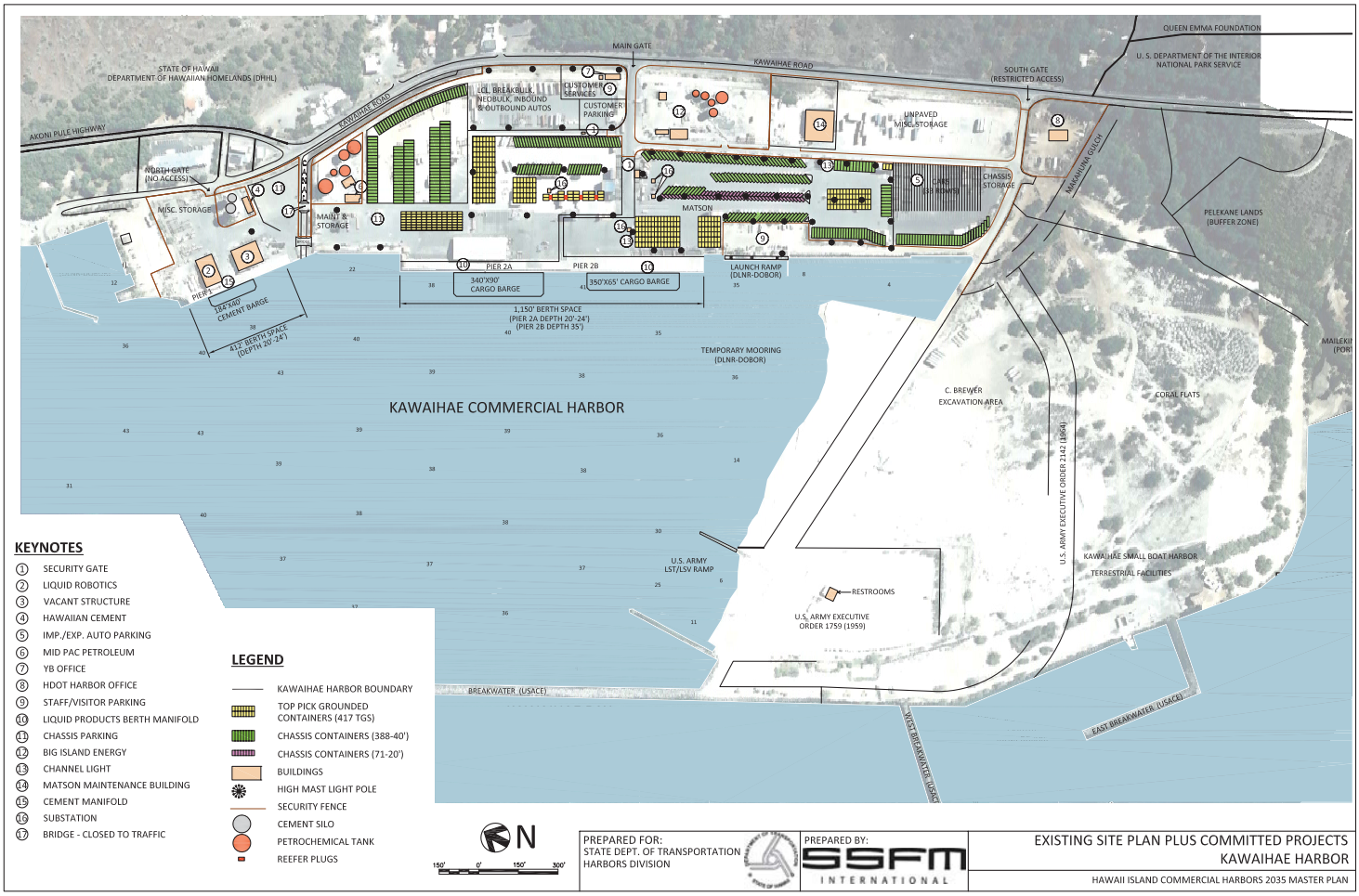
This item includes relocating existing fire hydrants within the Pier 2 container yard adjacent to new or relocated light poles, spaced at approximately 300 feet apart.

Lighting Poles

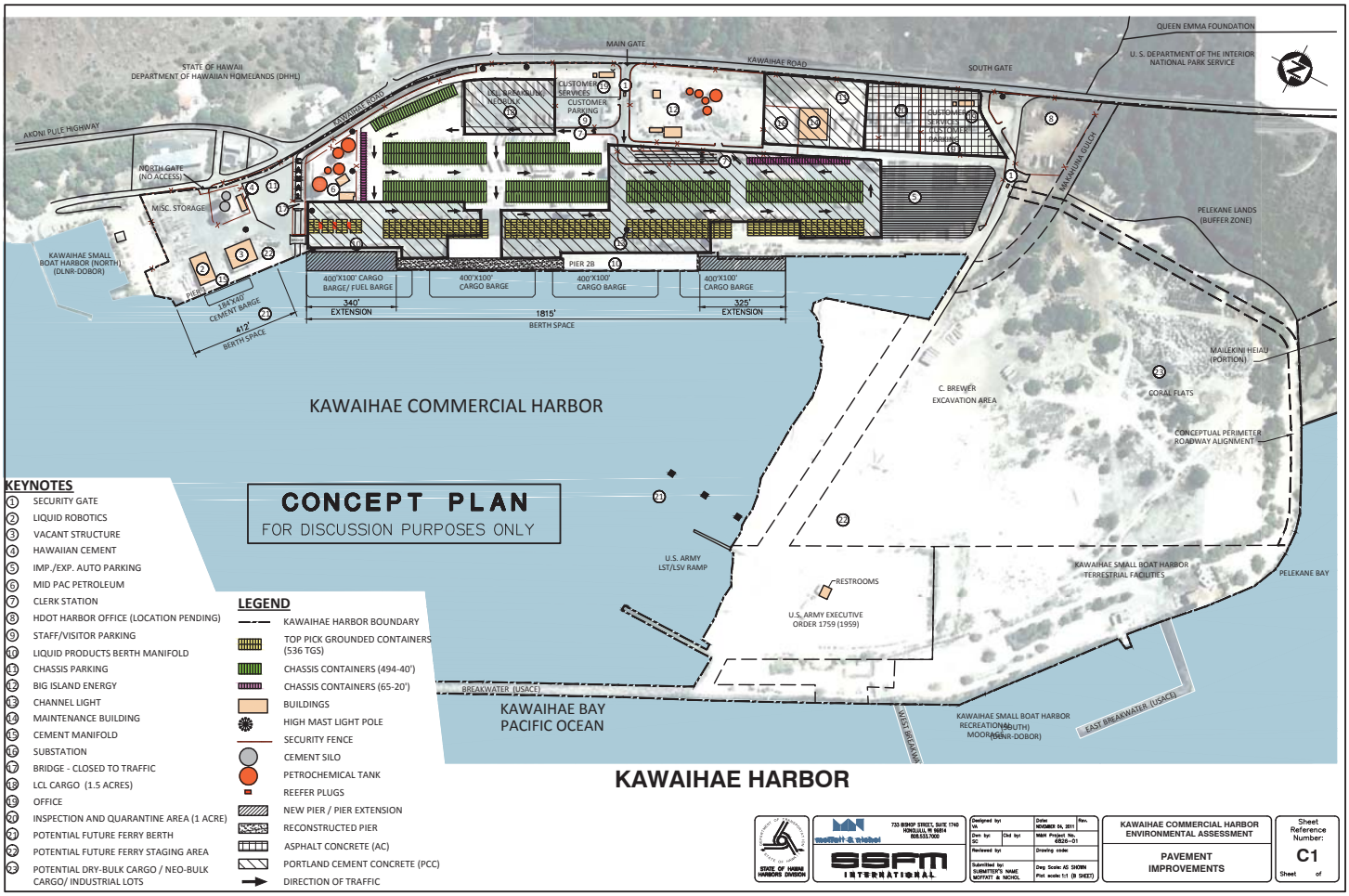
This item includes new 39’-0” light pole with lamp pole base (30-3/4”), concrete pedestal foundation (4’-11”), with related electrical distribution; maximum height of light poles, from finish grade to top of pole cap, is 46’-6”. The light fixtures are based on low-pressure sodium floodlights fitted with light shields / housing.

Truck Gate

This item includes gate arms and foundations, signage, barriers, etc. that are not included elsewhere in the estimate. The cost does not include any automated gate processing and communication equipment such as intercoms and cameras.



APPENDIX A
Conceptual Plans



KEYNOTES

1. SECURITY GATE
2. LIQUID ROBOTICS
3. VACANT STRUCTURE
4. HAWAIIAN CEMENT
5. IMP./EXP. AUTO PARKING
6. MID PAC PETROLEUM
7. CLERK STATION
8. HDOT HARBOR OFFICE (LOCATION PENDING)
9. STAFF/VISITOR PARKING
10. LIQUID PRODUCTS BERTH MANIFOLD
11. CHASSIS PARKING
12. BIG ISLAND ENERGY
13. CHANNEL LIGHT
14. MAINTENANCE BUILDING
15. CEMENT MANIFOLD
16. SUBSTATION
17. BRIDGE - CLOSED TO TRAFFIC
18. LCL CARGO (1.5 ACRES)
19. OFFICE
20. INSPECTION AND QUARANTINE AREA (1 ACRE)
21. POTENTIAL FUTURE FERRY BERTH
22. POTENTIAL FUTURE FERRY STAGING AREA
23. POTENTIAL DRY-BULK CARGO / NEO-BULK CARGO/ INDUSTRIAL LOTS

CONCEPT PLAN
FOR DISCUSSION PURPOSES ONLY

LEGEND

- KAWAIHAE HARBOR BOUNDARY
- TOP PICK GROUNDED CONTAINERS (536 TGS)
- CHASSIS CONTAINERS (494-40')
- CHASSIS CONTAINERS (65-20')
- BUILDINGS
- HIGH MAST LIGHT POLE
- SECURITY FENCE
- CEMENT SILO
- PETROCHEMICAL TANK
- REEFER PLUGS
- NEW PIER / PIER EXTENSION
- RECONSTRUCTED PIER
- ASPHALT CONCRETE (AC)
- PORTLAND CEMENT CONCRETE (PCC)
- DIRECTION OF TRAFFIC

STATE OF HAWAII HARBORS DIVISION

733 BISHOP STREET, SUITE 1740 HONOLULU, HI 96814 808.533.7000

SSFM INTERNATIONAL

Designed by: HB	Date: NOVEMBER 04, 2011	Rev.
Dwn. by: SC / Chd. by:	M&H Project No. 6826-01	
Reviewed by:	Drawing code:	
Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL	Dwg. Scale: AS SHOWN Plot. scale: 1:1 (F SHEET)	

KAWAIHAE COMMERCIAL HARBOR ENVIRONMENTAL ASSESSMENT

PAVEMENT IMPROVEMENTS

Sheet Reference Number: **C1**

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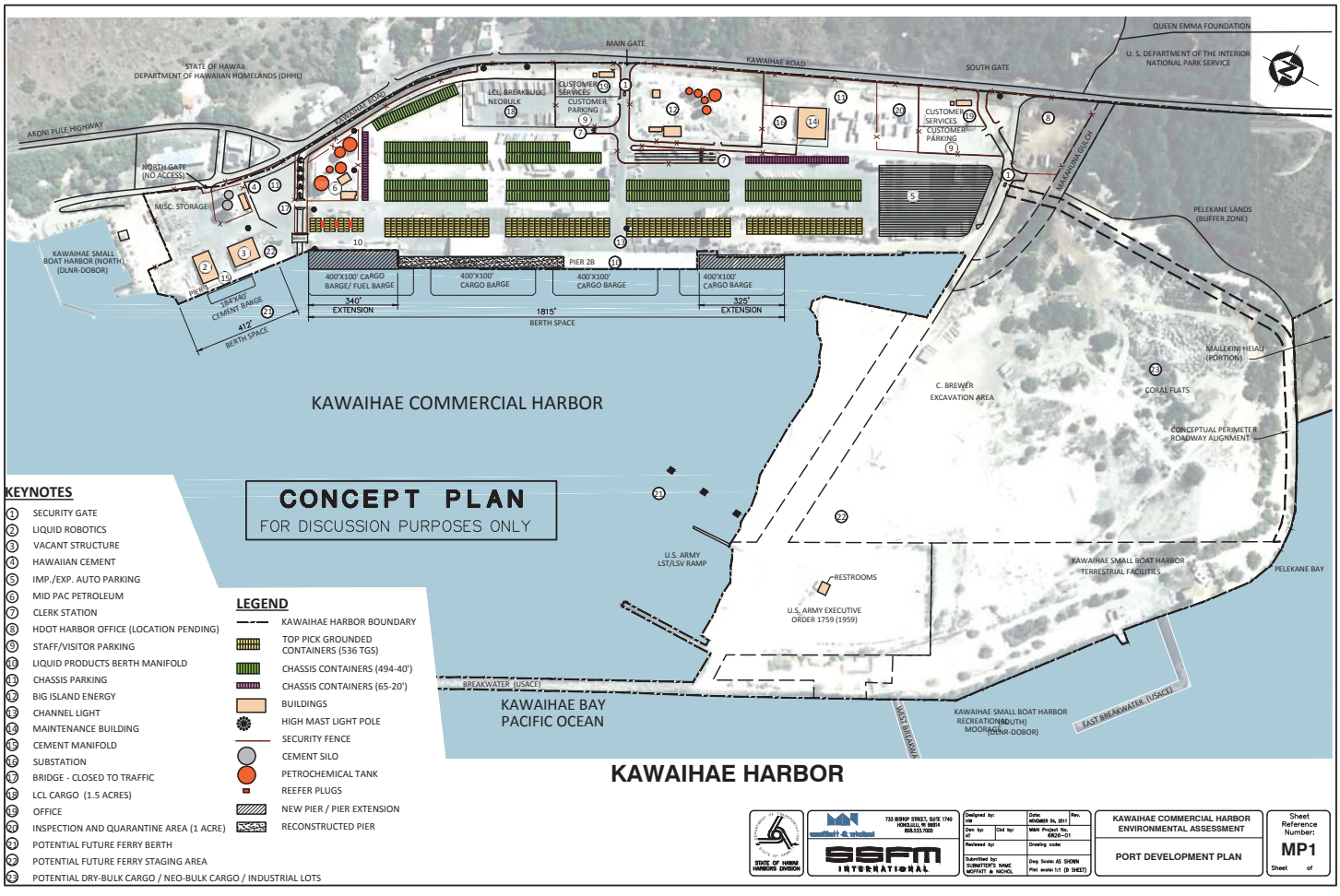

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FOR DISCUSSION PURPOSES ONLY

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- NEW PIER / PIER EXTENSION
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STATE OF HAWAII HARBORS DIVISION

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Reviewed by:	Drawing code:	
Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL	Dwg. Scale: AS SHOWN Plot. scale: 1:1 (F SHEET)	

KAWAIHAE COMMERCIAL HARBOR ENVIRONMENTAL ASSESSMENT

PORT DEVELOPMENT PLAN

Sheet Reference Number: **MP1**

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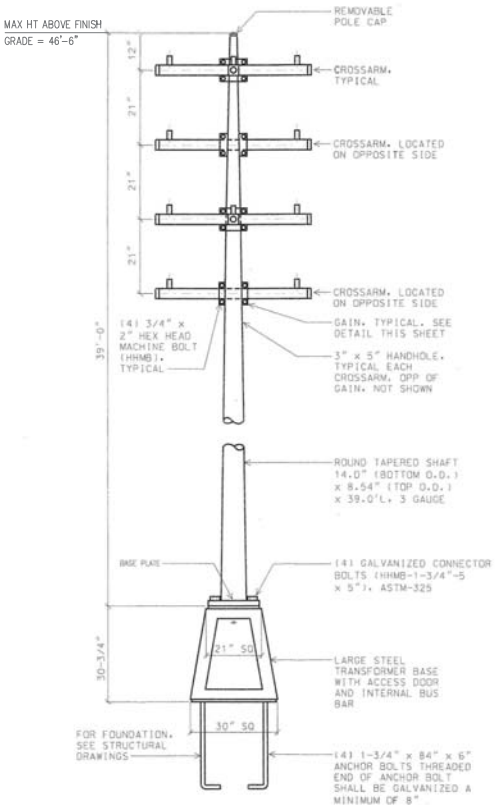

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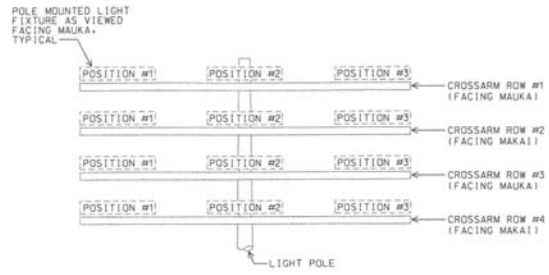
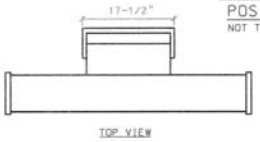
LIGHT POLE DETAILS
NOT TO SCALE

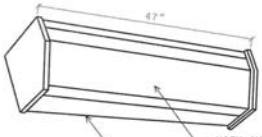


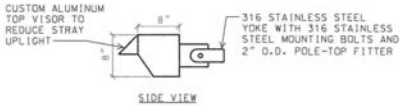
TYPICAL LIGHT FIXTURE POSITIONING ELEVATION
NOT TO SCALE



TOP VIEW

HOUSING	EXTRUDED AND DIE-CAST ALUMINUM
LENS	HIGH-IMPACT RESISTANT POLYCARBONATE LENS
LAMP	180W LPS
BALLAST	208V. HIGH POWER FACTOR
FINISH	DARK BRONZE





SIDE VIEW

LOW PRESSURE SODIUM FLOODLIGHT DETAIL
NOT TO SCALE

STATE OF HAWAII HARBORS DIVISION

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moffatt & nichol

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Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL	Dwg Scale: AS SHOWN Plot scale: 1:1 (D SHEET)	

KAWAIHAE COMMERCIAL HARBOR ENVIRONMENTAL ASSESSMENT

LIGHT POLE DETAILS

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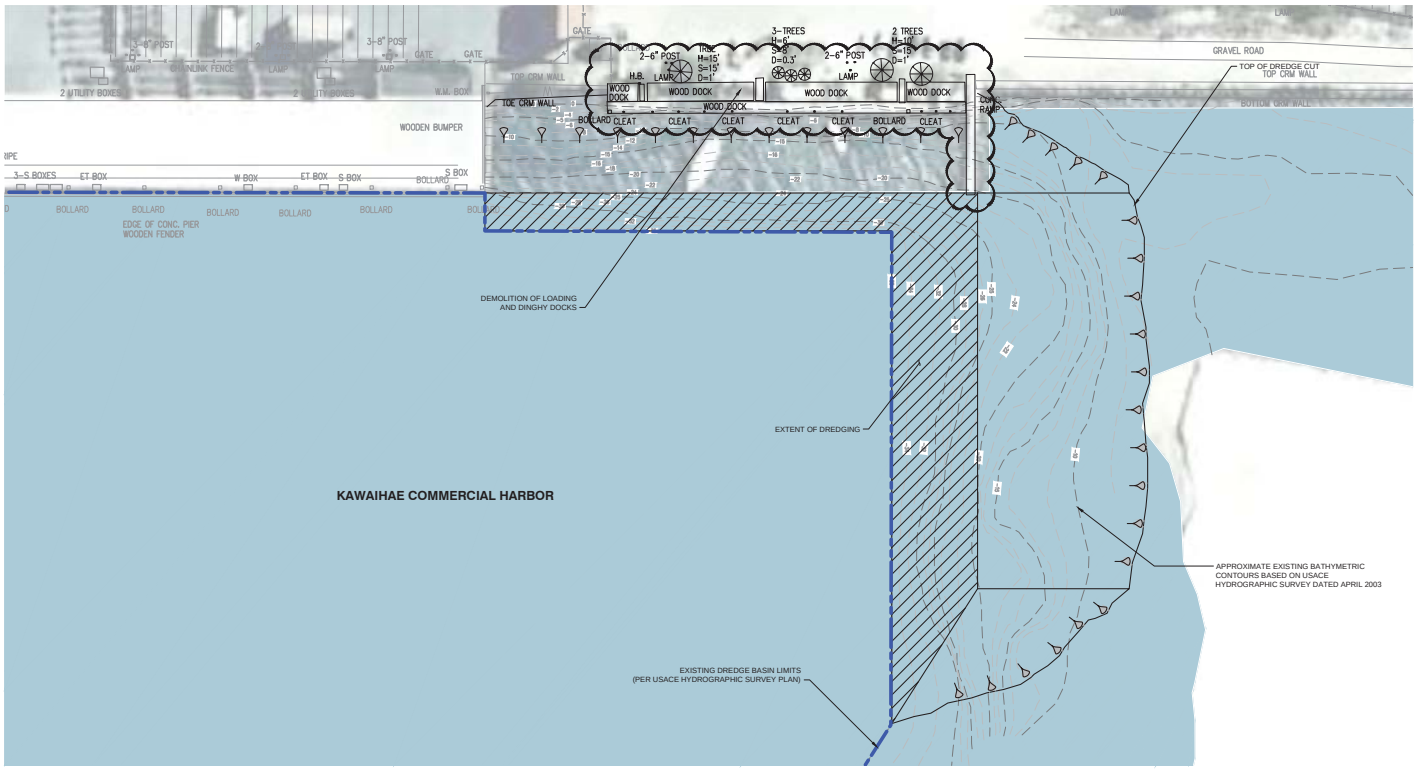
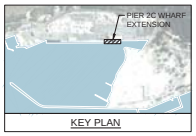


PIER 2C WHARF EXTENSION



KEY PLAN

STATE OF HAWAII HARBORS DIVISION

733 BISHOP STREET, SUITE 1740 HONOLULU, HI 96814 808.533.7000

moffatt & nichol

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Drn. by: WS Chd by:	M&N Project No. 6826-01	
Reviewed by:	Drawing code:	
Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL	Dwg Scale: AS SHOWN Plot scale: 1:1 (D SHEET)	

KAWAIHAE COMMERCIAL HARBOR ENVIRONMENTAL ASSESSMENT

DEMOLITION AND DREDGING PLAN

Sheet Reference Number: C2

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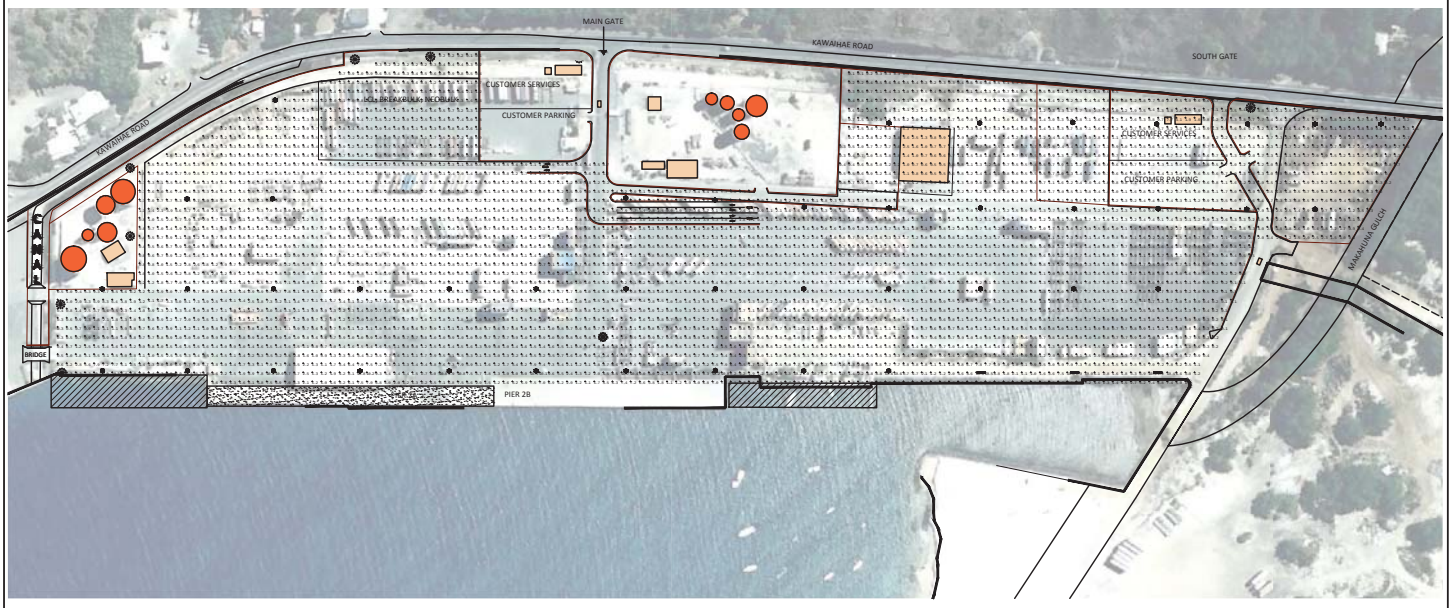

KAWAIHAE HARBOR

STATE OF HAWAII HARBORS DIVISION

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Reviewed by:		Drawing code:	
Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL		Dwg Scale: AS SHOWN Plot scale: 1:1 (B SHEET)	

KAWAIHAE COMMERCIAL HARBOR ENVIRONMENTAL ASSESSMENT

EXHIBIT PHOTOMETRIC

Sheet Reference Number: E3

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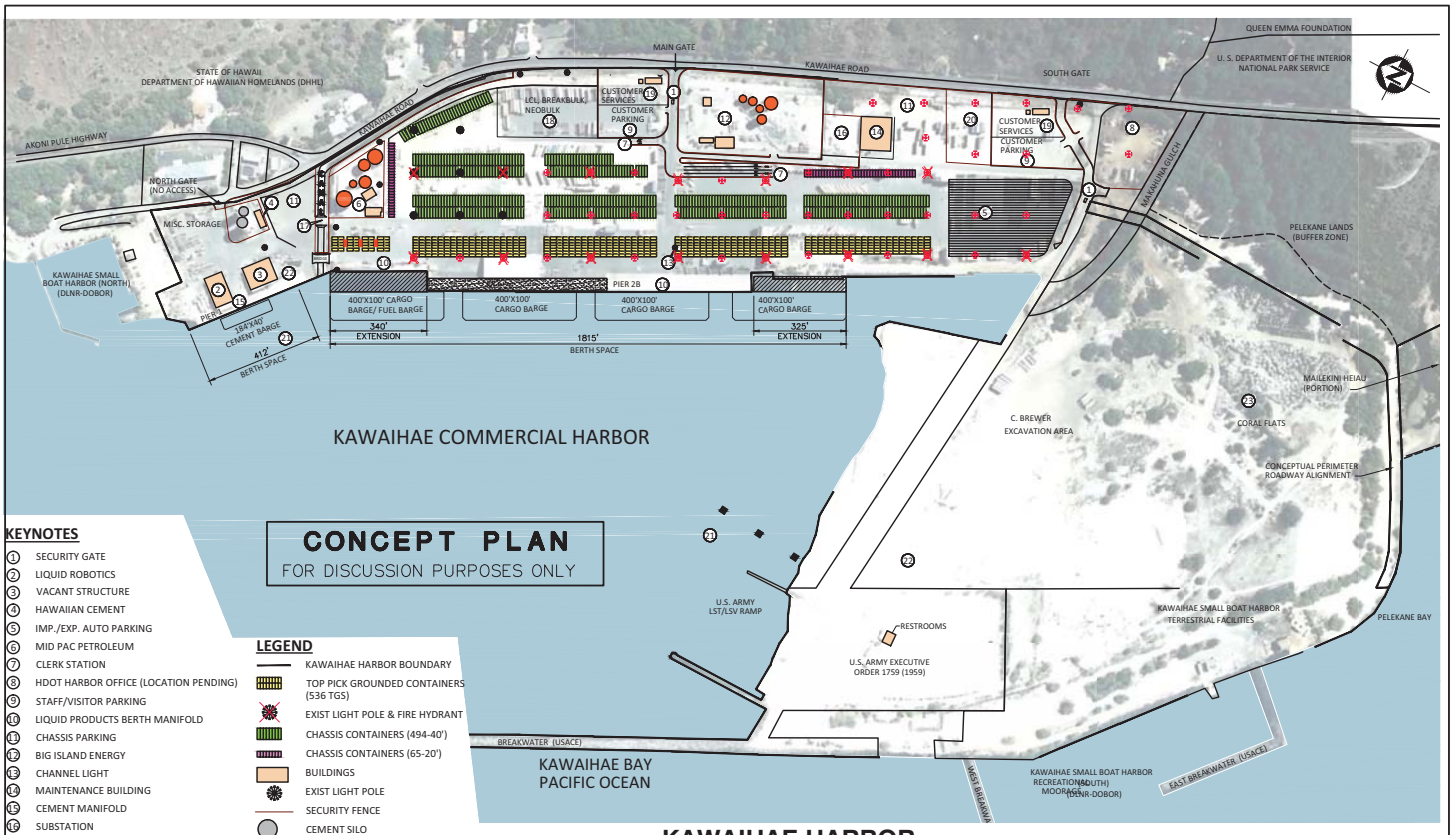

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10. LIQUID PRODUCTS BERTH MANIFOLD
11. CHASSIS PARKING
12. BIG ISLAND ENERGY
13. CHANNEL LIGHT
14. MAINTENANCE BUILDING
15. CEMENT MANIFOLD
16. SUBSTATION
17. BRIDGE - CLOSED TO TRAFFIC
18. LCL CARGO (1.5 ACRES)
19. OFFICE
20. INSPECTION AND QUARANTINE AREA (1 ACRE)
21. POTENTIAL FUTURE FERRY BERTH
22. POTENTIAL FUTURE FERRY STAGING AREA
23. POTENTIAL DRY-BULK CARGO / NEO-BULK CARGO / INDUSTRIAL LOTS

LEGEND

- KAWAIHAE HARBOR BOUNDARY
- TOP PICK GROUNDED CONTAINERS (536 TGS)
- EXIST LIGHT POLE & FIRE HYDRANT
- CHASSIS CONTAINERS (494-40')
- CHASSIS CONTAINERS (65-20')
- BUILDINGS
- EXIST LIGHT POLE
- SECURITY FENCE
- CEMENT SILO
- PETROCHEMICAL TANK
- REEFER PLUGS
- NEW PIER / PIER EXTENSION
- RECONSTRUCTED PIER
- NEW LIGHT POLE
- NEW LIGHT POLE & NEW FIRE HYDRANT

KAWAIHAE HARBOR

160' 0' 160' 320'
SCALE: 1"=160'

STATE OF HAWAII HARBORS DIVISION

mottalt & nichol
733 BISHOP STREET, SUITE 1740
HONOLULU, HI 96814
808.533.7000

SSFM INTERNATIONAL

Designed by:		Date: NOVEMBER 04, 2011	Rev.
Dwn by: AT	Ckd by:	M&N Project No. 6826-01	
Reviewed by:		Drawing code:	
Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL		Dwg Scale: AS SHOWN Plot scale: 1:1 (B SHEET)	

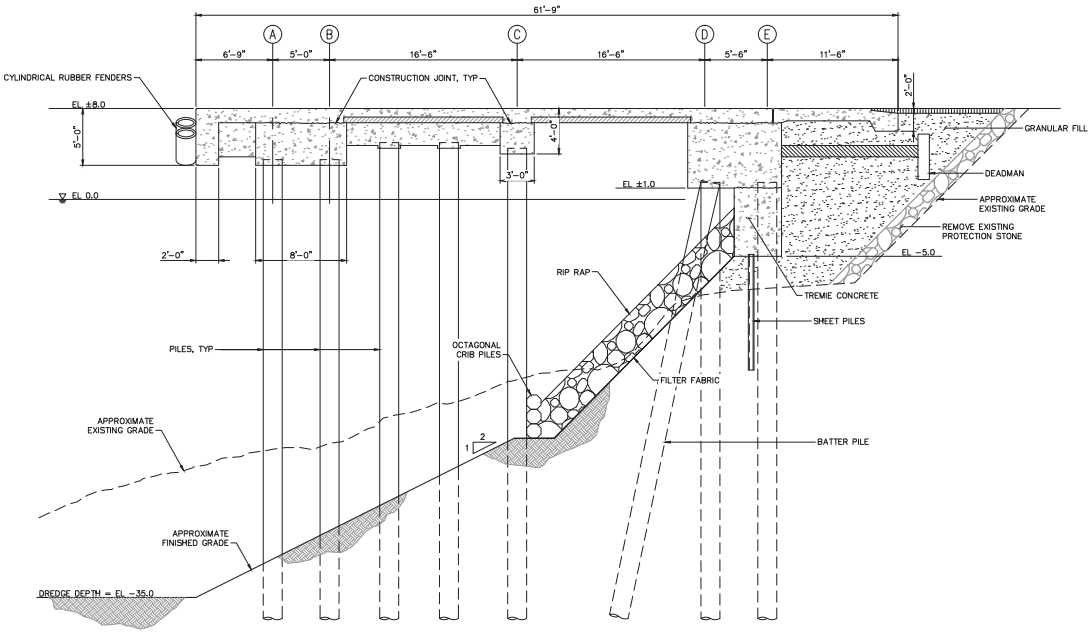
KAWAIHAE COMMERCIAL HARBOR ENVIRONMENTAL ASSESSMENT

MODIFIED LIGHTING AND FIRE HYDRANT PLAN

Sheet Reference Number: E2

Sheet of

File: P:\6826-01_Kaiahae_Kawaihae\Kawaihae\7 design information\Drawings\Exhibits\6826-01-E02; Plotted: 11/4/2011 4:48 PM by SMITH, WILLIAM; Saved: 11/4/2011 4:48 PM by WSMITH



WHARF EXTENSION

File: P:\16826-01_KahiHoc_JonesRoadArea\7 Design Information\Drawings\Exhibits\16826001-S02; Plotted: 11/4/2011 4:50 PM by SMITH, WILLIAM; Saved: 11/4/2011 4:48 PM by WSMITH

STATE OF HAWAII HARBORS DIVISION

733 BISHOP STREET, SUITE 1740
HONOLULU, HI 96814
808.533.7000

mottmac

SSFM INTERNATIONAL

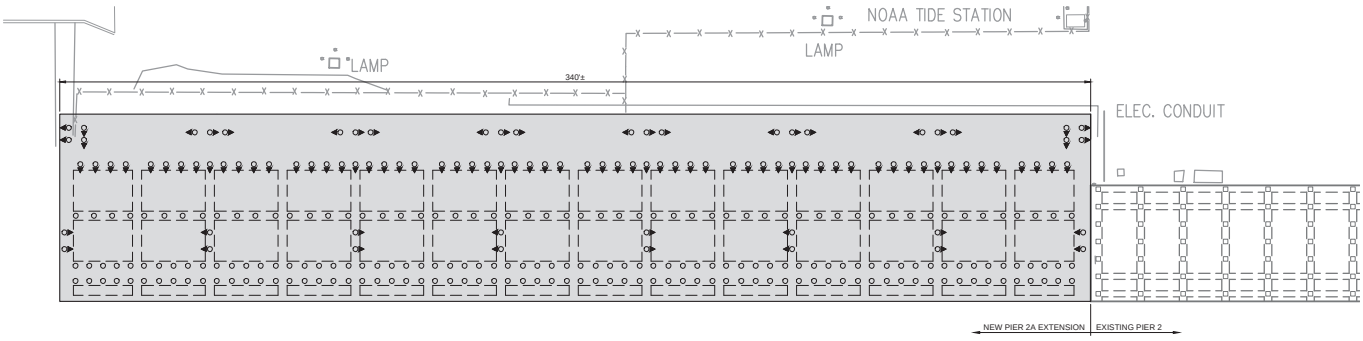
Designed by: VS	Date: NOVEMBER 04, 2011	Rev.
Dwn. by: WS	Chd. by:	MAH Project No. 6826-01
Reviewed by:		Drawing code:
Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL		Dwg Scale: AS SHOWN Plot scale: 1:1 (B SHEET)

KAWAIHAE COMMERCIAL HARBOR ENVIRONMENTAL ASSESSMENT

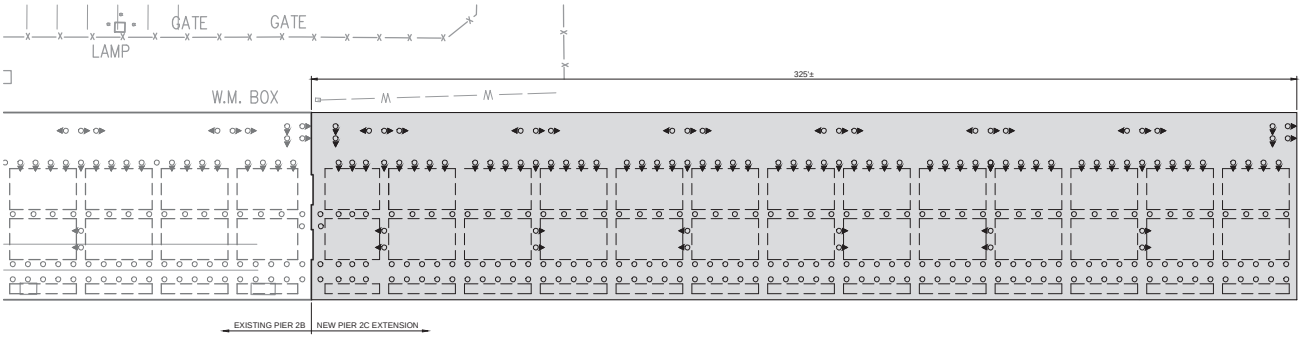
NORTH & SOUTH WHARF TYPICAL SECTIONS

Sheet Reference Number: **S2**

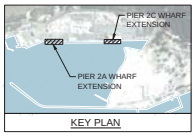
Sheet of



PIER 2A WHARF EXTENSION



PIER 2C WHARF EXTENSION



KEY PLAN

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N

STATE OF HAWAII HARBORS DIVISION

733 BISHOP STREET, SUITE 1740
HONOLULU, HI 96814
808.533.7000

mottmac

SSFM INTERNATIONAL

Designed by: VS	Date: NOVEMBER 04, 2011	Rev.
Dwn. by: WS	Chd. by:	MAH Project No. 6826-01
Reviewed by:		Drawing code:
Submitted by: SUBMITTER'S NAME MOFFATT & NICHOL		Dwg Scale: AS SHOWN Plot scale: 1:1 (B SHEET)

KAWAIHAE COMMERCIAL HARBOR ENVIRONMENTAL ASSESSMENT

NORTH & SOUTH WHARF EXTENSION SITE PLAN

Sheet Reference Number: **S1**

Sheet of

APPENDIX B

Itemized Order of Magnitude Cost Estimate

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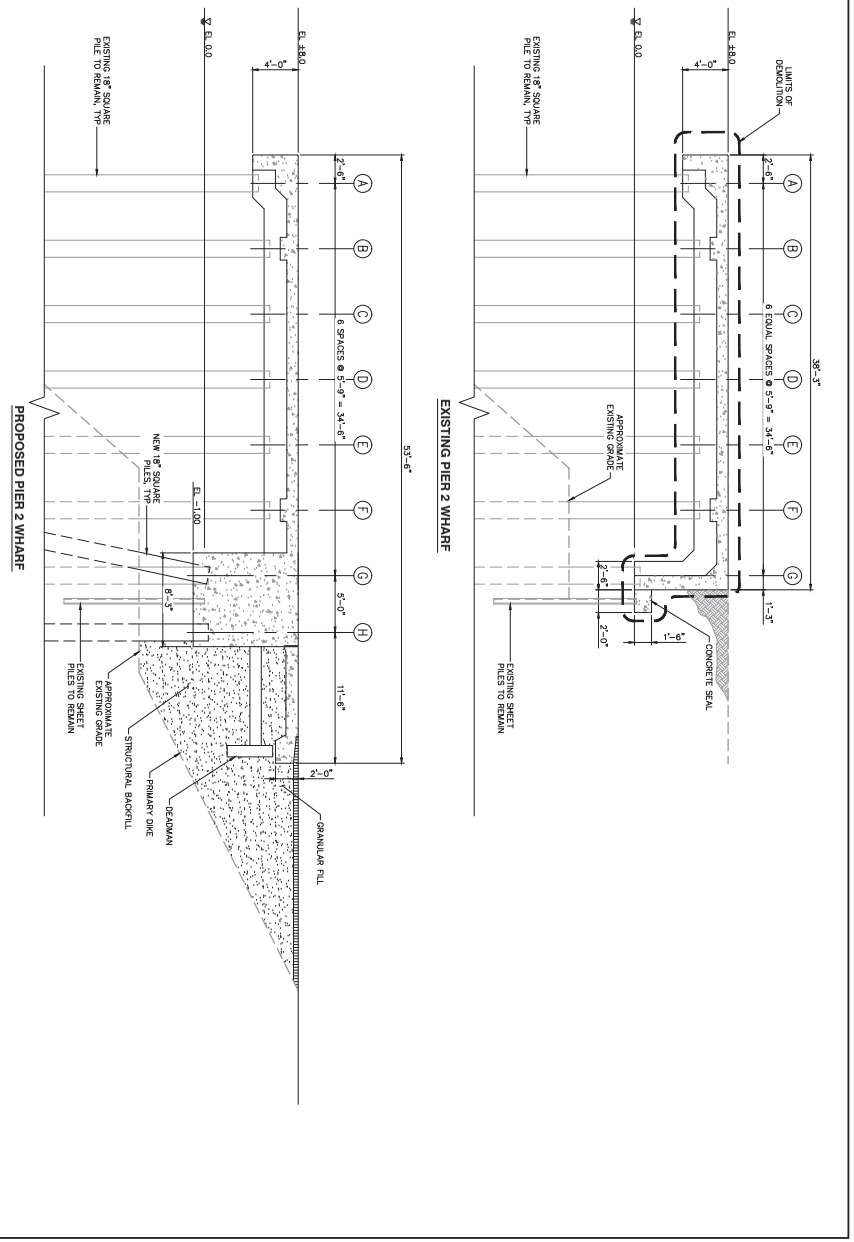

Parsons Brinckerhoff
1100 Alakea Street, Suite 1600
Honolulu, HI 96813-2836

SSFM INTERNATIONAL

STATE OF HAWAII DEPARTMENT OF TRANSPORTATION HARBORS DIVISION

Designed by:	Date:
JS	November 14, 2011
Drawn by:	Check by:
MS	WSMITH
Reviewed by:	Approved by:
	DAVID C. WATUMULL
Drawing status:	
FOR PLANNING PURPOSES ONLY, NOT SUBMITTED FOR PERMIT OR BIDDING	
Orig. Scale: AS SHOWN	
Plot Scale: 1:1 (F SIZE)	

KAWAIHAE COMMERCIAL HARBOR
ENVIRONMENTAL ASSESSMENT

PIER 2 REPAIR
TYPICAL SECTIONS

Sheet Reference Number: S3
Sheet of

Appendix B - Itemized Order of Magnitude Cost Estimate – Marine Structures and Dredging, Select Upland Yard Improvements

ITEM		DESCRIPTION	UNITS	EST QUANTITY	UNIT RATE	ITEM COST
1	**MOBILIZATION AND DEMOLITION**					
.1	Mobilization/Demobilization		L.S.	1	$4,500,000	$4,500,000
.2	Temporary Works		L.S.	0.15	$900,000	$135,000
		SUB-TOTAL FOR MOBILIZATION AND DEMOLITION				$4,635,000
2	**MARINE STRUCTURES AND DREDGING**					
.1	Dredging and Offsite Disposal		cu. yd.	30,000	$62	$1,860,000
.2	Demolition of Existing Pier 2 Superstructure		sq.ft	25,000	$70	$1,750,000
.3	Demolition of Existing Loading and Dinghy Dock		sq.ft	8,500	$90	$765,000
.4	Reconstruct Pier 2 Superstructure		sq.ft	32,000	$440	$14,080,000
.5	New Pier 2A and 2C Extensions		sq.ft	41,250	$630	$25,987,500
.6	Foreshore Fill		cu. yd.	36,800	$60	$2,208,000
.7	Slope & Scour Protection		cu. yd.	14,200	$100	$1,420,000
.8	New Manifold		L.S.	1	$50,000	$50,000
		SUB-TOTAL FOR MARINE STRUCTURES AND DREDGING				$48,120,500
3	**UPLAND YARD IMPROVEMENT**					
3.1	Civil, Demolition and Site Preparation					
	.1	Fence Demolition	L.S.	0.75	$10,000	$7,500
	.2	Bulk Excavation	cu. yd.	140,000	$108	$15,120,000
	.3	Heavy Duty Pavement	sq.ft	700,000	$30	$21,000,000
	.4	Medium / Light Duty Pavement	sq.ft	117,600	$11	$1,293,600
	.5	Fencing	lin.ft	1,700	$60	$102,000
	.6	Pavement Markings	L.S.	0.60	$125,000	$75,000
	.7	Pipe Rack for Liquid Products Berth	L.S.	1	$50,000	$50,000
	.8	Fire Hydrant Relocation	L.S.	9	$50,000	$450,000
		Sub-total for Civil, Demolition and Site Preparation				$38,098,100

Hawaii Department of Transportation Harbors Division
Kawaihae Commercial Harbor EA
Conceptual Level Design (10%) Engineering Report

ITEM		DESCRIPTION	UNITS	EST QUANTITY	UNIT RATE	ITEM COST
3.2	Electrical					
	.1	Lighting Poles, Foundation, with related electrical distribution	EA	47	$80,000	$3,760,000
	.2	Modification to Existing Substation (for Yard Lighting Modification)	LS	1	$130,000	$130,000
					Sub-total for Electrical	$3,890,000
3.3	Truck Gate					
	.1	Clerk Booth	LS	2	$25,000	$50,000
					Sub-total for Truck Gate	$50,000
					SUB-TOTAL FOR UPLAND YARD IMPROVEMENTS	$42,038,100
					SUB-TOTAL CONSTRUCTION	**$94,793,600**
					CONTINGENCY ALLOWANCE **35%**	**$33,177,760**
					TOTAL CONSTRUCTION INCL. CONTINGENCY	**$127,971,360**
						round to $128 M

Appendix B: Public and Agency Consultation Efforts

Appendix B1: Agency Pre-Assessment Consultation

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United States Department of the Interior
U.S. GEOLOGICAL SURVEY
Pacific Islands Water Science Center
677 Ala Moana Blvd., Suite 415
Honolulu, Hawai'i 96813
Phone: (808) 587-2400/Fax: (808) 587-2401

TAKE PRIDE IN AMERICA

August 12, 2011

RECEIVED
AUG 15 2011
SSFM INTERNATIONAL, INC.
HAWAII

Mr. Douglas Zang, AICP
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, Hawai'i 96720

Dear Mr. Zang:

Subject: Kawaihae Commercial Harbor Improvements, Kawaihae, South Kohala District, Island of Hawai'i, Pre-Assessment Consultation for Draft Environmental Assessment

Thank you for forwarding the subject Pre-Assessment Consultation for Draft Environmental Assessment letter and project summary for review and comment by the staff of the U.S. Geological Survey Pacific Islands Water Science Center. We regret however, that due to prior commitments and lack of available staff, we are unable to review this document.

We appreciate the opportunity to participate in the review process.

Sincerely,

Ron Rickman

Ronald L. Rickman
Acting Center Director

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, Hawaii 96814-4700
(808) 944-2200 • Fax (808) 973-2941

SEP 12 2011

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SEP 13 2011
SSFM INTERNATIONAL, INC.
HAWAII

SSFM International, Inc.
Atten: Douglas Zang, AICP
99 Aupuni Street, Suite 202
Hilo, HI 96720

Dear Mr. Zang,

Thank you for your letter dated August 5, 2011 requesting comments from the National Marine Fisheries Service (NMFS) Pacific Islands Regional Office on the Kawaihae Commercial Harbor Improvements project on the Big Island of Hawai'i. We hope that these comments on potential impacts to protected marine species will be considered in the development of the Draft EIS.

The NMFS Pacific Islands Region's Protected Resources Division is concerned about how the development may affect four marine species protected under the Endangered Species Act (ESA) that frequent the area in question: the endangered humpback whale (*Megaptera novaeangliae*), the threatened green sea turtle (*Chelonia mydas*), the endangered hawksbill sea turtle (*Eretmochelys imbricata*), and the endangered Hawaiian monk seal (*Monachus schauinslandi*); and the Hawaiian spinner dolphin (*Stenella longirostris*) that is protected under the Marine Mammal Protection Act.

Should the construction of the Pier 2A extension, the new Pier 3, and the dredging of the harbor and occur during months when humpback whales are in residency, impacts could occur to the whales as they breed, give birth, and nurture their young in waters near the harbor. Humpback whales typically arrive in the Hawaiian Islands as early as October and may stay as late as May or early June. Potential impacts could occur from the noise of construction such as pile-driving and vessel activity, and also from dredging of the harbor. Increased vessel traffic resulting from the increased capacity of the harbor following improvements and expansion may also pose an increased risk of vessel collisions with whales and should be addressed in the DEIS.

Green sea turtles are frequently found in nearshore waters of Hawai'i and can reside within the harbor. Impacts from noise are not usually a concern due to the turtles' limited hearing capabilities; however, they could be affected by siltation from dredging operations which may affect foraging on algae within the harbor. Increased vessel traffic may also pose an increased risk of collision with sea turtles residing within the harbor.

Hawksbill turtles may also be found near the harbor, however they are not common. The potential for increased vessel traffic to pose a risk of collision with hawksbill turtles is not as much of a concern as it is for green turtles, but should also be addressed in the DEIS.

The Hawaiian monk seal is known to occur on the Big Island of Hawai'i and their numbers have recently been increasing within the Main Hawaiian Islands. Several pups have been born within the past few years on Hawai'i Island and it is likely this trend will continue. Monk seals may forage for food near the harbor or may haul out on shoreline areas, and could be affected by the noise of construction and dredging as well as by vessel traffic.

Hawaiian spinner dolphins have been observed to use an area just north of Kawaihae Harbor as a daytime resting area, where groups of dolphins come after foraging during the night at offshore feeding grounds, to rest, socialize, and nurture their young. Dolphins can be affected by the noise of construction and increased vessel traffic as it affects their ability to communicate, and they may temporarily abandon the area.

To reduce the potential for impacts to protected marine species, we recommend the following mitigating measures be incorporated into the project:

- A survey of the project area must be performed just prior to commencement or resumption of construction activity to ensure that no protected spec(ies) are in the project area. If protected spec(ies) are detected, construction activities must be postponed until the animal(s) voluntarily leave the area.

- If any listed spec(ies) enters the area during the conduct of construction activities, all activities must cease until the animal(s) voluntarily depart the area.

- All on-site project personnel must be apprised of the status of any listed spec(ies) potentially present in the project area and the protections afforded to those species under Federal laws. A brochure explaining the laws and guidelines for listed species in Hawaii, American Samoa, and Guam may be downloaded from http://www.nmfs.noaa.gov/prot_res/MMWatch/hawaii.htm.

- Any incidental take of marine mammals must be reported immediately to NOAA Fisheries' 24-hour hotline at 1-888-256-9840. Hawaii only: Any injuries to sea turtles must be reported immediately to NOAA Fisheries at 1-808-983-5730. Information reported must include the name and phone number of a point of contact, location of the incident, and nature of the take and/or injury.

We also recommend using the attached Best Management Practices to further reduce potential impacts to protected marine species from the construction of proposed harbor improvements. If you have any questions about the comment letter, please contact Jayne LeFors of my staff at (858) 546-5653 or at jayne.lefors@noaa.gov.

Sincerely,

for Alecia Van Atta
Assistant Regional Administrator
for Protected Resources

Attachment: Best Management Practices

Best Management Practices
National Oceanic and Atmospheric Administration, National Marine Fisheries Service
Pacific Islands Regional Office, Protected Resources Division

---

The National Marine Fisheries Service, Pacific Islands Regional Office recommends that the following measures, as appropriate and germane to specific projects, be incorporated into projects to minimize impacts on protected resources:

a. Turbidity and siltation from project-related work should be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.

b. Any construction-related debris that may pose an entanglement hazard to marine protected species must be removed from the project site if not actively being used and/or at the conclusion of the construction work.

c. All project-related materials and equipment placed in the water should be free of pollutants.

d. No project-related materials (fill, revetment rock, pipe, etc.) should be stockpiled in the water (intertidal zones, reef flats, stream channels, etc.)

e. No contamination (trash or debris disposal, alien species introductions etc.) of marine (reef flats, lagoons, open ocean, etc.) environments adjacent to the project site should result from project-related activities.

f. Fueling of project-related vehicles and equipment should take place away from the water. A contingency plan to control the accidental spills of petroleum products at the construction site should be developed. Absorbent pads, containment booms and skimmers will be stored on-site to facilitate the cleanup of petroleum spills.

g. Underlayer fills will be protected from erosion with core-loc units (or stones) as soon after placement as practicable.

h. Attempts must be made to prevent discharge of dredged material into the marine environment during the transporting and off-loading of dredged material.

i. Return flow of or run-off from dredged material stored at inland dewatering or storage sites must be prevented.

NEIL ABERCROMBIE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF THE SUPERINTENDENT

RECEIVED
AUG 19 2011
SSFM INTERNATIONAL, INC.
HAWAII

August 16, 2011

Mr. Douglas Zang, AICP
SSFM International
99 Aupuni Street, Suite 202
Hilo, Hawaii 96720

Dear Mr. Zang:

Subject: Kawaihae Commercial Harbor Improvements
Kawaihae, South Kohala District, Island of Hawaii
Pre-Assessment Consultation for Draft Environmental Assessment

The Department of Education (DOE) appreciates the opportunity to provide pre-consultation comments for the Draft Environmental Assessment (DEA) of the proposed Kawaihae Commercial Harbor Improvements.

Based on the project information provided, the DOE has no comment to offer at this time. Should the project scope be expanded to include residential development, however, the DOE would appreciate the opportunity to comment accordingly.

Should you have any questions, please do not hesitate to call Roy Ikeda of the Facilities Development Branch at (808) 377-8301.

Very truly yours,

Kathryn S. Matayoshi
Superintendant

KSM:jmb

c: Randolph Moore, Assistant Superintendant, OSFSS
Duane Kashiwai, Public Works Administrator, FDB

NEIL ABERCROMBIE
GOVERNOR

BRUCE A. COPPA
COMPTROLLER 11184.1

JAN S. GOUVEIA
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

AUG 23 2011

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AUG 25 2011
SSFM INTERNATIONAL, INC.
HAWAII

Mr. Douglas Zang, AICP
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, Hawaii 96720

Dear Mr. Zang:

Subject: Pre-Assessment Consultation for Draft Environmental Impact Statement
Kawaihae Commercial Harbor Improvements
Kawaihae, South Kohala District, Island of Hawaii

This is in response to your letter dated August 5, 2011 regarding the subject project. The proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

If you have any questions, please call me at 586-0400 or have your staff call Mr. David DePonte of the Public Works Division at 586-0492.

Sincerely,

BRUCE A. COPPA
State Comptroller

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

GUY H. KAULUKUKUI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

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AUG 29 2011
SSFM INTERNATIONAL, INC.
HAWAII

REF:OCCL:TM

Correspondence: HA 12-28

AUG 25 2011

Douglas Zang
SSFM International
99 Aupuni Street, Suite 202
Hilo, HI 96720

SUBJECT: Pre-Assessment Consultation for Kawaihae Commercial Harbor Improvements, South Kohala, Hawaii

Dear Mr. Zang:

The Office of Conservation and Coastal Lands (OCCL) has reviewed your correspondence regarding the subject matter. Kawaihae Commercial Harbor area is a nonconforming facility encumbered by various Executive Orders to the Department of Transportation and the Division of Boating and Ocean Recreation.

Submerged land in this location lie within the resource subzone of the Conservation District. We have no objections to the improvements within the existing harbor basin as proposed. Proposed land uses beyond the existing basin would require further review by the OCCL. Please consult with the Department's Division of Aquatic Resources.

Should you have any questions regarding this correspondence, contact Tiger Mills of our Office at (808) 587-0382.

Sincerely,

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

C: HDLO/DAR

From: Keola Lindsey
To: Douglas Zang
Subject: Kawaihae Commercial Harbor Draft Environmental Assessment
Date: Thursday, September 01, 2011 3:30:28 PM

Aloha Doug- Thank you for taking the time to speak with me today regarding your Ausgut 5, 2011 letter seeking comments ahead of a draft environmental assessment (DEA) which will be prepared pursuant to Chapter 343, Hawaii Revised States to support multiple facility improvements (improvements) proposed by the State of Hawai'i Department of Transportation (HDOT) at Kawaihae Commercial harbor on the Island of Hawai'i.

Based on the information contained within your letter the improvements are described in the recently completed HDOT *Hawaii Commercial Harbors 2035 Master Plan* and the DEA will be a primary support document to facilitate the HDOT completing them.

As I mentioned to you the following groups and/or organizations should be considered as the DEA process moves forward: Kawaihae Canoe Club, Pua ka Ilima o Kawaihae Cultural Surf Park, the YMCA, Kanu o Ka Aina Charter School and the National Park Service-Puukohola National Historical Site. Since we spoke, I have thought of these additional groups and/or organizations: The DHHL Puakailima and Kailapa Community Homestead Associations, Makalii Voyaging Canoe and the Queen Emma Land Company. Please remember that this list is not all encompassing and we are sure you will identify others with an interest in this DEA as there are many who access the near shore waters and surrounding areas of the harbor for traditional and cultural purposes.

It is our understanding that SSFM was in attendance and facilitated the sign in sheet at the August 29, 2011 community meeting held in Kawaihae and we would like to request the sign in sheet from the meeting from you so that we may get an idea of the attendance and begin the work of supporting our beneficiaries and their concerns.

OHA has no additional comments at this time. We look forward to reviewing the DEA when it is available. Please send one electronic and one hardcopy of the DEA to OHA: attn Compliance Program when it becomes available. Thank you for the opportunity to provide comments. Should you have any questions or concerns, please feel free to contact me.

Aloha, Keola

Keola Lindsey
Office of Hawaiian Affairs
Compliance Program
711 Kapiolani Boulevard
Honolulu, Hawaii 96813
keolal@oha.org (email)
(808) 594-0244 (office)

NEIL ABERCROMBIE
GOVERNOR

MAJOR GENERAL DARRYLL D. M. WONG
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

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

PHONE (808) 733-4300
FAX (808) 733-4287

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SEP 15 2011
SSFM INTERNATIONAL, INC.

September 14, 2011

Mr. Douglas Zang, AICP
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, Hawai'i 96720

Dear: Mr. Zang:

Pre-Assessment Consultation for Draft Environmental Assessment
Kawaihae Commercial Harbor Improvements, Hawaii

Thank you for the opportunity to comment on this development. The project location is currently covered by Outdoor Emergency Warning Service by siren #HA407-Kawaihae Harbor. We have no further comments on this project at this time. We anticipate reviewing the Draft Environmental Assessment upon its completion.

If you have any questions, please call Ms. Fay Alailima-Rose, State Civil Defense (SCD) Assistant Telecommunications Officer, at (808) 733-4300, ext. 531.

Sincerely,

EDWARD T. TEIXEIRA
Vice Director of Civil Defense

c: Hawaii State Planning Office
SCD Radio Shop
Hawaii County Planning Office
Hawaii Civil Defense Agency

William P. Kenoi
Mayor

William T. Takaba
Managing Director

Dora Beck, P.E.
Acting Director

Hunter Bishop
Deputy Director

County of Hawai'i
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
25 Aupuni Street • Hilo, Hawai'i 96720
(808) 961-8083 · Fax (808) 961-8086
http://co.hawaii.hi.us/directory/dir_envmng.htm

August 11, 2011

VIA EMAIL – NO HARD COPY TO FOLLOW

Mr. Douglas Zang, AICP
SSFM INTERNATIONAL
99 Aupuni Street, Suite 202
Hilo, HI 96720
dzang@ssfm.com

RE: Kawaihae Commercial Harbor Improvements
Kawaihae, South Kohala District, Island of Hawai'i
Pre-ssessment Consultation for Draft EA

Dear Mr. Zang,

We have no comments to offer on the subject project.

Thank you for allowing us to review and comment on this project.

Sincerely,

Dora Beck

Dora Beck, P.E.
ACTING DIRECTOR

County of Hawai'i is an Equal Opportunity Provider and Employer.

SSFM
INTERNATIONAL

99 Aupuni Street
Suite 202
Hilo, Hawaii 96720
Phone: (808) 933-2727
Fax: (808) 887-8885
www.ssfm.com

August 5, 2011

SSFM 2007_086.003

Mr. Frank J. DeMarco, P.E.
Department of Environmental Management
County of Hawaii
25 Aupuni Street
Hilo, HI 96720

Subject: Kawaihae Commercial Harbor Improvements
Kawaihae, South Kohala District, Island of Hawai'i
Pre-Assessment Consultation for Draft Environmental Assessment

Dear Mr. Frank J. DeMarco, P.E.,

The State of Hawai'i, Department of Transportation Harbors Division (DOT-H) is proposing to perform multiple facility improvements at Kawaihae Commercial Harbor located in South Kohala District on the island of Hawai'i. The purpose for this project is to implement actions at Kawaihae Harbor that have been identified from current DOT-H facility planning efforts. The components included in this project will benefit harbor operations and involve actions associated with maintenance dredging of existing piers.

In 1998, DOT-H completed the *Hawai'i Commercial Harbors 2020 Master Plan*, a document focusing on long-range planning for the island's two commercial harbors at Hilo and Kawaihae. DOT-H has recently completed the *Hawai'i Island Commercial Harbors 2035 Master Plan Update* and preliminary engineering of near-term improvements identified in the Kawaihae Commercial Harbor Development Plan. These near-term improvements are consistent with future planning objectives of the recent master plan and development plan.

SSFM International, Inc. is preparing a Draft Environmental Assessment (Draft EA) to address impacts of these improvements pursuant to Chapter 343, Environmental Impact Statements, Hawai'i Revised Statutes (HRS), and Title 11, Chapter 200 of the State Department of Health's Hawai'i Administrative Rules (HAR). We are now engaging federal, state and county agencies for early consultation to help identify any potential impacts of the project on Kawaihae Harbor and surrounding areas.

The Draft EA will include a more detailed project description and address the direct impacts of the proposed action as well as secondary and cumulative effects on the environment. The predominant environmental issues of concern include water quality, marine environment, noise/vibration, roadways, archaeological and historical resources, cultural impacts, hazardous materials, sea-level rise, socio-economic impacts, and drainage.

SSFM INTERNATIONAL

August 5, 2011

We would appreciate your cooperation in providing us with any written comments stating your environmental concerns within 21 days from the date of your receipt of this letter. Please feel free to let me know if you should require additional time to comment.

Please send comments to:

SSFM International, Inc.
Attn: Douglas Zang, AICP
99 Aupuni Street, Suite 202
Hilo, Hawai'i 96720

Additionally, HDOT Harbors Division will be conducting a public informational meeting in Kawaihae on Monday, August 29, 2011 at Hamakua Macadamia Nut Factory; 61-3251 Maluokalani Street; Kawaihae from 5:00 p.m. to 7:00 p.m. You are invited and encouraged to attend this meeting. Thank you very much and if you have any questions on this matter, please contact me by email or phone at (808) 356-1249.

Sincerely,

SSFM INTERNATIONAL, INC.

Douglas Zang

Douglas Zang, AICP
Email: dzang@ssfm.com

Enclosures: 1) Project Summary
2) Location Map
3) Project Site Map

Kawaihae Commercial Harbor Improvements

Kawaihae, Island of Hawai'i
Project Summary
August 2011

The State of Hawai'i, Department of Transportation, Harbors Division (DOT-H) has completed the *Hawai'i Island Commercial Harbors 2035 Master Plan Update* and is proposing several infrastructure improvements to the Kawaihae Commercial Harbor. The Kawaihae Harbor Development Plan begins implementation of Master Plan features by preparing the preliminary engineering for near-term improvments involving the Pier 2 extensions, DOT-H office relocation, new comfort station, maintenance dredging, internal traffic circulation and entry connections to the regional highway network, as well as grading and provisions for a new perimeter access road and fencing to the south small boat harbor.

Kawaihae Commecial Harbor is located on the northwest coast of Hawai'i Island. Its basin measures 1,450 by 1,500 feet and has a depth of 35 feet. The entrance channel is 3,270 feet long and 500 feet wide. A 2,650 foot breakwater protects the harbor. The harbor is served by Queen Ka'ahumanu Highway and is located 28 miles north of Kona International Airport at Keāhole. The harbor has had tremendous growth in cargo volumes over the past decade. Expansion of its facilities to accommodate future growth is a priority. A Location Map is provided as Figure 1.

The harbor has two piers. Pier 1 has 412 feet of berthing space, 4.6 acres of yard space and 8,300 square feet of shed space and is primarily used by cement barges. Pier 2 has 1,150 feet of berthing space and 30.6 acres for storage and handling and is dedicated to cargo barges and shared by two users. The US Army owns and operates a landing ramp at the coral stockpile area ("Coral Flats") through Governor's Executive Order (EO) No. 1759, which allows them to conduct military operations and transfer goods including troops, vehicles, and ordnance.

A Draft Environmental Assessment (Draft EA) is being prepared for this project to address near-term improvements for Kawaihae Commercial Harbor as described in the *Hawai'i Island Commercial Harbors 2035 Master Plan Update* and Kawaihae Harbor Development Plan.

The Project Site Map (Figure 2) shows the existing harbor and actions included in this project. The following components make up the near-term improvements to be assessed in the Draft EA:

Perimeter road and fencing and possible new military access

The Kawaihae Small Boat Harbor (South) is located in the southwest corner of Coral Flats and is operated by DOBOR. The build-out of Kawaihae Small Boat Harbor (South) will be independent from the commercial harbor and future Coral Flats uses. A new dedicated access road to this facility will be provided for recreational users and the public, outside of the maritime secure area. The access road and fencing will be designed to separate the commercial harbor from the recreational boating facilities.

Entry connections to the regional highway network

DOT Highways Division has begun long-term planning for the Kawaihae Bypass Road that would provide additional roadway capacity to and from the harbor. An Environmental Impact Statement is being prepared for the bypass project. The future bypass road will include a direct connection into Kawaihae Harbor are being considered.

Improvements to Main Gate and South Gate to allow for queuing at all security levels

Traffic ingress and egress at Kawaihae Harbor is currently through the Main Gate. Sufficient area is needed to accommodate internal circulation queues at security gates. South Gate is currently closed, but will become more important following the Harbor district office relocation and additional uses at Coral Flats. The current roads used to access Kawaihae Harbor are in need of improvements which are being considered as part of the Kawaihae Development Plan.

Grading of Coral Flats for industrial lots and/or storage

There is a growing demand at Kawaihae Harbor for use of the Coral Flats area. Currently, these uses primarily include truck staging, stand-by, and storage areas. As demand for these lots increase, DOT-H will be grading additional areas for lease lots.

Pier 2A extension and new Pier 2C

To accommodate future cargo demands and increase berth capacity, Pier 2A will be extended 340 feet. A new Pier 2C will be constructed, providing an additional 325 feet of berth space. These improvements would allow for four 400-foot long barges. The construction of Pier 2C would require the removal of Department of Land and Natural Resources Division of Boating and Ocean Recreation's (DOBOR) boat mooring dock at the south of end of Pier 2B. DOBOR plans are in place to relocate the small boat moorings to the nearby Kawaihae Small Boat Harbor Facility (South).

Dredging Activities

Dredging of the berthing area fronting Pier 1 and Piers 2A, 2B, 2C will be needed to improve navigational operations within the harbor.

Relocation of DOT-H Office and Comfort Station

The DOT-H district office will be demolished and rebuilt in new locations. These facilities will be designed to LEED silver standards and with ADA compliance.

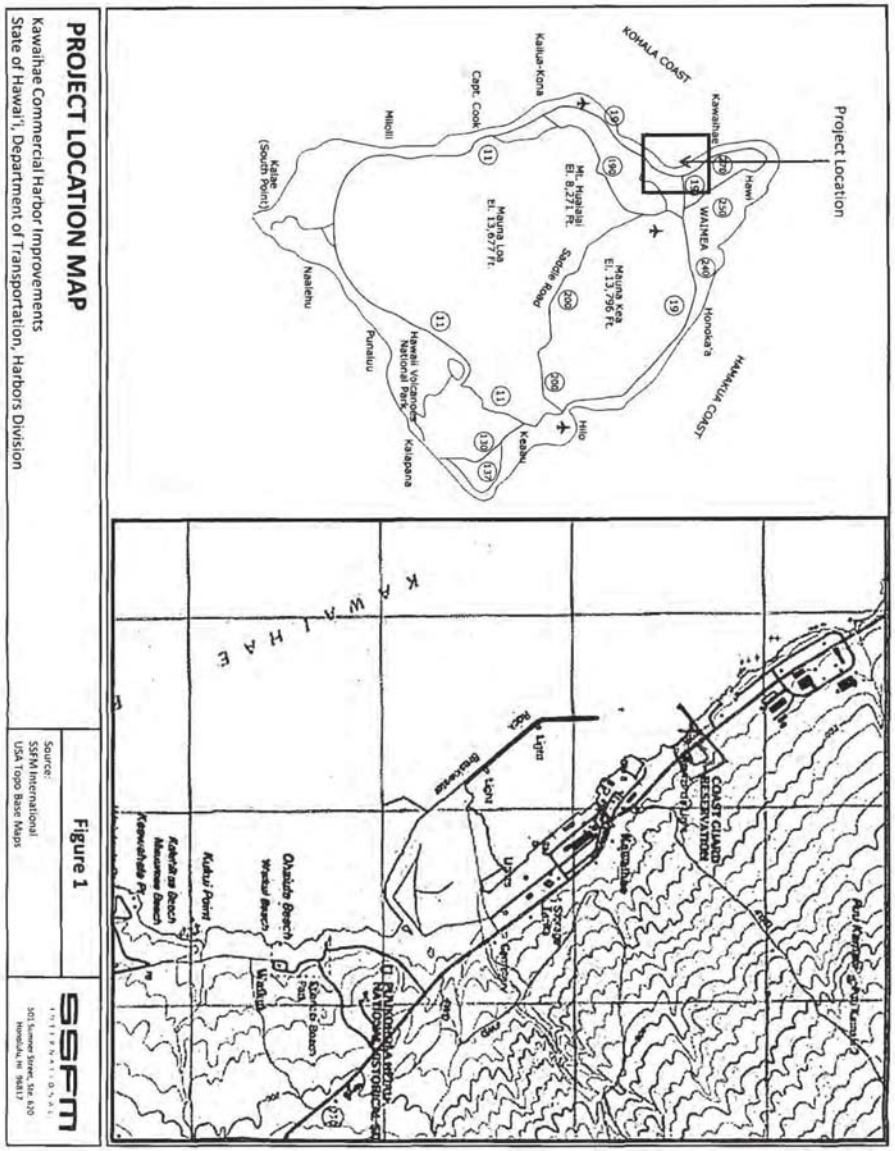
Operations Yard Improvements

These improvements include standard updates to harbor security facilities, yard lighting, internal roadway circulation, and pavement strengthening for cargo operations.

A number of planning efforts have been completed or are underway in the general area of Kawaihae Harbor. Because the harbor is such a prominent influence, it is important to consider these planning efforts and how they influence the harbor's development in relation to other critical regional issues.

- South Kohala Community Development Plan, County of Hawai'i
- Department of Hawaiian Home Lands Kawaihae Regional Plan
- Queen Emma Foundation Ahupuaa Strategic Management Plan
- Kawaihae Small Boat Harbor Master Plan, DLNR, DOBOR
- Watershed Management Plan, Pelekane Bay Watershed Restoration Project
- Evaluation of a proposed channel on the circulation and morphology changes at Kawaihae Harbor and Pelekane Bay, U.S. Army Corps of Engineers

More information can be found at the project's website: www.hawaiiharborsplan.com



PROJECT LOCATION MAP

Kawaihae Commercial Harbor Improvements
State of Hawai'i, Department of Transportation, Harbors Division

Figure 1

Source:
SSFM International
USA Topo Base Maps

SSFM INTERNATIONAL
501 Sumner Street, Ste. 620
Honolulu, HI 96817

William P. Kenoi
Mayor

Darryl J. Oliveira
Fire Chief

Glen P. I. Honda
Deputy Fire Chief

County of Hawai'i
HAWAI'I FIRE DEPARTMENT
25 Aupuni Street • Suite 2501 • Hilo, Hawai'i 96720
(808) 932-2900 • Fax (808) 932-2928

RECEIVED
AUG 31 2011
SSFM INTERNATIONAL INC.

August 16, 2011

Mr. Douglass Zang
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, HI 96720

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR DRAFT ENVIRONMENTAL ASSESSMENT FOR KAWAIHAE COMMERCIAL HARBOR IMPROVEMENTS

We have no comments to offer at this time in reference to the above-mentioned Pre-Assessment Consultation for Draft Environmental Assessment for the above referenced project.

DARRYL OLIVEIRA
Fire Chief

RP:lpc

Hawai'i County is an Equal Opportunity Provider and Employer.

PROJECT SITE

Kawaihae Commercial Harbor Improvements
State of Hawai'i, Department of Transportation, Harbors Division

Figure 2

Source:
HI Com Harbors 2035 MP Update, Aug 2011
SOEST Coastal Imagery

SSFM INTERNATIONAL
501 Sumner Street, Ste. 620
Honolulu, HI 96817

William P. Kenoi
Mayor

Harry S. Kubojiri
Police Chief

Paul K. Ferreira
Deputy Police Chief

County of Hawai'i

POLICE DEPARTMENT
349 Kapi'olani Street • Hilo, Hawai'i 96720-3998
(808) 935-3311 • Fax (808) 961-2389

August 22, 2011

Mr. Douglas Zang, AICP
SSFM International Inc.
99 Aupuni Street, Suite 202
Hilo, Hawai'i 96720

RECEIVED
AUG 31 2011
SSFM INTERNATIONAL, INC.
HAWAII

Dear Mr. Zang:

RE: Kawaihae Commercial Harbor Improvements
Kawaihae, South Kohala District, Island of Hawai'i
Pre-Assessment Consultation for Draft Environmental Assessment

The above-referenced project has been reviewed. We concur with your assessment regarding the improvements needed to the Main and South gates of the property as oftentimes community members complain of near collisions involving traffic entering and exiting the harbor.

Thank you for the opportunity to comment. Should you have any questions, please contact Captain James Sanborn, South Kohala District Commander, at 887-3080.

Sincerely,

HARRY S. KUBOJIRI
POLICE CHIEF

PAUL H. KEALOHA JR.
ASSISTANT CHIEF
AREA II OPERATIONS

JS:dmv

"Hawai'i County is an Equal Opportunity Provider and Employer"

William P. Kenoi
Mayor

BJ Leithead Todd
Director

Margaret K. Masunaga
Deputy Director

County of Hawai'i

PLANNING DEPARTMENT
Aupuni Center • 101 Pauahi Street, Suite 3 • Hilo, Hawai'i 96720
Phone (808) 961-8288 • Fax (808) 961-8742

RECEIVED
AUG 31 2011
SSFM INTERNATIONAL, INC.
HAWAII

August 26, 2011

Mr. Douglas Zang
SSFM International
99 Aupuni Street, Suite 202
Hilo, HI 96720

Dear Mr. Zang:

SUBJECT: Early Consultation for Draft Environmental Assessment
Project: Kawaihae Commercial Harbor Improvements
TMK: (3) 6-1-003: Various Parcels, Kawaihae, South Kohala, Hawai'i

Thank you for your letter dated August 5, 2011 requesting comments from this office regarding the preparation of a Draft Environmental Assessment (DEA). The State of Hawai'i Department of Transportation Harbors Division (DOT-H) is proposing to perform multiple facility improvements at Kawaihae Commercial Harbor. These will include perimeter road and fencing and possible new military access, entry connections, improvements to the Main Gate and South Gate, grading of Coral Flats, Pier 2A extension and new Pier 2C, dredging activities, relocation of DOT-H district office and comfort station, and operations yard improvements.

The subject project may incorporate several parcels within the Kawaihae Commercial Harbor. The majority of Kawaihae Commercial Harbor is zoned MG-1a (General Industrial-1 acre minimum lot size); the only exception is the breakwater which is zoned as Open by the County of Hawai'i. The proposed project is situated within the State Land Use Urban District. In addition, the Kawaihae Commercial Harbor is located entirely within the Special Management Area (SMA).

Pursuant to Hawai'i Revised Statutes (HRS) 266-2 (b), Department of Transportation is authorized to plan, construct, and maintain any commercial harbor facility in the State, without the approval of county agencies. However, please contact the State of Hawai'i Office of Planning regarding SMA and Coastal Zone Management (CZM) requirements.

Hawai'i County is an Equal Opportunity Provider and Employer

Along with the environmental issues stated to be addressed by the Draft Environmental Assessment, please include discussion of any anticipated impacts to public shoreline access in the immediate area.

In addition, we concur that the proposed development must also be considered relative to other planning efforts in the area. Please specify any consistencies or inconsistencies the project may have with the South Kohala Community Development Plan (CDP) and the Hawai'i County General Plan.

We have no further comments to offer, at this time. However, please keep us informed and provide our department with a copy of the Draft Environmental Assessment for our review.

If you have any questions or if you need further assistance, please feel free to contact Bethany Morrison of this office at 961-8138.

Sincerely,

BJ LEITHEAD TODD
Planning Director

BJM:cs
P:\wpwin60\Bethany\EA-EIS Review\preconsultdraftea Kawaihae Commercial Harbor Improvements.doc

xc: Long Range Planning
Planning Department - Kona

Honorable William P. Kenoi, Mayor
County of Hawai'i
25 Aupuni Street
Hilo, HI 96720

YOUNG BROTHERS
Your Neighbor Island Partner

P.O. Box 3288
Honolulu, HI 96801-3288
Phone: (808) 543-9311
www.youngbrothershawaii.com

August 22, 2011

RECEIVED
AUG 25 2011
SSFM INTERNATIONAL, INC.
HAWAII

Mr. Douglas Zang
SSFM International
99 Aupuni Street, Suite 202
Hilo, Hawaii 96720

Dear Mr. Zang:

Subject: Kawaihae Commercial Harbor Improvements Kawaihae, South Kohala District, Island of Hawai'i
Pre-Assessment Consultation for Draft Environmental Assessment

Thank you for your August 5, 2011 letter soliciting our comments on the Kawaihae Commercial Harbor facility improvements proposed by the Department of Transportation Harbors Division.

We concur that the proposed improvements will benefit harbor operations. Additional berthing space at Pier 2 will provide increased safety by allowing vessels to be moored farther apart and will afford much needed flexibility in the placement of vessels. The combination of two access gates, a perimeter access road to recreational boating facilities and the planned Kawaihae Bypass Road will relieve the increasing traffic on Akoni Pule Highway, making it safer for the non-commercial vehicles that use the highway. Finally, the smaller but no less important infrastructure improvements will allow the port to keep pace with growth and maintain compliance with current security requirements.

Considering that almost all the land now occupied by the commercial harbor is man-made of relatively recent origin it is doubtful that there will be any adverse archaeological, historical or cultural impact.

Please feel free to call me at 543-9406 if you have any questions.

Sincerely,

YOUNG BROTHERS, LIMITED

Jeffrey A. Low
Manager, Planning & Facilities

Hawaiian Telcom

RECEIVED
AUG 25 2011
SSFM INTERNATIONAL, INC.
HAWAII

August 11, 2011

SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, Hawaii 96720

Attn: Douglas Zang, AICP

Subject: Kawaihae Commercial Harbor Improvements
Kawaihae, South Kohala District, Island of Hawaiian Telcom
Pre-Assessment Consultation for Draft Environmental Assessment

Dear Mr. Zang,

Thank you for sending your pre-assessment consultation for Draft Environmental Assessment to Hawaiian Telcom. The information provided does not have enough information to determine how Hawaiian Telcom will be impacted by this project. However, our areas of concern would be the impact to our cable facilities along Kawaihae Road/Akoni Pule Highway as well as into the Kawaihae Harbor complex. We also have an interisland cable landing site at Spencer Beach Park that is in the vicinity of this project that may be impacted by the dredging.

Please keep Hawaiian Telcom involved with future reviews of the Environmental Assessment and construction plan reviews so we can determine the appropriate action that needs to be taken to help keep this project on schedule. All future correspondence can be routed directly to me.

Please give me a call at (808) 546-1677 if you have any questions.

Sincerely,

John Chun
Senior Manager
Network Planning -Access Planning

cc: Raymond Lam

PO Box 2200 • Honolulu • Hi 96841

Appendix B2: Public Input Received During Pre-Assessment Period

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Hand-written comments received from Mr. Leon Thevenin, Transcribed by Doug Zang 8/15/11. Text copied verbatim.

Mr. Leon A. Thervenin
104 Puako Beach Drive
Kamuela, HI 96743-9707

8-12-11
SSFM International Inc.
Kawaihae Harbor

Thank you for the invitation to attend the Public Hearing. Because of my age 96, and disabled I shall be unable to attend.

It is not for the lack of interest.

I personally got $10,000,000 Funding to dredge the deep draft portion to its present size.

I also supervised shipping through Kawaihae Terminus as a Sugar Plantation Manager.

One big problem is pleasure craft using the Harbor intended for commercial shipping. The small Boat Harbor remains unused after more than 10 years with 95% complete. Finish it.

The surge Problem is Bad because the Breakwater on the N end is too short and ineffective.

There are many so called "experts" who are cry babies masquerading as Adults. Their input is useless.

Most of the Pleasure Boat Problems can be resolved by the new Small Boat Harbor. Canoes on the other end pose another problem. They should be forced to accept the commercial harbor and keep out. Use by permit only.

Leon A. Therevin, Mgr. (retired)
Hamakua Mill Co.
Mayor – Puako 882-7969

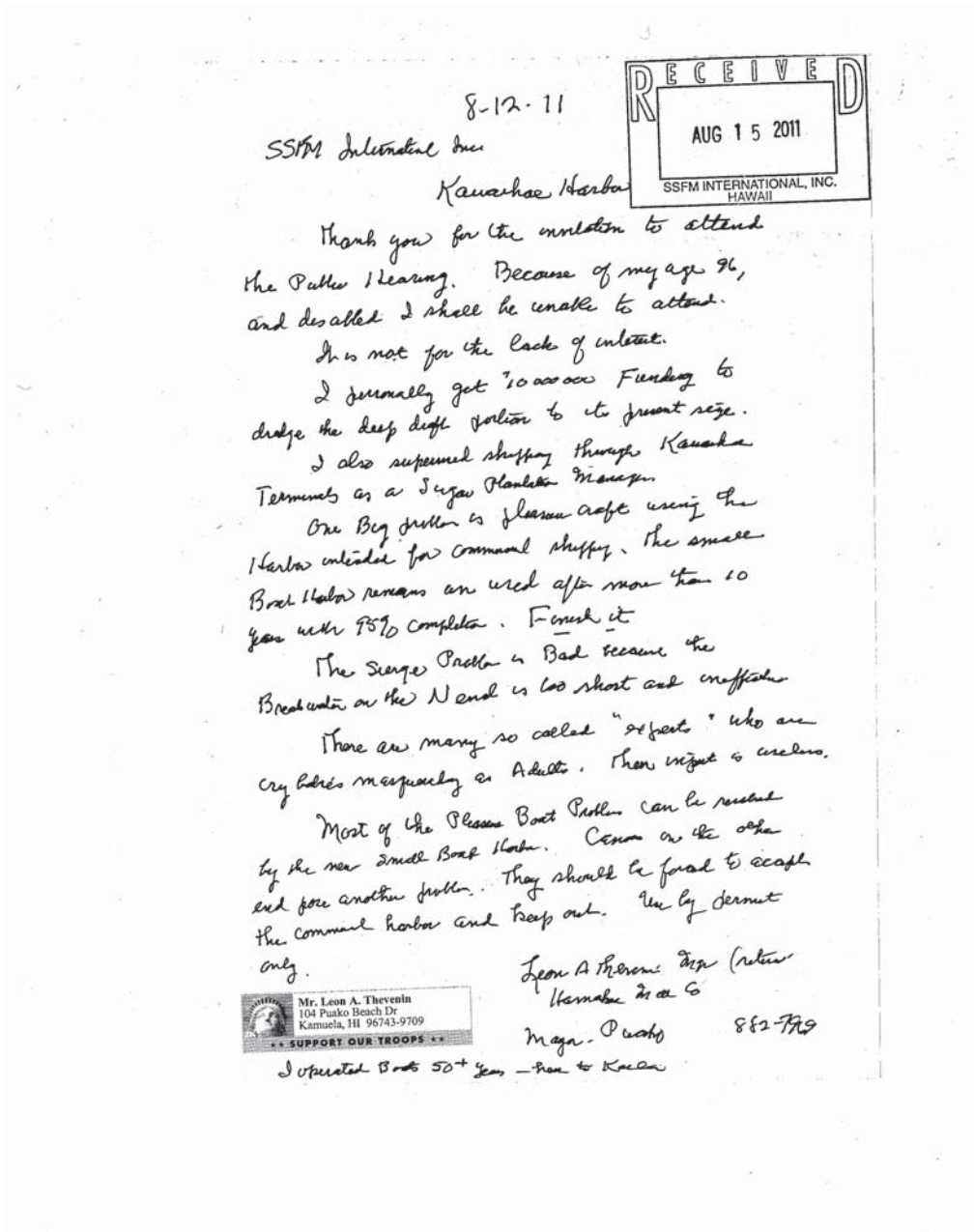
I operated Boats 50+ years – here to Kailua.

[Text Hand-written on back of envelope follows]:

"Correct surge from North"

#1 – Build 300' Breakwater at old wharf site – out west from shore-

#2 – Retain Bill Akau as consultant (retired Harbormaster)



"correct surge from North"

#1 Build 300' Breakwater at old wharf site – out West from Shore –



#2 Return Bill Apaw as Consultant (retired Harbormaster)

JOJO TANIMOTO
P.O. BOX 44337
KAWAIHAE, HI 96743
CELL PHONE NO.: 808-895-5226
EMAIL: HOMESTEADLADY001@YAHOO.COM

Ms. Cheryl Soon, Planning Director
SSFM International, Inc.
501 Summer St
Honolulu, Hawaii 96817

August 29, 2011

Dear Ms. Soon:

RE: KAWAIHAE COMMERCIAL HARBOR-2035 MASTER PLAN
PUBLIC HEARING, HAMAKUA MAC NUT FACTORY, 8/29/2011

Aloha and Mahalo for coming back to Kawaihae to meet with us-in our community.

While reviewing the Kawaihae Commercial Harbor-2035 Master Plan, I would like to ask the following be included.

#1. It is this community's desire to get Pelekane Bay cleaned and restored to its once healthy marine environment. This bay needs everyone's help to ***heal the past*** in order to work toward the future of Kawaihae. It has been a stumbling block to think past the hurt done to this fishing village in terms of this type of job viability and economic sustainability. Pelekane Bay is still home to the fish spawning resources and we need the Harbors Division to address this issue.

A **correction** needs to be included, that this Bay has a Memorandum of Understanding (MOU) or verify it is a monthly Lease.

#2. Sale of Lands---is not an acceptable option for generating funds for the Harbors Division.

#3. **Water**-Access to Potable Water and Marine Quality

It was unclear where the Harbors would access more potable water and address further issues of marine water quality.

#4 Include the issues of the **Stream Culvert** along Kawaihae Road and between Pier 1 and Pier 2A which **needs to be identified in this Plan.** (Copy attached).

a. This infrastructure seems to hold **an intricate issue** because it does not appear in any Plans no matter how many times the community brings it to the attention of Harbor Planning and Highway Planning.

b. The issues of erosion, storm water levels, and planning for what size vessels to dock there need to be entered as well.

#5. Executive Order 2142-Access to the Military Ramp (Army Road).(See Map) The section that accommodates the stream water has not been acceptably addressed. Future plans intend that many more vehicles will traverse this area.

A request to build a bridge over that section seems not an option as the flow of the stream and the sediment are carried into the harbor. However, it is not acceptable to allow foreign substances--attached to wheels and tires of vehicles that must traverse this section, to deposit these substances in the stream way as well. The issue of sediment into a harbor is acceptable by the State DLNR authority that allows sediment in the north small boat harbor. Every twenty years it gets cleaned out. **What is clear**, is the marine fishery need the freshwater that comes from the streams.

#6. When is the Harbors Division going to transfer lands to DLNR to access the South Harbor?

#7. **Navigational Issue**. This request has been made to the Harbormasters of the past; and this request needs to be **included** in the 2035 Master Plan.

When marine vehicles enter and exit the harbor, they tend to cruise close to shore in front of the homes on Hawaiian Home Lands homestead; closer than other subdivisions on the coastline. When they exited, they did the opposite process. There was a marked decrease of marine life at the homestead shoreline.

Those of us who camp and fish at the homestead camp grounds appreciate the concerted effort of approaching and exiting from directly ocean front and exiting straight out to sea. We have noticed families once again utilizing the Ala Kahakai Trails to camp and fish.

Kawaihae 2035 Harbors Plan
Public Hearing
Hamakua Mac Nut Factory
8/29.2011

#8. The "unmarked" Kawaihae Cemeteries across the South Gate is being reviewed for Historical significance. Any plans for the By-Pass Connector Road should involve plans to protect this area.

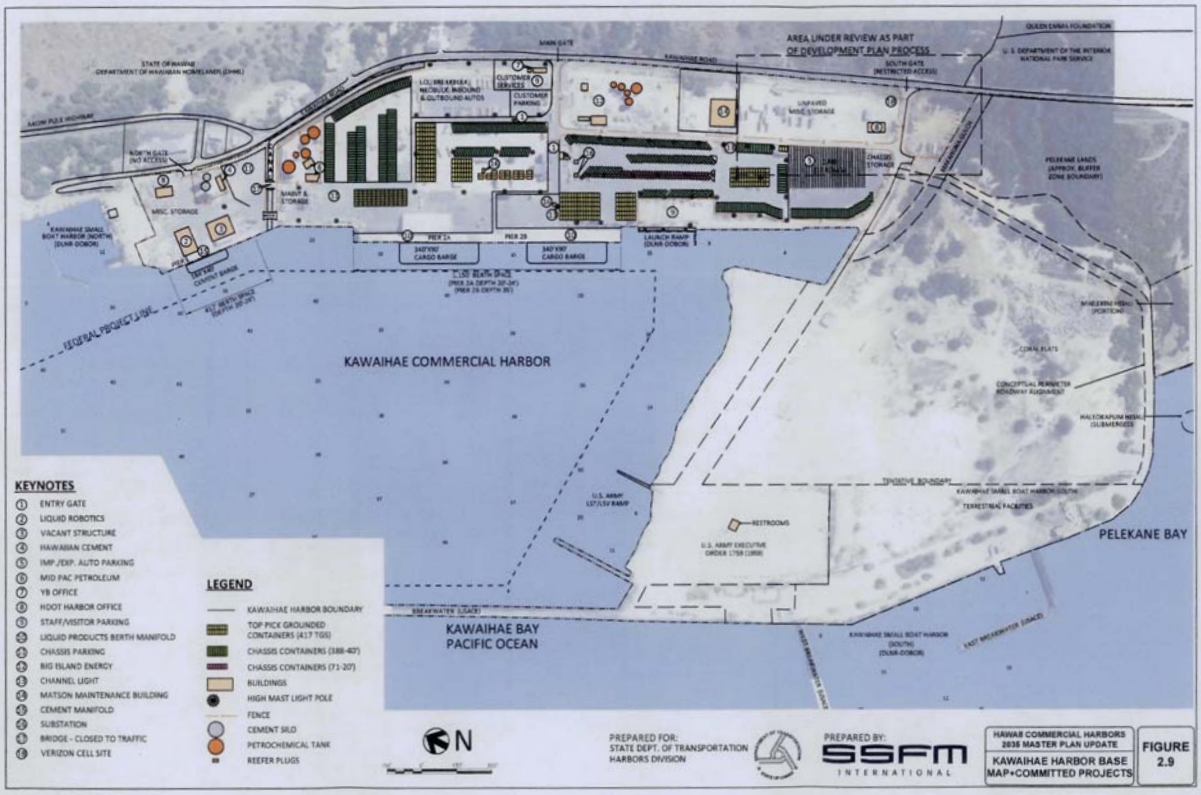
Mahalo for allowing my testimony. If you have any questions, please contact me.

Sincerely,

Jojo Tanimoto
Hawaiian Homes Lessee

cc: Mr. Jeff Hood, Big Island Harbormaster
Mr. Glenn Okimoto, DOT Director
All Trustees, Office of Hawaiian Affairs
Mr. Alapaki Nahale'a, Dept. of Hawaiian Home Lands

attached


AREA UNDER REVIEW AS PART OF DEVELOPMENT PLAN PROCESS
KAWAIHAE COMMERCIAL HARBOR
KAWAIHAE BAY
PACIFIC OCEAN
PELEKANE BAY
KEYNOTES
1 ENTRY GATE
2 LIQUID ROBOTICS
3 VACANT STRUCTURE
4 HAWAIIAN CEMENT
5 IMP./EXP. AUTO PARKING
6 MID PAC PETROLEUM
7 YB OFFICE
8 HOOT HARBOR OFFICE
9 STAFF/VISITOR PARKING
10 LIQUID PRODUCTS BERTH MANIFOLD
11 CHASSIS PARKING
12 BIG ISLAND ENERGY
13 CHANNEL LIGHT
14 MATSON MAINTENANCE BUILDING
15 CEMENT MANIFOLD
16 SUBSTATION
17 BRIDGE - CLOSED TO TRAFFIC
18 VERIZON CELL SITE
LEGEND
KAWAIHAE HARBOR BOUNDARY
TOP PICK GROUNDED CONTAINERS (417 TGS)
CHASSIS CONTAINERS (388-40')
CHASSIS CONTAINERS (71-20')
BUILDINGS
HIGH MAST LIGHT POLE
FENCE
CEMENT SILO
PETROCHEMICAL TANK
REEFER PLUGS
N
PREPARED FOR:
STATE DEPT. OF TRANSPORTATION
HARBORS DIVISION
PREPARED BY:
SSFM INTERNATIONAL
HAWAII COMMERCIAL HARBORS
2035 MASTER PLAN UPDATE
KAWAIHAE HARBOR BASE MAP+COMMITTED PROJECTS
FIGURE 2.9

Appendix C: Noise Study

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D. L. ADAMS ASSOCIATES, LTD.
Consultants in Acoustics and Performing Arts Technologies

Environmental Noise Assessment Report
Kawaihae Commercial Harbor Improvements Project
Kawaihae, Island of Hawaii, Hawaii

September 2011

DLAA Project No. 11-19

Prepared for:
SSFM International, Inc.
Honolulu, Hawaii

970 N. KALAHEO AVE. • SUITE A311 • KAILUA, HAWAII 96734
808/254-3318 • FAX 808/254-5295
www.dlaa.com • hawaii@dlaa.com

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1.0 EXECUTIVE SUMMARY

1.1 The proposed Kawaihae Commercial Harbor Improvements project involves extensions to Pier 2, relocation of the DOT-H office, the addition of a new comfort station, maintenance dredging of the basin, improvements to internal traffic circulation and entry connections to the regional highway network, as well as grading and provisions for a new perimeter access road and fencing to the south small boat harbor.

1.2 The project area currently experiences relatively quiet noise levels that vary with the time of day, harbor activities, and vehicular traffic patterns of Kawaihae Road. Daytime noise levels measured at the project site ranged from 37 dBA to 60 dBA where the average day-night level, L_{dn}, was 55 dBA.

1.3 Noises from Kawaihae Commercial Harbor must comply with the HDOH Community Noise Control Rule, which stipulates maximum permissible noise limits at the property line. For areas zoned industrial, the property line noise limit is 70 dBA during the day and night. On completion of the improvements project, noise due to harbor related activities may increase. In addition, new noise sources at the Coral Flats area will be closer in proximity to Puukohola Heiau National Historic Site than the existing plan. While future noise levels are expected to be below the HDOH noise limit, intermittent noises from harbor related activities will still be audible in the area surrounding the harbor and at Puukohola Heiau NHS.

1.4 Construction of the Kawaihae Commercial Harbor project will involve four general stages which utilize various types of construction equipment. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process, the duration of construction activities, and the number of pieces of equipment used. Construction noise levels were predicted at various noise receptor locations in vicinity of the project site.

1.5 Noise levels for all stages of construction are expected to exceed the daytime maximum permissible noise limits at the property line and a permit must be obtained from the State DOH to allow the operation of construction equipment. Intermittent noise from project construction activities will be audible in the vicinity of the project site. The dominant noise sources during construction will be from the hydraulic breaker used during the demolition stage and the pile driver used during the installation stage, when ambient noise levels may increase by up to 31 dB over the existing levels. Noise due to the grading of Coral Flats during the landside construction phase will also be clearly audible at the Puukohola Heiau NHS and ambient noise levels may also increase by up to 35 dB over the existing levels at Pelekane. However, noise from construction activities will be short term and must comply with State Department of Health noise regulations.

1.6 Vehicular traffic noise levels are not expected to increase by a significant amount in the future. However, noise levels at the Puukohola Heiau NHS may exceed the FHWA's noise abatement criteria for Activity Category A.

2.0 PROJECT DESCRIPTION

Kawaihae Commercial Harbor is located in the South Kohala region on the west side of the island of Hawai'i, 35 miles north of Kailua-Kona. The harbor is located off of Kawaihae Road (Route 270), just north of the intersection with Queen Kaahumanu Highway/Mamalahoa Highway (HI-19) and south of the intersection with Akoni Pule Highway.

The proposed Kawaihae Commercial Harbor Improvements project involves extensions to Pier 2, relocation of the DOT-H office, the addition of a new comfort station, maintenance dredging of the basin, improvements to internal traffic circulation and entry connections to the regional highway network, as well as grading and provisions for a new perimeter access road and fencing to the south small boat harbor.

3.0 NOISE STANDARDS

Various local and federal agencies have established guidelines and standards for assessing environmental noise impacts and set noise limits as a function of land use. A brief description of common acoustic terminology used in these guidelines and standards is presented in Appendix A.

3.1 State of Hawaii, Community Noise Control (HDOH)

The State of Hawaii Community Noise Control Rule [Reference 1] defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to *stationary* noise sources such as air-conditioning units, exhaust systems, generators, compressors, pumps, etc. The Community Noise Control Rule does not address most *moving* sources, such as vehicular traffic noise, aircraft noise, or rail transit noise. However, the Community Noise Control Rule does regulate noise related to agricultural, construction, and industrial activities, which may not be stationary.

The maximum permissible noise levels for stationary mechanical equipment are enforced by the State Department of Health (DOH) for any location at or beyond the property line and shall not be exceeded for more than 10% of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in Figure 1. With respect to mixed zoning districts, the rule specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level. In determining the maximum permissible sound level, the background noise level is taken into account by the DOH.

The criteria for *impulsive* or impact noise is separate from stationary noise due to the nature of the sound. The DOH defines impulsive noise as " any sound with a rapid rise and decay of sound pressure level, lasting less than one second, caused by sudden contact between two or more surfaces…". Noise from pile driving is considered impulsive noise and the maximum permissible noise level is 10 dB above the specified noise limits for stationary sources, as shown in Figure 1.

3.2 U.S. Federal Highway Administration (FHWA)

The FHWA regulation contains highway traffic noise abatement criteria (NAC) for seven land use activity categories and assigns corresponding maximum hourly equivalent sound levels, L_{eq}, for traffic noise exposure [Reference 2, 3]. These NAC are summarized in Figure 2 for each land use activity. For example, Category B, defined as residential, has a corresponding maximum exterior L_{eq} of 67dBA. Category E is defined for hotels, motels, offices, restaurants, bars, etc. and has a corresponding maximum exterior L_{eq} of 72 dBA. In determining traffic noise impacts, primary consideration is given to exterior areas where frequent human use occurs. An interior impact criterion is also defined for certain land use facilities that have sensitive interior uses, such as hospitals, churches, and schools.

3.3 Hawaii Department of Transportation (HDOT)

The HDOT has adopted FHWA's design goals for traffic noise exposure in its Noise Analysis and Abatement Policy [Reference 4]. According to the policy, a traffic noise impact occurs when the predicted traffic noise levels "approach" or exceed FHWA's design goals or when the predicted traffic noise levels "substantially exceed the existing noise levels." The policy also states that "approach" means at least 1 dB less than FHWA's design goals and "substantially exceed the existing noise levels" means an increase of at least 15 dB.

3.4 Federal Transit Administration (FTA)

Although the Kawaihae Commercial Harbor Improvements project is not associated with mass transit, the criteria developed by the Federal Transit Administration (FTA) is presented here as a relevant guideline for assessing construction noise. In general, the DOH Community Noise Rule is not very comprehensive for assessing the impact of a construction project as it only relates to nuisance and hours of allowed activity. Project construction noise criteria should take into account the existing noise environment, the equivalent sound levels, L_{eq}, during the construction activities, the duration of the construction activities, and the adjacent land use. While it is not the intention of the Federal Transit Administration (FTA) to specify standardized criteria for construction noise impact, it has defined guidelines for assessment [Reference 5]. According to the FTA, if the criteria shown in Table 1 are exceeded, there may be adverse community reaction.

Table 1. Federal Transit Administration Construction Noise Impact Threshold

	8- Hour L_{eq} (dBA)	
Land Use	Day (7am – 10pm)	Night (10pm – 7am)
Residential	80	70
Commercial	85	85
Industrial	90	90

3.5 Community Response to Change in Noise Level

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration,

and psychological factors such as emotions and expectations. However, the average ability of an individual to perceive changes in noise levels is well documented and has been summarized in Table 2 [Reference 4, 6]. These guidelines permit direct estimation of an individual's probable perception of changes in noise levels.

Table 2. Average Ability to Perceive Changes in Noise Level

Sound Level Change (dB)	Human Perception of Sound
0	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	Two times (or 1/2) as loud
20	Four times (or 1/4) as loud

A commonly applied criterion for estimating a community's response to changes in noise level is the 'community response scale' proposed by the International Standards Organization (ISO) of the United Nations [Reference 7]. The scale shown in Table 3 relates changes in noise level to the degree of community response and allows for direct estimation of the probable response of a community to a predicted change in noise level.

Table 3. Community Response to Increases in Noise Levels

Sound Level Change (dB)	Category	Response Description
0	None	No observed reaction
5	Little	Sporadic Complaints
10	Medium	Widespread Complaints
15	Strong	Threats of Community Action
20	Very Strong	Vigorous Community Action

The values stated in Tables 2 and 3 should not be considered regulatory requirements because they are not associated with a specific governing document for this project. However, these tables are very useful in assessing the human perception to changes in sound levels and they are considered to be supplemental information to the governing State of Hawaii Community Noise Control Rule, which does not discuss community response to changes in noise levels.

4.0 EXISTING ACOUSTICAL ENVIRONMENT

Two types of noise measurements were conducted to assess the existing acoustical environment in the vicinity of the project site. The first noise measurement type consisted of continuous long-term ambient noise level measurements (Locations L1 and L2). The second type of noise measurements were short-term traffic noise level measurements (Location S1). The methodology, location, and results for each of the measurements are described below and the measurement locations are illustrated in Figure 3. Photographs of the measurements locations can be viewed in Appendix B.

4.1 Long Term Noise Measurements

4.1.1 Long-Term Noise Measurement Procedure

Ambient noise level measurements were conducted in two different locations from September 9, 2011 to September 19, 2011to assess the existing acoustical environment on or near the project site. Continuous, hourly averaged sound levels, L_{eq}, were recorded for at least 5 days at each location. The measurements were taken using a Larson-Davis Laboratories, Model 820, Type 1 Sound Level Meter together with a Gras, Model 40AQ Type-1 Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended calibration period. The microphone was mounted on a tripod, approximately 6 feet above grade. A windscreen covered the microphone during the entire measurement period. The sound level meter was secured in a weather resistant case.

4.1.2 Long-Term Noise Measurement Locations

Kawaihae Harbor (L1): The meter was located at Coral Flats near the South Gate security entrance between the harbor and Makahuna Gulch. The meter was approximately 550 feet southwest of the Kawaihae Road. Dominant noise sources included heavy trucks along harbor's access road and harbor activities. Secondary noise sources included vehicular traffic from Kawaihae Road, aircraft flyovers, birds, and wind.

Puukohola Heiau National Historic Site (L2): The meter was located east of Puukohola Heiau, approximately 600 feet from Kawaihae Road. Noise sources at this location included vehicular traffic from Kawaihae Road, harbor activities, birds, and aircraft flyovers.

4.1.3 Long-Term Noise Measurement Results

The measured equivalent sound levels, L_{eq}, and the 90 percent exceedance level, L_{90}, in A-weighted decibels (dBA) are graphically presented in Figures 4 and 5 for each location. The ambient sound levels vary with the time of day. The range of equivalent sound levels, L_{eq}, during the day (7:00 a.m. to 10:00 p.m.) and during the night (10:00 p.m. to 7:00 a.m.) and

average calculated day-night level, L_{dn}, are summarized for each location below.

Table 4. Summary of Noise Measurement Results (dBA)

Measurement Location	AM L_{eq}	PM L_{eq}	Average L_{dn}
L1 – Kawaihae Harbor	37 - 60	34 - 56	55
L2 – Puukohola Heiau NHS	43 - 55	32 - 52	53

Figures 4 and 5 show a large difference between the hourly averaged equivalent sound level, L_{eq}, and the 90 percent exceedance level, L_{90}. This indicates that there are relatively brief periods of loud intermittent noises. These intermittent noises were observed on-site to be due to heavy trucks on the Harbor's access road and vehicular traffic on Kawaihae Road. When the intermittent noises are not present, the ambient noise environment is very quiet.

4.2 Short Term Noise Measurements

An approximate one-hour equivalent sound level, L_{eq}, was measured 40 feet north-east of the centerline of Kawaihae Road. This location is documented as Location S1 on Figure 3. Vehicular traffic counts and traffic mix were documented during the measurement period. The noise measurements were taken using a Larson-Davis Laboratories, Model 831, Type-1 Sound Level Meter together with a PCB, Model 377B20 Type-1 Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended calibration period. The microphone and sound level meter were mounted on a tripod, approximately 5 feet above grade. A windscreen covered the microphone during the entire measurement period.

The short-term measurements were conducted during the peak PM and AM traffic hour on September 9, 2011 and September 14, 2011 respectively. The purpose of the measurements and traffic counts were to validate the traffic noise model prediction software, as discussed in Section 5.4 below.

5.0 POTENTIAL NOISE IMPACTS

5.1 Harbor Operations Noise

The intention of the Kawaihae Commercial Harbor Improvements project is to accommodate future demand and capacity for the harbor. On completion of the improvements project, harbor related activities such as truck traffic and cargo movement may increase. Noises associated with these activities include backup alarms and engine noise from cranes and/or forklifts, trucks and other heavy equipment, stationary mechanical equipment noise, and horns from the ships. In addition, the Coral Flats area will be graded and leased for truck staging, standby and storage purposes. Noise from these trucks will be closer in proximity to Puukohola Heiau NHS than the existing plan. Noise from Kawaihae Commercial Harbor must comply with the HDOH Community Noise Control Rule, which stipulates maximum permissible noise limits at the property line. For areas zoned industrial, the property line noise limit is 70 dBA during the day and night.

Existing noise levels measured at the southern edge of the harbor (at measurement location L1) indicate that current harbor activities generate noise levels well below the HDOH maximum permissible noise limit. Future noise levels are also expected to be below the HDOH noise limit. However, intermittent noises from harbor related activities will still be audible in the area surrounding the harbor and at Puukohola Heiau NHS.

5.2 Construction Noise

The Kawaihae Commercial Harbor Improvements project construction will involve several stages which utilize various types of construction equipment, as described in Table 5. The estimated duration of each stage is included in the table, however, these estimations are based on the Contractor's ability to work with minimal interruptions from existing commercial harbor operations. The actual noise levels produced during construction of the proposed Kawaihae Commercial Harbor Improvements project will be a function of the methods employed during each stage of the construction process.

Table 5. General Construction Stages and Equipment

Construction Stage	Expected Equipment		
A Demolition (12-18 months)	Dump Trucks Crane	Barges Hydraulic Breaker	
B Pier Construction (3-4 months):	Flat Bed Trucks Crane Barges	Diesel, Hydraulic Impact, or Vibratory Hammer Concrete Mixer	
C Dredging (2 months)	Clamshell Dredge Crane	Barges	
D Landside Construction (6 months)	Pavement Cutter Trencher Compacter Concrete Pump	Trucks Grader Scraper	Roller Loaders Paver

Typical ranges of construction equipment noise are shown in Figure 6. The pile driver used during the demolition and installation stages will be the loudest equipment used during construction. However, the actual sound levels that will be experienced in the vicinity of the project site are a function of the distance from the noise source, the duration of the construction activities, and the number of pieces of equipment used. The Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) [Reference 8] was used to predict construction noise to receptor locations surrounding the project site. These receptor locations include the adjacent Puukohola Heiau NHS, nearby residences and businesses, and the small boat harbor (north). The model was based on a summary of the construction methodology provided by Moffat & Nichol. Table 6 summarizes the results of the construction noise analysis.

Table 6. Summary of Construction Noise Analysis Results

ID	Noise Receptor	Approx Dist.[N1] (ft)	Existing Ambient Noise[N2] (dBA)	Predicted Construction Noise per Stage[N3] (dBA)				Predicted Total Noise during Project Construction Stages [Ambient + Construction][N4] (dBA)			
				A	B	C	D	A	B	C	D
R1	Pelekane Beach (Puukohola Heiau NHS)	2100	45-55	52	62	48	-	53-57	62-63	50-56	-
		100		-	-	-	80	-	-	-	80
R2	Nearest Residence	800	45-67	61	70	57	62	61-68	70-72	57-67	62-68
R3	Nearest Restaurant (during Stage A, B, C)	400	45-67	67	76	63	-	67-70	76-77	63-68	-
	Nearest Restaurant (during Stage D)	400		-	-	-	68	-	-	-	68-71
R4	N Small Boat Harbor	1200	45-67	57	67	53	59	57-67	67-70	54-67	59-68

Notes:

N1. The value is the approximate distance from the noise receptor to the approximate location of the nearest construction activity. For Phase D (landside construction) at receptor R1, the distance from Pelekane Beach to Coral Flats was used, approximately 100 ft. For Phase D at receptors R2, R3, and R4, the distance from the noise receptors to the Main Gate area was used.

N2. Existing ambient noise at Puukohola Heiau NHS is the range of hourly equivalent sound levels, L_{eq}, measured at Location L2 (refer to Section 4). The hourly L_{eq} range is based on data collected from 7:00 am to 6:00 pm which corresponds to the allowable construction hours under the Department of Health noise permit. For the residential and commercial buildings along Kawaihae Road, the maximum ambient noise level was based on the predicted peak hour traffic noise level (refer to Section 5.4).

N3. The predicted construction noise levels are represented as L_{eq} and take into account the usage factor of each piece of equipment, as defined by the RCNM noise prediction model. The construction noise levels were calculated for each construction stage (defined in Table 5). The analysis assumed that all construction activities occur during the daytime and that all receptors have a line-of-sight to the project site, i.e., shielding was not considered.

N4. The ambient noise levels and predicted construction noise levels were summed logarithmically to estimate the total noise levels at each receptor location during each stage of construction.

The results of the construction noise analysis show that construction noise levels at all noise receptor locations are expected to be below the Federal Transit Authority's noise impact thresholds of 80 dBA and 85 dBA for residential and commercial land uses, respectively. Since both stationary and impulse construction noise levels will exceed maximum permissible noise limits specified in the *Community Noise Rule,* a permit must be obtained from the State DOH to allow the operation of construction equipment. Nevertheless, intermittent construction noises will still be audible in the vicinity of the project site, as described in the following sections.

5.2.1 Demolition and Pier Construction Phases

Construction noise will be most audible for the noise receptors immediately surrounding the project site, i.e., the homes, restaurants, and businesses along Kawaihae Road. During the demolition and installation stages, specifically during pile driving activities, ambient noise levels may increase by up to 31 dB over existing levels. This will likely be disturbing to people who participate in activities that take place outdoors (such as at the small boat harbor or restaurants with outdoor seating). During pile driving or extraction activities, people will need to raise their voice or reduce the talker-to-listener distance in order to communicate effectively. The severity of the speech interference will depend on how close the park users are to the project site. However, in the break between driving or extraction activities, ambient noise levels are not expected to be significantly higher than existing ambient noise levels. Furthermore, construction noises are expected to be intermittent and short term.

5.2.2 Landside Construction Phase at Coral Flats

During the landside construction phase of the proposed project, the Coral Flats area will be graded and a new road to the small boat harbor (south) will be constructed along the perimeter of Coral Flats. Due to the proximity of Puukohola Heiau NHS to Coral Flats, ambient noise levels at Pelekane may increase by up to 35 dB over existing levels. Again, construction noises are expected to be intermittent and short term.

5.3 Construction Noise vs. Vibration

Construction activities generate not only audible airborne sounds, but can also result in varying degrees of ground vibration depending on the equipment and methods employed. Pile driving is likely the greatest source of vibration associated with the equipment used during construction of the Kawaihae Commercial Harbor Improvements project. While the previous section of this report evaluates the airborne sound of pile driving to the Puukohola Heiau NHS and other areas, it does not assess human or structural responses to potential ground borne vibration due to pile driving activities

5.4 Vehicular Traffic Noise

A vehicular traffic noise analysis was completed for the existing conditions (2010) and the expected future year of completion (2025) projections using the FHWA Traffic Noise Model Look-up Tables Software Version 2.5 (2004) [Reference 9]. The traffic noise analysis is based on peak-hour traffic volumes for Kawaihae Road provided by the Traffic Consultant [Reference 10], vehicular mix data collected during the site visit, and a speed limit of 45 mph. Vehicular traffic noise levels were calculated at the Puukohola Heiau NHS and in the vicinity of the harbor north of the main gate. The results of the traffic noise analysis are described below and summarized in Table 7.

Table 7. Existing and Future Traffic Noise Projections for Kawaihae Road (dBA)

	Puukohola Heiau NHS[N1]		Areas North of Main Gate[N2]	
	AM	**PM**	**AM**	**PM**
Existing (2010)	55	55	65	67
Future (2025)	56	57	67	69
Future Change Due to Project	**1**	**2**	**2**	**2**

Notes:

N1. Traffic noise levels were calculated at a distance of 650 feet from Puukohola Heiau to the centerline of the Kawaihae Road.

N2. Traffic noise levels were calculated for the residences and businesses located north of the Kawaihae Commercial Harbor Main Gate at a distance of 40 feet from the centerline of Kawaihae Road.

Based on the results of the traffic noise analysis, a slight traffic noise level increase of less than 2 dB is expected. Therefore, a significant noise impact on the surrounding community due to the increase traffic noise is not expected. Although this traffic noise increase will not likely be noticeable to the general public (refer to Table 2), future traffic noise levels at the heiau may exceed the 57 dBA noise abatement criteria (NAC) defined by the FHWA for Activity Category A, as shown in Figure 2. It should be noted that the traffic noise model was based on the observed vehicular speed of 45 mph, which is 10 mph greater than the posted speed limit along Kawaihae Road. Higher vehicular speeds result in an increase in noise level, in this case by approximately 2 dB.

6.0 NOISE IMPACT MITIGATION

6.1 State DOH Noise Permit

In cases where construction noise exceeds, or is expected to exceed the State's "maximum permissible" property line noise levels [Reference 1], a permit must be obtained from the State DOH to allow the operation of vehicles, cranes, construction equipment, power tools, etc., which emit noise levels in excess of the "maximum permissible" levels.

In order for the State DOH to issue a construction noise permit, the Contractor must submit a noise permit application to the DOH, which describes the construction activities for the project. Prior to issuing the noise permit, the State DOH may require action by the Contractor to incorporate noise mitigation into the construction plan. The DOH may also require the Contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. The Contractor should use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, using properly tuned and balanced machines, etc. However, the State DOH may require additional noise mitigation, such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

Specific permit restrictions for construction activities [Reference 1] are:

> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels ... before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels... before 9:00 a.m. and after 6:00 p.m. on Saturday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays."

The use of pile drivers, hoe rams and jack hammers 25 lbs. or larger, high pressure sprayers, and chain saws are restricted to 9:00 a.m. to 5:30 p.m., Monday through Friday. In addition, construction equipment and on-site vehicles or devices whose operations involve the exhausting of gas or air, excluding pile hammers and pneumatic hand tools weighing less than 15 pounds, must be equipped with mufflers [Reference 1].

The DOH noise permit does not limit the noise level generated at the construction site, but rather the times at which noisy construction can take place. Therefore, noise mitigation for construction activities should be addressed using project management, such that the time restrictions within the DOH permit are followed.

6.2 State DOH Noise Variance

In cases where nighttime construction is expected, a variance must be obtained from the State DOH to allow the operation of a noise source which emits noise levels in excess of the maximum permissible levels and which operation does not conform to the requirements of the noise permit (i.e., nighttime construction activities which occur between 6:00 p.m. and 7:00 a.m., Monday through Friday).

In order for the State DOH to issue a construction noise variance, the Contractor must submit a noise variance application to the DOH which describes the construction activities for the project. The contractor is required to prove that nighttime work is in the public interest, that it does not substantially endanger public health or safety, and that appropriate measures for the attenuation of excessive noise will be taken. Reasonable and standard practices to mitigate noise include the use of mufflers on diesel and gasoline engines, using properly tuned and balanced machines, and temporary noise barriers. In addition, property owners and residents along the construction route must be notified of the variance application through a public notice procedure. A public hearing may be requested where the neighboring residents and business owners can discuss construction noise. If a public meeting is required, a letter stating the purpose of the project and indicating the time and place of the public meeting must be delivered to all affected residences and property owners.

Noise mitigation for nighttime construction activities should be addressed using management of construction equipment uses. Construction activities which generate the most noise (e.g., pile driving, cutting of pavement, hoe ramming, etc.) should be limited to the daytime hours while the quieter activities should take place at night. Generators used during nighttime activities should be low-noise and compressors should employ sound attenuating enclosures.

6.3 Mitigation of Construction Noise

6.3.1 Mitigation of Noise Source

Mitigating construction noise at the source is the most effective form of noise control. The source control methods listed in Table 8 below can be applied to most construction equipment.

Table 8. Construction Noise Source Control Methods

Scheduling	Limit activities that generate the most noise to less sensitive time periods (e.g. daytime hours).
Substitution	Use quieter methods/equipment when possible (e.g. low noise generators, smaller excavators, etc.).
Exhaust Mufflers	Install quality mufflers on equipment.
Reduced Power Options	Use smallest size and/or lowest power as required.
Quieter Backup Alarms	Install manual adjustable or ambient sensitive alarms. Do not use backup alarms during night work.

In general, a majority of the construction noise mitigation is in the form of scheduling, specifically, limiting the construction hours to the time frame specified by the State Department of Health. The pile driver is expected to be the most disruptive piece of equipment used during the construction process so the allowable hours of operation are even more restrictive, as described in Section 6.1.

6.3.2 Mitigation of Noise Path

When source control measures are not sufficient to avoid a noise impact, path control measures must be considered. Non-permanent noise barriers or curtains and equipment enclosures can be installed at the construction site to reduce construction noise in noise sensitive locations. However, mitigation of the noise path at the Kawaihae Commercial Harbor may not be practical due to the intensity of the construction noise sources.

6.4 Mitigation of Vehicular Traffic Noise

Vehicular traffic noise levels are not expected to increase by a significant amount in the future. However, noise levels at the Puukohola Heiau NHS may exceed the FHWA's noise abatement criteria for Activity Category A. Traffic management measures should be implemented to ensure that vehicles, especially heavy trucks, driving past the site do not exceed the posted speed limit of 35 mph.

REFERENCES

1. Chapter 46, *Community Noise Control*, Department of Health, State of Hawaii, Administrative Rules, Title 11, September 23, 1996.

2. *Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise*, Title 23, CFR, Chapter 1, Subchapter J, Part 772, 38 FR 15953, June 19, 1973; Revised at 75 FR 32820, July 13, 2010.

3. *Highway Traffic Noise: Analysis and Abatement Guidance*, U.S. Department of Transportation, Federal Highways Administration, January 2011.

4. *Highway Noise Policy and Abatement Guidelines*, Department of Transportation, Highways Division, State of Hawaii, April 25, 2011.

5. U.S. Department of Transportation - Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, May 2006.

6. M. David Egan, *Architectural Acoustics*, McGraw-Hill Book Company, 1998

7. International Standards Organization ISO/TC 43, *Noise Assessment with Respect to Community Responses*, New York: United Nations, November 1969.

8. *Federal Highway Administration's Roadway Construction Noise Model*, FHWA-HEP-05-054, U.S. Department of Transportation, February 2006.

9. Federal Highway Administration's Traffic Noise Model Look-up Tables Software, Ver. 2.5; U.S. Department of Transportation, December 17, 2004.

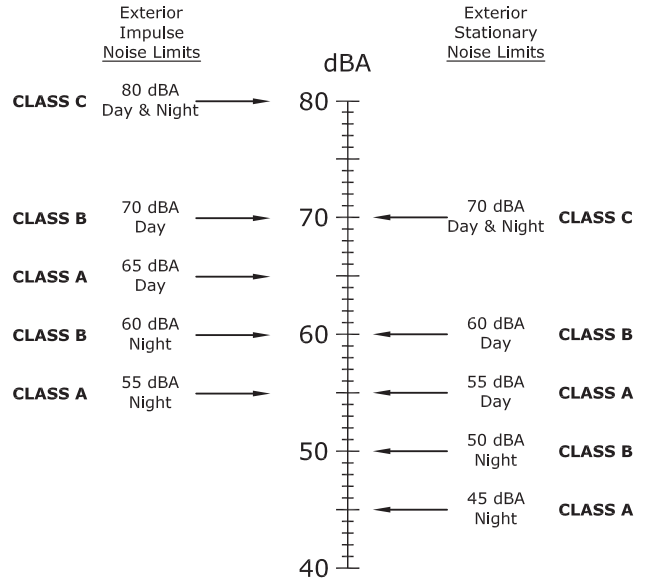
10. *Traffic Impact Analysis Report for the Kawaihae Harbor Environmental Assessment,* , SSFM International, Inc., September 2011

STATIONARY NOISE:

Zoning District	Day Hours (7 AM to 10 PM)	Night Hours (10 PM to 7 AM)
CLASS A Residential, Conservation, Preservation, Public Space, Open Space	55 dBA (Exterior)	45 dBA (Exterior)
CLASS B Multi-Family Dwellings, Apartments, Business, Commercial, Hotel, Resort	60 dBA (Exterior)	50 dBA (Exterior)
CLASS C Agriculture, Country, Industrial	70 dBA (Exterior)	70 dBA (Exterior)

IMPULSE NOISE:

The maximum permissible noise limit for impulsive noise is 10 dBA above the stationary noise limits.



Hawaii Maximum Permissible Sound Levels for Various Zoning Districts

Kawaihae Commercial Harbor Improvements Project

Figure No 1

Not to Scale

Date September 2011 | Project No. 11-19 | Drawn By DFD

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NOISE ABATEMENT CRITERIA FOR ADJACENT LAND USE

ACTIVITY CATEGORY	ACTIVITY CATEGORY DESCRIPTION	HOURLY EQUIVALENT SOUND LEVEL L_{eq}
A	LANDS ON WHICH SERENITY AND QUIET ARE OF EXTRAORDINARY SIGNIFICANCE AND SERVE AN IMPORTANT PUBLIC NEED AND WHERE THE PRESERVATION OF THOSE QUALITIES IS ESSENTIAL IF THE AREA IS TO CONTINUE TO SERVE ITS INTENDED PURPOSE.	57 dBA (EXTERIOR)
B	RESIDENTIAL	67 dBA (EXTERIOR)
C	ACTIVE SPORT AREAS, AMPHITHEATERS, AUDITORIUMS, CAMPGROUNDS, CEMETERIES, DAY CARE CENTERS, HOSPITALS, LIBRARIES, MEDICAL FACILITIES, PARKS, PICNIC AREAS, PLACES OF WORSHIP, PLAYGROUNDS, PUBLIC MEETING ROOMS, PUBLIC OR NONPROFIT INSTITUTIONAL STRUCTURES, RADIO STUDIOS, RECORDING STUDIOS, RECREATION AREAS, SECTION 4(F) SITES, SCHOOLS, TELEVISION STUDIOS, TRAILS, AND TRAIL CROSSINGS	67 dBA (EXTERIOR)
D	AUDITORIUMS, DAY CARE CENTERS, HOSPITALS, LIBRARIES, MEDICAL FACILITIES, PLACES OF WORSHIP, PUBLIC MEETING ROOMS, PUBLIC OR NONPROFIT INSTITUTIONAL STRUCTURES, RADIO STUDIOS, RECORDING STUDIOS, SCHOOLS, AND TELEVISION STUDIOS .	52 dBA (INTERIOR)
E	HOTELS, MOTELS, OFFICES, RESTAURANTS/BARS, AND OTHER DEVELOPED LANDS, PROPERTIES OR ACTIVITIES NOT INCLUDED IN A-D OR F.	72 dBA (EXTERIOR)
F	AGRICULTURE, AIRPORTS, BUS YARDS, EMERGENCY SERVICES, INDUSTRIAL, LOGGING, MAINTENANCE FACILITIES, MANUFACTURING, MINING, RAIL YARDS, RETAIL FACILITIES, SHIPYARDS, UTILITIES (WATER RESOURCES, WATER TREATMENT, ELECTRICAL), AND WAREHOUSING	N/A
G	UNDEVELOPED LANDS THAT ARE NOT PREMITTED	N/A

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Federal Highway Administration Noise Abatement Criteria for Highway Noise

Kawaihae Commercial Harbor Improvements Project

Not to Scale

Date	Project No.	Drawn By
September 2011	11-19	DFD

Figure No 2

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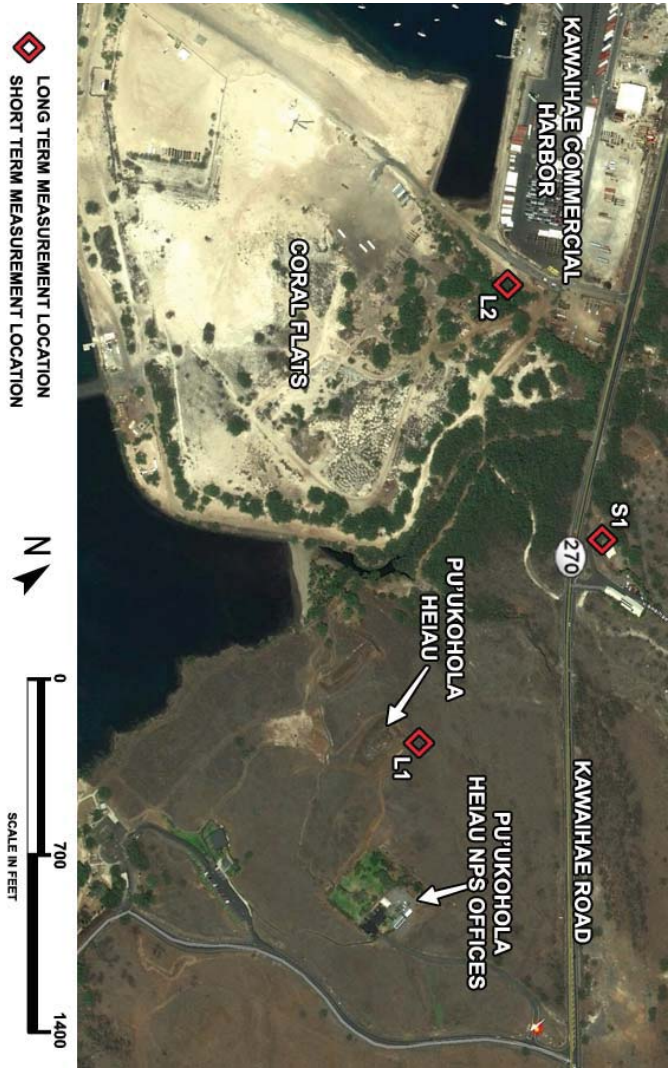
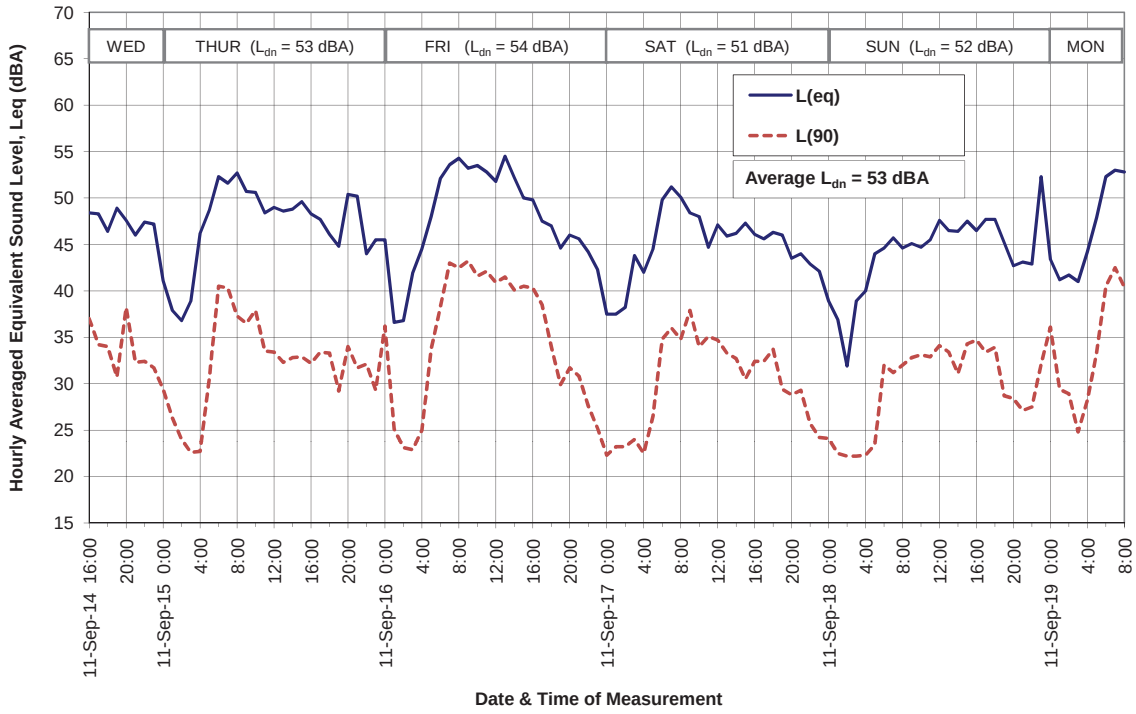
Long Term and Short Term Noise Measurement Locations

Date	Project No.	Drawn By
Sept 2011	11-19	DFD

Figure No 3





Long Term Noise Measurement Results - Puukohola Heiau NHS

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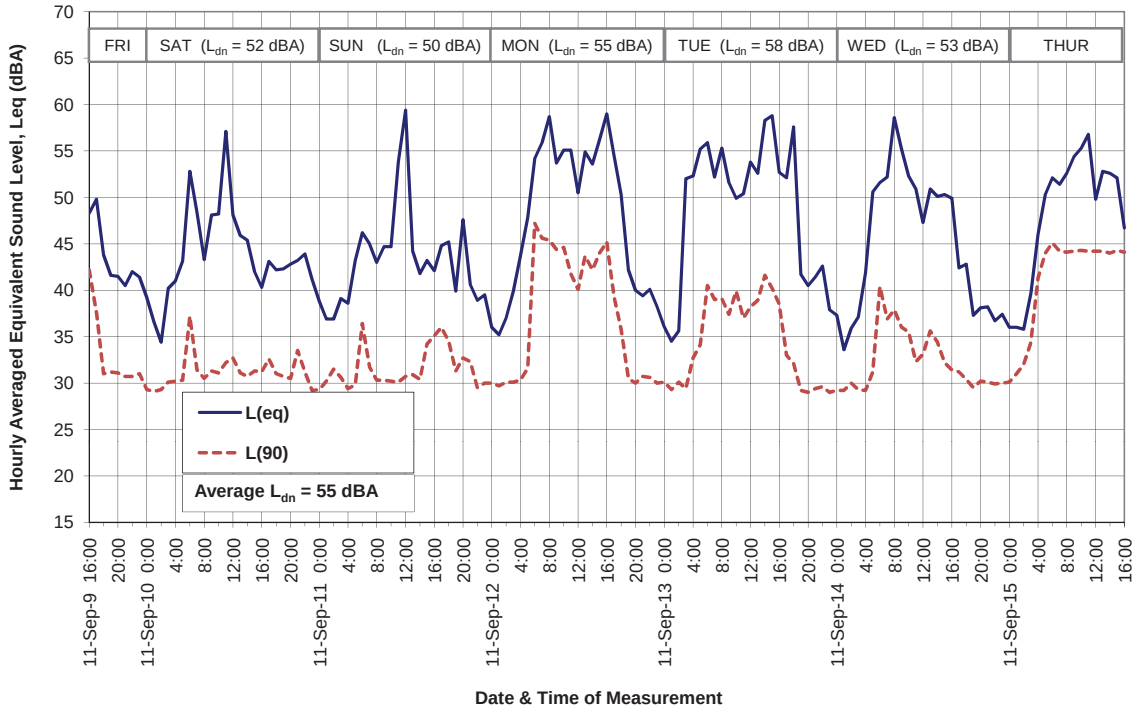
Date	Project No.	Drawn By	Figure No
Sept 2011	11-19	DFD	5



Long Term Noise Measurement Results - Kawaihae Harbor

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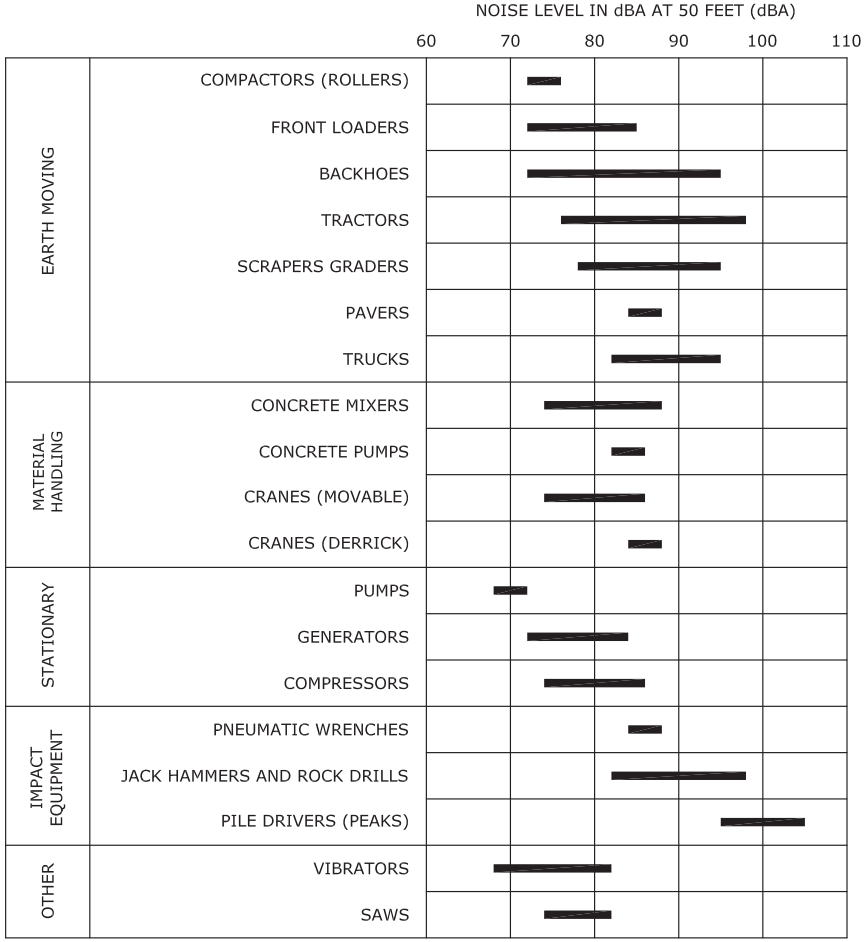
Date	Project No.	Drawn By	Figure No
Sept 2011	11-19	DFD	4



NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

Typical Sound Levels from Construction Equipment

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Kawaihae Commercial Harbor Improvements Project

Figure No 6

Not to Scale

Date	Project No.	Drawn By
September 2011	11-19	DFD

APPENDIX A

Acoustic Terminology

Acoustic Terminology

Sound Pressure Level

Sound, or noise, is the term given to variations in air pressure that are capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over such a large range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB). Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/P_{ref}) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and P_{ref} is the reference pressure, 20 µPa, which is approximately the lowest sound pressure that can be detected by the human ear. For example:

If P = 20 µPa, then SPL = 0 dB
If P = 200 µPa, then SPL = 20 dB
If P = 2000 µPa, then SPL = 40 dB

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound sources, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined sound level of 53 dB, not 100 dB. Two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 6 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

Studies have shown conclusively that at equal sound pressure levels, people are generally more sensitive to certain higher frequency sounds (such as made by speech, horns, and whistles) than most lower frequency sounds (such as made by motors and engines)[1] at the same level. To address this preferential response to frequency, the A-weighted scale was developed. The A-weighted scale adjusts the sound level in each frequency band in much the same manner that the human auditory system does. Thus the A-weighted sound level (read as "dBA") becomes a single number that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound. Different sounds with the same A-weighted sound level are perceived as being equally loud. The A-weighted noise level is commonly used today in environmental noise analysis and in noise regulations. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

[1] D.W. Robinson and R.S. Dadson, "A Re-Determination of the Equal-Loudness Relations for Pure Tones," *British Journal of Applied Physics*, vol. 7, pp. 166 - 181, 1956. (Adopted by the International Standards Organization as Recommendation R-226.

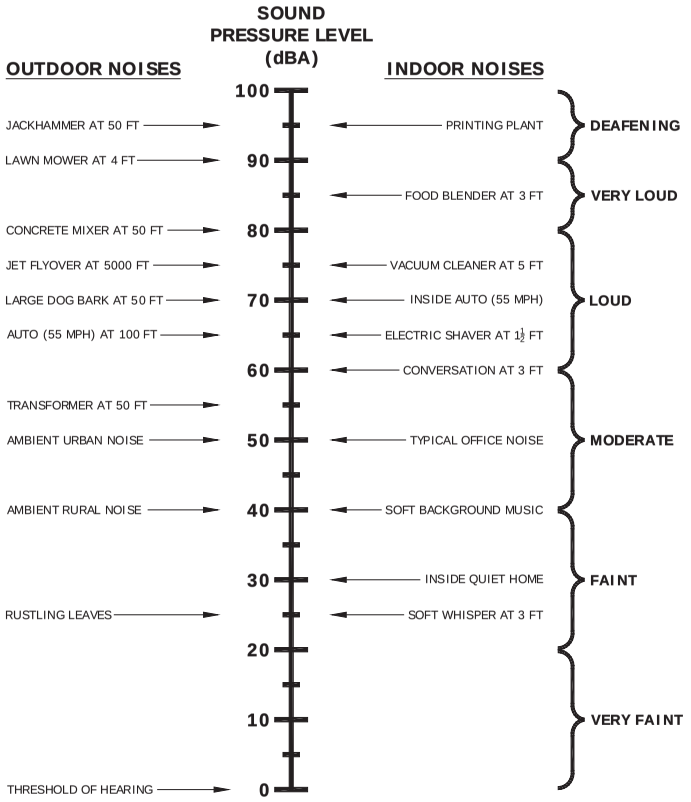

Figure A-1. Common Outdoor/Indoor Sound Levels

Equivalent Sound Level

The Equivalent Sound Level (L_{eq}) is a type of average which represents the steady level that, integrated over a time period, would produce the same energy as the actual signal. The actual *instantaneous* noise levels typically fluctuate above and below the measured L_{eq} during the measurement period. The A-weighted L_{eq} is a common index for measuring environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

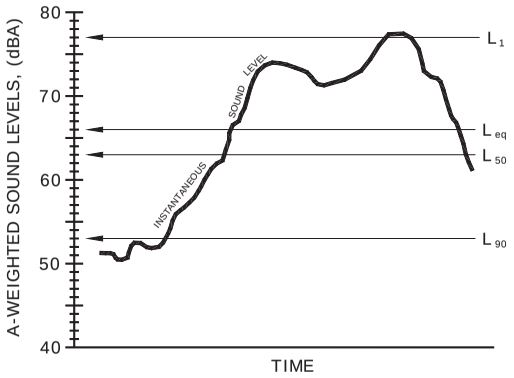

Figure A-2. Example Graph of Equivalent and Statistical Sound Levels

Statistical Sound Level

The sound levels of long-term noise producing activities such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels has been developed. It is known as the Exceedence Level, L_n. The L_n represents the sound level that is exceeded for n% of the measurement time period. For example, L_{10} = 60 dBA indicates that for the duration of the measurement period, the sound level exceeded 60 dBA 10% of the time. Typically, in noise regulations and standards, the specified time period is one hour. Commonly used Exceedence Levels include L_{01}, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 p.m. and 7 a.m. to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations.

APPENDIX B

Photographs at Project Site



Location L1:
Located at Coral Flats near the South Gate security entrance between the harbor and Makahuna Gulch.



Location L2:
Adjacent to Puukohola Heiau, overlooking Kawaihae Commercial Harbor.

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Appendix D: Archaeological Literature Review and Field Inspection

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Archaeological Literature Review and Field Inspection For the Kawaihae Harbor Project, Kawaihae 1 and 2 Ahupua'a, South Kohala District, Hawai'i Island [TMKs: (3) 6-1-003:022 por., :023 por., :025 por., :026, :055, :047, :067 and (3)-6-1-002:078 and :079]

Prepared by
Sarah Wilkinson, B.A.,
Douglas Borthwick, B.A.
and
Hallett H. Hammatt, Ph.D.

October 2011

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Tuesday, November 08, 2011

Statement of Cultural Surveys Hawai'i, Inc.'s Quality Process

It is the policy of CSH to have a consistent and systematic approach to the development and review of its reports and other project deliverables.

All projects and products of our service are subject to a quality process and in no case will the quality review be eliminated. The main purpose of this process is to assure:

- Clarity, completeness, coordination, and accuracy of documents.
- That the project, study or investigation meets the Client's objectives.
- That the requirements of our Agreement with the Client have been met, and the Client has received the value of the fee to be paid.

The Preparation of This Report Was The Responsibility of and Completed By:

Signature _____ Date 11/8/11

The Quality Review of This Report Was The Responsibility of and Completed By:

Signature _____ Date 11/8/11

Signature, _____ Date 11/8/11

If you have any questions or comments, please feel free to call me at (808) 262-9972 on O'ahu or toll-free at 1-800-599-9962. You may also reach me by e-mail at hhammatt@culturalsurveys.com.
Sincerely,

Hallett H. Hammatt, Ph.D, President

Management Summary

Reference	Archaeological Literature Review and Field Inspection For the Kawaihae Harbor Project, Kawaihae 1 and 2 Ahupua‘a, South Kohala District, Hawai‘i Island [TMKs: (3) 6-1-003:022 por., :023 por., :025 por., :026, :055, :047, :067 and (3)-6-1-002:078 and :079] (Wilkinson et al. 2011)
Date	October 2011
Project Number (s)	Cultural Surveys Hawai‘i’s (CSH) Job Code KAWAIHAE 4
Investigation Permit Number	Fieldwork for this investigation was performed under archaeological fieldwork permit number 11-17, issued by the Hawai‘i Department of Land and Natural Resources / State Historic Preservation Division (DLNR / SHPD).
Project Location	The project area is located in the *ahupua‘a* (traditional land division) of Kawaihae 1 and 2 in the Kohala District on Hawai‘i Island. The project area consists of the entire Kawaihae Harbor, which is situated at the coast along Kawaihae Road (Highway 270) just north of the Pu‘ukoholā Heiau National Historic Site.
Land Jurisdiction	State of Hawai‘i Department of Transportation (HDOT), Harbors Division
Agencies	SHPD
Project Description	SSFM has requested an Archaeological Literature Review and Field Inspection in order to prepare an Environmental Assessment (EA) for the HDOT Harbors Division Master Plan relating to short-term improvements for the Kawaihae Harbor. The proposed short-term improvements to the Kawaihae Harbor include: 1. Extensions to Piers 2A and 2B, and related dredging activities 2. Improvements to the Main Gate and South Gate 3. A new south gate connection to the regional highway 4. Grading of Coral Flats area for industrial lots/storage 5. Fencing to the Kawaihae Small Boat Harbor (South) and future transfer of Perimeter Road to Department of Boating and Ocean Recreation (BOBOR) 6. Relocation of Hawai‘i District Office and comfort station
Area of Potential Effect (APE)	For the purposes of this archaeological literature review and field inspection, the area of potential effect (APE) and project acreage are considered to be one and the same, consisting of the entire approximately 113-acre Kawaihae Harbor. The field inspection focused on the specific improvement areas described above, but included the entire Coral Flats area.

Document Purpose	This archaeological literature review and field inspection study was completed for use as a planning document. The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation [Hawai‘i Revised Statutes (HRS) Chapter 343 and HRS 6E-8/Hawai‘i Administrative Rules (HAR) Chapter 13-275, respectively]. While this investigation does not fulfill the requirements of an archaeological inventory survey investigation (per HAR Chapter 13-276), it serves as a document to facilitate the proposed project’s planning and supports historic preservation review compliance by assessing if there are any archaeological concerns within the study area and to develop data on the general nature, density and distribution of archaeological resources.
Fieldwork Effort	The fieldwork component of the archaeological literature review and field inspection was accomplished on September 15, 2011 by CSH archaeologists Sarah Wilkinson, B.A., and Olivier Bautista, B.A., under the general supervision of Hallett H. Hammatt, Ph.D (principal investigator). The fieldwork required approximately one (1) person-day to complete and consisted of a complete pedestrian inspection of the project area.
Results	Background research indicated a lack of historic properties[1] in the bounds of the present project area, due to the high level of disturbance within and along Kawaihae Bay over the last 50+ years. The construction of the harbor, completed in 1959, likely obliterated the original shoreline and any historic properties that may have once been present there. While the harbor itself is more than 50 years old, it functions as an active port and has undergone numerous subsequent improvements. Nevertheless, some potentially sensitive areas were identified during the field inspection. Most importantly, the *mauka* or eastern shoulder and hillside along Kawaihae Road are of concern given the presence of several signigicant historic properties including burial sites, cemeteries and habitation sites. A modern memorial and buried fiber optic cable are also present along the *mauka* shoulder. In addition, the following areas were identified as potentially sensitive, given their locations on coral landfill interface with the original shoreline: the project boundary with Pu‘ukoholā Heiau National Historic Site and the Pelekane Lands Buffer Zone; the entire Kawaihae Road corridor, including the western or *makai* (seaward) shoulder and the Main Gate and South Gate improvement areas; and the proposed DOT-H Office and comfort station locations. Though these areas have undergone extensive disturbance, there remains a potential (however unlikely) for the exposure of historic features or artifacts during subsurface construction activities.

Recommendations	Because the harbor facility is presently active and has undergone improvements since its construction in 1959, it is not recommended eligible to the State Inventory of Historic Places (SIHP). Impacts to the previously-recorded historic properties located along the eastern or *mauka* shoulder of Kawaihae Road and within the Pu‘ukoholā Heiau National Historic Site and Pelekane Lands Buffer Zone are not anticipated, given their locations outside of the proposed project APE. However, the existing right-of-way along the *mauka* shoulder of Kawaihae Road, and the boundary between the Coral Flats and the Pelekane Lands Buffer Zone/Pelekane Bay should be strictly observed in order to avoid impacts to any of the sites located in the vicinity. Any recommendations included in the EA regarding construction-related vibration impacts should be carefully implemented to avoid adversely affecting the historic properties. Given the close proximity of sensitive sites along the *mauka* shoulder of Kawaihae Road (SIHP 13749 and 13782 in particular) to the Main Gate and South Gate/Kawaihae Road corridor APE, a program of on-call monitoring by a qualified archaeologist is recommended to better ensure protection of the historic properties east of the shoulder, and is recommended for any subsurface excavation activities along the road APE, in order to mitigate the inadvertent discovery of subsurface features or artifacts that may be present there. While this area has been impacted by prior construction activities related to the road and its related infrastructure, the eastern limit of the coral landfill falls, according to Figure 6, west of Kawaihae Road, and therefore undisturbed deposits may still exist. The presence of disturbed features or artifacts would be important to document as well, as they may provide further information about life at Kawaihae in the hisotric era. A monitoring program would require the preparation of an SHPD-approved monitoring plan. Furthermore, there is a potential (however unlikely) for construction-related disturbance of subsurface features or artifacts along the coral landfill interface with the original shoreline. The landfill was constructed over the heavily-used natural shoreline, and covered several Land Commission Awards (LCAs). The landfill depth along the interface is likely to be variable. In the unlikely event that subsurface features or artifacts are project-related excavation within the proposed Coral Flats Perimeter Road APE or the DOT Hawai‘i District Office/ Comfort Station APE, CSH recommends that construction activites cease and the SHPD be contacted immediately.

[1]Historic properties, as defined under federal historic preservation legislation, are cultural resources that are at least 50 years old (with exceptions) and have been determined eligible for inclusion in the National Register of Historic Places based on their integrity and historic/cultural significance in terms of established significance criteria. Determinations of eligibility are generally made by a federal agency official in consultation with SHPD. Under federal legislation, a project’s (undertakings) potential effect on historic properties must be evaluated and potentially mitigated. Under Hawai‘i State historic preservation legislation, historic properties are defined as any cultural resources that are 50 years old, regardless of their historic/cultural significance under state law, and a project’s effect and potential mitigation measures are evaluated based on the project’s potential impact to “significant” historic properties (those historic properties determined eligible, based on their integrity and historic/cultural significance in terms of established significance criteria, for inclusion in the Hawai‘i Register of Historic Places). Determinations of eligibility to the Hawai‘i Register result when a state agency official’s historic property “significance assessment” is approved by SHPD, or when SHPD itself makes an eligibility determination for a historic property.

Determinations of eligibility to the National/Hawai‘i Register result when a state agency official’s historic property “significance assessment” is approved by SHPD, or when SHPD itself makes an eligibility determination for an historic property (HAR Chapter 13-275).

The five criteria used (Criterion E is specific to the HRHP and not the NRHP) are:

A Associated with events that have made an important contribution to the broad patterns of our history;

B Associated with the lives of persons important in our past;

C Embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or possesses high artistic value;

D Have yielded, or is likely to yield information important for research on prehistory or history;

E Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property, or due to associations with traditional beliefs, events or oral history accounts – these associations being important to the group’s history and cultural identity.

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Section 1 Introduction

1.1 Project Background

At the request of SSFM International, Inc., Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this Archaeological Literature Review and Field Inspection for the proposed Kawaihae Harbor Project. The project area consists of the entire Kawaihae Harbor (approximately 113 acres), which is located in the *ahupua‘a* (traditional land divisions) of Kawaihae 1 and 2, South Kohala District, Hawai‘i Island. The Harbor is situated at the coast along Kawaihae Road (Highway 270) just north of the Pu‘ukohola Heiau National Historic Site. The project area is depicted on a USGS topographic map and tax map (Figure 1 and Figure 2), as well as on an aerial photo (Figure 3). Please note that the extent of the rocks and coral reef depicted as scalloped lines on the 1996 USGS topographic map (Figure 1) does not reflect current conditions.

The State of Hawai‘i, Department of Transportation, Harbors Division (DOT-H) has completed the Hawai‘i Island Commercial Harbors 2035 Master Plan Update and is proposing several infrastructure improvements to the Kawaihae Commercial Harbor. The Kawaihae Harbor Development Plan begins implementation of Master Plan features by preparing the preliminary engineering for near-term improvements, for which a Draft Environmental Assessment (Draft EA) is being prepared. SSFM International, Inc. will include the findings of the present study in the EA. The near-term improvements being considered include (Figure 4):

1. **Extensions to Piers 2A and 2B and related dredging activities:** To accommodate future cargo demands and increase berth capacity, Pier 2A will be extended 340 feet. A new Pier 2C will be constructed, providing an additional 325 feet of berth space. These improvements would allow for four 400-foot long barges. The construction of Pier 2C would require the removal of Department of Land and Natural Resources Division of Boating and Ocean Recreation’s (DOBOR) boat mooring dock at the south of end of Pier 2B. DOBOR plans are in place to relocate the small boat moorings to the nearby Kawaihae (South) Small Boat Harbor Facility. Dredging of the berthing area fronting Pier 1 and Piers 2A, 2B, 2C will be needed to improve navigational operations within the harbor.
2. **Improvements to the Main Gate and South Gate:** Traffic ingress and egress at Kawaihae Harbor is currently through the Main Gate. Sufficient area is needed to accommodate internal circulation queues at security gates. South Gate is currently closed, but will become more important following the Harbor district office relocation and additional uses at Coral Flats. The current roads used to access Kawaihae Harbor are in need of improvements which are being considered as part of the Kawaihae Harbor Development Plan. A detailed schematic of these proposed improvements is shown in Figure 5.
3. **A new south gate connection to the regional highway:** DOT Highways Division has begun long-term planning for the Kawaihae Bypass Road that would provide additional roadway capacity to and from the harbor. An Environmental Impact Statement is being

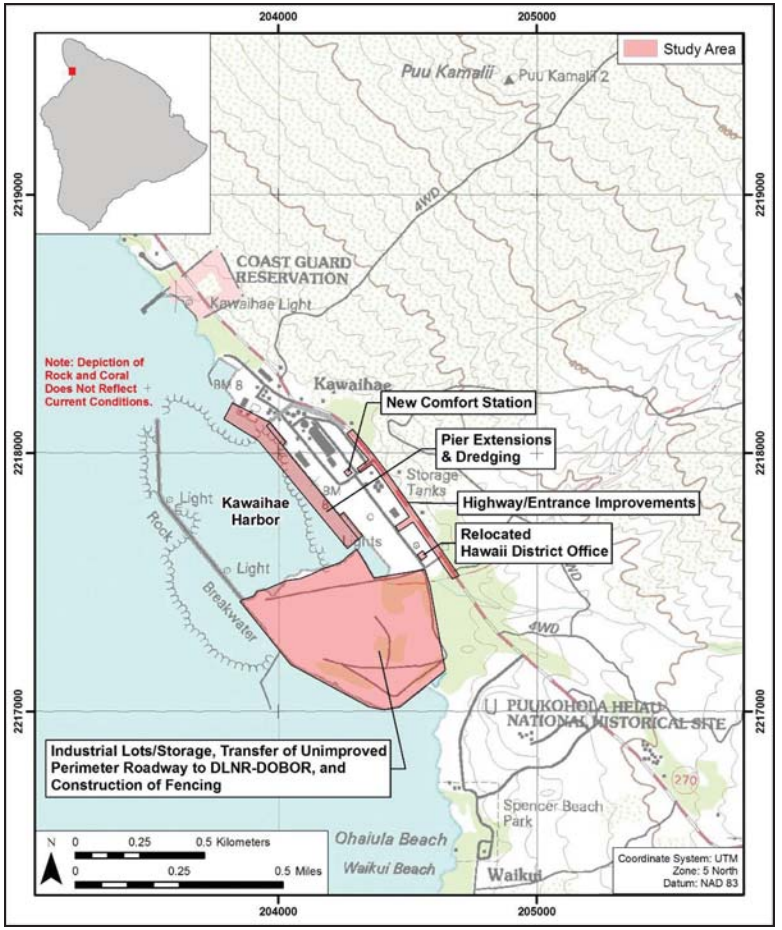

Figure 1. Portion of 1996 USGS 7.5-Minute Series Topographic Map, Kawaihae quadrangle, showing the locations of the various study areas (shaded in pink) at Kawaihae Harbor

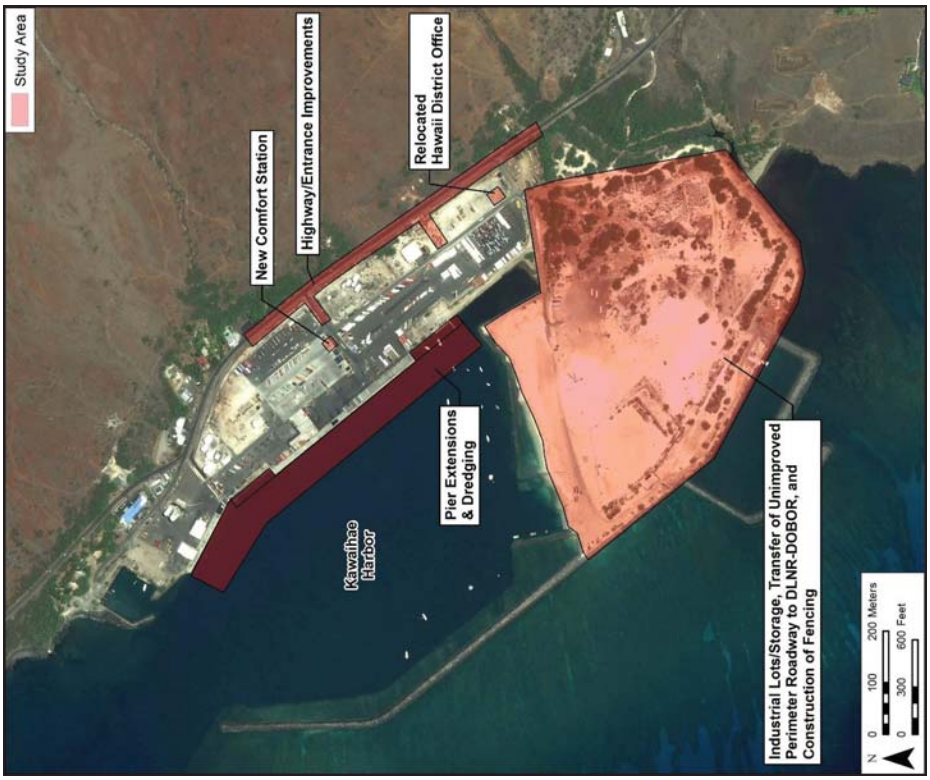

Figure 3. Aerial photograph (Google Earth 2011) showing the locations of the various study areas (shaded in pink) at Kawaihae Harbor

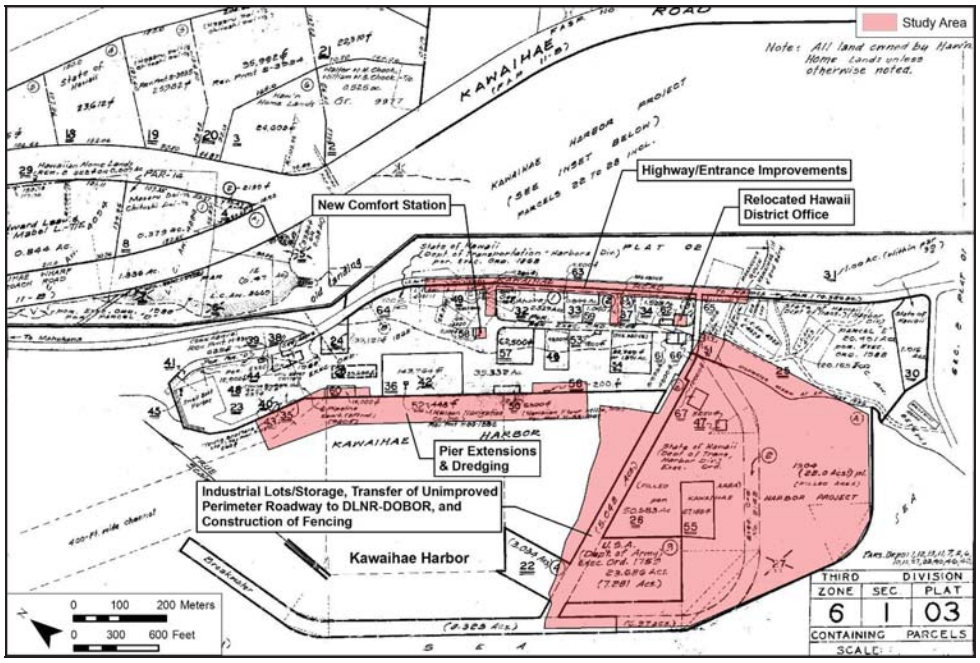

Figure 2. Tax Map Key [3] 6-2-003, showing the locations of the various study areas (shaded in pink) at Kawaihae Harbor

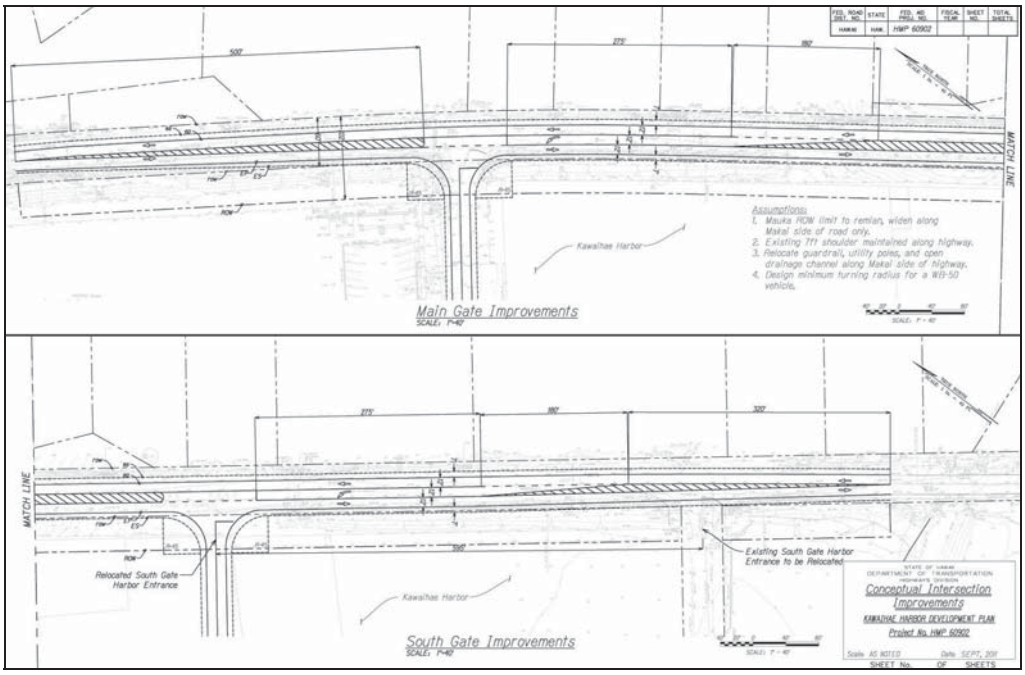

Figure 5. Client-provided map detailing the proposed improvements to the Main Gate and South Gate harbor entrances

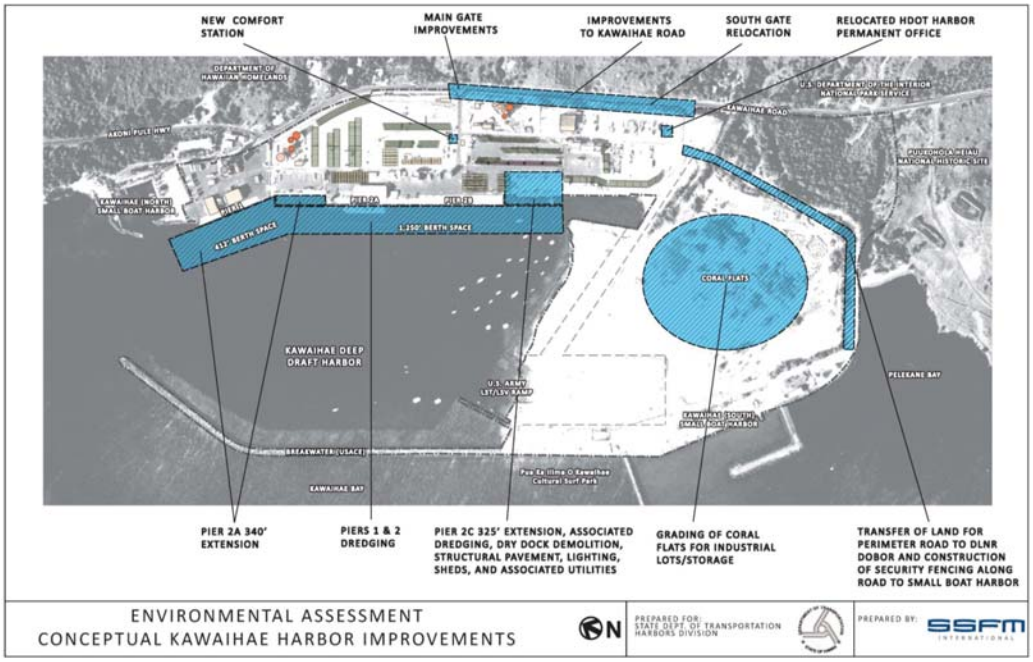

Figure 4. Client-provided map showing the improvement areas included in the preliminary scope of the EA (shaded in blue)

prepared for the bypass project. The future bypass road will include a direct connection into Kawaihae Harbor are being considered.

4. **Grading of Coral Flats area for industrial lots/storage:** There is a growing demand at Kawaihae Harbor for use of the Coral Flats area. Currently, these uses primarily include truck staging, stand-by, and storage areas. As demand for these lots increase, DOT-H will be grading additional areas for lease lots.
5. **New fencing along perimeter road to the Small Boat Harbor:** The Kawaihae Small Boat Harbor (South) is located in the southwest corner of Coral Flats and is operated by DOBOR. The build-out of Kawaihae Small Boat Harbor (South) will be independent from the commercial harbor and future Coral Flats uses. HDOT Harbors Division will be turning over the unimproved roadway to DOBOR; future improvements to the roadway by DOBOR are not included as part of the Proposed Action. However, HDOT Harbors Division will be building fencing designed to separate the commercial harbor from the recreational boating facilities.
6. **Relocation of Hawai‘i District Office and Comfort Station:** The Hawai‘i District Office will be demolished and rebuilt in new locations. These facilities will be designed to Leadership in Energy and Environmental Design (LEED) silver standards and with Americans with Disabilities Act (ADA) compliance.

The Kawaihae Commercial Harbor basin measures 1,450 by 1,500 feet and has a depth of 35 feet. The entrance channel is 3,270 feet long and 500 feet wide. A 2,650 foot breakwater protects the harbor. The harbor is served by Queen Ka‘ahumanu Highway and is located 28 miles north of Kona International Airport at Keāhole. The harbor has had tremendous growth in cargo volumes over the past decade. Expansion of its facilities to accommodate future growth is a priority.

The harbor has two piers. Pier 1 has 412 feet of berthing space, 4.6 acres of yard space and 8,300 square feet of shed space and is primarily used by cement barges. Pier 2 has 1,150 feet of berthing space and 30.6 acres for storage and handling and is dedicated to cargo barges and shared by two users. The US Army owns and operates a landing ramp on the portion of the coral landfill known as the Coral Flats.

1.2 Document Purpose

This archaeological literature review and field inspection study was completed for use as a planning document. The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation [Hawai‘i Revised Statutes (HRS) Chapter 343 and HRS 6E-8/Hawai‘i Administrative Rules (HAR) Chapter 13-275, respectively]. While this investigation does not fulfill the requirements of an archaeological inventory survey investigation (per HAR Chapter 13-276), it serves as a document to facilitate the proposed project’s planning and supports historic preservation review compliance by assessing if there are any archaeological concerns within the study area and to develop data on the general nature, density and distribution of archaeological resources.

1.3 Scope of Work

This study was designed to address archaeological site types and locations, and allow for future work recommendations. The goal is to identify, if possible, cultural resources and historic properties and to provide recommendations related to the State of Hawai‘i’s historic review process. The agreed upon scope of work is as follows:

1. Historic 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 adjacent to the subject property.
2. Limited 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 will identify any sensitive areas that may require further investigation or mitigation before the project proceeds.
3. Preparation of a report to include the results of the Historic research and the limited fieldwork with an assessment of archaeological potential based on that research, with recommendations for further archaeological work, if appropriate. It will also provide mitigation recommendations if there are archaeologically sensitive areas that need to be taken into consideration.

1.4 Environmental Setting

1.4.1 Natural Environment

The *ahupua‘a* of Kawaihae 1 and 2 are situated primarily on the saddle between Mauna Kea and the Kohala Mountains (Armstrong 1973:31). The project area is characterized as gently to moderately sloping from the coast to about 300 ft above mean sea level (amsl) (Sato et al. 1973:26; USGS Map, Kawaihae Quad., 1995). The geology of the area is composed of the Hāmākua volcanic series (Juvik et al. 1998:43).

The climate in Kawaihae 1 and 2 has a clearly defined summer (dry) and winter (wet) season with the average annual rainfall being 5 to 10 inches, most of which falls during the winter months (Juvik et al. 1998:57-59). There are no perennial streams within Kawaihae 1 or 2 (Wilcox et al. 1990:7-12, 44).

The project area is predominately underlain by Fill Land (FL) (Figure 6). In this particular location the fill consists of compacted coral material dredged from within the harbor. Small areas of soil belonging to the Kawaihae series are also present. Kawaihae very rocky very fine sandy loam (KOC) is found along the eastern boundary of the project area, along and adjacent to Kawaihae Road, where the natural shoreline existed prior to the construction of the present harbor facility in the late 1950s (see Figure 6). This soil is “extremely stony very fine sandy loam, 6 to 12 percent slopes, except that rock outcrops occupy 10 to 20 percent of the surface” (Sato et al. 1973:26). Land areas consisting of this soil are used mainly for pasture. The southwest corner of the project area is underlain by Kawaihae extremely stony very fine sandy loam, 6 to 12 percent slopes (KNC) (see Figure 6), which is very similar to KOC soils. This portion of the project area lies outside of the study areas. Please note that the extent of the rocks

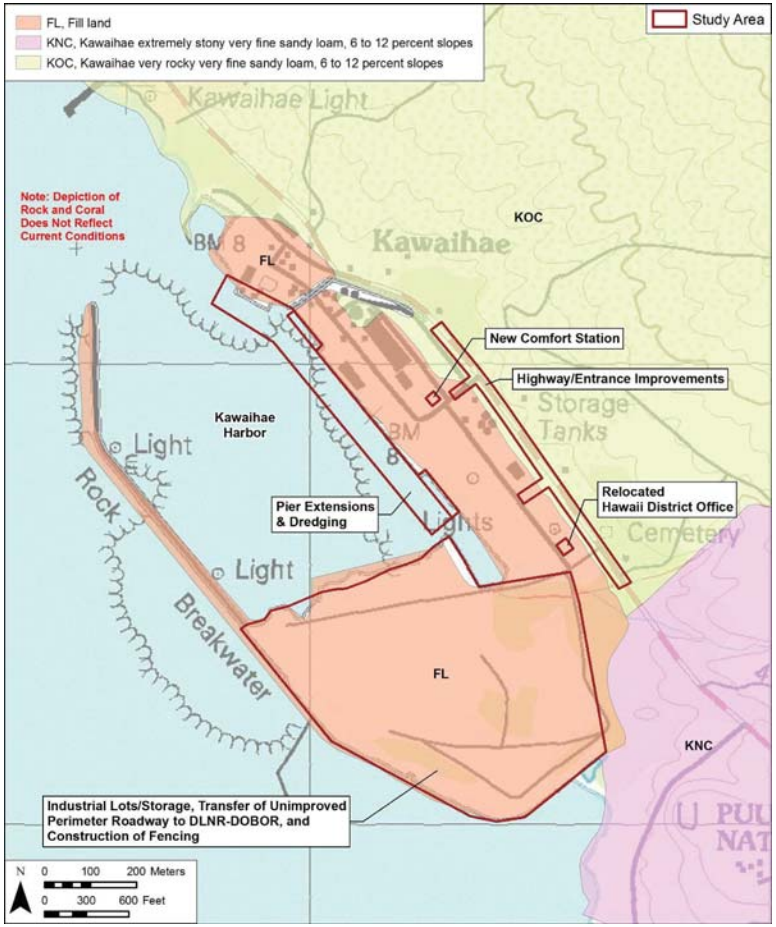

Figure 6. Portion of 1996 USGS 7.5-Minute Series Topographic Map, Kawaihae quadrangle, overlain with soil survey data (Sato et al. 1973), indicating soil types in and around the various study areas (outlined in red) at Kawaihae Harbor

and coral reef depicted as scalloped lines on the 1996 USGS topographic map (Figure 1 and Figure 6) does not reflect current conditions.

The vegetation is of limited diversity and consists predominantly of buffel grass (*Cenchrus ciliaris*), fingergrass (*Chloris Sw.*) and *kiawe* (*Prosopis pallida*), with scattered *koa haole* (*Leucaena leucocephala*), *‘ilima* (*Sida fallax*) and *‘uhaloa* (*Waltheria indica* var. *americana*). *Pua kalaunu* (*Calotropis gigantean*), or lavender crown flower, was observed in the vicinity of the historic properties along the *mauka* shoulder of Kawaihae Road (Figure 7). This flower was introduced to Hawai‘i toward the end of 19th century. It was a favorite of Queen Lili‘uokalani, and, after her death, lei makers. This plant grows best in warm, arid locations, like the project area.

Prior to human settlement, the native ecosystem of the project area consisted of lowland dry shrubland and grassland and rising to lowland dry and mesic forest, woodland and shrubland. Today, the ecosystem is characterized as “nonnative lands transformed by human activity” (Juvik et al. 1998:122-123).

1.4.2 Built Environment

The project area has been previously developed or disturbed by development. From 1957 to 1959, the U.S. Army Corps of Engineers (USACE) dredged the then-natural harbor, and used the extracted coral materials to create a level landfill extending from the natural shoreline on which new port facilities could be built. At the same time, a breakwater was constructed to protect the piers built at the edge of the main deep-draft landing area. Presently, the port includes a fuel depot, shipping terminal, and associated roadways and buildings (Figure 8). The shallower Kawaihae (North) Small Boat Harbor, adjacent to the north of the deep-water port, berths smaller private and commercial vessels. Immediately south of the main port/harbor area and north of the Pu‘ukoholā Heiau National Historic Site is the broad, roughly fan-shaped area of compacted dredged-coral landfill known as the “Coral Flats.” Vehicular traffic is allowed onto the flats in order to access the Kawaihae Small Boat Harbor (South) (constructed in 1970) and Kawaihae Canoe Club, a landing for U.S. Army vessels, and the Pua Ka‘ilima ‘O Kawaihae Cultural Surf Park. A quarry is located roughly in the middle of the Coral Flats study area shown on Figure 4, at which excess coral fill material is crushed for use elsewhere.

The harbor is accessed via Kawaihae Road (also called Highway 270, Akoni Pule Highway, or Kawaiae-Mahukona Road), and is surrounded by residences and commercial buildings to the north and northeast. The Queen Emma Foundation and U.S. National Park Service control large areas of undeveloped land across Kawaihae Road from the coral flats, while the Department of Hawaiian Homelands (DHHL) controls much of the area along the eastern or *mauka* (upslope) side of Kawaihae Road directly across from the main harbor area. Many previously-recorded historic properties are located here and within the Pu‘ukoholā Heiau National Historic Park to the south; the LCA parcels and much of the former shoreline at Kawaihae Town were covered by the dredged coral fill material, which is up to thirteen feet deep in places.



Figure 7. Photo of *pua kalaunu*, or crown flower, growing *mauka* of Kawaihae Road in the vicinity of the project area



Figure 8. Photo showing an example of the built environment at the Kawaihae Harbor; view to the north

Section 2 Methods

2.1 Field Methods

The fieldwork component of the archaeological literature review and field inspection was completed on September 15, 2011 by CSH archaeologists Sarah Wilkinson, B.A., and Olivier Bautista, B.A., under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator). The fieldwork was carried out under archaeological permit number 11-17 issued by the Hawai‘i State Historic Preservation Division/Department of Land and Natural Resources (SHPD/DLNR), per Hawai‘i Administrative Rules (HAR) Chapter 13-282.

The field inspection consisted of a pedestrian and vehicular inspection of most of the project area and of all of the study areas shown shaded in red on Figure 1. The Pier Extension and Dredging study areas along existing Piers 2A and 2B were inspected as best as possible from the surface; the clarity of the water there allowed for a view of the coral shelf and other sea life in the shallower areas. Both vehicular and pedestrian inspections were conducted for the remaining port facility, including the Comfort Station and HDOT Harbor Office study areas. The *mauka* shoulder of Kawaihae Road and the existing unpaved perimeter road adjacent to the Pu‘ukoholā Heiau National Historical Site and Pelekane Lands Buffer Zone/Pelekane Bay were thoroughly covered by pedestrian inspection, as these were considered to be archaeologically sensitive given their proximity to known historic properties. A vehicular inspection was conducted for the remaining Coral Flats study area, given its relatively large size, good visibility throughout and low probability for the presence of archaeologically significant features.

A Garmin GPS Map 60CSX was used to record the route traveled during the inspection. Notes and photographs were taken at all of the study areas and any other points of interest. Areas of potential concern were identified and included in the field notes.

2.2 Laboratory Methods

Given the scope of work for this project, which included only limited field inspection of surface sites, no materials were collected or recovered, and no laboratory work was undertaken.

2.3 Document Review

Historic and archival research was obtained from the University of Hawai‘i at Mānoa’s Hamilton Library, the State Historic Preservation Division Library, the Hawai‘i State Archives, the State Land Survey Division, and the Archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and primary and secondary Historic sources. Information on Land Commission Awards was accessed through Waihona ‘Āina Corporation’s Māhele Data Base (www.waihona.com).

This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources studied were used to formulate a predictive model regarding the expected types and locations of historic properties in the project area.

Section 3 Background Research

This section presents the results of the background research conducted during the present study. It includes a history of the *ahupua‘a* of Kawaihae from the pre-contact era to modern times.

3.1 Pre-Contact to 1800

3.1.1 Traditions

According to the 19th-century memoirist John Papa ‘Ī‘ī, the 18th-century Hawai‘i Island chief Alapa‘i-nui, in ill health and with his armies defeated by those of his rival Ka-lani-‘ōpu‘u, “returned to Kawaihae, for he recalled the warm sands of this land where he had lived and loved, the ‘land of the whispering sea’” (‘Ī‘ī 1959:4). Presumably, Alapa‘i-nui was only one of the Hawai‘i Island *ali‘i* (nobility) who sojourned to Kawaihae. As ‘Ī‘ī further reports, Kawaihae possessed attributes prized by the Hawaiian royalty:

> ...a bathing pool in the upland of Kawaihae was called Keliialaalahoolaawai (The chief who aroused to dedicate the water). Also in Kawaihae was a kapu bathing pool called Alawai [‘Ī‘ī 1959:59].
>
> There are many ways to show skill in canoe surfing. The king [Kamehameha] was especially noted for it, and so was his pupil, Gideon Laanui. They were often seen together gliding on the surf outside of Haleumiumiiole at Kawaihae... [‘Ī‘ī 1959:135].

While Kawaihae may have embodied the “land of the whispering sea” to the *ali‘i*, the region was also chronicled in Hawaiian traditions as the site of battles fought by the *ali‘i*, including Alapa‘i-nui, to wrest or retain power on the island, a consequence of its harbor being the safest mooring area in the region and one of Hawai‘i island’s best anchorages. Indeed, Kawaihae literally translates as “the water [of] wrath”, though Pukui et al. (1974:97) attribute this meaning to skirmishes over water from a pool in the area.

The pioneering 19th-century Hawaiian historian Samuel Kamakau recounts some of these battle traditions. He tells of the Maui ruling chief Kama-lala-walu who with “his chiefs, his royal sons, the heir to the government of Maui, the warriors, and learned counselors” invaded Kohala and moved on to Kawaihae where “two old men of Kawaihae” advised him to destroy his canoes and do battle with the Hawai‘i chiefs at Pu‘oa‘oaka outside of Waimea. Kama-lala-walu followed their advice: at Pu‘oa‘oaka his armies were routed and the “retreat to Kawaihae was long...but because of the lack of canoes, only a few escaped with their lives” (Kamakau 1992:58-60).

The Hawai‘i Island forces that defeated Kama-lala-walu were led by Lonoikamakahiki, *mō‘ī* (ruling chief) of the island. Further battle exploits of Lonoikamakahiki at or near Kawaihae are recounted by another 19th-century historian, Abraham Fornander; quelling a rebellion led by his elder brother Kanaloakuaana, Lonoikamakahiki:

> ...marched down and met the rebels at a place called Wailea, not far from Wainanalii...Lono won the battle, and the rebel chiefs fled northward with their forces. At Kaunooa [Kauna‘oa], between Puako and Kawaihae, they made another stand, but were again routed by Lono, and retreated to Nakikiaianihau...Two other engagements were fought at Puupa and Puukohola, near the Heiau [traditional place of worship] of that name [at Kawaihae], in both of which Lono was victorious [Fornander 1996:121].

Other events at Kawaihae are preserved in the Hawaiian traditions. ‘Ī‘ī tells of three chiefs, Luahine, Palena and Paia, who:

> [S]aved the life of chief Kuaana in Kawaihae when the ruling chiefess, Keakealaniwahine, ordered him drowned. They persuaded her to have Kuaana set adrift on a raft of beach morning-glory vines instead. When the raft was out of sight, they came to his aid, and Kuaana was able to land on Maui [‘Ī‘ī 1959:19].

Kamakau also tells of Kamalālāwalu, the king of Maui during the reign of Lonoikamakahiki, who sent spies to the island of Hawai‘i to assess the number of inhabitants. The spies landed at Kawaihae and passed through neighboring ‘Ōuli in their search of the island. The spies reported back to Kamalālāwalu:

> We went all around Hawaii. There were many houses, but few men. We went to Kohala and found the men only on the shores…Bare of inhabitants is Kohala, for the men are at the coast [Kamakau 1992:56-57].

According to Kamakau, Ke-kau-like, a ruling chief of Maui:

> ...[S]o delighted in war that he sailed to attack Hawaii. The fighting began with Alapa‘i at Kona. Both sides threw all their forces into the fight. Ke-kau-like cut down the trees throughout the land of Kona. Obliged to flee by canoe before Alapa‘i, he abused the country people of Kekaha. At Kawaihae he cut down all the coconut trees. He slaughtered the country people of Kohala, seized their possessions, and returned to Maui [Kamakau 1992:66].

Kawaihae is included among battle sites associated with Ka-lani-‘ōpu‘u, the ruling chief of Hawai‘i Island:

> As to the noted events of Ka-lani-‘opu‘u’s time, the first battles he fought were against Alapa‘i-nui, son of Ka-uaua. These were fought at Kalepolepo, Pua‘aloa, Pa‘ie‘ie, Mawae, Kuolo, Mokaulele, and Mahinaakaaka...The battles fought with Keawe-‘pala, the son of Alapa‘i, were at Ke-omo between Honaunau and Ke‘ei, on the mountain of Hualalai, the battle of Pae at Kahilina‘i, and the battle of Pu‘uki‘ilili’ on the plains of Kawaihae [Kamakau 1992:110-111].

Kamakau also records the last days of Alapa‘i-nui at Kawaihae: “...his illness became serious, and at Kikiako‘i in the *heiau* (traditional place of worship) of Mailekini, Kawaihae, he appointed his son Keawe-‘opala to be ruler over the island” (Kamakau 1992:77). Mailekini Heiau above Kawaihae Bay, an “extremely ancient and important prehistoric and historic site” was “one of the prizes gained by the Maui or Hawaii chief who held Kohala” (Cluff et al. 1969:12).

3.1.2 Kamehameha and Western Contact

During the last quarter of the 18th century, the Historic record of the Kawaihae region is drawn in sharper detail as Kawaihae became a focus of activities impelled by pivotal developments in the Hawaiian Islands: the arrival of the first western visitors and the ascendancy of Kamehameha.

On February 6, 1779, the British vessels *Resolution* and *Discovery* under the command of Captain James Cook were sailing north from Kealakekua Bay along the west coast of Hawai‘i when they reached Kawaihae Bay; there, Cook had been told, water and shelter could be found. William Bligh, master of the *Resolution* (and later of *H.M.S. Bounty* fame), went on shore but found no fresh water source. Lt. James King, aboard the *Resolution*, observed that the northeastern part of the bay “looks green and pleasant”; however he noticed “hardly any signs of culture” and only “a few houses” (Beaglehole 1955:525). A series of strong gales off Kawaihae damaged severely the foremast of the *Resolution*. Cook was forced to return to the shelter of Kealakekua Bay for the mast’s repair, and it was at Kealakekua that Cook was killed on February 14, 1779.

At the time of Cook’s death, Hawai‘i Island was under the rule of Kalani‘ōpu‘u; Kamehameha, his nephew, was then about twenty-five years old. Following Kalani‘ōpu‘u’s death in 1782, Kamehameha, who then controlled the districts of Kona, Kohala and north Hāmākua, would undertake the consolidation of his power on Hawai‘i. Kamehameha’s rule over Kohala gave him access to the foreign vessels that stopped at Kawaihae Bay during the latter 1780s. He would make good use of this opportunity to further his political aims. It was at Kawaihae in December 1788 that Kamehameha saw a sloop, the *North West America*, and asked its captain, William Douglas, for assistance in building a similar one; during the spring of the following year, 1789, Douglas returned to Hawai‘i and provided Kamehameha with arms and ammunition (Kuykendall 1965:23). However, the most imposing evidence of Kamehameha’s relationship with Kawaihae would be created about two years later.

Kapoukahi, a *kahuna* (priest) of Kaua‘i, solicited by Kamehameha for a means to gain victory over Keōua Ku‘ahu‘ula, Kamehameha’s cousin and chief rival on Hawai‘i, advised the “restoration of the heiau Mailekini and the building of the heiau of Puukohola in Kawaihae” for the god Kūkā‘ilimoku (‘Ī‘ī 1959:17). Kamehameha had already established a residence at Pelekāne, below Mailekini Heiau, along the shore of Kawaihae Bay. He assented to Kapoukahi’s counsel and the massive undertaking at Kawaihae commenced:

> Relays of people were ordered from Kona, Kohala, and Hamakua to repair to Kawaihae to carry stones and assist at the building. Chiefs of the highest degree and common natives worked side by side, and Kamehameha himself set the example of carrying stones to the building. (Fornander 1996:328)

Fornander, writing in the late 1800s, recalled:

> The author a few years ago conversed with a centenarian Hawaiian at Kawaihaeuka who had assisted in carrying stones towards building this Heiau. His description of the thousands of people encamped on the neighbouring hillsides, and taking their turns at the work, of their organisation and feeding, their time of work and relaxation, the number of chiefs that attended, and who, as the old man said, caused the ground to tremble beneath their feet; and the number of human victims that were required and duly offered for this or that portion of the building - this description was extremely interesting and impressive [Fornander 1996:328].

Pu‘ukoholā Heiau was completed in 1791. Rev. William Ellis, who visited Kawaihae in 1823, noted the imposing dimensions of the *heiau* and recorded the *heiau* traditions which endured in Kawaihae three decades after its completion:

> Its shape is an irregular parallelogram, 224 feet long, and 100 wide. The walls, though built of loose stones, were solid and compact. At both ends, and on the side next the mountains, they were twenty feet high, twelve feet thick at the bottom, but narrowed in gradually towards the top, where a course of smooth stones, six feet wide, formed a pleasant walk. The walls next the sea were not more than seven or eight feet high, and were proportionally wide. The entrance to the temple is by a narrow passage between too [sic] high walls...The upper terrace within the area was spacious, and much better furnished than the lower ones. It was paved with flat smooth stones, brought from a distance. At the south end was a kind of inner court, which might be called the sanctum sanctorum of the temple, where the principal idol used to stand, surrounded by a number of images of inferior deities.
>
> In the center of this inner court was the place where the anu [*anu‘u*] was erected, which was a lofty frame of wicker-work, in shape something like an obelisk, hollow, and four or five feet square at the bottom. Within this the priest stood, as the organ of communication from the god, whenever the king came to inquire his will; for his principal god was also his oracle, and when it was to be consulted, the king, accompanied by two or three attendants, proceeded to the door of the inner temple, and, standing immediately before the obelisk, inquired respecting the declaration of war, the conclusion of peace, or any other affair of importance...
>
> On the outside, near the entrance to the inner court, was the place of the rere (altar,) on which human and other sacrifices were offered...About the centre of the terrace was the spot where the king’s sacred house stood, in which he resided during the season of strict tabu, and at the north end, the place occupied by the houses of priests, who, with the exception of the king, were the only persons permitted to dwell within the sacred enclosures... Tairi or Kukairimoku, a large wooden image, crowned with a helmet, and covered with red feathers, the favourite war-god of Tamehameha, was the principal [Ellis 1969:97-98].

Shortly after the completion of Pu‘ukoholā, Kamehameha sent two chiefs on an embassy to his rival Keoua: they urged Keoua to go to Kawaihae and make peace with Kamehameha. Keoua assented. At some date between May and October 1791, Keoua and his entourage sailed into Kawaihae Bay:

> ...on a hill overlooking [the bay] was the great new heiau; near the shore, with his retinue about him, was Kamehameha...Keoua, prepared to disembark from his canoe. But at that moment, Keeaumoku [the Kona chief allied to

> Kamehameha]...hurled his spear at Keoua and after a brief struggle killed him. Keoua's immediate companions...were likewise killed by Keeaumoku and his followers; then Kamehameha intervened to stop the slaughter and save the lives of Kaoleioku [Keoua's younger brother] and those who were with him. The body of the dead chief was offered as a sacrifice on the altar of the new heiau of Puukohola [Kuykendall 1965:38].

Kamehameha consolidated his power on Hawai'i after Keoua's death. He ruled the entire island when the British vessel *Discovery*, under the command of Captain George Vancouver, anchored at Kawaihae Bay in March 1792 and February 1793. On both occasions, the chief Ke'eaumoku, who was also Kamehameha's father-in-law, was in residence at the village which Vancouver described as consisting "only of straggling houses, of two classes; those appropriated to the residence of the inhabitants were small, mean, miserable huts; but the others, allotted to the purposes of shading, building, and repairing their canoes, were excellent in their kind; in these occupations several people were busily employed, who seemed to execute their work with great neatness and ingenuity" (Vancouver 1967:II,116).

During Vancouver's second visit in February 1793, Archibald Menzies, a surgeon and naturalist aboard the *Discovery*, undertook a botanical expedition inland from Kawaihae toward the Waimea plains:

> I travelled a few miles back...through the most barren, scorching country I have ever walked over, composed of scorious dregs and black porous rocks, interspersed with dreary caverns and deep ravines, evidently indicating the volcanic revolution which the country at no very distant period had undergone. The herbs and grasses which the soil produced in the rainy seasons were now mostly in a shrivelled state, thinly scattered and by no means sufficient to cover the surface from the sun's powerful heat, so that I met with very few plants in flower in this excursion [Menzies 1920:55-56].

In contrast, Menzies could see further inland, "in the verge of the woods, several fine plantations, and my guides took great pains to inform me that the inland country was very fertile and numerously inhabited." The presence of this *mauka* population was confirmed for Menzies by the "number of people I met loaded with the produce of their plantations and bringing it down to the water side to market" where thronged a "concourse of people which curiosity [about the British ship] brought into the vicinity of the bay" (Menzies 1920:56).

The "concourse of people" Menzies noted at Kawaihae were, by 1793, well accustomed to trading with foreign vessels. Besides the produce from the *mauka* plantations, Kawaihae offered salt produced in the "middle of the village ...[from] a salt water pond, banked in and surrounded with a number of little square dams into which the water was conducted from the pond to deposit its salt by evaporation, and by assiduity and attention to this national [sic] process, the natives collected from these salterns a considerable quantity of very fine salt, not only sufficient for their own consumption, but they were likewise enabled to afford an ample supply of it to the different vessels which occasionally visited these islands" (Menzies 1920:55).

Menzies reveals other projects at Kawaihae incorporating wares bartered from visiting vessels:

> [Ke'eaumoku] showed us a large war canoe he was building, and asked Captain Vancouver to give him as much English canvas as would make a sail for it, which he was promised. He also took us into a house where he showed us several muskets that were kept in very good order, and amongst them was a double-barrelled fowling piece, two swivels and a carronade. These last were to be placed on his war canoes [Menzies 1920:55].

The war canoes being outfitted with western arms by Ke'eaumoku at Kawaihae in 1793 were intended for his son-in-law Kamehameha's conquest of the Hawaiian Islands. Training in the use of those arms would have been provided by two Englishmen who, three years earlier, had joined Kamehameha as trusted advisors. One of them, John Young, would come to reside in Kawaihae and would be intimately associated with life in the *ahupua'a* during subsequent decades.

3.1.3 John Young

John Young, an Englishman born at Liverpool, was boatswain on the American fur-trading vessel *Eleanora* when the ship anchored at Kealakekua Bay in 1790. Young happened to be ashore shortly after an incident had occurred further up the coast in North Kona. The schooner *Fair American*, a sister vessel of the *Eleanora*, had been commandeered by Kame'eiamoku, high chief of Kohala, and almost all aboard had been killed; the lone survivor was a Welshman, Isaac Davis. None of this was known to the company aboard the *Eleanora*. Kamehameha, paramount chief of the northwest side of Hawai'i Island, anxious that Young might have learned of the incident, ordered the Englishman to be detained on shore. The *Eleanora* departed a few days later without Young.

Both Young and Davis were placed under the protection of Kamehameha who treated them so well that

> ...[T]hey were soon reconciled to spending their remaining days in Hawaii. They were given wives, lands, and servants, and became in effect Hawaiian chiefs [Kuykendall 1965:25].

The two Englishmen became advisors to Kamehameha and participated in his consolidation of power, first on Hawai'i Island and then throughout the Hawaiian chain. Young became "a high Hawaiian staff chief" known as Olohana, the "Hawaiian language imitation of his boatswain's call 'All Hands' during the battles of conquest" (Apple 1978:5).

Within a few years, both Young and Davis had, under Kamehameha's patronage, established a presence at Kawaihae. Archibald Menzies, reporting on Vancouver's third layover at Kawaihae Bay in March 1793 after leaving Kealakekua Bay, recorded that Young and Davis had accompanied "us thither [i.e. to Kawaihae] on purpose to make presents of hogs and vegetables...from their plantations, which lay near this part of the island..." (Menzies 1920:101). In addition to his plantation at Kawaihae Young had a residence at Kealakekua Bay and "held property at Waiakea, in the district of Hilo (all assigned him by Kamehameha) and one estate near Cape Kumukahi, in the district of Puna, transferred to him by Ke'e-au-moku...Young was assigned these for his service, 1790-1791, as part of Kamehameha's land forces" (Apple 1978:9-10).

Young is reported to have had a residence at Kawaihae at the time of the 1795 Battle of Nu‘uanu on O‘ahu, in which both he and Davis fought for Kamehameha. By then, he had taken a Hawaiian wife, Namokuelua, with whom he had two sons, Robert Young and James Young Kānehoa. Near the end of the 18th century, Young was busy constructing at his Kawaihae homestead what were probably the first western-style buildings in the Hawaiian Islands. Entries in his journal in 1798-99 describe their construction. Materials included coral blocks from the reef at Puakō; mortar and plaster were a mixture of sand, burnt coral, poi and hair. Young wrote:

> Have begun four buildings. My house the cook house and storage room the house for the children and tahus [guardians] and near the small temple a house for storage. My house at the small rise below the great temple more suitable then [sic] the ravine which washes away withe Whymea floods. The great one [i.e. Kamehameha] comes to use my cook house several times. I make biskits and cook a lamb Have all enjoyed feast [in Apple 1978:47].

By March of 1799, Young could record that all the houses were plastered and the animal pen fences were whitewashed; the scene reminded him of his native land: “It is as in Wales” (Apple 1978:48).

Kawaihae Hikina, the present Kawaihae 2, was one of several *ahupua‘a* on Hawai‘i and other islands allocated to Young by Kamehameha:

> Ahupua‘a, the basic land units, varied in size, from a few acres to thousands of acres. An ideal ahupua‘a was a pie-slice shaped piece of land which ran from a mountain top, the apex, and broadened as it ran downslope and offshore...One such ahupua‘a, one with gulches and seaward boundaries, was the ahupua‘a of Kawaihae Hikina, assigned by Kamehameha to John Young. Its adjacent twin ahupua‘a was Kawaihae Komohana, assigned by Kamehameha to his “Prime minister,” Ka-lani-moku. Together the two ahupua‘a were known as the land of Kawaihae, or simply “Kawaihae” [Apple 1978:8-9].

When Vancouver brought the first cattle from California to the Hawaiian Islands in 1793 they were landed at Kawaihae since Young would have been familiar with them. The cattle were herded to Waimea, described by Vancouver as a “great tract of luxuriant, natural pasturage,” where they were to “roam unrestrained, to ‘increase and multiply’ far from the sight of strangers” (Kuykendall 1965:41). The proliferating cattle (Kamehameha had invoked a ten-year *kapu* or taboo on their killing) would play an increasing role in the evolution of the Kawaihae region during following centuries. John Young’s involvement in the introduction of cattle to Hawai‘i was only one of the events of Hawaiian history in which he would participate during his lifetime in the islands. As his residence, Kawaihae too would participate in, and be changed by, those events.

3.2 1800s to 1850

3.2.1 John Young (continued)

When the Russian brig *Rurik* reached the Hawaiian Islands in November 1816:

> We directed our course toward the northwest corner of O-Waihi [Hawai‘i], in order to sail around this and, according to advice given us by Mr. Elliot, to speak with Haul Hanna [‘Olohana], Mr. Jung [Young], in the Bay of Tokahai [Kawaihae] in the district of Kochala [Kohala], where the most famous man [Kamehameha] in the history of the Sandwich Islands was said to have his residence. Mr. Jung would furnish us with the necessary information about the present state of affairs and the sojourn of the king. We would, however, have to present ourselves to the king before we ran into the harbor of Hana-ruru [Honolulu] in the island of O-wahu [O‘ahu], which is situated farther toward the west [Chamisso 1986:113].

News of Young’s reputation and relationship with Kamehameha had spread outside the Hawaiian Islands, drawing early voyagers to Kawaihae during the first decades of the 19th century. Aboard the *Rurik*, the botanist Adelbert von Chamisso reported:

> From the open sea we saw the European-type houses belonging to Mr. Jung towering above the straw roofs of the native houses. The whole beach is encircled by human dwellings, but without shade. Not until one gets farther south along the coast are there coconut palms intermingled with the houses. The forests, which occupy a high zone in the mountains, do not extend into the valley. Columns of smoke rose in various sections of the country [Chamisso 1986:114].

Ten years earlier, about 1806, another visitor to the Kawaihae region noted the hard life of the inhabitants and reveals that Kamehameha, by then, also had a western-style residence at Kawaihae:

> The country around [the bay] looks like a hilly barren desert; nothing grows within ten miles of it, except a few cocoanut trees, of which a fine grove stands near the beach. The inhabitants and huts are thinly scattered along the shore, far less numerous than [at Kealakekua Bay], and seem more indigent, indeed, having to go so far for their subsistence, they are not seldom in want of the supports of life. Mr. Young occupies several stone buildings, which are the best (save those of the king, built on the same plan but now shut) I have seen in this island [in Clark 1986:88-89].

Young’s ties to Kamehameha remained firm during the remainder of the monarch’s life. Young served as governor of Hawai‘i Island from 1802 until 1812 while Kamehameha was absent from the island. It was during this period that the first horse imported to Hawai‘i was brought to Kawaihae on the *Lelia Bird* by Captain Richard J. Cleveland in 1803 (Wellmon 1969:15). Young would know how to care for the new animal, as he had the first cattle during the previous decade. The cattle, after the ten-year *kapu*, had indeed increased and multiplied. By the end of the first decade of the 19th century, Young was sending shipments of meat to Kamehameha on O‘ahu. Archibald Campbell, an English seaman, spent over a year on O‘ahu between 1808 and 1809 residing with Isaac Davis; he recalled: “We had...at all times abundance of pork, goat’s flesh, and mutton, and frequently beef sent by Young from Owhyhee [Hawai‘i]...” (Campbell 1967:98).

Namokuelua, Young’s wife, died in July of 1804 and was buried at Waimea. Young took as his second wife Mary Kuamo‘o Ka‘oana‘eha, the daughter of Kamehameha’s younger brother, Keli‘imaika‘i. With Ka‘oana‘eha, Young had four children: Fanny Young, the high chiefess Kekela, born in July 1806; Grace Kamaikui Young; John Young, Jr., also known as Keoni Ana, born in March 1810; and Jane Lahilahi Young. Young also took over the upbringing of Isaac Davis’ children after Davis’ death in 1810.

Kamehameha returned to Hawai‘i Island from Honolulu in 1812, bringing with him the western armaments he had amassed on O‘ahu. The cannons in his arsenal were brought to Kawaihae where Young installed twenty-one of them on Mailekini Heiau overlooking the bay and village. When a French expedition vessel arrived at Kawaihae Bay in August 1819, the cannons at Mailekini fired a salute. Ashore, the French visitors learned that Young had been ill for some time, deeply affected by the death of Kamehameha at Kailua, Hawai‘i on May 8th of that year. The expedition’s summary description of Kawaihae indicates little change, at least to western eyes, since the previous decade:

> Less spread-out and more irregular than Kayakakoua [Kealakekua], Kohaïhaï [Kawaihae] is surrounded by even sadder, even drier grounds, if that is possible. Here, in fact, not an atom of greenery appeared before our eyes. One could have said that it had been ravaged by fire. On an elevation near the southern section of the village, a morai [*heiau*] surrounded by a rock wall had the appearance of a European fort. Mr. Young’s house, built in European style, could be seen farther off on the shore to the north [de Freycinet 1978:41].

All of Young’s children were living at Kawaihae at the time. They were described as “three boys and three girls who all had interesting faces” and the family, “thanks to Taméhaméha's good graces, lives here in plenty...” (de Freycinet 1978:22).

Following Kamehameha’s death, Young resumed his function as advisor to the monarch, serving under Liholiho (Kamehameha II) and Kauikeaouli (Kamehameha III). His Kawaihae homestead continued to draw travellers on Hawai‘i Island. The organization of the homestead is revealed in a recollection of a visit there in 1830 by Laura Fish Judd, wife of the missionary and physician Gerrit Parmele Judd:

> [Young] lived in a dirty adobe house, adorned with old rusty muskets, swords, bayonets, and cartridge boxes. He gave us a supper of goat’s meat and fried taro, served on old pewter plates...We were sent up a rickety flight of stairs to sleep [Judd 1928:36].

Unable to sleep in the adobe house – “I was afraid of the wind, which sometimes sweeps down the gorge of the mountain” –Judd left Young’s adobe house “...and went down to the grass house of Mrs. Young, which was neat and comfortable. She is a noble woman. She lives in the native style...” (Judd 1928:36).

The homestead at Kawaihae comprised two distinct portions: an upper half which included Young’s primary residence, the adobe house; and the lower, the residence of his wife Ka‘oana‘eha and her retainers.

> As a high chiefess, Ka‘oana‘eha followed the practices which separated women from men when she lived under the traditional Hawaiian civilization, that is, up to and including the year 1819. For a high chiefess, this included quarters which were separate from those of her husband. For Ka‘oana‘eha, this housing arrangement persisted after 1819 [Apple 1978:18-19].

John Young was about 93 years old when he died in Honolulu on December 16, 1835. He was buried at the Royal Mausoleum in Nu‘uanu Valley on O‘ahu. In a journal, the missionary Levi Chamberlain reported on Young and his funeral:

> The funeral of Mr. Young was attended this afternoon from the house of Dr. Rooke [Thomas Charles Rooke, Young’s son-in-law]. He was buried with military honors & his funeral was attended by a numerous concourse of people. The procession formed and proceeded to the meeting house where prayers were offered and an address in both native & Eng. delivered by Mr. Bingham...Mr. Young was 93 years of age and forty seven of these have been spent at the Sandwich Islands. He has always been friendly to the missionaries and he has seemed to rejoice in the success of the missionary cause in the islands. His wife & one of his daughters are members of the S.I. [Sandwich Islands] church and two of his sons in law [in Apple 1978:19].

Young’s final will, dated June 26, 1834, identified the lands he had been granted by Kamehameha and had controlled during more than four decades in the Hawaiian Islands; according to Apple:

> There were mostly ahupua‘a, with a few ‘ili. On Hawai‘i Island there were 29 lands, including one land at Kawaihae. On Maui Island, there were five lands; on Lana‘i Island, one land; on Moloka‘i Island, one land and on O‘ahu Island, there were two lands [Apple 1978:10].

The will had been endorsed by Kamehameha III, “an endorsement which indicated royal consent in confirming Young’s continued possession, use and control” (Apple 1978:10). The will requested that the king divide Young’s lands among his surviving children and those of Isaac Davis; Young’s son-in-law Rooke and Alexander Adams, an old friend, were named as executors (Apple 1978:19). The disposition of Kawaihae Hikina would not be settled until the Māhele in 1848.

After Young’s death, the upper portion of his Kawaihae homestead was abandoned. Ka‘oana‘eha continued to reside on the lower portion. A visitor in 1837 described Ka‘oana‘eha as “now probably sixty years of age, a very pleasant and lady-like old woman” (Townsend 1839:280); she died thirteen years later on January 22, 1850 and was buried with Young on O‘ahu. The descendants of Young and Ka‘oana‘eha would figure significantly in 19th-century Hawaiian history and in the evolution of Kawaihae.

3.2.2 The *Ali‘i* at Kawaihae

John Young, his family and descendants were not the only *ali‘i* associated with Kawaihae during the first decades of the 19th century. Kamāmalu, daughter of Kamehameha and Kaheiheimalie was born at Pelekāne, Kawaihae, circa 1802: “Kamamalu, by Kaheiheimalie, was older than [Kamehameha’s] children born on Oahu. She was born at Kawaihae...at the time when the hula kala‘au, or stick hula, was popular” (‘Ī‘ī 1959:70). She would later become the wife of

her half-brother Liholiho [Kamehameha II], the son of Kamehameha and the high chiefess Keōpūolani.

As noted above, Kamehameha had granted Kawaihae Komohana Ahupua'a (present Kawaihae 1) to Kalanimoku, his "prime minister":

> As his principal executive officer (his kalaimoku according to the traditional scheme of government), Kamehameha appointed a young chief named (in modern writings) Kalanimoku; in his own lifetime, this chief was usually called Karaimoku by the Hawaiians, sometimes Kalaimoku; foreigners rendered his name Crymoku or Crimoku or gave it some similar form; he himself adopted the name of his contemporary, the great English prime minister, William Pitt, and he was frequently referred to and addressed by foreigners as Mr. Pitt or Billy Pitt. Kalanimoku was Kamehameha's prime minister and treasurer, the advisor on whom the king leaned most heavily. He was a man of great natural ability, both in purely governmental and in business matters. He was liked and respected by foreigners, who learned from experience that they could rely on his word [Kuykendall 1965:53].

Kalanimoku maintained a residence at Kawaihae and was there when the first company of Protestant missionaries reached the Hawaiian Islands in 1820.

Perhaps the most suggestive example of Kawaihae's place in the lives of the ruling *ali'i* would be chronicled when the French warship *l'Uranie*, under the command of Captain Louis de Freycinet and with a company of scientists and explorers aboard, arrived at Hawai'i Island in August of 1819. Informed at Kealakekua Bay that Kamehameha had died only three months earlier, de Freycinet sailed north to Kawaihae where the new ruler Liholiho, Kamehameha's son, had established his residence and was holding court. Liholiho was at Kawaihae to confer "with some of the most powerful chiefs who had supported his father. At stake was the issue of control over the land and its resources, and whether they would permit Liholiho his traditional right to redistribute the land among his followers and supporters. It was a crucial moment in Hawaiian history..." (Marion Kelley in de Freycinet 1978:xi).

When the French reached Kawaihae Bay on Aug. 12, 1819, they were met by "Kiaīmoukou [Ke'eaumoku], known also as Cox, principal chief or governor of the island of Mowi..." (de Freycinet 1978:14). Though governor of Maui, Ke'eaumoku, the son of the Kona chief of the same name who had supported Kamehameha I, also had a residence at Kawaihae. On shore, de Freycinet found:

> The monarch was already awaiting me on the beach; he was dressed in the full uniform of a captain in the British Navy, surrounded by his entire court. Notwithstanding the frightful aridity of this part of the island, the spectacle that this strange gathering of men and women offered appeared to us majestic and truly picturesque [de Freycinet 1978:14].

A map drawn during the French expedition shows that the "*Maisons du Roi*" (houses of the king) were constructed at Kawaihae Hikina (Kawaihae 2) around Mailekini Heiau, at the base of Pu'ukoholā Heiau, identified as the "*Morai du Roi*" (temple of the king) (Figure 9). The houses of Kawaihae village are shown extending along the coastline to the north and south of the royal

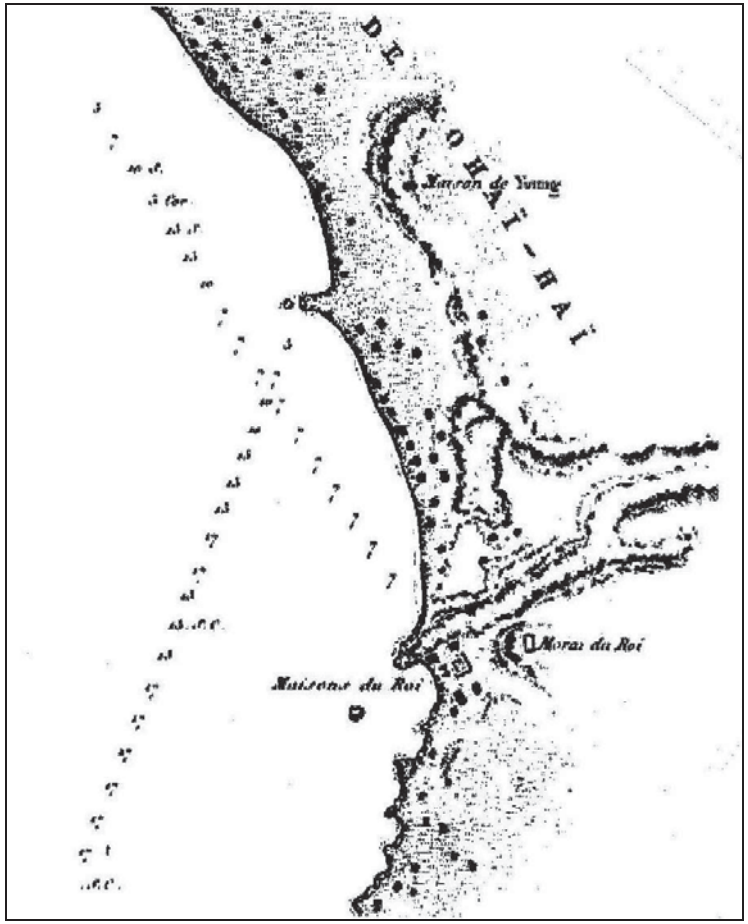

Figure 9. Chart drawn by Capt. Duperry of the de Freycinet expedition in 1819, showing points of interest along Kawaihae Bay, including features discussed in the text (reprinted in Hammatt et al. 1991:V-5)

residences. A fishpond appears just to the north of the residences; further north along the coast, John Young's house ("*Maison de Young*") is shown on a hill above the bay. On a point near the northwest end of the village, in Kawaihae 2, is Ke‘eaumoku's house ("*Maison de Kiaīmoukou*"). De Freycinet's description of the royal quarters at Kawaihae suggests that the simple structures he and other western visitors had noted at Kawaihae may have been superbly capable of taming the oppressive heat, the "frightful aridity of this part of the island":

> The King's house...was but a grass dwelling 10 to 12 feet long and little less in width; the flooring was padded with mats, as is the custom in the Sandwich Islands. Considering everything, one could not compare this royal habitation to anything better than the shepherds' huts of certain provinces in France, built for the purpose of occasional shelter. Be that as it may, I was surprised at the extremely cool temperature that we felt there in spite of the suffocating heat of the sun outdoors [de Freycinet 1978:17].

Also present at Kawaihae was Ka‘ahumanu who had been Kamehameha's principal wife. The description of her residence reveals that, upon closer inspection, the *ali‘i* dwellings not only maintained an "extremely cool temperature" within but their construction included "artistically" executed details:

> In the dwellings occupied by Queen Kamahamarou on Kohaīhaī, the lateral walls first went up vertically for six feet, then continued obliquely until they met at an acute angle. The construction of all these parts was very carefully planned. Eight upright posts, placed at the larger end of the hut, supported a fairly long beam going all the way across. The indentations in this crossbeam fitted over the vertical pieces supporting it. Eight rafters rose from this point, and all of this was entwined with thin sennit or other twine. Finally, after the outside of the buildings and the roof had been thatched, the interior walls were adorned with a large number of reeds or wooden sticks tied artistically together with strips of vacoua [de Freycinet 1978:63].

It was de Freycinet who found John Young ill and deeply affected by the recent death of Kamehameha. However Young was well enough to give a detailed account, which de Freycinet recorded, of the political situation in the islands following Kamehameha's death, always replying "with accuracy to my questions, and I felt sorry that because of his condition I could not indefinitely extend the conversation" (de Freycinet 1978:20-22).

An artist with the expedition, Jacques Arago, observed that traditional Hawaiian religious practices at Kawaihae were continuing near the royal compound and the two *heiau*:

> ...[T]he temple is given to a small spot enclosed by a hedge of cocoa-nut tree branches: in the middle are two huts; one of these serves as a residence for the priest, in the other are deposited the offerings with which the idols are presented; these are consecrated, and suspended on the branches of a banana-tree planted in the enclosure, or from the top of a high pole. The quantity is sometimes considerable; for I have seen the remains of four or five hogs, and enormous piles of bananas [Arago 1823:102].

De Freycinet's account of one day's events during *l'Uranie*'s visit to Kawaihae illuminates precisely two forces that would transform the Hawaiian landscape during the following decades: western religious proselytization and western commercial interests. Kalanimoku, continuing as prime minister under Liholiho, was among the king's retinue at Kawaihae. At his request, Kalanimoku was baptized aboard *l'Uranie* in Kawaihae Bay by the ship's chaplain, the Abbé de Quélen. On the same day, another ship, the "Anglo-American vessel Eagle of Boston", arrived at Kawaihae Bay. From Thomas Meek, the *Eagle's* captain, de Freycinet learned of the ship's mission:

> This vessel, which had left the United States of America several months previously, had first been to the Northwest Coast in the fur trade. From there it had come to the Sandwich Islands to load sandalwood, and while awaiting this part of its cargo, it had been in the coasting trade between the Islands. On the last trip, it had brought from the Island of Wahou [O‘ahu], along with a considerable number of Sandwich Islanders, a cargo of 90 tons (201,600 pounds avoirdupois=91,413 kilogrammes) of poé [poi], a kind of paste intended for the court of Riorio [Liholiho at Kawaihae]. Mr. Meek was at last to sail in company with the ship Paragon, which was then lying off Wahou, in order to proceed to China to sell its cargo [Arago 1823:28].

Kālanimōkū's baptism, the 90-ton load of poi delivered to the royal court, and the harvest of sandalwood for shipment to the Orient summarize the history of Kawaihae in the 19th century: an interplay of *ali‘i*, missionaries, and western entrepreneurs.

3.2.3 Missionary Records

The American Board of Commissioners for Foreign Missions, headquartered in Boston, sent its first company of missionaries to the Hawaiian Islands in 1819, leaving Boston on October 23rd aboard the brig *Thaddeus*. The vessel came in sight of Mauna Kea on March 30, 1820 and anchored at Kawaihae Bay a couple of days later. There they learned of the recent overturning of the *kapu* system. One member of the company, Rev. Hiram Bingham, went ashore and "called on Kalanimoku at his thatched hut or cottage in that small uninviting village" (Bingham 1847:84). With Kalanimoku, Bingham visited Pu‘ukoholā and called it the "large heathen temple at that place, a monument of folly, superstition and madness, which the idolatrous conqueror and his murderous priests had consecrated with human blood to the senseless deities of Pagan Hawaii" (Bingham 1847:84). At Kawaihae, the missionaries took aboard a number of chiefs who sailed with them south to Kailua, Kona where they anchored on April 4, 1820. Later, during the summer, one member of the company, Elisha Loomis, returned to Kawaihae "where he had charge of teaching Kalanimoku and his family School" (Hawaii Mission Children's Society 1969:140). Though Loomis and his pupils were moved to Honolulu in November, the schoolhouse at Kawaihae may represent the first missionary-run school in the Hawaiian Islands.

During subsequent decades, other missionaries visiting Hawai‘i Island would record their impressions of the life and landscape of the 19th-century Kawaihae region. According to Rev. William Ellis, who, along with other missionaries, stopped at Kawaihae in 1823, the village in the early 1820s contained one hundred houses. Ellis noted the same salt pans mentioned by Archibald Menzies in 1793 and described the salt-making operations he witnessed:

> The natives of this district manufacture large quantities of salt, by evaporating the sea water. We saw a number of their pans, in the disposition of which they display great ingenuity. They have generally one large pond near the sea into which the water flows by a channel cut through the rocks, or is carried thither by the natives in large calabashes. After remaining there some time, it is conducted into a number of smaller pans, about six or eight inches in depth, which are made with great care, and frequently lined with large evergreen leaves, in order to prevent absorption. Along the narrow banks or partitions between the different pans, we saw a number of large evergreen leaves placed. They were tied up at each end, so as to resemble a shallow dish, and filled with sea water, in which the crystals of salt were abundant.
>
> The Sandwich Islanders eat salt very freely with their food, and use large quantities in preserving their fish [Ellis 1969:397-398].

Ellis visited and bathed in a spring at the coast, perhaps the *kapu* bathing pool called “Alawai” mentioned by John Papa ‘Ī‘ī:

> Between seven and eight in the morning, we walked to the warm springs, a short distance to the southward of the large heiaus [i.e. Pu‘ukoholā and Mailekini], and enjoyed a most refreshing bathe. These springs rise on the beach a little below high-water mark, of course they are overflowed by every tide; but, at low tide, the warm water bubbles up through the sand, fills a small kind of cistern made with stones piled close together on the side towards the sea, and affords a very agreeable bathing place. The water is comfortably warm, and is probably impregnated with sulphur: various medicinal qualities are ascribed to it by those who have used it [Ellis 1969:397].

Ellis’ account of a two-day excursion by Rev. Asa Thurston from Kawaihae village to “the inland district of Waimea, having been furnished a guide by Mr. Young” gives a preliminary indication of the population *mauka* of the settlement at the shoreline. Thurston proceeded to ‘Ōuli; then on to Kalaloa, the “residence of the chief of Waimea, Kumuokapiki”; to Waiākea; to “Waikaloa” and Pukalani; and finally to “Puukapu, which is sixteen or eighteen miles from the sea-shore, and is the last village in the district of Waimea.” Thurston counted 220 houses during his circumambulation and estimated the population numbered “between eleven and twelve hundred” (Ellis 1969:399).

Three years after Ellis’ visit, in 1826 Kawaihae was the site of an event attended by the “largest audience probably ever assembled at the Sandwich Islands, for Christian worship”, as reported by Artemas Bishop “who went to Kawaihae to preach to the thousands of Kohala and Hamakua, assembled there to meet Kaahumanu, and other chiefs” (Bingham 1847:299). Bishop, who was stationed at Kailua, Hawai‘i from 1824 to 1836, noted:

> Sabbath evening, Nov. 5. I have just returned [to Kailua] from the services of this day, where I have preached twice to a congregation of more than ten thousand listening hearers. They were assembled in a cocoanut grove, and I delivered my message to them in the open air. The stillness of this immense multitude, the solemn occasion upon which we had met, the thought that all this people would

> pass into eternity in the lapse of a few years, gave a solemnity and an interest to the scene which I have seldom felt [in Bingham 1847:300].

It was not until the 1830s that a missionary would be stationed in northern Hawai‘i. On July 13, 1832 Lorenzo Lyons and his wife Betsy arrived at Kawaihae by brig from Honolulu to take up residence at Waimea. In his journal, Lyons called Kawaihae “about as desolate a place as I have ever seen, nothing but barrenness, with here and there a native hut” (Doyle 1945:41). Lyons may have been especially critical since, three days earlier, he had stopped at Ka‘awaloa, “...the most productive place on the islands, called the Paradise. You may see there the strawberry, melons, grapes, pomegranites, figs, bananas, pineapples, cotton, coffee” (Doyle 1945:40). One morning during his visit in 1835, Lyons walked south from Kawaihae through ‘Ōuli and on to Puakō and remarked,

> Rose at four o’clock and walked to Puako, five or six miles distant. When it was light I gather a few shells. I walked along the shore - alone. On one hand was the ocean; on the other a dreary, desolate waste – rocks, lava, coral [Doyle 1945:85].

At Kawaihae, Lyons and his wife took lodging in “a native house with Mr. Young” who Lyons described as a righteous man, then 87 years old. Young’s wife Ka‘oana‘eha is called a “very pious woman, a church member” (Doyle 1945:41). Lyons describes Pu‘ukoholā Heiau as an “...old heathen temple [standing] on an elevation near by. ‘Here,’ says Mr. Young, ‘I have seen many a human victim sacrificed’” (Doyle 1945:41).

Five months later, recounting a trip to Kawaihae, Lyons would plead: “Give me Waimea with all its cold winds and rain, instead of scorched, withered and desolate Kawaihae.” However, as Lyons also observed, “[Kawaihae’s] evenings are pleasant, and the ocean as the sun sets, indescribably beautiful” (Doyle 1945:70). Over the five decades that Lyons was stationed at Waimea, he developed into a sympathetic observer of the Hawaiians and their culture. He visited regularly the branch church he had established at Kawaihae Hikina (Kawaihae 2) within the lower portion of the John Young homestead, and his journals would include details of events at Kawaihae during those years. By 1835 Lyons had a church and school (for adults) at Kawaihae, serving a congregation of from 100 to 500 Hawaiians (Apple 1978:27).

Censuses taken by Protestant missionaries throughout the Hawaiian Islands beginning in 1831 provide the earliest documentation of the size of the native population after the first decades of western contact. During the first census of Hawai‘i Island in 1832, a total population of 8,679 was recorded in the Kohala District. Three years later, in the census of 1835, the total Kohala population had dropped to 6,175. In the 1835 census, the Kawaihae *ahupua‘a* population was recorded as 150 adult males, 178 adult females, and 109 children (Schmitt 1973:27, 39). Lyons was in charge of the 1835 census of north Hawai‘i; he noted the results in his journal and suggested causes for the diminished count:

> During the past year I have taken a census of the population of this district and find it to be as follows: Waimea, 1,396; Kohala 6,175; Hamakua 4,015; total 11,586, from which it appears there has been a diminution of the people 3,500, within three and a half years. Marriages are numerous. But the progeny are wanting. Children are not in general, objects of desire. Taxes are in proportion to the number of children. My census may not be correct. Many think I am

numbering them for the purpose of taxation, and conceal a part of their number [Lyons 1945:82-83].

In November 1837, Lyons enthused:

> A memorable day...Every hour occupied...Rode to Kohala. 3,000 professed to come out to the side of the Lord...Have visited Puakou [Puakō]. Sixty admitted to church, which embraces nearly all in the place. At Kawaihae, 140 or more. Busy from sunrise till 10 PM [Lyons 1945:100].

But Lyons also had to report in 1837:

> Something like a famine has been raging for about a year. The common food of the people has failed and they have been compelled to resort to the use of roots such as grow wild in woods and mountains, and yielding but very little nourishment, just enough to prevent starvation and enable the people to walk about some and attend to some of their ordinary business. The famine does not arise from the indolence of the people, but from the ravages of a worm that abounds in Waimea. As soon as food begins to sprout the worm commences the work of destruction. The famine does not prevail in all parts of the field. But the people are very poor [Lyons 1945:101].

Conditions had improved enough during the 1840s that Lyon's Kawaihae congregation was able in 1843 to build a new, larger, stone-walled church building (Apple 1978:29). And, at the end of the 1840s, Lyons announced a startling reversal in the fortunes of Waimea and Kohala:

> December, 1849. A great call for potatoes from California.
>
> Never so much cash before! Large quantities of sweet potatoes brought to light, hitherto concealed - growing wild for years unknown. The demands have revealed them. People took to it like good fellows to get a few dollars each. Some never had so much cash before - never had any before! Many natives growing rich. Potatoes bring 4 or 5 $ cash per bbl [Apple 1978:151].

The foreign trade that, by 1849, linked a demand for potatoes in California with new-found riches in Waimea had been developing throughout the century. Kawaihae's history mirrors that development.

3.2.4 Commerce at Kawaihae

The Hawaiian Islands began exporting sandalwood to the Orient shortly after 1800 and the commerce flourished until the supply dwindled in the mid-1830s. Trade in sandalwood was the strict monopoly of the *ali'i* beginning with Kamehameha. At the height of the sandalwood boom, Kamehameha was buying foreign ships, including six vessels between 1816 and 1818, to transport his own wood to the Orient (Kuykendall 1965:87). After Kamehameha's death in 1819, Liholiho (Kamehameha II) allowed his chiefs to share in the sandalwood trade, resulting in an unrestrained demand on the stocks of the wood and upon the commoners who did the harvesting.

At Kawaihae, John Young supervised royal warehouses that were the central depository for the wood brought in from the surrounding district. Rev. William Ellis, during his visit to

Kawaihae in 1823, witnessed the scale of the sandalwood operations there, with thousands involved:

> Before daylight on the 22d, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku [Kalanimoku], by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach [at Kawaihae], for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal wood, according to their size and weight. It was generally tied on their backs by bands made of ti leaves, passed over the shoulders and under the arms, and fastened across their breast. When they had deposited the wood at the storehouse, they departed to their respective homes [Ellis 1969:397].

Kawaihae Bay in the 1820s was the only trading port along the northwest coast of Hawai'i Island. The village at Kawaihae served not only the sandalwood trade; it was also the trading center for four Waimea villages stretching from Waikea to Pu'ukapu that, Ellis noted, contained a population of perhaps 1200 people (Ellis 1969:379). The surplus taro and vegetables raised at these villages were brought for trade to the coast at Kawaihae. The village there, as recorded by Ellis above, produced salt; the surplus was sold to visiting ships or exported to the "Russian settlements on the north-west coast of America, where it is in great demand for curing fish, &c" (Ellis 1969:398).

By the end of the 1820s the stands of sandalwood in northwest Hawai'i were exhausted and the once bustling commerce at Kawaihae Bay was no more. However, new enterprises were emerging to fill the void and activity at Kawaihae would continue apace. In October of 1819, two whale ships had anchored in the Hawaiian Islands. During the next decades, other whale ships would follow, as the islands became a victualing and layover base in the mid-Pacific. Supplies of fresh and salted beef were in demand, and a trade in hide and tallow was also developing. Hawai'i Island was now well-positioned to meet these demands. Following the delivery of the first cattle to the island in 1793, other ships had brought more animals from Spanish California. Protected by Kamehameha's *kapu*, the herds of wild cattle had multiplied unharmed across the plains of Waimea. Hunting of the cattle was primarily the work of foreigners given government permits to kill the animals; among the hunters was one John Parker, whose fortunes would be intimately connected to those of Kawaihae.

John Palmer Parker, an American born in Newton, Massachusetts in 1790, intended a sailing career when he left home in 1809. After several years at sea, in 1815 Parker arrived on Hawai'i Island and decided to remain there. He came under the protection of Kamehameha who was then residing at Kealakekua Bay. By 1819, Parker had a Hawaiian wife, Kipikane, and a baby daughter, Mary. Parker and his family went to live at Waiapuka in Kohala where he farmed on twenty-one acres that had been granted to him by Kamehameha. While farming at Kohala, Parker also began to hunt the cattle of Waimea:

> ...Parker was the ideal hunter. He trained dogs to trail cattle into the jungles and forested uplands of Mauna Kea, and following them afoot he traveled over much of northern Hawaii. During these years he killed thousands of cattle. With one

> gun that he affectionately preserved in later years he dispatched 1200 beasts [Wellmon 1969:34].

During the earliest years of cattle hunting, the market for the butchered and salted meat was limited to the king's fleet, the *ali‘i,* and the growing foreign population in the islands. In the early 1820s, Parker and the other hunters would have dealt with John Young, in charge of the navy, whose warehouses at Kawaihae stored the barrels of preserved meat. Increasing demand for meat, hides and tallow prompted Kuakini, governor of Hawai‘i Island, to establish a residence at Waimea in 1830. Emblematic of the changing times was the new road between Kawaihae and Waimea ordered built by Kuakini that same year. Previously, the only route between the two had been a rock-strewn trail, especially daunting to riders on horseback. Kuakini "wisely sentenced forty persons guilty of violating the seventh commandment" to construct a carriage road (Doyle 1945:38). The new road gave physical evidence of the symbiotic relationship between the fortunes of Kawaihae and Waimea.

> With the completion of Kuakini's road, the cumbersome two-wheeled Mexican oxcart became the characteristic feature of the new but difficult 12-mile trail between Waimea and Kawaih[a]e. Thousands of hides and barrels of salted meat, lumber, paia [sic; perhaps pa‘i‘ai, pounded hard poi], and New England rum were taken to and from the waiting ships on the creaking koa wood wheels and the groaning wooden axles of these simple flat-bedded, stick-framed, box-like carts. By the 1830's ox driving became a principal occupation for the natives, who were extremely severe taskmasters [Wellmon 1969:46].

Among the first western entrepreneurs drawn to Kawaihae and Waimea region was an American, William French. French had settled in Honolulu in 1826, becoming involved in business enterprises throughout the islands. In 1828, he was among a company of foreign residents who converted a Honolulu sugar mill into a rum distillery. Unfortunately for the investors:

> ...by this time the Queen Regent Kaahumanu and most of the powerful chiefs had become Christians and had taken a strong stand in favor of temperance. A kapu was placed upon the business of making rum; the missionaries, who had the only ox-carts in the village [Honolulu], refused to allow them to be used for carrying cane to the mill; and Kaahumanu caused the cane fields to be destroyed. This was about 1829. The foreign residents were greatly enraged and one of them, William French, afterwards accused the missionary Rev. Hiram Bingham of having made him lose $7,000 through the failure of the distillery [Kuykendall 1965:173].

Other investments undertaken by French were more successful and by the 1830s he was a leading merchant in the islands. A communication in 1835 from the Hudson's Bay Company noted:

> It appears that Mr. French, an American at the Sandwich Islands, carries on an intercourse with the Russian Company, and has a contract with them for the supply of certain articles; and that he combines with this a fur trade along the [Northwest American] coast, on the return of the ship to the Sandwich Islands [in Kuykendall 1965:300].

French may also have been involved in "what was possibly the earliest exportation of sugar from the Hawaiian islands": a letter of "William Hooper written at Koloa, Kauai, May 28, 1836...contains the statement, 'Mr. French made a shpt. per Don of 8000 lb. Sugar and abt. as many galls. Molasses'" (Kuykendall 1965:181).

In 1835, French set his sights on the trade in hides and tallow at Waimea: he envisioned setting up a ranch and trade company to replace the haphazard operations of individual cattle hunters. Among those he put on his payroll was John Parker, who French employed as a bookkeeper and cattle hunter (Wellmon 1969:53). French established his ranch operations and a store at Waimea. At Kawaihae village, he opened a second store on land acquired in 1838 from Governor Kuakini on condition that he build a pier for landing canoes at the bay; French built the pier and got the land. His store was apparently the first commercial building in the village. It was the only one there in 1840 when a visitor found Kawaihae "barren and almost destitute of inhabitants...A well-built store and a few houses constituted the only appearance of a town. There was no vegetation to be seen" (Jarves 1844:218-219).

French's enterprise at Waimea and Kawaihae prospered rapidly. He was not only shipping out tallow and hides from Kawaihae but also *koa* wood to meet the demands of the construction boom in Honolulu. Beginning in the 1840s, French shipped live cattle to Honolulu to supply the whale ships laying over there. His Waimea/Kawaihae operations seemed a sure success in the late 1840s when French's business dealings outside of Hawai‘i Island forced him into bankruptcy. However, the flow of goods through Kawaihae proceeded unabated as John Parker, who had himself become an independent ranch owner, and other ranchers and entrepreneurs at Waimea continued to ship their products off the island. By the mid-19th century, when the Māhele commenced transforming land ownership in the Hawaiian Islands, Kawaihae village was firmly established as the shipping center on northwest Hawai‘i Island. Records of the Māhele provide clues to life in the village and in the two Kawaihae *ahupua‘a* of Komohana and Hikina (1 and 2).

3.2.5 Māhele and Land Commission Award Documentation

The Organic Acts of 1845 and 1846 initiated the process of the Māhele - the division of Hawaiian lands - which introduced private property into Hawaiian society. In 1848 the crown and the *ali‘i* received their land titles.

Kawaihae Komohana (Kawaihae 1) was awarded as crown lands to Hawaiian princess and queen consort Anna Keahikuni (Miriam) Kekau‘onohi under Land Commission Award (LCA) 11216, in which she was also conveyed dozens of *ahupua‘a* and *‘ili* statewide (Barrére 1994:326-328). Chiefess Kekau‘onohi was the granddaughter of Kamehameha, by his son Kaho‘anoku Kina‘u, and she was one of the five wives of her uncle Liholiho. After Liholiho's death in London, she went to Kauai and married her half-brother Kahalai‘a Luanu‘u. In the early 1840s she was among the first members of Kamehameha III's House of Nobles, and was appointed as Governess of Kaua‘i (Kamakau 1994:280, 397). After the death of Queen Ka‘ahumanu in 1832, she remarried Kealiiahonui, former prince of Kaua‘i and the son of King Kaumuali‘i of Kaua‘i. They had no children. After his death in 1849 she remarried Kona Chief Levi Ha‘alelea, a relative of Queen Kalama (consort of Kamehameha III) and had a son named William Pitt Kīna‘u who died young. She inherited most of the land of her uncle William Pitt Kalanimoku.

She died in Honolulu June 2, 1851 age 46. In his journal, the non-missionary foreigner Stephen Reynolds noted at her death that she was "the last of the old stock of chiefs – one of the best of them – good natured, benevolent, liberal and generous."

Kawaihae Hikina (Kawaihae 2) was awarded as LCA 8515 to John Young, Jr. (Keoni Ana). Similar to his half brother James, he continued their father's legacy of service to the monarch.

> After the death of Ke-ka-ulu-ohi in 1845, John Young, Jr. (Keoni Ana) was made governor of Maui, and the king [Kamehameha III] appointed him to the premiership to succeed Ke-ka-ulu-ohi, not because of learning or intelligence but because he was a favorite and the choice of the king. The commoners were pleased because he was of the blood of the chiefs and a Hawaiian born, as the son of John Young, Kamehameha's favorite foreigner, and a Hawaiian woman from a family of chiefs, hence part Hawaiian and part foreign...As governor he often toured Maui, Molokai, and Lanai, and kept up the old duty of the governor to keep the peace, to teach and explain the laws of the land to the commoners, and put a stop to all mischief, dissipation, or idleness. The country was peaceful with scarcely a murder during the year in which he served as governor and premier [Kamakau 1992:399].

Kawaihae 2 was only one of several lands awarded to Keoni Ana in LCA 8515. Additional lands on Hawai'i Island were included in LCA 8515, as well as lands on Maui and 'Oahu.

By special dispensation of the Privy Council, Keoni Ana, James Kānehoa and the other children of John Young were exempted from division and commutation of their awarded lands; a Resolution of Aug. 29, 1850 declared:

> Resolved that the Minister of the Interior is hereby authorized to grant Royal Patents to the heirs of John Young (Olohana) for the lands they severally inherit from their father, without commutation or division.

Kuleana awards for individual parcels within both *ahupua'a* were subsequently granted in 1850. These awards were presented to tenants (native Hawaiians, naturalized foreigners, non-Hawaiians born in the islands, or long-term resident foreigners) who could prove occupancy on the parcels before 1845 (Apple 1978:45). Nine LCAs were recorded in Kawaihae Komohana (Kawaihae 1); these awards are presented in Table 1 and shown on Figure 10. With one exception, LCA 8513, all of the claimed and awarded parcels in Kawaihae Komohana were located along the natural Kawaihae shoreline. Many overlap or fall completely within the bounds of the project area, and have been obliterated by development. LCA 8513 to Lorenzo B. Lincoln is located approximately 8 kilometers *mauka* of the coast in Kawaihae Komohana (Kawaihae 1) along its boundary with Kawaihae Hikina (Kawaihae 2), and is therefore not shown on Figure 10.

The two Kawaihae Komohana parcels comprising LCA 9971 (also not included on Figure 10) were awarded to William Pitt Leleiohoku, the son of Kalanimoku. Leleiohoku was born on Maui and, after Kalanimoku's death in 1827, was adopted by Kuakini, governor of Hawai'i Island. He died at Hilo in 1848 during an epidemic of measles. The Kawaihae Komohana parcels had been granted to Leleiohoku by Kuakini in 1844.



Figure 10. Aerial photograph (Google Earth 2011) showing the locations of the project study areas (outlined in red) and *kuleana* awards in the vicinity (shaded in pink)

Table 1. Kawaihae Komohana (Kawaihae 1) *kuleana* awards

LCA #	Awardee	'Ili	Area	Apana
3668	Manuia, D		3.28 acres	2
3669	Makahi		.253 acre	1
3826	Punihaniha		.58 acres	1
4091	Kane		1.54 acres	2
4094	Kepaimaka		1.1 acres	1
4101	Kahananui		.19 acre	1
4884	French, Wm.		1.34 acres	1
8513	Lincoln, Lorenzo B		5.2 acres	1
9971	Leleiōhoku, W.P.	Kaaiao Pohua 1	.06 acre .49 acre	1 1

LCA 4884 to William French comprises the parcel French had received from Kuakini on condition that he "build a pier for the canoes to land" in 1838 (Native Testimony vol2 pg. 503). The witnesses testify that French built the pier and had constructed "storage and other houses too" on the parcel.

The remaining Land Commission Awards in Kawaihae Komohana were granted to Hawaiians, some claiming residency on their lands back to the time of Kamehameha (LCAs 3826, 4091, and 4094). The house lots contained from one to four houses. Three of the awards (LCAs 3668:2, 3826, and 4091) were located adjacent to the salt pans at Kawaihae village; the awardees may have been the operators of the Kawaihae salt works in the mid-19th century. Portions of LCAs 4094, 4884 and 4091 may have escaped harbor-related and subsequent impacts, however unlikely.

Five Land Commission Awards (LCAs) for individual parcels were recorded in Kawaihae Hikina (Kawaihae 2); these awards are listed in Table 2 and shown on Figure 10 in the vicinity of the Coral Flats.

Among the five LCA parcels within Kawaihae Hikina (Kawaihae 2) is the homestead of John Young located just south of Makahuna Gulch near the boundary of Kawaihae Hikina and Kawaihae Komohana. After Young's death, his wife Ka'oana'eha continued to reside on the lower portion of their homestead and it was this land she claimed in LCA 4522. Occupying the parcel with Ka'oana'eha in the 1840s was Ioba Puna, identified in the LCA documents as the *konohiki* (headman) of the *ahupua'a*; the homestead parcel is claimed in both their names. The homestead is identified as Pahukanilua and it is Ka'oana'eha herself who testified: "This is our lot at Kawaihae and our old houses which were mine and my kane's, John Young, deceased" (Native Register vol.8 pg.6). A witness, Kaleikaheaawa, described the parcel and its appearance in 1848:

Table 2. Kawaihae Hikina (Kawaihae 2) *kuleana* awards

LCA #	Awardee	'Ili	Area	Apana
240-O	Kahaawi, Nika	Kaneloa	.41 acres	1
240-P	Kaukahi	Makila	34.58	2
4103	Kahunaaliiole, J.P.		1.34 acres	1
4106	Kauai		.09 acres	1
4522	Kaoanaeha & Ioba Puna		1.05 acres	1

> I have seen Puna's house-lot in Kawaihae, Hawaii. Pahukanilua is the name [of the place] and the boundaries are: mauka, a pasture for the government; Puako, the stream Makahuna; makai [seaward], the sea; Kohala, Pokiahua. This place had been for Kaoanaeha and Olohana. Olohana had received it from Kamehameha I and that is Koapapaa here. No one has ever objected to them to this day. Five houses and plants are there which belong to Kaoanaeha and Puna at this time [Native Testimony vol. 4 pg.6-7].

Immediately adjacent to LCA 4522 is LCA 4106 which Ioba Puna testified was "in our lot and is surrounded by our boundaries" and had been acquired by Kaui in 1843; the parcel contained one house and had been enclosed within Ka'oana'eha's and Puna's lot (Native Testimony vol.4 pg.3). Kaui himself testified that the parcel had originally been granted to the retainers of Ka'oana'eha and John Young; it had been "passed...on until I have it" (Native Register vol.8 pg.4).

A third *kuleana* parcel in Kawaihae Hikina (LCA 4103 to Kaahunaliiole) was located to the south of LCA 4522. Kaahunaliiole testified to having gotten the parcel in 1842, under the authorization of Ka'oana'eha. Naniu, the witness for the claim, stated:

> I have seen this house-lot at Kahaleuku, Kawaihae, Hawaii. It has been enclosed with four houses in it, three of which are for Kaahunaliiole and one for the government [Native Testimony vol.4 pg.2].

Naniu further testified that the parcel "had been an idle place a long time ago in 1835", i.e. about the time of John Young's death. The only adjacent structure was the Kawaihae house of Lorenzo Lyons, which would have been constructed after Young's death.

The remaining two *kuleana* awards in Kawaihae Hikina, LCAs 240-O to Nika Kahaawi and 240-P to Kaukahi, were farther *mauka* than the other LCAs in the *ahupua'a* (not shown on Figure 10). LCA 240-O and Parcel 2 of LCA 240-P are located in the central portion of Kawaihae 2, approximately 6.3 kilometers inland from the coast at Kawaihae Bay. Parcel 1 of LCA 240-P is located below Pu'u Makela just *makai* of the Kohala-Waimea mountain road, approximately 7.5 kilometers inland from the coast.

LCAs 240-O and 240-P may be awards that were numbered differently at the time when testimonies for them were first recorded. Native Testimony documents, from testimonies

recorded on Oct. 6, 1848, suggest that LCA 240-O corresponds to LCA 5658-B claimed by Nika, and LCA 240-P corresponds to LCA 103-B claimed by “Kauakahi” (as spelled in the document). The renumbering of the awards may reflect an adjustment made after the parcels had been surveyed in 1851, when their locations in Kawaihae 2 were established. (The earlier testimonies had stated LCA 5658 was in “the ili land Kaneloa of Waimea aka [sic] ahupuaa” and LCA 103-B was in “the ili land at Makila [sic] of Kawaihae-uka ahupuaa.”) The testimonies for both awards assert that the parcels were cultivation areas.

The total 14 *kuleana* awardees in the two *ahupua‘a* of Kawaihae do not reflect the total population of Kawaihae. As Apple notes:

> They probably represent the local elite, those who could afford the survey and commutation [that were part of the award procedure], had proper authority for permanent occupancy, had reputable witnesses to sustain both the authority [to occupy] and continuous use [of the parcel], and who chose to apply [Apple 1978:62].

However, the records associated with these awards illuminate the character of the settlement within Kawaihae 1 and 2 Ahupua‘a at the mid-19th century. The distribution of the *kuleana* parcels along Kawaihae Bay within the subject *ahupua‘a* may reflect the traditional pre-contact Hawaiian settlement pattern. The shoreline of Kawaihae, dominated by the presence of the two *heiau*, may have been an enclave reserved for residences of the *ali‘i* and their retainers, as it was for Ka‘oana‘eha and the *konohiki* (headman) Puna in the 1840s. The three claims for *mauka* awards of cultivated land in Kawaihae may be the surviving remnants of a once much larger, agriculture-based, upland settlement in the *ahupua‘a*.

3.3 1850s to 1900

3.3.1 Life at Kawaihae Village

William French died at Kawaihae in November 1851. Other Waimea entrepreneurs meanwhile were establishing a presence at Kawaihae. Frank Spencer, a rancher, opened a store in the village in the 1850s. James Fay, a sawmill operator at Waimea, became a familiar sight with his bullock carts transporting lumber to Kawaihae to “trade for salted salmon and other goods that were brought...by passing ships” (Wellmon 1969:77). The village itself remained little changed since the previous decade, at least in the eyes of a visitor in 1853:

> Kawaihae is a small, dreary village, on the shores of Kawaihae Bay, without the least object to attract a resident. Excepting a few sickly cocoa-nut trees which stood near the tide-mark, I found scarcely a piece of foliage in the entire region. Hot, dry, and dusty, it is a perfect Sahara... [Bates 1854:391].

The physical desolation of the Kawaihae region in 1853 was amplified by the epidemic that had reached Hawai‘i Island that year; Lorenzo Lyons recorded:

> Smallpox, Kohala, Kona, Hilo. One case in Waimea, two in Hamakua, very many at Kawaihae. Rode over to Kohala to get vaccination matter. I am vaccinating many here...

> Kawaihae. Meeting house most desolate. As I gazed on the few that had escaped the pestilence, I could not refrain from tears. Where were the aged? Where were the young? Smallpox has carried off nearly three thousand from the Islands... [Doyle 1945:157].

By the early 1850s, the Lyons family had a house in Kawaihae village. Lyons’ son Albert, then twelve years old, described the house, its amenities and surroundings in May of 1853 (the smallpox epidemic had broken out on O‘ahu but had not yet reached Hawai‘i):

> After five hours we got to Kawaihae...
>
> Curtis [his brother] had opened the house and had got a lot of new *pili* grass to put on the ground under our sleeping mats...
>
> This house has thick adobe walls, plastered outside and in, and a thatched roof that slopes at the ends as well as the sides. There is one door only, and two windows with no glass, only shutters. In front there’s a level place covered with pebbles. The sea beach is black sand. Mr. [George Hueu] Davis has a tumble down stone wall around his place and a kou tree and a hala tree in the yard. There is a salt water pond at the mouth of a dry ravine that comes down from the mountain all full of rocks and caves [Doyle 1945:171].

The Lyons family was at Kawaihae to await the arrival of a vessel to take them to Honolulu. Their adobe house served as temporary lodgings during the sometimes weeks-long wait for transport off the island. Arrivals and departures of inter-island vessels were unpredictable and fares were negotiated at the dock. The Lyons family had been waiting at Kawaihae village three weeks when the schooner *Manuokawai* arrived. The captain informed them that the fare to Honolulu was $120 but, according to Albert Lyons, “there were only two berths in the cabin, and the schooner was very small and very dirty, so we did not go on her” (Doyle 1945:172).

Kawaihae village’s position as the center of inter-island trade and transport on northwest Hawai‘i is detailed in a description published in the Pacific Commercial Advertiser edition of January 29, 1857:

> KAWAIHAE is a small village in the bay of the same name in the western shore of Hawaii...It derives its importance from being the port of the rich and extensive grazing uplands of Waimea, one of the finest agricultural districts of the islands, which has not yet developed its full resources... Forty or fifty whale ships have annually visited this port for the last few years, to procure salted beefs and Irish potatoes, which are considered the finest produced in the islands.

Kawaihae in 1857 would have been especially desultory as, for nine months during the previous year, Kohala and Waimea had suffered through a severe drought. By the end of the 1850s, the area had apparently recovered. Lyons, in December of 1859, wrote in his journal fifteen reasons why the past year had been remarkable: one reason was the “enormous sum of 7,000$ or more received at Kawaihae for sweet potatoes” but another was the “wonderment as to where this sum has gone, as it has vanished” (Doyle 1945:161). The year was also memorable as in January a new church had been dedicated at Kawaihae village. Lyons described the celebration:

> A great day. Procession of three hundred with flutes and flags. Formed a circle for speeches, prayer, an original ode. Contributions enough to pay off the debt. Procession formed again. Marched up to Puukohola, the old heiau. Prayer there and singing. Then marched to the old church to say farewell. At last marched to the new church and dedicated it. A day long to be remembered [Doyle 1945:161].

The church was located on the brow of a hill in Kawaihae Komohana.

More ominously, 1859 was the year the whaling industry reached its peak. Prices for whale oil collapsed five years later. Since the 1840s, the Hawaiian economy had been dependent primarily on supplying whale ships during their long layovers in the islands. As the number of arriving ships dwindled during the 1860s, cattle ranchers and entrepreneurs of Waimea who could not find new markets were forced out of business. Among the survivors was the Parker Ranch which would play an ever-increasing role in the life of the Kawaihae region through subsequent decades.

However, these troubles were a few years off in 1860 when a consortium of the Hawaiian government and private investors formed the Hawaii Steam and General Inter-Island Navigation Company to initiate regularly-scheduled steamship transportation between the islands. As the experience of the Lyons family in 1853 revealed, the fare for passage between Kawaihae and Honolulu could cost up to $120 for a family, and the vessels themselves were often in questionable condition. Now the newly-built steamship *Kilauea* stopped at Kawaihae weekly; round-trip fare for two to Honolulu was only $27. The *Kilauea* would experience the hazards of sailing off Kawaihae during a storm on January 13, 1866 when the steamship was propelled over the reef, ending up in the shallows near shore. The ship was salvaged and repaired; it would continue in service until it was scrapped in 1878.

Features of the village in 1861 were described by Charles de Varigny, the secretary of the French Consulate in Honolulu (who later served Kamehameha V as finance minister and minister of foreign affairs). Varigny observed how much of the village was given over to its commercial functions:

> The village consists chiefly of a single large wooden structure which serves as a country store and warehouse for the products of the district. Around the shop are clustered several makeshift buildings providing annexes for further storage. Scattered along the seashore are a few kanaka grass houses, about twenty. The setting is desolate: not a blade of grass, not a tree, except for the infrequent coconut palms, nor a stream. Enormous volcanic rocks, jagged and cinder-black, lie strewn across the ground, and a fine dusty sand covers the beach. A small wharf serves for the departure and landing of travelers. At a short distance from shore floats an old stripped-down vessel, its melancholy hull balancing at anchor and providing storage for products arriving from Honolulu. It was difficult for me to imagine a more arid and barren setting... [Varigny 1981:72].

On May 16, 1861 three Englishwomen including Lady Franklin (the widow of Admiral Sir John Franklin) Sophia Cracroft, and Lady Franklin's maid, Sophia Buckland, were at Kawaihae awaiting the arrival of the *Kilauea*. They had been travelling around the islands and were accompanied by David Kalākaua, then aide-de-camp to Kamehameha IV, and later King

Kalākaua. The travellers were welcomed by "Mr. Allen, son of the Chancellor of the Kingdom, who keeps a store (Anglice 'shop'), where any and everything wanted in these parts may be bought" (Korn 1958:76). Exploring Kawaihae, they came upon George Davis Hueu and Isaac Davis II, son and grandson of Isaac Davis, Kamehameha's advisor. Isaac Davis II, then about 34 years old, was the second husband of Princess Ke'elikōlani, governess of Hawai'i Island. Lady Franklin recorded in her journal:

> Met Isaac Davis, husband of Governess, riding...fine handsome man [of] 6 ft. Shy in speaking the little English he knows - his father George Davis...has thatched house here on beach [at Kawaihae Bay]. Has three sons of which Isaac the eldest. Begged Mr. [Kalākaua] to get him [Isaac] to come in and dine with us, which he did. On the beach stopped to see the father, George - good-looking stout man of 61 with English features, but grown sallow or olive-coloured. Was dressed in pretty gray and white shirt and blue trousers - naked feet. Seemed shy - could not make him speak more English than good-bye... [Korn 1958:45].

George Hueu continued to live at Kawaihae until his death in 1873. At the time of his death, he owned, according to his son George Hueu Davis Jr., the land of Waikoloa, a parcel in Kiilae in South Kona, and a house at Kawaihae worth about $100. Isaac Davis II spent "most of his life at Kawaihae and in the Waimea region, where he raised cattle and was appointed from time to time to take charge of wild stock owned by the government" (Korn 1958:321); he died in 1882.

Shortly before leaving Kawaihae, the women also met Lorenzo Lyons, described as a "very odd-looking little man, without a tooth in his head: they were all dragged out some months ago in order to be replaced, and now be hopes to have his poor mouth filled once more" (Korn 1958:79). Lyons was then 54 years old and had been in the islands 35 years.

By the middle of the 1860s, Waimea was enduring hard times. Lyons estimated the population had diminished to 400. Not only had the whale ship trade collapsed, but the Kawaihae *mauka* and Hamakua mountain potatoes were "few and poor and dear." Waimea depended on Waipi'o for food supplies (Doyle 1945:194). Given its symbiotic relationship to Waimea, Kawaihae village too must have declined. Natural disasters escalated the distress. In early April 1868, Lyons reported:

> Earthquakes last night very severe. Tumbled down some fathoms of stone wall. People frightened. The sea at Kawaihae receded, leaving rocks and fish bare. Then returned with great ferocity, beyond its bounds. Such fearful earthquakes never before experienced in this region [Doyle 1945:197].

Four years later, in January of 1872, a great storm swept away all the wharves at Kawaihae: "Such a sea not known by [the] oldest inhabitants" (Doyle 1945:200). But Lyons would also report happier occasions. On April 6, 1874 the people of Waimea and Kohala thronged to Kawaihae to see the newly-crowned King Kalākaua and Queen Kapi'olani:

> Grand reception. King much pleased with military company. Singing and feasts. Kalakaua ma [Kalakaua and his party] left for Kohala [Doyle 1945:203].

On February 12, 1874, Kalākaua had been elected to the Hawaiian throne by the Legislative Assembly (the preceding monarch, Lunalilo, had died on February 3rd). The lone rival candidate had been the Dowager Queen Emma. Three months earlier, in November 1873, representatives

of Queen Emma, the granddaughter of John Young, had initiated procedures to determine the boundaries of Kawaihae Hikina. Records of those procedures present further glimpses into the life of the *ahupua'a*.

3.3.2 Commission of Boundaries Records

After Keoni Ana's death on July 18, 1857, Kawaihae Hikina was among his lands inherited by his niece, Emma Rooke, who was then queen of Hawai'i and consort to Alexander Liholiho, King Kamehameha IV. Miriam Kekau'onohi left all of her land to her last husband, Kona Chief Levi Ha'alelea.

When Kawaihae 1 and 2 were awarded to Keoni Ana at the time of the Māhele, no survey had yet determined their exact boundaries. Like the other awarded *ahupua'a*, the land had been defined in the Māhele documents only by its traditional name. In August 1862, the Hawaiian legislature created the office of Commissioner of Boundaries to decide the exact boundaries of these previously-unsurveyed *ahupua'a*. "All persons who had received awards for their lands by names only were required to appear before the Commissioners to have their boundaries determined and identified" (Chinen 1958:23).

In November 1873 the Commission of Boundaries for the island of Hawai'i met at the court house in Waimea to settle the boundaries of Kawaihae and Komohana and Hikina. During the sessions, the commission took the testimonies of *kama'āina* (native-born) who claimed long acquaintance with the *ahupua'a* and the landmarks defining their boundaries.

The testimonies of the *kama'āina* recorded in the proceedings of the Commission of Boundaries throughout the Hawaiian Islands provided otherwise anonymous Hawaiians an unprecedented opportunity to display not only a comprehensive understanding, passed down through generations, of the contours of the *ahupua'a*, but, at the same time, allowed them to reveal local traditions, place names, no-longer-existing sites including *heiau* and settlements, areas where traditional activities were practiced, and historic events they had witnessed or participated in.

3.3.3 Life at Kawaihae Village (continued)

Lorenzo Lyons continued to faithfully record the events in his parish until his death in 1886. On May 10, 1877: "Kaimimiku (tidal wave) at Kawaihae, subsiding and returning from 5½ A.M. till midnight. Very destructive at Hilo" (Doyle 1945:204). But natural disasters were offset by more joyous occasions. On March 25, 1880: "Great birthday feast at Kawaihae for Sam Parker's youngest child. Some 500 present...Large company of Parkers at church..." (Doyle 1945:218). On August 20, 1881: "Great crowds at Kawaihae to see Princess [Liliuokalani] leave" (Doyle 1945:207).

A map drawn in 1883 by the surveyor George Jackson (Figure 11) identifies the structures and features comprising Kawaihae village. Beginning at the northernmost extent and moving south along the coast, the village included the Kawaihae lighthouse; a cattle pen; "Macy's Grave" (probably George Macy, one of the early entrepreneurs in Waimea); an enclosed complex consisting of a jetty, woodshed, and storehouse; a "native store"; a jail; a boathouse; salt pans; "Davis' Grave" (George Davis Hueu who had died in 1873); a church; the "S. Parker

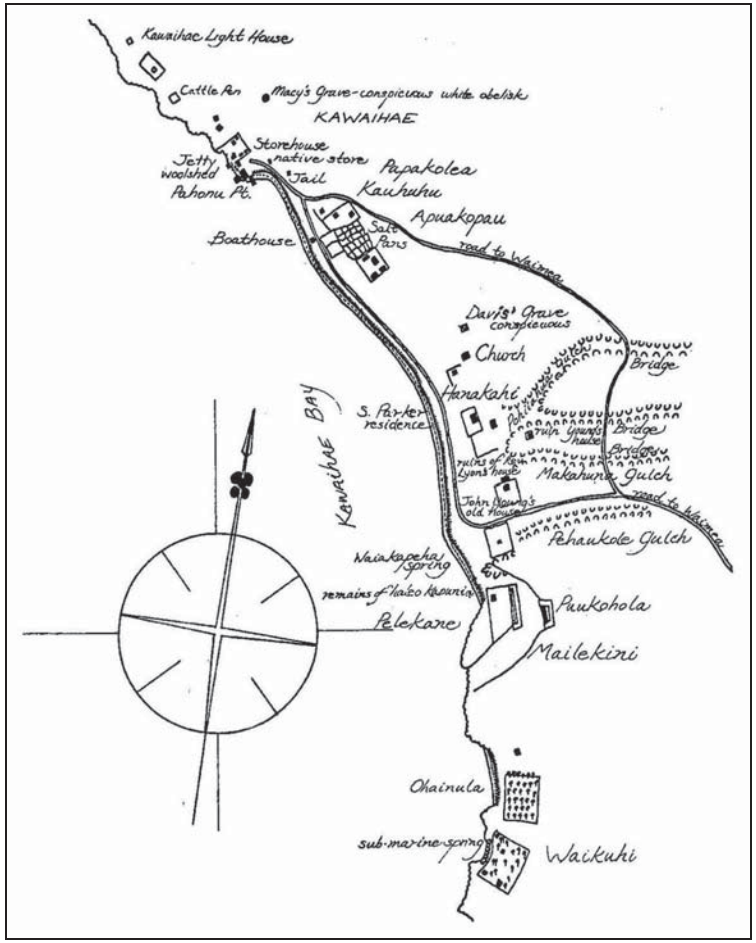

Figure 11. Portion of a map of Kawaihae Bay drafted by George E. Greely Jackson in 1883 (redrawn by K. Kelly in Kelly 1974:13)

residence"; "ruins of Lyons' house"; and "John Young's old house". The grave sites and house ruins suggest the passing of a phase in Kawaihae's history. The structures in active use during the 1880s reflect the Kawaihae region's continued dependence upon the economy of Waimea. Typical of the commercial schemes involving Kawaihae was a projected railroad line across North Hawai'i extending from Pā'auhau Landing on the Hamakua Coast, through Waimea, and terminating at Kawaihae. A group of businessmen commissioned a preliminary survey. The estimated cost for construction of the line was half a million dollars; it was never built (Kuykendall 1967:98).

3.4 1900s

Records from the Hawai'i State Archives document the ancient *ala loa,* or native trail system, that ran through Kawaihae and was modified and incorporated into the *Aanui Aupuni,* the Government Road (Maly 2000:25). In 1902, the magazine *Hawaii's Young People* published a series of articles by Charles Baldwin detailing the "Geography of Hawaii." In discussing the roads, Baldwin wrote:

> In traveling around the other islands of the group, we usually follow the seashore, but with Hawaii the case is different, for, to avoid waste regions and to accommodate the inhabitants, the road goes far inland in places. As the government could not always afford to build more than one road around the "big" island, that one was put where it would be of the most use to the greatest number of people.
>
> During my first tour around Hawaii I met a gentleman who said that he had driven around the island. I had always supposed that this was impossible, as there was only a trail between Kohala and Kona, but there was his buggy and horse which he had purchased in Hilo. Later, I discovered what he had done – and others like him, who claim that they have driven around Hawaii. Putting his horse and wagon on the little steamer Upolu, he sailed around to Kailua; but as the Upolu has since been wrecked, you cannot now "drive" around Hawaii.
>
> In a year or two the wagon road which is now building over the lava between Waimea and Kona [under the supervision of Eben Low] will have been completed and then one can drive around the island. But this section now being constructed, as well as that portion over the lava between Kona and Kau, will be rough traveling.
>
> Travelers from Kohala to Kona usually take the trail over the lava from Kawaihae. Most people speak of this as a journey to be avoided, but, with a horse that is used to traveling over lava, the ride is not an unpleasant one, particularly if we make an early start from Kawaihae, thus reaching Kiholo before the lava has had time to get thoroughly heated. Twenty miles of the trail is over lava; the first portion, that between Kawaihae and Kiholo, being the worst. Nowhere else in the world may one see so many recent lava flows as are gathered in this region. Most of them are *aa* flows. The ride is certainly a unique one, and consequently interesting… [Baldwin 1902:46].

Until 1903, the contour of the land called Kawaihae Hikina was well defined by oral traditions passed down over the centuries through generations of *kama'āina.* The formal settlement of boundaries at the beginning of the 20th century certified the entry of the *ahupua'a* , now definitively Kawaihae 2, into the modern economic world. Russell Apple neatly summarizes the historic record of Kawaihae 2 during most of this century:

> Starting in 1887, and continuing through 1973, there were leases of Kawaihae 2, subleases, lease mortgages and releases of lease mortgages, powers of attorney granted and recalled by leasees, selling of leases and suits over leases. Kahuā and Parker ranches were often involved. There were also quitclaim and other deeds for small parts of the *ahupua'a* from the trustees of The Queen's Hospital to the Territory of Hawai'i for roads and other public purposes [Apple 1978:23].

Three years before the Kawaihae 2 boundary settlement, a new manager took over operations at Parker Ranch. Alfred W. Carter, from 1900 until his death in 1949, directed a program of development that included the upgrading of cattle stock, horse breeding, the improvement of water systems, and the acquisition of land. Carter's plans inevitably affected the Kawaihae region. Loading of live cattle for shipment off-island continued to be the ranch's primary activity at Kawaihae. Even into the 1920s, cattle were loaded as they had been throughout the previous century.

Carter's attempts to diversify the ranch's interests, which included beekeeping and raising hogs, would involve the *ahupua'a* of Kawaihae and some of its residents. Parker Ranch had been acquiring land parcels at the shoreline of Kawaihae. As Apple (1978:37) notes:

> By 1959 the ranch, primarily through long-time activities of the Carter family (whose members in succession were trustees for the ranch owners) had acquired title to many of the land commission awards and later governmental grants of land along Kawaihae beach.

Apple also investigated thoroughly the history of Pahukanilua itself in this century:

> Whatever houses stood within the Pahukanilua enclosure in 1903 were gone by the 1950's. No one was paying the real estate taxes, and by then Pahukanilua's 1.05 acres carried Territorial tax map key 6-2-01-21. Dr. Charles H. Silva, of Honolulu, enroute to his summer home at Puakō, discovered a vacant enclosure at Kawaihae without an apparent owner. Dr. Silva hired a local "Japanese man" to build a house in the enclosure. The man then lived in it. Dr. Silva began to pay the taxes - for if he did so openly for a term of years without contest he could claim ownership through Hawai'i's legal process of adverse possession. Before the necessary years were up, however, the house lot was condemned, in 1958, by the Territory of Hawai'i for deep water port improvements. The court and title searchers could find no conveyances on record by the awardees, Puna and Ka'oana'ehua, and could find no probate of their estates. Dr. Silva, with a house on the land and in possession, claimed full title. But so did some suddenly revealed heirs of Puna: Violet Marie Pua, Matilda (Mary) Alfapada Palacio and her brother, a Mr. Alfapada. Hearings under Civil Court Case 276 (combined with 245) were held in Hilo. The final order of condemnation and judgment awarded

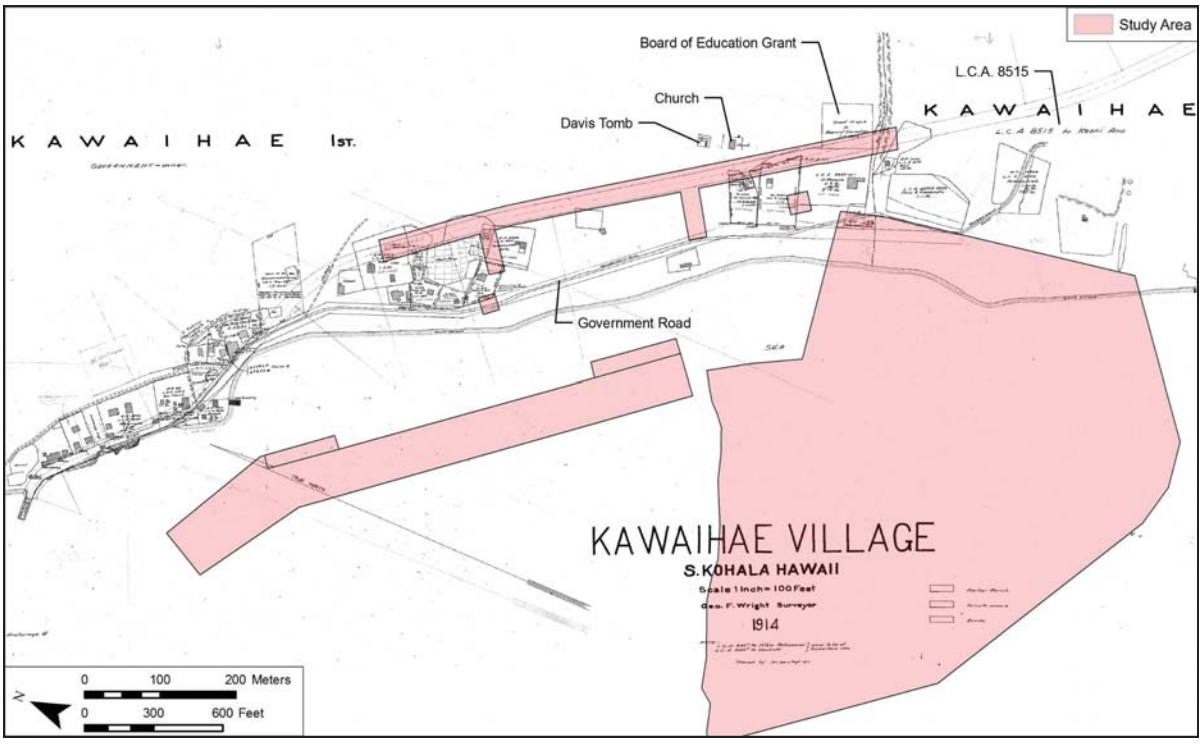

Figure 12. Registered Map (RM) 2690 (Wright 1914), showing the approximated locations of the various study areas (shaded in pink) at Kawaihae Harbor, in relation to the original shoreline of Kawaihae Bay and features discussed in the text

> $4,000 to the heirs of Puna, which sum included up to $750 to Dr. Silva for his improvements. Title to L.C.A. 4522 passed to the Territory of Hawai'i on January 7, 1959 [Apple 1978:26].

Despite changes in ownership of miscellaneous parcels and improvements to its port facilities, the landscape of the Kawaihae region remained little changed after the first decades of the 20th century. Into the 1930s, most of the residential and commercial buildings that comprised Kawaihae Town were located close to the shoreline of the bay; the uplands of the Kawaihae region remained undeveloped pasture land. A 1914 Registered Map (RM) 2690 (Figure 12) of Kawaihae Village depicts this concentration of development along the shoreline. This map also includes: the route of the old government road running along the shoreline and then *mauka*; the land award (LCA 8515) to Keoni Ana, other smaller *kuleana* awards, and some buildings within the present Pelekane Lands Buffer Area; the Davis tomb, adjacent church, Board of Education land grant, and "ruins" *mauka* of the current Kawaihae Road APE. The map clearly shows the relationship of the original shoreline at Kawaihae to the present harbor facility—everything *makai* of the road corridor APE would have been destroyed during the construction of the harbor.

During the years of the United States' involvement in World War II (1941-1945), Kawaihae's role as the shipping outlet for Waimea was intensified. O'ahu's burgeoning population of defense workers and military personnel demanded accelerated shipments of cattle from the Parker Ranch through Kawaihae. Only a few days after the bombing of Pearl Harbor, Alfred Carter reported that the ranch could ship 1.9 million pounds of beef as soon as transportation was available. Carter urged that the cattle be shipped from Kawaihae since it was nearest most of the ranch's best cattle (Brundage 1971:105).

Kawaihae and Waimea took on an additional function during the war. The vast isolated plains of Waimea were an ideal location for a troop training center and in the spring of 1942 an army recruit camp was built there. The recruits were followed by the Second and Fifth Marine Divisions which recuperated and trained at Waimea. At its height, the Waimea camp, consisting of tents and Quonset huts set on thousands of acres, housed up to 40,000 men. Troops were shipped in and out through Kawaihae. At the southern end of the bay, in Kawaihae 2, amphibious landing exercises were conducted and military emplacements were set up in the area of Pu'ukoholā Heiau.

The war in the Pacific had been over less than a year when the Hawaiian Islands were devastated by a tsunami that left at least 150 people dead and caused more than $25 million in property damage. On April 1, 1946, an earthquake off the Aleutian Islands at about 2:00 a.m. (Hawaiian time) generated the tsunami that reached the islands about four hours later. The severity of the tidal waves varied at different locales along the islands' coasts. At the Kawaihae wharf:

> ...the waves rose on shore to a height of 12 feet above sea level. The third wave is reported to be have been the largest. Between the waves, and reportedly before the first wave, recession of the water uncovered the reef for 1,000 feet offshore, the lowering of water level being estimated by one observer as about 20 feet below normal sea level. The old wharf was almost completely demolished, even pilings being carried away. However, the new wharf, which stood much higher

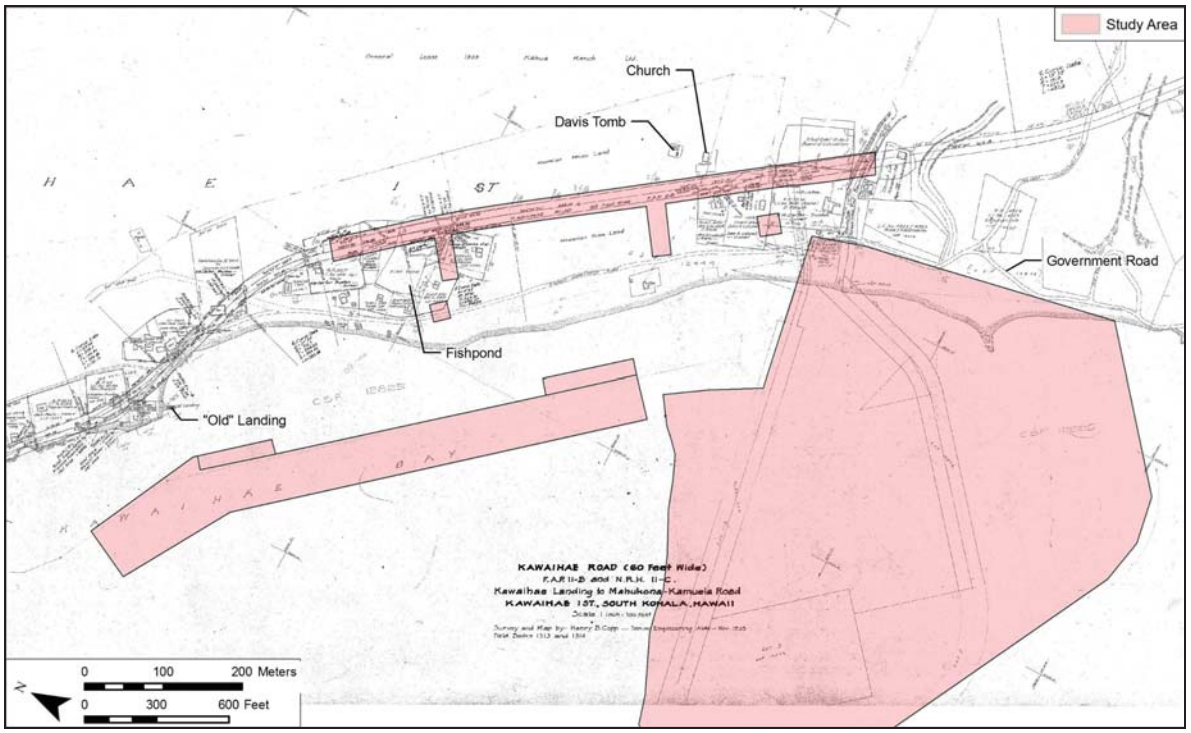

Figure 13. Portion of RM 2958 (Copp 1933), showing the approximated locations of the various study areas (shaded in pink) at Kawaihae Harbor, in relation to the original shoreline of Kawaihae Bay and features discussed in the text

above water, was unharmed. Many blocks of coral several feet across were thrown up onto the reef; and one about 3 feet in diameter was carried to the roadway 5 feet above sea level. For half a mile south of the wharf, houses along the shore, inside a half-mile-broad reef, were damaged or destroyed. However, these houses were built less than 5 feet above sea level. At the park at the southern end of Kawaihae the water rose 10 feet, but it caused no damage there because all structures were on higher ground. Several waves were observed, the fourth being the largest. The water withdrew far out from shore between the waves. (Shepard et al. 1950:440-441)

No lives were lost at Kawaihae. However, fishponds in the harbor area were filled with debris, which wiped out commercial fishing activity there. According to a synopsis of oral historic interviews in Hammatt et al. (1991:VI-4) the tsunami "…was the beginning of the end for the Kawaihae Fishing Village. People left." RM 2958 (Figure 13), drawn in 1933, shows a large fishpond in the vicinity of the Main Gate improvement area; this is likely one of the fishponds affected by the 1946 tsunami. Figure 13 includes features similar to those depicted on RM 2690 (see Figure 12), though it also depicts an additional branch of the government road extending towards the Pu'ukoholā Heiau complex, and identifies the location of the "old" landing at the harbor east of the Pier 2A extension area.

By the 1950s, the need for improved harbor facilities at Kawaihae was apparent. The old landing had been destroyed in the 1946 tsunami and the one built in 1937 had proven unsafe in high seas. The Kawaihae Deep-Draft Harbor project was authorized by the U.S. Congress in 1950, to be constructed were: "an entrance channel 400 feet wide, approximately 2,900 feet long, and 40 feet deep; a harbor basin 1,250 feet square and 35 feet deep; and a breakwater with a maximum crest elevation 13 feet above low water and approximately 4,400 feet long, of which 3,200 feet would be protected with heavy stone revetment" (van Hoften 1970:78). The Land Commission Award parcels at the shore were acquired, among other beach lands, by the Territory of Hawai'i through condemnation proceedings in the late 1950s. The new deep-draft harbor construction, a joint project of the Territory and the U.S. Army Corps of Engineers (USACE), was officially dedicated on October 5, 1959.

> The harbor's construction was hailed as an "economic shot in the arm," for sugar planters in the Kohala region of the island would no longer have to ship their crops overland to Hilo or to Kailua-Kona. The harbor would serve military needs as well. The Army was about to acquire a 100,000-acre training site nearby and could unload supplies at Kawaihae Harbor. Local residents also noted that, were Hilo Harbor blocked by a flow of lava, the new port of Kawaihae could service the entire island [van Hoften 1970:78].

During the harbor excavation, the coral reef that had been a danger to ships was cut and scraped. The materials dredged from the reef were used to create a landfill supported by a revetment upon which port facilities were built. The LCA parcels and much of the former shoreline at Kawaihae Town were now covered by up to thirteen feet of compacted, dredged coral fill material. The harbor construction completed the destruction of the fishponds that were initially impacted by the 1946 tsunami.

A USGS map from 1951 (Figure 14) provides another depiction of the harbor as it existed before construction began, and Figure 15 is a USACE map depicting the original coastline in relationship to the newly-constructed harbor facility.

With the development of the small boat harbor at the south end of the bay in 1970, the transformation of the town into a modern harbor and industrial park complex was completed. The Kawaihae (South) Small Boat Harbor was created by a series of controlled explosions. A comprehensive description of the Pu‘ukoholā Heiau National Historic Site on the National Park Service (NPS) website gives the following account of this event:

> …[T]he [U.S. Army] Corps and the Atomic Energy Commission had begun a joint research program focusing on the use of nuclear explosives for construction purposes. Some of the types of projects amenable to nuclear excavation included water channels, highway cuts, harbors, and dams. The army's Nuclear Cratering Group was anxious to try chemical high explosives in excavating the small boat harbor and entrance channel at Kawaihae. "Project Tugboat" would be the army's first major construction project using that method of excavation. Some local opposition arose, concerned about detrimental impacts on marine life and on historically significant structures such as the nearby *heiau*. Before setting off the explosions, engineers braced the walls of Pu‘ukohola Heiau and placed a seismograph next to the structure to monitor movement. Three phases of detonations were required to accomplish the job, which also included construction of an 850-foot-long breakwater to protect the new basin. The project was considered a success, but expensive. No known damage occurred to historic structures [www.nps.gov/history/history/online_books/kona/history7.htm].

On August 17, 1972 the U.S. Congress authorized the designation of Pu‘ukoholā Heiau as a National Historic Site. This site also encompassed Mailekini Heiau; Hale-ō-ka-puni Heiau (a "shark" *heiau* believed to be submerged offshore below Pu‘ukoholā); a stone post on the beach that, according to tradition, chief Alapa‘i-kupalupalu-manō leaned against while watching sharks circling around offerings placed at the submerged *heiau*; Pelekāne, Kamehameha's Kawaihae residence; and the site of John Young's house. Pu‘ukoholā Heiau is visible on a 1977-78 USGS Orthophoto (Figure 16), which also shows the adjacent constructed harbor facilities.

Today, Kawaihae Harbor attracts scuba divers and sports fishers. The southern small boat harbor is the home of Kawaihae Canoe Club. Scenes from the movie "Waterworld" were filmed in Kawaihae Harbor. Second only to Hilo Harbor on Hawai‘i island, Kawaihae Harbor often hosts the Makali‘i, one of the three Hawaiian sailing canoes. According to the *Hawai‘i Island Commercial Harbors 2035 Master Plan Update* (2011), since the first Master Plan was developed for Hilo and Kawaihae Harbors in 1989 usage of these ports has more than quadrupled.

The USACE and US Army continue to utilize the military landing for transport of troops, vehicles, explosive, and other goods traveling to and from Pōhakuloa Training Area. Under Executive Orders 1759 and 2142, the US Army owns approximately 10 acres of land at the harbor, adjacent to the military landing on the coral flats. According to the *Hawaii Commercial*

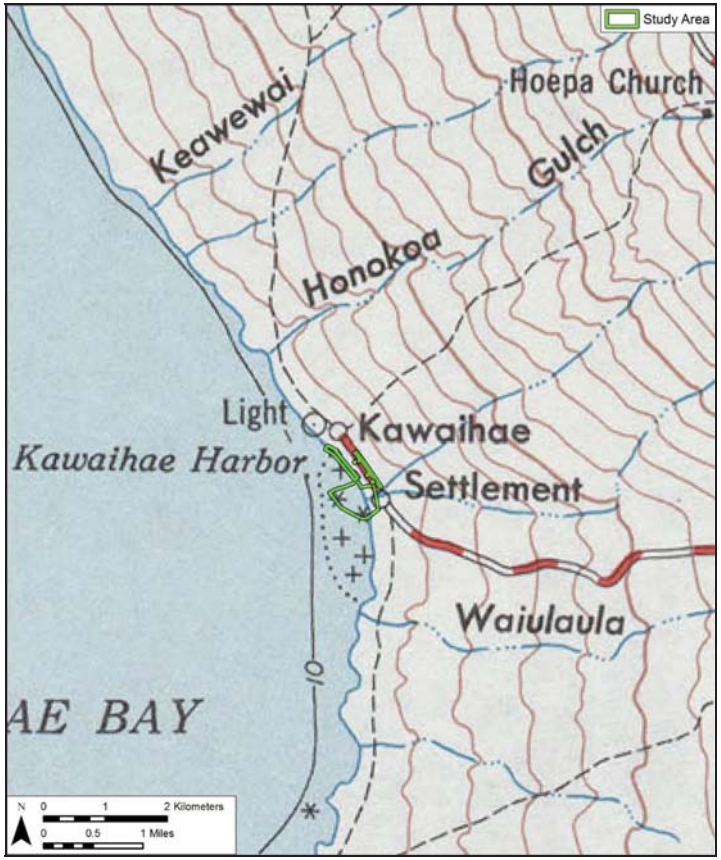

Figure 14. Portion of the 1951 USGS topographic map (1:250,000), Hawai‘i North Quad, showing the locations of the various study areas at Kawaihae Harbor (outlined in green here to differentiate from the red-and-white corridor representing the Kawaihae Road) in relation to Kawaihae Bay prior to the harbor construction (note: the cross symbols represent sunken rocks, the asterisks represent awash rocks, and the dotted line symbolizes the limits of the coral reef)



Figure 16. Portion of the 1977-78 USGS Orthophoto (Kawaihae Quad) showing the approximated locations of the various study areas (outlined in red) at Kawaihae Harbor in relation to Kawaihae Bay after the harbor construction

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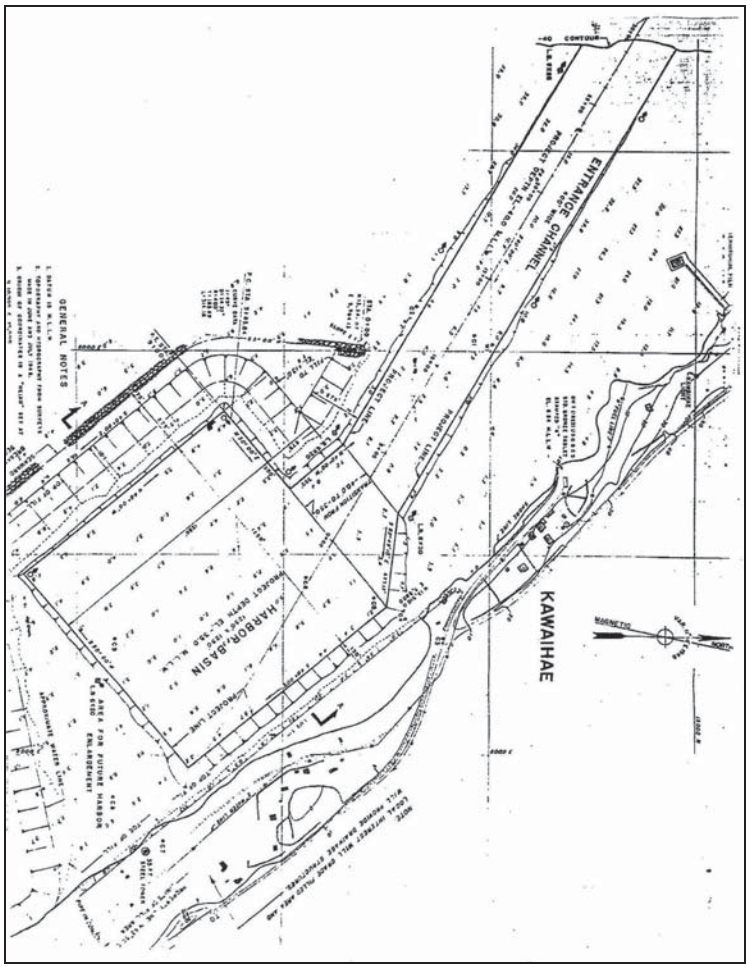

Figure 15. USACE map of Kawaihae Harbor, showing the relationship of the Deep Draft Harbor (dedicated in 1959) to the pre-1950s coastline (reprinted in Hammatt et al. 1991:V-21)

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Harbors 2020 Master Plan Environmental Impact Statement (1998:4-12), the Pelekane Lands, located just *mauka* of the coral flats, was created under Cooperative Agreement H-98-8 between the US Department of the Interior, the National Park Service and the Harbors Division as a buffer zone that "separates the archaeologically significant Puukohola Heiau National Historic Site from the commercial harbor area."

Table 3 presents a timeline of harbor-related construction activities and notable events, beginning with the Kawaihae Deep-Draft Harbor project.

Table 3. Timeline of Construction Activities and Other Notable Events at Kawaihae Harbor[2]

Year	Event
1937	A new concrete landing is built at Kawaihae Bay, allowing for larger vessels to moor directly at the harbor; previously, such ships had to anchor offshore and transfer goods to and from shore with a 40' life boat (Hammatt et al. 1991:VI-2)
1946	Tsunami waves cresting at 12 feet destroy the older landing at Kawaihae Bay and damage the new landing
1950	U.S. Congress authorizes the Kawaihae Deep-Draft Harbor project
Late 1950s	Land Commission Award parcels at the shore are acquired, among other beach lands, by the Territory of Hawai‘i through condemnation proceedings
1957-1959	Dredging and construction of the Kawaihae Deep-Draft Harbor occur, including construction of the breakwater and military landing ramp on the coral flats
1962	USACE decides to widen the harbor entrance channel and basin, extend the breakwater, and construct a small boat harbor; initial navigation from the small boat harbor occurs
1970	Construction of the Kawaihae (South) Small Boat Harbor and breakwater occurs, using explosive charges
1973	Akoni Pule Highway is dedicated, increasing access to the Kawaihae district and harbor
1975	Queen Ka‘ahumanu Highway is completed, connecting Kona International Airport to the harbor, generating further growth including high-end resort construction south of the harbor
1982	Channel is deepened to mitigate surge conditions; interisland barge and overseas terminals are developed; back areas are leased for petroleum and bulk cement storage; direct barge service begins
1986	Interisland cargo begins direct transshipment
1989	The *Hilo and Kawaihae Harbors 2010 Master Plan* is prepared

Year	Event
1992	A new bridge is added to connect terminals; silos are removed and the container yard paved; 550' extension of the overseas pier and 38' extension of the marginal wharf are accomplished; dredging occurs to increase draft
1995	Modifications made to the Kawaihae (South) Small Boat Harbor
1998	The *Hawaii Commercial Harbors 2020 Master Plan* is prepared
1999	Boring tests on the coral landfill indicate depths of 8 to 13 feet
2006	An earthquake centered in Kohala damages Piers 1 and 2A, rendering them temporarily unusable
2009	Repairs to the earthquake-damaged piers are financed from the proceeds from the State's insurance policy
2011	The *Hawai‘i Island Commercial Harbors 2035 Master Plan Update* is prepared.
Various dates	Accommodations are made for technological changes in the cargo handling industry such as longer containers

[2]Some of the information provided in the table above was taken from the Hawai‘i Island Commercial Harbors 2020 Plan Final EIS and the 2035 Master Plan Public Update.

Section 4 Previous Archaeological Research

4.1 Overview

Over the last fifty years numerous archaeological studies have been conducted within Kawaihae 1 and 2 and surrounding *ahupua'a* (Figure 17 and Table 4). These studies complement and amplify the Historic documentation record, suggesting patterns of Hawaiian settlement and activity within the *ahupua'a* during the pre-contact and early post-contact periods. Please note that the extent of the rocks and coral reef depicted as scalloped lines on the 1996 USGS topographic map (Figure 1, Figure 6 and Figure 17) does not reflect current conditions.

The primary focus of this research has been the coastal zone (from the shoreline to about 0.4 km inland) of Kawaihae 1 and 2. This past research includes several reconnaissance surveys of the immediate shoreline (Soehren 1963a, 1963b, 1964, 1980, Apple 1964, Kikuchi 1964). Several studies have examined Pu'ukoholā and Mailekini *heiau* and John Young's homestead (Cluff et al. 1969; Kelly 1974; Apple 1978; Rosendahl and Carter 1988; Schuster 1992; Durst 2001). The *makai* portion of Kawaihae 2 has been subjected to large, overlapping inventory surveys and testing (Clark and Kirch 1983; Carlson and Rosendahl 1990). Other inventory-level surveys and/or subsurface testing have been accomplished at Spencer Beach Park and other various parcels within the *makai* portion of both *ahupua'a* (Rosendahl and Carter 1988; Carter 1989; Carlson and Rosendahl 1990; Schilz 1991; Borthwick and Hammatt 1992; Borthwick et al. 2000; Borthwick and Hammatt 2002; Haun et al. 2004). The research has identified numerous archaeological sites representing a wide range of traditional and historic land use activities. Among the site types recorded were temporary and permanent habitation, ranching, agriculture, salt production, burials and religious observance.

In 1995 an assessment was conducted of the archaeological resources of the entire *ahupua'a* of Kawaihae 2 (Walsh et al. 1995). This assessment showed definite elevational patterns in the Hawaiian use of the prehistoric landscape. As expected, archaeological sites are heavily distributed around Pu'ukoholā Heiau in the *makai* portion of the *ahupua'a.* These sites are associated with the construction and use of the *heiau* around the time of Kamehameha I. In the dry mid-elevational zone, above the 300-ft. contour, there are few or no archaeological sites. Those that do occur mark the location of trails and historic roads traversing from *mauka* to *makai*. In the cooler climate between 2300 ft. and 3200 ft. above mean sea level (a.m.s.l.) lie the physical remains of a once thriving Hawaiian community. Agricultural fields, terraces, animal pens, small and large habitation sites and several *heiau* are found between these elevations. The greatest density of sites along the slope occurs in the northern part of Kawaihae 2, near its boundary with Kawaihae 1. This greater density along the slope could relate to the water source at Keawewai Stream to the north and to subtle variations in rainfall and other climatic considerations which would affect crop yields, such as wind patterns.

Most applicable to the current project area are a handful of studies dating back to the 1960s. In 1964, Lloyd Soehren surveyed coastal Kawaihae, focusing on the features surrounding and adjacent to the Pu'ukoholā Heiau complex. Four years later, William Bonk conducted a survey of the coast of Kawiahae 1 and Upolo to the north, identifying numerous sites, which were assigned four-digit state site numbers. In 1974, Marion Kelly completed a Historic survey of the

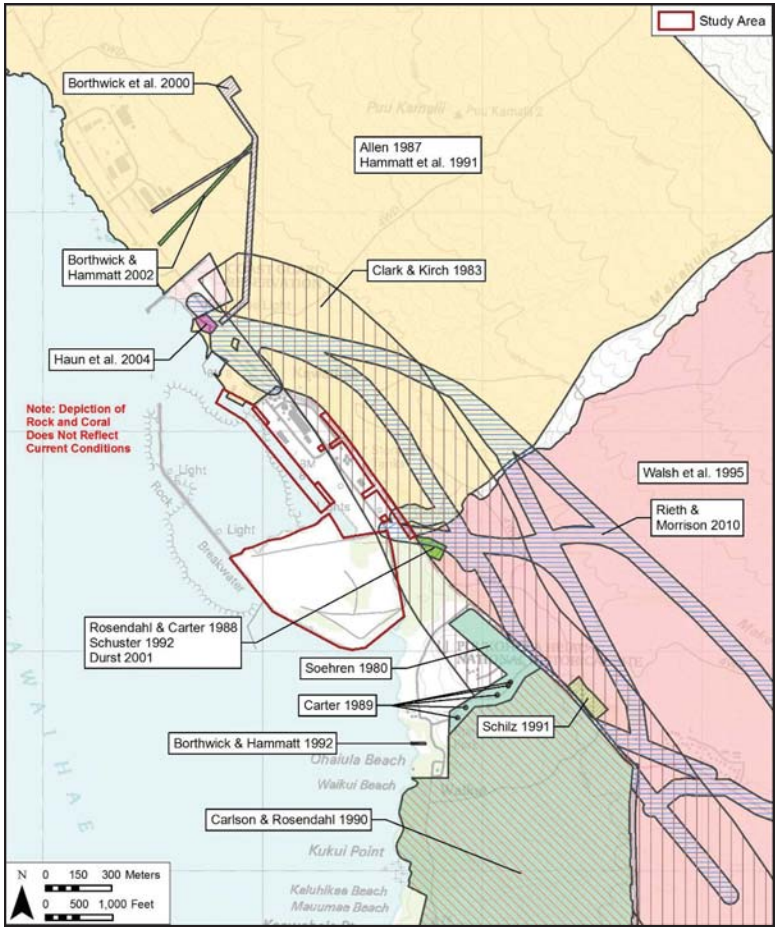


Figure 17. Portion of 1996 USGS 7.5-Minute Series Topographic Map, Kawaihae quadrangle, showing the showing the locations of the various study areas (outlined in red) at Kawaihae Harbor in relation to previous archaeological studies in the vicinity

Table 4. Previous Archaeological Studies in the Vicinity of the Kawaihae Harbor

Source	Nature of Study	Location	Finds/Comments
Reinecke 1930	Reconnaissance Survey	Kailua to Kalāhuipua‘a	Designated 146 sites along coast
Soehren 1963a	Reconnaissance Survey	Kawaihae	Pu‘ukoholā and Mailekini *heiau* complex
Soehren 1963b	Reconnaissance Survey	Kawaihae	Pu‘ukoholā and Mailekini *heiau* complex
Apple 1964	Reconnaissance Survey	Kawaihae	Pu‘ukoholā and Mailekini *heiau* complex
Kikuchi 1964	Reconnaissance Survey	Kawaihae	Pu‘ukoholā and Mailekini *heiau* complex
Soehren 1964	Reconnaissance Survey	Kawaihae to Lamalilo	Pu‘ukoholā and Mailekini *heiau* complex and several additional coastal sites
Bonk 1968	Reconnaissance Survey	Kawaihae 1 and Upolu	Identified numerous sites. Overlapped by Allen 1987 and Hammatt et al. 1991 studies.
Cluff et al. 1969	Archaeological “Surface” Survey	Kawaihae	Pu‘ukoholā and Mailekini *heiau* complex
Kelly 1974	Historic Survey	Kawaihae	Waimea to Akoni Pule Highway Corridor, including the Pu‘ukohola Heiau National Historic Site
Apple 1978	Archaeological Study	Kawaihae	John Young’s Homestead
Soehren 1980	Reconnaissance Survey	Portion of Kawaihae 2	Pu‘ukoholā and Mailekini *heiau* complex and several additional coastal sites
Clark and Kirch 1983	Reconnaissance Survey	Mudlane-Waimea-Akoni Pule Highway Corridor	Identified an additional 110 features

Source	Nature of Study	Location	Finds/Comments
Allen 1987	Archaeological Inventory Survey	Hawaiian Homes Lands at Kawaihae	Project area overlapped Bonk 1986 and was the subject of the later Hammatt et al. 1991 study; identified and recorded numerous features
Rosendahl & Carter 1988	Archaeological Study	Kawaihae	John Young’s Homestead
Carter 1989	Archaeological Excavations	Proposed Spencer Beach Park Entrance Road; Pu‘ukohola Heiau National Historic Site	Identified and tested numerous sites
Carlson & Rosendahl 1990	Archaeological Inventory Survey	Coastal Kawaihae	Identified 148 sites
Hammatt et al. 1991	Archaeological Survey and Testing	Kawaihae 1	Project area overlapped Allen 1987; identified and inventoried all sites of potential significance in selected lots and performed specific tasks at specific sites. Documented a number of sites not recorded by Allen 1987
Schilz 1991	Archaeological Inventory Survey	Coastal Kawaihae	Identified and tested numerous sites
Borthwick and Hammatt 1992	Archaeological Inventory Survey	Coastal Kawaihae	Identified and tested numerous sites
Schuster 1992	Archaeological Study	Kawaihae 2	Pu‘ukohola Heiau National Historic Site- John Young’s Homestead
Walsh et al 1995	Archaeological Inventory Survey	Kawaihae, *mauka* of Queen Ka‘ahumanu Highway	Identified numerous sites

Source	Nature of Study	Location	Finds/Comments
Borthwick et al. 2000	Archaeological Assessment	Kawaihae 1	No finds in the project corridor
Durst 2001	Archaeological Excavation	Kawaihae 2	Pu'ukoholā Heiau National Historic Site- John Young's Homestead
Borthwick & Hammatt 2002	Archaeological Assessment	Kawaihae 1	Three previously recorded sites (SIHP 13717, 13718 and 13908) were located near, but outside of, the project corridor
Haun et al. 2004	Archaeological Inventory Survey	Kawaihae 1	1.32-acre project area containing one site with four features (Site 24180), located just north of the Kawaihae (North) Small Boat Harbor
Rieth and Morrison 2010	Archaeological Inventory Survey	Kawaihae 1 & 2, 'Ōuli, Lālāmilo, and Waikoloa Ahupua'a	1,350 features comprising 157 previously identified and 234 newly recorded sites; the majority are late pre-contact/early post-contact traditional Hawaiian temporary habitation and agricultural sites

Waimea to Akoni Pule Highway Corridor, including all of the features and sites within the Pu'ukohola Heiau National Historic Site. Her study included the results of Soehren's survey.

More than a decade later, both the Bishop Museum (Allen 1987) and CSH (Hammatt et al. 1991) conducted inventory surveys of the Hawaiian Homelands at Kawaihae, overlapping the Bonk (1968) survey area. These studies covered an area of 2,600 acres extending from the shore to 1000 feet elevation. A total of 147 sites were recorded in all, comprising nearly 500 features. According to Haun et al (2004:23), 384 of these features were related to habitation, 31 served as burial sites, 25 were agricultural, 24 were historic in nature, 12 served as *ahu* (markers), seven were trails, six had miscellaneous or indeterminate functions, and two features served a ritual purpose. Four samples taken from habitation sites during the Hammatt et al. (1991:XII-1) study yielded radiocarbon dates, and included one modern result and three age ranges of A.D 1670-1935, 1510-1950, and 1330-1430. A number of sites documented during the Hawaiian Homelands studies are in the vicinity of the current project area, concentrated along the *mauka* shoulder of Kawaihae Road.

Between 2007 and 2009, International Archaeological Research Institute, Inc. conducted an inventory survey of proposed Kawaihae Road bypass corridors, encompassing 1,548 acres across Kawaihae 1 & 2, 'Ōuli, Lālāmilo, and Waikoloa Ahupua'a. According to the report (Rieth and Morrison 2010:iii):

> Fieldwork focused on documentation of the archaeological surface features within the proposed road alignments and limited subsurface testing. Multiple research questions guided the investigations which aimed to evaluate the settlement patterns, agricultural developments, and chronology of the Waimea-Kawaihae region. A total of 1,350 features were documented as components of 391 sites: 157 previously identified sites and 234 newly recorded sites. The majority of the features represent late pre-Contact/early post-Contact traditional Hawaiian temporary habitation and agricultural activities. Multiple previously recorded burials in coastal Kawaihae were relocated, along with four newly identified burials dispersed at more inland locations.

While the survey fieldwork and subsequent reporting focused on the features located within the proposed road corridors and spurs, many adjacent sites were also recorded. These included some sites located along the *mauka* shoulder of Kawaihae Road that had been previously-indentified by Allen (1987) and Hammatt et al. (1991), as well as a couple of newly-recorded sites. Descriptions of the historic properties in the vicinity of the current project area follow.

4.2 Sites Previously Identified in the Immediate Vicinity

The most prominent historic properties in the vicinity of the current project area are those associated with the Pu'ukoholā Heiau National Historic Site. These were surveyed, along with others in what is now the Pelekane Lands Buffer Zone, by Lloyd Soehren in 1964. Soehren assigned the features he recorded temporary site numbers prefixed "E5-," most of which can be found on Figure 18. Many of these were later given SIHP numbers. Marion Kelly (1974) included some of Soehren's findings in a report produced by the Bishop Museum, focusing in particular on the *heiau* complex.

Furthermore, several previously-identified sites lie along the *mauka* shoulder of Kawaihae Road, in the vicinity of the Main and South Gate intersection improvements APE. These include sites 13748 through 13755 and 13782, identified during the Allen (1987) and Hammatt et al. (1991) studies. Figure 19 shows the sites found by CSH in the vicinity of the harbor. The most recent archaeological inventory survey relevant to the current project area, reported by Rieth and Morrison (2010), also documented some of these sites along the road, and identified two new sites, SIHP 27642 and 27847; these sites can be seen on Figure 20 and Figure 21.

All of the SIHP numbers discussed below are prefixed by 50-10-05- or -06-.

Reith and Morrison determined that all of the sites identified during their survey are eligible for the National Register under significance Criterion D (see the footnote following the Management Summary), with a handful of sites being additionally evaluated as significant under criteria A and B (Rieth and Morrison 2010:219-220). They did not assess their sites using the State criterion for significance evaluation, which includes an additional category intended to

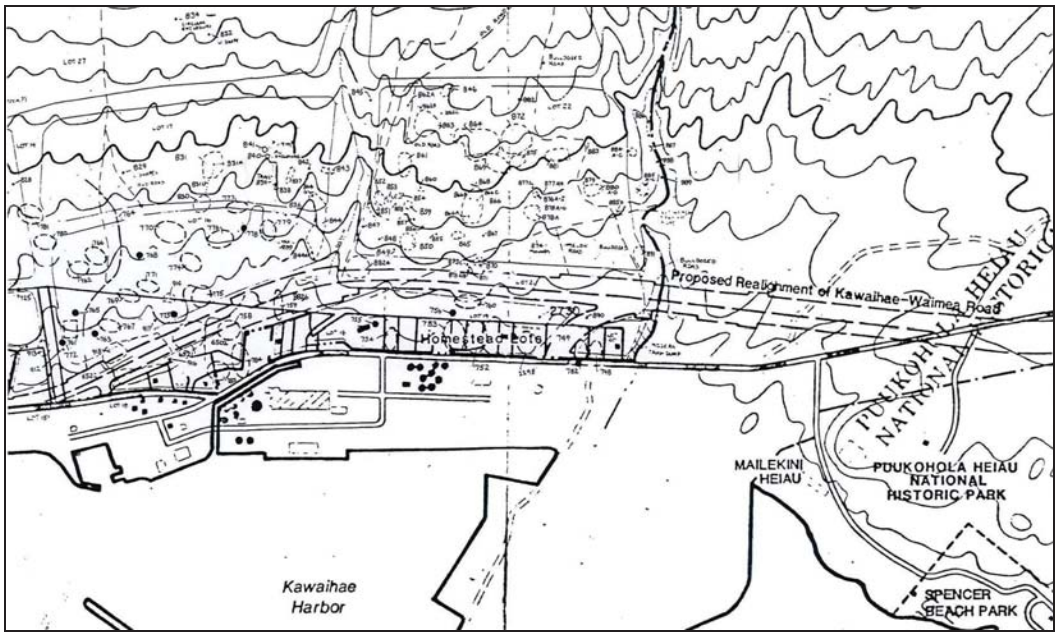


Figure 19. Portion of map from Hammatt et al. (1991), showing the locations of the sites located in the vicinity of the harbor (the three-digit site numbers would have been prefixed by -13)

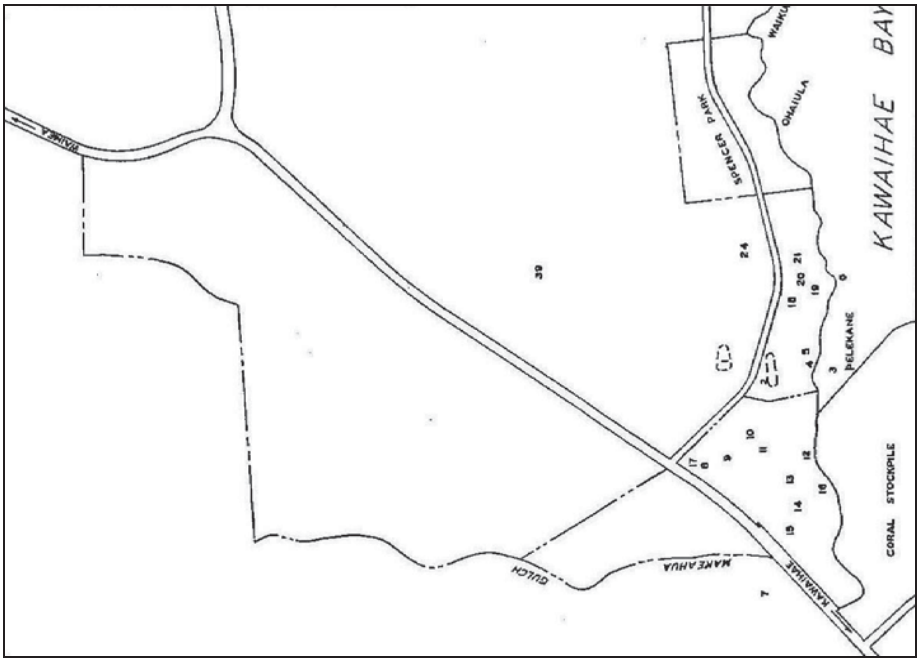


Figure 18. Portion of a map from Soehren 1964 (reprinted in Kelly 1974:64), showing the locations of sites recorded by him in the vicinity of Kawaihae Road and the Coral Flats

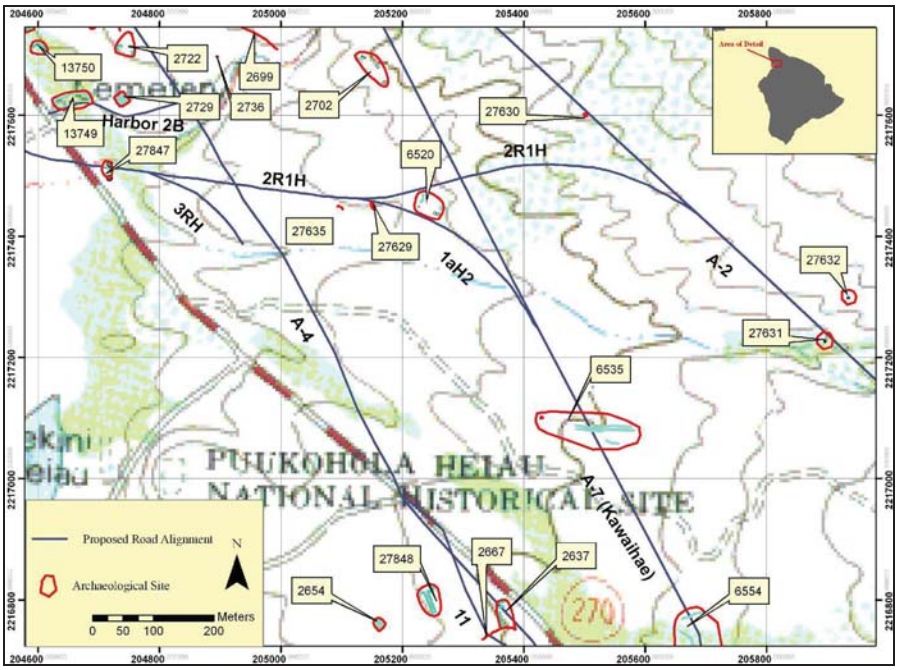


Figure 21. Map from Reith and Morrison (2010:47), showing the sites located in the vicinity of the harbor (top left corner)

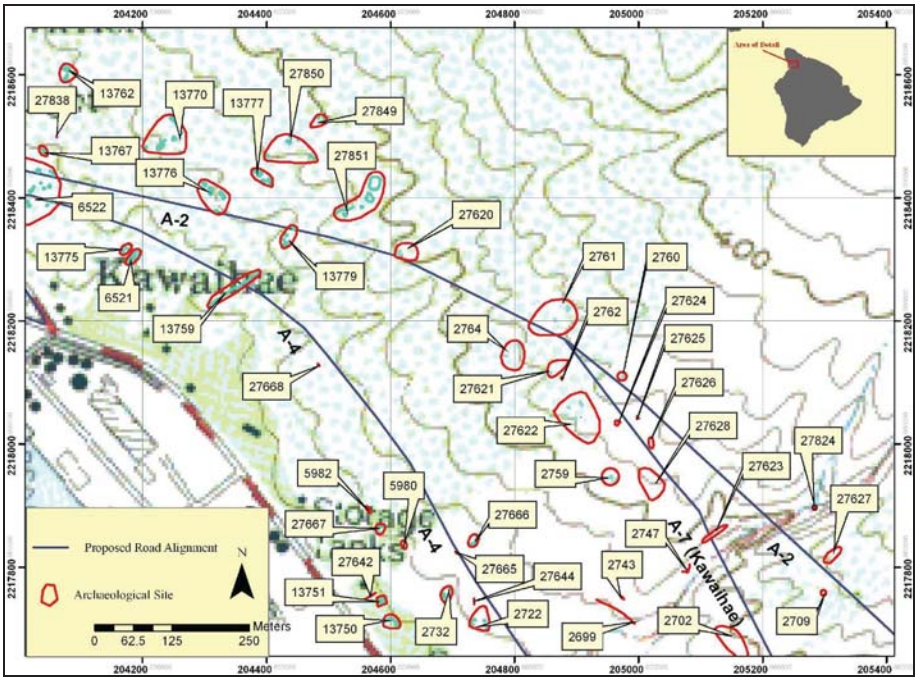


Figure 20. Map from Reith and Morrison (2010:46), showing the sites located in the vicinity of the harbor (lower register)

represent sites having an important value to the native Hawaiian people or to another ethnic group (Criterion E; see the footnote after the Management Summary for an explanation of this category). This criterion is typically applied to burial sites, and therefore sites 13749, 13751/2298, 13755 and 13782 should be evaluated as such.

To help provide some additional context, RM 2983 (Figure 22) is included here. This map, drafted between 1934 and 1935 for the Hawaiian Homeland Residence and Boathouse Lease Lots, depicts the location of the "New Kawaihae School Site" *mauka* of the northern end of the road corridor APE. This likely represents the school that was once located near SIHP 13754 and 13755 (see Sections 4.2.8 and 4.2.9 below). RM 2983 also shows a "Church Lot" across from and south of the South Gate improvements APE, bounded to the south by a "Proposed Cemetery Site". When examining RM 2690 (see Figure 12), RM 2958 (see Figure 13), and RM 2983, the approximated nature of the current project and study area overlay should be kept in mind. Sometimes distortions and/or inaccuracies in scale of the original maps can make a more precise overlay difficult. Therefore, it should be inferred that the "Church Lot" and "Proposed Cemetery Site" were located further north along the road corridor than depicted, theoretically placing them in line with the known locations of the church site (SIHP 13750) and the cemetery at SIHP 13749.

4.2.1 SIHP 2296, 2297 and 4139

The Puʻukoholā Heiau National Historic Site borders the project area to the south. This complex is designated as SIHP 4139, and encompasses the Puʻukoholā Heiau; Mailekini Heiau; Hale-ō-ka-puni Heiau (a "shark" *heiau* believed to be submerged offshore below Puʻukoholā); a stone post on the beach that, according to tradition, chief Alapaʻi-kupalupalu-manō leaned against while watching sharks circling around offerings placed at the submerged *heiau*; Pelekāne, Kamehameha's Kawaihae residence (SIHP 2297); and the site of John Young's house (2296). The Hale-ō-ka-puni (or "skark") Heiau is the component feature of SIHP 4139 that lies in closest proximity to the project area; its remains are located offshore under a layer of silt in Pelekane Bay. While the *heiau* complex was the subject of numerous studies through the year 1980, more recent studies have focused on the John Young's homestead. The component feature of this homestead closest to the current project area is SIHP 27847, discussed separately in Section 4.2.12 below

Kelly (1974:11) identifies SIHP 2296 as "John Young's old house" at the foot of Makahuna Ridge. The site is shown on Jackson's 1883 map of Kawaihae Bay, and is indicated as Soehren's site E5-7 *mauka* of the present Kawaihae Road (see Figure 11 and Figure 18). Kelly (1974:12) writes, "it [SIHP 2296] was part of the Puukohola Heiau -4139 complex... Much of which was once Young's backyard has been excavated away by recent quarry activities in that area." Results of an interview with Mr. William Akau were included in Kelly's discussion of this site. According to Kelly (1974:12), "William Akau said that his great-grandmother, Kamakahemaliʻiliʻi (born about 1840), told him when he was young that the ruin visible today on the ridge above Makahuna Gulch was a '*hale kula Palani*' (Catholic school)." In her footnotes on the same page, Kelly mentions that Governor Kuakini may have given the Catholic missionaries permission to use the building sometime between 1835 and 1844. Kelly (1974:16) summarizes evidence pointing out that Young's "old house" may have actually been located.

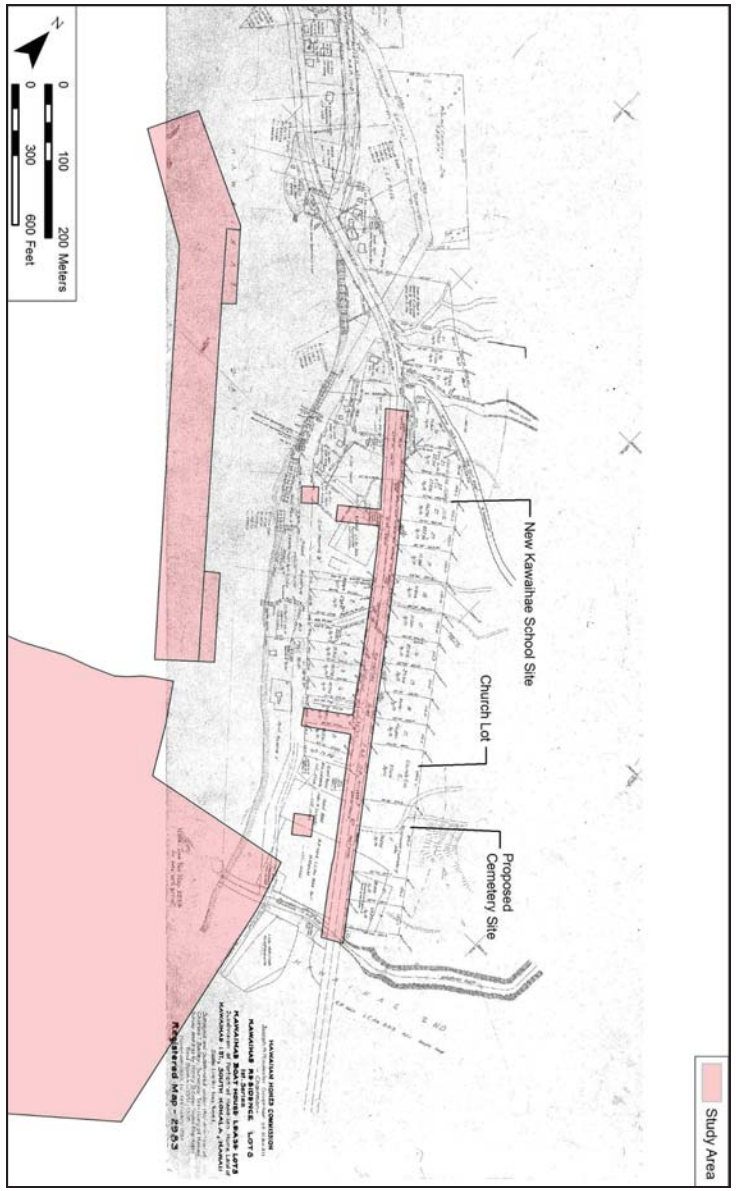


Figure 22. Registered Map (RM) 2983 (Copp 1934-35), showing the approximated locations of the various study areas (shaded in pink) at Kawaihae Harbor, in relation to the original shoreline of Kawaihae Bay and features discussed in the text

makai of these ruins; regardless, this site is considered to be part of the John Young Homestead (see Section 4.2.2.4)

SIHP 2297, or the "King's Residence," is introduced in Section 3.2.1. Curiously, Soehren does not seem to have assigned this complex a site number. Kelly (1974:18) writes:

> A photograph taken about 1889 indicates several enclosures *makai* of the *heiau*... One rather large house under some coconut trees may identify the site of the King's house. Although it is said that nothing presently remains of this site, an aerial view reveals the tops of a few coconut trees among the dense *keawe* trees that grow on the beach *makai* of Mailekini Heiau…Viewed from the coral stockpile Pelekani [sic] today is a small beach--one or two coconut trees surrounded by *keawe*--with the ever-present Puukohola Heiau presiding over the whole... Under the trees are platforms and stone walls that indicate former dwelling sites... Further archaeological work should be done in this area and efforts should be made to identify, preserve and perhaps even reconstruct ancient structures at the "King's Residence."
>
> Kamakau mentioned that Kamehameha I from time to time "...retired to the tabu district of Mailekini below Pu'ukohola…" [Kamakau 1961: 350]. [Historic photos included in the Kelly report] show stone walls emerging from the ends of Puukohola Heiau and veering toward the sea. Some of the stones in these walls were used, we were told, to build the County Road that now runs between the two *heiau*... These walls might indicate the limits of the "tabu district of Mailekini" referred to by Kamakau… Another explanation is that these walls were built to prevent cattle from wandering into the area.

Kelly (1974:27) describes the Hale-O-Kapuni Heiau, a component of SIHP 4139 designated as E5-3 by Soehren (see Figure 18):

> Hale-o-Kapuni is said to be an off-shore *heiau*, apparently having some connection with sharks [Apple 1969:17]. It is also mentioned in the story of Lonoikamakahiki as the place where "...all the chiefs...encamped," and was located "...immediate1y below the temple of Puukohola and Mailekini at Kawaihae" [Fornander 1917 cited in Kelly 1974].

Kelly goes on the mention that this *heiau* has been somewhat lost under the silt in the bay, and that Eddie Laau Sr. informed her "that that he had been told that the so-called 'chair' of Kamehameha was not a chair at all, but merely a high rock that Kamehameha used to rest his arm on while standing on land, watching the sharks circle in the vicinity of Hale-o-Kapuni below" (Kelly 1974:27).

Soehren recorded the Pu'ukoholā Heiau itself as site E5-1, while the Mailekini Heiau was designated as E5-2 (Kelly 1974:58, see Figure 18). Much has been written about these *heiau* (which are briefly introduced in Section 3.1.2 above), and thus the reader is referred to Kelly (1974) or a similar report for further detail.

4.2.2 Sites Within the Pelekane Lands Buffer Zone

Lloyd Soehren's 1964 survey of the *heiau* discussed above also covered the adjacent lands to the north that now comprise the Pelekane Lands Buffer Zone. Soehren identified ten sites, E5-8 through E5-17, within this area. Of these, five are located somewhat in the vicinity of the present project area. E5-15 is located some distance *makai* of Kawaihae Road, south of the project APE; E5-13 and -14 lie between E5-15 and E5-12 and -16, which are situated just beyond the eastern edge of the Coral Flats (see Figure 18). The following descriptions of these five sites were penned by Soehren and reproduced in Kelly's (1974) historical survey.

4.2.2.1 E5-12

> On a rock bluff on the S [south] side of a small gulch behind the old marine railway at Pelekane [no site number given] and opposite a lone coconut palm tree are several pictographs. They have been painted with a heavy white pigment, possibly white lead. They are undoubtedly modern although the style is old. Three stick figures are still distinct and several patches of the white pigment indicate that other figures have since been obliterated. Pictographs have not previously been recorded on the Island of Hawaii. The location and nature of these strongly suggests that they are of modern origin imitating an ancient style [Soehren 1964 in Kelly 1974:61].

4.2.2.2 E5-13

> On the N [north] side of the small gulch opposite the pictographs is a small clearing surrounded on the N and E [east] sides by a stone fence and bounded by the gulch to the S. The W [west] side apparently was left open. Lumber, broken glass and china were scattered over much of the area, which is undoubtedly a modern farm or house lot [Soehren 1964 in Kelly 1974:61].

4.2.2.3 E5-14

> About 200 ft N of the preceding site and just S of the Old Government Road [see Figure 13] is a well, presently lined with concrete. The pit is about 10 ft sq and 8 ft deep. The top is now open but appears to have been covered with a wooden deck. This is undoubtedly one of the principle wells which served the Kawaihae area until recently and may be he same as the spring named Waiakapea, shown on Jackson's 1870 hydrographic map [see Figure 11]… [Soehren 1964 in Kelly 1974:62].

4.2.2.4 E5-15

> On the N side of the old road and a short distance from the spring are the ruins of a stone fence surrounding a large house lot. Within were seen the remains of at least one house platform, traces of others, and possibly one grave site. Considerable rubble and numerous water-worn pebbles are scattered about the

entire area. Only one piece of broken china was observed. The entire area is now thickly covered with large trees.

A notation on the 1870 hydrographic chart of Kawaihae by Lt. Jackson [see Figure 11], would identify this site as that of "John Young's old house", along side of which were the ruins of the Rev. Lyon's house.

It was from this general area that drawings of the Puukohola Heiau were made by the early voyagers. These drawings, and photographs taken many years later, show a number of house sites in the vicinity [Soehren 1964 in Kelly 1974:62].

As mentioned in Section 4.2.1, there has been some debate in the past about whether or not the site of John Young's "old house" was located on the ridge *mauka* of the present Kawaihae Road, or more *makai* and in closer proximity to the royal residence. Though Kelly and Soehren differ in their evaluations of which area represented the location of the "old house", they both substantiate their assessment by citing the Jackson map (Figure 11). All debate aside, E5-15 appears to have represented some portion of the Young holdings.

4.2.2.5 E5-16

A few yards inland from the old beach line and just S of the old road is an old style charcoal oven. It is a low dome of concrete about 8 by 12 feet. The door of the oven faces the sea. Although this is obviously a recent feature it is rather interesting to note [Soehren 1964 in Kelly 1974:62].

4.2.3 SIHP 13748 and 13749

The following are site descriptions for SIHP 13748 and 13749 penned by Allen (1987:73-74):

Site complex B-19—Historic Period Residential Complex [SIHP 13748; Figure 23]

The structural components of this historic period site complex include minimally three wall segments and one large single boulder alignment; additional stone features may be found when the dense grass in the central portion of the lot is cleared. The site lies at ca. 30-ft elevation and is defined on the northeast, northwest, and southeast by a wire fenceline, and on the south west by Highway 270. There is also a currently occupied residence to the southeast. Historic period artifacts are scattered throughout the area and include sheet metal, lumber, and metal pipes. These historic period materials most likely date to the mid-1900s and are probably part of a residential unit. A site tag was placed on the north end of a well-built wall near the upslope end of the lot. The overall conditions of the structural remains, apart from the aforementioned wall, are fair to deteriorated.

A midden and volcanic glass scatter is located at the northern end of the site and extends across the slope to into adjacent Site Complex B-20 (see description under Feature F [of SIHP 13749]).

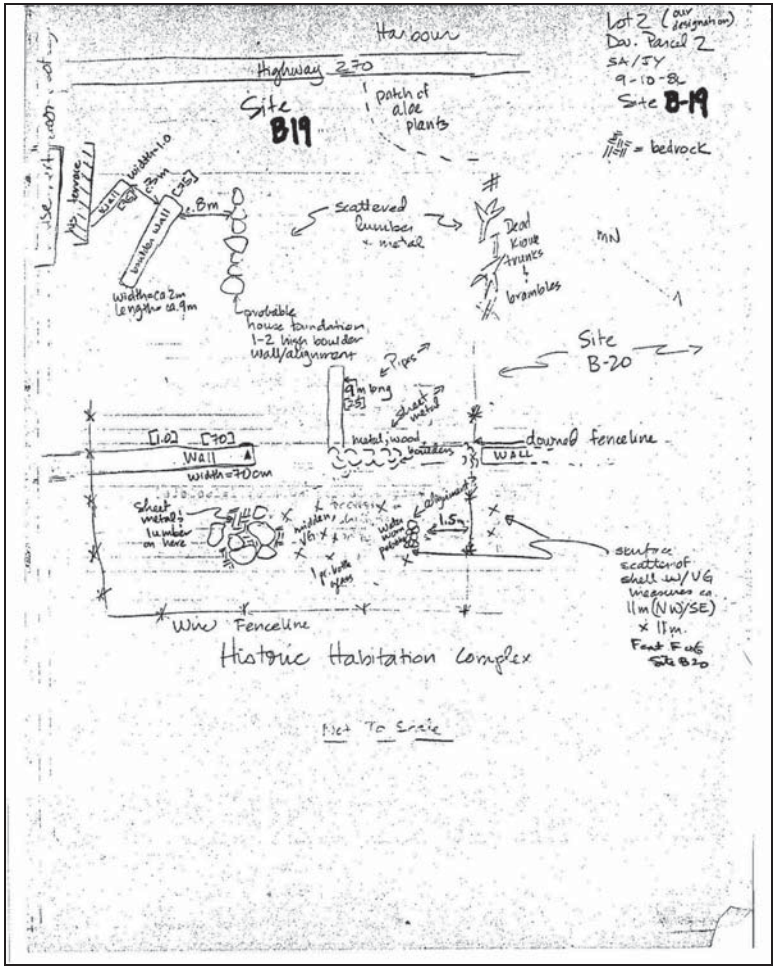


Figure 23. Field sketch of SIHP 13748 (B-19) from Allen (1987)

Site complex B-20—Historic Period Burial Complex and Prehistoric Midden Artifact Concentration [SIHP 13749; Figure 24]

This site is located ca. 30-ft elevation and immediately northwest of Site Complex B-19. Much of the area is exposed bedrock with only pockets of soil. Feature A is a large L-shaped wall that abuts site complex B-19 and may have once connected with the same aforementioned wall I the same. The wall has a boundary function. A site tag was placed on the north corner of this wall.

At the southern end of the lot, opposite the corner of the "L," are four platforms that are most likely burials. Feature B is a boulder-faced, cobble-filled, roughly circular platform with a single coral cobble on the surface. In the interior of the platform is a collapsed area that measures 75cm by 65cm by 30cm deep.

Feature C is a rectangular platform similar to Feature B in construction, and the stone facing appears chiseled...

Feature D, a basically square platform, has a single boulder alignment at the upslope side and is two stones high on the ocean side. The center of this feature also appears collapsed.

Feature E is a square boulder-faced platform with waterworn pebbles of ca. 5mm to 7mm size on the surface. Feature A suggests that Sites B-20 and B19 were once a single complex. The chronological relationships between this enclosure wall, the historic period occupation in site B-19, and the four burial platforms remains to be determined.

Feature F is a prehistoric midden scatter consisting of frequent marine shell, volcanic glass, and waterworn pebbles. This scatter is found upslope and outside of Site B-20 Feature A and extends southeast into Site Complex B-19. Three volcanic glass samples were collected from the Site B-19 area of the scatter (Acc #1). Two of these were submitted to Mohlab and yielded dates of A.D 1231 plus or minus 26 yrs and A.D 1686 plus or minus 4 yrs.

SIHP 13748 and 13749 are later discussed by CSH in the context of testing at the midden scatter and the burial platforms:

> We conclude that it is highly probable that a prehistoric site existed in the immediate vicinity but that heavy erosion and possibly mechanical activity as well, have mixed historic and prehistoric deposits. We conclude that the function of the midden scatter is as the remains of discarded food scraps relating to a prehistoric site, no longer extant. Sheet wash has deposited the midden in a disturbed context. The probability of an intact prehistoric deposit is very low [Hammatt et al. 1991: IX-3].

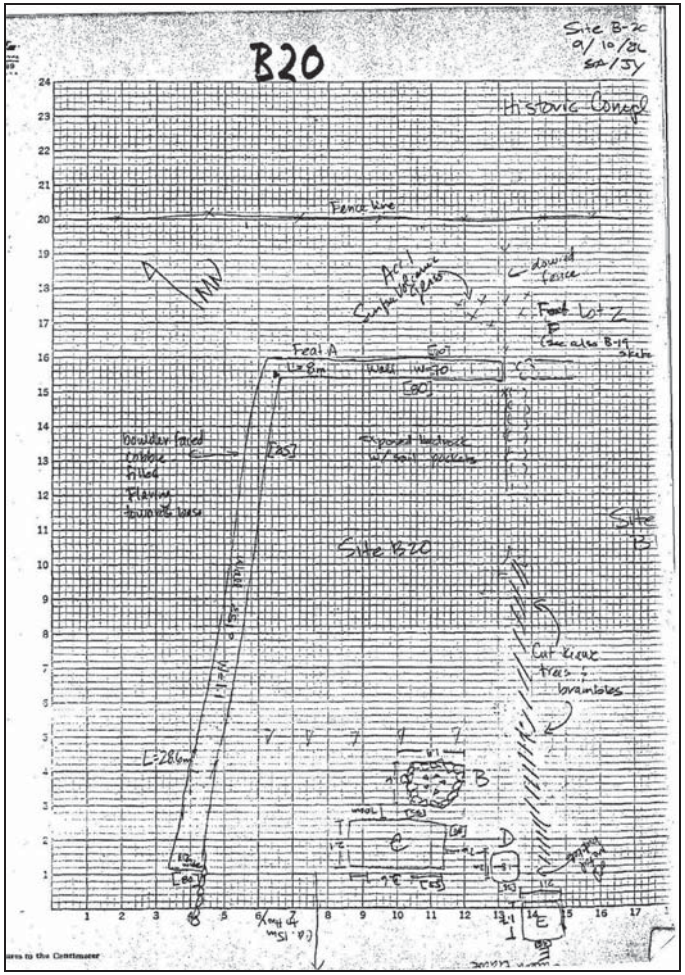


Figure 24. Field sketch of SIHP 13749 (B-20) from Allen (1987)

> The museum crew identified Site 13749 (B20) as a historic-period burial complex and identified four burial platforms. We agree with the Bishop Museum's descriptions (Allen, 1987:74) and that the location within a walled area near other burials, size (1.9 m. by 1.6 m. to 3.6 by 2.1 m.), height (25 cm. - 55 cm.) and collapsed central portions indicate that they are burials and that they are historic. Confidence is so high that it was felt that there was no need to disturb these remains [Hammatt et al. 1991:F-12].

Rieth and Morrison (2010:378-79) provide the following description of SIHP 13749:

> Allen (1987:74; recorded as B-20) documented six features as a Historic cemetery: four platforms (Features B, C, D, and E), one wall (Feature A), and one artifact scatter (Feature F). During the current survey Features A-E were relocated as well as a series of stone alignments and an additional platform. All of these features appear to be burials.
>
> Feature A (Feature 1287) is a wall. The L-shaped core-fill wall is constructed with subangular vesicular basalt boulders and cobbles. The feature measures 98.4 m in total length, 0.85 m in width, and 0.85 m in height. Two steps are present along the southwest edge. Feature 1287 encloses the Historic cemetery.
>
> Feature B (Feature 1283) is a probable platform. The feature is constructed with an alignment of subangular basalt cobbles and measures 2.1 m in total length, 1.6 m in total width, and 0.2 m in height. The interior of the feature, measuring 1.3 m in length by 1.2 m in width is free of stones, thus creating a C-shaped enclosure. However, the proximity of Feature 1283 with known burial features and its similarity in size and construction suggests that this feature was a burial platform which has had the human remains exhumed.
>
> Feature C (Feature 1284) is a platform. The platform is constructed with subangular vesicular basalt boulders along the edge with pebble and cobble infill. The feature measures 3.4 m in length, 2.1 m in width, and 0.6 m in height.
>
> Feature D (Feature 1282) is a platform. The platform is constructed with subangular vesicular basalt boulders along the edge with pebble and cobble infill. The feature measures 2.2 m in length, 1.9 m in width, and 0.35 m in height.
>
> Feature E (Feature 1285) is a platform. The platform is constructed with subangular vesicular basalt boulders along the edge with pebble and cobble infill. The feature measures 1.8 m in length, 1.8 m in width, and 0.7 m in height.
>
> Feature 1286 is a L-shaped alignment. The feature consists of a single course of subangular boulders with a depressed cobble-filled area behind the alignment edge. The feature measures 3.6 m in length, 2.3 m in width, and 0.3 m in height. It is unclear if the feature continues to the southeast because this area is heavily affected by tree fall and modern debris. Feature 1287 is a possible disturbed burial feature.
>
> Feature 1288 is a series of burials. At least six burials are defined by basalt cobble alignments arranged along the northwest interior edge of Feature 1287 and extending over an area measuring 6.1 m in length and 1.8 m in width. One grave stone is present, "Abraham Ah Chong Akau, 12/23/1931- 2/22/1932," and all of the graves are still tended as shown by the presence of synthetic flowers, leis, and statuary.
>
> Feature 1289 is a platform. The oval platform is outlined with subangular basalt cobbles with smaller cobble infill. The feature measures 1.65 m in length, 1.15 m in width, and 0.2 m in height. Tree roots disturb the southeast edge of the feature.

4.2.4 SIHP 13750

Allen (1987:75) provides the following information about SIHP 13750 (B-21; Figure 25):

> This complex is located at ca. 40-ft elevation on a prominent ridge that is cut by Highway 270. A set of white concrete stairs leads from Highway 270 up to the ridge crest and to the former Kawaihae Church site. According to Kelly, the church, known as "Keolahou," was razed in 1959 (1974:38-39). The church, but not the steps, appear on a 1957 black-and-white aerial suggesting that the area may have been used for some other purpose after the church was razed. During the survey, several boulder alignments (structural foundations?), lumber, and sheet metal were noted. The largest and most intact feature (Feature A…) is a well-built rectangular platform (4.4 m by 3.9 m and 110 c. to 60 c. in height) covered with waterworn pebbles. In the center is a stone-lined rectangular depression (2.0 m by 0.5 m). A small terrace (1.0 m by 1.4 m) abuts the northeast end. All indications are that the feature is a burial. The site tag was placed on the northwest corner of the platform.
>
> In the southwest area of the complex occasional shell midden was noted on exposed bedrock. Elsewhere the ground surface was obscured by dense grass.

As at SIHP 13748 and 13749, the CSH fieldwork focused on further documentation of the midden scatter:

> An inspection of the midden scatter area revealed mostly bulldozed bedrock with a sparse scatter of midden fragments. This site is thought to have no excavation potential. There probably was a site at this desirable locality but historic activity and recent bulldozing have destroyed the context. We believe that the function of the midden scatter was as discarded food scraps relating to a prehistoric site now destroyed [Hammatt et al. 1991:F-12].

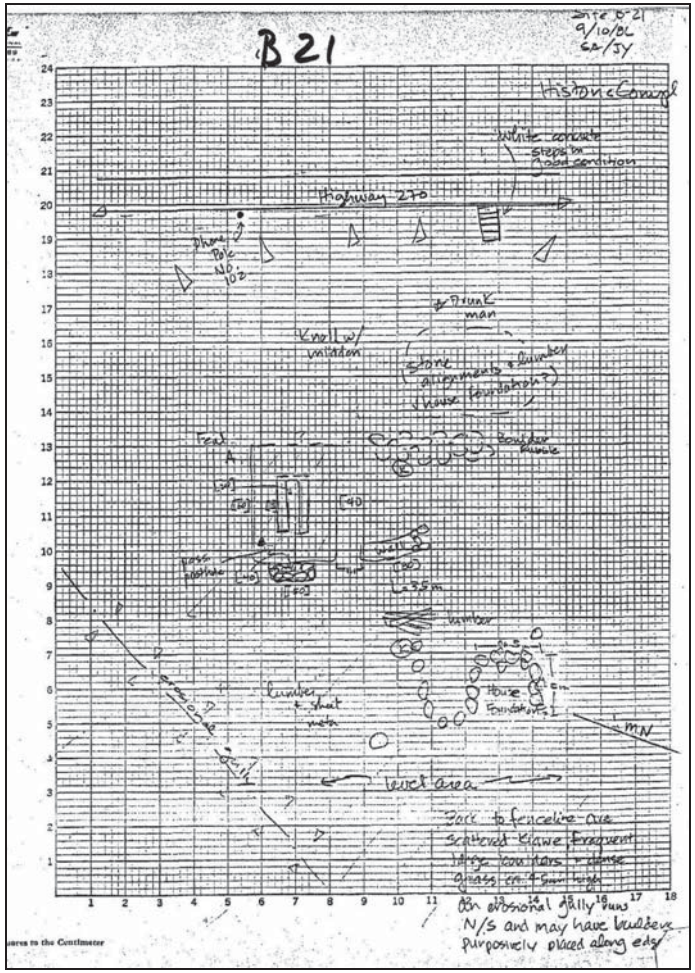


Figure 25. Field sketch of SIHP 13750 (B-21) from Allen (1987)

Rieth and Morrison (2010:379) report:

> This site complex was identified as the former Kawaihae Church, Keolahou. Hammatt et al. (1991) provided the current state site designation. During the current survey three features were recorded including Feature A, one wall, and one alignment.
>
> Feature A is a platform constructed with stacked basalt cobbles and boulders along the edges and smaller cobbles as infill. The feature measures 4.7 m in length, 3.2 m in width, and 0.2-0.4 m in height. This feature is likely a Historic burial.
>
> The core-fill wall is constructed with stacked basalt cobbles and boulders, measuring 3.7 m in length, 0.75 m in width, and 0.6-0.8 m in height. The wall may have been part of an enclosure surrounding the burial or general church area.
>
> The L-shaped alignment consists of piled cobbles and boulders, measuring 20.2 m in length, 0.8- 1.8 m in width, and 0.4-0.9 m in height. The alignment may be the remnants of an enclosure surrounding the church area.

Rieth and Morrison's assessment of the boulder alignment is in line with Marion Kelly's discussion of the church. She states: "[t]oday the church is gone. Only a few foundation stones remain. It was taken down in 1959 and the residents today say they don't know why" (Kelly 1974:38).

4.2.5 SIHP 2298/13751

Rieth and Morrison (2010:379) neatly summarize this site:

> Allen (1987:75-78; recorded as B-22) identified six features as 50-10-05-13751: four terraces (Feature B-E), one platform (Feature A), and one enclosure (Feature F). The site is a Historic cemetery that includes George Hu'eu Davis' grave (Feature A) [based on information from Kelly 1974:83-9]. The site had formerly been designated 50-10-05-2298, but received its current site number from a survey by Hammatt et al. (1991). During the current survey Features A, F, and a newly identified platform were recorded.
>
> Feature A is a large multi-tier platform marking George Hu'eu Davis' grave. The platform is constructed with basalt and lime cement blocks and the exterior surface has been plastered with lime stucco. The feature measures 5.5 m in length, 3.7 m in width, and 2.1 m in height.
>
> Feature F is an enclosure constructed with basalt cobbles and boulders, measuring 13.1 m in total length, 12.8 m in total width, and 0.8-1.05 m in height. The feature encloses the cemetery.
>
> The smaller platform is built immediately to the east of Feature A. The feature has stacked basalt cobbles and boulders along its edges with smaller cobbles as infill.

The platform measures 3.2 m in length, 2.5 m in width, and 0.15-0.25 m in height. This feature is also a Historic grave.

4.2.6 SIHP 13752

The following description of SIHP 13752 comes from Allen (1987:78; Figure 26):

> This site [recorded as B-23] is located on the exposed crest of a moderately high hill (ca. 55 ft elevation) which is cut by Highway 270. The ground surface of the complex is gently sloping and characterized by numerous outcrops and large boulders. The historic portion of the site is bounded by a large, enclosing wall, generally constructed with boulder facing and pebble and cobble-fill. Many of the exterior stones in the wall, and in others within the site complex, have been cut or chiseled to make an even facing (see also Site B-22 Feature F). Remains of a small wooden structure (also on the 1957 aerial) and a bedsprings [sic] are found at the southeast end of the complex. The northeast portion of the complex is characterized by a series of parallel terraces. A small diameter pipeline parallels one terrace, suggesting an agricultural function for the latter. Scattered across the site are occasional pieces of marine shell, crockery, and bottle glass. A small crudely constructed enclosure of large boulders (7.0 a by 3.0 a) is located outside the main enclosure wall of Site B-23, at the southeast corner. A recent trash pit filled with aluminum Olympia beer cans was also noted at the southeast corner of the site, but within the enclosing wall. Overall the features within this complex are in good condition. The site tag was placed on the western corner of the enclosing wall.
>
> At the west corner, outside the main enclosing wall, is a fairly extensive, undoubtedly prehistoric midden and artifact scatter. Volcanic glass, waterworn pebbles, marine shell, bottle glass and one polished basalt flake were noted. This midden scatter extends to the northwest, where it is contiguous with, and overlapped by, historic period components of Site Complex B-24. A maximum depth of 15 ca was probed.

As at other sites visited by CSH in 1990, it was the nature of the midden scatter here that was of interest. According to Hammatt et al. (1991:F-12) the tested unit, located about 3 m west of the B23 wall near the west corner (Figure 27), yielded a total of 147 grams of midden, including six grams of mammal bone. According To Hammatt et al. (1991:F-12, 13):

> The relatively large percentage of mammal bone may be because of a historic midden component as consumption of mammal meat seems to have increased greatly with the beginning of the historic period. The midden concentration index value (9 gm^3) for this excavation was 735 which is moderately high and would be compatible with longterm, recurrent, or permanent habitation in this area.
>
> Two polished basalt flakes, bottle glass, and seven volcanic glass flakes were recovered, but again, prehistoric artifacts were found overlying historic artifacts, suggesting the effects of sheet wash and/or mechanical grading. We conclude that

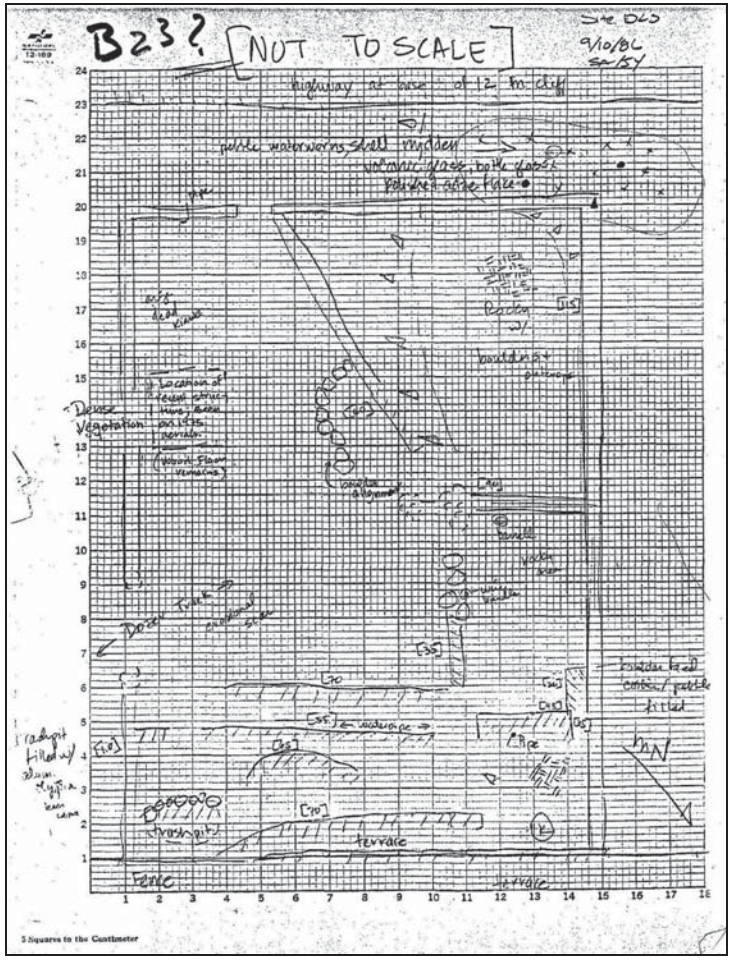


Figure 26. Field sketch of SIHP 13752 (B-23) from Allen (1987)

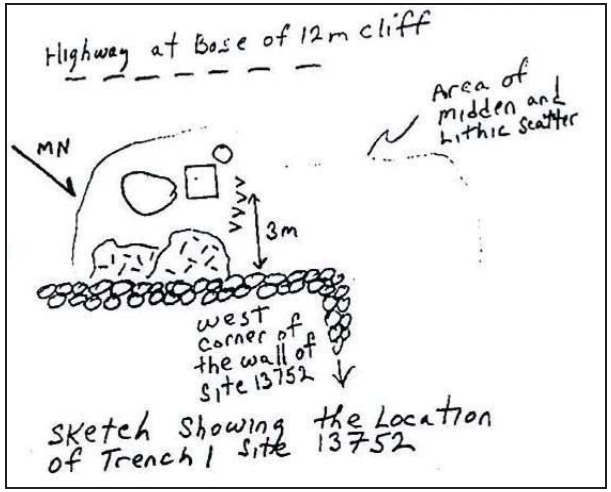


Figure 27. Field map of SIHP 13752 from Hammatt et al. (1991:F-13), showing the location of the test excavation unit (Trench 1) and other features mentioned in the site description

this is another bulldozed former site area with no intact deposits. In the entire area of Sites 13,748, 13,749, 13,750, 13,752, and 13,753, sheet wash and bulldozing have obliterated archaeological context.

This site was not located during the Rieth and Morrison (2010) study.

4.2.7 SIHP 13753

The Bishop Museum study (Allen 1987:79) concluded that SIHP 13753 (B-24; Figure 28) is a historic residential complex:

> Adjacent to Site Complex B-23 at ca. 50-ft elevation, this complex [B-24] is in part defined by a atone wall along the southeast edge, a fenceline wall along the northeast edge, a second atone wall along the northwest edge, and a short wall segment along the southwest edge. Two low cobble-filled platforms are found at the upslope end of the site, along the fenceline. At least three other boulder alignments are found within the fenced/walled area. Historic period artifacts are quite abundant and include burned lumber, rusted appliances, rusted cans, bottle glass, and other items. Frequent marine shell is also scattered across the site but is

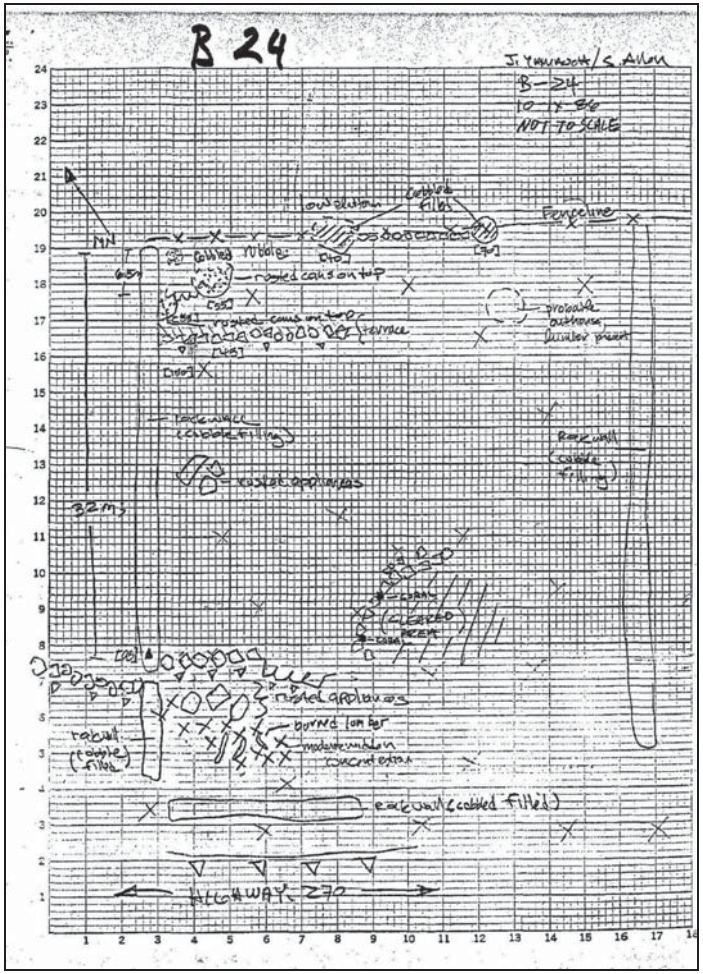


Figure 28. Field sketch of SIHP 13753 (B-24) from Allen (1987)

most concentrated along the south to west side. Two structures are visible on this site in the 1957 aerial. The site tag was placed on the southwest end of the wall that bounds the northwest side of the complex.

Testing conducted by Hammatt et al. (1991 F-13, 14) yielded findings similar to SIHP 13752:

> A 1 m^2 test unit was excavated just NE (*mauka*) of the seaward, core-filled wall in an area with a moderate midden concentration. Burned processed lumber and rusted appliances litter the vicinity. Stratum IA, from 0-5 cm, consisted of loose grayish-brown silt loam with organic material, moderate marine midden, a basalt waste flake, volcanic glass flakes and historic artifacts. Stratum IB, from 5-10 cm., was loose brown silt loam with volcanic glass flakes, a few historic artifacts and less midden. Stratum II, 10 cm.+, was yellowish brown silt with no midden or artifacts. Twelve pieces of volcanic glass, a basalt flake, 46 gms. of marine shell midden, and a variety of historic artifacts including window glass, sheet metal, nails, and phonograph record fragments were recovered but sterile soil was never more than 10 cm. below surface. This shallow deposit was all mixed with some prehistoric artifacts superimposed over debris associated with a modern house site and dump. The archaeological potential of this are [sic] is very low. Sheet wash and bulldozing have obliterated all archaeological context.

This site was also located outside of the Rieth and Morrison (2010) study area.

4.2.8 SIHP 13754

Allen (1987:79) penned this description of B-25/SIHP 13754:

> This historic period site complex is located at ca. 30-ft elevation, northwest of a currently occupied lot, and southeast of the old school house (currently the Kawaihae Fire Station). The area is under thick vegetation. Several unmortared rock foundations, lumber, sheet metal, a probable outhouse, and bottle glass were recorded. Near the fenceline at the upslope end of the site, marine shell, bone, and bottle glass are found. Other clearly modern recent trash is also present. A historic period residential function is suggested. No site tag was placed.

No prehistoric site component was suggested. By the time CSH surveyed the area, the site had been destroyed, possibly in connection with the demolition of the schoolhouse:

> This site was relocated and was observed to have been extensively bulldozed by the same bulldozing operation that destroyed 13755 (B26) during the post-1986 demolition of the schoolhouse. There appeared to have been older bulldozing as well. The midden at the *mauka* end of 13754 (B25) is mostly on bedrock, appears to be historic in nature and was judged to not have an intact prehistoric component. However, it appears that erosional washing out of contents from destroyed prehistoric sites, like Site 13755, *mauka* of the fence is occurring [Hammatt et al. 1991:F-14].

4.2.9 SIHP 13755

Similarly, SIHP 13755 was destroyed sometime between the Bishop Museum and CSH studies. Allen (1987:79-81) describes the site (B-26; Figure 29) as follows:

> Located on the grounds of the old school house at ca. 35-ft elevation, this site consists of three features. All three are in relatively good condition, although Feature B has been disturbed (see below). Feature A is a low boulder-faced, cobble-filled, relatively level square platform (2.3 m by 1.7 m by 45 c. high). One piece of coral and a waterworn cobble were noted on the feature and there is lumber on the ground around it. Feature A is probably a burial. The site tag was placed on the northern corner of the feature.
>
> Feature B is a boulder-faced vault that is built against a bedrock outcrop and has lots of soil and a few waterworn pebbles on the surface. It Measures 2.5 m by 2.1 a with a height of 65 ca on the south side: the vault opening is also on the south side and the capstone has been rolled away, exposing the interior. No bones were visible inside the vault, but a possible crustacea shell was noted. A piece of sheet metal is adjacent to the feature.
>
> Feature C is a U-shape formed by several large boulders, one to two courses high in alignment (3.4 m by 2.9 m by 75 cm high). The U-shape is built against the natural slope. Sheet metal and lumber are associated with it. The feature appears to have been a historic period structural foundation.

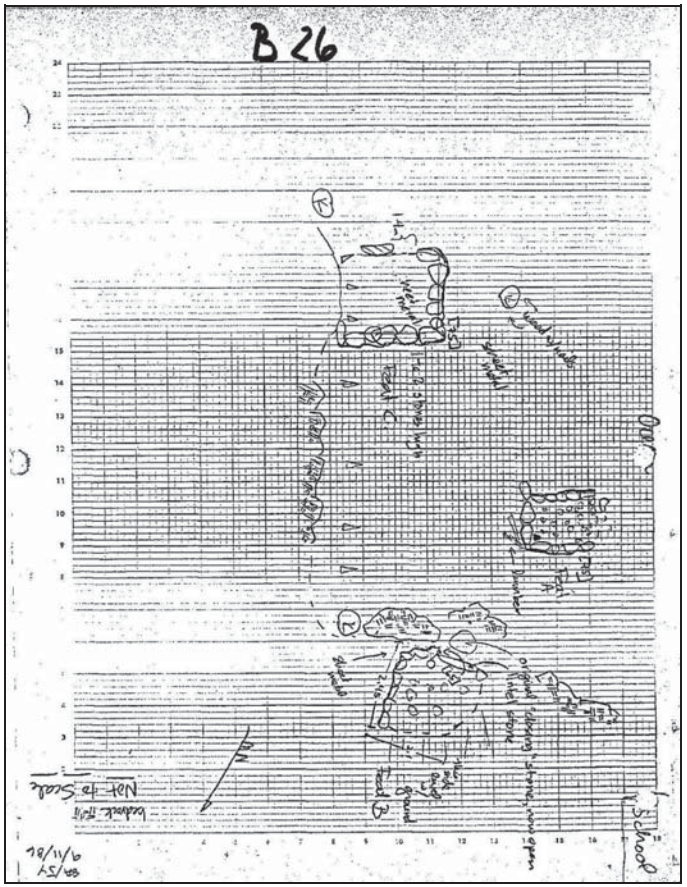
Hammatt et al. (1991:F-14) attempted to relocate the site in order "…to determine the presence of burials at Site 13755…[It] was destroyed in the course of demolition of the school house sometime between 1986 and 1989."

4.2.10 SIHP 13782

The following description of SIHP 13782 comes from the Bishop Museum report:

> Site Complex B-53—Recent Graves
>
> This site is visible from Highway 270 and consists of nine modern graves. They are marked by small plastic plaque with paper cards inside and all date between A.D. 1910 and 1920. The graves are partially enclosed by a wall that probably once connected with Feature A of Site Complex B-20. Evidently, these graves were once located near the beach and were relocated when the harbor was constructed. No site tag was placed.

The Hammatt et al. (1991:XIII-4) report includes this site in some site data tables, and on Figure 19 between SIHP 13748 and 13749 directly adjacent to the road. Curiously, Rieth and Morrison (2010) never mention this site in their report, but instead assigned the platform as Feature 1288 SIHP 13749 (see Section 4.2.3 above). The grave marker inscribed "Abraham Ah Chong Akau, 12/23/1931- 2/22/1932" noted by Rieth and Morrison almost certainly represents one of the burials relocated from the harbor.


B 26
Not to Scale
Basaltic Pahoehoe
Modern Trash
Modern Trash
Modern Trash

Nearly a dozen sites are located along the intermittently-disturbed *mauka* shoulder of Kawaihae Road. Two of these sites have been obliterated by dozing activities in the vicinity of the former Kawaihae School (SIHP 13754 and 13755), while "…in the entire area of Sites 13748, 13749, 13750, 13752, and 13753, sheet wash and bulldozing have obliterated archaeological context" (Hammatt et al. 1991:F-13). Four sites (SIHP 13749, 13751, 13755 and 13782) have been identified as burial sites/cemeteries. SIHP 13750 represents the former Kawaihae church, of which no structural remains exist. Several of the sites have been identified as historic residences, including SIHP 13748, 13752, 13753, 13754, and 27847; the presence of extensive midden scatters at these sites exemplifies the concentrated use of this section of the coastline in pre-contact times as well. SIHP 27642 is a wall segment near SIHP 13751 that may or may not be related to a historic residence once located near the Davis graveyard, or to historic agriculture.

Section 5 Results of Fieldwork

5.1 Overview

The field inspection of the project area was accomplished on September 15, 2011. Two CSH archaeologists were accompanied by SSFM International, Inc. planner Heather Forester. The field inspection was conducted as outlined in Section 2.1.

No new potential historic properties were identified during the inspection, as anticipated by the background research. The construction of the harbor and its subsequent improvement has obliterated any pre- or post-contact features that may have once been present at the natural shoreline. Some areas of concern were noted, however. These include the significant historic properties located along the eastern or *mauka* shoulder of Kawaihae Road, and the interface of the coral landfill with the original shoreline in the vicinity of Kawaihae Road and along the boundary of the Pu'ukoholā Heiau National Historic Site/Pelekane Lands Buffer Zone. The findings specific to each improvement area are presented below.

5.1.1 Extensions to Piers 2A and 2B and related dredging activities

Piers 2A and 2B were subjected to pedestrian inspection. The piers themselves are modern constructions and are contiguous (Figure 30). An effort was made to examine the revetment along these piers as best as possible from the surface, as the proposed pier extensions and related dredging will likely impact it. At the edge of Piers 2A and 2B, the water appears quite deep—despite good clarity, the harbor floor could not be observed. It could not be determined where the revetment lies underneath the piers, though it may fall in line with the edge that can be seen extending outward from the ends of the piers (Figure 31). In these pier extension areas, the stone and concrete revetment is clearly visible, and in places corals re-growth is present (Figure 32). An abundance of fish and other marine life was noted along these areas. The berth space along Pier 1 also appeared quite deep, and neither the revetment nor any coral growth were visible, though just beyond Pier 1 to the north (outside of the Project Area) both were observed. While the corals growing along the expansion areas would likely be impacted by dredging and pier construction activities, no potential historic properties were observed. Given that dredging has occurred in this part of the harbor from the 1950s to as recently as (an perhaps since) 1992, it can be surmised that any historic features that may have once been present within the waters of the harbor have been removed or destroyed.

It was noted that the view back toward the coast from the piers (at Pier 1 in particular) is extraordinary. The Kohala Range, Mauna Kea, Mauna Loa, Huālalai, vast swaths of land between the mountains, the coastline to the north and south, and the Pu'ukoholā Heiau are all clearly visible from this location. The Makali'i voyaging canoe was moored at the end of Pier 2B; Figure 33 shows this area, which will be impacted by the expansion of the pier, with Pu'ukoholā Heiau in the background over the ship.



Figure 30. Photo showing Piers 2A and 2B, with the deep-draft berth to the right, and the coral flats and Pu‘ukoholā Heiau in the background; view to the southeast



Figure 31. Photo of the Pier 2A proposed extension area, with the existing northern terminus of Pier 2A in the background (note the revetment visible above and below the waterline); view to the southeast



Figure 32. Photo of rocks, corals, fish and other sea life visible to the northwest of Pier 2A (note the water clarity); view to the west



Figure 33. Photo of the Makali‘i moored in the proposed Pier 2B extension area, with Pu‘ukoholā Heiau and a portion of the Coral Flats visible in the background above the ship; view to the southeast

5.1.2 Improvements to the Main Gate and South Gate; new south gate connection to the regional highway

The portion of Kawaihae Road from approximately 100 feet north beyond the proposed Main Gate APE to approximately 100 feet south of the proposed South Gate APE was also subjected to a pedestrian inspection. Ms. Forester of SSFM requested that we examine a 200-foot-wide corridor (100 feet on either side of the existing centerline) in order to account for any sensitive areas that might lie outside of but adjacent to the APE. During the inspection, this buffer was revised down to a 100-foot-wide corridor (50 feet on either side of the existing centerline).

The *makai* shoulder of Kawaihae Road lies within a disturbed area representing the coral landfill interface with the natural coastline. The purported John Young Homestead located in the proximity of the road further south within the Pelekane Lands (E-15) is situated well outside of the APE and was not observed during the inspection. The harbor's South Gate currently serves as a restricted access point and was closed during the inspection; a sign for the small boat harbor is present nearby (Figure 34 and Figure 35). The Main gate is currently serving as the primary public access to the harbor and the Coral Flats; the current operations at the harbor have the South Gate opened on Fridays when there are multiple barges present. A culvert runs between the road and harbor security fence. Despite the disturbed nature of the *makai* shoulder, any subsurface construction activities would be of concern due to the potential for the presence of subsurface features or artifacts here.

The *mauka* shoulder was paid considerably more attention, given a history of lesser disturbance and the presence of several known sites. The topography *mauka* of the road is characterized by undulating hills sloping upward to the east; the road was cut through these hills at several places. This means that some sections of the inspected buffer zone are roughly equivalent in elevation to the road itself, while other sections are cut by gulches or lie along ridges of greater, variable elevation with near-vertical faces at the road shoulder.

The inspection of the *mauka* shoulder began at the north end of the corridor, which has been completely paved over for a parking lot. Directly south of this parking lot is a level, dozed area containing what appears to be a modern memorial (Figure 36 and Figure 37). The sign includes the name "Akau"; in an interview a Mr. William Akau mentioned that his family has lived at Kawaihae since "the time of Kamehameha the Great" (Hammatt et al. 1991:C-2). It is likely that this feature functions to memorialize certain members of the Akau and Kahookano families, and it may be connected to the possible burial features of demolished site 13755 or any number of other gravesites in the vicinity (see Section 4.2). The bulldozer disturbance along this northern end of the *mauka* shoulder continues another 100 meters or so to the south, past the Main Gate entrance. This stretch covers the general vicinity of SIHP 13754 and 13755, which were reported by Hammatt et al. (1991) to have been destroyed. A road marker indicating the presence of the buried fiber optic cable in the existing right-of-way was noted here as well (Figure 38).

Beyond this extensively disturbed area, remains related to the historic residence(s) at SIHP 13753 were identified; a foundation observed here may represent the 1950s home of Dr. Silva discussed in Section 3.4. Some disturbance is present near the road shoulder, probably the result of road-related construction and/or the installation of the fiber optic line. Generally speaking, the



Figure 34. Photo of the restricted South Gate harbor entrance with the *kiawe* thicket of the Pelekane Lands Buffer Zone visible in the background; view to the south



Figure 35. Photo of the modern sign for the Kawaihae Small Boat Harbor located just north of the South Gate entrance; view to the southwest



Figure 36. Photo showing the disturbance mentioned in the text of the *mauka* portion of the northern end of the Main Gate intersection improvement APE; view to the north



Figure 37. Photo of the memorial discussed in the text; view to the north



Figure 38. Photo of the road marker indentifying the location of the buried fiber optic cable along the *mauka* shoulder; view to the northeast

site remnants are set further upslope, likely outside of the project APE. SIHP 13752 was also identified just to the south, on a ridge above the road (Figure 39 and Figure 40). Given its location on this ridge, it appears to have escaped the bulldozing noted at SIHP 13753. Bottle dumps, rusted appliances and car parts, stone walls, and other historic rubbish were observed. These "ridge sites," all visible on Figure 3, should not be impacted by the present project.

Beyond these sites to the south along the same ridge lie the tombs of the George Hueu Davis family and the adjacent wall recorded in 2010 (SIHP 2298/13751 and 27642, respectively; Figure 41). This gravesite is set well back from the road, and therefore should not be impacted by proposed improvements. A short distance south of the graveyard is the modern staircase leading from the road to the top of the ridge in the vicinity of the former church (SIHP 13750) discussed in Section 4.2.4 above. No structural remains of the church were observed and the area appeared to have been cleared, perhaps mechanically. The potential burial platform and related features located *mauka* of the church site were observed. No impacts are anticipated at SIHP 13750, 13751 or 27642.

Across from the existing South Gate harbor entrance in a *kiawe* thicket the SIHP 13749/13782 cemetery (Figure 42 and Figure 43) was encountered. The *makai* L-shaped enclosure wall (Reith and Morrison's Feature 1287 of SIHP 17349) lies less than ten feet from the guardrail along the road, making it clearly visible to passers-by. The cemetery was entered by the opening in the wall. Flowers and modern coins were observed on the graves representing SIHP 13782 (mistakenly described by Rieth and Morrison as Feature 1288 of SIHP 13749) at the northern



Figure 39. Photo taken from within SIHP 13752 back toward the harbor (note the rock wall, upright stone, rusted appliances, scattered rubbish and midden); view to the southwest



Figure 40. Photo taken from the *makai* end SIHP 13752, showing its location on a ridge above the road (note the Main Gate entrance to the harbor in the top left corner); view to the north



Figure 41. Photo of the George Hueu Davis family gravesite (SIHP 13751); view to the south



Figure 42. Photo of the cemetery (SIHP 19749/13782) located directly across from the South Gate entrance; view to the west



Figure 43. Photo taken from the *makai* shoulder looking back toward the South Gate entrance and the SIHP 13749/13782 cemetery (located under the *kiawe* thicket behind the SUV), showing the proximity of the cemetery to the road; view to the northwest

corner of the cemetery, and the marker inscribed "Abraham Ah Chong Akau, 12/23/1931-2/22/1932," was noted. Further into the thicket upslope and to the south, more graves were observed, ranging in form and size. An area of modern and historic rubbish bordered by a sizeable patch of *aloe* (*Liliaceae* family) indicated the general area of the historic residential complex of SIHP 13748. A modern residence was observed through the trees to the southeast. SIHP 27847 was not encountered during the inspection as it appears to lie well to the south of the roadway APE.

It should be mentioned that all of the sites *mauka* of the road could potentially be impacted by construction-related vibration. Such activities could also subject the historic properties in the Pelekane Lands Buffer Zone to vibration impacts, despite their location outside of the APE.

5.1.3 Grading of Coral Flats area for industrial lots/storage

The Coral Flats were traversed by vehicle. While a number of modern facilities and features were observed, nothing of archaeological significance was observed. Concrete pilings fitted with bollards associated with the Army landing along the northern edge of the flats (Figure 44) may date to the initial landing construction by 1959, making them more than 50 years old, but these are located just off of the shore, putting them out of the project area and well out of the proposed grading and dredging APE (see Figure 4). A portion of the Coral Flats area proposed for grading is currently part of an active quarry (Figure 45). Here, "excess" coral landfill material is processed and stockpiled for use at the harbor and by the public. Portions of the Coral Flats APE may already be used for storage. The remaining portion of the grading APE is characterized by coral "dunes" supporting scrub and *kiawe* growth (Figure 46), crisscrossed by various access roads and trails. Nothing of concern was noted in this area.

Aside from the military landing, the Coral Flats are used recreationally by the public. The Pua Ka'ilima 'O Kawaihae Cultural Surf Park was dedicated in the 1990s to help develop and preserve a section of the Kawaihae coastline for recreation, as stated on signage present along the western point of the flats (Figure 47). The Tiger Espere surfing meet is held here annually during the large winter swell that is generated off the shallow coral reef that lies just west of the breakwater. The YMCA maintains an aquatics facility near the small boat harbor, as does the Kawaihae Canoe Club. A school field trip was in session at this facility during the field inspection.



Figure 44. Photo showing boats moored in the harbor adjacent to the coral flats, with the military landing (including the offshore pilings/bollards) along the left side of the photo and the breakwater in the background; view to the northwest



Figure 47. Photo of the Pua Ka'ilima 'O Kawaihae Cultural Surf Park information sign located along the western edge of the coral flats (note that the sign includes a map depicting the location of the original shoreline at Kawaihae); view to the southwest



Figure 45. Photo of the quarry and stockpile area on the Coral Flats, taken from Pier 2B (portions of this quarry overlap the proposed grading APE); view to the south



Figure 46. Photo showing the coral "dunes" and vegetation characteristic of portions of the Coral Flats grading APE; view to the northeast

5.1.4 Fencing of perimeter road to the Small Boat Harbor

The APE of the proposed fencing of the existing unpaved Coral Flats perimeter road was subjected to pedestrian survey. HDOT Harbors Division intends to fence this unimproved road and turn over the road to DOBOR, who will improve the road in the future as part of separate improvements to the Kawaihae Small Boat Harbor (South). The road is situated along the south and eastern boundaries of the Coral Flats landfill, abutting the Pelekane Lands Buffer Zone (Figure 48). The existing road is accessed via the main harbor entrance, and is used by the public to access the Makahuna Gulch/Stream and its diversion, Pu‘ukoholā Heiau National Historic Site, and all of the facilities of the Coral Flats areas. At the time of the inspection, a family was fishing, crabbing and swimming in the waters of the Makahuna Stream diversion just east of Pelekane Bay. The coral landfill exhibits a greater height than the Makahuna Stream diversion and beach at Pelekane Bay, creating a shoulder of variable height at the interface.

While no historic properties were observed during the inspection, this is considered a sensitive area given its proximity to the Pu‘ukoholā National Historic Site (Figure 49) and the Pelekane Lands Buffer Zone, which also includes several historic properties. An attempt was not made to relocate the sites in the Buffer Zone that lie in closest proximity to the road (E-12, E-16; see Figure 18). While these areas technically lie outside of the project APE and should not be impacted by the proposed improvements, features or artifacts may still be present underneath the coral fill along the interface areas.



Figure 48. Photo (courtesy of the client) overlooking the Coral Flats and deep-draft harbor, with the northern end of the proposed new perimeter road APE visible as a cleared path through the *kiawe* at the center of the photo, the Pelekane Lands Buffer Zone in the lower right corner, and a portion of the grading APE on the left; view to the northwest



Figure 49. Photo of the interface of the Coral Flats and Pelekane Bay taken from the southwestern-most extent of the proposed new perimeter road APE, with the Pu‘ukoholā Heiau National Historic Site visible in the background; view to the east

5.1.5 Relocation of Hawai‘i District Office and Comfort Station

The proposed locations for the new Hawai‘i District Office and Comfort Station were inspected by foot and vehicle, respectively. The proposed Hawai‘i District Office location is situated near the existing South Gate entrance, in an unpaved storage area (Figure 50). This area, adjacent to Kawaihae Road, likely represents the approximate location of the original shoreline pre-1950s, but has since been completely disturbed/covered by the coral landfill. Indeed, the ground surface is comprised of crushed coral “sand”, likely from the quarry on the Coral Flats. The proposed Comfort Station would be situated just off of the Main Gate access road in a paved area currently used for parking (Figure 51). Nothing of concern was noted at either of these locations; however, given the locations of these proposed structures in relation to the original shoreline, there is some potential for the presence of subsurface features or artifacts.



Figure 50. Photo of the proposed location for the new Hawai‘i District Office, with the thick *kiawe* growth of the Pelekane Lands Buffer Zone visible in the background; view to the east



Figure 51. Photo of the proposed location for the new Comfort Station, with the harbor’s Main Gate entrance behind the vehicles parked along the right side of the photo; view to the northeast

Section 6 Summary and Recommendations

6.1 Summary

In pre-contact times, the village at coastal Kawaihae was a major coastal settlement focused on marine resource exploitation. Its advantage was its deep channels and a safe landing place for canoes. Kawaihae played an important part in battles between warring chiefdoms, likely due to its strategic location. It was the home of chiefs and became particularly important in the political career of Kamehameha I and his rise to power. Integral to the history of Kawaihae are its two major *heiau*, Mailekini and Pu‘ukoholā that lie adjacent to the southern portion of the present project area. Early descriptions of Kawaihae by western visitors present a bleak and dismal picture of the landscape and settlement. By contact, most of the dryland forest and native landscape had already been altered.

After contact, Kawaihae became a center for commerce, being the only port on the northwest side of Hawai‘i Island. The port contributed to entrepreneurship as people looked to develop new ways to support their changing lifestyle from traditional to non-traditional. Activities such as victualing ships with fruits and vegetables grown in Waimea, as well as supplying cattle for beef and exporting salt to places as far away as Russia, became common place in the early history of Kawaihae after contact.

During World War II Kawaihae’s role as the shipping outlet for Waimea was intensified, as demand for cattle from the Parker Ranch increased. By the 1950s, the need for improved harbor facilities at Kawaihae was apparent. The old landing had been destroyed in the 1946 tsunami and the one built in 1937 had proven unsafe in high seas. The Kawaihae Deep-Draft Harbor project was authorized by the U.S. Congress in 1950, and was a joint project of the Territory and the U.S. Army Corps of Engineers (USACE). The new harbor was officially dedicated on October 5, 1959.

During the harbor excavation, the coral reef that had been a danger to ships was cut and scraped. The materials dredged from the reef were used to create a landfill upon which the port facilities were built. The LCA parcels and much of the former shoreline at Kawaihae Village were now covered by up to thirteen feet of compacted, dredged coral fill material. With the development of the small boat harbor at the south end of the bay in 1970, the transformation of the town into a modern harbor and industrial area was completed.

On August 17, 1972 the U.S. Congress authorized the designation of Pu‘ukoholā Heiau as a National Historic Site, which also encompassed Mailekini Heiau and the shark *heiau* of Hale-ō-ka-puni among other features.

Numerous previous archaeological studies have been conducted along the coastline of Kawaihae. While many studies focused on the John Young Homestead or the Pu‘ukoholā Heiau National Historic Site (such as Soehren 1964 and Kelly 1974), a few larger-scale studies overlap the eastern limits of the current project area (Allen 1987, Hammatt et al. 1991, Rieth and Morrison 2010). These studies have identified a number of significant historic properties located to the south of the project area in the Pu’ukoholā Heiau National Historic Site and Pelekane Lands Buffer Zone, and along the eastern or *mauka* shoulder of Kawaihae Road. Aside from the

well-known *heiau* of the National Historic Site, these historic properties include burial sites, cemeteries and habitation sites, some of which are associated with individuals influential to the history of Kawaihae.

No new potential historic properties were identified during the field inspection. This was anticipated given the high level of disturbance to the original shoreline during the construction of the harbor in the late 1950s. Some areas of concern were noted, however. Recommendations intended to mitigate these concerns follow.

6.2 Recommendations

Because the harbor facility is presently active and has undergone improvements since its construction in 1959, it is not recommended eligible to the State Inventory of Historic Places (SIHP).

Impacts to the previously-recorded historic properties located along the eastern or *mauka* shoulder of Kawaihae Road and within the Pu'ukoholā Heiau National Historic Site and Pelekane Lands Buffer Zone are not anticipated for any improvements to Kawaihae Road, given their locations outside of the proposed project APE. However, the existing right-of-way along the *mauka* shoulder of Kawaihae Road, and the boundary between the Coral Flats and the Pelekane Lands Buffer Zone/Pelekane Bay should be strictly observed in order to avoid impacts to any of the sites located in the vicinity. Any recommendations included in the EA regarding construction-related vibration impacts should be carefully implemented to avoid adversely affecting the historic properties.

Given the close proximity of sensitive sites along the *mauka* shoulder of Kawaihae Road (SIHP 13749 and 13782 in particular) to the Main Gate and South Gate/Kawaihae Road corridor APE, a program of on-call monitoring by a qualified archaeologist is recommended to better ensure protection of the historic properties east of the shoulder, and is recommended for any subsurface excavation activities along the road APE, in order to mitigate the inadvertent discovery of subsurface features or artifacts that may be present there. While this area has been impacted by prior construction activities related to the road and its related infrastructure, the eastern limit of the coral landfill falls, according to Figure 6, west of Kawaihae Road, and therefore undisturbed deposits may still exist. The presence of disturbed features or artifacts would be important to document as well, as they may provide further information about life at Kawaihae in the hisotric era. A monitoring program would require the preparation of an SHPD-approved monitoring plan.

Furthermore, there is a potential (however unlikely) for construction-related disturbance of subsurface features or artifacts along the coral landfill interface with the original shoreline. The landfill was constructed over the heavily-used natural shoreline, and covered several Land Commission Awards (LCAs). The landfill depth along the interface is likely to be variable. In the unlikely event that subsurface features or artifacts are project-related excavation within the proposed Coral Flats Perimeter Road APE or the Hawai'i District Office/comfort station APE, CSH recommends that construction activites cease and the SHPD be contacted immediately.

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Appendix E: Cultural Impact Assessment

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CULTURAL IMPACT ASSESSMENT (CIA)
FOR THE
KAWAIHAE COMMERCIAL HARBOR ENVIRONMENTTAL ASSESSMENT
KAWAIHAE HARBOR, DISTRICT OF SOUTH KOHALA
HAWAIʻI ISLAND, HAWAIʻI
[TMK (3) 6–1-003]



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[TMK (3) 6– 1-003]

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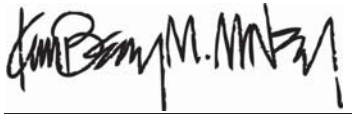

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ABSTRACT

Kawaihae has been a favored harbor since prehistoric times. It has a prominent place in the social, political, religious and economic history of Hawai'i and its culture.

During the construction of Kawaihae Harbor, in its current configuration, the bay was filled and the shoreline village was completely demolished. It would seem likely that any traditional practices conducted in the area would have been lost in that process. However, traditional practices persist and the area is used in many traditional ways.

The existence of an *ahu* on the southwestern end of the harbor testifies to the significance and importance of the area to the Hawaiian people.

CIA Kawaihae Commercial Harbor Environmental Assessment
Kawaihae Harbor, South Kohala, Hawai'i Island February 2012
i

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This report was prepared by Pacific Legacy, Inc.

Frontispiece: ***Pelekāne and Puʻukoholā (view to the southeast).***

1.0 INTRODUCTION

Archival research and interviews with knowledgeable individuals were undertaken in 2008 by Pacific Legacy. This information is used here for a Cultural Impact Assessment (CIA) to evaluate any consequences of the proposed implementation of features in the Master Plan for near-term improvements involving Pier 2 expansions, Department of Transportation, Harbors Division (DOT-H) office relocation, new comfort station, maintenance, dredging, internal traffic circulation, as well as grading and provisions for a new perimeter access road and fencing to the south small boat harbor.

According to the OEQC guidelines, types of cultural practices and beliefs may include those relating to subsistence, commercial, residential, agricultural, access-related, recreational, as well as religion and spirituality. Further, the CIA was designed to promote and protect cultural beliefs, practices, and resources of native Hawaiians, other ethnic groups, as well as other collective groups (OEQC 2011: 3-4). To determine the effects of the proposed development on cultural practices and beliefs, the following tasks are undertaken:

1. Identify and consult with individuals and organizations knowledgeable about cultural practices being conducted and/or may have taken place in the area;
2. Incorporate archival research about traditional practices that may have been conducted in the area;
3. Describe the cultural practices that took place within the potentially affected area, and;
4. Assess the impact of the proposed development on the cultural practices that may have taken place within the potentially affected area.

This CIA includes summary data compiled from archival and record searches of the following repositories:

1. University of Hawai'i Library System
2. County of Hawai'i Public Library
3. County of Hawai'i Finance Department, Real Property Tax Office
4. National Park Service, Pu'ukoholā National Historical Site
5. State Historic Preservation Division

Traditional oral historians provided accounts of personal experiences and information about traditional cultural practices and traditional uses of the project area.

2.0 PROJECT LOCATION AND ENVIRONMENT

2.1 LOCATION AND PROJECT DESCRIPTION

Kawaihae Bay is located in the District of South Kohala on the west side of the island of Hawai'i (Figures 1 and 2). It is situated at the southwest corner of the Kohala Mountain slope. Kohala Mountain is a volcanic dome reaching an elevation of 1,603 meters above sea level (a.s.l.).

The harbor boundaries and location of the proposed development project are provided in Figure 1. Figure 2 identifies the existing harbor and infrastructure as well as the proposed improvements and modifications.

2.2 ENVIRONMENTAL SETTING

Kawaihae Harbor and village exist at sea level to a few meters a.s.l. Kawaihae is characterized as hot and arid, with shallow soil cover over rocky land, and with intermittently flowing streams.

Kawaihae has an annual mean rainfall of 189mm or less and is considered the driest area on Hawai'i Island (Clark 1986:32). The name Kawaihae literally means 'water-of-wrath' because "people are said to have fought for water from a pool in this arid area" (Pukui et al. 1974:5).

Kawaihae supports vegetation characterized by sporadic coconut trees and "a closed canopy (60%) of tall (ca. 3-5m) *kiawe* trees (*Prosopis pallida*) with an understory of mixed grasses, shrubs and herbs" (Clark 1986:38).

The wind pattern is dominated by low velocity sea and land breezes. "An on shore sea breeze is usually present during the day, but by nightfall the wind has shifted and there is a diurnal dominance of the trades blowing down over the plain and out to sea…Approximately 34% of the winds come out of the WNW, 20.5% out of the ESE, 9% from ENE, & 7.5% from the SE…" (Clark 1986:31).

Kawaihae is noted for extremely strong winds prevalent during the winter months, called *mumuku*. "These are harsh gusty winds out of the NE which at their fiercest are difficult for persons to stand against" (Clark 1986:31).

Within the past 80 years, Kawaihae Harbor has gone through dramatic physical changes related to the increased use and expansion of the harbor for commercial and recreational activities. Figures 3 and 4 exhibit modifications made to the coast line and harbor itself.

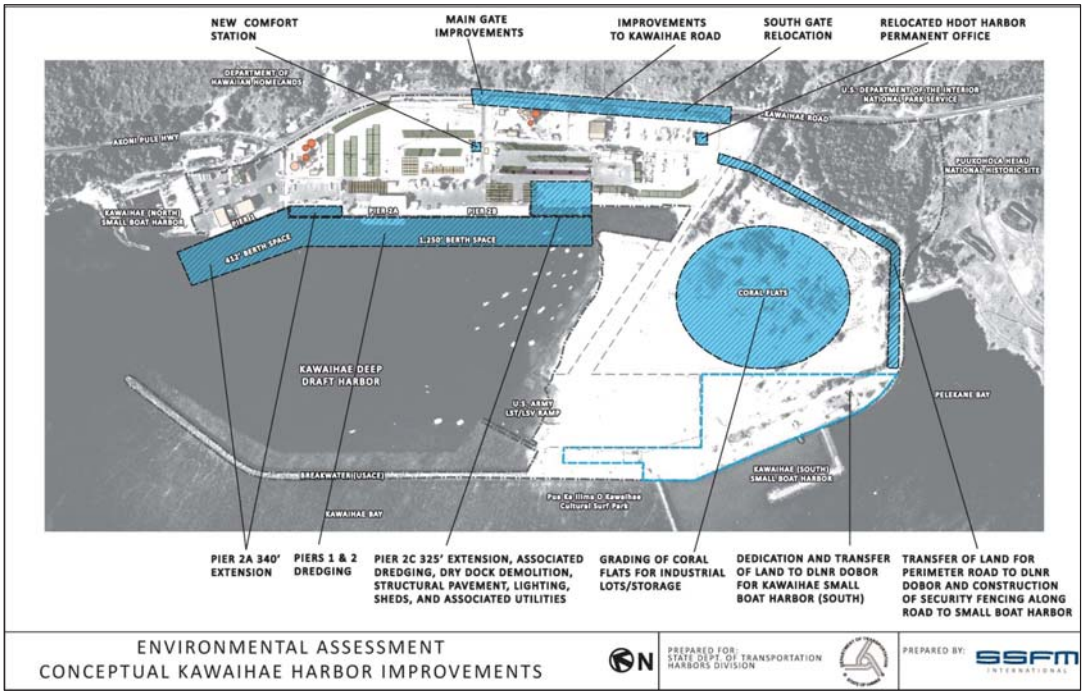

Figure 2. Aerial image of project area (courtesy of SSFM International 2011).

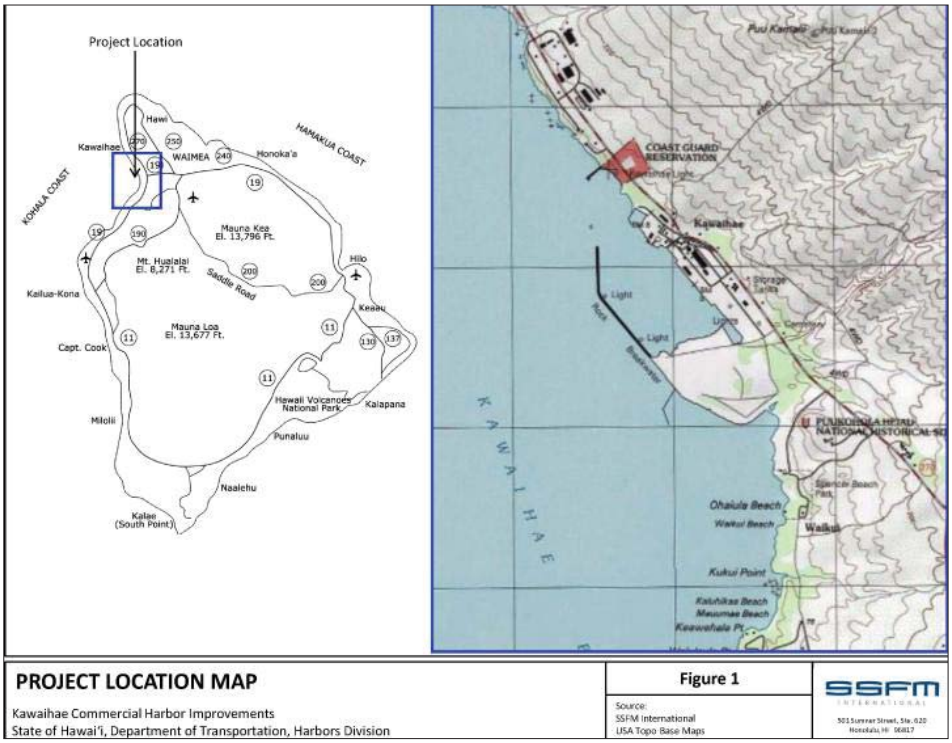

Figure 1. Project location (courtesy of SSFM International 2011).



Figure 3. View of Kawaihae, ca. 1930 from Puʻukoholā Heiau (Kelly 1978:43).



Figure 4. View of Kawaihae in 1974 from Puʻukoholā Heiau (Kelly 1978:43).

2.3 Environmental Zones in Hawaiian Tradition

Traditionally in Hawaiʻi, environmental zones were perceived and determined by various natural features and resource criteria. The following describes the environmental zones found within two general categories: Marine and Terrestrial.

Marine Environmental Zones (Handy and Handy 1991:56-57):

1. Neritic zone: Near-shore waters, extending from the upper reaches of the tidal edge to about 200m in depth. Contains the most resources for human use. (Midden remains from Hawaiian sites show a preponderance of species from neritic habitats [Clark 1986:34]). Corresponding to the Hawaiian marine habitats of: 1. *Kai puʻe one*: (heaps [of] sand) the sandy edge of the sea, inshore dunes, or outer sand bar; 2. *Kai poʻi:* (sea-breaking) out to where the wave breaks; 3. *Kai kohola*: the lagoon, the shallow sea inside the reef; 4. *Kai pualena*: the yellowish sea, where the streams flow in and roil the waters; 5. *Kai ʻele*: the dark sea; and 6. *Kai uli*: the deep blue-sea.
2. Pelagic zone: Open ocean, waters lying beyond or exceeding the depth of 200m. Corresponding to *kai-pōpolohua-mea-a-Kāne* or the far reaches of the open sea (Clark 1986:34).

Terrestrial Environmental Zones (Handy and Handy 1991:54-56):

1. *Ko Kaha Kai*: Land by the sea, or coastal region providing marine resources (fish and other marine animals, seaweed and salt).
   "*Kaha* was a special term applied to areas facing the shore but not favorable for planting."
2. *Kula*: The plains or sloping lands (without trees) above the coastal region.
   Kula kai: Seaward plains.
   Kula uka: Inland or upland slopes (towards the mountains).
3. *Kahawai:* The place (having) water. The area beyond or intersecting the *kula* lands. This upland zone provided suitable agricultural sites and abundant naturally occurring resources which were used for religious, domestic, and economic purposes.
4. *Wao:* Wilderness.
   Wao kanaka: Region of man.
   Lower forest, providing hard wood (*koa*) for spears, utensils, and logs for canoes; *lau hala* (pandanus leaves) for thatch and mats; *māmaki* for bark cloth (*tapa*); *kukui* (candlenut) for oil; wild yams, roots, and sandlewood.
   Wao akua: Region of deities.
   "…remote, awesome, seldom penetrated, source of supernatural influences, both evil and beneficent."
   Wao maʻukele: Rain forest.
   "Here grew giant trees and tree ferns (*ʻamaʻu*) under almost perpetual cloud and rain."

The immediate project affected environmental zones are: Neritic, Pelagic, *Ko Kaha Kai*, and *Kula Kai*.

3.0 LAND DIVISIONS AND MANAGEMENT

3.1 TRADITIONAL LAND DIVISION AND MANAGEMENT

Traditionally, the islands were divided into land units called *moku*, which later came to be referred as districts (Handy and Handy 1991:46). The *moku* were socio-political units or separate chiefdoms, belonging to the *aliʻi* or ruling class. The ruling chief over one or more *moku* was called the *aliʻi nui*.

Legend has it that the division of the islands into *moku* was initiated on the island of Hawaiʻi by ʻUmi-a-Liloa, first to unite the entire island through conquest in about AD 1600 (Kamakau 1961:19). The island of Hawaiʻi was divided into six *moku* — Kohala, Hāmākua, Hilo, Puna, Kaʻu, and Kona. In the mid 19th century, Kohala, Kona, and Hilo were each divided in two, creating north and south divisions.

Each *moku* was made up of smaller divisions of land units for resource and political management, called *ahupuaʻa*. The *ahupuaʻa* was probably the most significant land division in Hawaiian society. There were as many as 600 *ahupuaʻa* on the island prior to the end of Kamehameha I's reign (Cordy 2000:31). The *ahupuaʻa* is ideally a "pie-shaped wedge" land unit which extends from the mountain to the seashore and including the ocean, incorporating several ecological resource zones. In reality, few resemble the ideal wedge-shape. However, the majority did run from sea to the upland slopes, dividing the islands into vertical sections.

The size and shape of the *ahupuaʻa* reflect "…a mix of historical factors keyed to handle special resources (fisheries, meat birds, *koa* trees, etc.), population, and political factors. Importantly, size does not necessarily reflect population size or power of a community. Rather in some cases it simply means that special resources were included with in the *ahupuaʻa*, with those resources controlled by the resident or absentee landlord—the ruler or a high chief. Or, in arid regions, larger size may have compensated for poorer or more scattered farming soils…" (Cordy 2000:33).

The *ahupuaʻa* was a political unit under the authority of a *konohiki,* resident chief of lesser rank or status. It was the equivalent of a community and had an independent identity. It was generally a self-contained social unit composed of *ʻohana* (extended family groups) and economically self-supporting. The diversity of environments and products available within each *ahupuaʻa* allowed the ʻ*ohana* to be fairly self-sufficient through a system of mutual cooperation, and resource management and distribution between the coastal and upland zones.

At the end of prehistory Kawaihae seems to have been one *ahupuaʻa*. In the 1800s, Kawaihae was divided into two pieces – Kawaihae 1, also known as Komohana, and Kawaihae 2, also known as Hikina (Cordy 2000: 346). Kawaihae *ahupuaʻa* extends from the shore below Waimea, at the joining of today's north and south Kohala, and runs inland up into the forests of Kohala Mountain adjacent to Waimea.

The Kawaihae Harbor and Kawaihae villages straddle the *ahupuaʻa* of Kawaihae 1 and Kawaihae 2.

Ahupuaʻa were further divided into parcels called *ʻili (ʻili ʻāina),* narrow strips of land running lengthwise within the *ahupuaʻa*, which were allotted to the *makaʻāinana* (commoner) and their *ʻohana* (extended family units) for use and management. "…the right to continue to use and to cultivate an *ʻili* stayed with the *ʻohana* dwelling thereon, regardless of any transfer of title to the *ahupuaʻa* in which they were located (Handy and Handy 1991:49).

"As long as sufficient tribute was offered and *kapu* (sanctioned restrictions) were observed, the common people, who lived in a given *ahupuaʻa* had access to most of the resources from mountain slopes to the ocean. These access rights were almost uniformly tied to residency on a particular land, and earned as a result of taking responsibility for stewardship of the natural environment and supplying the needs of one's *aliʻi"* (Maly 2000:7).

4.0 TRADITIONAL HISTORICAL ACCOUNTS

4.1 LEGENDARY ACCOUNTS

Oral histories and legends provide insights of a people's traditions and beliefs, significant cultural events and places, subsistence land use, and relationships with the natural and supernatural environment.

The following legends are from areas of South Kohala:

Legend of Pupualenalena
Pupualenalena, a supernatural dog, lived in Puakō with a fisherman who allowed him to eat as much fish he wanted in exchange for *'awa* which he stole from Hakau, high chief of Hawai'i (around AD 1450) who lived in Waipi'o Valley. Hakau had Pupualenalena caught, and he and his master were sentenced to die. In exchange for their lives, Pupualenalena stole a shell trumpet owned by the spirits who lived above Waipi'o Valley for Hakau (Fornander 1917:558-560).

Legend of Kaulaapokii
This is a narrative of the adventures Mailelaulii and her four sisters traveling from Kona through Kohala. First they meet Puakō, a "...very handsome man whose form was perfect," who fell in love with Mailelaulii. The sisters did not approve of Puakō because he was only a salt maker. They were worried that he would ask them to help him with salt making and afraid that their skins would soon "...look like the windward bark of a noni tree."

They left Puakō and at Kokoiki they met Hikapoloa, the chief of Puuepa and Hukiaa, who took Mailelaulii for his wife. The sisters approved of his chiefly status and they stayed to live in his household.

Hikapoloa learned that Mailelaulii had five brothers in Holualoa, Kona, who possessed the very rare pearl shell fishhooks to catch all the *aku* they wanted. Hikapoloa visited the brothers who happily gave a pearl shell fishhook to Hikapoloa.

Out in his canoe, Hikapoloa took the fishhook and held it in his hand all day, expecting the fish to magically jump into the canoe. When the fish didn't, he believed that he was tricked, and vowed to kill his brother-in-laws.

During a period of drought in Kona, Mailelaulii's brothers travelled to Kohala to ask Hikapoloa to provide them with food. They landed their canoe at Kukuipahu. As each brother entered the house, Hikapoloa beheaded, cooked and ate them. When the Mailelaulii and her sisters found out what had happened, they trapped Hikapoloa in his house. They caused the *maile* and *'ie* vines to grow over and around the house. Hikapoloa died and the house was set on fire. The sisters collected the bones of their brothers, restored them to life, and all returned to Kona, vowing, "...never to be covered with the same *kapa* with any man or woman from Kohala" (Fornander 1917:568).

4.2 PROVERBS AND SAYINGS

The following *'ōlelo no'eau*, traditional Hawaiian proverbs and sayings, taken from Pukui (1983), captures the essence of the area or poetically allude to historical events associated with Kawaihae:

Proverb: *Kawaihae i ke kai hāwanawana.*
Translation: Kawaihae of the whispering sea.
Interpretation: Refers to Kawaihae, Hawai'i (178).

Proverb: *Ke kai hāwanawana o Kawaihae.*
Translation: The whispering sea of Kawaihae.
Interpretation: Refers to Kawaihae, Hawai'i (185).

Proverb: *Ka ua nāulu o Kawaihae.*
Translation: The cloudless rain of Kawaihae.
Interpretation: The rain of Kawaihae often surprises the visitors because it seems to come out of a cloudless sky. A native knows by observing the winds and other signs of nature just what to expect (172).

Proverb: *Na makani paio lua o Kawaihae.*
Translation: The two conflicting winds of Kawaihae.
Interpretation: Refers to the *mumuku* wind from the uplands and the *Nāulu* wind, which brings rain of Kawaihae (247).

Proverb: *Pua ka lehua.*
Translation: The lehua is in bloom.
Interpretation: Said of the people of Kawaihae when the *aku* fish appear in schools. It was considered unlucky to speak openly of going fishing (294).

Proverb: *Hele aku 'oe ma'ane'i, he wa'a kanaka; ho'imae 'oe ma'o he wa'a akua.*
Translation: When you go from here, the canoe will contain men; when you return, it will be a ghostly canoe.
Interpretation: Warning to Keouakuahu'ula by his *kahuna* not to go to meet Kamehameha at Kawaihae. He went anyway and was killed (81).

4.3 TRADITIONAL ACCOUNTS OF BATTLES

The area is a significant site of legendary battles between opposing district chiefs of Hawai'i island, and Maui and the chiefs of leeward Hawai'i probably from the 1500s to 1700s (Schilt 1984:22).

Battle between Lonoikamakahiki of Hawai'i and Kamalalawalu of Maui
Kawaihae was a strategic seaport for Maui chiefs to land their canoes and embarked on battles against the chiefs of Kohala and Kona. One of these events is said to have occurred in the late 16th to early 17th century, when the Maui chief, Kamalalawalu, sent spies to Hawai'i. Landing at

Kawaihae, the spies surveyed the coastal villages trying to determine the size of the population. The coastal residents were in the uplands, and as a result the spies report indicated a much smaller population than was the actually the case. Kamalalawalu decided to invade the Hawai‘i based on this misinformation (Kamakau 1961:56-58).

Kamalalawalu fought the first battle at Puakō and was victorious, killing the Hawai‘i chief Kanaloa-kua‘ana, eldest son of chief Keawe-nui-a-‘Umi (Fornander 1996:122-124).

Kamalalawalu marched inland to Waimea against the advice of his counselors who warned, “Waimea is not a good battle site for strangers because the plain is long, and there is no water. Should defeat be met with the warring strangers, they will all be slaughtered...” (Kamakau 1961:58).

There the Maui chief met the combined forces of six Hawai‘i *moku* lead by Lonoikamakahiki. Kamalalawalu was killed at Puakō as the Maui forces were being driven back to the coast (Kamakau 1961:60).

Lonoikamakahiki and His Brothers
Fornander recounts the tale of the battles fought by Lonoikamakahiki against his three rebellious brothers to regain his power. These battles were fought at ‘Anaeho‘omalu, Wailea, Kaunooa (between Puakō and Kawaihae), at Pu‘u Pa and Pu‘ukoholā. Lonoikamakahiki was victorious in suppressing the rebellion (Fornander 1996:121).

Alapa‘i-nui-a-ka-uaua
Alapa‘i -nui-a-ka-uaua was living on Maui when Keawe, a ruler of Hawai‘i, died. Alapa‘i went to battle with Hawaii's remaining chiefs and took possession of Kohala and Kona.

Kekaulike, ruler of Maui, heard of Alapa‘i’s victory and wanted to take over. He began his fight against Alapa‘i in Kona, but was forced to flee by the forces of Alapa‘i. As Kekaulike retreated he abused the people of Kekaha, slaughtered the people of Kohala, and fled to Maui.

At the end of his reign, Alapa‘i was living at Kikiako‘i in Kawaihae. At the heiau of Mailekini, in Kawaihae, he appointed his son, Keawe‘ōpala, to be his successor (Kamakau 1961:77).

5.0 PRE-CONTACT BACKGROUND

It is estimated that Hawai‘i was first settled by Polynesian voyagers as early as AD 300 (Kirch 1985:296-308; Cordy 2000:109). It is believed that the more “ecologically favorable” windward side of the islands were settled first and only after windward areas were fully developed and populated, did migration in search for new resources establish permanent settlements on the drier leeward side of the islands.

The first permanent settlements on the leeward or west side of the island of Hawai‘i are estimated to have been established around AD 900. These settlements were around coastal bays where marine resources were abundant. In this arid environment, drinkable water would have been an important consideration for the early settlers. Evidence of these early settlements was found south of Kawaihae at ‘Anaeho‘omalu at the boundary of South Kohala and North Kona (Barrera 1971:71; Oaks 2003:12).

The principal subsistence activities of these early settlers would have been related to inshore fishing and exploitation of marine resources. There would have been very limited cultivation activity as the coastal zone was dry and rocky, and not suitable for agriculture. It is believed that some food plants (sweet potatoes, coconut and taro) and utilitarian plants (gourds, *‘ilima*, Pandanus, etc.) may have been grown in the patches of sandy soil, and along seasonal and intermittent streams (Greene 1993:185; Clark 1986:247)

Interpretation of archaeological data suggests the earliest occupation of Kawaihae to have been at least by the early 1400s (Clark 1986: 176 and 189). “Fishing, along with shellfish, sea weed, echinoderm, and other resources collections were all undoubtedly good at Kawaihae. In addition, salt making was an important activity there” (Clark 1986:247). Kawaihae was also a favorite landing site for canoes and was the district’s chief seaport (Handy and Handy 1991:531).

It is believed that by AD 1200 developed an initial Chiefdom society, which eventually evolved into the classic Hawaiian four strata society: ruler, high chiefs, local chiefs, and commoner (Cordy et al 1991:575). Social and political inequality became institutionalized.

“By at least the sixteenth century, the Hawaiian Islands had numerous families of high status individuals who ruled their separate domains by birthright, by genealogical affinity to the major gods, and by the right of conquest. Everything on the land and in the sea in their domains belonged to these high chiefs. Since the high chiefs were the closest living relatives of the major gods, the right to conspicuous ownership was never challenged or denied them” (Apple and Kikuchi 1975:42). Social order was maintained through an elaborate *kapu* (restriction) system and strong belief in the supernatural concept of *mana*.

The *ahupua‘a* evolved into a political-based “feudal” land system (Cordy et al 1991:575) and was the “chief political subdivision… for the purpose of taxation” (Handy and Handy 1972:48). The *maka‘āinana* had the right to live on the land and to use its resources and cultivate it. In return, the farmers and fishermen regularly gave a portion of their harvest to the *ali‘i* in the form of

tribute or taxes. The tribute collection during the annual harvest festival or *makahiki* was one of the most important economic and religious events. The *ʻohana* presented the tribute as a symbolic offering to Lono, the god of agriculture, but the goods were distributed to support the chief and priest classes.

"Rights to…fishing areas, considered very valuable economic assets, were strictly controlled within an *ahupuaʻa*. Inshore fishing rights were explicitly stated. Normally, only members of an *ʻohana* had rights to exploit specific water areas of the *ʻohana* lands" (Greene 1993:45). Also, knowledge of location of good fishing places off shore was considered a family or community possession. Marine resources within an *ahupuaʻa* were *kapu*, off limits, to residents of other *ahupuaʻa* without permission (Cordy 2000:39).

The Hawaiians had a tradition of conservation management practices of marine resources. *Kapu*, or closed, seasons of exploitation of certain fish were often enforced (Handy 1991:110-111). Especially, during their spawning period. Other *kapu* involved prohibiting fishing at certain places along the shore when deep sea fishing was open; alternating fishing times at inshore fishing places; and making certain that seaweed remained off limits at certain times of the year to preserve it as fish food and thus ensure good shore fishing. The ancient Hawaiians were not only skilled and knowledgeable fisherman, but they also respected the customs and traditions associated with the activity..." (Greene 1993:27-28).

The early leeward settlers were dependent on coastal exploitation subsistence, but were basically farmers coming from an intensive agricultural subsistence tradition of the windward settlements. The uplands on the leeward side which was suitable for agriculture were cultivated providing an expanded subsistence resource base. The addition of agriculture provides a more efficient means of subsistence than total reliance on fishing. On the leeward side, a *makai-mauka* (coastal-upland) subsistence complex was practiced.

Handy and Handy state that in Kawaihae "…much dry taro was grown beyond in the lower forest zone, which formerly extended from the Kohala Mountains much farther to seaward over what is now open pasture land. Wet taro was grown also in small pockets of land wherever streams, even, intermittent ones, flowed down from the mountains in the wet seasons" (1991:531).

Kawaihae Uka exists at 1158 meters a.s.l. and within Kawaihae 1, at the boundary with Kawaihae 2. When Kawaihae constituted a single land unit, Kawaihae Uka fell approximately in the center. It was this *mauka* area that was most strongly linked with the coastal settlement at Kawaihae (Langlas 1994:15). Archaeological work in upland Kawaihae has identified extensive agricultural fields, irrigation canals, and evidence of permanent settlements — "suggesting that many food items may also have come down to the shore from this upland area" (Cordy 2000:414).

It is believed that development of the Kohala Field System, an intensive upland agricultural system, occurred between ca. AD 1400 and 1650, exploiting the lands at elevations where rainfall and soil levels were sufficient for productive cultivation. The establishment of the royal compound at Pelekāne probably increased the demand for food when the *aliʻi* were in residence and may have provided an impetus for increased food production (Greene 1993:301).

The inland area in the vicinity of Waimea, also shows evidence of agricultural as well as habitational utilization, while the coastal area near Kawaihae seems to have been the locus primarily of residential features that were probably associated with the upland agricultural field systems (Barrera 1974:64).

A network of trails knitted the social and economic system of ancient Hawaiian society. The permanent settlements found along the coast or *Ko Kaha Kai* zone, and in the higher elevation zones of *Kula* and *Wao* zones of an *ahupuaʻa* were connected by *mauka-makai* trails. These trails were the lifelines of the *ahupuaʻa*, transporting people and goods between the coastal and upland areas (Ching 1970). Lateral trails allowed for trading with neighboring *ahupuaʻa*.

A *mauka-makai* distribution relationship similar to that which existed within the *ahupuaʻa* also seemed to have existed between the *ahupuaʻa* of Kawaihae and Waimea. Waimea is a *mauka* land-locked *ahupuaʻa*, and dependent on the Kawaihae coast for its source of marine resources and salt. *Mauka-makai* trails connected Waimea and Kawaihae (Cordy 2000:312). Evidence of marine fauna was excavated at Waimea sites (Clark 1986:597). The dry and arid coastal settlement of Kawaihae would have been to some extent dependent on Waimea for agricultural products.

Aquaculture in the form of fishponds practiced by the ancient Hawaiians may have been built as early as the fourteenth century (Greene 1993:29). Fishpond development coincided with the development of intensive agricultural systems (Cordy et al 1991: 576).

The accessibility to the ponds (*loko*) and their products was strictly for the *aliʻi*. The *loko* were likened to "their terrestrial equivalents, the royal gardens (*kōʻele*)," products of which were taboo to the commoners (Apple and Kikuchi 1975:2). They yielded the common people no direct benefit. Indirectly, however, royal fishponds insured less demand on the *makaʻāinana* food resources (Greene 1993:29).

Ethnohistorical documents and archeological data presented indicate the development of a substantial settlement in Kawaihae in the prehistoric period (Clark 1986:247). The importance of Kawaihae to early Hawaiians is evidenced by the ancient Mailekini *heiau* (dating back to 1580) and the existence of an earlier Puʻukoholā *heiau* or *ahu* (built during the reign of Lonoikamakahiki around 1640-1660) on which the present Puʻukoholā *heiau* sits. Royal use of Kawaihae goes back at least to AD 1640-1660 (Cordy 2000:347).

6.0 HISTORICAL BACKGROUND

The earliest written account of Kawaihae Bay was left by Captain James King, member of Captain James Cook's expedition in 1779:

> Although the NEern part of the bay which…is call'd Toe-yah-ya (Kawaihae) looks green and pleasant, yet as it is neither wooded or hardly any signs of culture, and a few houses, it has certainly some defect, and does not answer the purposes of what the natives cultivate (Greene 1993:193).

Another early visitor was Captain George Vancouver of the *Discovery*, who left a detailed description of Kawaihae Bay in 1793:

> Situated in a small sandy bay, where over a space of twenty yards of rugged rocks and stones, a fine stream empties itself, whose water is easily to be procured by landing the casks on the sandy beach, and having the water brought in smaller vessels to fill them; a service the natives will readily perform for a trivial reward (Greene 1993:193).

Vancouver further wrote of Kawaihae and the village:

> Toeaigh (Kawaihae) is situated in a grove of cocoa-nut trees, just behind a sandy beach. A reef of coral rocks, extending thence about three quarters of a mile into the sea, rendered it inaccessible to our boats in a direct line, but we landed very commodiously in a narrow channel, between the reef and shore, near the morai (Puʻukoholā), to the S.E. of the beach…(Greene 1993:193).

South Kohala settlements during the early historic period, during the time of Kamehameha, continued to consist of coastal settlements with an economy of marine resource exploitation and limited cultivation. Two fishponds and salt pans were documented to have existed to supplement subsistence and trade (Greene 1993:196). Sweet potato and taro gardens were found scattered in patches of sandy soil and the seasonal intermittent streams between Kawaihae and Pauoa Bay. The coastal settlements were dependent on the *mauka* fields along the foothills of the Kohala Mountain for most of their agricultural supplies.

Kawaihae was one of the largest coastal settlements in leeward Hawaiʻi during the Early Historic Phases (Clark 1986:496). Kawaihae was the largest settlement in coastal Kohala because it had the best anchorage in Kohala. It was an important stopover for foreign ships needing supplies and repairs. Importantly, visiting ships stopped to call on the *aliʻi nui* of the district, Kamehameha, who controlled all trade and was often in residence in Kawaihae. While at Kawaihae, Kamehameha lived at the royal residence at Pelekāne below Mailekini and Puʻukoholā *heiau*.

When Kamehameha lived there, especially during the years he was constructing his *heiau* at Puʻukoholā, European and American traders documented encountering the major high chiefs of the area—each arriving offshore in large double-hulled canoes. One canoe carried 40-50 men (Cordy 2000:348).

Kawaihae occupies an important place in the history of Hawaiʻi. This is where in 1791, Kamehameha secured his position as *aliʻi nui* of the island of Hawaiʻi. Kamehameha had earlier sought the consul of Ka-pou-kahi, a *kahuna* soothsayer from Kauaʻi who instructed Kamehameha to build a *heiau* at Puʻukoholā to the war god Kukaʻilimoku if he expected to realize his ambition to unify the island (Kamakau 1961:154-155).

Fornander documents a conversation with "a centenarian Hawaiian at Kawaihae Uka who had assisted in carrying stones towards building this *heiau*. His description of the thousands of people encamped on the neighboring hillsides, and taking their turns at the work, of their organization and feeding, their time of work and relaxation, the number of chiefs that attended, and who, as the old man said, caused the ground to tremble beneath their feet; and the number of human victims that were required and duly offered for this or that portion of the building..." (Fornander 1996:328).

After completion of the *heiau* in 1791, Kamehameha invited his cousin Keōua-Kuahuula, *aliʻi nui* of Kaʻū, the last contender in his effort to unify the six *moku* of Hawaiʻi under his rule to Kawaihae. As Keōua was descending his canoe upon his arrival at Pelekāne, he was killed by Kamehameha's supporters and offered by Kamehameha to Kukaʻilimoku at the *heiau*. This established Kamehameha's rule over the island of Hawaiʻi and ended the inter-district battling on the island (Kuykendall 1947: 33-38).

Of further significance in the history of Hawaiʻi, this is where Kamehameha remained while he planned his campaign to consolidate all the Hawaiian islands under his rule. Five years later, he launched his invasion of Maui, Molokaʻi and Oʻahu. In 1805, Kaumualiʻi, *aliʻi nui* of Kauaʻi, recognized Kamehameha as his chief, uniting all of the islands under Kamehameha's rule.

From the beginning of Kamehameha's rise to power, two Englishmen, John Young and Isaac Davis, were his close personal advisors in Kawaihae regarding warfare, foreign relations, and business matters. These two became separated from their ships in 1790 and taken into the custody of Kamehameha, who was eager to have them help him in the use of the Western armaments in his possession and to train his warriors in the use of this new technology (Kamakau 1961:161-162).

"Kawaihae was not only the place where Kamehameha I became the *aliʻi nui* of Hawaiʻi Island, but also the place where Kamehameha II returned after the death of his father to seek consolidation of his forces and consecration of his leadership role" (Kelly 1974:18).

Kawaihae was the residence of *aliʻi* from pre-Contact to early historic times. Kawaihae was not only the spiritual site and safe seaport of the *aliʻi*, but it offered recreation. "Kawaihae is an ancient surfing area" (Kelly 1974:5). The waves at Kapuaʻilima in Kawaihae was known for surfing (ʻĪʻī 1959:135). ʻĪʻī writes that Liholiho and Gideon Laanui "...were often seen together gliding on the surf outside of Haleumiumiole at Kawaihae and at Kapuni, outside of Kiikiiakoi" (1959:137).

The growth of Kawaihae as a commercial port was a direct consequence of the productive uplands of Kawaihae Uka and Waimea. Initially, ships stopped in Kawaihae to restock their stores with food and water. On March 1, 1794, Kamehameha presented Vancouver with "near

an hundred hogs of the largest size, and as great a quantity of vegetables as both vessels could well dispose of; with offers of a further supply if these were insufficient" (Vancouver 1801:108 from Kelly 1974:29).

First, food was made available for the traders, then sandalwood, salted beef, and hides (Kelly 1974:36). Other products exported through Kawaihae were fowl, beans, wool, Irish potatoes, and *pulu* (the fiber from the tree fern used to stuff pillows and mattresses).

Vancouver introduced the first cattle and sheep through the port at Kawaihae. By the early 1800s Kamehameha had ordered controlled bull hunting to thin the herds. Since Hawaiians had no tradition of eating beef, it and its by-products (hide and tallow), were used to initially supply the demand by the whaling ships in the early to mid 1800s and later with trading ships supplying the demands created by the California Gold Rush.

The sandalwood trade reached its peak in the 1820s. The Kohala Mountain forests which once reached almost to the Kawaihae shore in 1815 were denuded to supply the vessels trading in China. The intensive logging of sandalwood coupled with herds of cattle roaming the slopes from Kawaihae to Waimea is responsible for the drastic change in the environment and climate of the area.

The first American missionaries to the islands arrived in Kawaihae on April 1, 1820, on the *Thaddeus*. They were met by two of Kamehameha I's widows, Kalakua and Nāmāhana, and the presiding chief of the area, Kālaimoku and his wives. The first mission station in the Hawaiian Islands was established in Kawaihae by 1821.

Ships heading into Kawaihae Bay in the early historic period used two visible graves as landmarks to navigate. One was the grave of George Hueu Davis, son of Isaac Davis. The other was the grave George W. Macy, a sea captain who was in business with Louzada, a Waimea merchant. Macy's grave was noted as a "conspicuous white obelisk" on Jackson's map of 1883 of Kawaihae (Figure 5).

"As ranching at Waimea expanded, and large ships were brought into interisland service, Kawaihae became one of West Hawai'i's largest ports of call….Cattle were shipped alive to Honolulu's slaughterhouses. They were driven into the water, floated to the waiting ship tied by their horns to a small boat and lifted in a belly sling on to the deck of the ship" (Kelly 1974:37).

> The village consisted only of straggling houses, of two classes; those appropriated to the residence of the inhabitants were small, mean, miserable huts; but the others, allotted to the purposes of shading, building, and repairing their canoes, were excellent in their kind…In about the middle of the village is a reservoir of salt water, nearly in the centre of a large inclosure, made by walls of mud and stones. Between these walls and the reservoir the whole space is occupied by shallow earten pans, of no regular size or shape, nor placed in any order or degree of elevation. The reservoir…constantly affords a sufficient quantity of excessively salt water, for supplying the numerous (salt) pans…" (Kelly 1974:37)

Louis de Freycinet, in command of a French expedition (1817-20) noted the following about Kawaihae:

> Less spread out and more irregular than Kayakakoua (Kealakekua), Kahaihai (Kawaihae) is surrounded by even sadder, even drier grounds, if that is possible. Here, in fact, not an atom of greenery appeared before our eyes. One could have said that it had been ravaged by fire. On an elevation near the southern section of the village, a morai (Mailekini) surrounded by a rock wall had the appearance of a European fort. Mr. Young's house, built in European style, could be seen farther off on the shore to the north (Kelly 1974:41).

Lyons, who came in 1832 as a missionary, wrote of his first impressions of the Kawaihae in the Mission Station Rept. 1832:

> Kawaihae is about as desolate a place as I have ever seen. Nothing but barrenness, with here and there a native hut (Kelly, 1974:29).

William Ellis toured the island in 1823 as a member of the American Board of Commissioners for Foreign Missions to seek out suitable sites for missions and schools. Arriving from North Kohala, the following is his description of what he saw at Kawaihae:

> Before daylight on the 22nd (July 1823) we were roused by vast multitudes of people passing through the district from Waimea with sandalwood, which had been cut in the adjacent mountains for Kawaimoku (Kalaimoku or Kalanimoku), by the people of Waimea and which the people of Kohala, as far as the north point, had been ordered to bring down to his store house on the beach, for the purpose of its being shipped to Oahu.
>
> There were between two and three thousand men, carrying each from one to six pieces of sandal wood, according to their size and weight. It was generally tied on their backs by bands made of *ti* leaves, passed over the shoulders and under the arms, and fastened across their breast. When they had deposited the wood at the storehouse, they departed to their respective homes (Ellis 1963:286-287).

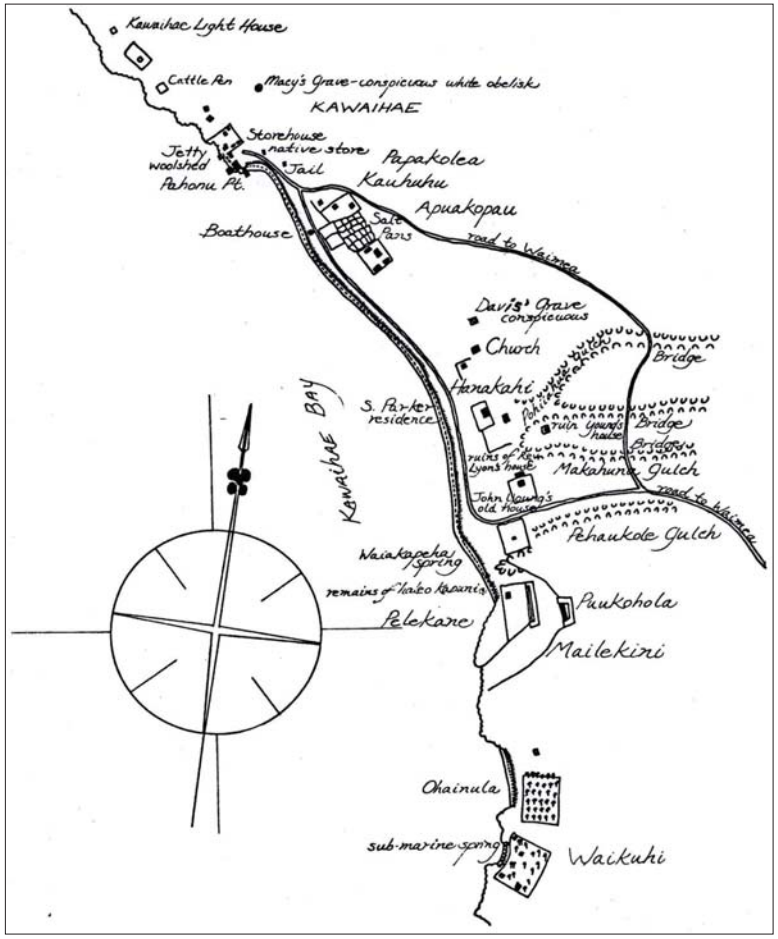

Figure 5. Map of Kawaihae Bay, Hawai'i, By G. Jackson, July 1883 (Kelly 1974:13).

Ellis mentions a warm springs area located "...a short distance to the southward of the large Heiaus" where he enjoyed a "...most refreshing bathe." The springs were a little below high-water mark and had stones piled around them to enclose the water that bubbled up through the sand (Ellis 1963:287).

Ellis also wrote about the making of salt at Kawaihae:

> The natives of this district manufacture large quantities of salt, by evaporating the sea water. We saw a number of their pans, in the disposition of which they display great ingenuity. They have generally one large pond near the sea, into which the water flows by a channel cut through the rocks, or is carried thither by the natives in large calabashes. After remaining there some time, it is conducted into a number of smaller pans about six or eight inches in depth, which are made with great care, and frequently lined with large evergreen leaves, in order to prevent absorption. Along the narrow banks or partitions between the different pans, we saw a number of large evergreen leaves placed. They were tied up at each end, so as to resemble a shallow dish, and filled with sea water, in which the crystals of salt were abundant (Ellis 1963:28)

Charles Wilkes was a member of the United States Exploring Expedition, made the following observation about the Kawaihae area in 1845:

> The tradewind is exceedingly strong, bringing with it a mist toward sunset. It rushes furiously down between the mountains which bound the valley of Waimea and become very dangerous to shipping in the bay. It is called by the natives *mumuku* and is foretold by them from an illuminated streak that is seen far inland. This is believed to be caused a reflection of the twilight on the mist that always accompanies the *mumuku*... (Kelly 1974:37)

Isabella Bird Bishop writes of her impression of Kawaihae in 1870s:

> A Foreign store, a number of native houses, a great heiau, or heathen temple on a height, a fringe of cocoa-nut palms, and a background of blazing hills, flaring with varieties of red, hardly toned down by any attempt at vegetation, a crystalline atmosphere palpitating with heat, deep, rippleless, clear water, with coral groves below, and a view of the three great Hawaiian mountains, are the salient features of this outlet of Hawaiian commerce (Greene 1993:205).

Casper Whitney, describes the changes in time at Kawaihae in 1899:

> Once many years ago, Kawaihae was a thriving port, where the whalers came for the potatoes raised on the hills directly back of the settlement,
>
> and people lived here and prospered. Now the settlement owes its life to the weekly arrival of steamer from Honolulu (Greene 1993:205).

"Today, Kawaihae Bay and its coastline differ drastically from the views described in historical journals. In….the late eighteenth and early nineteenth centuries, the original hardwood forests stretched almost to the beach. Freshwater streams flowing down gulches from Kohala

Mountain provided the water supply of Kawaihae and potable water for ships. Ultimately logging activities related to the sandalwood trade and the repair of visiting ships, clearing for agricultural terracing, and uncontrolled cattle grazing and tree removal caused the forest to recede. And streams dried up, erosion intensified, creating a semi-barren desert environment" (Greene 1993:209).

6.1 Population of Kawaihae — Reflecting Changes in Time

"The simplest characterization of the population history of Waimea-Kawaihae is to say that the prehistoric period was marked by fluctuating increase, while the historic period saw fluctuating decline" (Clark 1986:495).

The population of the Kawaihae area declined steadily in the 1800s. Population fluctuations were experienced due to periodic public work projects, such as during the construction of Puʻukoholā *heiau*, or to carry sandalwood from the upland forests to Kawaihae Bay. When chiefs were in residence in Kawaihae, the population increased with the addition of their entourages and the various service providers and the curious. People would congregate at the bay to watch the arrival of ships and the foreigners and engage them in trade. Reduced fertility and increased mortality affected the population figures in a more permanent way. For instance, the smallpox epidemic in 1853 took half the population (Clark and Kirch 1983:51-52).

Depopulation was a major consequence of these events and changes. Cordy (2000) compares estimated AD 1778 census with 1831-1832 census information from Schmitt (1977:120): Hawaiʻi island 1778 = 106,028 and 1831 = 45,592; Kohala 1778 = 23,503 and 1831-1832 = 10,106 (Cordy 2000:49).

Lyons' observation of his congregation at the time of the 1853 smallpox epidemic, taken from the Mission Station Rept. 1853: "In April one hundred communicants were present, many of them in the bloom of life--now (November?) there were but twenty-four, and not a youth among them..." (Kelly 1974:53).

6.2 Mahele of 1848

The 1848 Mahele ʻĀina is the historic land division of the kingdom initiated during the reign of Kamehameha III. The Mahele had a crucial impact on Hawaiian society and culture. It was "the most important event in the reformation of the land system in Hawaiʻi…the separation and identification of the relative rights of the king, the chiefs, and the *konohiki*, in the lands within the islands. This event led to the end of the feudal system in the kingdom" (Chinen 1958:15).

Prior to the Mahele, all lands were held in trust by the *aliʻi*:

> By at least the sixteenth century, the Hawaiian Islands had numerous families of high status individuals who ruled their separate domains by birthright, by genealogical affinity to the major gods, and by the right of conquest. Everything on the land and in the sea in their domains belonged to these high chiefs. Since the high chiefs were the closest living relatives of the major gods, the right to conspicuous ownership was never challenged or denied them (Apple and Kikuchi 1975:42).

The Mahele divided the land into three categories: 1) Crown Lands, 2) Government Lands, and 3) *Konohiki* Lands (Chinen 1958:13). The *ahupuaʻa* of Kawaihae 1 or Kawaihae Komohana was kept by Kamehameha III as crown land. The *ahupuaʻa* of Kawaihae 2 or Kawaihae Hikina was given by Kamehameha III to John Young's son and his premier, Keoni Ana.

During the Mahele, all of John Young's children and Isaac Davis' children received awards of large amounts of land in various districts of Hawaiʻi in recognition of their fathers' service to Kamehameha I. Below is a list of the children who, along with Keoni Ana, were awarded *ahupuaʻa* in Kohala (Indices of Awards...1929:58-81 from Kelly 1974:46-47):

John Young's Children:

Kamaiku (w):	Waiaka (1)
James Y. Kanehoa (k):	ʻŌuli
Kaoanaeha (w):	Opuoao
	Hoowaliohalawa
	Kealahiwa
	Kaupo
Gini Lahilahi (w):	Waiaka (2)
	Waika
Fanny Kekela (w):	Kiiokalani

Isaac Davis' Children:

George Davis Hueu (k):	Waikoloa
Kale (w):	Kapaa

Other awards issued along the coast of Kawaihae Village from the old wharf at the northern end of the beach to Pelekāne at the southern end are listed in Table 1 and indicated on Figure 6. The number of awards does not represent the total population of Kawaihae Bay in 1848. "They probably represent the local elite, those who could afford the survey and commutation, had proper authority for permanent occupancy, had reputable witness to sustain both the authority and continuous use, and who chose to apply" (Apple 1978:62).

Table 1. Land Commission Awards (LCA) for Kawaihae 1 and 2

Kawaihae 1 (Komohana) — *the old wharf to Makahuna*		
LCA No.	4094	Occupied before the time of Kamehameha I.
Awardee	Kepaimaka	
Royal Patent No.	5233	
LCA No.	4884	Authority was Kuakini; occupied in 1838; structures for storage and dwellings.
Awardee	Wm. French	
Royal Patent No.	4929	
LCA No.	3669	Houselot occupied in 1841.
Awardee	Makahi	
Royal Patent No.	5240	
LCA No.	4091:1,2	Authority was Kamehameha I; houselot and salt beds.
Awardee	Kaue	
Royal Patent No.	5217	
LCA No.	3826	Authority was Kamehameha I.
Awardee	Punihahiha	
Royal Patent No.	5264	
LCA No.	9971	Authority was Kuakini; occupied in 1844.
Awardee	W.P. Lele-io-hoku	
Royal Patent No.	6692	
LCA No.	3668:1,2	Authority was Kaʻoanaʻeha; occupied in 1840; houselot and salt pans.
Awardee	David Manuia	
Royal Patent No.	5514	
LCA No.	4101	Authority was ʻOlohana (John Young) and Kaʻaoanaʻeha; occupied in 1847.
Awardee	Kahananui	
Royal Patent No.	6385	
Kawaihae 2 (Hikina) — *Makahuna to Pelekane*		
LCA No.	4106	Authority was ʻOlohana and Kaʻaoanaʻeha.
Awardee	Kaui	
Royal Patent No.	5098	
LCA No.	4522	Authority was Kamehameha I; occupied ca. 1793.
Awardee	Puna and Kaʻaoanaʻeha	
Royal Patent No.	None	
LCA No.	4103	Authority was Kaʻaoanaʻeha.
Awardee	Kahunaliiole	
Royal Patent No.	4929	

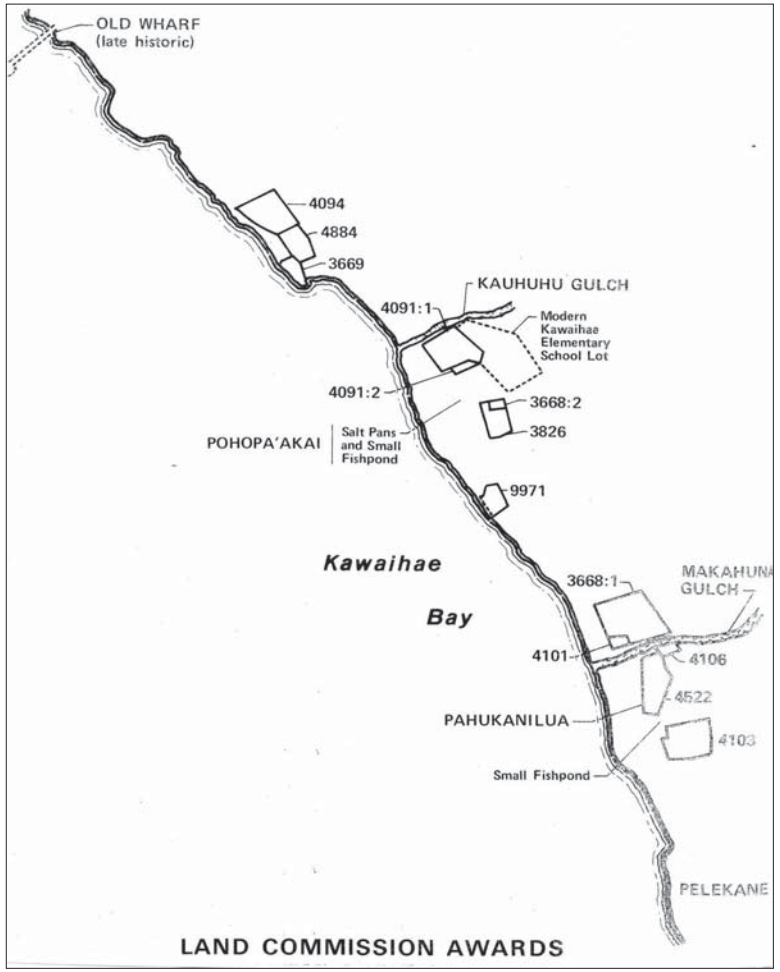

Figure 6. Kawaihae Bay, ca. 1850 (from Apple 1978:28).

7.0 ARCHAEOLOCIAL RECORD OF PROJECT AREA

Kawaihae Harbor "is primarily a coral stockpile formed from dredge tailings after the current harbor was created on the site of a coral reef" (Towill 2001: 4-12) and beach from the early 1950s to 1960s. Any historical or archaeological sites which may have existed within the boundary of the harbor during the period of construction would have been buried.

The southern boundary of the harbor is contiguous with the culturally and historically significant Puʻukoholā Heiau National Historic Site. Hale O Kapuni (known as the shark *heiau*) is submerged in the water south of the harbor in Pelekāne Bay.

The area of Kawaihae has been surveyed for various development projects. A comprehensive inventory and data of archaeological sites is available in these reports: Barrera (1974), Soehren (1980), and Clark (1983). Appendix A, provides the locations and an indication of the number of recorded archaeological sites in the vicinity of the harbor and village.

The archaeological features recorded for the area are many and varied. The list and descriptions will not be reiterated here, except to say that the prehistoric and historic sites have been grouped into 6 major categories: residential structures, community-oriented structures, burial monuments, agricultural features, military features and miscellaneous.

8.0 CONTACTS AND INTERVIEWS

8.1 METHODOLOGY

Interviews were conducted to obtain personal experiences and knowledge of the project area. Particularly, information pertaining to traditional cultural practices and the historical events associated with the area. The interviews were informal interviews conducted between 4 May and 14 June 2008. A list of *kūpuna* and knowledgeable consultants as possible interviewees was developed by contacting community leaders and members.

Seven interviews were conducted. A basic questionnaire (Appendix B) was used as a guide to solicit interviewees' biographical information, relationship, and knowledge of the area. A map of the project area was used in explaining the project to the interviewees. Copies of Personal Release of Interview forms are provided in Appendix C and summaries of the interviews are provided in Appendix D.

All of the consultants interviewed were personally associated with the area and were repeatedly recommended by various sources in the community. They are all active in the Hawaiian community and well respected for their leadership and knowledge of the project area and its history. The interviews were supplemented with personal and telephone conversations with stakeholders of the area for clarification and additional information.

Additional information was garnered from public information meetings regarding the Statewide Large-Capacity Inter-Island Ferry, which essentially shares the same interest area with the current project.

8.2 CONTACTS

Table 2 is a list of people contacted for interviewee recommendations and/or information regarding the project area.

Table 2. List of Contacts

NAME	AFFILIATION	REASON CONTACTED	COMMENTS
Elizabeth Becerra	YMCA Center Director, Kailua-Kona	Contacted for information on programs and use of harbor.	YMCA established an Aquatic Center at the southwestern end of the harbor. Programs offered include canoeing, surfing, marine ecosystem education, and water recreation.
Darlene Dupont	YMCA, Executive Assistant CEO for Hawaiʻi island	Contacted for information on programs and use of harbor.	YMCA Aquatic Center at the southwestern end of the harbor is an integral part of the programs offered by the Kona YMCA Center. Programs at the Aquatic Center also to be offered through the Waimea YMCA Center. Annual YMCA festival held at the Aquatic Center.

NAME	AFFILIATION	REASON CONTACTED	COMMENTS
Kale Gumapac	Kanaka Council	Kanaka Council is a grassroots Hawaiian community organization. Attended meeting to discuss their position on the issues.	Resents the fact that an impact assessment is being conducted after the decision had already been made to operate the Superferry. Strongly opposes the operation of a large-capacity ferry. The access and harvesting of resources by ferry uses will impact to the environment (from ocean to the mountain) and deplete the resources which belong to the people of the *moku* and island. The resources sustain a lifestyle on the island, and a change in the environment is a change in the lifestyle and their Hawaiian identity, and cannot be mitigated. Feels that an assessment of their culture should be conducted by a cultural practitioner and not by an outsider.
Melvin Kalahiki	Royal Court Assembly, Pu'ukoholā Heiau.		Discussed the role of the Royal Court Assembly and perpetuation of culture through activities at the *heiau*.
Daniel Kawaiaea	Superintendent of the Pu'ukoholā National Historic Site (NHS).	Contacted for references and interviewees.	Provided information of the National Historic Site. Discussed programs and activities, such as the reconstruction of the *heiau* walls, as opportunities for education and perpetuation of cultural practices.
Wendy Machado	State Historic Preservation Office	Contacted for information and references.	Discussed continuing inquiries from the community regarding burials in the area.
Ruby McDonald	Community Resource Coordinator, Office of Hawaiian Affairs.		Letter provided to inform OHA of CIA project and requested a list of recommended interviewees.
Harry Ruddle	Former County Council Member	Contacted for interviewees and information	Provided list of interviewees and background information of Kawaihae village.
Francis Ruddle		Contacted for information about the area.	Grew up in Puakō when the only way to get there was by boat from Kawaihae Bay. Currently uses the inner harbor for mooring. Provided information on boating and fishing activities associated with Kawaihae.
Bob Simms	Organizer of Pua Ka ʻIlima ʻO Kawaihae Cultural Surf Park	Contacted for information on use of harbor.	Discussed concept of the Park and programs, and information on the use of the park and surfing activities, such as the Pua Ka ʻIlima ʻO Kawaihae Cultural Surf Park Long Board Classic competition January or February. The intent is to encourage the use of the park for all types of cultural activities—hula, canoe building, etc.—while promoting tradition of surfing. The waves were the longest in the State. The *aliʻi* surfed there.
Elton Suganuma	Harbor Master, Kawaihae Harbor		Provided information of the harbor and its operation.

8.3 INTERVIEWEES

Table 3 provides a list of interviewees, their affiliation with the project area, and additional comments.

Table 3. Interviewees

NAME	AFFILIATION	COMMENTS
Daniel Kahikina Akaaka, Jr.	Cultural Practitioner and Director of Cultural Affairs at Mauna Lani Resort, Kalahuipuaʻa	Born in Honolulu to father Daniel Kahikina, Sr. and mother Mary Mildred Chong. Hawaiʻi Island has been home for past 30 years.
William Akau	Former Harbor Master of Kawaihae Harbor	Grew up in Kawaihae. His father was also a former Harbor Master of Kawaihae Harbor.
Annie Kahikilani "Lani" Akau		Grew up in Kawaihae. Father from Kawaihae Uka, South Kohala, William Akau. Mother from Makapala, North Kohala, Helen Kahoʻu.
Eddie "Lala" Laʻau		Born in Puakō to parents, Eddie Laʻau, Sr., and Rachel Obata. Grew up in Kawaihae. Father was a fisherman in Kawaihae.
Naomi Kaiamakini Laʻau		Born in Kalaoa, Kona, but raised at Kahua Ranch. When 2-3 years old moved to Kahua Ranch. Father was John Kaimakini; mother was Elizabeth Lincoln.
Martin Ikua Purdy, Sr.		Born on Kauaʻi, and raised on Maui at Ulupalakua Ranch. Worked as a cowboy since age 17. Came to Waimea at 31 to work as a *paniolo* for Parker Ranch (30+ years). Father was Ikua Purdy who was born in Waimea and also worked for Parker Ranch. Mother was Keala Margaret Napuupahee.
Manuel (Manny) Veincent	Coach of the Kawaihae Canoe Club	Born in Hilo, moved to Waimea 40 years ago. Coach of the Kawaihae Canoe Club for 36 years.
Ku Kahakalau *(telephone interview)*	Cultural Practitioner and Director of Kanu o ka ʻĀina New Century Public Charter School (KANU)	

9.0 TRADITIONAL USE AND CULTURAL PRACTICES TODAY

Traditional uses and cultural practices in Kawaihae Harbor and immediate area have been identified through archival research and ethnographic interviews. Following are major themes garnered from research and interviews. An aerial image highlighting the major cultural activity areas of Kawaihae Harbor provided in Figure 7. However, it should be noted that fishing, marine resource gathering, boating, diving, snorkeling, surfing, and other aquatic activities likely take place on nearly all accessible coastal areas to some degree.

9.1 TRADITIONAL VALUES AND ORIENTATION

There is still a strong connection to the land even if Native Hawaiians may not "legally" own the land. The concept of "*mālama ʻāina*" is more than a modern day environmentally correct saying. It is deep rooted in Hawaiian culture. "*ʻāina*" refers to that which "feeds". Traditionally, the welfare and survival of the *ʻohana* depended on the sustainable management of the natural resources of the *ahupuaʻa* in which they lived. The concept of landownership was non-existent, as the land was under the control of the reigning *aliʻi*. Prior to European contact, Hawaiians were stewards of the land. The land did not belong to any individual, but an individual and their *ʻohana* belonged to and had rightful use of the land. Not only did each *ʻohana* have to take care of the land assigned to them, but only that *ʻohana* could use that land. The land was not yours, but through your labor, the fruits of it were yours. So, there was and is a strong ownership of resources. Thus, you often hear people say, "Ask before you take", even of naturally occurring resources on public land but in the vicinity of where they live.

Protection and conservation of resources, particularly the subsistence resources, were practiced by ancient Hawaiians as a means to ensure a continued supply of resources. Traditionally, *kapu* (restricted) periods were declared on harvesting of certain types of fish or *limu* (seaweed) which was fish food to manage the fish population. Management practices were not only those externally imposed, but the day-to-day practice of "take only what you need and leave something for next time" conserved resources. Sharing, exchange and reciprocity of resources which characterized the economic distribution system of the *ahupuaʻa* are still practiced in daily social economic context at Kawaihae.

Kawaihae Harbor also plays into the *mauka-makai ahupuaʻa* concept, as the coastal region of Kawaihae Ahupuaʻa. Its orientation and relationship make it the "beach" or "*makai*" for the large population center of Waimea. Waimea residents frequent Kawaihae for recreational swimming, social gatherings and fishing. Approximately 90% of the fishermen who sell fish to the Kawaihae Fish Market are from Waimea. In addition, Kanu o ka ʻĀina New Century Public Charter School (KANU) maintains a "*makai*" campus in Kawaihae.

Additionally, the presence of a "living" *ahu* located on the southwestern end of the harbor that is currently being used for ceremonies and maintained by contemporary cultural practitioners, suggests that this area maintains its spiritual significance.

9.2 KAWAIHAE: THE SEAPORT

Kawaihae has been a favored harbor since prehistory. Besides being the seaport of chiefs, it was in the past as it is today, an important fishing area and popular recreational venue. The inner harbor is still used by a variety of outrigger canoe and other recreational marine vessels for practice and competition.

Currently, the non-profit organization, Na Kalai Waʻa Moku ʻO Hawaiʻi, conducts educational programs based on traditional knowledge and cultural practices for the community with Hawaiian voyaging and traditional navigation (non-instrument) as its foundation. The central focus of the organization is the double-hulled canoe, Makaliʻi, which is stored in the far southwest corner of Coral Flats near the mouth of Pelekane Bay. The Makaliʻi has made numerous voyages throughout the Hawaiian Islands as well as the Marshall Islands, Micronesia, Guam and Saipan. This celebrated vessel also serves as the primary classroom for Na Kalai Waʻa Moku ʻO Hawaiʻi's educational and cultural programs. Na Kalai Waʻa Moku ʻO Hawaiʻi has had a temporary dry storage permit issued to them for the Makaliʻi by DLNR DOBOR since January, 2008. This temporary permit is intended to only be in place until a new storage facility is completed.

9.3 AN IMPORTANT SOURCE FOR TRADITIONAL SUBSISTENCE

The ocean or marine environmental zones continue to be a significant subsistence resource. Fishing is still extensively practiced. Traditional fishing methods of using currents and landmarks are still being practiced. Further, the traditional knowledge of *koʻa* (fisheries) is used to locate fish and manage the establishment and development of *koʻa* for future harvests. The gathering of marine resources, such as *limu* (seaweed) as well as a wide variety of shellfish, is also an ongoing cultural practice. As evidenced in the archaeological record, these foods have been distributed and/or traded within the *ahupuaʻa* from the coast to the mountains since ancient times.

9.4 AN IMPORTANT LOCALE FOR TRADITIONAL AND CONTEMPORARY RECREATION

Traditional recreational sports have been occurring at Kawaihae from time immemorial. The shoreline or *ko kaha kai* zone still a "living" environment, used by an ancient, but "living" culture. The earliest occupational activities on the leeward side of Hawaiʻi Island, such as marine resource gathering and shoreline or reef fishing along the coastline, are still evident. The *aliʻi* also traditionally lived and worshiped at Pelekāne and Mailekini**.** Kawaihae Harbor continues to be a traditional get-together and recreational location for families of any status.

Kawaihae Harbor has continuously been an important locale for paddling the outrigger canoe, which is a canoe that is of traditional Hawaiian design. Koa is still used for many of these canoes, built using traditional skills from selection to completion. The construction of the canoe is used to educate the paddlers on canoe building and other aspects of Hawaiian culture. Paddling is a means to perpetuate the traditional sport of outrigger canoe racing and to promote the culture. The Kawaihae Canoe Club maintains 15 canoes and has a membership of

approximately 200 paddlers. Paddlers come from Kawaihae, Waimea, Honokaʻa, Waikoloa, and Kohala to the harbor to practice this tradition. Approximately half of the paddlers are of Hawaiian ancestry.

Surfing is also an important cultural activity that currently occurs at Kawaihae. We know from oral and written history, that the *aliʻi* surfed at Kawaihae. Pua Ka ʻIlima ʻO Kawaihae Cultural Surf Park is located at the southwest edge of the outer break of Kawaihae Harbor, where the waves are purported to be the longest surfable waves in the state. The concept of this park is to promote cultural activities at the site, such as hula and canoe building, but primarily is designed to promote the traditional sport of surfing at a traditional surfing site. The Pua Ka ʻIlima Long Board Classic competition is held every January or February. The park has a gratis monthly revocable permit with DLNR DOBOR to use the property.
Kanu o ka ʻĀina New Century Public Charter School (KANU) maintains a "*makai*" campus, Hale Kukui, on the coral flats. The vision of KANU is to expand the school into a comprehensive Native Hawaiian learning center or *kauhale* which can address the educational and cultural needs of all stakeholders "from the womb to the tomb". The school is culturally driven, which means that students learn in a culturally congruent way, how to continue Hawaiʻiʻs native heritage, values and practices, including the native language. The Hale Kukui complex also houses the YMCA Aquatic Center. Here the YMCA of Waimea teaches traditional sports such as canoe paddling and surfing. Further, marine ecology and science instruction is conducted here by the Waimea YMCA as well as traditional crafts and hula. The YMCA has a gratis monthly revocable permit with DLNR DOBOR to use the property, while KANU currently does not have a formal agreement to use the property.

9.5 The Significance of Puʻukoholā

Puʻukoholā continues to be an integral part of traditional Hawaiʻiʻs social, political and religious culture. John Lake, former *kahuna nui* of Puʻukoholā, referred to the *heiau* as "State temple for Hawaiians." The Royal Court Assembly associated with the *heiau* is composed of *aliʻi*, direct descendents of Kamehameha and meet regularly at the *heiau*. That there are more than the usual number of religious structures (Puʻukoholā which Kamehameha built, the previously existing *ahu* attributed to Lonoikamakahiki, Mailekini Heiau, and Hale O Kapuni Heiau) at one location testifies to the prominence and spiritual significance of the site. On-going repairs of damage due to the 15 October 2006 earthquake incorporate traditional methods and techniques of *heiau* wall construction. This activity is being used to educate young Hawaiians on *heiau*, culture and traditional technology.

9.6 The Ala Kaha Kai National Historic Trail

The Ala Kaha Kai National Historic Trail follows the footpaths of ancient fishermen to and from villages and local Hawaiian Kingdom roads. This trail runs parallel to the coast and would have passed through Kawaihae. A segment of the trail, located just southeast of the harbor at Puʻukoholā Heiau National Historic Site, has been made traversable to the public. Use, restoration, and maintenance of the trail is ongoing. The trail, being a remnant of ancient infrastructure that is still used to access cultural resource areas, plays a major role in preserving

cultural practices taking place along the coast. The system also contains a segment of the ancient Ala Loa Trail, which was a major land trail connecting around 600 communities during the 15th-18th centuries.

9.7 Graves and *Iwi Kūpuna*

The State Historical Preservation Office in Hilo indicates that there still are a significant number of people inquiring into ancestral graves in Kawaihae. Historical grave sites are still being attended to by relatives. No burials have been inadvertently discovered in the Kawaihae Harbor area.

10.0 IMPACT ANALYSIS AND ASSESSMENT

The following discussion of potential impacts and analysis is provided based on the results and findings from archival research, interviews (Appendix D), and public meetings (Appendix E).

10.1 Near-term Improvement Components

According to the Hawai'i Island Commercial Harbors 2035 Master Plan Update (DOT-H 2011), a series of near-term improvements have been proposed for Kawaihae Harbor, which are to be addressed in the current Draft Environmental Assessment. Figure 2 provides a map with the proposed near-term improvement components.

10.1.1 Perimeter Road and Small Boat Harbor Land Dedication and Fencing
Land will be dedicated from HDOT Harbors Division to DOBOR for a new access road to the Small Boat Harbor (South) and an approximately 13 acre harbor area. As the Department of Land and Natural Resources/Division of Boating and Ocean Recreation (DLNR/DOBOR) currently operates the Kawaihae Small Boat Harbor (South) located in the southwest corner of Coral Flats, construction activities at the small boat harbor will be independent from the commercial harbor and Coral Flats. However, a new fence will be installed as an element of this project for recreational and public safety.

10.1.2 Improvements to Main Gate and South Gate for Security
Currently, the traffic ingress and egress for Kawaihae Harbor runs through the Main Gate that will need expanding to accommodate queues at security gates. As of now, the South Gate is closed. Following the Harbor district office relocation and Coral Flats area improvements, the South Gate will be reopened. The Kawaihae Harbor access roads are in need of improvements that are being considered as part of the Kawaihae Development Plan.

10.1.3 Grading of Coral Flats for Industrial Lots and/or Storage
Due to the increased demand of the Coral Flats area for activities related to truck staging and stand-by as well as storage, the DOT-H will be grading additional areas to accommodate these needs.

10.1.4 Pier 2A extension and new Pier 2C
Pier 2A is planned to be extended 340 feet to accommodate "future cargo demands and increase berth capacity" (DOT-H 2011). In addition, reconstruction of Pier 2C to expand it an additional 325 feet will allow a maximum of four 400-foot long barges to berth. The proposed expansion of Pier 2C would also require the removal of the DOBOR boat mooring dock located at the south of end of Pier 2B, which the DOBOR plans to relocate to the nearby Kawaihae Small Boat Harbor Facility (South).

Figure 7. Major Cultural Features of Kawaihae Harbor (adapted from Google Earth).

10.1.5 Dredging Activities
According to the Hawai'i Island Commercial Harbors 2035 Master Plan Update (DOT-H 2011), the berthing area fronting Pier 1 and Piers 2A, 2B, 2C will be dredged to improve navigation within the harbor.

10.1.6 Relocation of DOT-Harbors Office and Comfort Station
In addition, the 2035 Master Plan Update states that, "The DOT-Harbors district office will be demolished and rebuilt in new locations. These facilities will be designed to LEED silver standards and with ADA compliance" (DOT-Harbors 2011).

10.1.7 Operations Yard Improvements
Finally, the 2035 Master Plan Update calls for "…standard updates to harbor security facilities, yard lighting, internal roadway circulation, and pavement strengthening for cargo operations" (DOT-Harbors 2011).

10.2 Potential Impacts from Near-term Improvement Components

In general, to mitigate potential impacts from the following construction projects, a consultative body composed of stakeholders and community leaders could be organized as a "cultural compass" and consulted on issues regarding traditional use associated with the harbor to ensure that impacts and restrictions required by construction activities do not obstruct Native Hawaiians or other groups of their rights to traditional practices.

10.2.1 Impacts from Perimeter Fencing Construction
Cultural activity areas on the southern corner of the Coral Flats, the Pelekāne Bay side of the Coral Flats, and the Pu'ukoholā Heiau National Historic Site may be impacted by construction of the proposed perimeter fencing. Impacts include visual disruptions, noise disruptions, ocean access, and/or ocean water quality deterioration.

The Kanu o ka 'Āina New Century Public Charter School (KANU) has a *makai* campus, Hālau Pukui, on the Coral Flats just southeast of the Kawaihae Small Boat Harbor (South)'s East Breakwater. This *makai* curriculum component of KANU plays a vital role in the school's goal in being a comprehensive Native Hawaiian learning center or *kauhale*. The *makai* campus allows KANU to continue traditional Hawaiian cultural practices associated with multiple marine resource areas as described by Handy and Handy (1991:56-57). Furthermore, KANU also uses the area for physical educational and recreational water activities (swimming and diving), as it is considered a preferred location for its water depth and safety reasons. The Hālau Kukui complex is shared with the Waimea YMCA as their Aquatic Center, where recreational activities are scheduled twice a week during the summer. A modern *ahu* (traditional Hawaiian shrine) has also been erected in this area, which serves as a ceremonial and spiritual conduit between cultural practitioners of the area and the divine aspects of land and sea. Typical noises from the construction of roads and fencing could distract children from their teachings and lessen their cultural experience. The noise would also be problematic to those paying their respects, leaving offerings, or wanting to *pule* (pray) at the modern *ahu*. Further, ocean water quality may be affected by unintentional run-off of disturbed sediment, which could obscure visibility during recreational and educational activities of both KANU and YMCA.

As Pu'ukoholā Heiau National Historic Site is located immediately to the southeast of the proposed perimeter fencing, impacts from construction would include audio and visual disturbances to cultural activities occurring at this prominent traditional Hawaiian cultural and religious center. Another potential impact from construction noises and run-off could be the discouragement of sharks from frequenting the submerged *heiau*, Hale o Kapuni, which was created out of reverence for sharks in ancient times. While human sacrifices to the shark deity no longer occur, many cultural practitioners feel that there is a lasting connection between sharks and the *heiau*.

Furthermore, on-shore fishing and marine resource collection is likely occurring along the southeast coast, access to these spots and run-off contamination could also temporarily impact these cultural practices. Another major cultural activity area is the Kawaihae Small Boat Harbor (South), which is a DLNR DOBOR facility that will be constructed, operated, and maintained under the oversight of DOBOR. However, this facility continues to be a cultural activity area used by cultural practitioners such as fishermen and marine resource gatherers, whose resources may be impacted by run-off related to the fence construction.

One way to mitigate the noise and visual impacts from construction of the perimeter fencing could be to create a community relations program that could offer information to the public about construction schedules and create construction schedules that avoid major cultural events. If the fencing should obstruct access to the modern *ahu* or marine resource gathering and fishing areas, this subject should also be discussed by the consultative body of stakeholders and community leaders. Public notices could also be provided to notify cultural practitioners of alternative marine resource areas are. To address the potential for water quality being impacted by run-off, which would in turn, impact a variety of aquatic activities and marine resources, developers contracted to perform this work should prepare a comprehensive erosion and sediment control (ESC) plan prior to sediment-disturbing activities.

10.2.2 Impacts from Improvements to Main Gate and South Gate for Security
As with the proposed entry connection component, the Main Gate security improvements will only impact cultural activities if an alternative entry is not provided. As the South Gate is not open to the public, construction of the security gate should pose no threat to cultural activities. However, construction of security elements of the South Gate would best be performed in tandem with the Perimeter Road fencing improvements to serve as a complete entry way and access road to the outer areas of the Coral Flats, as this expanse of coastline provides numerous cultural activity and resource areas. After the South Gate and Perimeter Road are completed, improvements to the Main Gate would have little effect on cultural practices.

10.2.3 Impacts from the Grading of Coral Flats for Industrial Lots and/or Storage
Cultural resource and activity areas have not been identified in the central Coral Flats area, yet many have been identified along its southern edges. Care should be taken to avoid cutting off access to the Pua Ka 'Ilima 'O Kawaihae Cultural Surf Park, the Waimea Family YMCA Aquatic Center, Na Kalai Wa'a Moku 'O Hawai'i's temporary storage location for the Makali'i, Kanu o ka 'Āina's Hālau Pukui, Kawaihae Small Boat Harbor (South), and marine resource gathering locations situated on the outer edge of the Coral Flats along pacific side of the main breakwater. This area is already a popular surfing locale that holds the annual Tiger Long Board Classic surf

competition and fund raisers to construct a cultural center and park for swimmers, divers, fishermen, sailors and/or surfers. Neighboring this park is the Waimea Family YMCA Aquatic center, which is an important locale for water sports and recreation. This area is also home to several traditional Hawaiian educational facilities, including Na Kalai Waʻa Moku ʻO Hawaiʻi's Makaliʻi and Kanu o ka ʻĀina's Hālau Pukui. Furthermore, the area contains the Kawaihae Small Boat Harbor (South) and numerous marine resource gathering locations. If the current access route is cut off, an alternate route should be provided during the construction of these near-term improvement components. Again, the potential for water quality being impacted by run-off is always a concern when ground disturbing activities are carried out, such as grading. The run-off, if allowed to enter the marine environment would impact a variety of aquatic activities and marine resources. Therefore, developers contracted to perform this work should prepare a comprehensive erosion and sediment control (ESC) plan prior to sediment-disturbing activities.

10.2.4 Impacts from Pier 2A extension and new Pier 2C

Pier 2 is in a secured area, and while the public can get to this area, it is only for harbors business. The proposed extension of Pier 2 towards the Kawaihae Small Boat Harbor North and the inner Deep Draft Harbor basin poses little to no threat to cultural practices. However, increase in the size and number of cargo barges may impact the use of the harbor by small boats that currently moor there. Many of these boats are used for recreation, yet, there are some who may depend on the ocean for traditional sustenance and/or business. Should the Pier 2A extension component be initiated, impacts to cultural uses of the inner harbor may occur, as navigation through the harbor's opening will be more hazardous with the arrival and departure of more high-capacity barges berthing at the extended Pier 2A.

The Pier 2C Extension is proposed for the current location of a small craft "dinghy dock" (running parallel to the revetment) and a "finger pier" or "boat dock" (running perpendicular) in the southeast corner of the inner harbor which is heavily used by fishermen and recreational boaters. Canoe clubs currently utilize the inner harbor during practices and regattas. If the inner harbor is no longer available, paddlers may need to utilize the open ocean. Further, as with the Pier 2A Extension, the addition of Pier 2C Extension will usher in more high-capacity barges, increasing the danger of capsizing for paddlers and boaters utilizing the inner harbor. Given the dangers that accompany these near-term improvements, the best way to mitigate the potential displacement of such a large number of small boat users is to encourage and support DLNR DOBOR in their efforts to complete the Kawaihae Small Boat Harbor (South) before these improvements are initiated, to ensure that enough space for safe traffic and affordable mooring is available for the displaced inner harbor boaters. However, DOT-H has no direct control over the development of the Kawaihae Small Boat Harbor (South), but, DOT-H acknowledges that it is preferable to complete the Small Boat Harbor (South) facilities prior to the near-term improvements to avoid impacts to cultural practices currently occurring in the inner harbor. In conclusion, impacts to boating and/or fishing are likely if the Small Boat Harbor (South) is not completed prior to building the Pier 2C Extension as an alternate launching and berthing area. Furthermore, paddling activities will also be impacted with the increase of large vessel traffic.

10.2.5 Impacts from Dredging Activities

Similar to the Pier 2A and 2C extensions, fishing and small boat activities will be impacted from maintenance dredging occurring in front of the existing piers. The area referred to as "the

swale" by locals, will be blocked from the interior harbor by the dredging area, hindering the movement of fish as well as boat traffic to and from the interior harbor to this locale (Figures 2 and 7). Fishing is a popular cultural activity in the swale area, especially when *oama* or juvenile *weke* (Mullidae spp.) and *halalū* or juvenile *akule* (*Trachurops crumenophthalmus*) are in season. Furthermore, there may be an impact on Puʻukoholā Heiau. The threat to Puʻukoholā during the dredging construction phase of the drilling and blasting has been considered in the Final Environmental Impact Statement for Hawaiʻi Commercial Harbors 2020 Master Plan (Towill 2001). The drilling and blasting activities will result in noise and vibration that could affect the rock walls of the nearby *heiau* — Puʻukoholā, Mailekini, and Hale O Kapuni. Towill (2001) proposes the following mitigation measures to address the noise and vibration threat to Puʻukoholā Heiau:

> Under the 2020 Master Plan, Harbors Division will retain the current buffer zone between the Puʻukoholā Heiau National Historic Site and the Kawaihae Harbor…Risk of vibrations from pile driving and/or blasting posed to nearby Puukohola will be evaluated during the design phase. If the risk is determined to be prohibitive, alternative methods will be considered for dredging and pier construction [such as drilling]…Technologies that would be considered as an alternative to blasting at Kawaihae Harbor during the dredging process are the use of cutterheads, drag line operations or roadcutters, to dredge designated areas. Other alternatives to blasting, such as technology using pre-drilling and expansion gels to split rock, will also be evaluated" (Towill 2001:4-14).

As previously stated, cultural activities related to boating in the inner harbor can be protected if the Kawaihae Small Boat Harbor (South) as an alternate boating location is completed before dredging begins.

10.2.6 Impacts from the Relocation of DOT-H Hawai'i District Office and Comfort Station

No cultural resources or activity areas were identified for these components of the near-term improvements project. However, if new comfort stations are to replace existing comfort stations, the new comfort stations should be completed prior to the closure of existing comfort stations to prevent the contamination of cultural and natural resource areas with human effluent.

10.2.7 Impacts from Operations Yard Improvements

As these proposed improvements appear small in scale, though ubiquitous throughout the project area, there appears to be no cultural activity areas that will be impacted.

11.0 CONCLUSION

This CIA is designed to promote and protect cultural beliefs, practices, and resources of Native Hawaiians, other ethnic groups, as well as other collective groups associated with the subject area under Chapter 343 HRS, and Act 50, SLH 2000 (OEQC 2011: 3-4). Further, OEQC guidelines state that types of cultural practices and beliefs may include those relating to subsistence, commercial, residential, agricultural, access-related, recreational, as well as religion and spirituality. Mitigation measures have been proposed, which include the establishment of a consultative body to ensure the measures are appropriate and acceptable.

There is minimal concern of any impacts associated with the Main and South Gate improvements, grading of Coral Flats, relocation of the DOT-Harbors office and comfort station, or operations yard improvements at this time.

However, several impacts have been identified with the construction of perimeter fencing, Pier 2A extension, and Pier 2C, as well as the dredging of the Kawaihae Deep Draft Harbor, also known as the inner harbor.

As the South Gate improvements are designed to improve access for cultural practitioners and recreationists to the outer coast of the harbor, construction related impacts would be tolerable if mitigated properly. However, proposed improvements to the inner harbor, including Pier improvements and dredging, are designed to expand and enrich commercial use rather than cultural use of the inner harbor. Perhaps, in terms of public safety, these improvements benefit the community by protecting them from potential dangers related to commercial and military activities occurring within the inner harbor. Nonetheless, in order to protect current cultural resources and practices associated with Kawaihae Harbor, it is crucial that access to comparable activity areas be provided to the public before these projects are initiated.

A formal "town hall" style meeting with stakeholders would be a good way to dispel misconceptions and begin a healthy discourse regarding the proposed project. Further, the proposed establishment of a consultative body would serve as a "cultural compass" and would ensure the implementation of appropriate mitigation measures to minimize any impacts, particularly those concerning traditional cultural practices.

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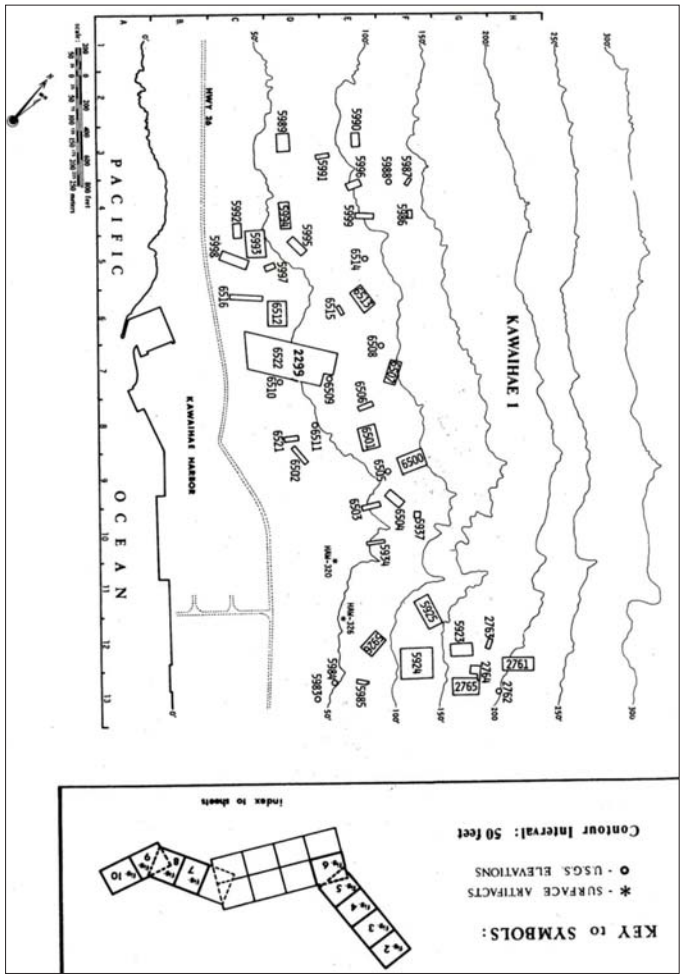
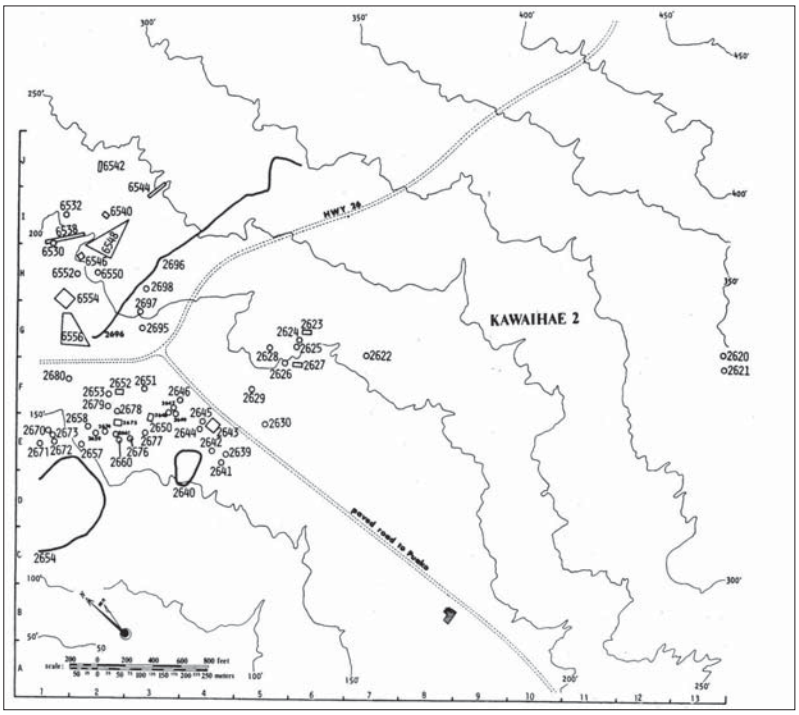
APPENDIX A

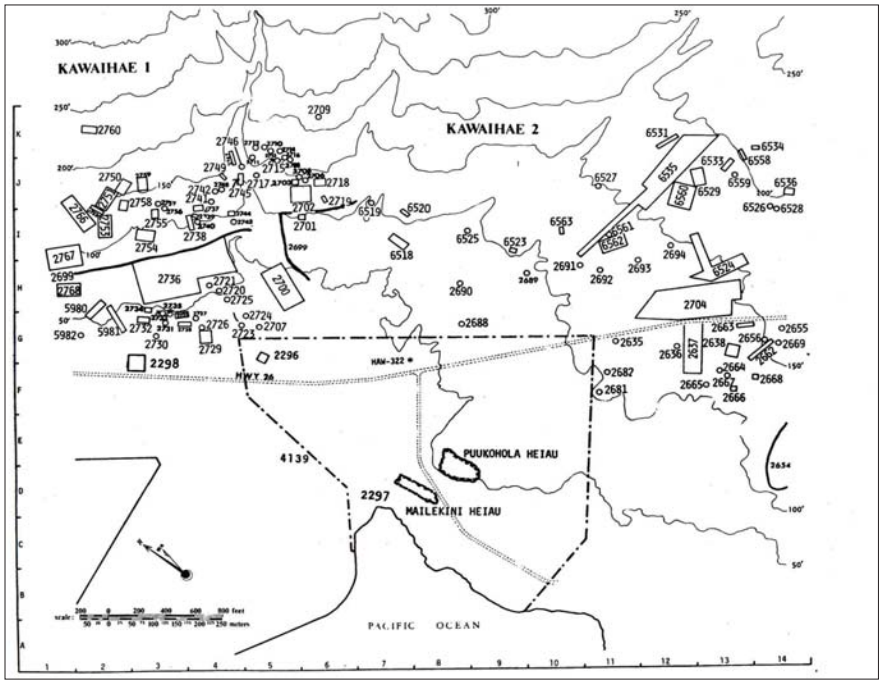
SELECTED MAPS IDENTIFYING ARCHAEOLOGICAL SITES (FROM BARRERA 1974:5-7)



Location of sites in Kawaihae 1 (Contours show elevation above mean sea level.).



Location of sites in Kawaihae 2 (Contours show elevation above mean sea level.).



Location of sites in Kawaihae 1 and 2 (Contours show elevation above mean sea level.).

APPENDIX B

QUESTIONNAIRE FOR KAWAIHAE HARBOR DEVELOPMENT CULTURAL IMPACT ASSESSMENT

QUESTIONNAIRE FOR KAWAIHAE HARBOR DEVELOPMENT CULTURAL IMPACT ASSESSMENT

Name: Birth Name:
Birth Date: Birth Place:
If not born here, when did you move here?
Current Address:
Where did you grow up?
Parents:

What is your relationship to the area?

How familiar are you of the subject area?

What is this area called (What do you call this area)?

What are the physical characteristics of the area?

Any significant or special features in this area as it related to land use and/or history?

How was the area used by the people?

Land Use:

What kinds of activities have you observed in the area?

Activities	What	Season	Who
Hunt			
Gather			
Habitation			
Ceremonial (Burials)			
Agriculture			

Intensity of land and/or resource use?

What have you heard of this area?

Have you observed land/resource modification in the area? Why?

What are your thoughts about the project proposal?

APPENDIX C

PERSONAL RELEASE OF INTERVIEW INFORMATION

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Kawaihae Harbor Development CIA

Date of Interview: June 14, 2008

I, Daniel Akaka, Jr., have been interviewed by Betty Fielder of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this document is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Interviewee Signature

7/17/08
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Kawaihae Harbor Development CIA

Date of Interview: June 6, 2008

I, Annie Kahikilani Akau, have been interviewed by Betty Fielder of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this document is accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Annie K. Akau
Interviewee Signature

27 July 2008
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Kawaihae Harbor Development CIA

Date of Interview: May 14, 2008

I, William Akau, have been interviewed by Betty Fielder of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this document is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

William Akau
Interviewee Signature

17 July 2008
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Kawaihae Harbor Development CIA

Date of Interview: June 24, 2008 via Telephone

I, Kū Kahakalau, have been interviewed by Betty Fielder of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this document is accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:
Please note the correction on 1st page - Should be Kukui - as indicated. Also, an (') in front of ohw.

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Interviewee Signature

7/22/08
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Kawaihae Harbor Development CIA

Date of Interview: May 13, 2008

I, Eddie Laau, have been interviewed by Betty Fielder of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this document is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Edward Laau
Interviewee Signature

7/17/08
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Kawaihae Harbor Development CIA

Date of Interview: May 16, 2008

I, Naomi Laau, have been interviewed by Betty Fielder of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this document is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Interviewee Signature

7/17/08
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Kawaihae Harbor Development CIA

Date of Interview: June 13, 2008

I, Martin Ikua Purdy, Sr, have been interviewed by Betty Fielder of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this document is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Martin P Purdy Sr
Interviewee Signature

7-17-08
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Kawaihae Harbor Development CIA

Date of Interview: May 14, 2008

I, Manny Veincent, have been interviewed by Betty Fielder of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this document is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Manny Veincent
Interviewee Signature

July 17, 2008
Date

APPENDIX D

INTERVIEWS

DANIEL KAHIKINA AKAKA, JR.
Cultural Practitioner and Director of Cultural Affairs at Mauna Lani Resort

Born in Honolulu to father Daniel Kahikina Akaka, Sr., and mother Mary Mildred Chong. Hawai'i Island has been home for past 30 years.

First stayed at a cottage at Kalahuipua'a in 1972 as a UH student. The Kihei family that lived down here worked for Tokyu Corp. maintaining the ponds. This became something of an outdoor classroom … working with this old couple who spoke mainly in the Hawaiian language and shared stories of the area.

Many of the *kūpuna* of the area were still around and it was an opportunity to have them share their knowledge of the area. Try to bring those things out to educate people of the value of this area. Many of the things may be gone, but, it's still an important part of the place.

Kawaihae is one of those areas which has gone through many changes over time—the *pā honu* are not there, the *poho pa'akai* are not there, the old houses and ponds are not there, most of the area was filled in, the island of Puakailima is no longer there. A lot of things are gone, but the memories remain.

We often think of how things used to be. Although we live in a time of change, we still maintain a sense of respect. Today the opportunity to share thoughts of the land hopefully will help people gain more respect for the place. Share things we grew up with, you "*mālama* the *'āina* the *'āina* will *mālama* you". *'Āina* refers to "that which feeds", so if you take care of that, the *'āina* will give back to you. Never abuse the place, always need to take care of it.

In an earlier time land "ownership" was not thought of, it was a foreign concept. In time the Hawaiians did not get the land that was rightfully theirs, and lost it through adverse possession and other ways. But, yet, they still have that strong connection to the land. So, we would hope that the people that come here to live would treat it with respect and look at it as a gift, a place to cherish. So if you must change it try not to change it to the point that it looks so different. Look at what nature has given to you and work within the parameters you have so you don't cover up and erase everything. Keep the things that are important. And if there are cultural sites, *mālama* those sites. Sometimes there's *iwi* resting there, sometimes there's *ki'i pōhaku*, whatever there might be…that's a valuable part of the past. If you were honored and destined to have this, then you need to take care of it.

Things change, and the present generation should try and help steer the change so we don't go to the far end. We have the opportunity to pass on the knowledge and to help and guide the progress/process.

In change, we should be considered as a "cultural compass." And, we should look for the balance. Things will come around, usually to make things right.

Twilight at Kalahuipua'a is an opportunity to share history and culture through song and music. The program is spontaneous and the invited special guests and *kūpuna* talk about how it was growing up in Hawai'i and share their stories.

The Hawaiians of this area had intimate knowledge of the area, all the names, all the things that existed here, the best fishing spots, the times to go to get certain things—for example, *he'e*. Understood that everything had its place and everything was important. You always ask before you take and you always respect, always give back in some way.

Whatever we do today will affect the future. Ancient way of planning…whatever you produce or do to save the natural resources, you think seven generations ahead…what is done today should provide for seven generations ahead. Think about the impact down the line. How will it affect the surrounding areas, the coast and the fishing, for example.

The community can be a partner in the development. Consult local people and seek their advice, because they have longevity here and know the area intimately. Ask for community input. (Such as a Community Cultural Advisor Group.)

Hawaiians didn't do anything without a reason. They didn't waste their motion. There was purpose in everything. That's why when you see something, it was placed there for a reason. (Pu'ukoholā was built there for a reason.)

Regarding the Superferry:
1. Concerned about the convenience of access to the natural resources by people coming in from where they don't have those resources anymore. We understand the very the fragile nature of the resources. We see it already with people who throw net and take even the young fish, or when they try to catch mullet when off-season. People who might not respect the areas will impact the food gathering resources.

   a. Management/regulation enforcement should be initiated to limit catch or harvest.

   b. Education program should be implemented. The superferry has an opportunity to create the understanding of respect. It can be done in a gentle Hawaiian way as to impart the message to *mālama* and soften the impact of the areas.

2. Transporting of harmful alien species. For example, Big Island honey bee population could be threatened by the importation of parasites. Think about it ahead of time. Save and protect things here and prevent importation of harmful things and species.

WILLIAM AKAU

Born and raised in Kawaihae. Former Harbor Master of Kawaihae Harbor, as was his father before him.

Kawaihae beach stretched from the small boat harbor to the heiau. Every year, families from all over would come to Kawaihae beach to picnic and play games.

Younger years, fish all along the coast down to Kona and even to South Point. But, did a lot of shoreline and reef fishing, as well--spearing (*kole*) and net fishing. Also, *hukilau*. *Limu* grew in Pelekāne area where the fresh water used to run. There were a lot of crabs. Raised pigs, mules, and chicken (Leghorn) all along the beach.

Kawaihae had coconut trees. Mango trees were on the other side of Spencer Park and up *mauka*.

Kawaihae Uka was the farm area. Cattle ranching replaced the farms. The *mauka-makai* trails are not used today. These are historical trails and should have markers so people will know. In ancient times, during the winter months, Waipiʻo was rainy and not much to do, so the *aliʻi* would walk the trails and come to Kawaihae. Mailekini was a temporary camp.

Behind great grandfather's house there were 4 fishponds. Every year, the young *pua-ʻawaʻa*, mullet were caught by net in Pelekāne Bay. The *pua* were counted and placed in the ponds to raise 'til a certain size. Then they were transplanted to the ponds at Anaehoomalu. Every year they were harvested for the Parker Ranch party.

The Kawaihae fishponds were the old salt pans.

Pelekāne is getting shallow because of the silt building up in it. This is due to the harbor which was constructed and blocked the natural current of the area. Now the small fish do not have a safe place to grow up. What they should do is cut a channel through the harbor. If they open it up, the fish will come back.

The current comes in from the south and goes north along the shore line. The harbor blocks the flow of the current and it can't clean the bay and bring in new sand. Even Spencer Beach before had white sand, now it is getting dirty.

Before Mother Nature took care of things. When you disturb Mother Nature, you have to do something. In this case, open a channel to improve the flow of water. Improve the beach for the kids. It is important for children to have good things in their life growing up.

Participate at Puʻukoholā in an advisory capacity now.

Regarding the Superferry:

1. Travel between islands used to be with ships. Then the airlines came in and we flew between islands. Now, we have a choice if we want to go by sea or by air.(Before, we had no choice—first it was by boat, then when the airplanes came, the boat went out of business, so we had no choice but to fly).
2. It should be the responsibility of the State and County to regulate the harvesting of natural resources. The ferry is to transport you and your family, and maybe your car, but not to take freight or cargo in your car.

ANNIE KAHIKILANI (LANI) AKAU

Father, William Akau, from Kawaihae-Uka, South Kohala. Mother, Helen Kahoʻu, from Makapala, North Kohala.

Site visitation to harbor and Puʻukoholā.

Not much vegetable were grown in Kawaihae. Some sweet potato was grown. People *mauka* (Waimea) would bring down vegetables. For example, when the farmers got through working, they would come down to catch *namako*. They wanted to go to Mauna Lani, that's what they call it now, but that's Kalahuipuaʻa. They would ask my father if they can go in there, because my father had a key—he was harbor master and post master. When *pau* they would return the key. They would all bring down some vegetable - bag of cabbage, lettuce, diakon, gobo - half bag this and half bag that.

We couldn't eat all the vegetables, so it was shared with the people at Kawaihae. We were all one big family - Hawaiians, Japanese, Chinese, Filipino, Korean, Portuguese. We give and they give back. We don't buy, we barter. It was the way of life.

At times we would call one of my father's first cousins to come from Kohala and pick up fish for the family. And, when they have *limu kohu* they would bring for my father. All cleaned ready for eat.

Kamehameha came to Puʻukoholā because his *kahuna* Kapouʻahi told him "you build a *heiau* for your god Kukaʻilimoku. That is why it was built here in 1791. There is an *ahu* in this *heiau*. The *ahu* is still there. It belongs to Lono – Lonoikamakahiki. He built in 1540.

Enter the temple? Just be careful. When you die your bones go to the earth, but your spirit go to heaven. The good spirits are not going to hurt you, because when they were here they did not hurt people. The bad spirits, yes.

Kamehameha used to sit here on the side of the hill on the stone chair and watch the sharks come into Pelekāne Bay. Inside the bay is Hale-o-Kapuni, where the sharks come. So Kamehameha would be right here and pick up the sharks and break their backs over his knee. That was his game.

Pelekāne is where the ships used to come in because this is where Kamehameha was. Mailekini used to have thatched roof. That's where people used to stay. Later, Kamehameha turned it into place where his warriors could practice.

The path below Mailekini is part of the old trail. The trail goes past the *heiau* and down across to Spencer Park and Ohaiula Beach.

The harbor construction began in 1953. They dredged the coral and used it to fill in the bay to build the harbor and blocked up one-end of the bay. They disturbed the area. They blocked the currents and the water cannot pass through.
Pelekāne Bay used to be where the fish came in to spawn. Not anymore. Pelekāne is silted

because the currents do not flow through to clean and circulate the water. The ocean water outside the bay is much cleaner than the water inside Pelekāne Bay. The scientists are telling us that there's no more fish out there—big fishes in the ocean. Because the fish no longer come in to spawn at Pelekāne.

We used to catch the *pua*-fingerlings at Pelekāne to raise in the fishponds behind my great grandfather's house. When they got bigger, we would take them to the fishponds at Anaehoomalu and Kalahuipuaʻa.

There were about 13 kinds of *limu* over here at Pelekāne. Now there's none. The only *limu* we did not have was *limu kohu*. *Limu kohu* was found in Kohala, because it needs rough water. We used to come on the boat from Kawaihae side through Pelekāne, because the channel was here. When the waves were really big you come in from where the pavilion is at Spencer and come along the coast and come straight into Pelekāne. Now, the coast is silted. We went fishing almost every day in the summer.

There is a well that is called Kawaihae. It is close to the intersection of the Kawaihae and Akoni Pule Highway, where the big anchor is at the junction.

Kawaihae is a place for family. My great grandfather lived here. Isaac Davis, grandson married the twin of my great grandmother. My grandmother's mother's name was Kamakaehukaiopuapoai. And, Tutu Anna's mother's name was Punohuulaokekai. All the names had something about the ocean. Because they depended on the ocean.

On the makai side of the Queen Kaʻahumanu Highway are stone walled square structures--these were for animals. During the day, the animals were let free to graze. (Indicated that there were family graves in the vicinity.)

Regarding Pier 4: That is the only place open for swimming. That should be reserved for the families and *keikis* for them to enjoy. Kawaihae was used by everybody from all over the island to enjoy.

Regarding the Superferry: Concerned that people will come from other islands and horde the resources, such as *limu*, *ʻopihi*, etc. It is like coming to your house to steal from you. Resources should be taken only as needed and left for another time or other people, not horded.

Strongly feels that a channel should be constructed through the coral flats, but closer the water's edge to open it up and allow for the flow of water west to south. Then the currents can clean Pelekāne and the coast line down to Spencer Park and Ohaiula Beach.

KŪ KAHAKALAU
Director of KANU O KA ʻĀINA NEW CENTURY PUBLIC CHARTER SCHOOL (KANU) and a cultural practitioner.

Halau Kukui in Kawaihae is the school's makai campus. Various curriculum subjects are taught at the site—math, science, P.E. Students also work on a variety of projects relating to the ocean and the shoreline.

An *ahu* is located at Halau Pukui. It is a living *ahu*, meaning that it is being taken care of and used in the conduct of various ceremonies as part of the cultural curriculum (such as the annual Makahiki activities) or by the public. The entire school participates in the Makahiki. Traditional water sports are part of the celebration.

Makahiki festivities start at the ocean, because Lono comes from the ocean, and proceeds mauka to Waimea.

Significance of the area: Being in direct alignment with Puʻukoholā, it is a cultural and spiritual powerful area.

Regarding the harbor development plans: Feels very strongly that any changes to the harbor will be detrimental to the environment — not seen anything positive from the construction of the harbor. Dramatic changes with the fish population and reef over the years and it's not getting better.

The harbor is used by lots of families as it is a preferred spot for swimming, fishing and picnics. Directly impact on the rights of native people. Restricts access to the ocean to practice customary spiritual, ceremonial and fishing activities.

Regarding the Superferry: Strongly against the operation. We have already seen the impact of non-Hawaiʻi residents when they come to the island and indiscriminately harvest the island's resources. Many on the island are subsistence farmers, fishermen and hunters. We should be working for island sustainability. Hawaiʻi island sustainable resources have to be protected — *mālama ʻāina*. We will be encouraging the opposite with the superferry.

From the KANU web site as reference to telephone interview:

- MISSION: A culturally-driven, family-oriented and community-based model of education. As a result, the community and the surrounding environment become our living learning laboratories, where students and community work together to create a future that is *pono* — everything that is good and right from a Hawaiian perspective.
- VISION: The vision of KANU is to expand our quality K-12, standards-based charter school into a comprehensive Native Hawaiian learning center or *kauhale* which can address the educational and cultural needs of all stakeholders from the womb to the tomb.
- BELIEFS: KANU is based on the following beliefs:

- Hawaiian knowledge structure differs significantly from the Western system of education. As an indigenous people, Hawaiians have the right to design and control our own education.
- Hawaiian students can succeed in the 21st century without having to give up their Hawaiian cultural values and traditions.
- When Hawaiian culture, language and values are incorporated into the pedagogical process at all levels, education has its deepest relevance and meaning for Hawaiian children. As a result, students are able to learn, to grow and to excel both in the academic setting and in life.
- The integration of the natural environment into a quality Hawaiian curriculum is absolutely essential.

Culturally driven — this means that students learn in a culturally congruent way, how to continue Hawaiʻi's native heritage, values and practices, including our native language, into the next millennium. In addition, KANU's educational foundations including curriculum and instruction, assessment, epistemology, school structure and other facets are aligned with Hawaiian values, which have guided our behavior for centuries. Some of these culturally driven foundations of KANU include:

- Promotion of the use of Hawaiian language at all age levels.
- A formal and informal system guided by Hawaiian values.
- Strong familial relationships and family involvement, especially utilization of the essential wisdom of elders in the education process.
- Inclusion of Hawaiian protocol and traditional spirituality.
- An educational environment that recognizes, respects and promotes Hawaiian values, ideologies and philosophies.
- Instruction and assessment tailored to Native learning styles and multiple intelligences.
- Traditional Hawaiian educational methods such as interdisciplinary and interactive education, hands-on activities, project based learning, aural/oral learning, multi-age grouping etc. that appeal to native students.
- A strong integration of the natural environment, the Native community and Native concerns into daily learning.
- Emphasis on academic rigor based on traditionally valued personal and collective excellence.
- An ongoing culturally appropriate and sensitive professional development component for all staff.
- An in depth research and evaluation process founded on Indigenous research methodologies.

EDDIE (LALA) LA'AU

Born in Puakō.

Married Naomi Kaiamakini, originally from Kalaoa, Kona, but raised at Kahua Ranch.

Father: Eddie La'au
Mother: Rachel Obata (*hānai* to La'au). Lived 'til 90.
Grandmother: Annie Martinson
Step Grandfather: Jack Paula

Lived right on the beach, on the sand. Neighbor was Nakazawa.

Livelihood activity for the village was fishing.

The sampans were built by Matsumoto in Kawaihae.

Fished mostly for *aku*, *'ōpelu*, and bottom fish — *onaga*, *'ōpakapaka*, *uku*.

Aku was fished in the summer, *'ōpelu* and bottom fish in the winter. *Nehu* was used for bait to catch *aku*. Catch the *nehu* with net at the beach (Pelekāne).

Sold to fish peddlers. The fish peddlers trucks with ice would be waiting on the beach.

'Ōpelu fishing is a dying art. Use net to fish *'ōpelu*. Catch of 300-500 up to 700lb of *'ōpelu*. Dried and delivered.

Bottom fishing is done with hand line.

The Hawaiian way of fishing-use of currents and landmarks (mountains, rivers).

Have knowledge of *ko'a* (fisheries).

Reef fishing was for the home consumption.

Gathered *limu*, *'opihi*.

Hunt for pig, birds (dove), goats.

Village had coconut trees and mango trees.

Doi's had watermelon patch and piggery.

Grave sites: Chinese/Japanese/Hawaiian

Favor the ferry. Don't like to fly. But, concerned that people may use the ferry to come to fish and gather resources (like *'opihi*) for commercial purposes.

NAOMI KAIAMAKINI LA'AU

Born in Kalaoa, North Kona, but raised at Kahua Ranch, Kawaihae, South Kohala. When 2-3 years old moved to Kahua Ranch.

Father was John Kaiamakini; mother was Elizabeth Lincoln.

Served in the Army 4 years. Married Eddie La'au in 1958 and moved to O'ahu for 5 years. Moved to Kawaihae in 1962. The La'au house was across the street from the fish market. Eddie's father did *aku* fishing. He had Filipino hired men to work on the boat. Behind the fish market were houses where the Filipino families lived (that was the Filipino camp).

Mounds in the back of the fish store are believed to be graves. Surveyed the mounds along with her father-in-law with people from the Bishop Museum who indicated that one of the sites may be the grave of Macy. (Pictures of her and her father-in-law next to these mounds are in Marion Kelly's 1974 Historical Survey of the Waimea to Kawaihae Road Corridor, Bishop Museum).

The ocean water used come right up to where the road is below the shopping complex.

Remembers coming down to visit relatives (uncle and family) who lived on the sand. The beach was on the Spencer Park side of the bay. That's were a lot of the houses in Kawaihae were located. Came down from the ranch during the weekend to stay with relatives.

In the morning the aunty would go out on the sand all the way out to where the breakwater is now. She would go out during low tide and would walk out as far as the breakwater. She would go out early in the morning just before the sun rises to catch crabs. That's what was for breakfast — with *poi*. Looked forward to that every weekend.

Relatives from Kawaihae are Louie Tavares and children, his wife was an Akau. He and dad and Bill Akau are all second cousins.

The road from Kahua Ranch to Kawaihae was dirt road. It was the path the cowboys used to bring down the cattle for shipping. Dad used to haul molasses for the cattle, and I used to come down with the truck with him.

There was a hall in the front of where the fish market is now. The building was called Polihale — the house of gathering. It was a house where people could get together. The people from the mountain would gather in the house and exchange food. The people from the mountain would bring taro, potato, vegetables and the fishermen would bring in fish. This place is called Polihale because of that.

When horseback riding while living in Kahua, saw evidence of settlements—stone walls, enclosures. Of the enclosures, the old ranch hands would say this or that family used to live there.

The majority of people in Kawaihae were fishermen. Mostly, canoes at that time, eventually the outboard came in.

There used to have ʻ*ele*ʻ*ele* and *waewaeole limu* by Mailekini. Not anymore, because of the silting. Brother used to gather for consumption. ʻ*A*ʻ*ama* crab used to be plentiful, not anymore. There were not as many *kiawe* trees, in pictures of the old Kawaihae you don't see any *kiawe*, only coconut trees.

MARTIN IKUA PURDY, SR.

Wife Doris Johnson Purdy and son Leslie Purdy participated in the interview.

Born on Kauai, and raised on Maui at ʻUlupalakua Ranch. Worked as a cowboy since age 17. Came to Waimea at 31 to work as a *paniolo* for Parker Ranch and for 30+ years.

Father was Ikua Purdy who was born in Waimea and also worked for Parker Ranch. Mother was Keala Margaret Napuupahee.

Drove cattle down to Kawaihae and out to the ships. They left with the herd before sunrise from Waimea. He rode up front at times to warn oncoming cars of the cattle herd on the road. Sometimes, the cars did not stop because they thought they would be held-up and caused the cattle to scatter and they had to chase them and round them up.

Down at Kawaihae three of the *paniolo* would drive about 10 cattle at a time into the water and out to the ship.

Took the family down to Kawaihae almost every weekend (leave Friday, come back Sunday). Usually, camped at Spencer Park or the Parker Ranch Beach (Mauna Kea Beach). Would walk the shoreline with sons and throw-net, gather salt and ʻ*opihi*. What was caught was what was eaten while at the beach.

Now, son Leslie takes his family from Waimea to Spencer or the small boat harbor at Kawaihae for the day of swimming and fishing. Laments the fact that areas to camp, fish, and swim are getting increasingly less and difficult to access.

Regarding the ferry: In a way it will be like the old times with the ocean transportation.

MANUEL (MANNY) VEINCENT

Born in Hilo, moved to Waimea 40 years ago.

36 years as coach of the Kawaihae Canoe Club. The club maintains 15 canoes (two of which are koa canoes) and has a membership of approximately 200 paddlers. Approximately 3,000 paddlers have been coached during the 36 years.

The paddlers come from Kawaihae, Waimea, Honoka'a, Waikoloa, and Kohala. Approximately half of the paddlers are of Hawaiian ancestry.

Responsible for the building of the koa canoes. Spent a week in the koa forest to select the tree in the Hawaiian tradition of assess the qualities of the tree. Hawaiian ritual blessing and ceremony were observed in felling and building the canoes. Uses the construction of the canoe as a tool to educate the paddlers on canoe building and other aspects of Hawaiian culture. Two *koa* canoes were lost in the 1982 hurricane.

Teaches the cultural aspect of the canoe and paddling. Impart Hawaiian traditional values to paddlers as well—discipline and respect for the land and ocean. Learned about Hawaiian traditions from parents and grandparents.

Teaches canoeing to Hawaiian Preparatory Academy and Kanu o ka 'Āina students in addition to club paddlers. Paddlers are taught to respect the canoe in minute detail. All paddlers know how to rig the canoe in the traditional manner.

The outrigger canoe is historically Hawaiian. The design is traditionally Hawaiian. It moves with the sea and doesn't resist it.

Paddling is a means to perpetuate the traditional sport of out rigger canoe racing and to promote the culture.

Regarding the Superferry:

1. Concerned about the possibility of increased homeless. The ferry may encourage the homeless to move to the Big Island, especially to the Kawaihae area. This would increase use of resources and may increase crime rate. The canoe club has been at Honouli Beach for 36 years and have had no problems with their equipment being stored in the open on the beach. It has been a *pu'uhonua*, refuge or safe haven.

2. Concerned about possible regulations which may be imposed on the club. They launch from the mouth of the bay, close to Pier 1. What distance do they have to maintain from the ferry. Is there a buffer zone regulation.

APPENDIX E

INPUT FROM PUBLIC MEETINGS ON THE PROPOSED STATE-WIDE SUPERFERRY

Response	Comments
Kona	I have a few pros and cons to state on this issue. Pro: include cost effective traveling for local travelers and families. For our vehicles to travel with us to Oahu without cost of a rental car. As far as socioeconomics crime and drug trafficking need to be regulated. No Drugs! In Hawaii! Cons: Parking and vehicle routes need to be drafted to regulate traffic overflow and not to affect our near Kawaihae (Puʻukoholā) heiau preservations and finally how will the Superferry operation manage overflow and cancellation of our traveler and their safety.
Kona	I do not care what these people say - But I agree in having the Superferry run. Because I think it really helps families in taking their cars with them instead of renting a car. I think it is good to have the ferry run in Kawaihae - go - go - go *** Good-Luck
Kona	Hawaii Superferry's Whale Avoidance Policy relies primarily on night vision binoculars/ goggles in the hands of two observers. The problem: there are many moonless, dark nights when Hawaii Superferry won't see whales in time to avoid them. As the Hawaiʻi Island alternate member on the Sanctuary Advisory Council, I participated in a demonstration of Superferry's night vision binoculars. I have followed this matter carefully as I am an engineer who has been involved in field tests of night vision equipment for many years. To avoid whales at 35 to 40 knots, whales must be reliably identified at 1,000 yards, either daytime or nighttime. Even the most advanced (Generation 4** *)night vision binoculars require some moonlight to see even high contrast targets at 1,000 yards. A high contrast whale will be moving or spouting. A whale at rest and not spouting will be very difficult for the observer to detect at 1,000yards, even in optimum light conditions, e.g. full moon. The night vision binoculars will be of no use to see whales at 1,000 yards for several days either side of a new moon or when overcast hides the moon. Even on moonlit nights, the moon is only in the sky for a portion of the night. Four days after the full moon there would be no moon between sunset and 10 PM and no visible moon rise earlier enough until at least four days after the new moon and then it wouldn't be more than a sliver for a week and a half Night visions binoculars are useless during these times, unable to see 1,000 yards. While Hawaii Superferry has additional night vision equipment on board, including the Night Navigator 8540, they have not disclosed expected performance information that would allow anyone to judge whether any of this can reliably see a whale at 1,000 yards. Instead they continue to depend on two men with night vision binoculars. From the above it is clear that Hawaii Superferry's night vision capabilities need to be assessed in connection with the Environmental Impact Statement. Belt Collins should engage skilled sub-contractors to: 1) Confirm that night vision binoculars will be of no use to see whales at 1,000 yards for several days either side of a new moon or when overcast hides the moon. 2) Evaluate additional night vision equipment on board. 3) Determine whether the additional night vision equipment on board will be able to see whales at 1,000 yards any better than the night vision binoculars. Hawaii Superferry should only go its maxim urn speed when there was sufficient light to reliably see whales at 1,000 yards with night vision binoculars. On other nights they should go 13 knots, a speed relatively safe for whales.

Kona	Number 1. Act 2 is illegal and unconstitutional. Number 2. The EIS that Belt Collins will prepare is also illegal and unconstitutional. Number 3. I hope that legal action will eventually straighten out this mess and will force the Superferry to suspend operations until after an EIS has been prepared. In the meantime, I am concerned that the Superferry may soon return to illegal operation and will again be a threat to marine mammals. Belt Collins should require that instrumentation be installed to detect collisions by the Superferry. First, I would like to express my complete support for the letter submitted by Dr. Alex Leonard to Senator Suzanne Chun Oakland. Dr. Leonard can not be here tonight. His letter pointed out that the Superferry will hit and kill whales if it is permitted to travel at speeds greater than 13 knots. However, most whale strikes are not likely to be observed. Dr. Leonard recommended that cameras and other devices be installed in the Superferry's bows to continuously record the bow of the ship when it is in transit and, hopefully, to detect whale strikes. I would like to elaborate on and slightly modify Dr. Leonard's recommendations. 1. The other devices would be in the form of accelerometers and hydrophones. One or more of each would be mounted on each bow - probably just below the waterline. Both devices would put out electrical pulses at the time of a collision. These signals would be run into a computer and continuously recorded on an external bard drive. 2. The cameras would be video cameras which would probably be pointed straight down. To save storage space on the external hard drive, the recorded video signal would be saved for only a few seconds before and after either the hydrophone or accelerometer records a signal indicating a possible collision This would require some clever electronic circuitry -but it should not be difficult to accomplish. 3. The above detection system might not work at night -even with a very sensitive video camera. However, it can be made to work at night by installing long fluorescent light tubes running down each pontoon -both above and below the water line. The tubes must put out enough light to extend in front of the bow waves. This will permit the video cameras to see and identify a whale or other large body shortly before it is struck by a pontoon. 4. The external hard drive on which potential collision data will be recoded should be periodically analyzed by an independent contractor. Precautions must be taken to prevent Superferry personnel from gaining access to the hard drive because I would expect them to destroy collision data and then claim that the detection system had malfunctioned. The above 4 recommendations are cone only with detecting collisions -not avoiding them. Collisions could be also be detected by low-intensity high-frequency sonars placed under the water line of both bows. The sonar sound levels must be low enough so as to not injure whales. These sonars could be used in place of- or along with -video cameras.

Kona	First and foremost, I am here to state that I believe this EIS is unlawful and invalid because: 1. Act 2, under which this EIS is being conducted, does not take precedence over the National Environmental Policy Act 1 (NEPA); 2. Act 2 does not allow anyone to challenge the resulting document in court; 3. The Hawaii Superferry project and its secondary impacts should actually be part of the statewide harbor improvements EIS, otherwise "segmenting" is taking place. However, in light of the fact that there are those who seek to overturn laws for their benefit, I will take this opportunity to voice the concerns I have about Hawaii Superferry coming to Kawaihae so that they are part of the record. 1. Act 50, SLH 2000 (Cultural Impact Statements) Act 50 is a law passed by the 2000 Hawai'i legislature that requires cultural impacts be analyzed during the state's environmental review process. This protects Native Hawaiian traditional and customary practices. Please make certain that the EIS addresses cultural impacts, including fishing, paddling and surfing. 2. 1995 Kohanaiki Case The court said the state has an obligation to protect the traditional and customary rights of Native Hawaiians and it recognized that unique conditions are placed on the rights of landowners in Hawai'i. Justice Klein wrote, "Within the scope of their authority, 'all agencies in Hawai'i must ensure that their rules comply with the objectives and policies of the CZMA (Coastal Zone Management Act), HRS 205A, etc. and requires agencies to give 'full consideration to cultural and historic values as well as the needs for economic development f when implementing the objectives, policies, and SMA (Shoreline Management Area) guidelines set forth in the CZMA." In other words, administrative agencies are there to protect the rights of the people; not of corporations. Also, the right of resource management outweighs the right to make money. This decision says that Native Hawaiians have legal "standing" to raise issues relating to subsistence, cultural and religious practices. Please make certain that the EIS addresses the protection of traditional and customary rights of Native Hawaiians. I understand that Kanu o ka 'Aina uses an area in or around Kawaihae Harbor for cultural studies -how will this be affected? Also, what will happen to the YMCA in the area? In a paper titled "Guidelines for Assessing Cultural Impacts" from 1997 it states: "In scoping the cultural portion of an environmental assessment, the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. Thus, for example, a proposed action that may not physically alter gathering practices, but may affect access to gathering areas would be included in the assessment." It goes on to talk about how an ahupua'a is usually the appropriate geographical unit to begin an assessment of cultural impacts of a proposed action. Areas by the harbor sometimes flood during heavy rains. How will construction that will be taking place at the harbor affect the possibility of flooding? In addition, it has been pointed out that in order to let the water in Pelekane Bay flow properly so that it does not create silt, proper drainage must be addressed. Bill Akau has been saying this for at least four years, and a paper by Brian N. Tissot "Changes in the Marine Habitat and Biota of Pelekane Bay, Hawai'i Over a 20-Year Period") commented on this as far back as 1977. Still, nothing has been done. How will this be addressed before any construction takes place?

	3. HRS 205A Coastal Zone Management Program This is a detailed document addressing a number of issues, including the need to "Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems" (How will dredging affect this; how will backwash from Hawaii Superferry's engines affect this; how will noise from Hawaii Superferry's engines affect this?, etc.); the need to "protect beaches for public use and recreation"; and promoting "the protection, use, and development of marine and coastal resources to assure their sustainability." Please make certain that all aspects of HRS 205A are addressed. 4. The EIS should not address only Kawaihae Harbor -that is segmenting. Hawaii Superferry will affect the north boat harbor area which will impact fishing, surfing and paddling and other Hawaiian cultural activities, as well as swimming and boating -activities enjoyed by local families. It will also affect traffic in the harbor area because there are only two lanes -one for ingress to and one for egress from the harbor. Please address how these activities will be impacted and how traffic will be controlled. 5. The transfer of invasive species onto our island is a grave possibility, as is the transport of cultural resources. Please address the steps that will be taken to mitigate both problems. It is necessary to have qualified, trained inspectors at each port. And they should have to perform "inspections"; not "screenings". Having HSF employees doing the inspections should not be allowed. Increased traffic will increase the use of our roads. How will traffic be handled at the intersection of Kawaihae Rd. and Akoni Pule Hwy., and how will traffic be handled at the intersection of Kawaihae Rd. and Queen Ka'ahumanu Hwy.? Also, how will the condition and maintenance of our roads be addressed since increased traffic will cause additional wear and tear on them? 6. Queen Emma land sits on or near an area of Kawaihae Harbor. How is this being addressed with regard to Native Hawaiian rights as well as any roads or access ways that will be needed? 7. Will the shark heiau also be affected? 8. Kawaihae is well known as an area where whales and dolphins are found in large numbers. What is being done to mitigate collision with these mammals? 9. With increased visitors, how will our police, fire, parks & recreation personnel be impacted, and how will those impacts be addressed? 10. Pu'ukohola Heiau is in the Kawaihae Harbor area. Will there be any impact on this National Historic site? 11. How will the barge and ferry affect the north small boat harbor? What will happen to those who use this area for fishing, paddling and surfing? 12. In addition to other "challenges" noted in the Hawaii Harbors Modernization Plan Fact Sheet, an increase in cargo container volume by 2010 and lack of adequate space for harbor-user operations are two that are mentioned. With Hawaii Superferry being at Pier 4, will this hamper the freight business and storage for Hawaii's shipping companies, i.e. could this space be better utilized for our shipping companies? 13. In a document obtained through the Freedom of Information Act, it states, "...They have no good predictors of conditions at this time, and expect to have both unnecessary cancellations and cancellations after the HSF has left Honolulu. This is critical issue for the analysis. Tom Smith has been told by DOT that they feel the 3 ft. criteria are completely unrealistic. IF we are to use alternative criteria, how do we arrive at it, and how do we evaluate the uncertainty of those criteria?..." We've seen the problems encountered in Kahului Harbor. What will you do to insure the safety of passengers and vehicles during rough seas, and what compensation is planned for passengers who experience cancellations?

Kona	Hawaii Superferry's Terry O'Halloran ignored requests to have underwater noise measurements made to determine how fast Hawaii Superferry could go without causing behavior harassment to various marine mammals. Fortunately, Dr. Lee Tepley and Don Erway located a peer-reviewed technical paper with relevant data on underwater noise ***. From data on the Condor Express, Hawaii Superferry will likely harass humpback whales when they get closer than 1,000 yards. Behavior harassment is any act which has the potential to disturb a marine mammal in the wild by causing disruption of behavioral patterns, including, migration, breathing, nursing, breeding, feeding, or sheltering. This Level B harassment is unlawful under the Marine Mammal Protection Act. It is also possible that the noise level from the Hawaii Superferry could be high enough to cause direct hearing damage to various marine mammals (Level A harassment). This follows from observations by Dr. Michel Andre in the Canary Islands on dead Sperm whales. He found direct hearing damage. It is not known if this was caused by fast ferries (similar to the Hawaii Superferry) or by some other noise source – but there are many fast ferries in the waters of the Canary Islands. From the above it is clear that underwater noise measurements need to be made and evaluated in connection with the Environmental Impact Statement. Belt Collins should engage skilled sub-contractors to: 1. Measure the underwater noise level of Hawaii Superferry at least 3 speeds – 37 knots, 24 knots, and 13 knots. 2. Determine what speed Hawaii Superferry can safely travel without exhibiting Level B harassment from noise. 3. Determine how close Hawaii Superferry can come to a whale without causing hearing injury from noise. 4. Evaluate marine mammal harassment by noise at different distances from Superferry's course for various species. These measurements and evaluation need to be made soon in order to minimize the noise impact by establishing a safe speed of the Superferry with respect to noise. P.S. We would be happy to suggest subcontractors for underwater noise.
Kona	Input: I am writing because I am concerned that you are considering allowing the Super Ferry to operate while the EIS is being prepared. It is precisely the need for an EIS prior to the operating of the Super Ferry that is at issue. There is significant concern about the environmental impact of the Super Ferry on the islands. There is a valid concern that the Super Ferry will cause harm and potentially death to the whales that give birth in the islands. There is valid concern that the Super Ferry will promote the spread of invasive species, such as mongoose; fire ants; coqui frogs and other harmful species. We must learn how to deal with the environmental problems we have already created on the islands before we exacerbate these issues. I implore you to stop the Super Ferry from operating until and EIS can be prepared. If the Super Ferry is allowed to operate during the EIS process, the potential environmental damage of the Super Ferry could begin.

Kona	In February, my husband and I flew to Maui, planning on taking the Superferry to Oahu. The ferry was delayed for maintenance, so we flew to Oahu, and, finally, were able to make a roundtrip to Maui and back. We loved it! We look forward to taking the Superferry in and out of Kawaihae for many years to come. (1) Thirty years ago, SeaFlights interisland schedule included trips between the Islands of Hawaii and Maui. Such a schedule for the Hawaii would Superferry increase the ferry's popularity with residents and scenic riders, adding viability and return for the State's taxpayers who are invested in the ferry's success. **Could the ferry be required to include at least a weekly trip between the Islands of Hawaii and Maui?** (2) For years, the State has funded increased facilities at Kawaihae Harbor, including security fencing, pavement for the striping, and pier improvements, for the benefit of Matson, Young Brothers, and other ships, without triggering the EIS procedure. The military has repeatedly come into Kawaihae Harbor, with a ship similar to the Superferry, using existing harbor facilities with one major exception: the ferry used by the military carried its own ramp. The-Act 2 EIS Description of the Action and Altematives states: "Improvements to the existing pier would include the installation of a floating barge and ramp system to facilitate loading and unloading of passengers, vehicles, and cargo; and installation of fendering and mooring systems, shoreside power to the barge and ramp systems, security fencing, and pavement striping necessary to allow operations to occur in a safe manner." Kawaihae is one of the windiest harbors in Hawaii, as well as being subject to surf swells from the northwest direction. Through the years, barges have broken loose and caused damage The floating barge and ramp system for the loading and unloading of ferry passengers, vehicles, and cargo will be problematic during times of surf and/or wind, expensive to maintain, and, at times, dangerous, even when the ferry is elsewhere or hauled out. Kawaihae does not have a tug, so, when one is needed, as has happened in Kahului Harbor during surf to protect the barge from pounding the pier and the ferry, a tug will have to come from Hilo. The Hawaii Superferry chose a ramp-less ferry design to avoid the extra weight, allowing the ferry to carry more payload, although the difference is probably only a truck or two. The ramifications of that one decision have been enormous. If the ferry did not require a "floating barge and ramp system", "shoreside power to the barge and ramp system", the extra "fendering and mooring systems" required by the barge, and a tug necessary during surf, the State would have far less to construct and maintain. In fact, the excessive State funding and the resulting EIS might have been necessary. **Could the second ferry, which is scheduled to serve Kawaihae, and is still under construction, be required to carry its own ramp?** Thank you for this opportunity to comment.
Kona	There are lots of users of Kawaihae Harbor, including commercial, fishing and industrial. There are more to come soon, including extensive industrial. Visitors are coming to the harbor and the island for the first time. **Is the harbor something we will have to make excuses for or be proud of?** Plans call for industrial uses spreading up the hills, which are presently the only redeeming features of the area. **Is there any way the EIS can help insure good development for our visitors and residents?**
Kona	Because night vision binoculars will be no use to see whales at 1,000 yards except for a full moon (see attached) Hawaiian Superferry should not generally travel at night unless radar can reliably see marine mammals at 1000 yards. It therefore becomes all the more important to know the limitations of radar.

	The Dept. of Transportation is still listing radar as a way to avoid marine mammals by 500 yards, in your presentations seeking public comment for the Hawaiian Superferry EIS. To accomplish this, Hawaiian Superferry's radars will need to positively identify marine mammals at 1000 yards and detecting them at longer distances. Dr. Joe Mobley informs me that he has ---" been part of an R&D team looking at the feasibility of using shipboard radar to detect great whales since 2001. Our experience is that it works in good to ideal conditions (Beaufort seastate 1-4), but its reliability is unknown beyond that point [simply because we haven't tested it in anything worse than Beaufort 4)." Normal trade conditions in Hawaii with windspeeds of 17-20 knots would be expected to produce sea state in excess of Beaufort 5 and winter storms produce much higher seastates. Radar should not be relied upon as a method of detection in rough seas. I am also concerned about the propagation of Hawaiian Superferry's radar signals in heavy rains. Positively identifying marine mammals at 1000 yards and detecting them at longer distances may be Impossible. *I request an operational evaluation of the* capabilities *of Hawaiian Superferry's* radar as part of the EIS process being conducted by Belt Collins.
Kona	I attended the public informational meeting on the 27th March and I personally feel that 5 business days to submit my written comments on the Draft EIS is insufficient. I would have liked more time to study the DEIS to state my comments intelligently. Therefore, my comments are brief and not too specific. As a life-long resident of the Big Island, I'm fully aware of the benefits a large-capacity ferry vessel would present; however, the Kawaihae Harbor should be developed and improved <u>beforehand</u> to accommodate this new vessel. Knowing the problems of a floating barge and ramp system; which the Kahului Harbor experience, would it not behoove the DOT to make the necessary modifications? I would like to see a stationary type of on and off loading ramp similar to the ferry system in Seattle, Washington. In closing, the location of the March 27th meeting should have been conducted in the Kawaihae community NOT IN Kailua-Kona. That community would be impacted the most and would be able to participate in this much needed public debate of a large-capacity ferry vessel at Kawaihae Harbor. Mahalo nui loa for the opportunity to submit my comments.
Kona	On 3/17 I only mentioned the last time I witnessed whales unexpectedly surfacing near a whale cruise boat. Out of appx 34 trips this happened at least 9-10 times (once 15 feet side of bow.) Are you getting input from whale cruise boat captains? Boat speed is a serious issue – whale/boat collisions happen every year. Are you working with NOAA? They have the power to impose a speed limit on boats within 200 miles of land to protect endangered species. I doubt the superferry wants a reputation of being a baby whale killer. Next meeting – PUBLICIZE it!!
Kona	I am concerned Kawaihae does not have the needed infrastructure to accept the ferry. Traffic flow, no sidewalks for pedestrians when walking to shops. Piers were not repaired from damage done by earthquake. Where will the ferry dock? No bathroom facilities or waiting area for ferry passengers, what about car rentals? I am also concerned about the speed at which the ferry goes (37 knots) and striking a humpback whale, Kawaihae is near a marine sanctuary.

Kona	Thank you for coming to Kailua-Kona on March 27, 2008. <u>Meeting Location</u> I was disappointed this meeting could be not held closer to Kawaihae where the discussion is all about. Many of the Kupuna and long time residents of Kawaihae do not drive at night; surely not 35 miles away from home. Further, the Kupuna would probably do verbal testimony and not written ones. These are probably the first issues that need to be addressed. <u>Alternative Plan/Recreation Impacts</u> I would oppose utilizing the Alternative Plan of (interim or otherwise) use of Piers 1 and/or 2 for use by the Super Ferry. 1) Occasionally, there is pandemonium at the access to and from Kawaihae Road and Akoni Pule Highway. 2) Public use of the north-Small Boat Harbor for community recreational uses would be overly imposed upon. 3) The south-Small Boat Harbor is not yet constructed so the small boat owners that would use the south-Small Boat Harbor, currently wash down their boats at the north-small boat harbor and they will also be affected. The County manages a public park with bathroom facilities. These facilities are used all day long by a wide range of park users. The ferry needs to construct their own facilities at the proposed security area on the coral flats. <u>Ferry</u> I was quite interested to see the ferry on their trial run to Kawaihae. This ferry was moving awfully fast compared to other vessels that pass by my home. It was faster than the fishing vessels, faster than the barges and almost came to a halt when they came upon the Coast Guard Cutter who was waiting for the ferry in front of my subdivision. That speed is definitely too fast for these waters. During Whale season, 1) the ferry seems to have used the same area as the dolphins and the whales. The ferry should use the route that the barges use because the ferry cruises too close to the shoreline that I could see someone walking the across the boat. If I can see people in the boat; people on the boat can see me in my home. During the day many families are either gone to work or gone to school. The neighborhood watch program would not work if someone from the boat came cruising through our subdivision. During winter weather, the winds are quite strong in Kawaihae and there have been times when the cargo shipment has to sit in open waters waiting to enter the harbor. I would be upset if the ferry parked in front of my subdivision waiting to enter the harbor. My request would be 1) the ferry needs to slow down; 2) the ferry needs to use the same approach to the harbor as the cargo ships when approaching the harbor; 3) the ferry should not be allowed to safe harbor in front of the subdivisions. <u>Communication</u> The opposition to this location was conveyed to Barry Fukunaga and Mr. John Garibaldi when they attended the community meetings in Kawaihae. Barry Fukunaga's attitude was intent on

	"telling the community" and no further discussion; has created such a disregard and distrust toward the Lingle Administration. Hopefully, the completion of ACT 2 will repair some of the sensitivity of this community. Education Per my testimony at the first meeting; I think education about this community is primary. I think that adding the on-board media for users of the Ferry prior to landing in Kawaihae is a great way to inform people of the historical and cultural background of this community. My concern is when the ferry users leave the harbor; there is no signage indicating what the on-board media is talking about. Kawaihae has been a rural country until now. Even the Ironman Triathlon participants pass through the town; not park and visit. The community has not caught up with the overwhelming prosperity that is being dropped on Kawaihae. Confiscation Process It is interesting to watch the TV news say that banned items will be confiscated. What happens then? Opihi and plants are living organisms. Is it thrown away? Hawaiians are trying to propagate the Hawaiian food item; and the ferry is throwing it away? Plants can be flown island to island without soil; what happens to the plants? Kawaihae does not have an inventory storage location to keep these items, where does the DOA do with these items? Also, will there be a list of banned items in the news media; at the inspection point, etc. Harbor Facility Kawaihae has only gas station in the community which is regularly busy. Adding to this traffic and at this location and availability of fuel seems over whelming for the community. Harbor Access Access for the ferry is currently planned to use a shared access with the Military and the south-small boat harbor users. That means the traffic on Kawaihae Road will be backed up because of the left-turn/right-turn into the harbor. Perhaps if the traffic was allowed within the harbor during inspection; the rest of the traffic could continue on Kawaihae Road. This problem is already prevalent with the truck users entering the harbor at a different gate entrance. Until such time as the Kawaihae portion of the By-Pass road is built, there needs to be traffic directors on the Kawaihae Road; as well as on the harbor. Hopefully, this will be police officers so any conflicts will be handled directly. It will be very appreciated by the community, if the traffic is not allowed to pull off the Kawaihae Road and onto the mountainside shoulder at the ferry access into the harbor. Directly across the street is a known cemetery; and a larger unmarked cemetery. People trying to pass on the shoulder of Kawaihae Road may damage the cemetery perimeters. Historic Sites The most predominant feature the ferry users will view is the Pu'ukoholā National Park. In the park is the Pelekāne Bay. This Bay has become very polluted with silt and sedimentation caused mostly by the blasting used to create the Kawaihae Harbor. There is a plan to create a channel from the Bay through the Coral Flats to the Harbor. When this channel is completed, all traffic will need to crossover this channel. Therefore, the ferry will become one of the partners on the Coral Flats that should be contributing to the creation of this channel to keep the Pelekāne Bay current flowing in order to keep the Bay clean. This is a unique living and historical environment that needs to be protected. Employment It is unknown if this business will hire from the Big Island. Who is hiring, what the job will be, when they can start. It seems the positions are being filled elsewhere; and no equal opportunity here.

	Inspection Process During the observation period held on Oahu and Maui, how long did it take from the time a passenger arrives at the harbor front gate; until the time the ferry leaves? A process of what will happen on the harbor is great on the paper but inspecting and accepting passengers; and inspecting and releasing-passengers seem a little longer process than the airline process. Even though the arrival and departure time hopefully is during the least impacting hours; Kawaihae already has a serious problem with the harbor area. The airlines have a citation program for banned items. I think the governments should begin creating new rules for banned items being transported by the Ferry; for the ferry company as well as the perpetrator. Environmental Concerns Kawaihae Harbor is unique in many ways. One is the configuration of the Harbor has a drainage, flood control, in an earthquake and tsunami area. There will need some improvements made for the traffic during these seasonal times. Kawaihae is known for the high wind conditions that occasionally impact everyone in this community. Three effects occur: a) Sandstorms may affect the users of the ferry and, b) Coral dust storms sometimes blow towards Kawaihae Road. Some type of watering to keep the dust down while the numbers of vehicles pass on the coral flats. 3) Any bits of trash will be carried into the air. This pollution could land in the ocean; on the highway, etc. Probably the most important environmental concern for Kawaihae is that this is a fire hazard community. There should be media, signage, and high penalties created and made known for all visitors to Kawaihae. The harbor area is where the water availability is located. Everywhere past the specific harbor area has limited water availability. For over 25 years the residents in Kawaihae have been requesting the County Water Department to identify a water resource for areas surrounding the harbor area. Having large numbers of people and unknown products enter through the harbor area (to and from the community) warrants extra protection measures from the ferry and the harbors division. Security Measures It is confusing as to how security procedures will be implemented. Historically, the community was allowed access on the coral flats. Today, a limited number of users are allowed access for specific reasons. It will be helpful to understand what other impositions will occur for these users. Thank you for allowing me to testify regarding this environmental review process.
Kona	The EIS needs to identify potential impacts on natural resources including, but not limited to: 1) Increased fishing and hunting pressure from off-island visitors. Removal of plants, rocks, and artifacts from county, state and private lands. 2) Increased camping and use of parks. The Super Ferry will result in an unprecedented change in access to the natural resources of the Big Island. These resources will be extracted by visitors. There are no mechanisms or funding in place to manage or monitor this change. The EIS needs to propose detailed, reasonable and practicable enforcement methods for mitigation/prevention. As an example, fisheries are managed by Division of Aquatic Resources (DAR) and regulations are enforced by Division of Conservation and Resource Enforcement (DOCARE). There is virtually no mechanism in place to adequately enforce fishing regulations and there is little funding to track the impacts of increased access to the aquatic resources. Changes in DAR powers and responsibilities may be needed prior to starting Super Ferry service. Off-island-user fees and regulations, including, but not limited to fishing
	licenses, launch fees, daily use fees, bag limits will likely be needed to manage the resource. These mechanisms need to be in place and not just proposed prior to Super Ferry service initiation to the Big Island.

	The EIS needs to identify potential infrastructure impacts including, but not limited to: 1) Increased vehicle numbers on overtaxed Big Island roads. 2) Increased small boat traffic at the launch ramps and in harbors. 3) Pulses of traffic surrounding Super Ferry arrivals and departures. Overtaxing understaffed Big Island law enforcement with transfer of stolen property between islands, including vehicles. As above any proposed mitigation methods need to be detailed, reasonable and practicable. For example, proposing that the Big Island build more roads or harbor facilities is not sufficient to offset traffic impacts. Funding mechanisms, such as vehicle use impact fees, need to be developed and implemented prior to Super Ferry operation. Concurrency of roads with increased traffic from Super Ferry needs to be considered The EIS needs to identify potential impacts to the environment including but not limited to: 1) Unregulated transfer of plants and animals between islands. 2) Potential introduction of non-native species such as coqui frog. As above any proposed mitigation methods need to be detailed, reasonable and practicable. Proposal of Department of Agriculture (DOA) inspections of cars is not sufficient if funding and inspectors do not exist. Further, sufficient time and facilities need to be made available to allow inspection of vehicles and cargo moving on the Super Ferry. Summary comment on the draft EIS is that it needs to include analysis of the potential impacts and detailed discussion of remedies proposed for any impacts. Remedies need to be reasonable and practicable. It will not be sufficient to propose remedies that cannot or will not be implemented.
Email	Please consider this notice for conspiracy to misappropriate tax dollars and conspiracy to defraud the government. For the record, I acknowledge only purported lawful authorization of performance of a DRAFT EIS by your conflicted firm of Belt Collins, as this is an authorization executed through the subversion of HRS 343 by an illegal special session. I would like to take this time to submit, my acknowledgment of the criminal act being perpetrated through you by the state of Hawaii and its representatives against the constitution and subsequently the people of Hawaii. Furthermore, my submittal of protest to this whole sordid affair, shall voice my invalidation of Belt Collins, Linda Lingle, Mark Bennet, DOT representatives and any and all state officials who have chosen to collaborate in these criminal acts against the constitution that they have sworn to uphold in this state of Hawaii putting them on notice. Listed below are aspects of this illegal process of which I expect to see an explanation; an explanation in extensive detail. They are numbered so that I can easily access my questions later to see that they are addressed by you: 1) First and foremost: in your draft i demand clarification of how causing irreparable harm to hawaii and environment as determined by judge cardoza is in the public interest. You have not satisfied this impact. An alternate mode of travel is not a viable explanation; as to why it is not, i am not at liberty to divulge that to you at this time.

	2) Address justification. 3) Public interest is given. Elaborate because the Oahu hearings had 0 interest. 4) This is not in the public interest because it jeopardizes the public's sustainability. 5) It will inflict irreparable damage to the islands resources and the culture which is sustained by the resources. 6) It is far bigger than you and your EIS firm. It is the mandate of the hawaii state constitution...the permission slip for the state to carry on. 7) Your understating the harm is a terroristic threat to hawaii's people and environment. 8) How is obstructing local fishermen in the public good? 9) Day passes and permission slips and scheduling of a fishing day according to superferry agenda is not acceptable for a fisherman. 10) Conditions imposed on a local fishermans freedom to go and return when he damn well pleases are not in superferrys jurisdiction, nor in the states. 11) This is an obstruction of federally protected native hawaiian rights. Please clarify and specify how you plan to skirt these laws. 12) Do you still contend that declaring opihi, imu rocks, fishing nets, etc. As contraband if brought on the superferry is an effective deterrent to resource depletion and pilfering? 13) Do you believe that hsf monitors, scouts or even experts watching for these things being brought on board is an effective deterrent? 14) Will this rule change when we sue you and the state for discrimination and fraudulent representation because these items are legal throughout the state and you have no legal right to ban them from island to island? I live right behind the harbor, and every day I see all the mess that they have down there. My father was harbor master in Kawaihae, so was my brother, William. Mr. Birnie knows that. And it's very important that I come today to speak for my birthplace. Kawaihae was a beautiful place. I also come to speak for the area in front where Halau Kukui is. Halau Kukui looks over at Mau Mai (phonetic). And in the front of Ma'u Mai, that's where all the Ali'i's and the Kings used to surf. The full name of that place is Hale He'e Nalu. You're a surfer, you know about surfing. So where else can the people come to Kawaihae and go and enjoy? When the tidal wave came in '46, the tidal wave came in from the west. You build the harbor, you block off where the natural flow of the ocean goes along the coast. So on the other side, in front of Pu'ukohola, where the fishes used to come and spawn, they used to come there and take care of business they were supposed to take. And then they go back out to the wide ocean and grow up. And then we have the fishes come in when they're big enough. Now there's nothing there. Lucky we still have some sharks that swim around, but not too many more. I don't like sharks. But Hale O'Kupuni is there. They have been there before I was born, before my dad was born, before my grandfather was born and my great-grandfather and all my grandmother's family. I don't want the Hawaii Superferry. It's going to take more of Kawaihae. Let Kawaihae be what it is so that people can enjoy it. It's my home town. Don't ruin it any more. Thank you. And it will also block off the small boat harbor on the north end. That's basically it. And the other one I already talked about, the cultural site. I can expand on 15 that later on.

	Natural resources, I would like to see a definition of natural resources. Because what you got right now don't even cover. It's very inadequate. This statement about wide range of users. Because the wide range of users -- and I think we already talked about that. People don't know about Kawaihae. And one of the things is the fiber optics. There's two fiber optic cables in the ocean. Also, for the audience, I invite you all to be sure to contact me with your issues, with your concerns, so that we can bring these issues to the table at the Oversight Task Force. I would like to say that so far the reports from DOCARE as well as the Department of Ag, it seems to me that Hawaii Superferry is doing exactly what they've been asked.

Appendix F: Marine Environment and Water Quality Study

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BASELINE ASSESSMENT OF WATER, SEDIMENT AND BIOTIC COMPOSITION IN KAWAIHAE COMMERCIAL HARBOR, SOUTH KOHALA, HAWAII

FINAL REPORT

Prepared for:
State of Hawaii
Department of Transportation
Harbors Division

March 2012

I. EXECUTIVE SUMMARY

Kawaihae Harbor is a deep-draft harbor on the coastline of the South Kohala district of the Island of Hawaii that contains piers and berths for large commercial vessels and serves as a site for various marine recreational activities. The State of Hawai'i, Department of Transportation, Harbors Division (DOT-H) has completed the *Hawai'i Commercial Harbors 2035 Master Plan Update* and is proposing several infrastructure improvements to Kawaihae Harbor. With respect to in-water work, the Kawaihae Harbor Development Plan begins implementation of Master Plan features by preparing the preliminary engineering for near-term improvements involving extensions of Pier 2 and maintenance dredging. As part of this planning process, a preliminary baseline assessment of water quality, sediment quality and biotic community composition has been conducted. The assessment consisted of a quantitative assessment of marine biota in the area that might be affected by new dredging and extension of piers, as well as the reef habitats surrounding the harbor. In addition, an assessment of water quality was conducted, which included measurements of all constituents listed in the Department of Health Water Quality Standards for estuarine waters. Sediment samples collected within the harbor area where new dredging is planned were analyzed for a suite of constituents to evaluate the presence of contaminants.

Water samples collected from 22 stations within the main harbor basin and outside the harbor and extending through the entrance channel to the open ocean surrounding the harbor revealed very little input of groundwater to the harbor basin or outer reef areas (owing to time constraints no wet weather sampling has been conducted to date). Water quality throughout the basin was similar to that of open coastal waters with the exception of clear patterns of vertical stratification of temperature. For the samples collected within the harbor, no constituents had concentrations over State of Hawai'i, Department of Health Water Quality Standards.

Analyses of a variety of chemical constituents in sediment collected from four sites within the inner basin revealed no detectable concentrations of petroleum products. TCLP metals were absent in all samples with the exception of barium, which occurred at all four sampling sites, and lead was detected at a single site. No volatile organic compounds tested were detected, while a single sample resulted in a detectable level of one PCB compound. Semi-volatile compounds were detected at three of the four sites.

Composition of the bottom of the basin consists of a ubiquitous layer of fine-grained muddy sand. Numerous burrows from a variety of infauna penetrate the sediment layer.

Vertical surfaces composed of column piles supporting Piers 2A-2B and sheet-piling fronting Pier 1 and the area between Piers1 and 2A, as well as boulders forming the shoreline off the end of Pier 2B support substantial colonization of reef corals. The most prolific occurrence of reef corals within the harbor occurs on the corrugated sheet-piling along the front margin of Pier 1 and between Piers 1 and 2A. Typically, corals covered the sheet-piling from about one meter below the water surface to just above the juncture of the harbor floor. The cover of these vertical faces consists predominantly of merged and overlapping colonies that in places form a near continuous mass of living coral on the outer surfaces of the sheet-piling. Evaluation of coral colony size frequency distribution along the vertical surfaces of Piers 1, 2A-2B, and the areas of proposed Piers 2C and extension of Pier 2A revealed a total of nine species of coral, with a total count of about 7,000 colonies. The most abundant coral was *Porites lobata*, accounting for about 50 percent of the colonies, followed by *Pocillopora meandrina* and *Montipora capitata*, each accounting for about 23 percent of the number of colonies. Hence, these three species comprised 96 percent of all colonies. With respect to size class, the overall most abundant class was the 10-25 cm group, accounting for 35 percent of the colonies, followed by the 5-10 cm class which accounted for about 30 percent of the colonies. The least abundant class was the largest size (>50 cm) accounting for about 3 percent of the colonies. The low number of large colonies is likely a result of the mostly vertical substratum, which limits the maximum size of colonies.

The area with the highest number of coral colonies was the corrugated sheet-piling fronting Pier 1 (2,350 colonies), followed by the sheet-piling fronting the area between Piers 1 and 2A (2,103 colonies). The lowest number of colonies occurred on the boulders in the area of proposed Pier 2C. When the number of colonies per meter of shoreline, the lowest number occurs on the column piles supporting Piers 2A-2B, with 3.9 colonies per meter, while the highest colony counts per meter occurred on the sheet-piling between Piers 1 and 2A, and Pier 1 (20 and 16 colonies per meter, respectively). In sum, the entire submerged region of the working area of inner Kawaihae Harbor, as well as the adjacent areas proposed for future development provide suitable surfaces for successful coral settlement and growth, resulting in dense coral communities that do not appear to be negatively affected by normal harbor operations.

Biotic colonization of the solid surfaces of all piers and pilings also included some components of typical harbor fouling community, made up primarily of bryozoans, hydroid, algae and sponges. Fouling communities were most abundant in the most innermost (with respect to the harbor entrance) area of Pier 2B and decreased to almost non-existent at the outermost area of Pier 1.

Of the communities colonizing the harbor walls, only one sea urchin (*Echinothrix diadema*) is listed as "regulated" by DLNR. In addition, none of the species on the harbor walls can be considered rare or of particular commercial value. As the commercial harbor is off-limits to the public, there is no recreational value or service. Descriptions of introduced invertebrates prepared by the Bishop Museum and University of Hawai'i indicate that most common alien invertebrates are also common members of fouling communities throughout harbors in the main Hawaiian Islands. No introduced invertebrate species were noted as occurring solely within Kawaihae Harbor.

The reef bordering the outer side of the breakwater consists of a wide, flat platform which grades into a zone of large knolls created by the continual upward accretion of living corals. Biotic composition on the outer reef represents a pristine setting with no apparent effects to community structure from the existing deep draft harbor. A strip of reef platform left undredged inside the breakwater presently contains a thriving reef community, although coral diversity is low owing to the competitive superiority of a single species that is protected from wave impact damage by the breakwater. Such protection, along with suitable physical and chemical water conditions, provides an ideal habitat for coral growth with the harbor.

Utilizing the spectral properties of corals detectable in satellites imagery, a map depicting coral abundance on reefs surrounding Kawaihae Harbor was produced. A clear advantage of this method is that it treats all areas of a reef with the same importance, something that is not possible by traditional survey techniques which examine a small area and then extrapolate to the larger context. Mapping of coral abundance in the Kawaihae area reveals a total of five coral-acres (22,000 m^2) within the harbor and 48 acres (193,000 m^2) on the reefs outside the harbor. These values can be interpreted as an area of 5 acres completely covered with coral on the undredged strip off the inner side of the breakwater within the harbor.

The proposed new dredging and pier improvements will have some unavoidable environmental impacts that will require mitigative actions. With regard to dredging, it is expected that turbidity and TSS of the water column will be temporarily increased as a result of sediment resuspension and dredge leakage. As is typical in other past harbor new dredging projects, best management practices will include requirements for silt containment devices to minimize and localize the effects of dredging. A water quality monitoring program carried out during the new dredging activity will likely set limits of exceedance which will trigger cessation of new dredging until conditions return to acceptable levels. Results of the water chemistry survey conducted for this assessment reveal that there is little effect from groundwater intrusion in the area of proposed dredging, so there should be no hydrological effects from dredge activities. While some sediment infauna will undoubtedly be lost as a result of dredging, the dredge area is small with respect to the entire harbor floor, and it is

likely that the "new" sediment column will be rapidly recolonized from surrounding areas. A somewhat unique aspect of the Kawaihae Harbor is the extensive coral colonization of the pilings that are adjacent to the new dredging site. As a best management practice to minimize potential negative effects from resuspension of dredge materials, it is suggested that the silt barriers are placed not only on the outer boundary of the dredge zone, but also between the dredge zone and the pilings.

The areas planned for construction of Pier 2C and extension of Pier 2A presently contain extensive communities of reef corals. These populations will unavoidably be eliminated under the proposed scenario of pier extension. Unless the existing sheet-piling and boulders are left in place during the pier extension, removal and transplantation of the existing corals would be the only way to ensure their survival, although such an action would be very difficult or impossible owing to the flat encrusting growth forms of many of the coral colonies. Mitigative strategies for potential loss of coral will be negotiated as part of the permitting process.

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KAWAIHAE HARBOR
Marine Environmental Assessment - 2011

II. INTRODUCTION

The State of Hawai'i, Department of Transportation, Harbors Division (DOT-H) has completed the *Hawai'i Commercial Harbors 2035 Master Plan Update* and is proposing several infrastructure improvements to the Kawaihae Commercial Harbor. With respect to in-water work, the Kawaihae Harbor Development Plan begins implementation of Master Plan features by preparing the preliminary engineering for near-term improvements involving extensions of Pier 2 and new dredging (see Figure 1).

Kawaihae Deep Draft Harbor is located in the South Kohala District on the northwest coast of the Island of Hawai'i, about 17 miles south of Upolu Point—the northwestern tip of the island—and 28 miles north of Kona International Airport. The harbor was constructed in 1959 by blasting and dredging out a portion of the coral reef and constructing a breakwater 2,650 feet in length from basalt boulders to form the seaward boundary of the harbor. The harbor also includes a small boat basin on the northeastern corner of the main harbor adjacent to the entrance channel. The main basin of the commercial harbor was expanded through dredging in 1972. In 1969-70, a small boat harbor was added on the south side of the Deep Draft Harbor jetty seaward of the boulder revetment. While the small boat harbor was modified in 1995, it is has never been put into operation as a working harbor.

At present, Kawaihae Harbor offers facilities for handling both overseas and inter-island cargo with room for future expansion. The harbor is generally unimproved, with the exception of the inter-island barge and overseas terminals. The small boat harbor at the north end of the deep draft harbor includes limited moorings for small vessels, as well as a boat launching ramp. The two piers at Kawaihae are constructed of both sheet-piling (Pier 1) and a piling system (Piers 2A and 2B), and offer combined berthing space of over 1,562 feet. Pier 1 is 412 feet long and used for barges; Pier 2 is 1,150 feet in length and has an alongside water depth of 35 feet. Pier 2A is used primarily for loading and offloading barges and has an alongside depth of 20 to 24 feet. The harbor turning basin measures approximately 1,450 feet wide and 1,500 long with an average depth of 35 feet. The entrance channel if 3,270 feet long, 500 feet wide and 40 feet deep.

The eastern boundary of the harbor is a wide sand-rubble beach shoreline formed by the tailings from the dredging of the coral reef which previously covered the area of the present harbor basin. The U.S. Army owns and operates a landing ramp in the southwest corner of the basin.

In addition to the commercial port operations, recreational water activities such as fishing, swimming, canoe paddling, and mooring of small recreational boats occur along the southeast side of harbor.

To accommodate future cargo demands and increase berth capacity, Pier 2A will be extended 340 feet. A new Pier 2C will be constructed, providing an additional 325 feet of berth space. These improvements will allow for berthing of four 400-foot long barges. The construction of Pier 2C will require the removal of the Department of Land and Natural Resources Division of Boating and Ocean Recreation (DOBOR) boat moorings and dock at the south end of Pier 2B. Plans are in place to relocate the small boat moorings to the completed, but as yet unused, small boat harbor located off the southern end of the Kawaihae Deep Draft Harbor (Figure 1).

Owing to the buildup of sediment in Kawaihae Harbor from stormwater runoff, new dredging (i.e., dredging of areas never dredged) of the harbor floor fronting Piers 1 and 2 will be necessary to provide adequate depth for safe navigational operations for that area. Maintenance dredging (dredging of areas to remove sediment buildup and return the previously dredged area to designed water depths) will be performed at the rest of the existing piers.

As part of this planning process, a preliminary baseline assessment of water quality, sediment quality and biotic community composition was conducted in 2011. The assessment consisted of a quantitative assessment of marine biota in the area that might be affected by new dredging and construction operations. As reef corals are a keystone taxa in terms of community structure and regulatory procedures, the biotic assessment focused on evaluating the status of coral communities in the area. A quantitative assessment of water chemistry within the main basin, as well as outside the harbor breakwater, includes measurements of all constituents listed in the Department of Health Water Quality Standards for embayments and open coastal waters. Sediment samples were analyzed for a suite of constituents to evaluate the presence of contaminants. Presented below are the methods, results, and conclusions of the baseline assessment.

III. METHODS

A. Water Chemistry

Water chemistry was evaluated at twenty-two (22) stations spaced at regular intervals throughout Kawaihae Harbor extending through the entrance channel, harbor basin, and off the outer breakwater into the coastal ocean (Figure 2). The sampling design was considered adequate to cover all areas in and around the basin within a reasonable number of samples.

Samples were collected at two depths at each sampling station: a surface sample was collected within approximately 10 centimeters (cm) of the sea surface and a bottom sample was collected within 50 cm of the harbor floor.

Water quality parameters evaluated included all of the specific criteria designated in Chapter 11-54, Section 06 (a) (Marine Waters, Embayments) and (b) (Open Coastal Waters) of the State of Hawai'i Department of Health (DOH) Water Quality Standards. These criteria include: total nitrogen (TN), nitrate + nitrite nitrogen (NO_3^- + NO_2^-, hereafter referred to as NO_3^-), ammonium nitrogen (NH_4^+), total phosphorus (TP), chlorophyll a (Chl a), turbidity, pH, salinity and temperature. In addition, orthophosphate phosphorus (PO_4^{3-}), silica (Si), total organic nitrogen (TON) and total organic phosphorus (TOP) were also reported because these parameters are sensitive indicators of biological activity, as well as the degree of groundwater or surface water mixing.

The proposed sampling plan included two increments of sampling: one during a period of dry weather and a second following an episode of substantial rainfall. Field collection of water samples for the dry period sampling was conducted on August 17, 2011 between the hours of 08:40 and 11:30 during which the tide fell from about +1.0 foot to +0.4 foot. Prevailing weather conditions consisted of sunny skies and light tradewinds (10-15 knots). No periods of heavy rainfall have occurred in the Kawaihae area during the project duration. Hence, there has been no opportunity to conduct the wet period sampling.

All samples were collected from a small boat using a Niskin-type oceanographic sampling bottle. The bottle was lowered to the desired sampling depth with spring-loaded endcaps held open so water could pass freely through the bottle. At the desired sampling depth, a weighted messenger released from the surface triggered closure of the endcaps, isolating a volume of water. Upon retrieval, water from the Niskin bottle was poured into 1-liter triple-rinsed polyethylene bottles.

Following collection, subsamples for nutrient analyses were immediately filtered through GF/C filters and placed in 125-milliliter (ml) acid washed, triple-rinsed polyethylene bottles and stored on ice. Analyses for NH_4^+, PO_4^{3-} , and NO_3^- were performed on the filtered samples with a Technicon autoanalyzer using standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TN and TP were analyzed in a similar fashion following oxidative digestion on unfiltered samples. Total organic nitrogen (TON) and total organic phosphorus (TOP) were calculated as the difference between TN and dissolved inorganic N and TP and dissolved inorganic P, respectively.

Water for other analyses was subsampled from 1-liter polyethylene bottles and kept chilled until analysis. Chl a was measured by filtering enough water through glass fiber filters to detect color; pigments on filters were extracted in 90 percent acetone in the dark at 20° C for

12-24 hours. Fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer. Salinity was determined using an AGE Model 2100 laboratory salinometer with a readability of 0.0001‰ (parts per thousand, ppt). Turbidity was determined on 60 ml subsamples using a Monitek Model 21 nephelometer and reported in nephelometric turbidity units (NTU). pH was measured on a laboratory meter with readability of 0.001 pH units.

Continuous vertical profiles of water temperature, dissolved oxygen and salinity were acquired using an RBR Model XR-620 CTD calibrated to factory specifications. The CTD has a readability of 0.001°C, 0.001 percent saturation, and 0.001 ppt (salinity).

All laboratory analyses were conducted by Marine Analytical Specialists in Honolulu, Hawai'i. Marine Analytical Specialists possesses the acceptable rating from EPA-compliant proficiency and quality control testing under the National Pollutant Discharge Elimination System (NPDES) program. This testing, termed the Discharge Monitoring Report-Quality Assurance (DMR-QA), evaluates the analytical ability of laboratories that routinely perform self-monitoring analyses required by their NPDES permit.

Sediment samples were collected at four sites within the inner areas of Kawaihae Harbor. These sites were selected to provide a representation of the areas of pier expansion and new dredging (Figure 2). Sediment samples were collected by divers using acid-washed glass jars that were cored approximately 8 inches into the sediment surface and capped. On return to the boat, sediment samples were immediately placed on ice. Samples were shipped to the analytical lab (Calsciences Environmental Laboratories) located in Garden Grove, CA on the day following collection. Chemical analyses included total solids, flashpoint, Total Petroleum Hydrocarbons (TPH) as gas, diesel and oil, TCLP metals (Toxicity Characteristic Leaching Procedure which is an analytical method to evaluate metals leaching through a solid medium), PCBs (Polychlorinated biphenyls) and variety of volatile and semi-volatile organic compounds (the list of sediment parameters for analysis was provided by DOT based on the Final Environmental Assessment for Maintenance Dredging of Pier 51A in Honolulu Harbor).

B. Evaluation of Biotic Community Composition

The nearshore marine environment in and around Kawaihae Harbor consists of variety of physical structures and diverse biotic communities that represent a relatively unique Hawaiian coral reef habitat. The intent of this study is to describe qualitatively and quantitatively the overall physical and biotic setting of these features of the marine environment. To obtain such an overview, we employed an approach that has become widely used in the field of coral reef science based on utilizing the optical properties of remote sensing imagery to generate habitat maps. As no detailed benthic habitat maps of the

Kawaihae Harbor region (or most of west Hawai'i) presently exist, a main objective of this assessment was to create such maps. In brief, this method involved obtaining commercially available remote sensing satellite imagery of the area of interest. Extensive ground-truth data were collected throughout the marine environment within and adjacent to Kawaihae Harbor. The ground-truth data were then used to develop a classification system that calibrated the spectral information contained in the remote sensing images. The resulting classification scheme was translated on a pixel-by-pixel basis into area coverage of categories of living coral, as well as non-coral bottom (e.g., sand, mud, rock). Bathymetry was also added to the maps using available LiDAR (Light Detection and Ranging) data.

The survey area encompassed approximately 1.2 miles [approximately 2 km] of linear coastline and extended from the shoreline to a water depth of approximately 33 feet (10 m), which encompasses an area of about 1,315,200 square meters (m^2) or 325 acres. While it is acknowledged that there are deeper reef areas, these reefs are not likely to be affected by activities on land and, hence, were not part of the present survey. The resulting map product provides a unique tool for quantification of components of the entire marine setting that is a valuable asset for understanding the effects of human inputs and subsequent impacts. It is important to note that the purpose of the study was not to generate an exhaustive species list of all biota occupying the area.

All methods utilized in this study to generate nearshore marine habitat maps followed standard procedures for processing coral reef remote sensing imagery (e.g., Andréfouët et al. 2003, Green et al. 2000, Mumby et al. 1998). The benthic habitat map was created based on a fully georeferenced, cloud-free WorldView-2 multispectral satellite image of Kawaihae Harbor that was purchased from the Image Library at DigitalGlobe.com (image data acquired on February 22, 2010). The image had 2.0 m (6.6 ft) ground sample distance. The WorldView-2 image was processed to highlight submerged features, which revealed areas of different bottom composition.

Fieldwork was carried out on August 17, 2011, and September 12-13, 2011 by divers working from a 21-foot boat. Field operations consisted of assessing 24 "calibration-validation" (cal/val) sites placed strategically throughout the survey areas. Locations of cal/val sites were selected in the field based on investigator knowledge and visual interpretation of existing satellite "true-color" imagery, with the intent of maximizing coverage of all reef areas within the region of interest. Exact locations of cal/val sites were recorded during the course of fieldwork using a waterproofed GPS with a presumed accuracy of <1 m.

At each geo-located site, cal/val data were obtained by digitally recording the composition of the benthic surface using an underwater camera fitted with a 14 mm wide-angle lens. To

ensure uniformity of the area of data collection, the camera was mounted on a platform centered over a PVC quadrat frame by four legs, similar to a tripod. The base of the frame forms a quadrat with dimensions of 1 m x 0.66 m, which is the same proportion as a photographic frame. Each cal/val site consists of five photo-quadrats arranged in a "cross" pattern ~5 m in diagonal, resulting in total reef surface area of 3.33 m^2, which encompasses an area of approximately four pixels of remote sensing imagery.

Following fieldwork, the digital images were analyzed by projecting a grid dividing the frame into 100 equal-sized segments. Coral cover by species, as well as bottom cover of benthic algae, motile macro-benthos and non-living categories including sand, mud, bare limestone and rubble, were estimated by tabulating cover types within the segments. Zoom features of computer software and the high resolution of the digital photographs (~10 megapixels) generally allowed delineation of corals to the species level. Total cover of all five photographic frames constituted the cover estimates for each cal/val site. An advantage of using such a photo-quadrat method is that it allows for the collection of far more data per unit time than traditional *in-situ* transect techniques, with little or no loss of data quality or interpretation capability. Thus, the photo-quadrat technique provides far more extensive coverage of the subject area without any significant loss of information. In addition, the photographic survey method provides a permanent data record that can be utilized for future time-course surveys that are of value in determining changes to reef structure. All photo-quadrats evaluated by point counts are contained in Appendix B.

In the lab, map generation was accomplished by locating cal/val points on the geo-referenced satellite multispectral image that served as the basis for statistical image classification. "Training classes" (defined as the combination of geo-morphological zone and bottom cover) were created by assigning a class label to a survey point using the ground truth data for context. To spectrally define a "region of interest" for a training class, 20-30 adjoining pixels were isolated and included in the class. All training classes with the same spectral label were used to create a map showing the distribution of that particular bottom cover over the reef. The resultant analysis produced maps showing discrete classifications of coral, algal and mud/sediment cover. The data used to create the maps are compatible with ArcGIS.

Full cross-validation was utilized to evaluate accuracy of the habitat classification. In cross-validation, all but one data point are used to build a classifier and the classifier is then tested on the withheld point. This process is then repeated on every point in the data set. The result is a matrix of classification rates, with correct classifications on the diagonal and incorrect classification off-diagonal. Because each classifier is tested on a data point that was not used to build the classifier, the result is unbiased. Also, because the test classifiers use almost all

the available data points, they more closely represent the classifier actually used to generate the image product (which used all data points).

In addition to the quantitative cal/val data collection, quantitative evaluations of coral community structure were conducted on the vertical surfaces of the entirety of Pier 1, Piers 2A-2B, the corrugated sheet-piling between Piers 1 and 2 (proposed area for extension of Pier 2A) and the boulders lying along the shoreline in the area proposed for construction of Pier 2C (see Figure 1). Coral community structure was evaluated by classifying coral colonies of each species into one of five size categories based on length of longest colony axis as measured using a metal ruler (0-5 cm; >5<10 cm; >10<25 cm; >25<50 cm; >50 cm). For the boulders in the area of proposed Pier 2C and the column piles comprising Piers 2A-2B, all colonies were counted. For the sheet-piling forming Pier 1 and the area between Piers 1 and 2A, a 50-meter tape measure was stretched taut along the horizontal sheet-piling. At each 5-meter mark on the tape, all colonies extending 1-meter on either side of the mark along the entire vertical surface were measured and recorded. For colonies that occurred on the boundaries of the 2-meter strip, only those that were deemed to contain more than one-half of the colony area were counted. For the 148-meter long Pier 1, 30 2-meter vertical belts were surveyed; for the 105-meter long section of sheet pile between Piers 1 and 2, 21 2-meter vertical belts were surveyed. An estimate of total coral abundance was extrapolated from the surveyed area to the entire area pier areas.

Abundance of reef fish was estimated at selected cal/val sites using five-minute stationary point counts. At these locations, an observer remained at the location of the calibration-validation site and recorded all fish visible within a 360˚ viewplane.

IV. RESULTS

A. Water Chemistry

Tables 1 and 2 show results of water chemistry analyses. Table 1 shows concentrations of dissolved nutrients in micromolar (µM) units, while Table 2 shows concentrations of nutrients in units of micrograms per liter (µg/L). It should be noted that both micromolar and microgram units are for the elemental composition of each nutrient element and not for the entire compound, (e.g., 1µM NO_3^--N = 14 µg/L, where the molecular weight of nitrogen is 14). Figures 3-5 are histograms showing concentrations of nine water chemistry constituents in surface and deep samples at each of the 22 sampling stations shown in Figure 2.

Several trends are apparent in Tables 1-2 and Figures 3-5. The most evident characteristic is that, with the exceptions of Stations 1 and 2, there is an overall constancy in values of all

constituents throughout the sampling regime. The two exceptions to the overall constancy of data, Stations 1 and 2, are located near the shoreline off the small beach north of the Harbor and in the small boat basin, respectively. At Station 1, values of salinity were lower while concentrations of Si and NO_3^- were elevated in both surface and deep water compared to all other sampling sites (Figures 3 and 5). Values of turbidity and Chl *a* were also elevated at Station 1, while temperature was lowest at this station relative to all areas (Figure 5). At Station 2, located within the Kawaihae Small Boat Harbor (North), salinity was low and nutrients were elevated at the surface, but not in the deep sample. Turbidity, Chl *a*, and temperature did not differ substantially at Station 2 relative to the rest of the sampling sites (Figure 5).

Figure 6 shows vertical profiles of salinity through the water column separated by stations located within the harbor and outside the harbor. As with the discrete sampling, there is a distinctive surface layer of low salinity water at Station 2 (note that a profile was not possible at Station 1 owing to shallow depth and breaking surf). Stations 3 and 4 along the face of Piers 1 and 2A also displayed a surface layer of slightly lower salinity. Outside the harbor none of the vertical gradients of salinity displayed distinct stratification in the surface layer. At Station 22, within the small boat harbor at the southern end of the deep draft harbor, there was a mid-water layer of slightly lower salinity.

These patterns are likely a reflection of fresh groundwater that enters the nearshore ocean through discharge at the shoreline forming a buoyant surface lens. Data collected for this study indicate that groundwater efflux in the Kawaihae area is relatively small in magnitude compared to many other areas of west Hawai‘i, and detectable only at several locations very close to the shoreline at the northern end of the deep draft harbor (Stations 1-4) . At stations within the deep draft harbor, where physical mixing processes are minimal, the largest reduction in salinity over open ocean values is about 0.2‰, indicating only a small input of groundwater (Figure 3, Tables 1-2). As groundwater typically contains elevated concentrations of Si and NO_3^- and lower salinity relative to ocean water, the buoyant lens also contains elevated concentrations of these nutrients. Inspection of Tables 1-2 and Figure 3 reveals that the highest concentrations of surface Si and NO_3^- within the harbor occur at Stations 3 and 4, with very uniform values throughout the rest of the harbor. It is also evident that, while salinity of surface waters is consistently lower than corresponding deep waters at each station (Figure 5), surface values of Si and NO_3^- were elevated or identical to the corresponding deep values (Figure 3). These patterns suggest that while groundwater input to the area is small, there still is a detectable effect of input of low-salinity, high-nutrient groundwater throughout the Kawaihae area.

Histograms of other water chemistry constituents do not reflect the same patterns as Si, NO_3^- and salinity. Concentrations of PO_4^{3-} show a slight trend of diminishing values with distance from shore; at most stations concentrations were also elevated in deep waters relative to surface values (Figure 3). Concentrations of NH_4^+ were substantially elevated at Station 1 relative to all other stations and showed no consistent pattern with respect to vertical stratification (Figure 4). These elevated values of PO_4^{3-} and NH_4^+ in deep samples may be a result of biotic respiration in the sediment column. Histograms of total nitrogen (TN) and total phosphorus (TP) reveal weaker patterns of variation than other nutrients and are consistent throughout the sampling regime (Figure 4).

Histograms of turbidity reveal substantial elevation at Station 1, likely as a result of resuspension of fine-grained sediment from wave action (Figure 5). Within the harbor basin turbidity was relatively constant, with values of approximately 0.2-0.4 NTU. Turbidity at stations within the harbor basin were overall slightly elevated relative to stations outside the harbor, although there was no consistent pattern with respect to vertical stratification of turbidity (Figure 5). The lack of elevated turbidity in deep samples within the harbor, in which the bottom is composed of a fine-grained sediment, indicates very little resuspension of material from water movement. Similarly, values of Chl *a* were slightly elevated within the harbor basin relative to outside the harbor. However, within the harbor, values of Chl *a* were consistently elevated in deep samples relative to surface samples, while outside the harbor such a pattern did not occur (Figure 5). The elevated values of Chl *a* in bottom samples suggest increased benthic planktonic growth near the sediment surface relative to the water surface.

Vertical profiles of temperature reveal distinct vertical stratification within the harbor basin (Figure 7). At a depth of about four meters there is a distinct thermocline with surface waters about 1˚C higher than in the bottom layer. As groundwater is generally cooler than ocean water, the elevated temperature in the surface waters of the basin is likely a result of solar warming. Cooler deep water may be drawn into the harbor basin in response to warm surface water flowing out of the entrance channel. Outside the harbor basin vertical temperature stratification is far less pronounced than inside the basin. The only profile displaying a similar surface layer occurred at Station 22, located within the small boat harbor at the southern end of the deep draft harbor (Figure 7). At the open ocean sampling sites, temperature was essentially constant through the water column. The difference in vertical profiles of temperature inside and outside the harbor is likely a response to the longer residence time of water within the basin resulting in the formation of a well-defined surface layer.

Vertical profiles of dissolved oxygen display relatively consistent trends within the harbor basin, with slightly lower values in surface waters relative to bottom waters (Figure 8). The

consistent values below a depth of 4 meters also suggest a subsurface inflow of ocean water. Outside the harbor, vertical profiles of dissolved oxygen varied substantially between stations. Profiles near the entrance channel (Stations 14 and 15) and at the sites farthest offshore (Stations 18 and 21) displayed straight line profiles, indicating a lack of stratification in offshore waters. At stations over the reef close to the outer side of the breakwater (Stations 16, 17, 19 and 20) profiles of dissolved oxygen displayed lower concentrations and distinct stratification, suggesting some uptake over the reef flat (Figure 8).

The survey was conducted during a period of prolonged dry weather, which is the typical condition at Kawaihae. Hence, there was little or no surface flow entering the basin. Had surface water draining the upland watershed been flowing into the basin, it is likely that there would be a different structure to the water chemistry.

Kawaihae Harbor is classified as a "Class A" embayment within DOH Water Quality Standards; embayments are defined as land-confined and physically-protected marine waters with restricted openings to open coastal waters. The region of study outside of Kawaihae Deep Draft Harbor is considered "open coastal waters" according DOH classifications.

The "Class A" embayment classification includes three sets of specific criteria: values that are not to be exceeded 10 percent of the time, values not to be exceeded more than 2 percent of the time, and values that are not to be exceeded by the geometric means of samples. These criteria are based on statistical treatment of multiple repetitive time-series measurements. The present assessment does not include such time-series measurements. However, comparing sample concentrations from the single sampling event to these criteria provides an indication of whether water quality is near the stated specific criteria.

Noted in Tables 1 and 2 are samples that exceed DOH geometric means of water quality standards for embayments. The criteria for "dry" conditions are applied, as it is not likely that the basin receives more than 1 percent of the volume in freshwater input per day. As the determination of the exact volume of freshwater input per day is not likely possible, the more conservative dry criteria are considered.

Examination of Tables 1 and 2 reveals that the only constituent that exceeded the specific 2 percent criteria within the harbor was NO_3^- in the surface sample of Station 2 (no values exceeded the 10 percent criteria). As Station 2 is located within the Kawaihae Small Boat Harbor (North), no samples within the main deep draft basin exceeded any the specific standards for embayments. Similarly, Station 1 was the only sampling site to exceed the specific standards for open coastal waters. At this site, concentrations of NO_3^-, NH_4^+ and turbidity all exceeded the 2 percent criteria in both the surface and deep samples. One

sample of TN (Station 1S) and one sample of turbidity (Station 22S) exceeded the 10 percent criteria (Tables 1-2). It should also be noted that DOH Water Quality Standards contain a specific set of standards for west Hawai'i based on scaling nutrient concentrations to salinity [§11-54-6(d)]. This scaling is restricted to samples with salinity less than 32‰. As none of the samples collected in and around Kawaihae Harbor had salinity less than 32‰, these standards are not applicable to the present survey.

Table 3 shows summary statistics (geometric means, standard deviations, maxima, minima) for samples collected in surface and deep waters both inside and outside of Kawaihae Deep Draft Harbor. DOH Water Quality Standards also contain specific criteria for geometric means. Based on the single sampling at Kawaihae, geometric means are calculated over space rather than time. When comparing these geometric means to standards for embayments, none of the values exceed the limiting values shown in Table 3. When geometric means from samples collected outside the harbor are compared to the open ocean standard values, values of TN in both surface and deep waters, TP in deep water, and turbidity in both surface and deep water exceed standards.

B. Sediment Chemistry

The entirety of the floor of both Kawaihae Harbor and the inner entrance channel is covered with a layer of fine-grained muddy sediment. Four sediment samples were collected at locations shown in Figure 2 approximately 20 feet from the piers. Sediment samples cored from the surface to a depth of approximately eight inches into the sediment column were analyzed for the set of chemical constituents routinely analyzed for permitting decisions for allowable dredge spoils disposal. All results of sediment chemistry are shown in Appendix A, while Table 4 shows a summary of results of the testing concentrations of those constituents that were reported above the detection limits, as well as the limits of detections.

Overall, results from all four sample sites were similar. Total solids ranged from 54.4 percent (Site 2) to 73.8 percent (Site 1). No TPH, as gasoline, oil, or diesel, was detected at any of the sampling sites, and all four samples had ignitibility flashpoints of greater than 212 ˚F. With respect to TCLP metals, none of the samples contained detectable levels of arsenic, cadmium, chromium, silver, mercury or selenium. All four samples contained TCLP barium at concentrations ranging from 0.200 to 0.397 mg/L. The only PCB detected was Aroclor 1242 at a concentration of 93 µg/kg at Site 3. None of the samples contained any detectable levels of volatile organic compounds (Method 8260B). Various semi-volatile compounds (Method 8270C) were detected at Sites 1, 2 and 3, while none were detected at Site 4. The highest number of compounds, and the highest concentrations were measured at Site 3, near the end of Pier 2A (Table 4, Appendix A).

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C. Marine Community Structure

1. Inner Harbor Benthic Communities

The existing berthing areas of Kawaihae Harbor that include Piers 1, 2A and 2B are shown in blue in Figure 1. Also outlined in Figure 1 are the regions proposed for the extension of Pier 2C. The area of proposed new dredging extends along the entire length of the combined existing and proposed piers (~515 meters) (Figure 1). Examination of the floor of the dredged harbor basin shows that it is covered with a layer of fine-grained sand-mud sediment (Figure 9). The surface of the sand-mud harbor floor is perforated by numerous burrows of infaunal organisms; no macro-epifaunal organisms including corals were observed on the sand-mud surface. Quantification of infaunal burrowing macro-organisms would entail analysis of sediment collection utilizing large-scale box-cores which was beyond the scope of the present survey.

All of the vertical surfaces of the corrugated sheet-piling forming the edge of Pier 1 and the area between Piers 1 and 2, as well as the outer row of column pilings supporting Piers 2A-2B, provide habitats that has been extensively colonized by corals and other benthic invertebrates. While corals are common along the entire span of Piers 1 and 2A-2B there is a distinct pattern of zonation between the areas of sheet piles and cylindrical piles. Column piles supporting Piers 2A-2B are colonized mainly by two species of coral consisting of *Montipora capitata*, occurring as either flat encrustations or delicate plating growth forms (Figure 10) and rounded lobes of *Porites lobata* (Figure 11). While not as common, colonies of *Pocillopora* spp. also occurred on the cylindrical piles (Figure 11). Coral colonization on the cylindrical columns was restricted to the outermost row of piles, while the inner rows were essentially devoid of growth, likely as a result of light limitation.

Similar colonization of pier pilings by the same growth form of *M. capitata* has been observed in other harbors in Hawai'i, particularly on the island of Maui, where this coral covers a large percentage of submerged pilings in both Hana and Kahului Harbors. Also abundant on the pilings were a variety of other invertebrates typical of fouling communities within harbors including sponges, hydroids and algae. AECOS reported that Pier 2B contained the lowest number of species of any area within the harbor, recording only 13 invertebrates, which included only three species of coral.

The most prolific occurrence of reef corals within Kawaihae Harbor occurs on the corrugated sheet-piling along the front margin of Pier 1 and between Piers 1 and 2A. The cover of these vertical faces consists predominantly of merged and overlapping colonies of *Porites lobata*

that in places form a near continuous mass of living coral on the outer surfaces of the sheet-piling (Figures 12-14). Typically, corals covered the sheet-piling from about one meter below the water surface to just above the juncture of the harbor floor. At the northern end of Pier 1, the other predominant coral species occurring on the sheet-piling is *Montipora capitata* and *M. patula* (Figure 13), while at the southern end of Pier 1, and in the area between Piers 1 and 2A, the other predominant coral on sheet-piling is *Pocillopora meandrina* (Figures 12 and 14). While the dominant corals on the cylindrical piles were large encrustations or horizontal plates of *Montipora capitata*, far fewer of these growth forms were observed on the sheet-piling, and were restricted only to the northern end of Pier 1. Hence, while both types of vertical surfaces forming the Piers were encrusted with corals, the community structure of these two surfaces differs substantially.

While the majority of the sheet-piling stretching from Pier 1 to Pier 2A extended to the sediment floor of the harbor, in several areas there were other intervening structures. Approximately 30 meters from the northern end of Pier 2A, a large (~3-4 meters in length) coral cover boulder was situated on the harbor floor adjacent to the sheet-piling (Figure 15). Owing to the size and prolific coral cover on the boulder it is possible that it is a remaining remnant of the original reef that was not removed during the initial construction. Further north along the area proposed for extending Pier 2A, the juncture of the sheet-piling and sediment floor was lined with piles of basaltic rocks and boulders (Figure 15). Many of the boulders are colonized by small corals, consisting predominantly of *Pocillopora meandrina*. Some areas of the rock piles also contained numerous sea urchins, primarily *Echinothrix diadema, Tripneustes gratilla,* and *Heterocentrotus mammilatus* (Figure 15). It is likely that these aggregations of rocks and boulders are also a remnant of construction activities as the shoreline in the area between Piers 1 and 2A is constructed of similar material.

South of Pier 2B, in the area proposed for Pier 2C, the submerged shoreline is also composed of similar basaltic boulders that extend to the existing wooden docks (Figure 16). These boulders are also colonized by a variety of corals, predominantly encrusting forms of *Porites lobata, Montipora capitata* and *M. patula*, and heads of *Pocillopora meandrina*. In addition to corals, the boulders are also covered with numerous sea urchins, predominantly *Echinothrix diadema, Tripneustes gratilla,* and *Heterocentrotus mammilatus* (Figure 16).

Table 5 shows results of evaluation of coral colony size frequency distribution along the vertical surfaces of Piers 1, 2A-2B, and the areas of proposed Piers 2C and extension of Pier 2A. A total of nine species of coral were observed, with a total colony count of 6,982. The most abundant coral was *Porites lobata*, accounting for about 50 percent of the colonies, followed by *Pocillopora meandrina* and *Montipora capitata*, each accounting for about 23

percent of the number of colonies. Hence, these three species comprised 96 percent of the colonies.

With respect to size class, the overall most abundant class was the 10-25 cm group, accounting for 35 percent of the colonies, followed by the 5-10 cm class which accounted for about 30 percent of the colonies. The least abundant class was the largest size (>50 cm) accounting for about 3 percent of the colonies. The low number of large colonies is likely a result of the mostly vertical substratum, which limits the maximum size of colonies.

The area with the highest number of coral colonies was the corrugated sheet-piling fronting Pier 1 (2,350 colonies), followed by the sheet-piling fronting the area between Piers 1 and 2A (2,103 colonies). The lowest number of colonies occurred on the boulders in the area of proposed Pier 2C. When the number of colonies per meter of shoreline, the lowest number occurs on the column piles supporting Piers 2A-2B, with 3.9 colonies per meter, while the highest colony counts per meter occurred on the sheet-piling between Piers 1 and 2A, and Pier 1 (20 and 16 colonies per meter, respectively). In sum, the entire submerged region of the working area of inner Kawaihae Harbor, as well as the adjacent areas proposed for future development provide suitable surfaces for coral settlement and growth, resulting in dense coral communities that do not appear to be negatively affected by normal harbor operations.

2. Outer Harbor Benthic Communities

Figure 9 shows the area of inner Kawaihae Harbor adjacent to the breakwater and the surrounding outer harbor areas surveyed in this study, along with depth contours and locations of survey stations. The main structural component of the nearshore marine area is a wide, shallow reef flat on which the harbor and entrance channel were dredged. A remnant strip of the original reef flat, approximately 60 feet wide, extends from outside the channel entrance along the entire length of the submerged portion of the inner breakwater. The inner harbor reef remains essentially undamaged between the edge of the dredged basin and the boulder breakwater. Coral community structure on the outer edge of the dredge cut platform differs considerably from community structure on the inner harbor platform, although both areas contain well-developed assemblages. On the platform adjacent to the outer entrance channel, coral community structure is dominated by colonies of *Pocillopora meandrina*, which occurs as sturdy hemispherical colonies composed of short branches. *P. meandrina* is considered a "pioneering species" in that it is generally the first coral to colonize new substratum and is generally found in areas that are too physically harsh for most other species (Figure 17). Below the near-vertical channel cut, *P. meandrina* does not occur; rather, the main colonizer of the channel wall down to the channel floor is a combination of *Porites*

compressa, commonly referred to as "finger coral," and *Porites lobata*, commonly referred to a "lobe coral" (Figure 18).

Along the reef bench inside the harbor breakwater, composition of the coral community changes substantially from outside the breakwater. Nearly the entire bench extending from the edge of the breakwater boulders to over the dredged reef cut is covered with a continuous mat of interconnected *Porites compressa* branches (Figures 19 and 20). *Porites compressa* is generally considered a "climax" species in that, in the absence of physical disturbance, it will generally outcompete other corals for space and dominate the community (Dollar 1982, Dollar and Tribble 1992). This is clearly the case on the inner reef flat where the shelter from wave impacts provided by the breakwater results in ideal conditions for *P. compressa* to cover the available substratum to the exclusion of most other species. Of particular interest is a study conducted in 1978 of the Kawaihae reefs by the same author as the present report (Orca 1978) that reports that coral cover on the inner reef platform was relatively low at about 30-40 percent of bottom cover, while coral species diversity was the highest encountered anywhere in the area. These observations suggest that, in 1978, the coral community was in an intermediate stage of recovery from what was likely near complete mortality during blasting of the harbor basin. In the intervening 33 years since the study, coral community succession has progressed to the present climax state with high coral cover dominated by a single species resulting in extremely low diversity.

Biotic structure of the nearshore environment outside of Kawaihae Harbor is somewhat unique along the coastline of west Hawai'i owing to the wide, shallow fossil reef flat on which the harbor was dredged. The shallow inner reef flat fronting the breakwater coral community structure is typified by areas of large (2-3 feet in diameter) colonies of *Porites lobata* (Figure 21) or mixes of smaller colonies of *Porites lobata* and *Pocillopora meandrina* (Figure 22). Near the edge of the reef flat, topography of the bottom becomes more irregular with more evidence of bioerosion of the fossil reef structure (Figure 23).

At the outer boundary of the reef platform, bottom composition grades into a series of elongated ridges or knolls oriented perpendicular to the shoreline and separated by sand and rubble-filled channels. The ridges and knolls are composed of the depositional accretion of a vast interconnected framework of *Porites compressa* (finger coral) (Figure 24). These features increase in width and height with distance seaward and terminate with nearly vertical sides extending into sand plains at a depth of about 40 feet (Figure 25).

Of interest is that the entire reef, including both the reef platform and the coral knoll zone, shows no evidence of recent damaging effects of storm waves and, as a result, is covered with living coral colonies. As no major storm events have occurred in Hawai'i since Hurricane

Iniki in 1992, about 19 years ago, coral communities have had a chance to proceed toward a climax successional stage, which can be considered nearly complete at the present time on the outer reefs.

Within the region of study, one area stands out as being completely dissimilar to the pattern described above. The anomalous area is located off the entrance channel to the Kawaihae Small Boat Harbor (South), which is outside of the commercial harbor. To ensure safe entrance to the small boat harbor, it appears that a channel was dredged from the small boat harbor mouth in a southwesterly direction. The floor of the channel is covered with rubble coated with a layer of fine-grained dark sediment (Figure 26). Small corals occur on the channel floor, but in far less abundance than in neighboring areas. Adjacent to the channel, the reef is covered with encrustations of crustose coralline algae that are gold, pink or dark burgundy in color (e.g., *Porolithon*, *Peyssonnelia*, *Lithophyllum*) (Figure 27). Crustose coralline algae play two important roles in the coral reef community, first by contributing calcium carbonate to reef structure and second by possibly facilitating settlement of coral recruits. With further distance from the dredged channel area, crustose algae diminish in abundance, while coral cover increases.

Of note is that perhaps the richest area of coral cover encountered in the entire study area occurred adjacent to the southern edge of the small boat entrance channel (Station 6 in Figure 17). Coral in this area covered the entirety of reef surfaces with a variety of species (Figure 28).

Ten coral species have been listed as candidates for endangered species status. These species are: *Cyphastrea agassizi, C. ocellina, Leptoseris incrustans, L. yabei, Montipora dilatata, M. flabellata, M. turgescens, M. patula, Porites pukoensis* and *Psammocora stellata.* The only one of these corals observed on the sheet piling, piles and boulders within the harbor was *Montipora patula*. This species was also observed on the reef outside the harbor during the present survey. An earlier study (AECOS, 2000) also reported *M. patula* in the vicinity of Pier 1.

3. Mapping and Quantitative Analysis of Coral Reef Community Structure

Figure 29 shows a classification map of coral that was generated by applying the spectral signatures of the 24 calibration/validation sites to satellite imagery. In the map, the density of color corresponds to the density of the coral bottom cover. Inspection of the map provides a good overview of the distribution of major bottom cover types throughout the area of study. It can be seen that the areas of densest coral occurrence are located on the strip of undredged reef along the inner side of the breakwater and along the outer edge of the reef flat fronting the outside of the breakwater.

Table 6 shows a summary of the data generated from analysis of the calibration validation sites (the complete data set is shown in Appendix B). Nine species of coral were identified in photo-quadrats taken at the cal/val sites, with a total coral cover of the bottom of about 39 percent. Considering individual species, *Porites lobata* comprised the highest cover (17 percent bottom cover, 43 percent coral cover), while *Porites compressa* accounted for 14 percent of bottom cover and 36 percent of coral cover. The third most abundant species was *Pocillopora meandrina*, accounting for 5 percent of bottom cover and 12 percent of bottom cover. Hence, these three species, which are typically the most abundant on all Hawaiian reefs, accounted for about 91 percent of all corals in the present Kawaihae study. When considering non-coral bottom cover, the most abundant classes were bare limestone (21 percent), crustose coralline algae (11 percent) and turf-bound sediment (11 percent). In total, about 61 percent of the bottom cover in the photo-quadrats consisted of non-coral classes, while about 39 percent consisted of living coral (Table 6).

Table 7 shows area of coral cover within the mapped reef area inside and outside the harbor divided into five classes of abundance (a sixth class contains no coral). Based on these data, 211 acres were included in the area surveyed outside the harbor and 114 acres inside the harbor. Of these areas, about 72 acres outside the harbor contained substrate other than coral (i.e., sand) and 102 acres inside the harbor did not contain any coral (e.g. harbor basin). There was a total of about 48 "coral acres" outside the harbor which accounted for about 36 percent of hard bottom area. Within the harbor, there was about 5.4 coral acres, which accounted for about 61 percent of hard bottom. Hence, on a percentage basis, more of the hard bottom surfaces within the harbor were covered with coral than outside the harbor. Such a result makes intuitive sense as the inside of the harbor is a protected environment and, with suitable water quality, corals have the opportunity to grow relatively undisturbed.

Of the coral cover categories, the largest is the 30-50 percent grouping for the outside reefs which amounts to bottom coverage of about 27 acres, or 20 percent of the bottom area, that contains any coral. Within the harbor, the highest cover class is the 50-70 percent category which accounts for about 41 percent of the bottom coverage in the areas of the harbor containing coral (this excludes the basin floor). While the overall cover is higher on the inner

harbor reefs, cover of the highest cover class (70-90 percent) and lowest cover class (<10 percent) represent the smallest areas of the reef, comprising less than 1 percent of the mapped reef within the harbor. Interestingly, cover of the highest class (70-90 percent) occurs on the outer reef in greater abundance than the inner harbor. Hence, while coral occurs in the harbor habitat in a higher overall percentage of cover of hard bottom, there are areas outside the harbor which apparently have denser cover communities.

To test the accuracy of the classifiers for the Kawaihae Harbor data, coral cover was divided into six classes between zero cover and greater than 70-90 percent coral cover (Table 8). The overall accuracy of the classification (total correct classification divided by total number of data points) is 97 percent, which is considered very high accuracy. The "50-70 percent coral" class has the lowest correct classification rate at 91 percent; 8 percent of this class is misclassified as "0 percent coral," while 1 percent of this class is misclassified at 10-30 percent coral. The 0 percent, 0-10 percent and 70-90 percent coral classes all had accuracy rates of 100 percent. Between 30 percent and 70 percent cover, accuracy was slightly lower. Thus, slightly greater confusion occurred between the classes describing coral cover between 10 percent and 70 percent. While the overall accuracy of the map product is considered high, the cross-validation suggests that the image product provides a conservative estimate of coral cover in the study area.

4. Motile Benthic Macrofauna

The dominant group of motile macroinvertebrates observed on the outer reefs is the sea urchins (Class Echinoidea). The most common urchin is *Echinometra matheai*, which occurred in all reef zones. *E. matheai* are small urchins that are generally found within interstitial spaces bored into basaltic and limestone substrata. *E. matheai* were most abundant at the mid-reef. *Echinostrephus aciculatus* is another small urchin with thin spines that is found in bored holes on the reef surface. *Tripneustes gratilla, Echinothrix* spp. and *Heterocentrotus mammillatus* are other species of urchins that occurred across the reef platform. These urchins occur as larger individuals (compared with *E. matheai*) that are generally found on the reef surface, rather than within interstitial spaces. All of these larger urchins were also observed on the sheet pilings on the inner harbor piers.

Sea cucumbers (Holothurians) observed during the survey consisted of three species, *Holothuria atra, H. nobilis*, and *Actinopyga obesa*. Individuals of these species were distributed sporadically across the mid-reef and deep reef zones. The most common starfish (Asteroidea) observed on the reef surface were *Linckia* spp. No crown-of-thorns starfish (*Acanthaster planci*) were observed during field studies. Sponges were not abundant on the

reef surface outside of Kawaihae Harbor; however, numerous sponges were observed on the piles and sheet piling lining the harbor face. The most common of these sponges was the grey encrusting sponge *Gelliodes fibrosa*, the lobate sponge *Suberites zeteki*, and the orange sponge *Mycale armata*.

The most common algae observed on the reef off Kawaihae Harbor were the encrusting red calcareous algae (e.g., *Porolithon spp., Peysonellia rubra, Hydrolithon* spp.). These algae were abundant on bared limestone surfaces and on the nonliving parts of coral colonies. As discussed above, crustose calcareous algae comprised a large percentage of bottom cover in the boundary zone between the small boat entrance channel and the outer reef areas. Similar zones of crustose calcareous algae have also been observed outside of Pelekane Bay adjacent to Kawaihae in transition zones between mud-dominated areas and coral communities. Based on calibration-validation photo-quadrat analysis, crustose calcareous algae covered about 11 percent of the reef surface. While crustose algae were abundant, frondose algae were essentially absent from the reef surface in all zones.

The design of the reef survey was such that no cryptic organisms or species living within interstitial spaces of the reef surface were enumerated. However, no dominant communities of these classes of biota were observed during the reef surveys at any of the study stations.

5. Reef Fish Community Structure

The reef fish community off Kawaihae Harbor is typical of that found along most of the Kona Coast, as described by Hobson (1974) and Walsh (1984). Reef fish were quantitatively evaluated at the cal/val sites shown in Figure 17 and the resulting counts are listed in Table 9. Of the total of 1,498 fish observed, the two most numerous families were the Pomocentridae (damselfish) and Acanthuridae (surgeonfish) which comprised about 28 percent and 25 percent of the fish population, respectively. Labrids (wrasses) and Chaetodonts (butterflyfish) were the next most abundant families comprising about 13 percent and 15 percent of the fish, respectively. Hence, these four families accounted for about 81 percent of the fish observed. The most common individual species was the blackfin chromis (*Chromis vanderbilti*) followed by the Saddle-back wrasse (*Thalassoma duperrey)* and brown surgeonfish (*Acanthurus nigrofuscus*).

Distribution of reef fish community structure indicates that abundance is largely determined by the topography and composition of the benthos. With respect to fish abundance per sampling site, the number of species ranged from two (Station 4) to 31 (Station 22). The number of individuals per site ranged from three (Station 4) to 149 (Station 22). Station 4

was located in the interior of the Kawaihae Small Boat Harbor (South), while Station 22 was located at the corner of the dredged reef on the inner side of the Kawaihae breakwater.

Fish community structure along the west Hawai'i coastline can be divided into six general categories: juveniles, planktivorous damselfishes, herbivores, rubble-dwelling fish, swarming tetrodonts, and surge-zone fish. Juvenile fish belonged mostly to the family Acanthuridae (surgeon fish), with representatives from the families Labridae (wrasses), Mullidae (goat fish) and Chaetodontidae (butterfly fish). Juveniles were most abundant in areas dominated by finger coral (*P. compressa*) or basalt boulders. The complex habitat created by the spreading growth form of *P. compressa* provides shelter for small fish. Planktivorous damselfish, principally of the genus *Chromis*, were abundant in all areas surveyed. Agile chromis (*Chromis agilis*) were very abundant along the outer edge of the shelf and in deeper water, whereas blackfin chromis (*C. vanderbilti*) was the primary shallow water species.

Herbivores, primarily the yellow tang (lau'i-pala, *Zebrasoma flavescens*) and goldring surgeonfish (kole, *Ctenochaetus strigosus*), were also abundant. On the shallower reef terrace, adult whitebar surgeonfish (maikoiko, *Acanthurus leucopareius*), orangeband surgeonfish (na'ena'e, *A. olivaceus*), brown surgeonfish (ma'i'i'i, *A. nigrofuscus*) and parrotfish (uhu, *Scarus* spp.) were also common. The inner surge zone along the wave-swept basalt terraces supported a large number of fish, principally herbivores such as surgeonfish (*Acanthurus* spp.) and unicornfish (mostly umaumalei, *Naso lituratus*). Saddle wrasses (hinalea lau-wili, *Thalassoma duperrey*) were also abundant throughout all zones of the reef. Black durgons (humuhumu-ele'ele, *Melanichthys niger*) and pinktail durgons (humuhumu-hi'u-kole, *M. vidula*) were also observed congregating in the water column over the reef platform.

Overall, fish community structure outside Kawaihae Harbor is fairly typical of the assemblages found in undisturbed Hawaiian reef environments. However, the lack of fish species that are prized as food fish suggests the outer reef area has been subjected to significant amounts of fishing pressure.

During surveys of the Piers, several large schools of fish, including weke (*Mulloidichthys flavolineatus*), aholehole (*Kulia sandvicensis*), papio (*Caranx* spp.), brown surgeonfish (*Acanthurus nigroris*) and manini (*Acanthurus triostegus*) were observed within the column pilings under Pier 2A-2B.

6. Endangered Protected and Invasive Species

Several species of marine animals that occur in Hawaiian waters have been declared threatened or endangered by Federal jurisdiction. The threatened green sea turtle (*Chelonia*

mydas) occurs commonly along the Kona Coast, and turtles are frequently observed on beaches throughout the area. The endangered hawksbill turtle (*Eretmochelys imbricata*) is known infrequently from waters off the Kona Coast. Several green sea turtles were observed during the course of underwater surveys for the present report and were particularly abundant on the southern portion of the outer reef flat. Populations of the endangered humpback whale (*Megaptera novaeangliae*) winter in the Hawaiian Islands from December to April. The present survey was conducted in October -November, before whales are generally present in Hawaiian waters. The Hawaiian monk seal, (*Monachus schauinslandi*) is an endangered earless seal that is endemic to the waters off the Hawaiian Islands. Monk seals commonly haul out of the water onto sandy beaches to rest. Hence, while there is no greater potential for haul out to the beaches at Kawaihae Harbor than any other area, there is a probability that seals will haul out on these beaches. No individuals were observed on the beach or in the water during the course of the present survey.

Review of the "Guidebook of Introduced Marine Species of Hawai'i" prepared by the Bishop Museum and University of Hawai'i (R. DeFelice, L. Eldredge and J. Carlton) (see http://www2.bishopmuseum.org/HBS/invertguide/index.htm) describe many of the more common alien marine invertebrates known in the Hawai'ian Islands. These authors consider 201 species to be introduced, with an additional 86 species considered cryptogenic (not demonstratively native or introduced). A total of 248 species have become established; additionally, 15 arrived but failed to become established, six were intercepted, and the population status of 18 species is unknown. It is stated that the greatest number of introduced marine invertebrates have probably arrived to Hawai'i through hull fouling, but many may also have arrived through solid ballast and in ballast water. Of the common introduced sponges, Cnidarians, Polycheates, Molluscs, Crustaceans, Bryozoans and Ascidians described in the publication, many are described as very common foulingorganisms in harbors throughout the main islands. None are noted to exist only in Kawaihae Harbor.

The State of Hawai'i Department of Land and Natural Resources (DLNR) Division of Aquatic Resources lists a variety of "regulated" marine fishes and invertebrates. Marine invertebrates include primarily species valued as food sources, including abalone, various clams and oysters, crabs, shrimp, lobsters, and sea urchins (for complete list and scientific names of regulated species, see http://hawaii.gov/dlnr/dar/regulated_fish_names.html). The only species observed within the confines of Kawaihae Harbor on the list was the sea urchin *Echinothrix diadema*. It is possible that burrows noted within the sediment floor of the basin may be from shrimp (`opae); however, no individuals were observed.

KAWAIHAE HARBOR
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V. SUMMARY and CONCLUSIONS

Kawaihae Harbor is a deep-draft harbor that contains piers and berths for large commercial vessels and serves as a site for various marine recreational activities. Existing structures are inadequate for the proposed increase uses of the harbor, prompting planning for in-water work to increase pier space and conduct maintenance dredging.

As part of this planning process, a preliminary baseline assessment of water quality, sediment quality and biotic community composition was conducted in 2011. The assessment consisted of a quantitative assessment of marine biota in the area that might be directly affected by new dredging and extension of piers, as well as the reef habitats surrounding the harbor. In addition, an assessment of water quality was conducted, which included measurements of all constituents listed in the Department of Health Water Quality Standards for estuarine waters. Sediment samples collected within the harbor area where new dredging is planned were analyzed for a suite of constituents to evaluate the presence of contaminants.

Water samples collected from 22 stations within the main harbor basin and outside the harbor, extending through the entrance channel to the open ocean surrounding the harbor, revealed very little input of groundwater to the harbor basin or outer reef areas (Timing and weather conditions have prevented wet weather sampling). Water quality throughout the basin was similar to that of open coastal waters with the exception of clear patterns of vertical stratification of temperature. Overall, values of both turbidity and Chl *a* were elevated in bottom samples relative to surface samples within the harbor basin.

For the samples collected within the harbor, no constituents had concentrations over State of Hawai'i, Department of Health Water Quality Standards.

Analyses of a variety of chemical constituents in sediment collected from four sites within the inner basin revealed no detectable concentrations of petroleum products. TCLP metals were absent in all samples with the exception of barium, which occurred at all four sampling sites, and lead was detected at a single site. No volatile organic compounds tested were detected, while a single sample resulted in a detectable level of one PCB compound. Semi-volatile compounds were detected at three of the four sites.

Composition of the bottom of the basin consists of a ubiquitous layer of fine-grained muddy sand. Numerous burrows from a variety of infauna penetrate the sediment layer.

Vertical surfaces composed of column piles supporting Piers 2A and 2B and sheet-piling fronting Pier 1 and the area between Piers1 and 2, as well as boulders forming the shoreline

off the end of Pier 2B support substantial colonization of reef corals. The most abundant occurrence of reef corals within the harbor occurs on the corrugated sheet-piling along the front margin of Pier 1 and between Piers 1 and the northern end of Pier 2. The cover of these vertical faces consists predominantly of merged and overlapping colonies of *Porites lobata* that in places form a near continuous mass of living coral on the outer surfaces of the sheet-piling. Typically, corals covered the sheet-piling from about one meter below the water surface to just above the juncture of the harbor floor. At the northern end of Pier 1, the other predominant coral species occurring on the sheet-piling is *Montipora capitata* and *M. patula*, while at the southern end of Pier 1, and in the area between Piers 1 and 2A, the other predominant coral on sheet-piling is *Pocillopora meandrina*. While the dominant corals on the column piles supporting Piers 2A and 2B were large encrustations or horizontal plates of *Montipora capitata*, far fewer of these growth forms were observed on the sheet-piling. Occurrence of *Montipora* spp. on sheet-piles was largely restricted to the northern end of Pier 1. Hence, while both types of vertical surfaces (column piles and sheet-piles) forming the Piers were encrusted with corals, the community structure of these two surfaces differs considerably.

While the majority of the sheet-piling stretching from Pier 1 to Pier 2A extended to the sediment floor of the harbor, in several areas there were other intervening structures. Approximately 30 meters from the northern end of Pier 2A, a large (~3-4 meters in length) coral cover boulder was situated on the harbor floor adjacent to the sheet-piling. Owing to the size and prolific coral cover on the boulder it is possible that it is a remaining remnant of the original reef that was not removed during the initial new dredging of the harbor. Further north along the area proposed for extending Pier 2A, the juncture of the sheet-piling and sediment floor was lined with piles of basaltic rocks and boulders. Many of the boulders are colonized by small corals, consisting predominantly of *Pocillopora meandrina*. Some areas of the rock piles also contained numerous sea urchins, primarily *Echinothrix diadema, Tripneustes gratilla,* and *Heterocentrotus mammilatus*.

South of Pier 2B, in the area proposed for Pier 2C, the submerged shoreline is also composed of similar basaltic boulders that extend to the existing wooden docks. These boulders are also colonized by a variety of corals, predominantly encrusting forms of *Porites lobata, Montipora capitata* and *M. patula,* and heads of *Pocillopora meandrina*. In addition to corals, the boulders are also covered with numerous sea urchins, predominantly *Echinothrix diadema, Tripneustes gratilla,* and *Heterocentrotus mammilatus*.

Evaluation of coral colony size frequency distribution along the vertical surfaces of Piers 1, 2A and 2B, and the areas of proposed Piers 2C and extension of Pier 2A revealed a total of nine species of coral, with a total count of about 7,000 colonies. The most abundant coral was *Porites lobata*, accounting for about 50 percent of the colonies, followed by *Pocillopora*

meandrina and *Montipora capitata*, each accounting for about 23 percent of the number of colonies. Hence, these three species comprised 96 percent of all colonies. With respect to size class, the overall most abundant class was the 10 to 25 cm group, accounting for 35 percent of the colonies, followed by the 5 to10 cm class which accounted for about 30 percent of the colonies. The least abundant class was the largest size (>50 cm) accounting for about 3 percent of the colonies. The low number of large colonies is likely a result of the mostly vertical substratum, which limits the maximum size of colonies.

The area with the highest number of coral colonies was the corrugated sheet-piling fronting Pier 1 (2,350 colonies), followed by the sheet-piling fronting the area between Piers 1 and 2A (2,103 colonies). The lowest number of colonies occurred on the boulders in the area of proposed Pier 2C. When the number of colonies per meter of shoreline, the lowest number occurs on the column piles supporting Piers 2A-2B, with 3.9 colonies per meter, while the highest colony counts per meter occurred on the sheet-piling between Piers 1 and 2A, and the sheet piles along Pier 1 (20 and 16 colonies per meter, respectively). In sum, the entire submerged region of the working area of inner Kawaihae Harbor, as well as the adjacent areas proposed for future development provide suitable surfaces for coral settlement and growth, resulting in dense coral communities that do not appear to be negatively affected by normal harbor operations.

Biotic colonization of the solid surfaces of all piers and pilings also included some components of typical harbor fouling community, made up primarily of bryozoans, hydroid, algae and sponges. Fouling communities were most abundant in the most innermost (with respect to the Harbor entrance) area of Pier 2B and decreased to almost non-existent at the outermost area of Pier 1.

Of the communities colonizing the harbor walls, only one sea urchin (*Echinothrix diadema*) is listed as "regulated" by DLNR. In addition, none can be considered rare or of particular commercial or recreational value. Descriptions of introduced invertebrates prepared by the Bishop Museum and University of Hawai'i indicate that most common alien invertebrates are also common members of fouling communities throughout harbors in the main Hawaiian Islands. No introduced invertebrate species were noted as occurring solely within Kawaihae Harbor.

The reef bordering the outer side of the breakwater consists of a wide, flat platform which grades into a zone of large knolls created by the continual upward accretion of living corals. Biotic composition on the outer reef represents a pristine setting with no apparent effects to community structure from the existing deep draft harbor. A strip of reef platform left undredged inside the breakwater presently contains a thriving reef community, although coral diversity is low owing to the competitive superiority of a single species that is

protected from wave impact damage by the breakwater. Such protection, along with suitable physical and chemical water conditions, provides an ideal habitat for coral growth with the harbor.

Utilizing the spectral properties of corals detectable in satellites imagery, it is possible to create a map depicting coral abundance on reefs. A clear advantage of this method is that it treats all areas of a reef with the same importance, something that is not possible by traditional survey techniques which examine a small area and then extrapolate to the larger context. Mapping of coral abundance in the Kawaihae area reveals a total of five coral-acres (22,000 m^2) within the harbor and 48 acres (193,000 m^2) on the reefs outside the harbor. These values can be interpreted as an area of 5 acres completely covered with coral within the harbor. While the mapping tools provide a unique data product, a decided deficiency is that they are not able to deal with vertical surfaces. Therefore, it was not possible to use the mapping tools to evaluate coral cover on the vertical faces of the harbor structures.

The proposed improvements within waters of Kawaihae Harbor include new dredging of soft sediment covering the harbor floor, as well as construction of a new pier at the southern end of the existing operational piers, and extension of one of the existing piers. These actions will have some unavoidable environmental impacts that will require mitigative actions. With regard to dredging, it is expected that turbidity and TSS of the water column will be temporarily increased as a result of sediment resuspension and dredge leakage. As is typical in other past harbor new dredging projects, best management practices will include requirements for silt containment devices to minimize and localize the effects of dredging. A water quality monitoring program carried out during the new dredging activity will likely set limits of exceedance which will trigger cessation of dredging. Results of the water chemistry survey conducted for this assessment reveal that there is little effect from groundwater intrusion in the area of proposed dredging, so there should be no hydrological effects from dredge activities. While some sediment infauna will undoubtedly be lost as a result of dredging, the area is small with respect to the entire harbor floor, and it is likely that the "new" sediment column will be rapidly recolonized from surrounding areas. A somewhat unique aspect of the Kawaihae Harbor is the extensive coral colonization of the pilings that are adjacent to the new dredging site. As a best management practice to minimize potential negative effects from resuspension of dredge materials, it is suggested that the silt barriers are placed not only on the outer boundary of the dredge zone, but also between the dredge zone and the pilings.

The areas planned for construction of Pier 2C and extension of Pier 2A presently contain extensive communities of reef corals that have likely been in place since the original construction of the harbor. Unless provisions are made to keep the existing sheet-piles and boulder shorelines in place during construction of new piers, these populations will

unavoidably be eliminated under the proposed scenario of pier extension. Strategies to mitigate coral loss will be negotiated as part of the permitting process.

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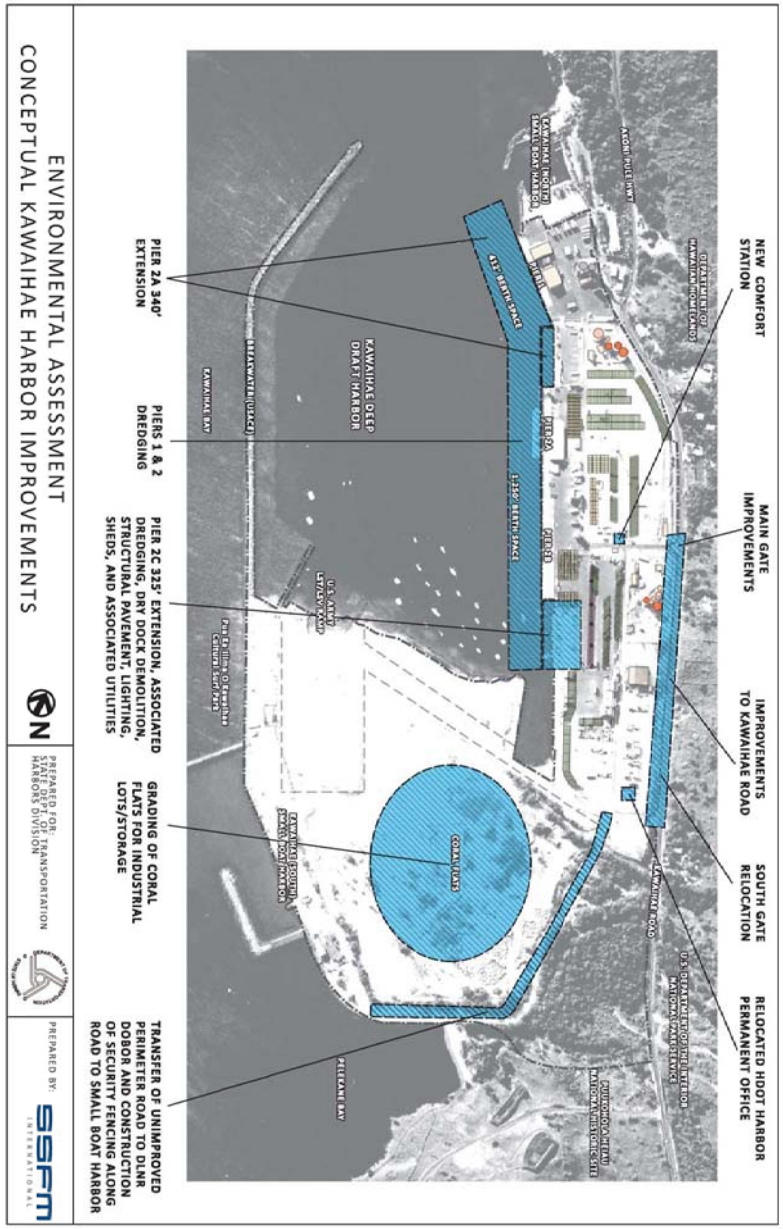


FIGURE 1. Aerial photograph of Kawaihae Harbor, South Kohala, Island of Hawaii showing locations and descriptions of conceptual improvements.

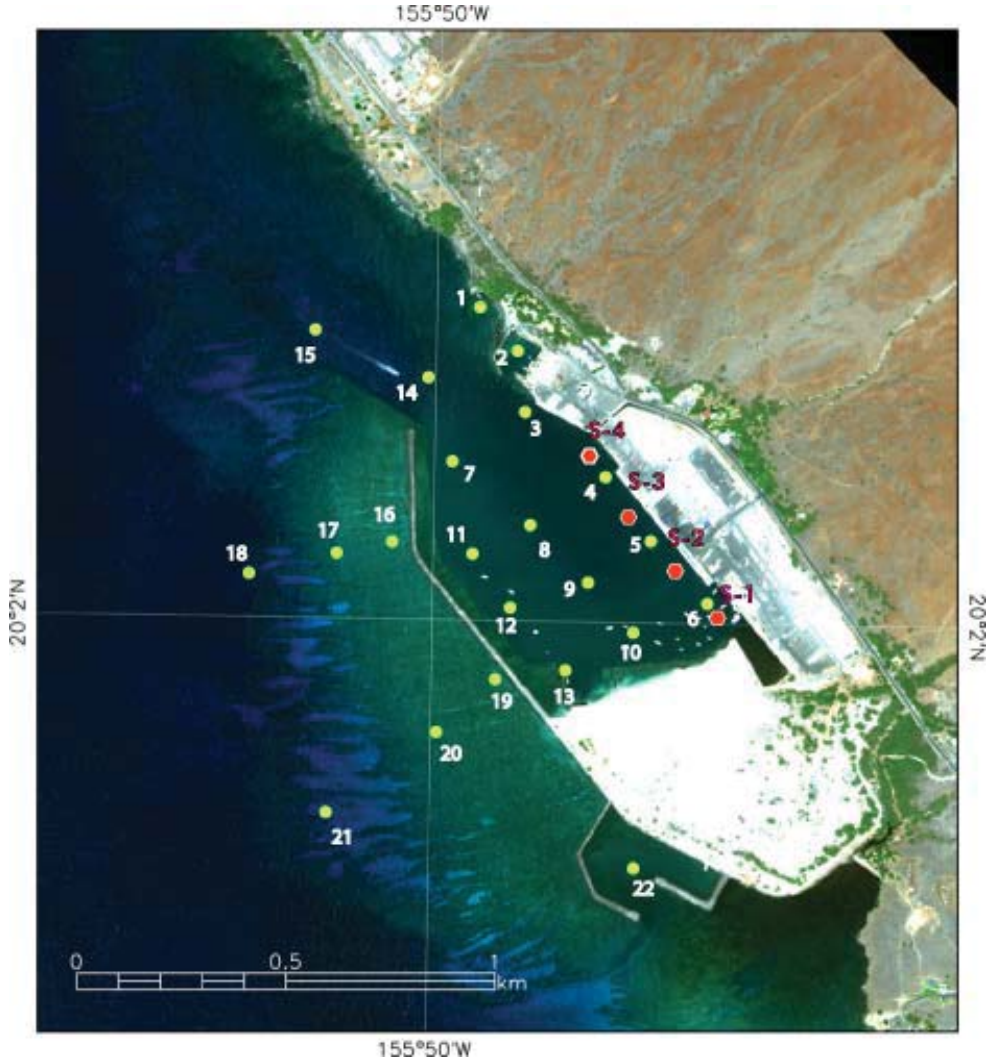


FIGURE 2. Aerial photograph of Kawaihae Deep Draft Harbor and surrounding reef showing locations of 22 water sampling stations (green-orange circles with white numbers) and 4 sediment sampling stations (red octagons with red numbers).

TABLE 1. Water chemistry measurements of surface and near-bottom water from 22 sample sites within Kawaihae Harbor and on the reef outside of the Harbor collected on August 17, 2011. Nutrient concentrations are shown in micromolar units (μM). Abbreviations as follows: S=surface; D=deep; BDL=below detection limit. Also shown are the State of Hawaii, Department of Health (DOH) "not to exceed more than 10% of the time" and "not to exceed more than 2% of the time" water quality standards for open coastal waters (outside the Harbor) and embayments under "dry" conditions (the interior of Kawaihae Harbor is considered an embayment). Boxed values exceed DOH 10% "wet" standards; shaded values exceed DOH 2% standards. For sampling site locations, see Figure 1.

SAMPLE LOCATION	SAMPLE SITE	DEPTH (m)	PO_4^{3-} (μM)	NO_3^- (μM)	NH_4^+ (μM)	Si (μM)	TOP (μM)	TON (μM)	TP (μM)	TN (μM)	TURB (NTU)	SALINITY (ppt)	pH (std.units)	CHL a (μg/L)	TEMP (deg.C)	O2 % Sat
INSIDE HARBOR	2S	0.1	0.19	1.60	0.10	22.37	0.29	7.51	0.48	9.21	0.33	34.595	8.23	0.06	26.78	102.5
	2D	2.5	0.13	0.20	0.16	3.93	0.32	7.32	0.45	7.68	0.36	35.039	8.24	0.10	26.19	99.7
	3S	0.1	0.14	0.62	0.10	8.16	0.31	7.58	0.45	8.30	0.29	34.966	8.23	0.12	26.49	102.2
	3D	11.8	0.13	0.07	0.11	1.80	0.32	7.52	0.45	7.70	0.21	35.105	8.25	0.18	25.56	104.7
	4S	0.2	0.15	0.39	0.08	8.66	0.30	6.80	0.45	7.27	0.30	34.973	8.24	0.12	26.27	102.9
	4D	11.8	0.16	0.11	0.09	2.08	0.29	6.89	0.45	7.09	0.49	35.187	8.25	0.18	25.57	103.6
	5S	0.1	0.11	0.03	0.08	2.70	0.32	6.83	0.43	6.94	0.37	35.070	8.26	0.09	26.22	103.8
	5D	12.6	0.14	0.09	0.10	1.93	0.29	7.56	0.43	7.75	0.27	35.097	8.25	0.10	25.54	104.0
	6S	0.1	0.09	0.05	0.08	2.74	0.34	8.57	0.43	8.70	0.30	35.101	8.26	0.09	26.04	104.2
	6D	10.6	0.14	0.10	0.06	1.94	0.32	8.19	0.46	8.35	0.48	35.122	8.25	0.20	25.57	103.5
	7S	0.1	0.10	0.11	0.09	2.76	0.33	7.65	0.43	7.85	0.44	35.080	8.25	0.08	25.88	101.9
	7D	13.3	0.14	0.13	0.08	1.97	0.29	8.37	0.43	8.58	0.39	35.124	8.25	0.15	25.54	104.4
	8S	0.1	0.12	0.21	0.06	3.56	0.31	7.52	0.43	7.79	0.35	35.107	8.22	0.07	26.56	96.6
	8D	11.7	0.14	0.07	0.06	2.08	0.32	8.12	0.46	8.25	0.49	35.182	8.25	0.23	25.56	103.6
	9S	0.1	0.09	0.01	0.06	2.86	0.32	7.45	0.41	7.52	0.35	35.110	8.25	0.12	24.42	101.9
	9D	12.0	0.13	0.04	0.07	2.19	0.29	7.02	0.42	7.13	0.21	35.095	8.26	0.13	25.53	105.1
	10S	0.1	0.10	0.02	0.06	2.98	0.32	8.50	0.42	8.58	0.35	35.095	8.25	0.13	25.60	102.6
	10D	11.3	0.14	0.04	0.03	1.78	0.28	7.22	0.42	7.29	0.39	35.164	8.26	0.13	25.55	105.3
	11S	0.1	0.12	0.29	0.10	3.90	0.34	8.08	0.46	8.47	0.32	35.126	8.22	0.08	25.62	98.8
	11D	11.4	0.14	0.09	0.12	1.97	0.34	8.58	0.48	8.79	0.37	35.164	8.25	0.12	25.53	103.6
	12S	0.1	0.12	0.07	0.12	3.45	0.32	8.83	0.44	9.02	0.35	35.146	8.25	0.10	26.30	103.7
	12D	11.3	0.12	0.05	0.11	1.71	0.30	6.36	0.42	6.52	0.42	35.184	8.26	0.14	25.54	104.3
	13S	0.1	0.07	0.37	0.09	4.36	0.35	7.06	0.42	7.52	0.22	35.119	8.19	0.08	26.47	99.8
	13D	11.8	0.06	0.04	0.12	2.16	0.35	6.59	0.41	6.75	0.30	35.106	8.25	0.14	25.54	104.7
OUTSIDE HARBOR	1S	0.1	0.16	3.34	1.27	40.01	0.36	8.32	0.52	12.93	2.48	33.772	8.24	0.23	24.58	**103.4**
	1D	0.8	0.16	2.37	0.81	33.23	0.35	8.48	0.51	11.66	1.82	34.145	8.25	0.19	24.98	**102.5**
	14S	0.1	0.10	0.02	0.12	2.47	0.31	6.50	0.41	6.64	0.29	35.108	8.26	0.06	26.31	103.6
	14D	12.4	0.13	0.09	0.36	2.18	0.40	4.88	0.53	5.33	0.20	35.056	8.26	0.07	25.52	104.8
	15S	0.1	0.07	bdl	0.10	1.69	0.36	10.76	0.43	10.87	0.06	35.044	8.27	0.02	25.98	104.8
	15D	13.5	0.11	0.03	0.10	1.83	0.30	7.86	0.41	7.99	0.10	35.075	8.27	0.06	25.58	107.5
	16S	0.1	0.12	0.47	0.19	2.84	0.29	9.38	0.41	10.04	0.15	35.076	8.19	0.07	26.01	94.7
	16D	2.6	0.12	0.52	0.08	2.96	0.28	7.77	0.40	8.37	0.11	35.074	8.20	0.05	26.07	92.7
	17S	0.1	0.05	0.13	0.05	2.07	0.36	7.91	0.41	8.09	0.13	35.070	8.23	0.06	25.67	98.9
	17D	3.1	0.11	0.29	0.06	2.46	0.30	8.26	0.41	8.61	0.12	35.059	8.21	0.05	25.78	92.1
	18S	0.1	0.09	0.13	0.06	4.09	0.33	7.16	0.42	7.35	0.16	35.002	8.25	0.04	25.91	101.7
	18D	12.7	0.11	0.09	0.07	2.41	0.31	6.52	0.42	6.68	0.12	35.077	8.26	0.08	25.77	105.1
	19S	0.1	0.05	0.56	0.15	3.74	0.30	7.90	0.35	8.61	0.12	35.061	8.11	0.05	26.43	90.1
	19D	2.1	0.05	0.55	0.03	3.79	0.29	8.98	0.34	9.56	0.16	35.075	8.10	0.02	26.53	72.4
	20S	0.1	0.05	0.43	bdl	2.82	0.30	6.88	0.35	7.32	0.10	35.102	8.12	0.07	25.89	87.7
	20D	2.0	0.05	0.44	0.04	2.94	0.30	7.04	0.35	7.52	0.15	35.090	8.13	0.06	26.05	73.4
	21S	0.1	0.05	bdl	0.02	2.53	0.36	9.60	0.41	9.63	0.09	35.037	8.26	0.03	25.91	101.1
	21D	12.0	0.04	0.08	bdl	2.03	0.38	10.30	0.42	10.39	0.10	35.083	8.26	0.06	25.65	98.2
	22S	0.1	0.04	0.38	0.01	5.00	0.41	11.04	0.45	11.43	0.55	35.023	8.22	0.07	23.67	93.5
	22D	5.4	0.03	0.09	0.01	1.97	0.40	10.46	0.43	10.56	0.42	35.112	8.24	0.08	25.56	91.4
DOH WQS	EMBAYMENTS DRY		10%	1.00	0.61				1.29	17.86	1.00	*	***	1.00	**	****
			2%	1.78	1.07				1.93	25.00	1.50			1.50		
	OPEN COASTAL DRY		10%	0.71	0.36				0.96	12.86	0.50	*	***	0.50	**	****
			2%	1.43	0.64				1.45	17.86	1.00			1.00		

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.
** Temperature shall not vary by more than one degree C. from ambient conditions.
***pH shall not deviate more than 0.5 units from a value of 8.1.
****Dissolved Oxygen not to be below 75% saturation.

TABLE 2. Water chemistry measurements of surface and near-bottom water from 22 sample sites within Kawaihae Harbor and on the reef outside of the Harbor collected on August 17, 2011. Nutrient concentrations are shown in units of micrograms per liter (µg/L). Abbreviations as follows: S=surface; D=deep; BDL=below detection limit. Also shown are the State of Hawaii, Department of Health (DOH) "not to exceed more than 10% of the time" and "not to exceed more than 2% of the time" water quality standards for open coastal waters (outside the Harbor) and embayments under "dry" conditions (the interior of Kawaihae Harbor is considered an embayment).Boxed values exceed appropriate DOH 10% "dry" standards; boxed and shaded values exceed DOH 2% "dry" standards. For sampling site locations, see Figure 1.

SAMPLE LOCATION	SAMPLE SITE	DEPTH (m)	PO_4^{3-} (µg/L)	NO_3^- (µg/L)	NH_4^+ (µg/L)	Si (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (NTU)	SALINITY (ppt)	pH (std. units)	CHL a (µg/L)	TEMP (deg.C)	O2 % Sat
INSIDE HARBOR	2S	0.1	5.89	22.40	1.40	628.60	8.99	105.14	14.88	128.94	0.33	34.595	8.23	0.06	26.78	102.5
	2D	2.5	4.03	2.80	2.24	110.43	9.92	102.48	13.95	107.52	0.36	35.039	8.24	0.10	26.19	99.7
	3S	0.1	4.34	8.68	1.40	229.30	9.61	106.12	13.95	116.20	0.29	34.966	8.23	0.12	26.49	102.2
	3D	11.8	4.03	0.98	1.54	50.58	9.92	105.28	13.95	107.80	0.21	35.105	8.25	0.18	25.56	104.7
	4S	0.2	4.65	5.46	1.12	243.35	9.30	95.20	13.95	101.78	0.30	34.973	8.24	0.12	26.27	102.9
	4D	11.8	4.96	1.54	1.26	58.45	8.99	96.46	13.95	99.26	0.49	35.187	8.25	0.18	25.57	103.6
	5S	0.1	3.41	0.42	1.12	75.87	9.92	95.62	13.33	97.16	0.37	35.070	8.26	0.09	26.22	103.8
	5D	12.6	4.34	1.26	1.40	54.23	8.99	105.84	13.33	108.50	0.27	35.097	8.25	0.10	25.54	104.0
	6S	0.1	2.79	0.70	1.12	76.99	10.54	119.98	13.33	121.80	0.30	35.101	8.26	0.09	26.04	104.2
	6D	10.6	4.34	1.40	0.84	54.51	9.92	114.66	14.26	116.90	0.48	35.122	8.25	0.20	25.57	103.5
	7S	0.1	3.10	1.54	1.26	77.56	10.23	107.10	13.33	109.90	0.44	35.080	8.25	0.08	25.88	101.9
	7D	13.3	4.34	1.82	1.12	55.36	8.99	117.18	13.33	120.12	0.39	35.124	8.25	0.15	25.54	104.4
	8S	0.1	3.72	2.94	0.84	100.04	9.61	105.28	13.33	109.06	0.35	35.107	8.22	0.07	26.56	96.6
	8D	11.7	4.34	0.98	0.84	58.45	9.92	113.68	14.26	115.50	0.49	35.182	8.25	0.23	25.56	103.6
	9S	0.1	2.79	0.14	0.84	80.37	9.92	104.30	12.71	105.28	0.35	35.110	8.25	0.12	24.42	101.9
	9D	12.0	4.03	0.56	0.98	61.54	8.99	98.28	13.02	99.82	0.21	35.095	8.26	0.13	25.53	105.1
	10S	0.1	3.10	0.28	0.84	83.74	9.92	119.00	13.02	120.12	0.35	35.095	8.25	0.13	25.60	102.6
	10D	11.3	4.34	0.56	0.42	50.02	8.68	101.08	13.02	102.06	0.39	35.164	8.26	0.13	25.55	105.3
	11S	0.1	3.72	4.06	1.40	109.59	10.54	113.12	14.26	118.58	0.32	35.126	8.22	0.08	25.62	98.8
	11D	11.4	4.34	1.26	1.68	55.36	10.54	120.12	14.88	123.06	0.37	35.164	8.25	0.12	25.53	103.6
	12S	0.1	3.72	0.98	1.68	96.95	9.92	123.62	13.64	126.28	0.35	35.146	8.25	0.10	26.30	103.7
	12D	11.3	3.72	0.70	1.54	48.05	9.30	89.04	13.02	91.28	0.42	35.184	8.26	0.14	25.54	104.3
	13S	0.1	2.17	5.18	1.26	122.52	10.85	98.84	13.02	105.28	0.22	35.119	8.19	0.08	26.47	99.8
	13D	11.8	1.86	0.56	1.68	60.70	10.85	92.26	12.71	94.50	0.30	35.106	8.25	0.14	25.54	104.7
OUTSIDE HARBOR	1S	0.1	4.96	46.76	17.78	1124.28	11.16	116.48	16.12	181.02	2.48	33.772	8.24	0.23	24.58	103.4
	1D	0.8	4.96	33.18	11.34	933.76	10.85	118.72	15.81	163.24	1.82	34.145	8.25	0.19	24.98	102.5
	14S	0.1	3.10	0.28	1.68	69.41	9.61	91.00	12.71	92.96	0.29	35.108	8.26	0.06	26.31	103.6
	14D	12.4	4.03	1.26	5.04	61.26	12.40	68.32	16.43	74.62	0.20	35.056	8.26	0.07	25.52	104.8
	15S	0.1	2.17	bdl	1.40	47.49	11.16	150.64	13.33	152.18	0.06	35.044	8.27	0.02	25.98	104.8
	15D	13.5	3.41	0.42	1.40	51.42	9.30	110.04	12.71	111.86	0.10	35.075	8.27	0.06	25.58	107.5
	16S	0.1	3.72	6.58	2.66	79.80	8.99	131.32	12.71	140.56	0.15	35.076	8.19	0.07	26.01	94.7
	16D	2.6	3.72	7.28	1.12	83.18	8.68	108.78	12.40	117.18	0.11	35.074	8.20	0.05	26.07	92.7
	17S	0.1	1.55	1.82	0.70	58.17	11.16	110.74	12.71	113.26	0.13	35.070	8.23	0.06	25.67	98.9
	17D	3.1	3.41	4.06	0.84	69.13	9.30	115.64	12.71	120.54	0.12	35.059	8.21	0.05	25.78	92.1
	18S	0.1	2.79	1.82	0.84	114.93	10.23	100.24	13.02	102.90	0.16	35.002	8.25	0.04	25.91	101.7
	18D	12.7	3.41	1.26	0.98	67.72	9.61	91.28	13.02	93.52	0.12	35.077	8.26	0.08	25.77	105.1
	19S	0.1	1.55	7.84	2.10	105.09	9.30	110.60	10.85	120.54	0.12	35.061	8.11	0.05	26.43	90.1
	19D	2.1	1.55	7.70	0.42	106.50	8.99	125.72	10.54	133.84	0.16	35.075	8.10	0.02	26.53	72.4
	20S	0.1	1.55	6.02	bdl	79.24	9.30	96.32	10.85	102.48	0.10	35.102	8.12	0.07	25.89	87.7
	20D	2.0	1.55	6.16	0.56	82.61	9.30	98.56	10.85	105.28	0.15	35.090	8.13	0.06	26.05	73.4
	21S	0.1	1.55	bdl	0.28	71.09	11.16	134.40	12.71	134.82	0.09	35.037	8.26	0.03	25.91	101.1
	21D	12.0	1.24	1.12	bdl	57.04	11.78	144.20	13.02	145.46	0.10	35.083	8.26	0.06	25.65	98.2
	22S	0.1	1.24	5.32	0.14	140.50	12.71	154.56	13.95	160.02	0.55	35.023	8.22	0.07	23.67	93.5
	22D	5.4	0.93	1.26	0.14	55.36	12.40	146.44	13.33	147.84	0.42	35.112	8.24	0.08	25.56	91.4
DOH WQS	EMBAYMENTS DRY		nte 10%	14.00	8.50				39.99	250.00	1.00	*	***	1.00	**	****
			nte 2%	25.00	15.00				59.83	350.00	1.50			1.50		
	OPEN COASTAL DRY		nte 10%	10.00	5.00				29.76	180.00	0.50	*	***	0.50	**	****
			nte 2%	20.00	9.00				44.95	250.00	1.00			1.00		

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.
** Temperature shall not vary by more than one degree C. from ambient conditions.
***pH shall not deviate more than 0.5 units from a value of 8.1.
****Dissolved Oxygen not to be below 75% saturation.

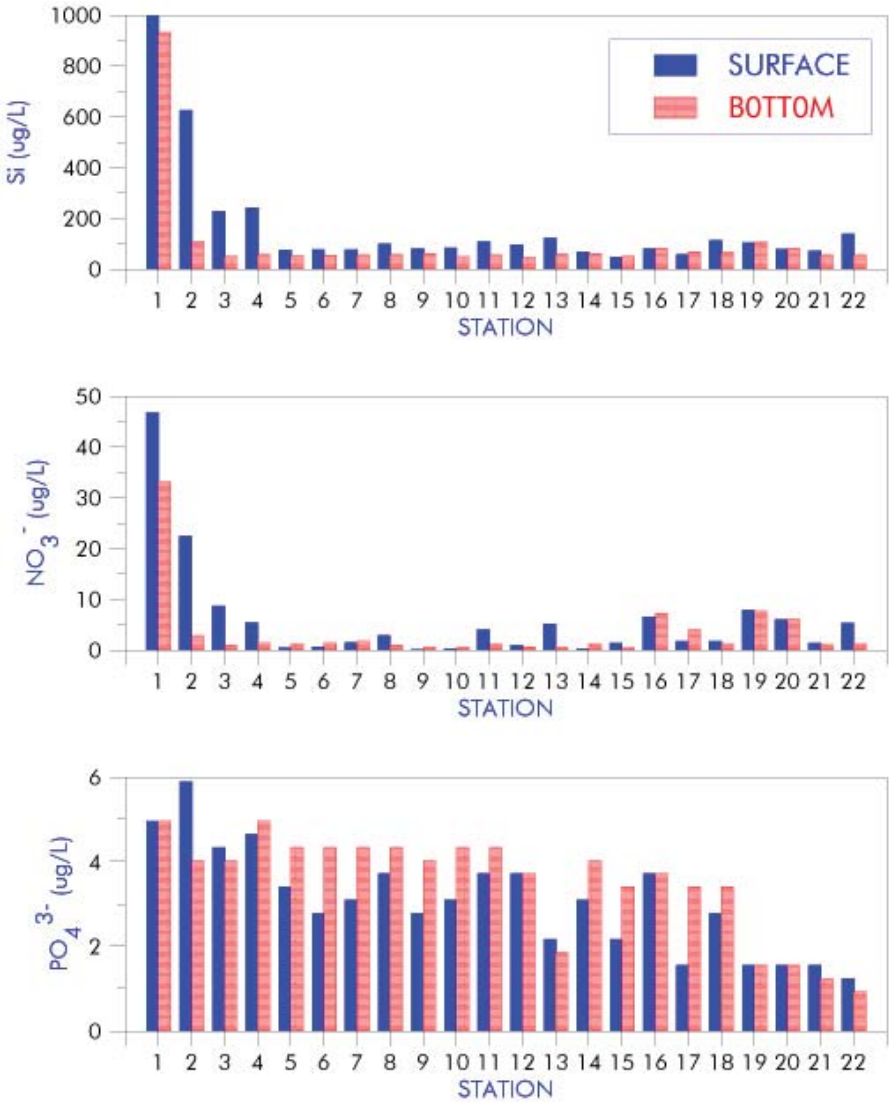


FIGURE 3. Histograms of nutrient concentrations (silica, nitrate, phosphate) at sampling stations within and outside Kawaihae Deep Draft Harbor, South Kohala Hawaii. For locations of sampling stations, see Figure 1.

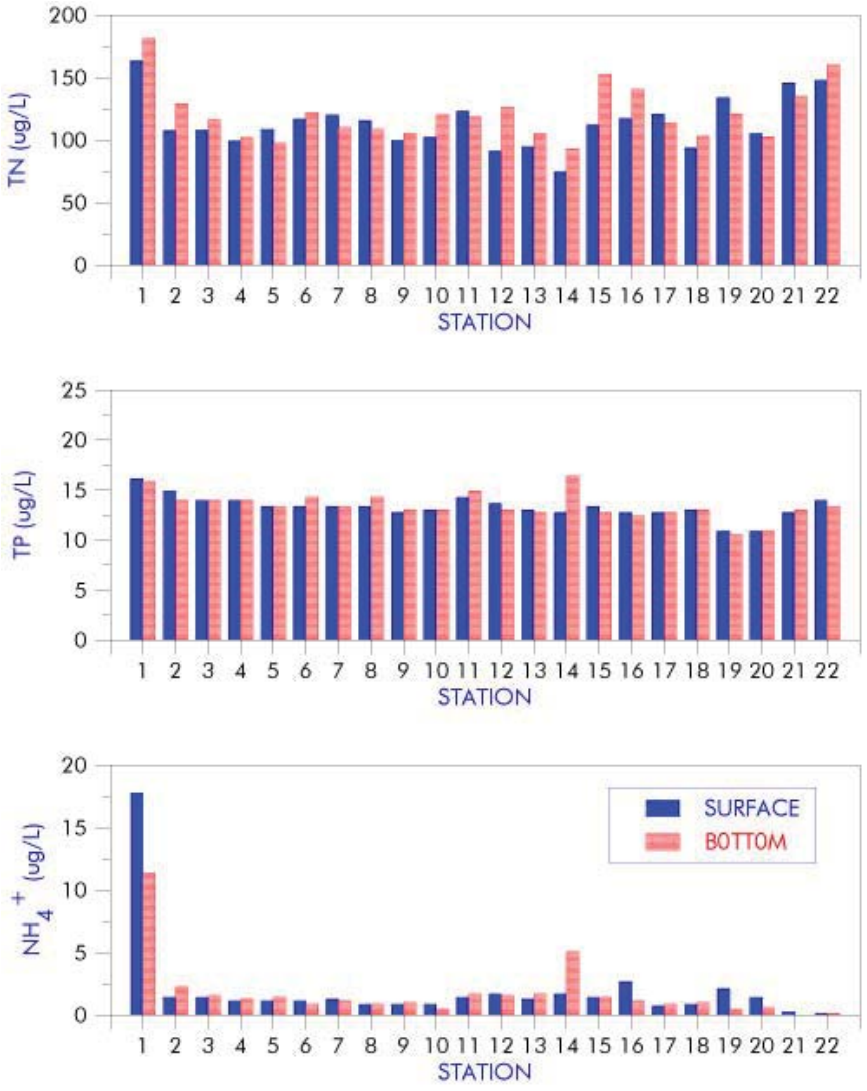


FIGURE 4. Histograms of nutrient concentrations (Total N, Total P, and ammonium nitrogen) at sampling stations within and outside Kawaihae Deep Draft Harbor, South Kohala, Hawaii. For locations of sampling stations, see Figure 1.



FIGURE 5. Histograms of salinity, turbidity and Chlorophyll a at sampling stations within and ouside Kawaihae Deep Draft Harbor, South Kohala, Hawaii. For locations of sampling stations, see Figure 1.

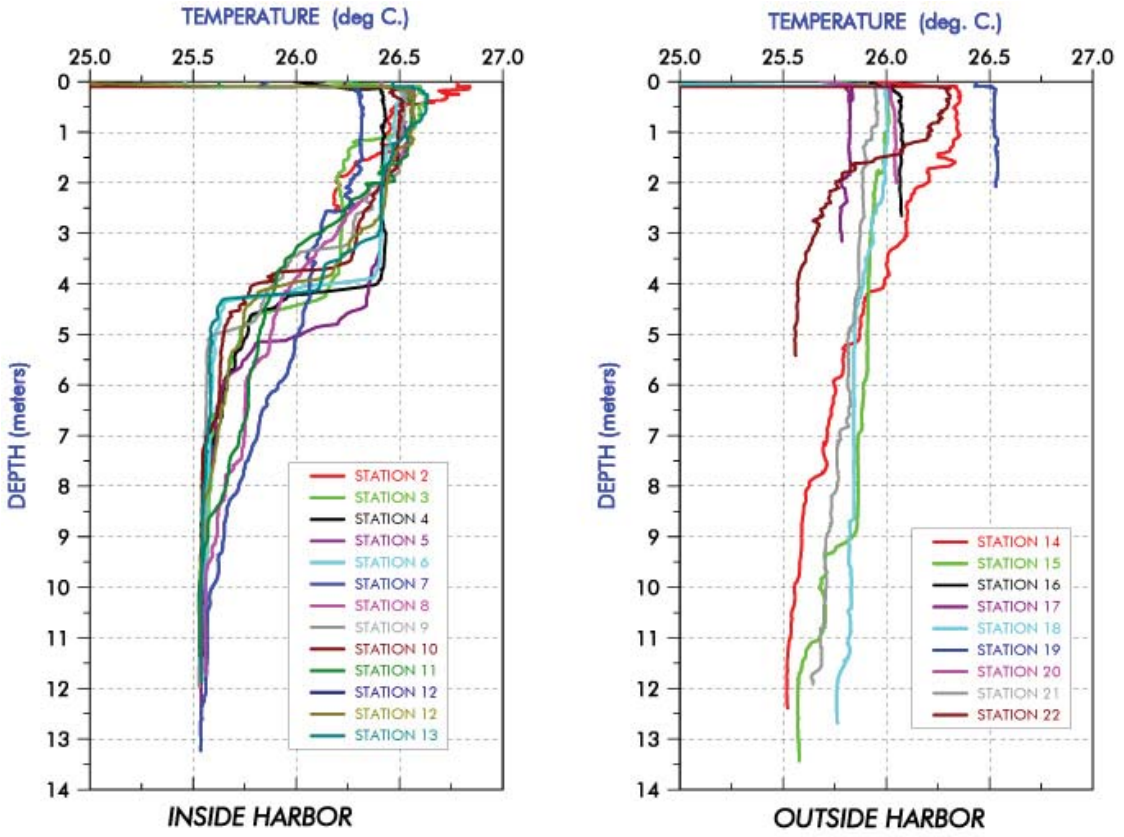


FIGURE 7. Vertical profiles of temperature at 21 sampling stations inside (left) and outside (right) Kawaihae Deep Draft Harbor acquired on August 17, 2011. See Figure 2 for station locations (note that no profile was acquired at station 1).

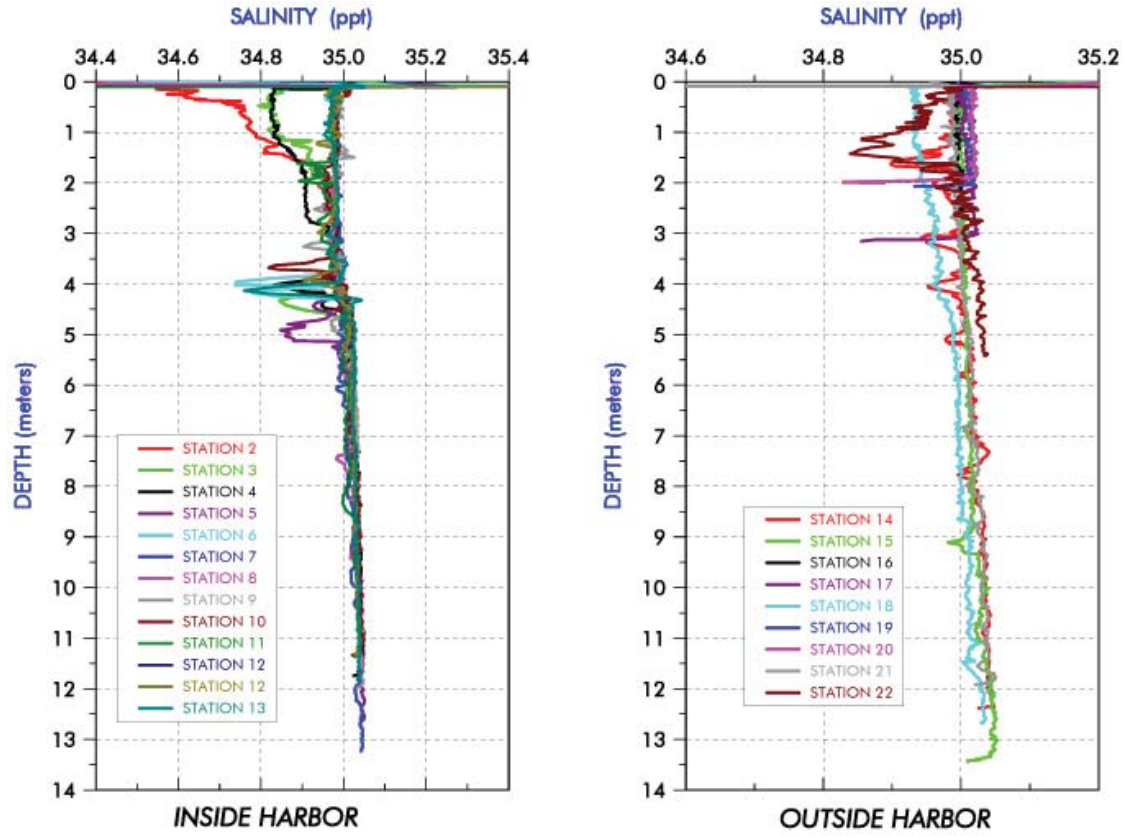


FIGURE 6. Vertical profiles of salinity at 21 sampling stations inside (left) and outside (right) Kawaihae Deep Draft Harbor acquired on August 17, 2011. See Figure 2 for station locations (note that no profile was acquired at station 1).

TABLE 3. Summary statistics (geometric means, standard deviation, maxima, minima) of water chemistry measurements of surface and near-bottom water from sample sites within Kawaihae Harbor and on the reef outside of the Harbor collected on August 17, 2011. Nutrient concentrations are shown in micromolar units (μM) in top table and micrograms per liter (μg/L) in bottom table. Also shown are the State of Hawaii, Department of Health (DOH) geometric mean water quality standards for open coastal waters (outside the harbor) and embayments (inside the harbor) under "dry" conditions. Shaded values exceed DOH standard for geometric means of all samples within each zone.For sampling site locations, see Figure 1.

SAMPLE LOCATION	DEPTH	STATISTIC	PO_4^{3-} (μM)	NO_3^- (μM)	NH_4^+ (μM)	Si (μM)	TOP (μM)	TON (μM)	TP (μM)	TN (μM)	TURB (NTU)	SALINITY (ppt)	pH (std.units)	CHL a (μg/L)	TEMP (deg.C)	O2 % Sat
INSIDE HARBOR	SURFACE	GEOMEAN	0.11	0.10	0.08	3.83	0.32	7.69	0.43	7.97	0.33	35.08	8.24	0.10	25.98	101.65
		SD	0.02	0.20	0.02	2.15	0.02	0.70	0.02	0.66	0.06	0.06	0.02	0.02	0.62	2.36
		MAX	0.15	0.62	0.12	8.66	0.35	8.83	0.46	9.02	0.44	35.15	8.26	0.13	26.56	104.25
		MIN	0.07	0.01	0.06	2.70	0.30	6.80	0.41	6.94	0.22	34.97	8.19	0.07	24.42	96.59
	DEEP	GEOMEAN	0.13	0.07	0.08	1.96	0.31	7.46	0.44	7.62	0.35	35.14	8.25	0.15	25.55	104.26
		SD	0.03	0.03	0.03	0.16	0.02	0.75	0.02	0.76	0.10	0.04	0.00	0.04	0.01	0.65
		MAX	0.16	0.13	0.12	2.19	0.35	8.58	0.48	8.79	0.49	35.19	8.26	0.23	25.57	105.30
		MIN	0.06	0.04	0.03	1.71	0.28	6.36	0.41	6.52	0.21	35.10	8.25	0.10	25.53	103.55
OUTSIDE HARBOR	SURFACE	GEOMEAN	0.06	0.17	0.06	2.87	0.33	8.43	0.40	8.74	0.15	35.06	8.21	0.05	25.74	97.16
		SD	0.03	0.20	0.06	1.05	0.04	1.68	0.03	1.69	0.15	0.04	0.06	0.02	0.81	6.09
		MAX	0.12	0.56	0.19	5.00	0.41	11.04	0.45	11.43	0.55	35.11	8.27	0.07	26.43	104.77
		MIN	0.04	0.02	0.01	1.69	0.29	6.50	0.35	6.64	0.06	35.00	8.11	0.02	23.67	87.74
	DEEP	GEOMEAN	0.07	0.16	0.06	2.44	0.33	7.82	0.41	8.17	0.15	35.08	8.21	0.06	25.83	92.21
		SD	0.04	0.21	0.10	0.63	0.05	1.78	0.05	1.71	0.10	0.02	0.06	0.02	0.33	12.93
		MAX	0.13	0.55	0.36	3.79	0.40	10.46	0.53	10.56	0.42	35.11	8.27	0.08	26.53	107.45
		MIN	0.03	0.03	0.01	1.83	0.28	4.88	0.34	5.33	0.10	35.06	8.10	0.02	25.52	72.36

SAMPLE LOCATION	DEPTH	STATISTIC	PO_4^{3-} (μg/L)	NO_3^- (μg/L)	NH_4^+ (μg/L)	Si (μg/L)	TOP (μg/L)	TON (μg/L)	TP (μg/L)	TN (μg/L)	TURB (NTU)	SALINITY (ppt)	pH (std.units)	CHL a (μg/L)	TEMP (deg.C)	O2 % Sat
INSIDE HARBOR	SURFACE	GEOMEAN	3.34	1.43	1.14	107.50	10.02	107.62	13.44	111.60	0.33	35.08	8.24	0.10	25.98	101.65
		SD	0.72	2.78	0.27	60.53	0.47	9.80	0.47	9.25	0.06	0.06	0.02	0.02	0.62	2.36
		MAX	4.65	8.68	1.68	243.35	10.85	123.62	14.26	126.28	0.44	35.15	8.26	0.13	26.56	104.25
		MIN	2.17	0.14	0.84	75.87	9.30	95.20	12.71	97.16	0.22	34.97	8.19	0.07	24.42	96.59
	DEEP	GEOMEAN	3.96	0.97	1.13	55.04	9.53	104.42	13.60	106.68	0.35	35.14	8.25	0.15	25.55	104.26
		SD	0.79	0.44	0.41	4.38	0.72	10.47	0.69	10.69	0.10	0.04	0.00	0.04	0.01	0.65
		MAX	4.96	1.82	1.68	61.54	10.85	120.12	14.88	123.06	0.49	35.19	8.26	0.23	25.57	105.30
		MIN	1.86	0.56	0.42	48.05	8.68	89.04	12.71	91.28	0.21	35.10	8.25	0.10	25.53	103.55
OUTSIDE HARBOR	SURFACE	GEOMEAN	1.99	2.43	0.91	80.77	10.34	117.96	12.50	122.42	0.15	35.06	8.21	0.05	25.74	97.16
		SD	0.87	2.80	0.84	29.59	1.23	23.55	1.04	23.67	0.15	0.04	0.06	0.02	0.81	6.09
		MAX	3.72	7.84	2.66	140.50	12.71	154.56	13.95	160.02	0.55	35.11	8.27	0.07	26.43	104.77
		MIN	1.24	0.28	0.14	47.49	8.99	91.00	10.85	92.96	0.06	35.00	8.11	0.02	23.67	87.74
	DEEP	GEOMEAN	2.28	2.22	0.87	68.70	10.10	109.48	12.69	114.34	0.15	35.08	8.21	0.06	25.83	92.21
		SD	1.23	2.95	1.46	17.58	1.53	24.89	1.68	23.89	0.10	0.02	0.06	0.02	0.33	12.93
		MAX	4.03	7.70	5.04	106.50	12.40	146.44	16.43	147.84	0.42	35.11	8.27	0.08	26.53	107.45
		MIN	0.93	0.42	0.14	51.42	8.68	68.32	10.54	74.62	0.10	35.06	8.10	0.02	25.52	72.36
DOH GM	EMBAYMENTS DRY			5.00	3.50				20.00	150.00	0.40			0.5		
	OPEN COASTAL DRY		5.00	4.50	2.50				12.50	100.00	0.10			0.3		

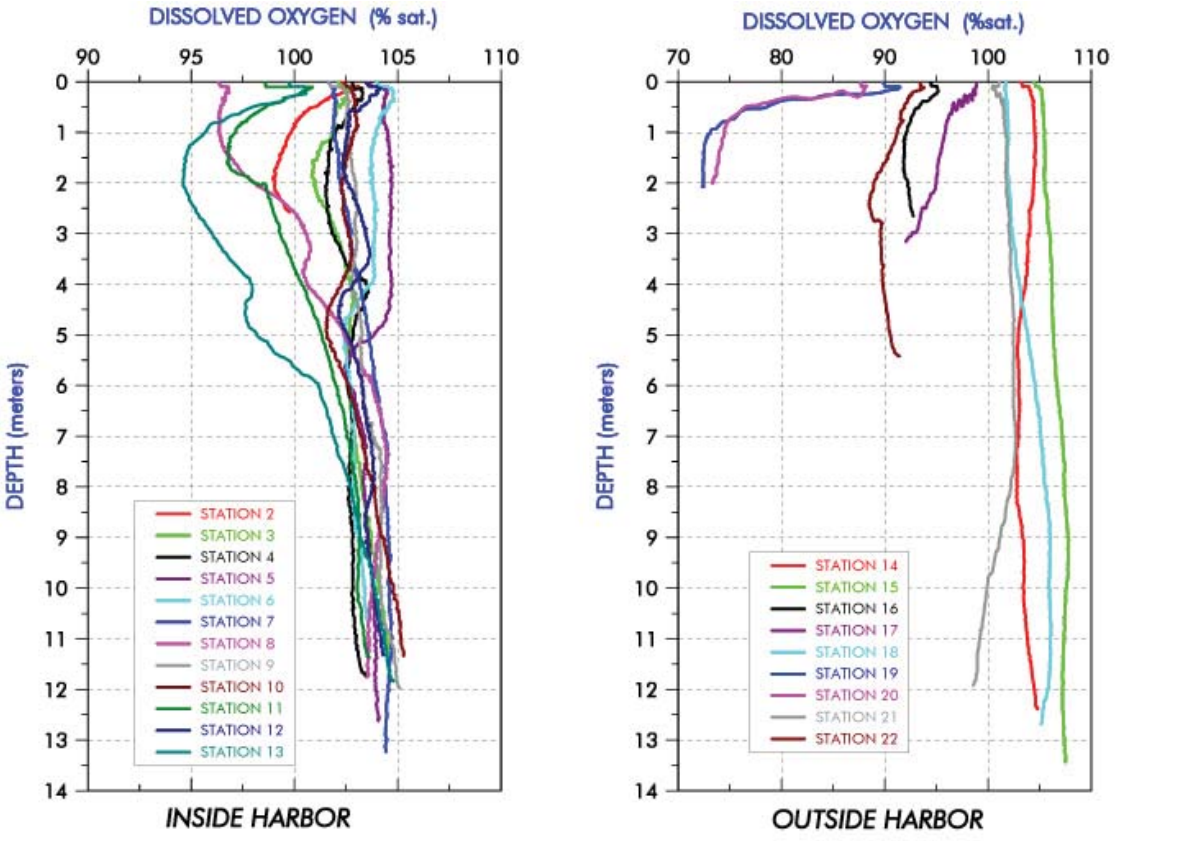


FIGURE 8. Vertical profiles of dissolved oxygen at 21 sampling stations inside (left) and outside (right) Kawaihae Deep Draft Harbor acquired on August 17, 2011. See Figure 2 for station locations (note that no profile was acquired at station 1).

TABLE 5. Size frequency distribution of coral colonies on boulders compising shoreline in area proposed for Pier 2C expansion, vertical surfaces of pier pilings supporting Piers 2 and 2B, sheetpiling extending between Piers 1 and 2A proposed for Pier 2A extension, and sheet-piling comprising Pier 1. For locations of Piers, see Figure 1.

		SIZE CLASS (cm)					
LOCATION	SPECIES	0-5	>5<10	>10<25	>25<50	>50	TOTAL
PIER 2C EXTENSION REVETMENTS	*Porites lobata*	173	145	168	77	60	623
	Pocillopora meandrina	16	26	32	4		78
	Montipora capitata	76	126	149	42	11	404
	Montipora patula		7	6			13
	Leptastrea purpurea		2	2			4
	Porites compressa			3			3
	Pavona duerdeni		1				1
	Pavona varians		1				1
	TOTAL	265	308	360	123	71	1127
PIERS 2 and 2B	*Porites lobata*	92	132	96	28		348
	Pocillopora meandrina	16	40	32	4		92
	Montipora capitata	60	260	292	276	72	960
	Pocillopora eydouxi				2		2
	TOTAL	168	432	420	310	72	1402
PIER 2A EXTENSION SHEET PILE	*Porites lobata*	142	265	374	248	32	1061
	Pocillopora meandrina	396	330	222	18		966
	Montipora capitata	24	24	8	16		72
	Porites compressa		4				4
	TOTAL	562	623	604	282	32	2103
PIER 1	*Porites lobata*	62	396	627	296	69	1450
	Pocillopora meandrina	34	210	225	13		482
	Montipora capitata	0	76	89	8	2	175
	Montipora patula	0	87	97	13		198
	Porites compressa	2	12	29	2		44
	Pocillopora eydouxi			1			1
	TOTAL	97	781	1068	333	71	2350
TOTAL		1092	2144	2452	1048	246	6982

TABLE 4. Results of sediment testing for contaminant compounds in four samples collected in Kawaihae Harbor adjacent to Piers. RL = reporting limit. For sample locations, see Figure 2. For detailed laboratory report, see Appendix A.

ANALYTE	Method	RL	SAMPLE ID			
			1	2	3	4
Total Solids (%)	SM 2540B	0.1	73.8	54.4	77.3	64.9
Flashpoint (deg F.)	EPA 1010A(m)	70	>212	>212	>212	>212
TPH as gas (mg/kg)	EPA 8015B (M)	0.5	ND	ND	ND	ND
TPH as diesel (mg/kg)	EPA 8015B (M)	5	ND	ND	ND	ND
TPH as oil (mg/kg)	EPA 8015B (M)	25	ND	ND	ND	ND
UNITS (mg/L)						
TCLP Arsenic	EPA 6020/EPA 7470A	0.1	ND	ND	ND	ND
TCLP Barium	"	0.1	0.200	0.274	0.397	0.272
TCLP Cadmium	"	0.1	ND	ND	ND	ND
TCLP Chromium	"	0.1	ND	ND	ND	ND
TCLP Lead	"	0.1	0.0235	ND	ND	ND
TCLP Silver	"	0.1	ND	ND	ND	ND
TCLP Mercury	"	0.005	ND	ND	ND	ND
TCLP Selenium	"	0.1	ND	ND	ND	ND
UNITS (µg/kg)						
PCB Aroclor 1016	EPA 8020	10	ND	ND	ND	ND
PCB Aroclor 1221	"	10	ND	ND	ND	ND
PCB Aroclor 1232	"	10	ND	ND	ND	ND
PCB Aroclor 1242	"	10	ND	ND	92	ND
PCB Aroclor 1248	"	10	ND	ND	ND	ND
PCB Aroclor 1254	"	10	ND	ND	ND	ND
PBC Aroclor 1260	"	10	ND	ND	ND	ND
PBC Aroclor 1262		10	ND	ND	ND	ND
Benzene	EPA 8260B	5	ND	ND	ND	ND
Toluene	"	5	ND	ND	ND	ND
Ethylbenzene	"	5	ND	ND	ND	ND
Total Xylenes	"	5	ND	ND	ND	ND
Naphthalene	EPA 8270C SIM PAHS	10	14	ND	ND	ND
Acenaphthylene	"	10	13	ND	ND	ND
Acenaphthene	"	10	ND	ND	ND	ND
Fluorene	"	10	ND	ND	ND	ND
Phenanthrene	"	10	ND	ND	18	ND
Anthracene	"	10	ND	ND	12	ND
Fluoranthene	"	10	ND	17	68	ND
Pyrene	"	10	ND	22	92	ND
Benzo(a)anthracene	"	10	ND	15	59	ND
Chrysene	"	10	ND	17	82	ND
Benzo(b)fluoranthene	"	10	ND	19	100	ND
Benzo(k)fluoranthene	"	10	ND	19	83	ND
Benzo(a)pyrene	"	10	ND	17	74	ND
Indeno(1,2,3-cd)pyrene	"	10	ND	10	51	ND
Dibenz(a,h)anthracene	"	10	ND	ND	22	ND
Benzo(g,h,i)perylene	"	10	11	14	66	ND

TABLE 6. Mean values of percent coral cover and non-coral substratum at calibration validation sites surveyed inside and outside Kawaihae Deep Draft Harbor. Each value is the mean of five individual photo-quadrats comprising an area of 3.3 m^2. Abbreviations of coral species and non-coral substrata are shown at bottom of table. Cover values from individual photo-quads are shown in Appendix B.

SITE	*Lp*	*Mc*	*Pc*	*Pd*	*Pe*	*Pl*	*Pm*	*Pr*	*Pv*	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV
004	0	0	0	0	0	0	0	0	0	0	0	4	0	19	0	0	0	77	0	0
005	0	9	14.4	0	0	48.6	2.4	0	0	74.4	0	1	0	0	0	0	5.6	1	17	1
006	0	0.6	63.6	0	0	17	6.4	0	0.4	88.0	0	4	0	0	0	0	8	0	0	0
007	0	0	0	0	1	1	0	0	0	2.0	0	0	0	0	5	92.4	0	0	0	0.6
008	0	0	63.6	0	1.4	11	1.2	0	0.6	77.8	3	6	0.2	0	5	0	7	1	0	0
009	0	0	0.2	0	0	3.8	0	7.4	0	11.4	2	0	0	0	0	0	86.6	0	0	0
010	0	0	0	0	0	0	0	0	0	0	1	15	0	0	38	0	46	0	0	0
011	0	0	6.8	0	0	9.8	0	0	0	16.6	2	9	0	0	23.6	0	48.8	0	0	0
012	0	0	2	0	18	27	0	0	0	47.0	1	13	0	0	38.2	0	0	0	0	0.8
013	0	0	1.8	0	0	16.8	3.4	0	0	22.0	1	22	0	0	36	2	17	0	0	0
014	0	0	5.4	0	0	26	0	0	0	31.4	5	2	0	0	49.6	0	12	0	0	0
015	0	0.4	0.8	0	0	26	12.2	0	0	39.4	2	7	0	0	51	0	0.6	0	0	0
016	0	0	3.4	0	0	17.4	7.4	0	0.2	28.4	2	0	0	2	17.8	0	0	49.8	0	0
017	0	0	1.6	0	17.6	15.4	0	0	0	34.6	0	0	0	0	0	54.8	0	10.6	0	0
018	13.6	0	0	3	0	1.8	2.4	0	0	20.8	0	0	0	1	45.6	19.6	11	2	0	0
019	0	0	0	0	0.6	2	15	0	0	17.6	0	0	0	5	50.4	3	22	2	0	0
020	0	0	0	0	0	26.4	13	0	0	39.4	0	0	0	14.8	37.8	2	6	0	0	0
021	0	0	0	0	1.6	9.4	34	0	0	45.0	0	18	0	0	37	0	0	0	0	0
022	0.2	0	0	0.8	3.2	17.2	7.4	0	0.4	29.2	0	21	0	2	44.8	0	0	3	0	0
023	0	0.2	23.4	0	0.6	43	0.6	0	0	67.8	1	1	0	1	1	0	0	28.2	0	0
024	0	0	46.4	0	0.6	20	0	0	0	67.0	2	5	0	0	4	0	0	22	0	0
025	0	0.2	51	0	0.8	9.2	0	4	0.2	65.4	0	4	0	0.6	21	0	0	9	0	0
026	0	0.2	50.6	0	0.8	9	0	0	0	60.6	0	11	0	1	3	0	0	24.4	0	0
027	0	0.8	0.4	0	0.8	48	5.4	0	0	55.4	0	1	0	0	13	0	0	29.8	0	0.8
MEAN	0.6	0.5	14.0	0.2	2.0	16.9	4.6	0.5	0.1	39.2	0.9	6.0	0.0	1.9	21.7	7.2	11.3	10.8	0.7	0.1
	1.5	1.2	35.7	0.4	5.0	43.1	11.8	1.2	0.2	100.0										
						90.6														
MAX	13.6	9.0	63.6	3.0	18.0	48.6	34.0	7.4	0.6	88.0	5.0	22.0	0.2	19.0	51.0	92.4	86.6	77.0	17.0	1.0
MIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Lp = "Leptastrea purpurea"
Mc = "Montipora capitata"
Pc = "Porites compressa"
Pd = "Porites duerdeni"
Pe = "Porites lutea"
Pl = "Porites lobata"
Pm = Pocillopora meandrina
Pr = "Porites rus"
Pv = "Pavona varians"
TC = "Total Coral Cover"
A = "Algae"
TUR = "Turf"
SP = "Sponge"
SA = "Sand"
LS = "Limestone"
RU = "Rubble"
CCA = "Crustose Coralline Algae"
TBS = "Turf-Bound-Sediment"
MUD = "Mud"
INV = "Invertebrate"

TABLE 7. Area of coral cover in six abundance classes on reefs inside and outside of Kawaihae Harbor based on pixels of satellite imagery classified by field calibration. Coral area is calculated as the product of the mid-point value of each class and pixel area of that class. The last column represents the percentage cover of each class excluding the area with zero coral cover.

OUTSIDE HARBOR REEFS

CORAL COVER CLASS (percent cover)	PIXELS	PIXEL AREA (m^2)	PIXEL AREA (acres)	CORAL AREA (m^2)	CORAL AREA (acres)	PERCENT OF TOTAL AREA
coral = 0	72814	291256	72	0	0.0	0.0
0 < coral ≤ 10 (≈5)	5250	21000	5	1050	0.3	0.2
10 < coral ≤ 30 (≈20)	53496	213984	53	42796.8	10.6	7.6
30 < coral ≤ 50 (≈40)	69428	277712	69	111084.8	27.4	19.8
50 < coral ≤ 70 (≈60)	1019	4076	1	2445.6	0.6	0.7
70 < coral ≤ 90 (≈80)	11135	44540	11	35632	8.8	7.9
TOTAL	213142	852568	211	193009.2	47.7	36.3

INSIDE HARBOR REEFS

CORAL COVER CLASS (percent cover)	PIXELS	PIXEL AREA (m^2)	PIXEL AREA (acres)	CORAL AREA (m^2)	CORAL AREA (acres)	PERCENT OF TOTAL AREA
coral = 0	103217	412868	102	0	0.0	0.0
0 < coral ≤ 10 (≈5)	32	128	0	6.4	0.0	0.0
10 < coral ≤ 30 (≈20)	2597	10388	3	2077.6	0.5	4.2
30 < coral ≤ 50 (≈40)	4660	18640	5	7456	1.8	15.0
50 < coral ≤ 70 (≈60)	5073	20292	5	12175.2	3.0	40.8
70 < coral ≤ 90 (≈80)	81	324	0	259.2	0.1	0.7
TOTAL	115660	462640	114	21974.4	5.4	60.6

TABLE 8. Cross-validation accuracy assessment matrix for coral covel in map product produced for Kawaihae Harbor survey sites. In cross-validation, all but one data point are used to build a classifier, and the classifier is tested on the withheld point. This process is repeated on every point in the data set. The result is a matrix of classification rates, comparing the actual classes with classes predicted from the classifer. Correct classifications on the diagonal and incorrect classification off-diagonal. The lowest accuracy (91%) occurred in the class with 50-70% coral, indicating that only 8% of the time pixels were classified as containing 50-70% coral when some other percentage was actually present.

		Actual Classes					
		coral = 0	0 < coral ≤ 10	10 < coral ≤ 30	30 < coral ≤ 50	50 < coral ≤ 70	70 < coral ≤ 90
Predicted Classes	coral = 0	100	0	0.7	0.9	7.8	0
	0 < coral ≤ 1	0	100	0	0	0	0
	10 < coral ≤ 3	0	0	98	0	0.9	0
	30 < coral ≤ 4	0	0	0	99.1	0	0
	50 < coral ≤ 7	0	0	1.4	0	91.4	0
	70 < coral ≤ 9	0	0	0	0	0	100

TABLE 9. Abundance of reef fish at sample node locations off of the Kawaihae Harbor, South Kohala, Hawaii. For locations of stations, see Figure 9.

FAMILY	STATION																								
Species	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25	26	27	**TOTAL**
CIRRHITIDAE																								
Paracirrhites arcatus		1	1		2	2		4	3	2	3	2	4	3	3	1	2	2	1		2		3	**41**
P. forsteri								1	3		2				3			1	1				1	**12**
MULLIDAE																								
Parupeneus bifasciatus			1	2			2	2	4	2	4						2	4	6	2	2	3	4	**40**
P. multifasciatus							4	1	3		3					1	4		4			3	5	**28**
CHAETODONTIDAE																								
C. ornitissimus		2	2				2	2	2	2	3				2		2	2	6	2	2		2	**33**
C. multicinctus		6	4		2		3	4	5		2	6	2		6	3	4	5	10	2	3	2	3	**72**
C. lunula								1			2													**3**
C. miliaris		6	4	2	2		4	5	4		4	6	7		8		4	4	8	2		2	5	**77**
C. quadrimaculatus		2	2				2	2	2			2			2	1	2	2	4					**23**
Forcipiger longirostris		2					1	1	2		1		1		2		2		2				1	**15**
POMACENTRIDAE																								
Chromis vanderbilti		10	12	4	5		5	8	10	2	8	6	8	15	12		20	6	10	4	5	4	6	**160**
C. hanui				5	5			2			6	8	10		10				2			3		**51**
Dascyllus albisella		18						12	15			6			6		4		10					**71**
Stegastes fasciolatus		10	2	4	6		1		2	2	4	5	3	6	8		6	4	6	3	2	2	2	**78**
Abudefduf abdominalis	2	6	6	2	4		2	2	2		2	3			3		8	4	2	2	3	2	3	**58**
LABRIDAE																								
C. gaimard		2	1					1			1	1		1	1		2	1						**11**
Gomphosus varius		2	4				1		3	3	1	2	2	3	2	1	2	1	2	2				**31**
Thalassoma duperrey	1	6	10	2	2	9	2	3	5	6	7	8	10	11	6	5	7	3	4	3	2	2	3	**117**
Halichoeres ornatissimus		2			2					1		2			2				2		1	1		**13**
Labroides phthirophagus		1	1			1			1	1		1			1	1	2							**10**
Oxycheilinus unifasciatus			2		2							2					2	1			1			**10**
ACANTHURIDAE																								
Acanthurus olivaceus		5	5		2				4		2	6	4		4		4		8	2			2	**48**
A. nigrofuscus			10		2	11	4	13	9	12	4	3	8	3	6	4	4	4	10	3	1	2	4	**117**
A. leucopareius										1							6		10					**17**
A. blochii									2								2		4				2	**10**
A. dussumieri							6										3		4					**13**
Naso lituratus		3	2				2	2	3		4		2		4	2	8	3	6				2	**43**
Zebrasoma flavescens		4	2				2	11	3	2	4	2	2	1	3		4	2	4		2	1		**49**
Ctenochaetus strigosus		4	3		4		2		4	10	4	2	7	7	8	3	4	4	6	2	4	2	3	**83**
BALISTIDAE																								
Sufflamen bursa		3		1				1		2	4	2	1		2	1		2			2	1	1	**23**
Melichthys niger		4			4				3	1														**12**
M. vidua									2	2										2				**6**
Rhinecanthus oculeatus																								**0**
TETRADONTIDAE																								**0**
Canthigaster jactator		1			1											1	1				1		2	**7**
SCARIDAE																								**0**
Scarus rubroviolaceus		2	2		1		1		3		2	3	1	2	3		2	2	2		2		2	**30**
S. psittacus									2			2		2	2		3		3					**14**
Chlorurus sordidus		2	2				1		1	4					6		5	2	4					**27**
SERRANIDAE																								**0**
Cephalopholis argus			2			1						1						1	2					**7**
CARANGIDAE																								**0**
Caranx melamphygus									2														2	**4**
KYPHOSIDAE																								**0**
Kyphosus biggibus					5								10						5				4	**24**
BLENNIDAE																								**0**
Cirripectes vanderbilti														1										**1**
MURAENIDAE																								**0**
Gymnothorax		1			1	1	1		1			1		1					1	1				**9**
NUMBER SPECIES	**2**	**25**	**22**	**8**	**18**	**6**	**20**	**20**	**29**	**17**	**23**	**24**	**16**	**14**	**26**	**12**	**29**	**23**	**31**	**13**	**16**	**14**	**22**	**430**
NUMBER INDIVIDUALS	**3**	**105**	**80**	**22**	**52**	**25**	**48**	**78**	**105**	**55**	**77**	**82**	**72**	**66**	**115**	**24**	**121**	**61**	**149**	**31**	**35**	**30**	**62**	**1498**



FIGURE 9. Sand-mud surface of the floor of Kawaihae Harbor adjacent to Pier 1 (top) and Pier 2B (bottom).

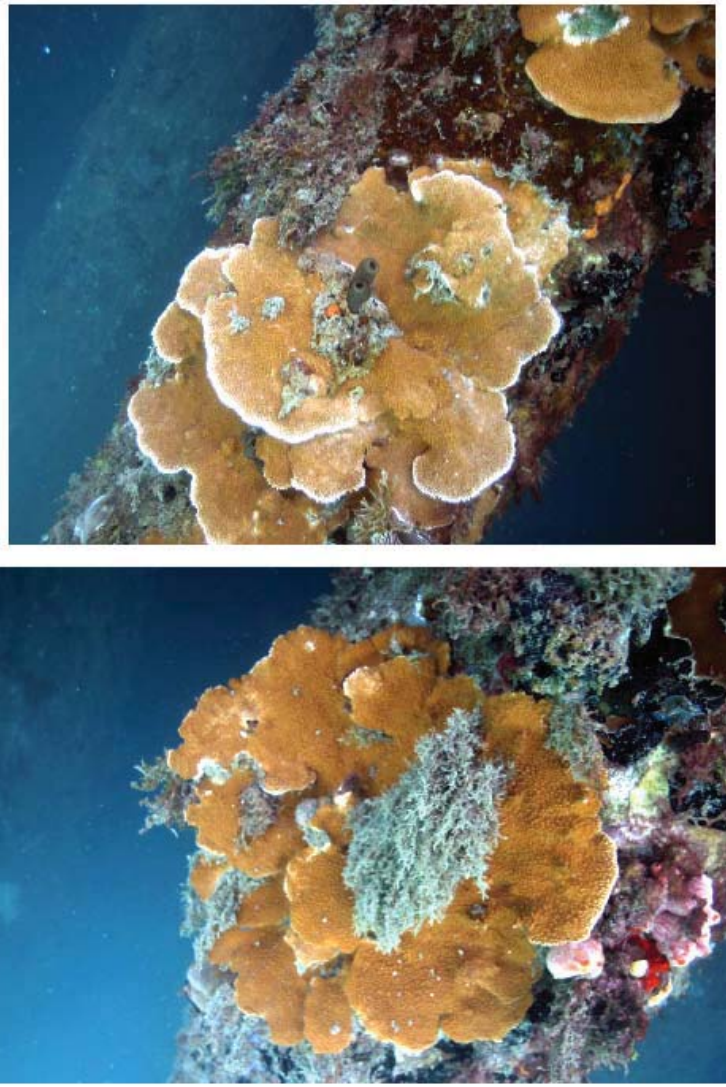


FIGURE 10. Two colonies of *Montipora capitata* growing on pilings of Pier 2B at a depth of approximately 6 feet.

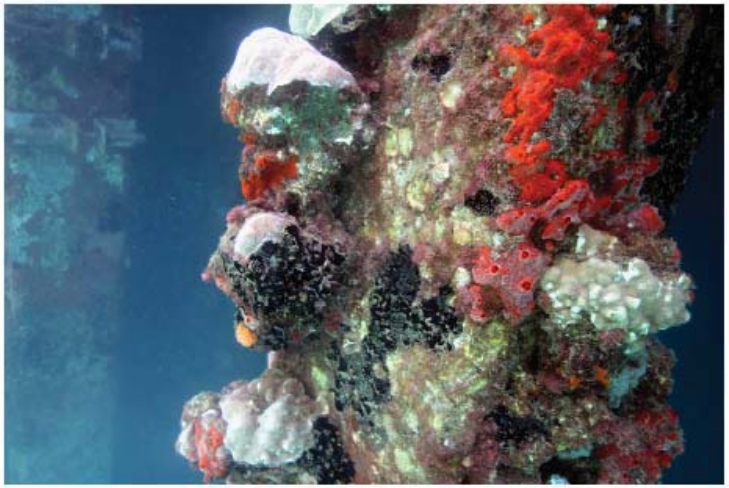




FIGURE 11. Top photo pile Pier 2B encrusted with a variety of invertebrates including several species of sponges, and small colonies of the coral *Porites lobata*. Bottom photo shows colony of *Pocillopora* sp. approximately 12 inches in diameter growing on face of Pier 2A.



FIGURE 12. Representative photos of corrugated sheet-piling on southern area of Kawaihae Harbor Pier 1. Corals growing on sheet-piling are predominantly *Porites lobata* (knobby green and brown colonies) and *Montipora* spp. (white-bordered brown encrusting colonies).



FIGURE 13. Representative photos of corrugated sheet-piling on northern area of Kawaihae Harbor Pier 1. Corals growing on sheet-piling are predominantly *Porites lobata* (knobby green and brown colonies) and *Montipora* spp. (white-bordered brown encrusting colonies).

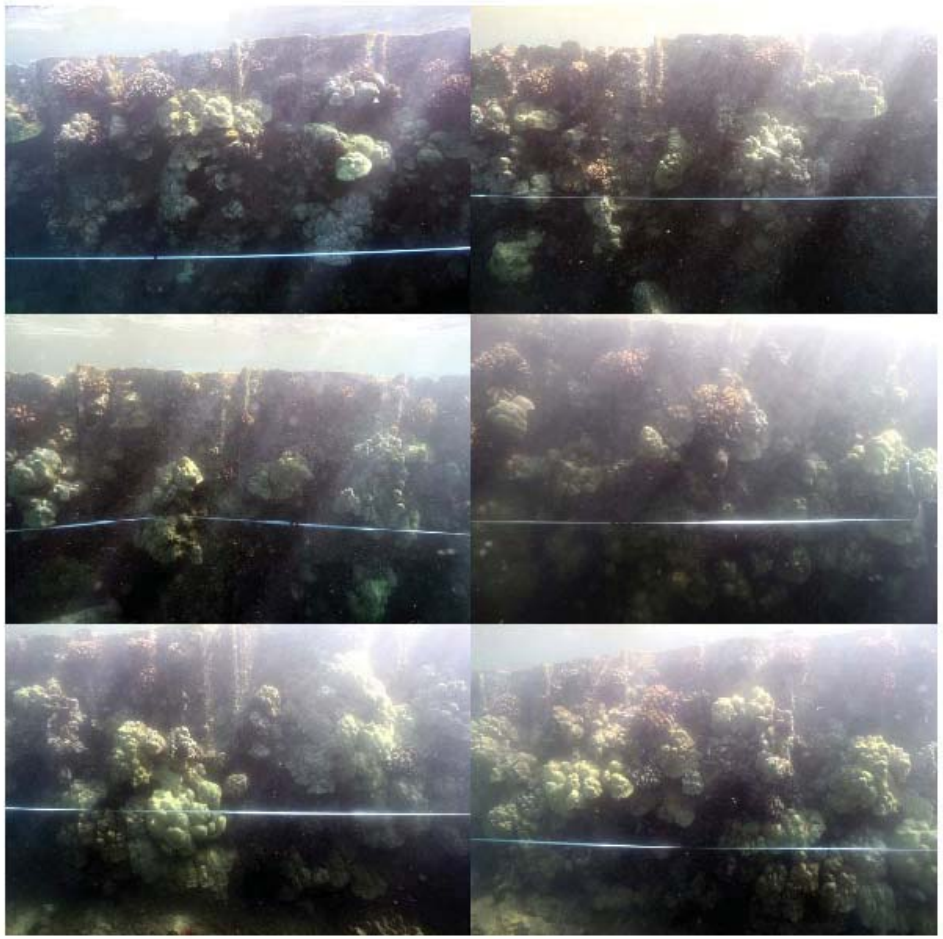


FIGURE 14. Representative photos of corrugated sheet-piling in area between Piers 1 and 2A, which is proposed location for Pier 2A expansion. Corals growing on sheet-piling are predominantly *Porites lobata* (green knobble colonies) and *Pocillopora meandrina* (brown hemispherical branching colonies).

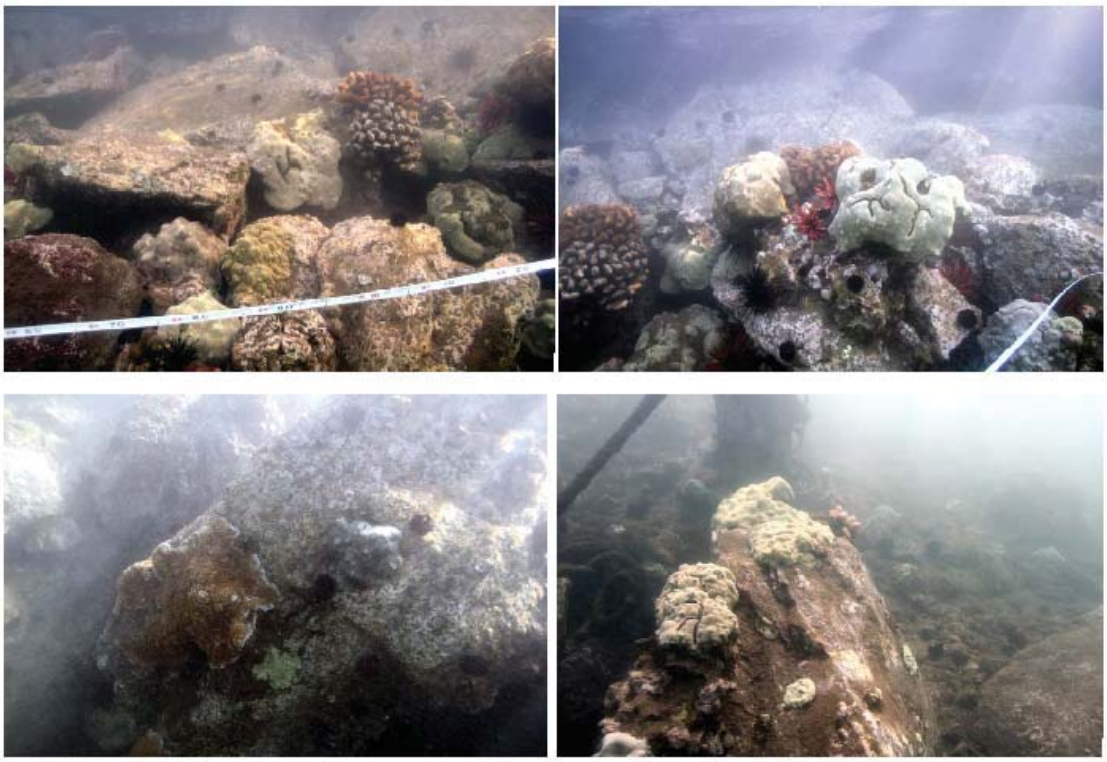


FIGURE 16. Photos of boulders forming the shoreline along the eastern edge of Kawaihae Harbor in the area of proposed Pier 2C. Boulders are colonized by numerous corals as well as sea urchins.



FIGURE 15. Photos in top row show two views of large coral-covered boulders that occur approximately 30 meters north of the north end of Pier 2A. Coral covered boulders are located just off the corrugated sheet piling in the area proposed for the extension of Pier 2A. Bottom photos show colonization of basaltic boulders at the base of sheet piling in the area between Piers 1 and 2A.

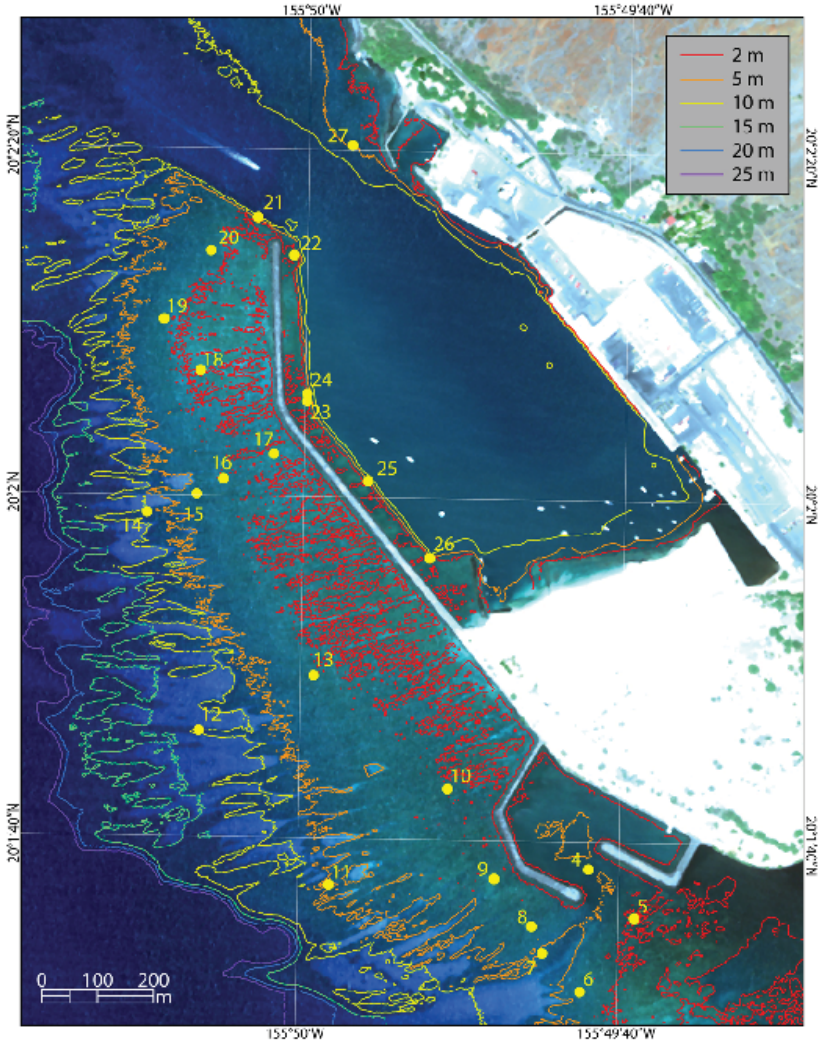


FIGURE 17. Satellite photograph of Kawaihae Deep Draft Harbor and surrounding reef showing bathymetric contours and locations of locations of 27 calibration/validation sites used to quantify coral community structure.



FIGURE 18. Two views of the southwestern edge of the entrance channel to the Kawaihae Deep Draft Harbor (Station 21 in Figure 17). The upper photo shows the coral community on the reef flat at the top of the reef flat adjacent to the sloping edge of the channel. The bottom photo shows the steeply sloping wall of the entrance channel. The primary corals occupying the reef top is *Pocillopora meandrina*, while the dominant coral on the channel slope is *Porites lobata* and *Porites compressa*. Water depth is approximately 8 feet in the upper photo and 10-30 feet in the bottom photo.



FIGURE 19. Two views of the reef bench adjacent to the breakwater on the inside the Kawaihae Deep Draft Harbor (Station 24 in Figure 17). The upper photo shows a large tree that lying on top of the reef platform. The bottom photo shows top of the reef edge that slopes sharply to the harbor floor. The reef bench and slope edge in both photos is covered with near continuous mats of interconnected lattices of *Porites compressa*. Note in both photos pockets of fine grained muddy sediment interspersed on the reef surface. Water depth is approximately 8 feet in the upper photo and 12 feet in the bottom photo.

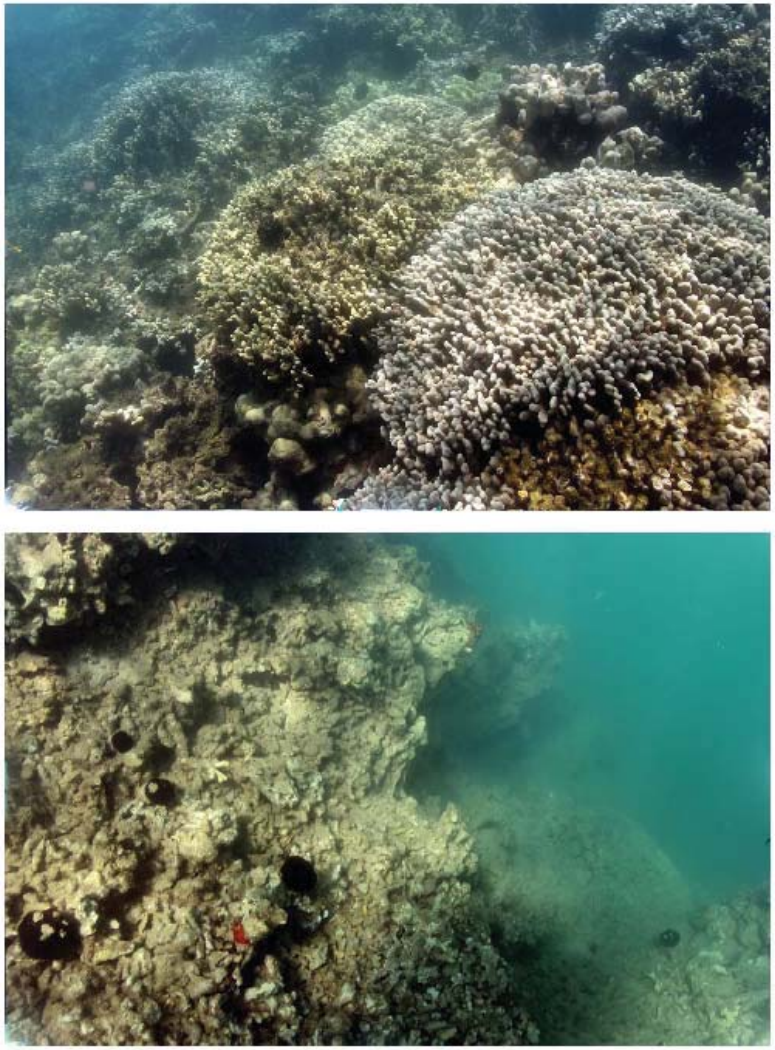


FIGURE 20. Two views of the reef bench adjacent to the breakwater on the inside the Kawaihae Deep Draft Harbor (Station 26 in Figure 17). The upper photo shows a large rounded amalgamated colonies of *Porites compressa* on top of the reef platform. The bottom photo shows the vertical cut of the basin wall through the reef platform near the floor of the harbor basin. Note lack of coral growth on the lower section of the dredged wall. Water depth is approximately 10 feet in the upper photo and 25 feet in the bottom photo.

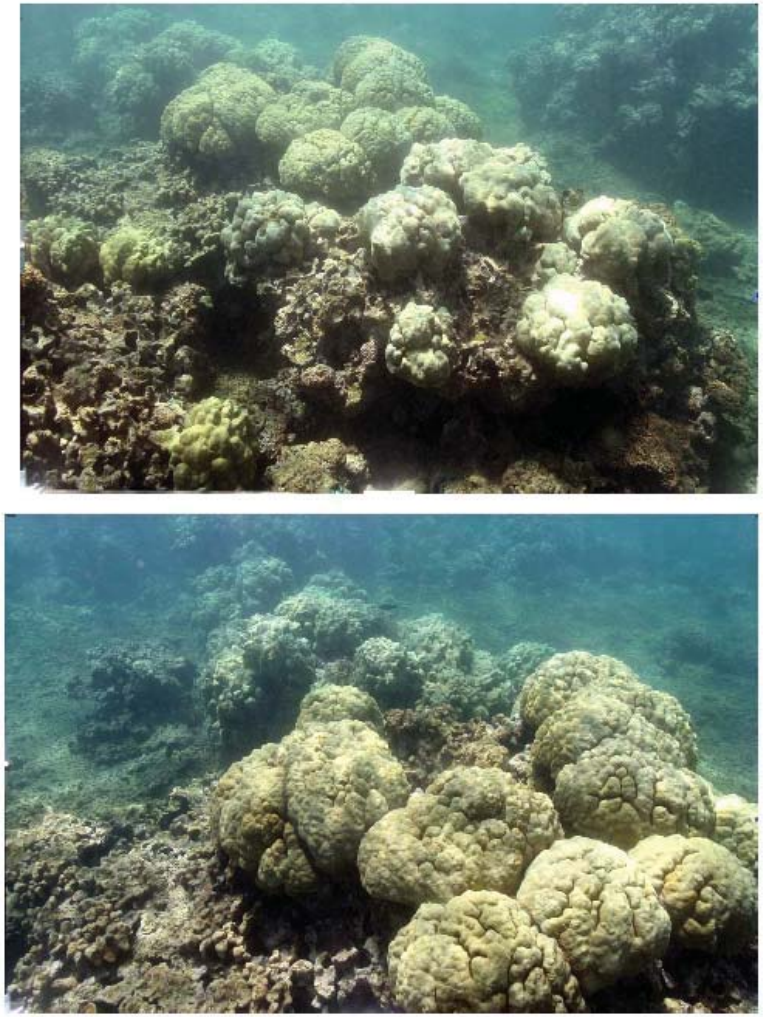


FIGURE 21. Two views of inner reef flat of the Kawaihae reef bench (Station 17 in Figure 17). The coral community on the reef flat is composed primarily of similar sized hemispherical colonies of *Porites lobata* on the fossil limestone reef bench. Water depth is approximately 10 feet.



FIGURE 22. Two views of inner reef flat of the Kawaihae reef bench (Stations 18-20 in Figure 17). The coral community on the reef flat is composed primarily of similar sized hemispherical colonies of *Pocillopora meandrina* and *Porites lobata* on the fossil limetone reef bench. Water depth is approximately 10 feet.



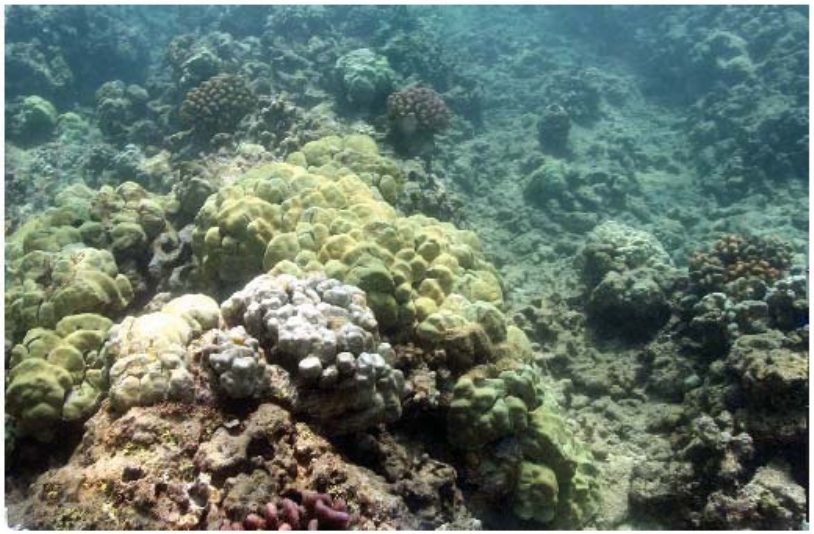
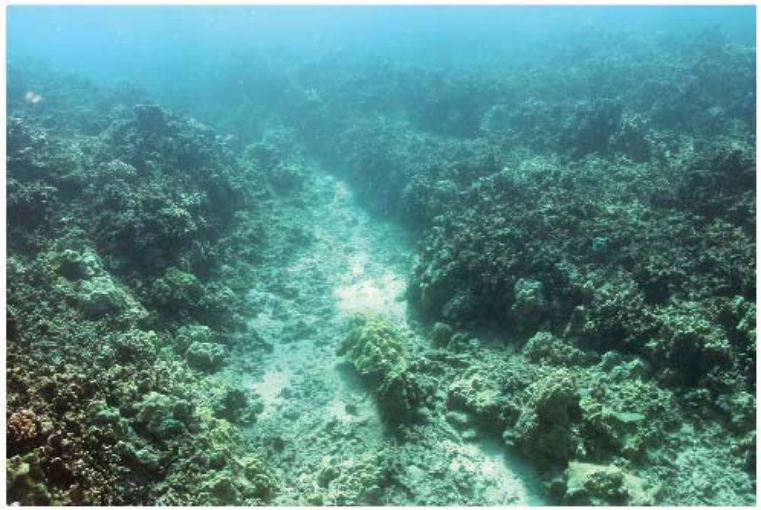


FIGURE 23. Two views of inner reef flat of the Kawaihae reef bench (Station 13 in Figure 17). The coral community on the reef flat is composed primarily of colonies of *Porites lobata* and *Pocillopora meandrina* growing on the pitted limestone reef bench. Water depth is approximately 10 feet.



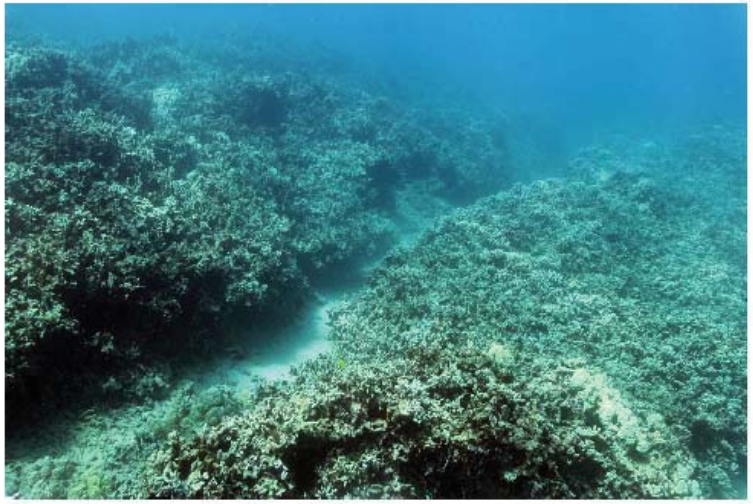


FIGURE 24. Two views of sand channels separating coral knolls on outer zone of the Kawaihae reef bench (Station 11 in Figure 17). The knolls are composed of upwardly accreting coral mass comprised primarily of interconnected mats of branching finger coral Porites compressa. Water depth is approximately 18 feet.

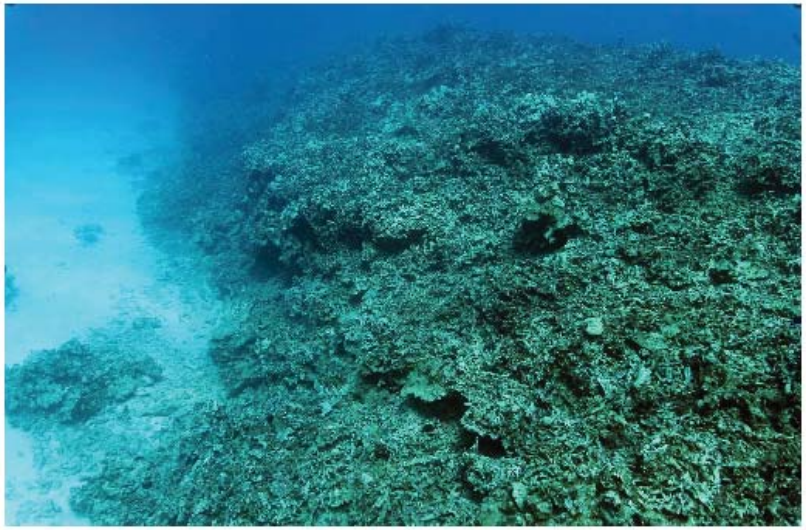




FIGURE 25. Two views of outer edges of knolls on outer zone of the Kawaihae reef bench (Station 12 in Figure 17). The knolls are composed of upwardly accreting coral mass comprised primarily of interconnected mats of branching finger coral *Porites compressa*. The reef edge in some areas forms a vertical wall extending to the sand plains that extend seaward Water depth is approximately 30 feet.



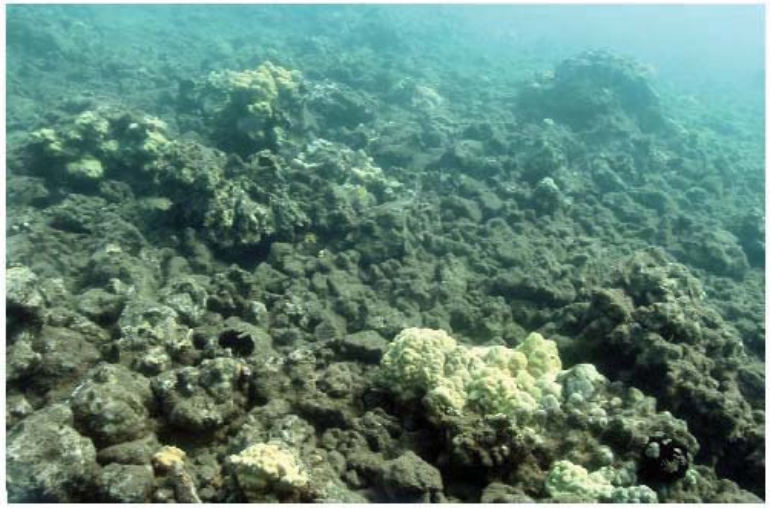


FIGURE 26. Two views of floor of channel through the reef leading to the Kawaihae small boat basin at the south end of the deep draft harbor (Station 7 in Figure 17). Predominant corals are encrusting colonies of lobe coral (*Porites lobata*) growing on the rubble surface. Living coral covers essentially the entire reef surface. Water depth is approximately 18 feet.



FIGURE 27. Two views of reef bench off the Kawaihae small boat harbor (Station 9 in Figure 17). The majority of the reef surface is covered with a layer of crustose coralline algae. Predominant corals growing amongst the crustose algae are clumps of branching finger coral (*Porites compressa*) and small knobby heads of lobe coral (*Porites lobata*). Water depth is approximately 12 feet.

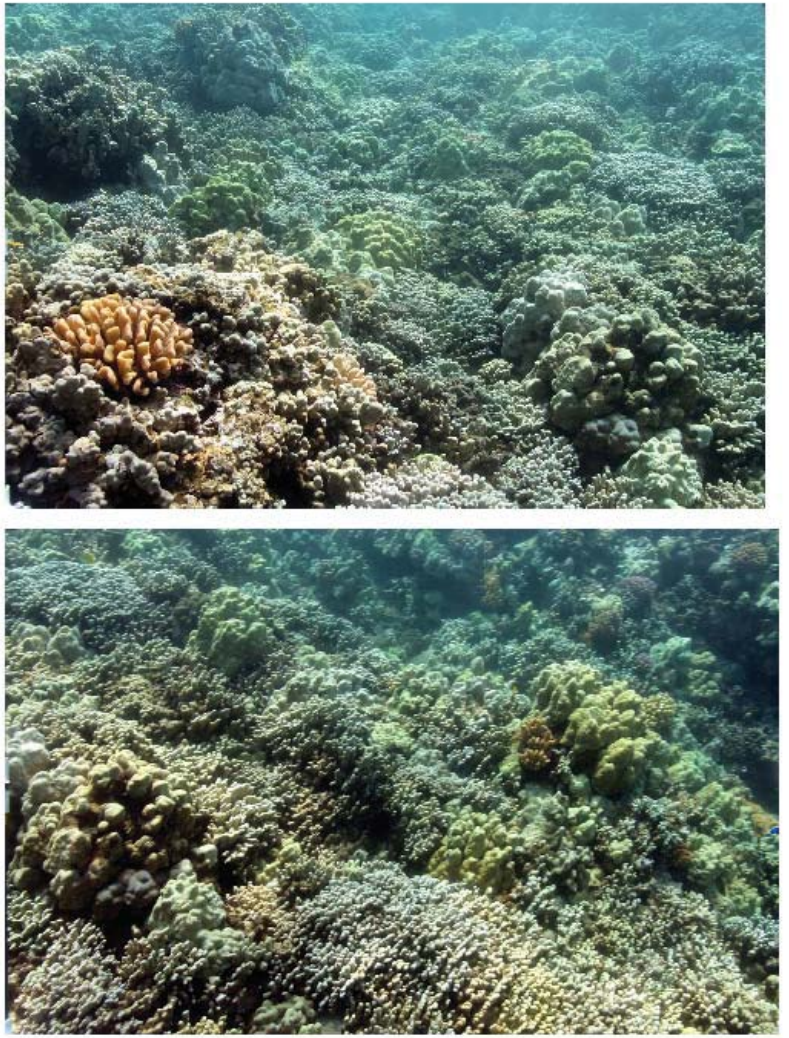


FIGURE 28. Two views of reef bench southwest of Kawaihae small boat harbor (Station 6 in Figure 17). Predominant corals are interconnected mats of branching finger coral (*Porites compressa*) and knobby heads of lobe coral (*Porites lobata*). Living coral covers essentially the entire reef surface. Water depth is approximately 12 feet.

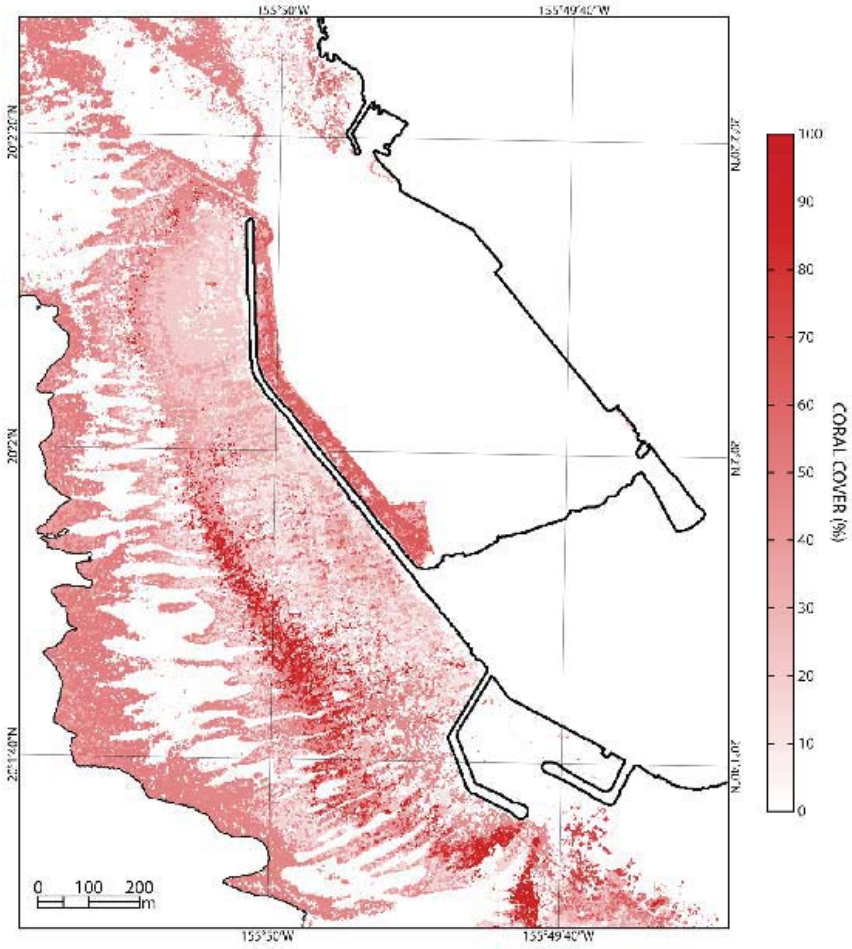


FIGURE 29. Coral abundance map of Kawaihae area created by classifying community composition from ground-truthed calibration-validation data. Density of red color corresponds to percent coral cover on reef surface.

APPENDIX A

RESULTS OF SEDIMENT TESTING
KAWAIHAE HARBOR

CALSCIENCES ENVIRONMENTAL LABORATORIES, INC.

AUGUST 17, 2011

Calscience
Environmental & Marine Chemistry Laboratories

CALSCIENCE
WORK ORDER NUMBER: 11-08-1379

The difference is service



AIR | SOIL | WATER | MARINE CHEMISTRY

Analytical Report For
Client: Marine Research Consultants, Inc.
Client Project Name: KAWAIHAE HARBOR
Attention: Steve Dollar
1039 Waakaua Pl.
Honolulu, HI 96822-1173

Approved for release on 08/30/2011 by:
Don Burley
Project Manager

ResultLink
Email your PM

Calscience Environmental Laboratories certifies that the test results provided in this report meet all NELAC requirements for parameters for which accreditation is required or available. Any exceptions to NELAC requirements are noted in the case narrative. The original report of subcontracted analyses, if any, is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety. Note that the Chain-of-Custody Record and Sample Receipt Form are integral parts of this report.

7440 Lincoln Way, Garden Grove, CA 92841-1432 • TEL:(714) 895-5494 • FAX:(714) 894-7501 • www.calscience.com
NELAP ID: 03220CA | DoD-ELAP ID: L10-41 | CSDLAC ID: 10109 | SCAQMD ID: 93LA0830

Calscience
Environmental & Marine Chemistry Laboratories

Client Project Name: KAWAIHAE HARBOR
Work Order Number: 11-08-1379

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CASE NARRATIVE

Calscience Work Order No: 11-08-1379

Provided below is a narrative of our analytical effort, including any unique features or anomalies encountered as part of the analysis of the marine sediment samples.

Sample Condition on Receipt

Four (4) marine sediment samples were received for this project on August 19, 2011. The samples were housed in glass jars (16-oz. and 2-oz). All samples were transferred to the laboratory in an ice-chest, following strict chain-of-custody (COC) procedures. The temperature of the samples upon receipt at the laboratory was 5.4°C. The samples were logged into the Laboratory Information Management System (LIMS), given laboratory identification numbers, and stored in refrigeration units pending analysis.

No anomalies were discovered upon sample receipt and log-in.

Data Summary

Each of the samples housed in 16-oz. jars was homogenized prior to testing. Each of the samples housed in 2-oz jars was tested as-received for the purgeable analytes, TPH Gasoline and BTEX.

Samples were analyzed for the following parameters:

Ignitibility by EPA1010A (M)
TPH Diesel by EPA 8015B (M)
TPH Motor Oil by EPA 8015B (M)
TPH Gasoline by EPA 8015B (M)
PCB Aroclors by EPA 8082
BTEX by EPA 8260B
PAHs by EPA 8270C SIM
Total Solids by EPA 2540 B
TCLP Metals by EPA 1311/6020/7470

Holding times

All holding time requirements were met.

Calibration

Frequency and control criteria for initial and continuing calibration verifications were met.

Blanks

Concentrations of target analytes in the method blanks were found to be below reporting limits for all testing.

Laboratory Control Samples

Laboratory Control Sample analyses were performed at the required frequencies. All metals were within control limits.

Matrix Spikes

Matrix spike analyses were performed at required frequencies. Sample KH-1 was spiked. All recoveries were in control for each test with the following exceptions.

For the TCLP metals by EPA 6020, Barium, Cadmium, and Silver showed MSD recoveries slightly above the established control limit for the respective metal. However, in all cases, the corresponding LCS/LCSD recoveries and RPDs for all testing were within acceptable limits, indicating a matrix interference effect, and thus the data is released with no further qualification.

For the PCB Aroclors, the matrix spike recovery and RPD for Aroclor-1016 fell above the established control limit. However, the corresponding LCS/LCSD recoveries were in control, which points to a matrix interference effect, and the data is released with no further action.

For the PAHs by EPA 8270C SIM, the RPD for the MS/MSD for pyrene fell above the laboratory established control limit for this compound. However, the MS/MSD recoveries were in control, as were the LCS/LCSD recoveries for this compound, and the data is thus released with no further action.

Acronyms

TPH:	Total Petroleum Hydrocarbons
BTEX:	Benzene, Toluene, Ethylbenzene, Xylenes
PAHs:	Polynuclear Aromatic Hydrocarbons
MS/MSD:	Matrix Spike/Matrix Spike Duplicate
LCS/LCSD:	Laboratory Control Sample/Laboratory Control Sample Duplicate
RPD:	Relative Percent Difference

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: N/A
Method: EPA 1010A(M)

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-1	**11-08-1379-1-B**	**08/17/11 10:34**	**Solid**	**FP 3**	**N/A**	**08/23/11 18:00**	**B0823FPD1**

Parameter	Result	RL	DF	□ual	□nits
Ignitability	□212	70	1		°F

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-2	**11-08-1379-2-A**	**08/17/11 10:41**	**Solid**	**FP 3**	**N/A**	**08/23/11 18:00**	**B0823FPD1**

Parameter	Result	RL	DF	□ual	□nits
Ignitability	□212	70	1		°F

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-3	**11-08-1379-3-A**	**08/17/11 10:53**	**Solid**	**FP 3**	**N/A**	**08/23/11 18:00**	**B0823FPD1**

Parameter	Result	RL	DF	□ual	□nits
Ignitability	□212	70	1		°F

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-4	**11-08-1379-4-A**	**08/17/11 10:59**	**Solid**	**FP 3**	**N/A**	**08/23/11 18:00**	**B0823FPD1**

Parameter	Result	RL	DF	□ual	□nits
Ignitability	□212	70	1		°F

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: N/A
Method: SM 2540 B

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-1	**11-08-1379-1-A**	**08/17/11 10:34**	**Solid**	**N/A**	**08/23/11**	**08/23/11 16:00**	**B0823TSB1**

Parameter	Result	RL	DF	□ual	□nits
Solids, Total	73.8	0.100	1		□

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-2	**11-08-1379-2-A**	**08/17/11 10:41**	**Solid**	**N/A**	**08/23/11**	**08/23/11 16:00**	**B0823TSB1**

Parameter	Result	RL	DF	□ual	□nits
Solids, Total	54.4	0.100	1		□

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-3	**11-08-1379-3-A**	**08/17/11 10:53**	**Solid**	**N/A**	**08/23/11**	**08/23/11 16:00**	**B0823TSB1**

Parameter	Result	RL	DF	□ual	□nits
Solids, Total	77.3	0.100	1		□

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-4	**11-08-1379-4-A**	**08/17/11 10:59**	**Solid**	**N/A**	**08/23/11**	**08/23/11 16:00**	**B0823TSB1**

Parameter	Result	RL	DF	□ual	□nits
Solids, Total	64.9	0.100	1		□

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-05-019-1,713**	**N/A**	**Solid**	**N/A**	**08/23/11**	**08/23/11 16:00**	**B0823TSB1**

Parameter	Result	RL	DF	□ual	□nits
Solids, Total	ND	0.100	1		□

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3550B
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-1	**11-08-1379-1-A**	**08/17/11 10:34**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 20:03**	**110823B04**

Parameter	Result	RL	DF	□ual	□nits
TPH as Motor Oil	ND	25	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	93	61-145	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-2	**11-08-1379-2-A**	**08/17/11 10:41**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 20:50**	**110823B04**

Parameter	Result	RL	DF	□ual	□nits
TPH as Motor Oil	ND	25	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	94	61-145	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-3	**11-08-1379-3-A**	**08/17/11 10:53**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 21:05**	**110823B04**

Parameter	Result	RL	DF	□ual	□nits
TPH as Motor Oil	ND	25	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	90	61-145	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-4	**11-08-1379-4-A**	**08/17/11 10:59**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 21:21**	**110823B04**

Parameter	Result	RL	DF	□ual	□nits
TPH as Motor Oil	ND	25	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	96	61-145	

Return to Contents

RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3550B
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-12-254-2,122**	**N/A**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 15:22**	**110823B04**

Parameter	Result	RL	DF	□ual	□nits
TPH as Motor Oil	ND	25	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	104	61-145	

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

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Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3550B
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-1	**11-08-1379-1-A**	**08/17/11 10:34**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 20:03**	**110823B03**

Parameter	Result	RL	DF	□ual	□nits
TPH as Diesel	ND	5.0	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	93	61-145	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-2	**11-08-1379-2-A**	**08/17/11 10:41**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 20:50**	**110823B03**

Parameter	Result	RL	DF	□ual	□nits
TPH as Diesel	ND	5.0	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	94	61-145	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-3	**11-08-1379-3-A**	**08/17/11 10:53**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 21:05**	**110823B03**

Parameter	Result	RL	DF	□ual	□nits
TPH as Diesel	ND	5.0	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	90	61-145	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-4	**11-08-1379-4-A**	**08/17/11 10:59**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 21:21**	**110823B03**

Parameter	Result	RL	DF	□ual	□nits
TPH as Diesel	ND	5.0	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	96	61-145	

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3550B
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-12-275-4,101**	**N/A**	**Solid**	**□□ 46**	**08/23/11**	**08/23/11 15:22**	**110823B03**

Parameter	Result	RL	DF	□ual	□nits
TPH as Diesel	ND	5.0	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
Decachlorobiphenyl	104	61-145	

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-1	**11-08-1379-1-A**	**08/17/11 10:34**	**Solid**	**□□ 42**	**08/23/11**	**08/23/11 17:18**	**110823B01**

Parameter	Result	RL	DF	□ual	□nits
TPH as Gasoline	ND	0.50	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
1,4-Bromofluorobenzene	81	42-126	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-2	**11-08-1379-2-B**	**08/17/11 10:41**	**Solid**	**□□ 42**	**08/23/11**	**08/23/11 19:36**	**110823B01**

Parameter	Result	RL	DF	□ual	□nits
TPH as Gasoline	ND	0.50	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
1,4-Bromofluorobenzene	79	42-126	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-3	**11-08-1379-3-B**	**08/17/11 10:53**	**Solid**	**□□ 42**	**08/24/11**	**08/24/11 17:32**	**110824B01**

Parameter	Result	RL	DF	□ual	□nits
TPH as Gasoline	ND	0.50	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
1,4-Bromofluorobenzene	81	42-126	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-4	**11-08-1379-4-B**	**08/17/11 10:59**	**Solid**	**□□ 42**	**08/23/11**	**08/23/11 20:45**	**110823B01**

Parameter	Result	RL	DF	□ual	□nits
TPH as Gasoline	ND	0.50	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
1,4-Bromofluorobenzene	81	42-126	

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-12-279-4,624**	**N/A**	**Solid**	**□□ 42**	**08/23/11**	**08/23/11 13:17**	**110823B01**

Parameter	Result	RL	DF	□ual	□nits
TPH as Gasoline	ND	0.50	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
1,4-Bromofluorobenzene - FID	86	42-126	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-12-279-4,630**	**N/A**	**Solid**	**□□ 42**	**08/24/11**	**08/24/11 12:56**	**110824B01**

Parameter	Result	RL	DF	□ual	□nits
TPH as Gasoline	ND	0.50	1		mg/kg

Surrogates:	REC (□)	Control Limits	□ual
1,4-Bromofluorobenzene - FID	80	42-126	

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3545
Method: EPA 8082
□nits: ug/kg

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-1	**11-08-1379-1-A**	**08/17/11 10:34**	**Solid**	**□□ 58**	**08/24/11**	**08/25/11 12:37**	**110824□11**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Aroclor-1016	ND	10	1		Aroclor-1248	ND	10	1	
Aroclor-1221	ND	10	1		Aroclor-1254	ND	10	1	
Aroclor-1232	ND	10	1		Aroclor-1260	ND	10	1	
Aroclor-1242	ND	10	1		Aroclor-1262	ND	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2,4,5,6-Tetrachloro-m-Xylene	110	50-130			Decachlorobiphenyl	120	50-130		

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-2	**11-08-1379-2-A**	**08/17/11 10:41**	**Solid**	**□□ 58**	**08/24/11**	**08/25/11 17:24**	**110824□11**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Aroclor-1016	ND	10	1		Aroclor-1248	ND	10	1	
Aroclor-1221	ND	10	1		Aroclor-1254	ND	10	1	
Aroclor-1232	ND	10	1		Aroclor-1260	ND	10	1	
Aroclor-1242	ND	10	1		Aroclor-1262	ND	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2,4,5,6-Tetrachloro-m-Xylene	110	50-130			Decachlorobiphenyl	120	50-130		

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-3	**11-08-1379-3-A**	**08/17/11 10:53**	**Solid**	**□□ 58**	**08/24/11**	**08/26/11 11:36**	**110824□11**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Aroclor-1016	ND	10	1		Aroclor-1248	ND	10	1	
Aroclor-1221	ND	10	1		Aroclor-1254	ND	10	1	
Aroclor-1232	ND	10	1		Aroclor-1260	ND	10	1	
Aroclor-1242	92	10	1		Aroclor-1262	ND	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2,4,5,6-Tetrachloro-m-Xylene	71	50-130			Decachlorobiphenyl	98	50-130		

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-4	**11-08-1379-4-A**	**08/17/11 10:59**	**Solid**	**□□ 58**	**08/24/11**	**08/25/11 18:00**	**110824□11**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Aroclor-1016	ND	10	1		Aroclor-1248	ND	10	1	
Aroclor-1221	ND	10	1		Aroclor-1254	ND	10	1	
Aroclor-1232	ND	10	1		Aroclor-1260	ND	10	1	
Aroclor-1242	ND	10	1		Aroclor-1262	ND	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2,4,5,6-Tetrachloro-m-Xylene	96	50-130			Decachlorobiphenyl	105	50-130		

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3545
Method: EPA 8082
□nits: ug/kg

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-12-565-202**	**N/A**	**Solid**	**□□ 58**	**08/24/11**	**08/25/11 11:43**	**110824□11**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Aroclor-1016	ND	10	1		Aroclor-1248	ND	10	1	
Aroclor-1221	ND	10	1		Aroclor-1254	ND	10	1	
Aroclor-1232	ND	10	1		Aroclor-1260	ND	10	1	
Aroclor-1242	ND	10	1		Aroclor-1262	ND	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2,4,5,6-Tetrachloro-m-Xylene	105	50-130			Decachlorobiphenyl	116	50-130		

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3545
Method: EPA 8270C SIM PAHs
□nits: ug/kg

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-1	**11-08-1379-1-A**	**08/17/11 10:34**	**Solid**	**□□/MS AAA**	**08/24/11**	**08/25/11 20:48**	**110824□07**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Naphthalene	14	10	1		Benzo (a) Anthracene	ND	10	1	
Acenaphthylene	13	10	1		Chrysene	ND	10	1	
Acenaphthene	ND	10	1		Benzo (k) Fluoranthene	ND	10	1	
Fluorene	ND	10	1		Benzo (b) Fluoranthene	ND	10	1	
Phenanthrene	ND	10	1		Benzo (a) Pyrene	ND	10	1	
Anthracene	ND	10	1		Indeno (1,2,3-c,d) Pyrene	ND	10	1	
Fluoranthene	ND	10	1		Dibenz (a,h) Anthracene	ND	10	1	
Pyrene	ND	10	1		Benzo (g,h,i) Perylene	11	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2-Fluorobiphenyl	91	13-127			Nitrobenzene-d5	112	17-137		
p-Terphenyl-d14	84	4-160							

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-2	**11-08-1379-2-A**	**08/17/11 10:41**	**Solid**	**□□/MS AAA**	**08/24/11**	**08/25/11 21:14**	**110824□07**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Naphthalene	16	10	1		Benzo (a) Anthracene	15	10	1	
Acenaphthylene	ND	10	1		Chrysene	17	10	1	
Acenaphthene	ND	10	1		Benzo (k) Fluoranthene	19	10	1	
Fluorene	ND	10	1		Benzo (b) Fluoranthene	19	10	1	
Phenanthrene	ND	10	1		Benzo (a) Pyrene	17	10	1	
Anthracene	ND	10	1		Indeno (1,2,3-c,d) Pyrene	10	10	1	
Fluoranthene	17	10	1		Dibenz (a,h) Anthracene	ND	10	1	
Pyrene	22	10	1		Benzo (g,h,i) Perylene	14	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2-Fluorobiphenyl	78	13-127			Nitrobenzene-d5	102	17-137		
p-Terphenyl-d14	65	4-160							

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3545
Method: EPA 8270C SIM PAHs
□nits: ug/kg

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-3	**11-08-1379-3-A**	**08/17/11 10:53**	**Solid**	**□□/MS AAA**	**08/24/11**	**08/25/11 22:33**	**110824□07**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Naphthalene	ND	10	1		Benzo (a) Anthracene	59	10	1	
Acenaphthylene	ND	10	1		Chrysene	82	10	1	
Acenaphthene	ND	10	1		Benzo (k) Fluoranthene	83	10	1	
Fluorene	ND	10	1		Benzo (b) Fluoranthene	100	10	1	
Phenanthrene	18	10	1		Benzo (a) Pyrene	74	10	1	
Anthracene	12	10	1		Indeno (1,2,3-c,d) Pyrene	51	10	1	
Fluoranthene	68	10	1		Dibenz (a,h) Anthracene	22	10	1	
Pyrene	92	10	1		Benzo (g,h,i) Perylene	66	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2-Fluorobiphenyl	89	13-127			Nitrobenzene-d5	115	17-137		
p-Terphenyl-d14	87	4-160							

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-4	**11-08-1379-4-A**	**08/17/11 10:59**	**Solid**	**□□/MS AAA**	**08/24/11**	**08/25/11 21:40**	**110824□07**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Naphthalene	ND	10	1		Benzo (a) Anthracene	ND	10	1	
Acenaphthylene	ND	10	1		Chrysene	ND	10	1	
Acenaphthene	ND	10	1		Benzo (k) Fluoranthene	ND	10	1	
Fluorene	ND	10	1		Benzo (b) Fluoranthene	ND	10	1	
Phenanthrene	ND	10	1		Benzo (a) Pyrene	ND	10	1	
Anthracene	ND	10	1		Indeno (1,2,3-c,d) Pyrene	ND	10	1	
Fluoranthene	ND	10	1		Dibenz (a,h) Anthracene	ND	10	1	
Pyrene	ND	10	1		Benzo (g,h,i) Perylene	ND	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2-Fluorobiphenyl	66	13-127			Nitrobenzene-d5	81	17-137		
p-Terphenyl-d14	53	4-160							

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3545
Method: EPA 8270C SIM PAHs
□nits: ug/kg

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-14-035-62**	**N/A**	**Solid**	**□□/MS AAA**	**08/24/11**	**08/24/11 19:58**	**110824□07**

Parameter	Result	RL	DF	□ual	Parameter	Result	RL	DF	□ual
Naphthalene	ND	10	1		Benzo (a) Anthracene	ND	10	1	
Acenaphthylene	ND	10	1		Chrysene	ND	10	1	
Acenaphthene	ND	10	1		Benzo (k) Fluoranthene	ND	10	1	
Fluorene	ND	10	1		Benzo (b) Fluoranthene	ND	10	1	
Phenanthrene	ND	10	1		Benzo (a) Pyrene	ND	10	1	
Anthracene	ND	10	1		Indeno (1,2,3-c,d) Pyrene	ND	10	1	
Fluoranthene	ND	10	1		Dibenz (a,h) Anthracene	ND	10	1	
Pyrene	ND	10	1		Benzo (g,h,i) Perylene	ND	10	1	
Surrogates:	REC (□)	Control Limits		□ual	Surrogates:	REC (□)	Control Limits		□ual
2-Fluorobiphenyl	92	13-127			Nitrobenzene-d5	112	17-137		
p-Terphenyl-d14	89	4-160							

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8260B
□nits: ug/kg

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-1	**11-08-1379-1-B**	**08/17/11 10:34**	**Solid**	**□□/MS □ □**	**08/19/11**	**08/22/11 16:35**	**110822□01**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□□flag.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Benzene	ND	5.0	0.13	1		p/m-Xylene	ND	5.0	0.27	1	
Ethylbenzene	ND	5.0	0.15	1		o-Xylene	ND	5.0	0.56	1	
Toluene	ND	5.0	0.52	1							
Surrogates:	REC (□)	Control Limits		□ual		Surrogates:	REC (□)	Control Limits		□ual	
1,4-Bromofluorobenzene	97	60-132				Dibromofluoromethane	106	63-141			
1,2-Dichloroethane-d4	95	62-146				Toluene-d8	99	80-120			

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-2	**11-08-1379-2-B**	**08/17/11 10:41**	**Solid**	**□□/MS □□**	**08/19/11**	**08/23/11 15:23**	**110823□01**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□□flag.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Benzene	ND	5.0	0.13	1		p/m-Xylene	ND	5.0	0.27	1	
Ethylbenzene	ND	5.0	0.15	1		o-Xylene	ND	5.0	0.56	1	
Toluene	ND	5.0	0.52	1							
Surrogates:	REC (□)	Control Limits		□ual		Surrogates:	REC (□)	Control Limits		□ual	
1,4-Bromofluorobenzene	92	60-132				Dibromofluoromethane	83	63-141			
1,2-Dichloroethane-d4	89	62-146				Toluene-d8	99	80-120			

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-3	**11-08-1379-3-B**	**08/17/11 10:53**	**Solid**	**□□/MS □□**	**08/19/11**	**08/23/11 15:50**	**110823□01**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□□flag.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Benzene	ND	5.0	0.13	1		p/m-Xylene	ND	5.0	0.27	1	
Ethylbenzene	ND	5.0	0.15	1		o-Xylene	ND	5.0	0.56	1	
Toluene	ND	5.0	0.52	1							
Surrogates:	REC (□)	Control Limits		□ual		Surrogates:	REC (□)	Control Limits		□ual	
1,4-Bromofluorobenzene	93	60-132				Dibromofluoromethane	86	63-141			
1,2-Dichloroethane-d4	89	62-146				Toluene-d8	102	80-120			

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8260B
□nits: ug/kg

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-4	**11-08-1379-4-A**	**08/17/11 10:59**	**Solid**	**□□/MS □ □**	**08/19/11**	**08/22/11 13:48**	**110822□01**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□□flag.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Benzene	ND	5.0	0.13	1		p/m-Xylene	ND	5.0	0.27	1	
Ethylbenzene	ND	5.0	0.15	1		o-Xylene	ND	5.0	0.56	1	
Toluene	ND	5.0	0.52	1							

Surrogates:	REC (□)	Control Limits	□ual	Surrogates:	REC (□)	Control Limits	□ual
1,4-Bromofluorobenzene	97	60-132		Dibromofluoromethane	105	63-141	
1,2-Dichloroethane-d4	96	62-146		Toluene-d8	99	80-120	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-12-796-5,071**	**N/A**	**Solid**	**□□/MS □ □**	**08/22/11**	**08/22/11 12:52**	**110822□01**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□□flag.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Benzene	ND	5.0	0.13	1		p/m-Xylene	ND	5.0	0.27	1	
Ethylbenzene	ND	5.0	0.15	1		o-Xylene	ND	5.0	0.56	1	
Toluene	ND	5.0	0.52	1							

Surrogates:	REC (□)	Control Limits	□ual	Surrogates:	REC (□)	Control Limits	□ual
1,4-Bromofluorobenzene	97	60-132		Dibromofluoromethane	106	63-141	
1,2-Dichloroethane-d4	98	62-146		Toluene-d8	98	80-120	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-12-796-5,073**	**N/A**	**Solid**	**□□/MS □□**	**08/23/11**	**08/23/11 11:40**	**110823□01**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□□flag.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Benzene	ND	5.0	0.13	1		p/m-Xylene	ND	5.0	0.27	1	
Ethylbenzene	ND	5.0	0.15	1		o-Xylene	ND	5.0	0.56	1	
Toluene	ND	5.0	0.52	1							

Surrogates:	REC (□)	Control Limits	□ual	Surrogates:	REC (□)	Control Limits	□ual
1,4-Bromofluorobenzene	94	60-132		Dibromofluoromethane	84	63-141	
1,2-Dichloroethane-d4	88	62-146		Toluene-d8	99	80-120	

Return to Contents

RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 1311 / EPA 1311
Method: EPA 6020 / EPA 7470A
□nits: mg/L

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-1	**11-08-1379-1-A**	**08/17/11 10:34**	**Solid**	**□P/MS 04**	**08/22/11**	**08/23/11 17:52**	**110823□02**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□□flag.
-The analysis was performed on an TCLP extract of the sample.
-Mercury analysis was performed on 08/23/11 16:12 with batch 110823L04.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Arsenic	ND	0.100	0.0589	100		Lead	0.0235	0.100	0.0170	100	□
Barium	0.200	0.100	0.0105	100		Mercury	ND	0.00500	0.000825	1	
Cadmium	ND	0.100	0.0266	100		Selenium	ND	0.100	0.0554	100	
Chromium	ND	0.100	0.0618	100		Silver	ND	0.100	0.0120	100	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-2	**11-08-1379-2-A**	**08/17/11 10:41**	**Solid**	**□P/MS 04**	**08/22/11**	**08/23/11 17:56**	**110823□02**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□□flag.
-The analysis was performed on an TCLP extract of the sample.
-Mercury analysis was performed on 08/23/11 16:14 with batch 110823L04.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Arsenic	ND	0.100	0.0589	100		Lead	ND	0.100	0.0170	100	
Barium	0.274	0.100	0.0105	100		Mercury	ND	0.00500	0.000825	1	
Cadmium	ND	0.100	0.0266	100		Selenium	ND	0.100	0.0554	100	
Chromium	ND	0.100	0.0618	100		Silver	ND	0.100	0.0120	100	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-3	**11-08-1379-3-A**	**08/17/11 10:53**	**Solid**	**□P/MS 04**	**08/22/11**	**08/23/11 17:59**	**110823□02**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□□flag.
-The analysis was performed on an TCLP extract of the sample.
-Mercury analysis was performed on 08/23/11 16:16 with batch 110823L04.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Arsenic	ND	0.100	0.0589	100		Lead	ND	0.100	0.0170	100	
Barium	0.397	0.100	0.0105	100		Mercury	ND	0.00500	0.000825	1	
Cadmium	ND	0.100	0.0266	100		Selenium	ND	0.100	0.0554	100	
Chromium	ND	0.100	0.0618	100		Silver	ND	0.100	0.0120	100	

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

Analytical Report

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 1311 / EPA 1311
Method: EPA 6020 / EPA 7470A
□nits: mg/L

Project: KA□ AIHAE HARBOR

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
KH-4	**11-08-1379-4-A**	**08/17/11 10:59**	**Solid**	**□P/MS 04**	**08/22/11**	**08/23/11 18:02**	**110823□02**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□flag.
-The analysis was performed on an TCLP extract of the sample.
-Mercury analysis was performed on 08/23/11 16:18 with batch 110823L04.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Arsenic	ND	0.100	0.0589	100		Lead	ND	0.100	0.0170	100	
Barium	0.272	0.100	0.0105	100		Mercury	ND	0.00500	0.000825	1	
Cadmium	ND	0.100	0.0266	100		Selenium	ND	0.100	0.0554	100	
Chromium	ND	0.100	0.0618	100		Silver	ND	0.100	0.0120	100	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-14-023-41**	**N/A**	**A□□eo□□**	**□P/MS 04**	**08/22/11**	**08/23/11 17:33**	**110823□02**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□flag.

Parameter	Result	RL	MDL	DF	□ual	Parameter	Result	RL	MDL	DF	□ual
Arsenic	ND	0.100	0.0589	100		Lead	ND	0.100	0.0170	100	
Barium	ND	0.100	0.0105	100		Selenium	ND	0.100	0.0554	100	
Cadmium	ND	0.100	0.0266	100		Silver	ND	0.100	0.0120	100	
Chromium	ND	0.100	0.0618	100							

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	□C Batch ID
Method Blank	**099-04-005-203**	**N/A**	**A□□eo□□**	**Merc□ry**	**08/22/11**	**08/23/11 16:01**	**110823□04**

Comment(s): -Results were evaluated to the MDL, concentrations □□ to the MDL but □ RL, if found, are qualified with a □□flag.
-Preparation/analysis for Mercury was performed by EPA 7470A.

Parameter	Result	RL	MDL	DF	□ual
Mercury	ND	0.00500	0.000825	1	

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RL - Reporting Limit , DF - Dilution Factor , □ual - □ualifiers

□□ality □ontrol - Spike/Spike D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 1311
Method: EPA 6020

Project KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KH-1	**Solid**	**□P/MS 04**	**08/22/11**	**08/23/11**	**110823S02**

Parameter	MS □ REC	MSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
Arsenic	110	118	73-127	7	0-11	
Barium	116	131	74-128	12	0-10	3,4
Cadmium	107	115	84-114	7	0-8	3
Chromium	112	122	73-133	8	0-11	
Lead	110	120	79-121	8	0-10	
Selenium	100	105	59-125	5	0-12	
Silver	119	131	68-128	10	0-14	3

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RPD - Relative Percent Difference , CL - Control Limit

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□□ality □ontrol - D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: N/A
Method: EPA 1010A(M)

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared:	Date Analyzed:	Duplicate Batch Number
11-08-1507-1	**Solid**	**FP 3**	**N/A**	**08/23/11**	**B0823FPD1**

Parameter	Sample Conc	D□P Conc	RPD	RPD CL	□ualifiers
Ignitability	□212	□212	0	0-25	

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RPD - Relative Percent Difference , CL - Control Limit

Ca□□□□□□□□
E□□r□□m□□ta□
L a□□rat□r□□□□□□□

□□ality □ontrol - D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: N/A
Method: SM 2540 B

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared:	Date Analyzed:	Duplicate Batch Number
KH-1	**Solid**	**N/A**	**08/23/11**	**08/23/11**	**B0823TSD1**

Parameter	Sample Conc	D□P Conc	RPD	RPD CL	□ualifiers
Solids, Total	73.8	73.3	1	0-10	

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RPD - Relative Percent Difference , CL - Control Limit

7440 Lincoln □ ay, Garden Grove, CA 92841-1427 . TEL:(714) 895-5494 . FAX: (714) 894-7501

□□ality □ontrol - Spike/Spike D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3550B
Method: EPA 8015B (M)

Project KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KH-1	**Solid**	**□□ 46**	**08/23/11**	**08/23/11**	**110823S04**

Parameter	MS □ REC	MSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
TPH as Motor Oil	102	102	64-130	0	0-15	

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RPD - Relative Percent Difference , CL - Control Limit

□□ality □ontrol - Spike/Spike D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3550B
Method: EPA 8015B (M)

Project KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KH-1	**Solid**	**□□ 46**	**08/23/11**	**08/23/11**	**110823S03**

Parameter	MS □ REC	MSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
TPH as Diesel	86	88	64-130	3	0-15	

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RPD - Relative Percent Difference , CL - Control Limit

□□ality □ontrol - Spike/Spike D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8015B (M)

Project KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KH-1	**Solid**	**□□ 42**	**08/23/11**	**08/23/11**	**110823S01**

Parameter	MS □ REC	MSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
TPH as Gasoline	87	83	48-114	4	0-23	

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RPD - Relative Percent Difference , CL - Control Limit

□□ality □ontrol - Spike/Spike D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8015B (M)

Project KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KH-3	**Solid**	**□□ 42**	**08/24/11**	**08/24/11**	**110824S01**

Parameter	MS □ REC	MSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
TPH as Gasoline	65	62	48-114	5	0-23	

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RPD - Relative Percent Difference , CL - Control Limit

□□ality □ontrol - Spike/Spike D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 1311
Method: EPA 7470A

Project KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KH-1	**Solid**	**Merc□ry**	**08/22/11**	**08/23/11**	**110823S04**

Parameter	MS □ REC	MSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
Mercury	102	103	71-134	1	0-14	

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RPD - Relative Percent Difference , CL - Control Limit

□□ality □ontrol - Spike/Spike D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
□ ork Order No: 11-08-1379
Preparation: EPA 3545
Method: EPA 8082

Project KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KH-1	**Solid**	**□□ 58**	**08/24/11**	**08/25/11**	**110824S11**

Parameter	MS □ REC	MSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
Aroclor-1016	136	92	50-135	39	0-25	3,4
Aroclor-1260	126	116	50-135	8	0-25	

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RPD - Relative Percent Difference , CL - Control Limit

Quality Control - Spike/Spike Duplicate

Marine Research Consultants, Inc.
1039 Kaakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
Work Order No: 11-08-1379
Preparation: EPA 3545
Method: EPA 8270C SIM PAHs

Project KAHE AIHAE HARBOR

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KH-1	Solid	HP5973/MS AAA	08/24/11	08/25/11	110824S07

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Naphthalene	94	102	13-169	7	0-41	
2-Methylnaphthalene	128	114	23-155	11	0-41	
1-Methylnaphthalene	116	115	30-144	1	0-36	
Acenaphthylene	79	100	34-136	20	0-28	
Acenaphthene	96	116	45-123	19	0-22	
Fluorene	98	120	46-130	20	0-25	
Phenanthrene	94	115	44-140	20	0-26	
Anthracene	79	95	19-109	18	0-29	
Fluoranthene	83	100	36-150	19	0-21	
Pyrene	112	140	33-171	22	0-20	4
Benzo (a) Anthracene	96	116	41-125	19	0-20	
Chrysene	101	122	40-136	19	0-20	
Benzo (k) Fluoranthene	115	134	24-144	15	0-20	
Benzo (b) Fluoranthene	103	122	21-147	16	0-20	
Benzo (a) Pyrene	111	129	32-146	15	0-20	
Indeno (1,2,3-c,d) Pyrene	98	113	36-138	14	0-22	
Dibenz (a,h) Anthracene	93	110	16-154	16	0-28	
Benzo (g,h,i) Perylene	84	95	31-127	11	0-26	

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RPD - Relative Percent Difference , CL - Control Limit

Quality Control - Spike/Spike Duplicate

Marine Research Consultants, Inc.
1039 Kaakaua Pl.
Honolulu, HI 96822-1173

Date Received: 08/19/11
Work Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8260B

Project KAHE AIHAE HARBOR

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
KH-4	Solid	HP5973/MS HP5	08/19/11	08/22/11	110822S01

Parameter	MS %REC	MSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Benzene	100	102	61-127	2	0-20	
Ethylbenzene	100	103	57-129	4	0-22	
Toluene	96	99	63-123	3	0-20	

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RPD - Relative Percent Difference , CL - Control Limit

7440 Lincoln Kay, Garden Grove, CA 92841-1427 , TEL:(714) 895-5494 , FAX: (714) 894-7501

Ca□□□□□□□
□□r□□m□□ta□ □□ality □ontrol - Spike/Spike D□plicate
La□□rat□r□□□□□□□

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received:	08/19/11
□ ork Order No:	11-08-1379
Preparation:	EPA 5030C
Method:	EPA 8260B

Project KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
11-08-1443-4	**Solid**	**□□/MS □□**	**08/20/11**	**08/23/11**	**110823S01**

Parameter	MS □REC	MSD □REC	□REC CL	RPD	RPD CL	□ualifiers
Benzene	102	101	61-127	1	0-20	
Ethylbenzene	95	96	57-129	2	0-22	
Toluene	98	98	63-123	1	0-20	

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RPD - Relative Percent Difference , CL - Control Limit

Ca□□□□□□□
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La□□rat□r□□□□□□□

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received:	N/A
□ ork Order No:	11-08-1379
Preparation:	EPA 1311
Method:	EPA 6020

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-14-023-41	**A□□eo□□**	**□□P/MS 04**	**08/22/11**	**08/23/11**	**110823□02**

Parameter	LCS □REC	LCSD □REC	□REC CL	RPD	RPD CL	□ualifiers
Arsenic	104	106	80-120	3	0-20	
Barium	103	106	80-120	2	0-20	
Cadmium	107	109	80-120	2	0-20	
Chromium	102	105	80-120	3	0-20	
Lead	102	104	80-120	2	0-20	
Selenium	106	108	80-120	2	0-20	
Silver	99	102	80-120	2	0-20	

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RPD - Relative Percent Difference , CL - Control Limit

Ca□□□□□□□□
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a□□rat□r□□□□□□□□

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: N/A
□ ork Order No: 11-08-1379
Preparation: EPA 3550B
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-12-254-2,122	**Solid**	**□□ 46**	**08/23/11**	**08/23/11**	**110823B04**

Parameter	LCS □ REC	LCSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
TPH as Motor Oil	100	102	75-123	2	0-12	

Return to Contents

RPD - Relative Percent Difference , CL - Control Limit

Ca□□□□□□□□
□□r□□m□□ta□ □□ality □ontrol - □□S/□□S D□plicate
a□□rat□r□□□□□□□□

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: N/A
□ ork Order No: 11-08-1379
Preparation: EPA 3550B
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-12-275-4,101	**Solid**	**□□ 46**	**08/23/11**	**08/23/11**	**110823B03**

Parameter	LCS □ REC	LCSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
TPH as Diesel	96	92	75-123	4	0-12	

Return to Contents

RPD - Relative Percent Difference , CL - Control Limit

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a□□rat□r□□□□□□□□

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: N/A
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-12-279-4,624	**Solid**	**□□ 42**	**08/23/11**	**08/23/11**	**110823B01**

Parameter	LCS □ REC	LCSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
TPH as Gasoline	109	108	70-124	1	0-18	

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RPD - Relative Percent Difference , CL - Control Limit

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Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: N/A
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8015B (M)

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-12-279-4,630	**Solid**	**□□ 42**	**08/24/11**	**08/24/11**	**110824B01**

Parameter	LCS □ REC	LCSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
TPH as Gasoline	107	101	70-124	5	0-18	

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RPD - Relative Percent Difference , CL - Control Limit

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Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: N/A
□ ork Order No: 11-08-1379
Preparation: EPA 1311
Method: EPA 7470A

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-04-005-203	**A□□eo□□**	**Merc□ry**	**08/22/11**	**08/23/11**	**110823□04**

Parameter	LCS □REC	LCSD □REC	□REC CL	RPD	RPD CL	□ualifiers
Mercury	98	98	90-122	0	0-14	

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RPD - Relative Percent Difference , CL - Control Limit

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Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: N/A
□ ork Order No: 11-08-1379
Preparation: EPA 3545
Method: EPA 8082

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-12-565-202	**Solid**	**□□ 58**	**08/24/11**	**08/25/11**	**110824□11**

Parameter	LCS □REC	LCSD □REC	□REC CL	RPD	RPD CL	□ualifiers
Aroclor-1016	123	112	50-135	9	0-25	
Aroclor-1260	116	112	50-135	3	0-25	

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RPD - Relative Percent Difference , CL - Control Limit

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a□□rat□r□□□□□□□

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: N/A
□ ork Order No: 11-08-1379
Preparation: EPA 3545
Method: EPA 8270C SIM PAHs

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-14-035-62	**Solid**	**□□/MS AAA**	**08/24/11**	**08/24/11**	**110824□07**

Parameter	LCS □REC	LCSD □REC	□REC CL	ME□CL	RPD	RPD CL	□ualifiers
Naphthalene	93	93	76-120	69-127	0	0-20	
2-Methylnaphthalene	84	84	75-123	67-131	0	0-20	
1-Methylnaphthalene	96	96	70-124	61-133	0	0-20	
Acenaphthylene	86	86	51-120	40-132	0	0-20	
Acenaphthene	93	94	74-120	66-128	1	0-20	
Fluorene	95	95	76-120	69-127	0	0-20	
Phenanthrene	91	92	70-120	62-128	1	0-20	
Anthracene	80	80	33-120	18-134	0	0-20	
Fluoranthene	86	87	59-125	48-136	2	0-20	
Pyrene	98	95	60-120	50-130	3	0-20	
Benzo (a) Anthracene	89	89	65-120	56-129	0	0-20	
Chrysene	100	100	62-122	52-132	0	0-20	
Benzo (k) Fluoranthene	113	110	74-122	66-130	2	0-20	
Benzo (b) Fluoranthene	90	91	74-122	66-130	1	0-20	
Benzo (a) Pyrene	91	91	68-120	59-129	0	0-20	
Indeno (1,2,3-c,d) Pyrene	90	88	72-126	63-135	2	0-20	
Dibenz (a,h) Anthracene	87	86	79-120	72-127	2	0-20	
Benzo (g,h,i) Perylene	84	82	66-120	57-129	2	0-20	

Total number of LCS compounds : 18
Total number of ME compounds : 0
Total number of ME compounds allowed : 1
LCS ME CL validation result : Pass

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RPD - Relative Percent Difference , CL - Control Limit

Ca□□□□□□□
CEL □□r□□m□□ta□ □□ality □ontrol - □□S/□□S D□plicate
a□□rat□r□□□□□□□

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: N/A
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8260B

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-12-796-5,071	**Solid**	**□□/MS □□**	**08/22/11**	**08/22/11**	**110822□01**

Parameter	LCS □REC	LCSD □REC	□REC CL	RPD	RPD CL	□ualifiers
Benzene	96	95	78-120	2	0-20	
Ethylbenzene	99	97	76-120	2	0-20	
Toluene	96	94	77-120	2	0-20	

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RPD - Relative Percent Difference , CL - Control Limit

Ca□□□□□□□□
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□□ality □ontrol - □□S/□□S D□plicate

Marine Research Consultants, Inc.
1039 □ aakaua Pl.
Honolulu, HI 96822-1173

Date Received: N/A
□ ork Order No: 11-08-1379
Preparation: EPA 5030C
Method: EPA 8260B

Project: KA□ AIHAE HARBOR

□uality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-12-796-5,073	**Solid**	**□□/MS □□**	**08/23/11**	**08/23/11**	**110823□01**

Parameter	LCS □ REC	LCSD □ REC	□ REC CL	RPD	RPD CL	□ualifiers
Benzene	106	104	78-120	2	0-20	
Ethylbenzene	99	100	76-120	1	0-20	
Toluene	101	101	77-120	0	0-20	

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RPD - Relative Percent Difference , CL - Control Limit

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□lo□□ary o□Ter□ □and □□ali□ier□

□ ork Order Number: 11-08-1379

□ualifier	Definition
□	See applicable analysis comment.
□	Less than the indicated value.
□	Greater than the indicated value.
1	Surrogate compound recovery was out of control due to a required sample dilution, therefore, the sample data was reported without further clarification.
2	Surrogate compound recovery was out of control due to matrix interference. The associated method blank surrogate spike compound was in control and, therefore, the sample data was reported without further clarification.
3	Recovery of the Matrix Spike (MS) or Matrix Spike Duplicate (MSD) compound was out of control due to matrix interference. The associated LCS and/or LCSD was in control and, therefore, the sample data was reported without further clarification.
4	The MS/MSD RPD was out of control due to matrix interference. The LCS/LCSD RPD was in control and, therefore, the sample data was reported without further clarification.
5	The PDS/PDSD or PES/PESD associated with this batch of samples was out of control due to a matrix interference effect. The associated batch LCS/LCSD was in control and, hence, the associated sample data was reported without further clarification.
6	Surrogate recovery below the acceptance limit.
7	Surrogate recovery above the acceptance limit.
B	Analyte was present in the associated method blank.
B□	Sample analyzed after holding time expired.
E	Concentration exceeds the calibration range.
ET	Sample was extracted past end of recommended max. holding time.
HD	The chromatographic pattern was inconsistent with the profile of the reference fuel standard.
HDH	The sample chromatographic pattern for TPH matches the chromatographic pattern of the specified standard but heavier hydrocarbons were also present (or detected).
HDL	The sample chromatographic pattern for TPH matches the chromatographic pattern of the specified standard but lighter hydrocarbons were also present (or detected).
□	Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
ME	LCS/LCSD Recovery Percentage is within Marginal Exceedance (ME) Control Limit range.
ND	Parameter not detected at the indicated reporting limit.
□	Spike recovery and RPD control limits do not apply resulting from the parameter concentration in the sample exceeding the spike concentration by a factor of four or greater.
SG	The sample extract was subjected to Silica Gel treatment prior to analysis.
X	□ Recovery and/or RPD out-of-range.
□	Analyte presence was not confirmed by second column or GC/MS analysis.

Solid - □nless otherwise indicated, solid sample data is reported on a wet weight basis, not corrected for □ moisture. All □C results are reported on a wet weight basis.

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Calscience Environmental Laboratories, Inc.

Analytical Services Quotation

Quote No. 953451 **Prepared** 08/17/2011 **By** Robert Stearns

Client Information		Project Information	
Name:	Steve Dollar	Project ID:	Sediment Samples
Client:	Marine Research Consultants, Inc.	Location:	Honolulu, HI
Address:	1039 Waakaua Pl. Honolulu, HI 96822-1173	Expected Start Date:	7/14/2011
		Quote Valid Until:	10/14/2011
Phone:	808-779-4009	**Analytical Fees Include :**	
Fax:		☐ Courier Services	
E-mail:		☑ Sample Disposal	
		☑ EDD Standard	

5 Business Day Turnaround Time (TAT), except as noted.

Matrix	Test	Quantity	TAT	Unit Costs	Subtotal 1	Rush Surcharge	Subtotal 2
Sediment	EPA 1010A(M) Ignitability (flashpoint)	4	5	$30.00	$120.00	$0.00	$120.00
Water	EPA 6020/7470 TCLP Metals (Ba,Cd,Cr,Pb,Ag,As,Hg,Se)	4	5	$80.00	$320.00	$0.00	$320.00
Sediment	EPA 8015B (M) TPH Diesel	4	5	$40.00	$160.00	$0.00	$160.00
Sediment	EPA 8015B (M) TPH Gasoline	4	5	$35.00	$140.00	$0.00	$140.00
Sediment	EPA 8015B (M) TPH Motor Oil	4	5	$40.00	$160.00	$0.00	$160.00
Sediment	EPA 8082 PCB Aroclors	4	5	$90.00	$360.00	$0.00	$360.00
Sediment	EPA 8260B BTEX	4	5	$75.00	$300.00	$0.00	$300.00
Sediment	EPA 8270C SIM PAHs	4	5	$165.00	$660.00	$0.00	$660.00
Sediment	SM 2540 B Total Solids	4	3	$15.00	$60.00	$0.00	$60.00
Sediment	TCLP Extraction for Metals	4	5	$40.00	$160.00	$0.00	$160.00

Total for Testcodes : **$2,440.00**

Quote total: **$2,440.00**

Deliverables: Level II ☑ (Standard) Level III ☐ (Surcharge applies) Level IV ☐ (Check availability)

Comments: Standard Level II deliverables apply. Price does not include return shipping to laboratory.

7440 Lincoln Way, Garden Grove, CA 92841-1427 • TEL:(714) 895-5494 • FAX: (714) 894-7501

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CHAIN OF CUSTODY RECORD

Calscience Environmental Laboratories, Inc.

7440 Lincoln Way, Garden Grove, CA 92841-1427 (714) 895-5494

NorCal Service Center, 5063 Commercial Circle, Suite H, Concord, CA 94520-8577 (925) 689-9022

WO# / LAB USE ONLY **11-08-1379**

Date 8/17/11 Page 1 of 1

LABORATORY CLIENT: S. DOLLAR - MRC

ADDRESS: 1039 WAAKAUA PL CITY HONOLULU STATE HI ZIP 96822

TEL: 808 779 4009 E-MAIL: SDollar@mrc-hawaii.com

CLIENT PROJECT NAME / NUMBER: KAWAINUI HARBOR

PROJECT CONTACT: S. DOLLAR

SAMPLER(S): (PRINT) S. DOLLAR

P.O. NO.:

TURNAROUND TIME: ☐ SAME DAY ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ STANDARD

☐ COELT EDF GLOBAL ID LOG CODE

SPECIAL INSTRUCTIONS:

REQUESTED ANALYSES

LAB USE ONLY	SAMPLE ID	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	Unpreserved	Preserved	Field Filtered	TPH (g) or GRO	TPH (d) or DRO or (C6-C36) or (C6-C44)	TPH ( )	BTEX / MTBE (8260) or ( )	VOCs (8260)	Oxygenates (8260)	En Core / Terra Core Prep (5035)	SVOCs (8270)	Pesticides (8081)	PCBs (8082)	PNAs (8310) or (8270)	T22 Metals (6010/747X)	Cr(VI) [7196 or 7199 or 218.6]	Air - VOCs (TO-14A) or (TO-15)	Air - TPH (g) [TO-3]
1	KH-1	8/17/11	1034	S	2	X																	
2	KH-2		1041		1																		
3	KH-3		0953		1																		
4	KH-4		1029		1																		

SEE ATTACHED LIST SENT TO BOB GREENS

Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date: 8/17/11	Time: 09:30

DISTRIBUTION: White with final report, Green and Yellow to Client.
Please note that pages 1 and 2 of 2 of our T/Cs are printed on the reverse side of the Green and Yellow copies respectively.

06/01/10 Revision

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Calscience Environmental Laboratories, Inc.

Analytical Services Quotation

ACCREDITED IN ACCORDANCE WITH nelac

Quote No. 953451 Prepared 08/17/2011 By Robert Stearns

Your Project Manager will be : Don Burley , dburley@calscience.com . Please Contact him/her to order sampling supplies (e.g. bottles, coolers) . Unless otherwise stated, all analytical work conducted by Calscience is subject to its standard terms and conditions, a copy of which is available upon request.

Unused sample containers cannot be returned to Calscience for reuse due to possible contamination issues. Calscience can only dispose of unused containers. If a client insists on returning unused containers for disposal, a $100 minimum disposal fee applies.

Disposal of solid and aqueous samples will occur 60 days following sample receipt unless other arrangements are made. Air samples will be retained only until analysis is completed.

7440 Lincoln Way, Garden Grove, CA 92841-1427 • TEL:(714) 895-5494 • FAX: (714) 894-7501

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FedEx Express NEW Package US Airbill

FedEx Tracking Number 8768 4863 3766

Form ID No. 0200

Recipient's Copy

1 From

Date 8/18/11 [redacted]

Sender's Name Steve Dollar Phone 808 7794009

Company MARINE RESEARCH

Address 1039 WAAKAUA PL Dept./Floor/Suite/Room

City HONOLULU State HI ZIP 96822

2 Your Internal Billing Reference

3 To

Recipient's Name CAL SCIENCE Phone 714 895 5494

Company ENVIRONMENTAL

Address 7440 LINCOLN WAY Dept./Floor/Suite/Room

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address

Use this line for the HOLD location address or for continuation of your shipping address.

City GARDEN GROVE State CA ZIP 92841-1427

HOLD Weekday FedEx location address REQUIRED. NOT available for FedEx First Overnight.

HOLD Saturday FedEx location address REQUIRED. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

8768 4863 3766

4 Express Package Service * To most locations.

NOTE: Service order has changed. Please select carefully.

Packages up to 150 lbs. For packages over 150 lbs., use the new FedEx Express Freight US Airbill.

Next Business Day

- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations. Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Priority Overnight — Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [x] FedEx Standard Overnight — Next business afternoon.* Saturday Delivery NOT available.

2 or 3 Business Days

- [ ] NEW FedEx 2Day A.M. — Second business morning.* Saturday Delivery NOT available.
- [ ] FedEx 2Day — Second business afternoon.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Express Saver — Third business day.* Saturday Delivery NOT available.

5 Packaging * Declared value limit $500.

- [ ] FedEx Envelope*
- [ ] FedEx Pak*
- [ ] FedEx Box
- [ ] FedEx Tube
- [x] Other

6 Special Handling and Delivery Signature Options

- [ ] SATURDAY Delivery — NOT available for FedEx Standard Overnight, FedEx 2Day A.M., or FedEx Express Saver.
- [ ] No Signature Required — Package may be left without obtaining a signature for delivery.
- [ ] Direct Signature — Someone at recipient's address may sign for delivery. Fee applies.
- [ ] Indirect Signature — If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only. Fee applies.

Does this shipment contain dangerous goods? One box must be checked.

- [x] No
- [ ] Yes — As per attached Shipper's Declaration.
- [ ] Yes — Shipper's Declaration not required.
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg
- [ ] Cargo Aircraft Only

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

7 Payment *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below.

- [x] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

Obtain recip. Acct. No. [ ]

[redacted]

Total Packages 1 Total Weight 24 lbs. Total Declared Value† $ ____ .00 Credit Card Auth. ____

†Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

612

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(1379)

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Calscience Environmental Laboratories, Inc.

WORK ORDER #: 11-08-[1][3][7][9]

SAMPLE RECEIPT FORM

Cooler 1 of 1

CLIENT: MRCI DATE: 08/19/11

TEMPERATURE: Thermometer ID: SC1 (Criteria: 0.0 °C – 6.0 °C, not frozen)

Temperature 4.9 °C + 0.5 °C (CF) = 5.4 °C ☐ Blank ☑ Sample

☐ Sample(s) outside temperature criteria (PM/APM contacted by: _____).

☐ Sample(s) outside temperature criteria but received on ice/chilled on same day of sampling.

☐ **Received at ambient temperature, placed on ice for transport by Courier.**

Ambient Temperature: ☐ Air ☐ Filter Initial: RS

CUSTODY SEALS INTACT:

☐ Cooler ☐_____ ☐ No (Not Intact) ☑ Not Present ☐ N/A Initial: RS

☐ Sample ☐_____ ☐ No (Not Intact) ☑ Not Present Initial: D.C

SAMPLE CONDITION:	Yes	No	N/A
Chain-Of-Custody (COC) document(s) received with samples	☑	☐	☐
COC document(s) received complete	☐	☑	☐
☑ Collection date/time, matrix, and/or # of containers logged in based on sample labels.			
☐ No analysis requested. ☐ Not relinquished. ☐ No date/time relinquished.			
Sampler's name indicated on COC	☑	☐	☐
Sample container label(s) consistent with COC	☑	☐	☐
Sample container(s) intact and good condition	☑	☐	☐
Proper containers and sufficient volume for analyses requested	☑	☐	☐
Analyses received within holding time	☑	☐	☐
pH / Res. Chlorine / Diss. Sulfide / Diss. Oxygen received within 24 hours	☐	☐	☑
Proper preservation noted on COC or sample container	☐	☐	☑
☐ Unpreserved vials received for Volatiles analysis			
Volatile analysis container(s) free of headspace	☐	☐	☑
Tedlar bag(s) free of condensation	☐	☐	☑

CONTAINER TYPE:

Solid: ☐4ozCGJ ☐8ozCGJ ☑16ozCGJ ☐Sleeve (_____) ☐EnCores® ☐TerraCores® ☑ 2ozCGJ

Water: ☐VOA ☐VOA**h** ☐VOA**na$_2$** ☐125AGB ☐125AGB**h** ☐125AGB**p** ☐1AGB ☐1AGB**na$_2$** ☐1AGB**s**

☐500AGB ☐500AGJ ☐500AGJ**s** ☐250AGB ☐250CGB ☐250CGB**s** ☐1PB ☐500PB ☐500PB**na**

☐250PB ☐250PB**n** ☐125PB ☐125PB**znna** ☐100PJ ☐100PJ**na$_2$** ☐_____ ☐_____ ☐_____

Air: ☐Tedlar® ☐Summa® **Other:** ☐_____ **Trip Blank Lot#:**_____ **Labeled/Checked by:** D.C

Container: **C:** Clear **A:** Amber **P:** Plastic **G:** Glass **J:** Jar **B:** Bottle **Z:** Ziploc/Resealable Bag **E:** Envelope **Reviewed by:** RS

Preservative: **h:** HCL **n:** HNO_3 **na$_2$:** $Na_2S_2O_3$ **na:** NaOH **p:** H_3PO_4 **s:** H_2SO_4 **znna:** $ZnAc_2$+NaOH **f:** Field-filtered **Scanned by:** _____

SOP T100_090 (03/24/11)

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APPENDIX B

CORAL REEF CALIBRATION-VALIDATION DATA TABLE

AND

PHOTO-QUADRATS

APPENDIX B. Benthic cover (%) of calibration-validation photo-quadrats, Kawaihae Harbor.

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
004	0063	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	80	0	0	100
	0064	0	0	0	0	0	0	0	0	0	0	0	10	0	20	0	0	0	70	0	0	100
	0065	0	0	0	0	0	0	0	0	0	0	0	10	0	20	0	0	0	70	0	0	100
	0066	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	80	0	0	100
	0067	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	85	0	0	100
	MEAN	0	0	0	0	0	0	0	0	0	0	0	4	0	19	0	0	0	77	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
005	0069	0	25	20	0	0	25	0	0	0	70	0	0	0	0	0	0	0	0	25	5	100
	0070	0	5	5	0	0	45	0	0	0	55	0	0	0	0	0	0	0	0	45	0	100
	0071	0	10	35	0	0	35	5	0	0	85	0	0	0	0	0	0	0	0	15	0	100
	0072	0	0	0	0	0	75	2	0	0	77	0	5	0	0	0	0	13	5	0	0	100
	0073	0	5	12	0	0	63	5	0	0	85	0	0	0	0	0	0	15	0	0	0	100
	MEAN	0	9	14.4	0	0	48.6	2.4	0	0	74.4	0	1	0	0	0	0	5.6	1	17	1	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
006	0077	0	3	48	0	0	20	12	0	2	85	0	5	0	0	0	0	10	0	0	0	100
	0078	0	0	65	0	0	25	5	0	0	95	0	5	0	0	0	0	0	0	0	0	100
	0079	0	0	75	0	0	10	0	0	0	85	0	10	0	0	0	0	5	0	0	0	100
	0080	0	0	70	0	0	20	5	0	0	95	0	0	0	0	0	0	5	0	0	0	100
	0081	0	0	60	0	0	10	10	0	0	80	0	0	0	0	0	0	20	0	0	0	100
	MEAN	0	0.6	63.6	0	0	17	6.4	0	0.4	88	0	4	0	0	0	0	8	0	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
007	0089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	95	0	0	0	0	100
	0090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	100
	0091	0	0	0	0	5	0	0	0	0	5	0	0	0	0	0	95	0	0	0	0	100
	0092	0	0	0	0	0	2	0	0	0	2	0	0	0	0	10	85	0	0	0	3	100
	0093	0	0	0	0	0	3	0	0	0	3	0	0	0	0	10	87	0	0	0	0	100
	MEAN	0	0	0	0	1	1	0	0	0	2	0	0	0	0	5	92.4	0	0	0	0.6	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
008	0103	0	0	45	0	0	25	0	0	0	70	0	0	0	0	10	0	15	5	0	0	100
	0104	0	0	69	0	0	5	0	0	0	74	0	0	1	0	15	0	10	0	0	0	100
	0105	0	0	65	0	5	10	0	0	0	80	0	10	0	0	0	0	10	0	0	0	100
	0106	0	0	68	0	2	10	0	0	0	80	10	10	0	0	0	0	0	0	0	0	100
	0107	0	0	71	0	0	5	6	0	3	85	5	10	0	0	0	0	0	0	0	0	100
	MEAN	0	0	63.6	0	1.4	11	1.2	0	0.6	77.8	3	6	0.2	0	5	0	7	1	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
009	0118	0	0	0	0	0	17	0	0	0	17	0	0	0	0	0	0	83	0	0	0	100
	0119	0	0	1	0	0	0	0	25	0	26	0	0	0	0	0	0	74	0	0	0	100
	0120	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	98	0	0	0	100
	0121	0	0	0	0	0	0	0	12	0	12	5	0	0	0	0	0	83	0	0	0	100
	0122	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	95	0	0	0	100
	MEAN	0	0	0.2	0	0	3.8	0	7.4	0	11.4	2	0	0	0	0	0	86.6	0	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
010	0134	0	0	0	0	0	0	0	0	0	0	0	20	0	0	15	0	65	0	0	0	100
	0135	0	0	0	0	0	0	0	0	0	0	0	10	0	0	30	0	60	0	0	0	100
	0136	0	0	0	0	0	0	0	0	0	0	0	20	0	0	65	0	15	0	0	0	100
	0137	0	0	0	0	0	0	0	0	0	0	5	10	0	0	40	0	45	0	0	0	100
	0138	0	0	0	0	0	0	0	0	0	0	0	15	0	0	40	0	45	0	0	0	100
	MEAN	0	0	0	0	0	0	0	0	0	0	1	15	0	0	38	0	46	0	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
011	0148	0	0	5	0	0	5	0	0	0	10	5	10	0	0	10	0	65	0	0	0	100
	0149	0	0	2	0	0	20	0	0	0	22	0	10	0	0	10	0	58	0	0	0	100
	0150	0	0	7	0	0	0	0	0	0	7	5	10	0	0	38	0	40	0	0	0	100
	0151	0	0	10	0	0	12	0	0	0	22	0	5	0	0	25	0	48	0	0	0	100
	0152	0	0	10	0	0	12	0	0	0	22	0	10	0	0	35	0	33	0	0	0	100
	MEAN	0	0	6.8	0	0	9.8	0	0	0	16.6	2	9	0	0	23.6	0	48.8	0	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
012	0162	0	0	5	0	0	60	0	0	0	65	5	20	0	0	10	0	0	0	0	0	100
	0163	0	0	0	0	35	10	0	0	0	45	0	10	0	0	43	0	0	0	0	2	100
	0164	0	0	0	0	35	0	0	0	0	35	0	10	0	0	53	0	0	0	0	2	100
	0165	0	0	0	0	0	35	0	0	0	35	0	15	0	0	50	0	0	0	0	0	100
	0166	0	0	5	0	20	30	0	0	0	55	0	10	0	0	35	0	0	0	0	0	100
	MEAN	0	0	2	0	18	27	0	0	0	47	1	13	0	0	38.2	0	0	0	0	0.8	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
013	0183	0	0	0	0	0	50	0	0	0	50	5	25	0	0	10	10	0	0	0	0	100
	0184	0	0	0	0	0	15	0	0	0	15	0	30	0	0	45	0	10	0	0	0	100
	0185	0	0	0	0	0	10	6	0	0	16	0	20	0	0	39	0	25	0	0	0	100
	0186	0	0	3	0	0	5	6	0	0	14	0	20	0	0	56	0	10	0	0	0	100
	0187	0	0	6	0	0	4	5	0	0	15	0	15	0	0	30	0	40	0	0	0	100
	MEAN	0	0	1.8	0	0	16.8	3.4	0	0	22	1	22	0	0	36	2	17	0	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
014	0200	0	0	10	0	0	45	0	0	0	55	0	0	0	0	20	0	25	0	0	0	100
	0201	0	0	5	0	0	35	0	0	0	40	0	5	0	0	40	0	15	0	0	0	100
	0202	0	0	10	0	0	10	0	0	0	20	10	0	0	0	60	0	10	0	0	0	100
	0203	0	0	2	0	0	20	0	0	0	22	10	0	0	0	63	0	5	0	0	0	100
	0204	0	0	0	0	0	20	0	0	0	20	5	5	0	0	65	0	5	0	0	0	100
	MEAN	0	0	5.4	0	0	26	0	0	0	31.4	5	2	0	0	49.6	0	12	0	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
015	0215	0	2	0	0	0	20	6	0	0	28	0	10	0	0	62	0	0	0	0	0	100
	0216	0	0	0	0	0	15	25	0	0	40	0	0	0	0	60	0	0	0	0	0	100
	0217	0	0	4	0	0	30	0	0	0	34	0	5	0	0	58	0	3	0	0	0	100
	0218	0	0	0	0	0	40	15	0	0	55	0	15	0	0	30	0	0	0	0	0	100
	0219	0	0	0	0	0	25	15	0	0	40	10	5	0	0	45	0	0	0	0	0	100
	MEAN	0	0.4	0.8	0	0	26	12.2	0	0	39.4	2	7	0	0	51	0	0.6	0	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
016	0229	0	0	0	0	0	5	6	0	0	11	0	0	0	10	0	0	0	79	0	0	100
	0230	0	0	5	0	0	40	5	0	0	50	0	0	0	0	0	0	0	50	0	0	100
	0231	0	0	3	0	0	25	10	0	0	38	0	0	0	0	15	0	0	47	0	0	100
	0233	0	0	8	0	0	15	4	0	0	27	5	0	0	0	10	0	0	58	0	0	100
	0234	0	0	1	0	0	2	12	0	1	16	5	0	0	0	64	0	0	15	0	0	100
	MEAN	0	0	3.4	0	0	17.4	7.4	0	0.2	28.4	2	0	0	2	17.8	0	0	49.8	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
01□	0244	0	0	0	0	35	12	0	0	0	47	0	0	0	0	0	0	0	53	0	0	100
	0245	0	0	0	0	3	5	0	0	0	8	0	0	0	0	0	92	0	0	0	0	100
	0246	0	0	0	0	0	50	0	0	0	50	0	0	0	0	0	50	0	0	0	0	100
	0247	0	0	0	0	50	5	0	0	0	55	0	0	0	0	0	45	0	0	0	0	100
	0249	0	0	8	0	0	5	0	0	0	13	0	0	0	0	0	87	0	0	0	0	100
	MEAN	0	0	1.6	0	17.6	15.4	0	0	0	34.6	0	0	0	0	0	54.8	0	10.6	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
01□	0262	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	98	0	0	0	0	100
	0263	1	0	0	0	0	1	12	0	0	14	0	0	0	0	81	0	5	0	0	0	100
	0264	17	0	0	0	0	2	0	0	0	19	0	0	0	0	56	0	25	0	0	0	100
	0265	25	0	0	15	0	0	0	0	0	40	0	0	0	0	50	0	10	0	0	0	100
	0266	25	0	0	0	0	4	0	0	0	29	0	0	0	5	41	0	15	10	0	0	100
	MEAN	14	0	0	3	0	1.8	2.4	0	0	20.8	0	0	0	1	45.6	19.6	11	2	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
01□	0278	0	0	0	0	3	0	12	0	0	15	0	0	0	5	65	15	0	0	0	0	100
	0279	0	0	0	0	0	5	20	0	0	25	0	0	0	10	55	0	0	10	0	0	100
	0280	0	0	0	0	0	5	15	0	0	20	0	0	0	10	50	0	20	0	0	0	100
	0282	0	0	0	0	0	0	8	0	0	8	0	0	0	0	42	0	50	0	0	0	100
	0283	0	0	0	0	0	0	20	0	0	20	0	0	0	0	40	0	40	0	0	0	100
	MEAN	0	0	0	0	0.6	2	15	0	0	17.6	0	0	0	5	50.4	3	22	2	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
020	0295	0	0	0	0	0	20	6	0	0	26	0	0	0	74	0	0	0	0	0	0	100
	0296	0	0	0	0	0	30	25	0	0	55	0	0	0	0	30	0	15	0	0	0	100
	0297	0	0	0	0	0	50	12	0	0	62	0	0	0	0	28	0	10	0	0	0	100
	0298	0	0	0	0	0	20	12	0	0	32	0	0	0	0	58	10	0	0	0	0	100
	0299	0	0	0	0	0	12	10	0	0	22	0	0	0	0	73	0	5	0	0	0	100
	MEAN	0	0	0	0	0	26.4	13	0	0	39.4	0	0	0	14.8	37.8	2	6	0	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
021	0311	0	0	0	0	0	12	35	0	0	47	0	20	0	0	33	0	0	0	0	0	100
	0312	0	0	0	0	5	4	45	0	0	54	0	10	0	0	36	0	0	0	0	0	100
	0313	0	0	0	0	0	12	40	0	0	52	0	15	0	0	33	0	0	0	0	0	100
	0315	0	0	0	0	0	15	25	0	0	40	0	20	0	0	40	0	0	0	0	0	100
	0316	0	0	0	0	3	4	25	0	0	32	0	25	0	0	43	0	0	0	0	0	100
	MEAN	0	0	0	0	1.6	9.4	34	0	0	45	0	18	0	0	37	0	0	0	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
022	0334	1	0	0	4	0	1	12	0	2	20	0	10	0	10	45	0	0	15	0	0	100
	0336	0	0	0	0	0	40	10	0	0	50	0	20	0	0	30	0	0	0	0	0	100
	0337	0	0	0	0	15	15	3	0	0	33	0	25	0	0	42	0	0	0	0	0	100
	0338	0	0	0	0	1	10	4	0	0	15	0	30	0	0	55	0	0	0	0	0	100
	0339	0	0	0	0	0	20	8	0	0	28	0	20	0	0	52	0	0	0	0	0	100
	MEAN	0.2	0	0	0.8	3.2	17.2	7.4	0	0.4	29.2	0	21	0	2	44.8	0	0	3	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
023	0348	0	1	15	0	0	40	2	0	0	58	0	0	0	0	0	0	0	42	0	0	100
	0349	0	0	17	0	3	70	0	0	0	90	5	0	0	0	0	0	0	5	0	0	100
	0350	0	0	25	0	0	40	0	0	0	65	0	5	0	0	0	0	0	30	0	0	100
	0351	0	0	25	0	0	40	1	0	0	66	0	0	0	5	0	0	0	29	0	0	100
	0352	0	0	35	0	0	25	0	0	0	60	0	0	0	0	5	0	0	35	0	0	100
	MEAN	0	0.2	23.4	0	0.6	43	0.6	0	0	67.8	1	1	0	1	1	0	0	28.2	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
024	0358	0	0	25	0	0	30	0	0	0	55	10	10	0	0	5	0	0	20	0	0	100
	0361	0	0	15	0	0	35	0	0	0	50	0	10	0	0	5	0	0	35	0	0	100
	0362	0	0	50	0	0	0	0	0	0	50	0	0	0	0	0	10	0	40	0	0	100
	0363	0	0	48	0	2	35	0	0	0	85	0	0	0	0	0	0	0	15	0	0	100
	0364	0	0	94	0	1	0	0	0	0	95	0	5	0	0	0	0	0	0	0	0	100
	MEAN	0	0	46.4	0	0.6	20	0	0	0	67	2	5	0	0	4	0	0	22	0	0	100

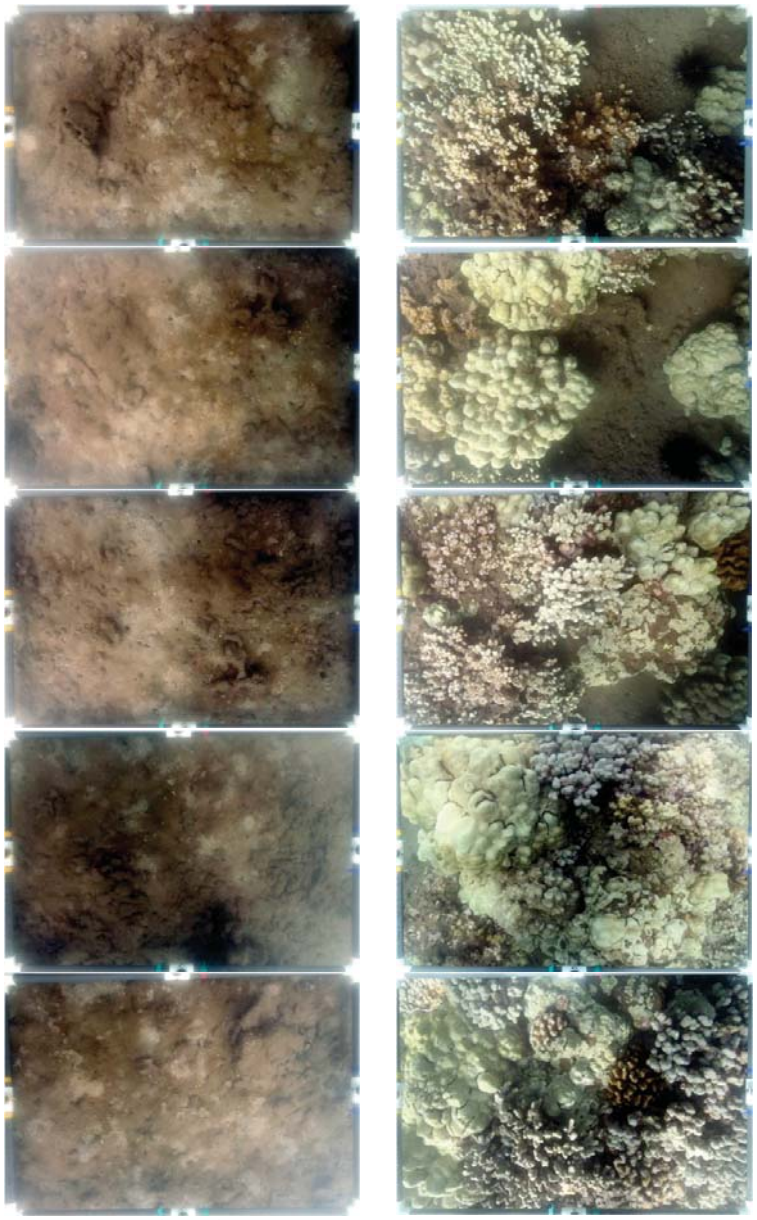
SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
025	0379	0	0	65	0	0	5	0	15	0	85	0	10	0	0	5	0	0	0	0	0	100
	0380	0	0	60	0	0	25	0	5	0	90	0	0	0	0	0	0	0	10	0	0	100
	0381	0	0	51	0	4	12	0	0	0	67	0	0	0	3	10	0	0	20	0	0	100
	0382	0	1	44	0	0	4	0	0	1	50	0	0	0	0	35	0	0	15	0	0	100
	0383	0	0	35	0	0	0	0	0	0	35	0	10	0	0	55	0	0	0	0	0	100
	MEAN	0	0.2	51	0	0.8	9.2	0	4	0.2	65.4	0	4	0	0.6	21	0	0	9	0	0	100

SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
026	0393	0	1	2	0	0	45	0	0	0	48	0	5	0	0	10	0	0	37	0	0	100
	0394	0	0	80	0	0	0	0	0	0	80	0	20	0	0	0	0	0	0	0	0	100
	0395	0	0	45	0	0	0	0	0	0	45	0	0	0	0	0	0	0	55	0	0	100
	0396	0	0	61	0	4	0	0	0	0	65	0	15	0	5	5	0	0	10	0	0	100
	0397	0	0	65	0	0	0	0	0	0	65	0	15	0	0	0	0	0	20	0	0	100
	MEAN	0	0.2	50.6	0	0.8	9	0	0	0	60.6	0	11	0	1	3	0	0	24.4	0	0	100

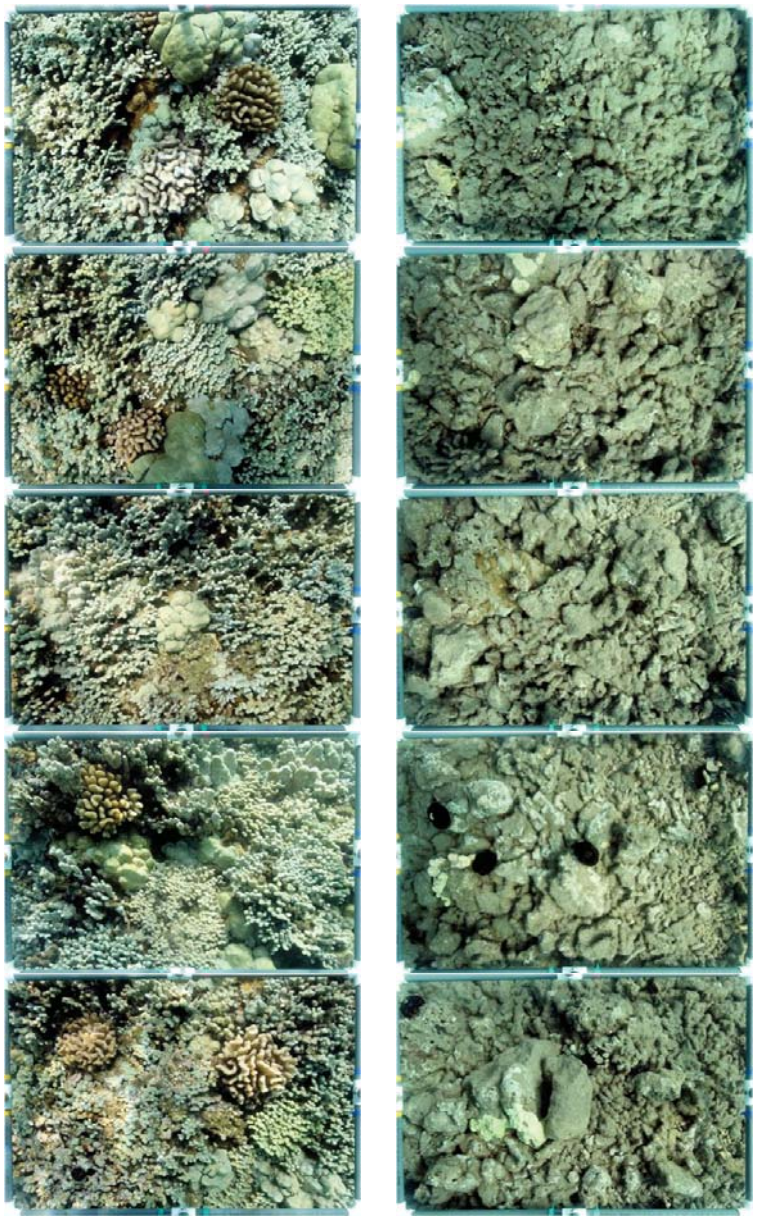
SITE	PHOTO	Lp	Mc	Pc	Pd	Pe	Pl	Pm	Pr	Pv	TC	A	TUR	SP	SA	LS	RU	CCA	TBS	MUD	INV	TOTAL
02□	0410	0	0	0	0	0	30	5	0	0	35	0	0	0	0	25	0	0	39	0	1	100
	0411	0	0	0	0	0	45	8	0	0	53	0	5	0	0	20	0	0	20	0	2	100
	0412	0	0	2	0	0	60	5	0	0	67	0	0	0	0	5	0	0	28	0	0	100
	0413	0	0	0	0	0	45	6	0	0	51	0	0	0	0	10	0	0	38	0	1	100
	0414	0	4	0	0	4	60	3	0	0	71	0	0	0	0	5	0	0	24	0	0	100
	MEAN	0	0.8	0.4	0	0.8	48	5.4	0	0	55.4	0	1	0	0	13	0	0	29.8	0	0.8	100

Lp = "Leptastrea purpurea"
Mc = "Montipora capitata"
Pc = "Porites compressa"
Pd = "Porites duerdeni"
Pe = "Porites lutea"
Pl = "Porites lobata"
Pm = Pocillopora meandrina
Pr = "Porites rus"
Pv = "Pavona varians"
TC = "Total Coral Cover"

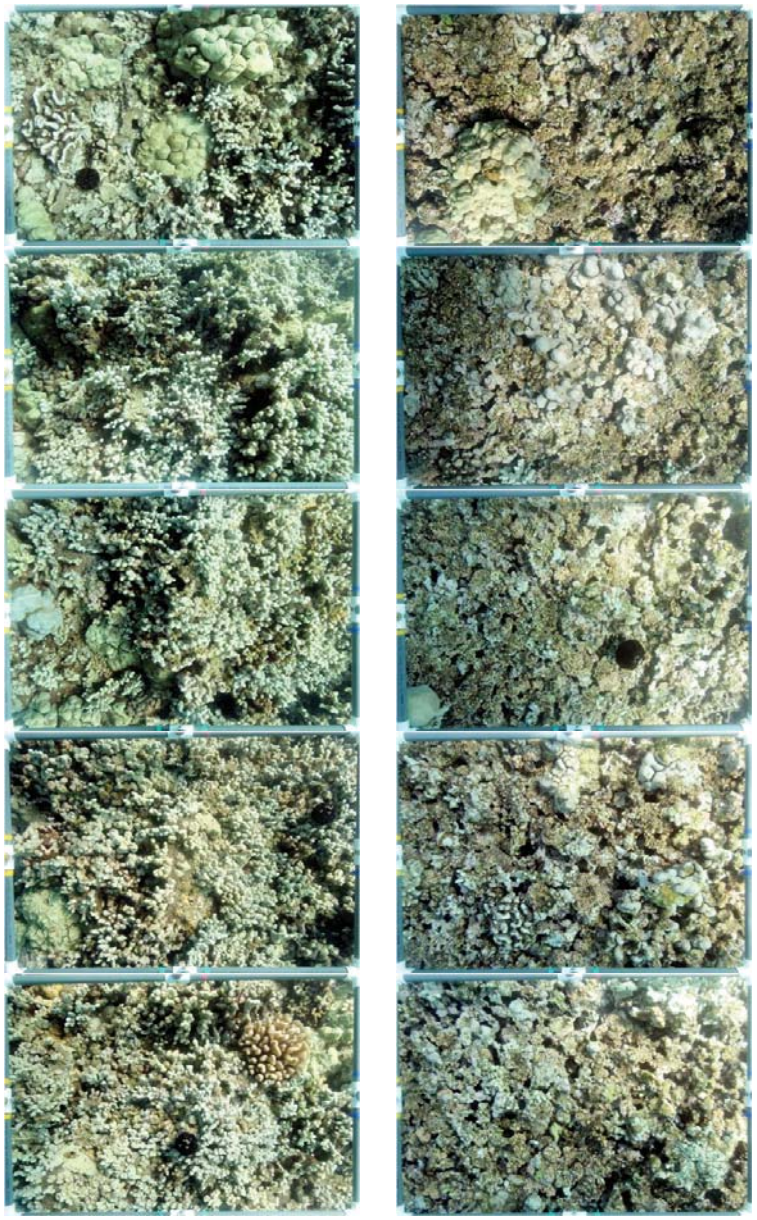
A = "Algae"
TUR = "Turf"
SP = "Sponge"
SA = "Sand"
LS = "Limestone"
RU = "Rubble"
CCA = "Crustose Corraline Algae"
TBS = "Turf-Bound-Sediment"
MUD = "Mud"
INV = "Invertebrate"



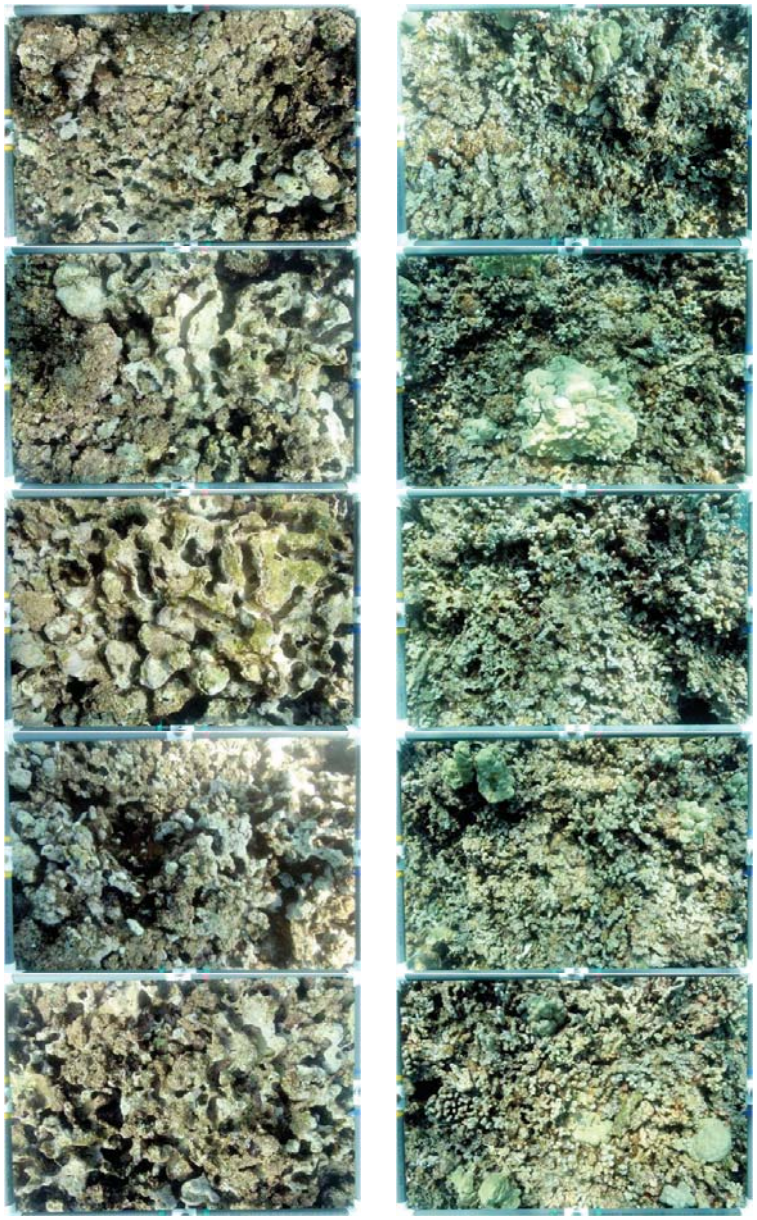
Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 004 and 005



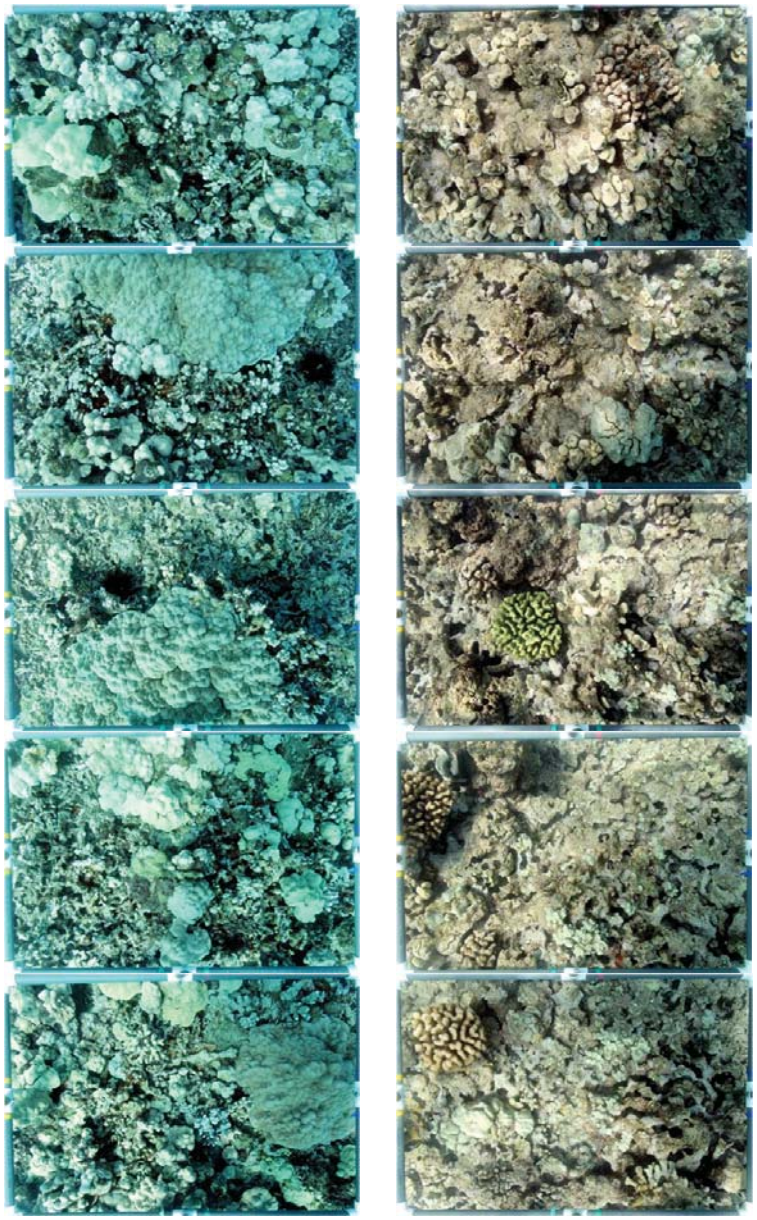
Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 006 and 007



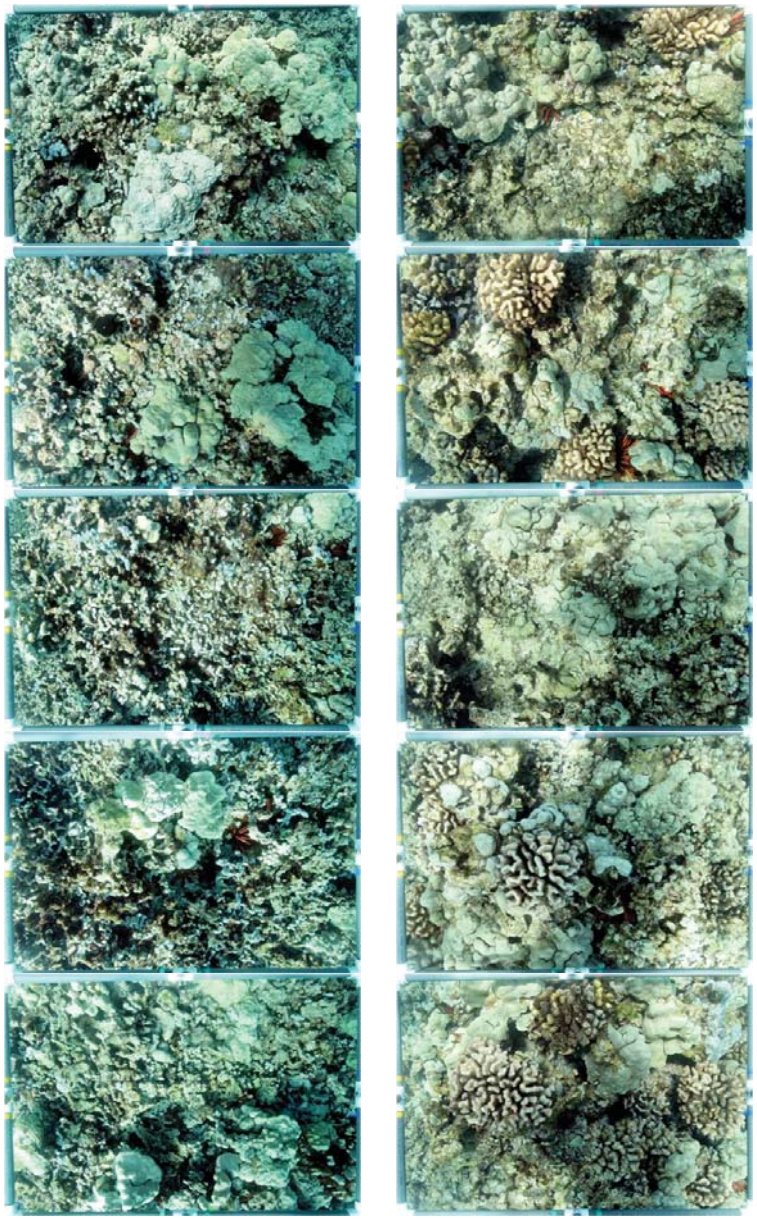
Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 008 and 009



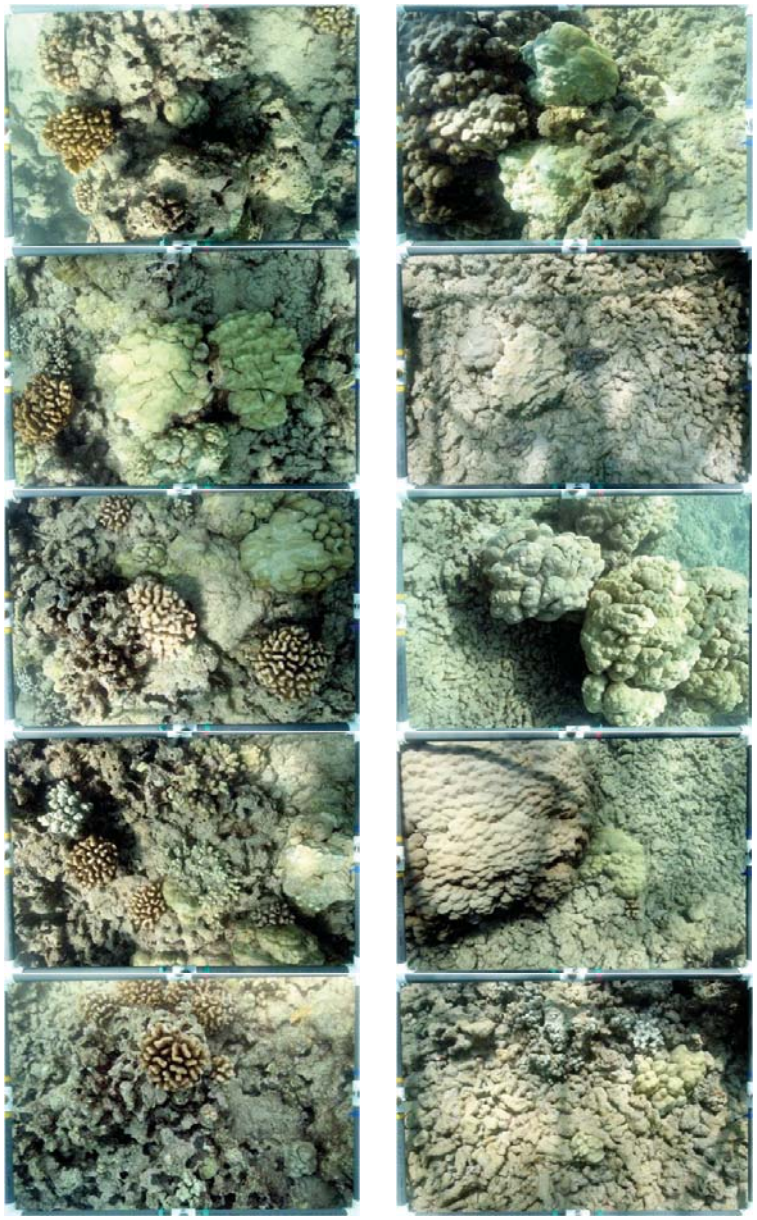
Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 010 and 011



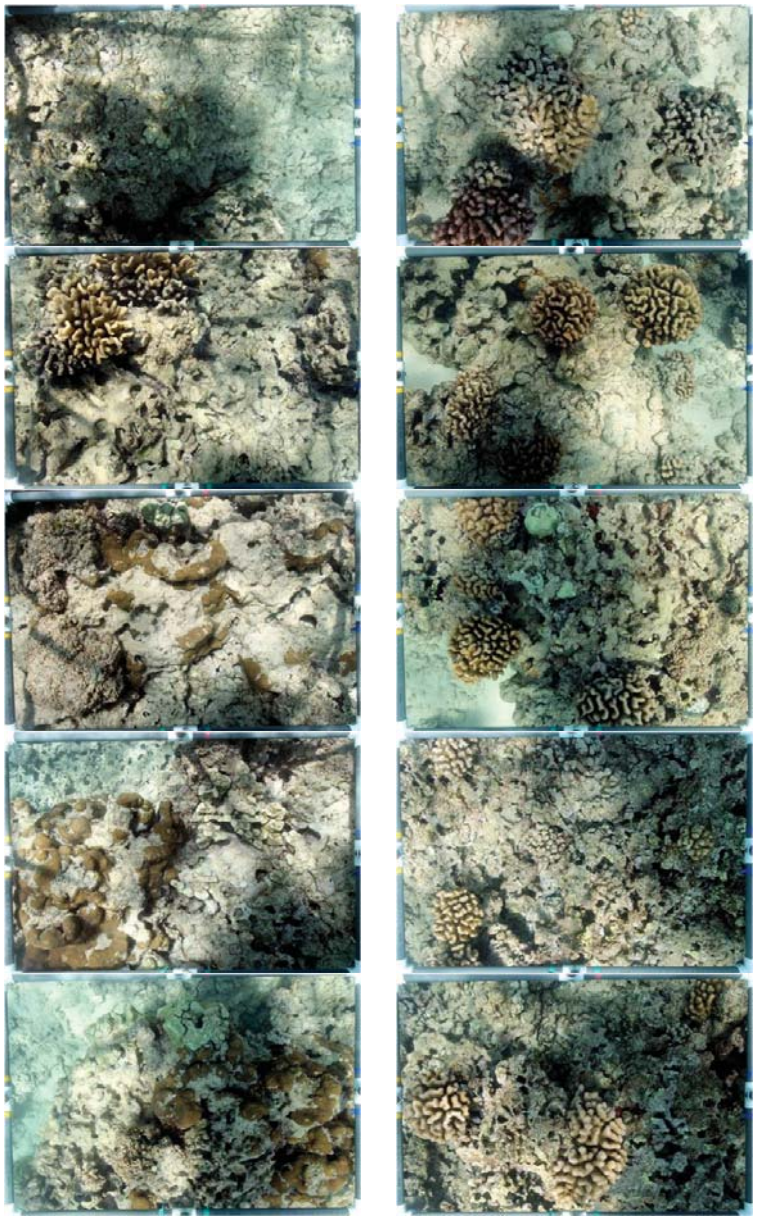
Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 012 and 013



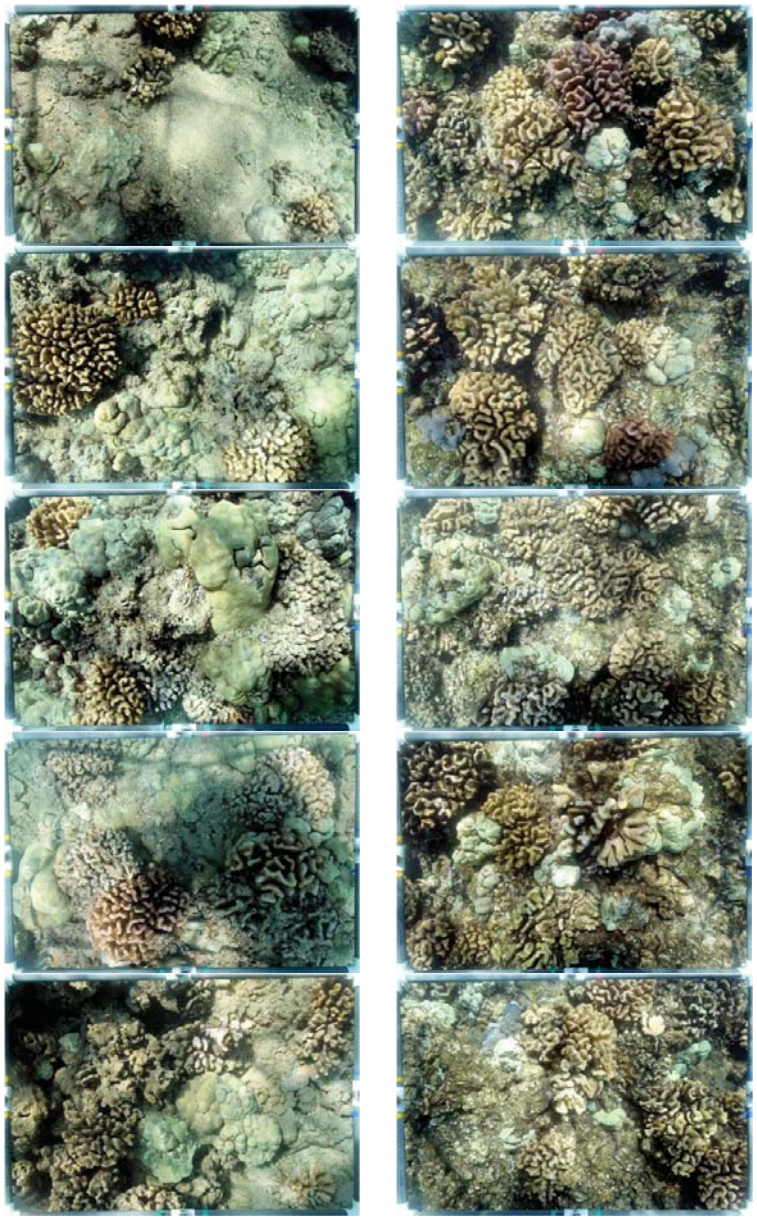
Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 014 and 015



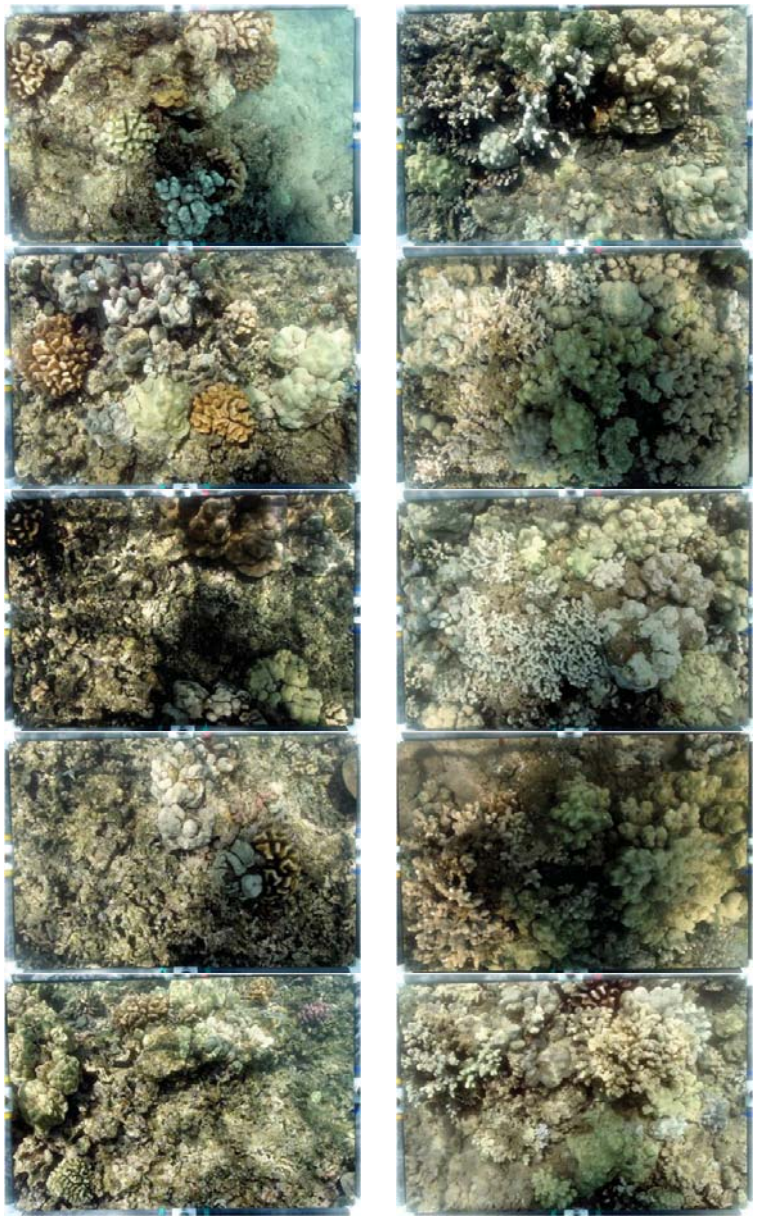
Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 016 and 017



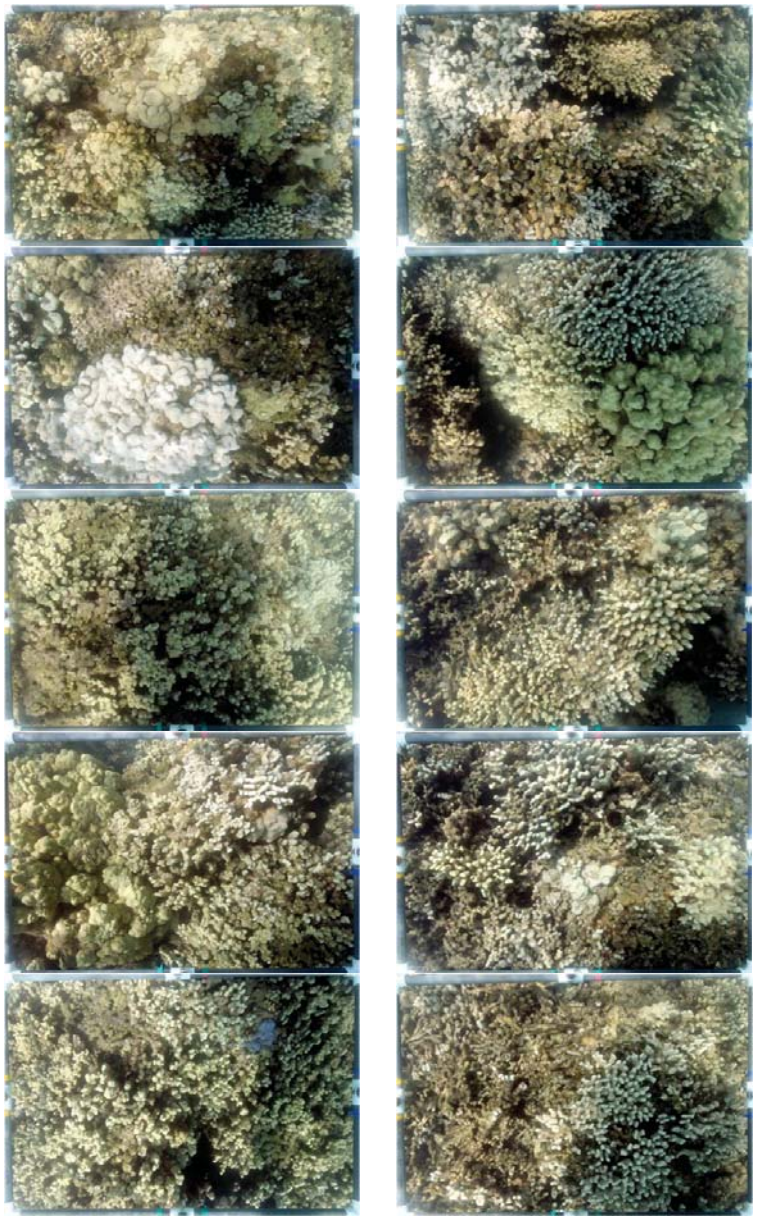
Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 018 and 019



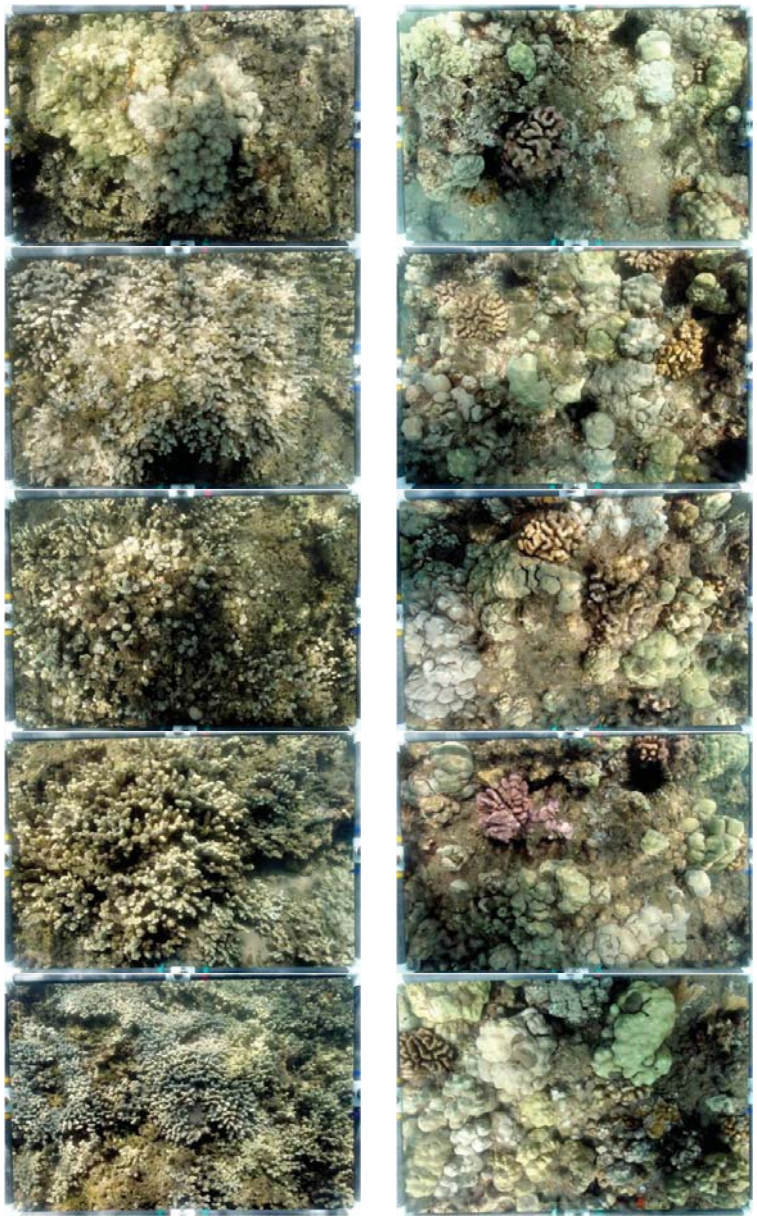
Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 020 and 021



Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 022 and 023



Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 024 and 025



Kawaihae Harbor Repairs Marine Assessment – 2011: Sites 026 and 027

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Appendix G: Drainage Report

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DRAINAGE REPORT

for Makahuna Gulch Crossing

Improving New Terminal Cargo Facilities
At Kawaihae Harbor
Project No. H.M.P. 60902

Kawaihae Harbor, Hawaii

Department of Transportation - Harbors Division

May 2011

Submitted By

SSFM INTERNATIONAL, INC.

Project Managers, Planners, & Engineers

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SSFM INTERNATIONAL

Statement of SSFM International, Inc.'s Quality Process

It is the policy of SSFM to have a consistent and systematic approach to the development and review of its reports and other project deliverables.

All projects and products of our service are subject to a quality process and in no case will the quality review be eliminated. The main purpose of this process is to assure:

- Clarity, completeness, coordination, and accuracy of documents.
- That the project, study or investigation meets the Client's objectives.
- That the requirements of our Agreement with the Client have been met, and the Client has received the value of the fee to be paid.

The Preparation of This Report Was The Responsibility of and Completed By:

signature — May 16, 2011 (date)

The Quality Review of This Report Was The Responsibility of and Completed By:

signature — May 16, 2011 (date)

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FIGURE A.1 – Overall Site Plan

Figure A.2– Existing Drainage Condition

FIGURE A.3 – Culvert Conceptual Layout

FIGURE A.4 – Culvert Cross Section

FIGURE A.5 – Hydrologic Calculations

I. Introduction

Kawaihae Harbor, located on the northwest side of the Big Island of Hawaii is an important lifeline for supplies to the west side of Hawaii as well as an essential port for handling military equipment moving to Pohakuloa Training Grounds. In anticipation to increased use of the harbor, the State of Hawaii, Department of Transportation (HDOT) will improve existing intersections and the perimeter road within the harbor.

The new perimeter roadway will replace the existing dirt road that runs along the perimeter of Coral Flats. Increased security for nearby military tenants shall require a new fence separating the public roadway from the inner harbor. A new drainage structure is to be built where the new road crosses Makahuna Gulch so as not to obstruct the existing drainage through the area. This drainage report will provide recommendations to HDOT as to the drainage structure required at this crossing. The location and extents of the project have been shown in Figure A.1 of the Appendix.

Coral Flats is located on the south side of the harbor and is minimally developed. Mountainous terrain slopes up to the north east with the harbor opening to the Pacific Ocean to the west. The topography of the mountainside consists of small rocky hills with an uphill slope averaging 1V:2H. Geologically the harbor consists of a wide range of material and is described as extremely stony, rocky and fine sand. Drainage down the mountainside consists of overland flow over a mixture of grass, shrubs and exposed soil. Coral Flats averages a 1V:20H slope, but also contains small hills over the general topography.

II. Criteria

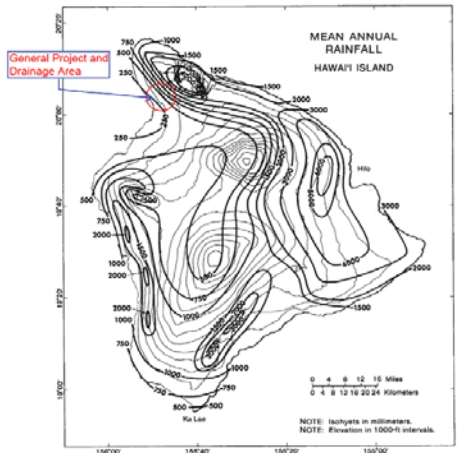
This section outlines the applicable criteria to be used in the drainage assessment, and presents summary of the design parameters used within the enclosed analysis and recommendation.

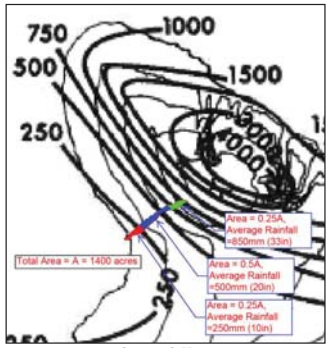
Drainage design is to be in accordance with “Design Criteria for Highway Drainage”, State of Hawaii, Department of Transportation, Highways Division (HDOT), dated 10/01/10. In accordance with HDOT criteria, since the contributing area was found to be in excess of 200 acres, use of the Rational Method for estimating the peak runoff rates was not suitable.

The USGS Regression Analysis was used to analyze runoff flow rates. This method is used to estimate peak discharge for medium and large watersheds. The annual rainfall depth near the harbor is around 10 to 12 inches but would be greater at higher elevations. The mean annual rainfall isohyetal map contained in the HDOT Design criteria manual was used to estimate the average rainfall depth over the entire watershed. Figure 1 shows the project location on the isohyetal map. Within the USGS Regression analysis, a weighted average mean annual rainfall was calculated to be 20.75 inches. This meets the minimum of 18.3inches that the regression analysis recommends for the Northern Hawaii area.

Weighted Average Mean Annual Rainfall Calculation:
[(33” x 0.25A) + (20” x 0.50A) + (10” x 0.25A)] / A = 20.75” =21”

The project site is located within the 100 year flood plain, as shown in FIRM Map number 1551660137C. The project location has been indicated on the FIRM mapping, and shown on Figure 2, for reference. The new drainage structure to be installed at the gulch/road crossing was analyzed for both 50 and 100 year recurrence intervals. Table 1 includes the relevant recurrence interval criteria from the above noted HDOT Design Criteria manual. Since the project site is situated within the 100 year flood plain, the 1 in 100 year return frequency was selected as the design basis for the proposed drainage structure.





Inset of Rainfall Map

Figure 1. Rainfall Atlas of Hawai'i, Mean Annual Rainfall

RECURRENCE INTERVAL

The design recurrence interval selected in the analysis of existing and proposed drainage facilities shall be in accordance with the following:

RECURRENCE INTERVALS (yrs)			
Functional Classification*	Bridge/Culvert Crossing	Roadway (at grade)	Roadway (sump)
Interstate	50 **	25	50
Freeway/Expressway	50 **	25	50
Arterial	50 **	25	25
Collector	25	10	10
Local	10	10	10

* Refer to the current State Route System *(Straight Line Diagram)* prepared by the Department of Transportation for the roadway functional classification.

** 100 year interval for sites covered under the Flood Insurance Rate Map (FIRM). The Design Engineer shall comply with the National Flood Insurance Program's regulations and requirements.

- Designated recurrence intervals shall include associated ramps and auxiliary lanes.
- All bridge structures shall be analyzed for both 50 and 100 year storm event.

Table 1. From HDOT Drainage Standards – Recurrence Interval Table

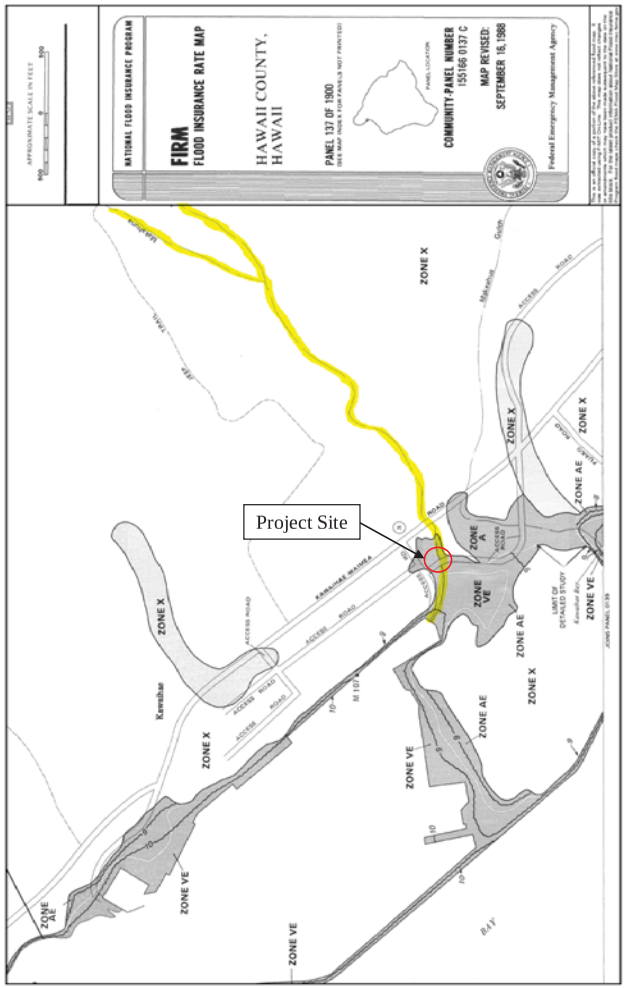


Figure 2. FIRM Map

III. Analysis

Existing Storm Drainage System

Makahuna Gulch is located on the south side of Kawaihae Harbor. Runoff into the gulch is collected from uphill drainage areas along the Kohala mountain side. A combination of overland flow and flow into existing channels carry runoff down the mountainside towards the harbor. Near the coast, the topography flattens out from an average 1V:2H slope along the mountainside to a 1V:20H slope within the harbor.

The drainage basin was delineated using the 40' contour mapping as published by U.S. Geological Survey (USGS). For the USGS Regresssion analysis, a single basin was delineated to estimate the runoff into Makahuna gulch including the Kohala mountain side as well as the harbor. Figure A.2 depicts the existing topography, upstream drainage basins and Makahuna Gulch. The cumulative drainage area totals 1400 acres (2.19 sq mi) and produces a calculated flow of 616 cfs during a 50 yr storm and flow of 882 cfs during a 100 year storm as shown below in Figure 3.

```
                          Kawaihae NSS Regression 110512
National Streamflow Statistics Program
Version 5
Based on Techniques and Methods Book 4-A6
Equations from database C:\Users\User\Documents\SSFM Projects\100_50 Misc
Projects\50.23 High Capacity Rail Project\Calcs\Design Calcs as of Feb
2011\NSS_v5_2011-02-04.mdb
Updated by tkoenig 2/4/2011 at 1:31:02 PM fix units for CSLBlue_ff in statewide TX
region

Site: Kawaihae Harbor, Hawaii
User: User
Date: May-12-11 02:18 PM

Equations for Hawaii developed using English units

Rural Estimate: Rural 1
   Basin Drainage Area: 2.19 square miles
   1 Region
   Region: Peak_Region_9_2010_5035_Hawaii_northern
      Drainage_Area = 2.19 square miles
      Mean_Annual_Precipitation = 21 inches


Results for:  Rural 1

Equations used:
PK2 = 0.148*DRNAREA^(0.763)*PRECIP^(1.664)
PK5 = 1.12*DRNAREA^(0.782)*PRECIP^(1.356)
PK10 = 3.16*DRNAREA^(0.787)*PRECIP^(1.203)
PK25 = 9.55*DRNAREA^(0.789)*PRECIP^(1.042)
PK50 = 19.1*DRNAREA^(0.789)*PRECIP^(0.938)
PK100 = 36.3*DRNAREA^(0.788)*PRECIP^(0.845)
PK500 = 126*DRNAREA^(0.782)*PRECIP^(0.662)

             Value,Prediction
Statistic      cfs   Error, %
PK2            42.7      100
PK5           128         72
PK10          228         61
PK25          423         53
PK50          616         51
PK100         882         51
PK500        1750         54
```

Figure 3. Calculations Summary – Regression Equations

Box culvert construction, in comparison to a bridge structure, is typically more cost effective and provides advantages in constructability. To maintain existing drainage through Makahuna Gulch, a double 8ftx8ft box culvert has been selected to accommodate 882 cfs from the 100 year storm.

The culvert to be installed under the proposed road alignment will be long enough in length to span the width of two 12ft lanes, two 3ft wide pedestrian walkways and bridge railings on each side of the bridge. The double box culvert will fit within the existing channel and the boxes aligned to the existing flow pattern of the gulch.

Existing side slopes left and right of the culvert shall be backfilled to the top of the structures. Headwalls angled at 45 degrees were utilized in the analysis to improve inlet efficiency and provide slope retention on each side of the channel. Grading improvements near the outlet of the culvert may be required to help direct the path of flow to the more defined downhill channel as shown in Figure A.1. Slope protection measures will be installed over the re-graded areas.

The depth of flow generated within the double 8ftx8ft box culvert is 3.79ft based on 882 cfs of flow. The resulting downstream velocity is 13.22 ft/s. To help dissipate energy and protect the structure from scour, 2 ft diameter rock rip rap are recommended along the bottom of the channel for a minimum length of 40 ft directly upstream and downstream of the box culvert.

With the increased channel roughness due to the rip rap protection, the depth of flow on the inlet side increases to 6.28ft. Only a minimum of 1.72ft of freeboard remains which does not meet the minimum 2ft freeboard requirement for bridges as specified in the HDOT Drainage Standards. The minimum freeboard is met however for the 50 year storm where the depth of flow at the inlet is only 5.26 ft, leaving 2.74 ft of freeboard. Figure A.4 provides a summary of the culvert size and Hydraulic Grade Lines (HGL) for the 1 in 50 year and 1 in 100 year recurrence intervals.

Because the perimeter road is not a highway but rather a private interior road within the harbor, it will most likely not see high traffic volumes. During the 100 year storm flows, 1.72 ft of freeboard will still allow floating debris to pass through the culvert and should be adequate for this design. See Figure A.5 in the appendix for complete flow analysis.

Detailed design at the roadway and site drainage was not included within the scope of this report. The design of future roadway and site improvement should include in the implementation of storm water Best Management Practices to provide water quality improvements and ensure that the stream and coastal areas are adequately protected. It is recommended the Harbor maintain and clean out the double box culvert and channel above and below the culvert to protect the structure.

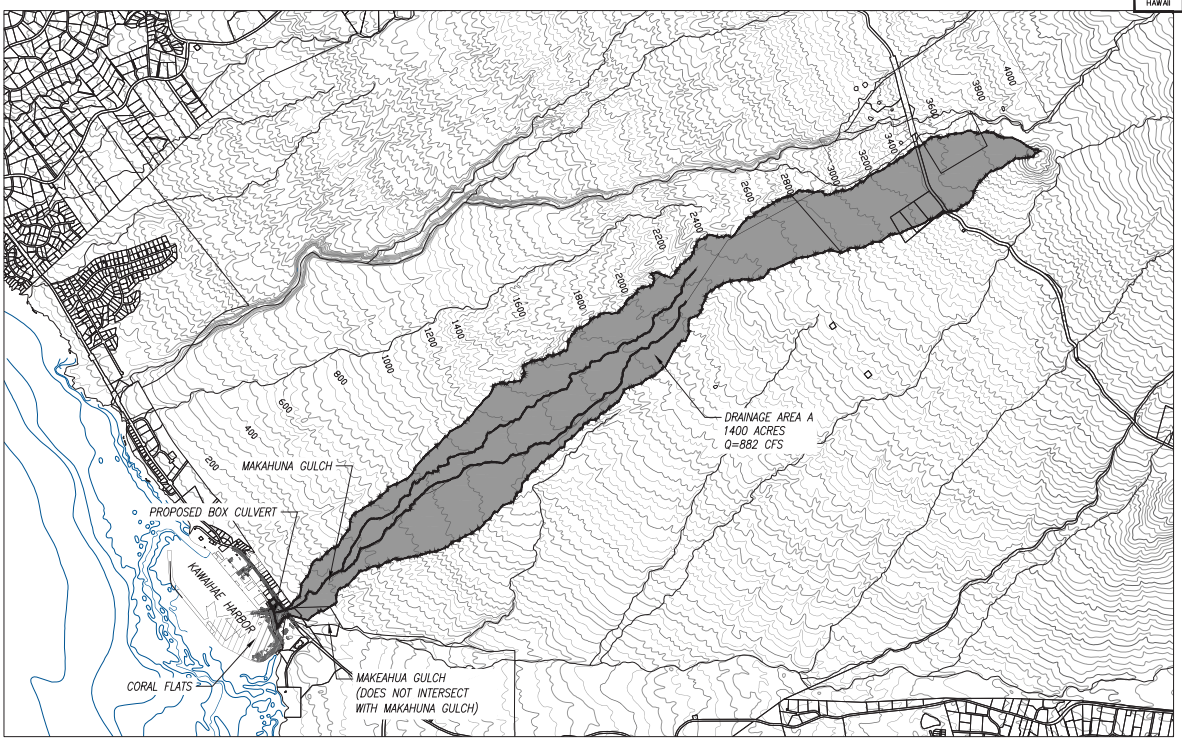
IV. Conclusions

Future development will build a new road within Coral Flats that crosses Makahuna Gulch. Currently, Makahuna Gulch captures runoff from a total of 1400 acres spanning from the Coral Flats area of Kawaihae Harbor to the Kohala mountains north east of the project site. The total runoff generated from this area is 882 cfs based on a 100 year recurrence interval.

To maintain drainage through the gulch, a double 8ftx8ft box culvert has been recommended at the future crossing. Headwalls at the inlet of the culvert shall be angled at 45 degrees and rip rap protection should be installed along the bottom of the channel at the inlet and outlet of the structure.

Appendix A

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.				



NORTH

1500' 750' 0 1500' 3000'
SCALE: 1" = 1500'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

EXISTING DRAINAGE CONDITION

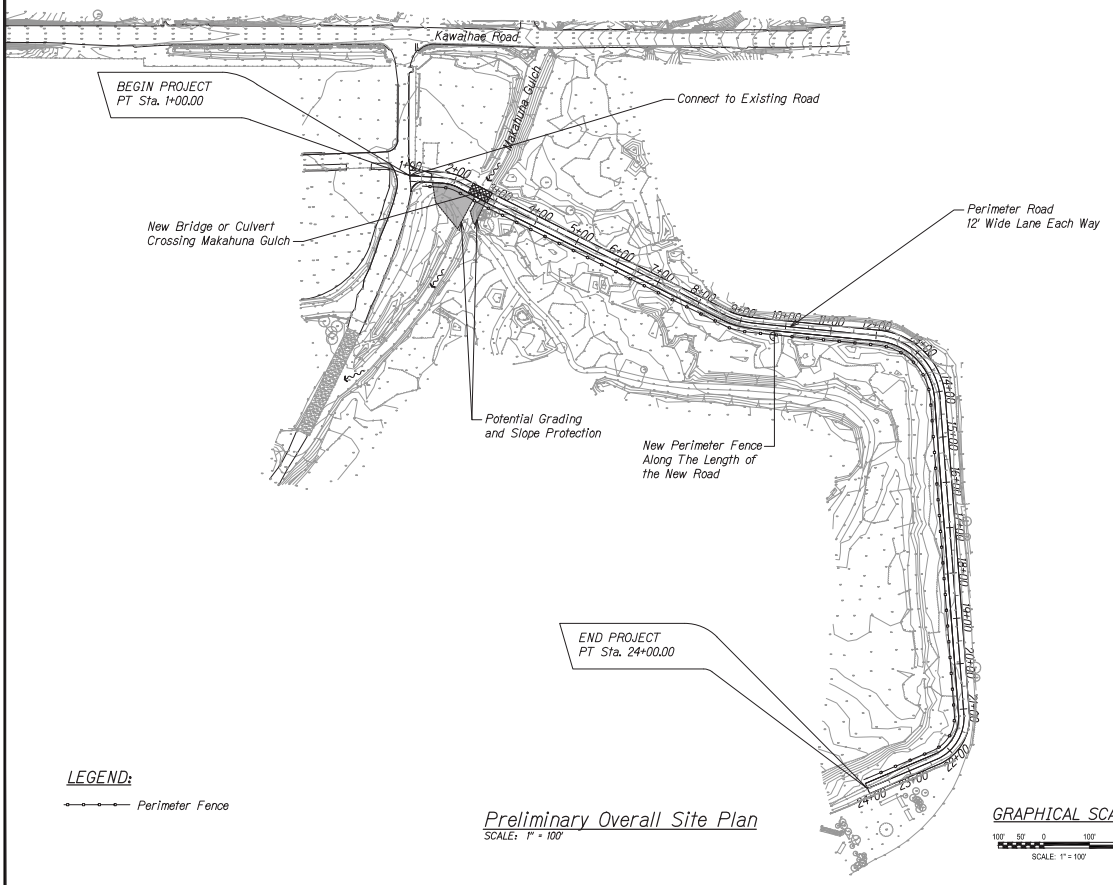
IMPROVING NEW TERMINAL CARGO FACILITIES
AT KAWAIHAE HARBOR
Project No. HMP 60902

Scale: AS NOTED Date:

SHEET No. OF SHEETS

FIGURE A.2

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	HMP 60902			



LEGEND:

Perimeter Fence

Preliminary Overall Site Plan

SCALE: 1" = 100'

GRAPHICAL SCALE:

100' 50' 0 100' 200'
SCALE: 1" = 100'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PRELIMINARY OVERALL SITE PLAN

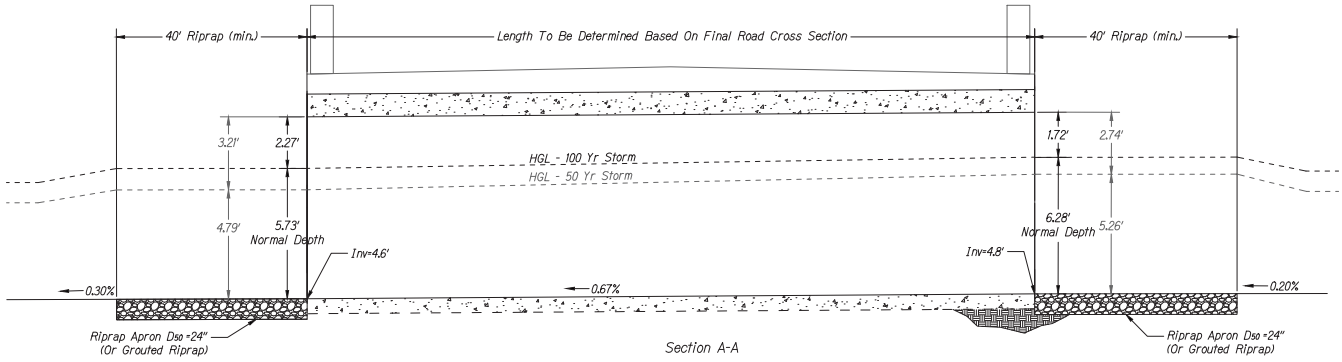
IMPROVING NEW TERMINAL CARGO FACILITIES
AT KAWAIHAE HARBOR
Project No. HMP 60902

Scale: AS NOTED Date: APRIL, 2011

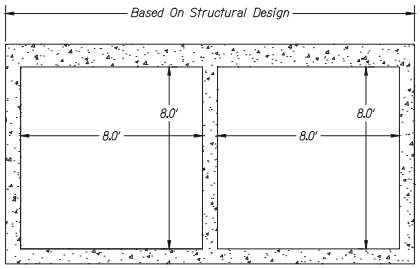
SHEET No. OF SHEETS

FIGURE A.1

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	HMP 60902			



Section A-A



Section B-B

Note:
Thickness of culvert walls and top and bottom slab to be determined by Structural Engineer.

Box Culvert Cross Sections

SCALE: NTS

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

CULVERT CROSS SECTION

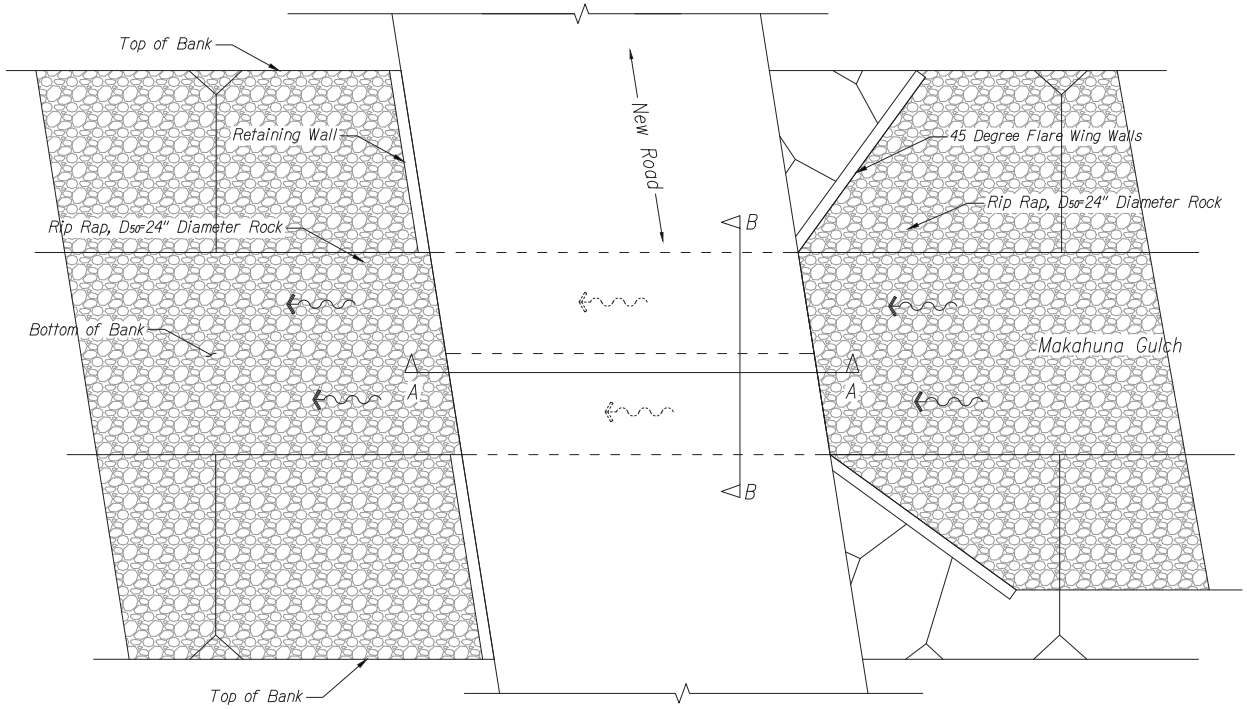
IMPROVING NEW TERMINAL CARGO FACILITIES
AT KAWAIHAE HARBOR
Project No. HMP 60902

Scale: AS NOTED Date:

SHEET No. OF SHEETS

FIGURE A.4

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	HMP 60902			



Conceptual Culvert-Road Crossing - Plan View

SCALE: NTS

NORTH

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

CONCEPTUAL LAYOUT

IMPROVING NEW TERMINAL CARGO FACILITIES
AT KAWAIHAE HARBOR
Project No. HMP 60902

Scale: AS NOTED Date:

SHEET No. OF SHEETS

FIGURE A.3

FIGURE A.5
(REMAINING SHEETS)

Natural Channel - Inlet Side

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.20000	%
Left Side Slope	45.00	%
Right Side Slope	30.00	%
Bottom Width	17.00	ft
Discharge	882.00	ft^3/s

Results

Normal Depth	5.38	ft
Flow Area	172.03	ft^2
Wetted Perimeter	48.85	ft
Hydraulic Radius	3.52	ft
Top Width	46.91	ft
Critical Depth	3.57	ft
Critical Slope	0.00997	ft/ft
Velocity	5.13	ft/s
Velocity Head	0.41	ft
Specific Energy	5.79	ft
Froude Number	0.47	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.38	ft
Critical Depth	3.57	ft
Channel Slope	0.20000	%

Natural Channel - Inlet Side

GVF Output Data

Critical Slope	0.00997	ft/ft

Rip Rap (24" dia)- Inlet Side

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.041	
Channel Slope	0.20000	%
Left Side Slope	45.00	%
Right Side Slope	30.00	%
Bottom Width	17.00	ft
Discharge	882.00	ft^3/s

Results

Normal Depth	6.28	ft
Flow Area	216.21	ft^2
Wetted Perimeter	54.15	ft
Hydraulic Radius	3.99	ft
Top Width	51.88	ft
Critical Depth	3.57	ft
Critical Slope	0.01862	ft/ft
Velocity	4.08	ft/s
Velocity Head	0.26	ft
Specific Energy	6.54	ft
Froude Number	0.35	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	6.28	ft
Critical Depth	3.57	ft
Channel Slope	0.20000	%

Rip Rap (24" dia)- Inlet Side

GVF Output Data

Critical Slope	0.01862	ft/ft

Culvert Calculator Report
Kawaihae Box Culvert at Roadway Crossing - Q100

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	3.00	ft	Headwater Depth/Height	1.05	
Computed Headwater Elev	13.22	ft	Discharge	882.00	cfs
Inlet Control HW Elev.	12.56	ft	Tailwater Elevation	3.00	ft
Outlet Control HW Elev.	13.22	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	4.80	ft	Downstream Invert	4.60	ft
Length	30.00	ft	Constructed Slope	0.6667	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	4.17	ft
Slope Type	Steep		Normal Depth	3.79	ft
Flow Regime	Supercritical		Critical Depth	4.55	ft
Velocity Downstream	13.23	ft/s	Critical Slope	0.4093	%

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	8.00	ft
Section Size	8 x 8 ft		Rise	8.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	13.22	ft	Upstream Velocity Head	2.28	ft
Ke	0.70		Entrance Loss	1.59	ft

Inlet Control Properties					
Inlet Control HW Elev.	12.56	ft	Flow Control	Unsubmerged	
Inlet Type	0° wingwall flares		Area Full	128.0	ft²
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	3	
C	0.04230		Equation Form	1	
Y	0.82000				

Rip Rap (24" dia) - Outlet Side

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.041	
Channel Slope	0.30000	%
Left Side Slope	50.00	%
Right Side Slope	30.00	%
Bottom Width	17.00	ft
Discharge	882.00	ft³/s

Results

Normal Depth	5.73	ft
Flow Area	185.09	ft²
Wetted Perimeter	49.77	ft
Hydraulic Radius	3.72	ft
Top Width	47.57	ft
Critical Depth	3.60	ft
Critical Slope	0.01862	ft/ft
Velocity	4.77	ft/s
Velocity Head	0.35	ft
Specific Energy	6.09	ft
Froude Number	0.43	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.73	ft
Critical Depth	3.60	ft
Channel Slope	0.30000	%

Rip Rap (24" dia) - Outlet Side

GVF Output Data

Critical Slope	0.01862	ft/ft

Natural Channel - Outlet Side

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.30000	%
Left Side Slope	50.00	%
Right Side Slope	50.00	%
Bottom Width	17.00	ft
Discharge	882.00	ft^3/s

Results

Normal Depth	5.15	ft
Flow Area	140.68	ft^2
Wetted Perimeter	40.04	ft
Hydraulic Radius	3.51	ft
Top Width	37.61	ft
Critical Depth	3.75	ft
Critical Slope	0.00992	ft/ft
Velocity	6.27	ft/s
Velocity Head	0.61	ft
Specific Energy	5.76	ft
Froude Number	0.57	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.15	ft
Critical Depth	3.75	ft
Channel Slope	0.30000	%

Natural Channel - Inlet Side - Q50

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.20000	%
Left Side Slope	45.00	%
Right Side Slope	30.00	%
Bottom Width	17.00	ft
Discharge	616.00	ft^3/s

Results

Normal Depth	4.49	ft
Flow Area	132.52	ft^2
Wetted Perimeter	43.59	ft
Hydraulic Radius	3.04	ft
Top Width	41.97	ft
Critical Depth	2.91	ft
Critical Slope	0.01051	ft/ft
Velocity	4.65	ft/s
Velocity Head	0.34	ft
Specific Energy	4.83	ft
Froude Number	0.46	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.49	ft
Critical Depth	2.91	ft
Channel Slope	0.20000	%

Natural Channel - Outlet Side

GVF Output Data

Critical Slope	0.00992	ft/ft

Rip Rap (24" dia)- Inlet Side - Q50

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.041	
Channel Slope	0.20000	%
Left Side Slope	45.00	%
Right Side Slope	30.00	%
Bottom Width	17.00	ft
Discharge	616.00	ft^3/s

Results

Normal Depth	5.26	ft
Flow Area	166.29	ft^2
Wetted Perimeter	48.12	ft
Hydraulic Radius	3.46	ft
Top Width	46.22	ft
Critical Depth	2.91	ft
Critical Slope	0.01962	ft/ft
Velocity	3.70	ft/s
Velocity Head	0.21	ft
Specific Energy	5.47	ft
Froude Number	0.34	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.26	ft
Critical Depth	2.91	ft
Channel Slope	0.20000	%

Natural Channel - Inlet Side - Q50

GVF Output Data

Critical Slope	0.01051	ft/ft

Rip Rap (24" dia)- Inlet Side - Q50

GVF Output Data

Critical Slope	0.01962	ft/ft

Culvert Calculator Report
Kawaihae Box Culvert at Roadway Crossing - Q50

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	3.00	ft	Headwater Depth/Height	0.83	
Computed Headwater Elev	11.43	ft	Discharge	616.00	cfs
Inlet Control HW Elev.	10.88	ft	Tailwater Elevation	3.00	ft
Outlet Control HW Elev.	11.43	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	4.80	ft	Downstream Invert	4.60	ft
Length	30.00	ft	Constructed Slope	0.6667	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	3.23	ft
Slope Type	Steep		Normal Depth	2.91	ft
Flow Regime	Supercritical		Critical Depth	3.58	ft
Velocity Downstream	11.93	ft/s	Critical Slope	0.3777	%

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	8.00	ft
Section Size	8 x 8 ft		Rise	8.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	11.43	ft	Upstream Velocity Head	1.79	ft
Ke	0.70		Entrance Loss	1.25	ft

Inlet Control Properties					
Inlet Control HW Elev.	10.88	ft	Flow Control	Unsubmerged	
Inlet Type	0° wingwall flares		Area Full	128.0	ft²
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	3	
C	0.04230		Equation Form	1	
Y	0.82000				

Rip Rap (24" dia) - Outlet Side - Q50

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.041	
Channel Slope	0.30000	%
Left Side Slope	50.00	%
Right Side Slope	30.00	%
Bottom Width	17.00	ft
Discharge	616.00	ft^3/s

Results

Normal Depth	4.79	ft
Flow Area	142.53	ft^2
Wetted Perimeter	44.37	ft
Hydraulic Radius	3.21	ft
Top Width	42.54	ft
Critical Depth	2.93	ft
Critical Slope	0.01962	ft/ft
Velocity	4.32	ft/s
Velocity Head	0.29	ft
Specific Energy	5.08	ft
Froude Number	0.42	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.79	ft
Critical Depth	2.93	ft
Channel Slope	0.30000	%

Rip Rap (24" dia) - Outlet Side - Q50

GVF Output Data

Critical Slope	0.01962	ft/ft

Natural Channel - Outlet Side - Q50

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.30000	%
Left Side Slope	50.00	%
Right Side Slope	50.00	%
Bottom Width	17.00	ft
Discharge	616.00	ft^3/s

Results

Normal Depth	4.26	ft
Flow Area	108.76	ft^2
Wetted Perimeter	36.06	ft
Hydraulic Radius	3.02	ft
Top Width	34.05	ft
Critical Depth	3.04	ft
Critical Slope	0.01044	ft/ft
Velocity	5.66	ft/s
Velocity Head	0.50	ft
Specific Energy	4.76	ft
Froude Number	0.56	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.26	ft
Critical Depth	3.04	ft
Channel Slope	0.30000	%

Natural Channel - Outlet Side - Q50

GVF Output Data

Critical Slope	0.01044	ft/ft

Appendix H: Traffic Impact Assessment Report

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FINAL

Kawaihae Commercial Harbor Environmental Assessment

Kawaihae Harbor, Island of Hawai'i

Job H.C. 90032

Traffic Impact Analysis Report

February 2012

Prepared for

State of Hawai'i Department of Transportation

Harbors Division

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Statement of SSFM International, Inc.'s Quality Process

It is the policy of SSFM to have a consistent and systematic approach to the development and review of its reports and other project deliverables.

All projects and products of our service are subject to a quality process and in no case will the quality review be eliminated. The main purpose of this process is to assure:

- Clarity, completeness, coordination, and accuracy of documents.
- That the project, study or investigation meets the Client's objectives.
- That the requirements of our Agreement with the Client have been met, and the Client has received the value of the fee to be paid.

The Preparation Of This Report Was The Responsibility Of And Completed By:

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Prepared by
SSFM International, Inc.

I. INTRODUCTION

Kawaihae Harbor is located in the South Kohala region on the west side of the island of Hawai'i, 35 miles north of Kailua-Kona. The harbor is located off of Kawaihae Road (Route 270), just north of the intersection with Queen Ka'ahumanu Highway/Mamalahoa Highway (HI-19) and south of the intersection with Akoni Pule Highway, as seen in Figure 1, Location Map.

Kawaihae Harbor is essential for the import and export of cargo to the Island of Hawai'i including consumer goods, fuel, cement, lumber, livestock, automobiles and military equipment. Improvements to expand the harbor facilities, as discussed in the *Hawai'i Island Commercial Harbors 2035 Master Plan* (SSFM, August 2011), are being considered in the future to accommodate the anticipated growth in cargo volume.

The majority of existing commercial access to the harbor occurs at the Main Gate located off of Kawaihae Road. Harbor traffic, which primarily consists of trucks, shares this road with through-traveling vehicles. Secondary access for commercial/recreational traffic into the harbor occurs through the South Gate which provides direct access to Coral Flats area and operations at the south side of the harbor. The North Gate currently is closed to access.

SSFM International was contracted by Hawai'i Department of Transportation, Harbors Division, to provide professional services in preparing an environmental assessment (EA) addressing short-term improvements for Kawaihae Harbor as described in the *Hawai'i Island Commercial Harbors 2035 Master Plan* (SSFM, August 2011) and the *Kawaihae Commercial Harbor Development Plan* (SSFM, September 2011). This traffic impact analysis report (TIAR) is prepared in support of the EA. A checklist of items covered in this TIAR, per recommendations stated in the *Hawai'i Department of Transportation Best Practices for Traffic Impact Reports* (CH2M Hill, May 2011), is included in Appendix G. It should be noted that at the time of this submittal this report was still in draft form, requiring final approval, and therefore is subject to change.

Prior to this, the *Kawaihae Commercial Harbor Development Plan Traffic Circulation Memorandum* (SSFM, September 2011) was submitted in support of the *Kawaihae Commercial Harbor Development Plan* (SSFM, September 2011) for improving existing terminal cargo facilities at Kawaihae Harbor. Included in that was the review of the harbor ingress and egress and recommendations of near and long-term traffic improvements deemed desirable prior to the future development of the Kawaihae Road Bypass.



Figure 1: Location Map
Kawaihae Commercial Harbor EA, Kawaihae Harbor, Island of Hawai'i

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II. EXISTING (2010) TRAFFIC CONDITIONS

Adjacent to Kawaihae Harbor, Kawaihae Road is a two-lane, undivided highway oriented in the north-south direction with no turn lanes. According to the State Roadway Inventory, Kawaihae Road is classified as a rural principal arterial. Kawaihae Road intersects Akoni Pule Highway north of the Kawaihae Harbor Main Gate. The Main Gate access, also referred to as Pier 2 access, is centrally located on the harbor facilities. The South Gate access intersects Kawaihae Road approximately 250 feet north of the Makahuna Gulch crossing. The North Gate, located off of Kawaihae Road north of the intersection with Akoni Pule Highway, does not currently allow access. One mile south of the intersection with South Gate, Kawaihae Road intersects with Queen Ka'ahumanu Highway. At this location Kawaihae Road has a posted speed limit of 45mph and Queen Ka'ahumanu Highway (Route 11) is a principle arterial with posted speed limit of 55mph.

A. Internal Harbor Traffic Operations

Field visits and traffic counts were conducted on Tuesday, May 25, 2010 and Friday, September 3, 2010 to document existing conditions in and around Kawaihae Harbor. Harbor master and security were consulted with to gain a better understanding of existing operations. This included interviews with the Interim Harbor Master on September 3, 2010 and Kawaihae Harbor Security on September 10, 2010.

Along Kawaihae Road there are no turn lanes at the intersections with harbor access points and intersecting roads, as seen in Figure 2, Existing (2010) Lane Configurations. Therefore, vehicles attempting to turn into the harbor can sometimes block through-traveling vehicles.

Access to Kawaihae Harbor is primarily through the Main Gate which is open and manned by security guards 24-hours a day, seven days a week. Trucks typically start arriving at the harbor at approximately 6:00 am. These are usually for cement or fuel pick-ups from Hawaiian Cement, Mid-Pac Petroleum or Akana Petroleum. Shortly thereafter, traffic for Matson and YBL begin to arrive for cargo pick-ups. Prior to the opening of Matson and YBL yards, trucks can enter the outside perimeter of the harbor at the Main Gate driveway. The South Gate is only open on Fridays from 7:00 am – 5:00 pm, providing direct access to the Coral Flats part of the harbor.

In accordance with Federal Regulations, all open access must be manned by properly trained and certified security personnel. Those wishing to access the beach park or Coral Flats must provide a valid driver's license, proof of no-fault insurance and current automobile registration. When the South Gate is closed, vehicles accessing Coral Flats enter through the Main Gate, proceeding through the security check and then driving down the access road which connects to the South Gate road.

At the time of harbor operation observations in September 2010, the typical movement of vehicular access into the harbor was as shown in Figure 3. Vehicles accessing harbor facilities at the Main Gate would go through an initial security checkpoint in which the driver declares their destination and purpose at the harbor. Those entering into the security perimeter must also pass clearance. They traveled down the access road, which runs parallel to the Matson fence, and made a U-turn at the staging area. The trucks then returned towards the Matson and YBL gates and queued along the access road, waiting for the opening of the harbor facilities. Since July 2011, early access into the harbor on

Fridays changed to allow truck entrance into the harbor through the South gate with an immediate turn and queuing along the access road awaiting the security check.

The access road is about 1/4-mile long and 24-feet wide and serves bi-directional traffic. The majority of trucks waiting to enter the harbor drop off a container prior to picking one up. The access road can hold a queue of about 20 trucks with containers, considering the maximum length of a truck with container, including a buffer between vehicles, is about 70-feet. Since July 2011, when the South Gate opened for early access, the access road is intended for one-way traffic use, although two-way traffic was still observed.

Harbor operations were observed on Friday, September 3, 2010, which was a "double barge day," a day when two commercial barges arrive at the harbor. As previously noted, on these high volume days the South Gate is open to handle the additional truck traffic. Prior to the opening of Matson's gates, 14 trucks loaded with containers were lined up along the access road. Once Matson and YBL opened, it took less than five minutes for the first vehicle to go through the security inspection. Since trucks were able to line up along the access road, there was minimal queuing observed along Kawaihae Road at the entrance gates. After entering the container yard, it took 15-25 minutes for a truck to load freight and exit the facilities.

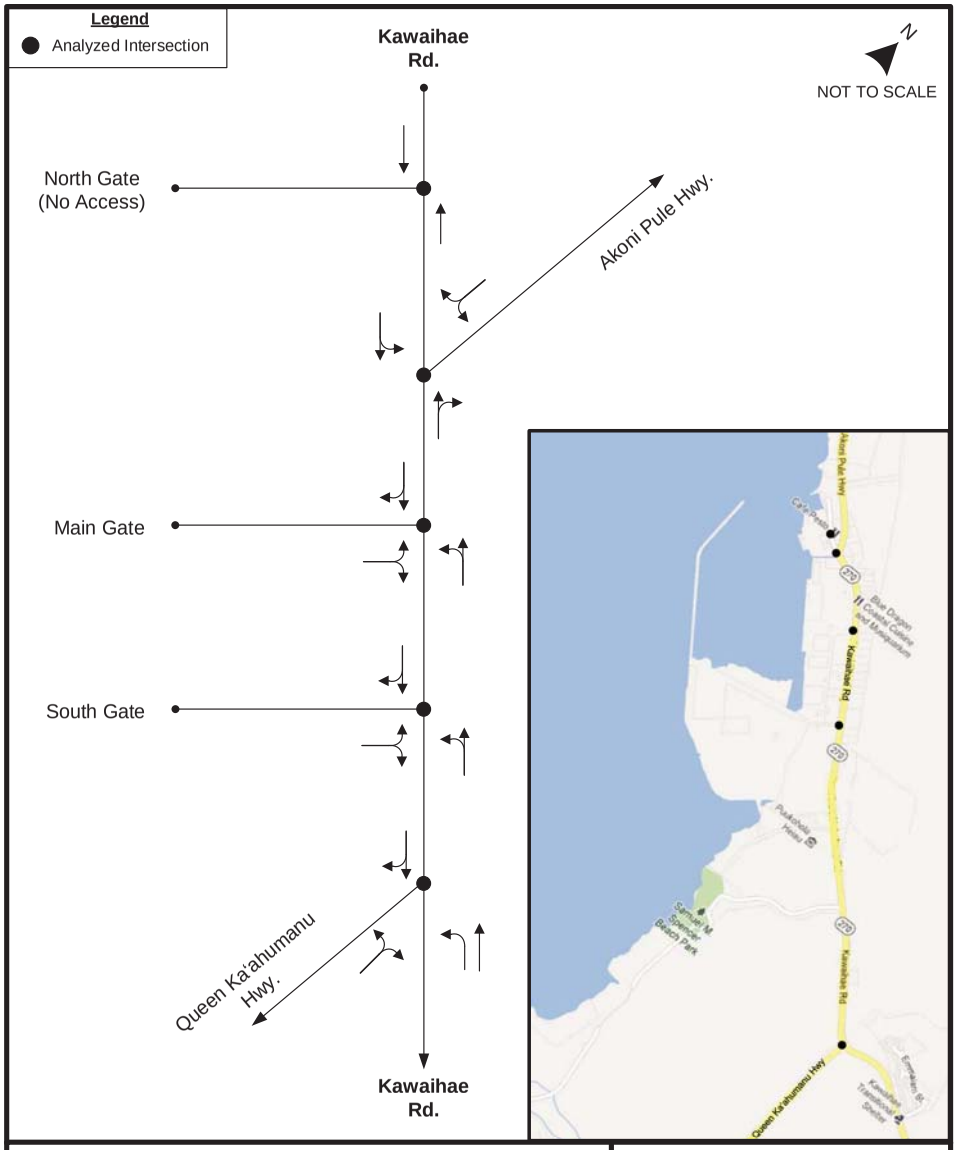

Figure 2: Existing (2010) Lane Configurations

Kawaihae Commercial Harbor EA - Kawaihae Harbor, Island of Hawai'i

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B. Traffic Volumes

1. Peak Hour Volumes

Manual turning movement traffic counts were conducted during the weekday AM and PM peak periods on Tuesday, May 25, 2010, a day in which barges were scheduled to arrive and depart from the harbor, at the following intersections:

Intersection	Access/Intersection Traffic Control
Kawaihae Road/Akoni Pule Highway	T-intersection/Stop sign controlled
Kawaihae Road/ Main Gate access	T-intersection/Stop sign controlled

The AM and PM peak period counts were taken from 6:00 – 8:00 am and 3:30 – 5:30 pm, which was in line with peak periods as noted from historical *HDOT counts* (HDOT, 2008). It was assumed that the peak periods along Kawaihae Road coincided with harbor operation peaks. Barge arrival was expected by 7:00 am on the morning of the traffic counts; however, it didn't arrive until around 9:00 am. The barge departed at 5:00 pm. Peak hours at the intersections were found to be from 7:00 – 8:00 am and 3:15 – 4:15 pm.

Since counts were not taken on a Friday, the South Gate was not open and therefore no traffic movements were observed accessing the harbor at that location although for our analysis, volumes were inserted here for consideration of all access locations. Peak hour traffic volumes at the intersection of Kawaihae Road and Queen Ka'ahumanu Highway were taken from the *Kawaihae Road Bypass Waimea to Kawaihae, Revised Draft Transportation Impact Study* (Wilbur Smith, November 2008) and adjusted to reflect 2010 conditions, considering surrounding HDOT historical traffic counts.

Existing (2010) peak hour volumes at each intersection are shown in Figure 4 and Table 1. The complete count data can be referenced in Appendix A.

Figure 3: Traffic Circulation

Kawaihae Commercial Harbor EA, Kawaihae Harbor, Island of Hawai'i

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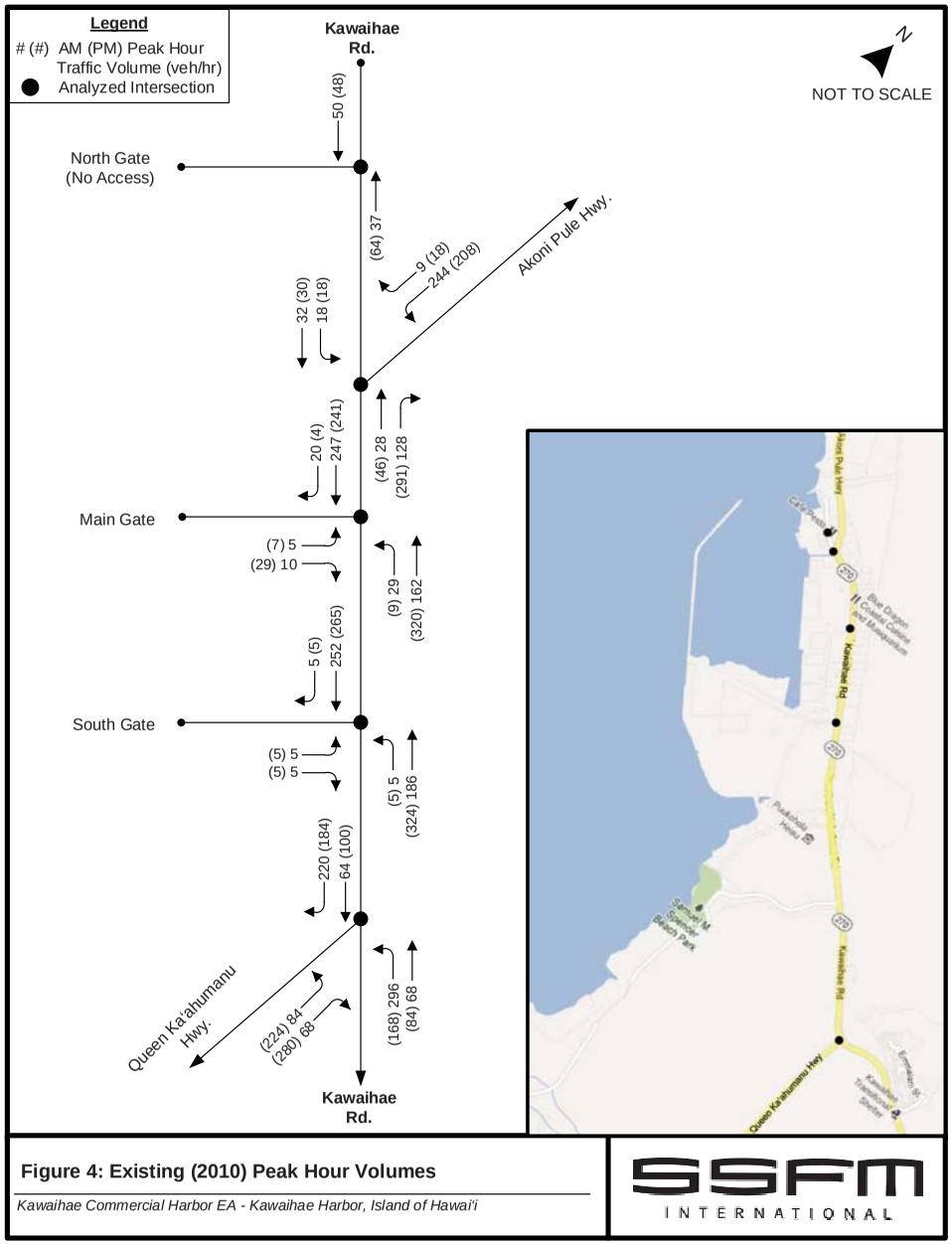

Figure 4: Existing (2010) Peak Hour Volumes

Kawaihae Commercial Harbor EA - Kawaihae Harbor, Island of Hawai'i

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Table 1: Existing (2010) Peak Hour Volumes

Unsignalized Intersection	Approach	Movement	Peak Hour Volumes	
			AM	PM
Kawaihae Road and Akoni Pule Highway	Northbound	Thru	28	46
		Right	128	291
	Southbound	Left	18	18
		Thru	32	30
	Westbound	Left	244	208
		Right	9	18
Kawaihae Road and Main Gate access	Northbound	Left	29	9
		Thru	162	320
	Southbound	Thru	247	241
		Right	20	4
	Eastbound	Left	5	7
		Right	10	29
Kawaihae Road and South Gate access	Northbound	Left	5	5
		Thru	186	324
	Southbound	Thru	252	265
		Right	5	5
	Eastbound	Left	5	5
		Right	5	5
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound	Left	84	224
		Right	68	280
	Eastbound	Thru	64	100
		Right	220	184
	Westbound	Left	296	168
		Thru	68	84

2. 24-Hour Volumes

24-hour counts were taken on Tuesday, May 25, 2010 on Kawaihae Road, south of the harbor, and on Akoni Pule Highway, north of the harbor as shown on Figure 1. Average daily traffic (ADT) for these count locations are shown in Table 2.

Table 2: Existing (2010) ADT

Road Segment	NB	SB
Akoni Pule Highway	2,710	2,840
Kawaihae Road	3,610	3,490

3. Heavy Vehicle Percent Traffic

Average heavy vehicle percent along Kawaihae Road was found to be 11% throughout the day, as collected in the 24-hour count data, with the majority of these vehicles traveling to and from the harbor. Individual movement heavy vehicle percent, as collected during the peak period turning movement

counts, were used for peak hour intersection analysis. Heavy vehicle percent for weekday intersection approaches at Kawaihae Road and Queen Ka'ahumanu Highway were taken from the *Kawaihae Road Bypass TIAR* and included with the collected data in Table 3.

Table 3: Existing (2010) Heavy Vehicle Percentage

Intersection	Approach	Movement	AM	PM
Kawaihae Road and Akoni Pule Highway	Northbound	Thru	0%	0%
		Right	4%	2%
	Southbound	Left	7%	0%
		Thru	3%	0%
	Westbound	Left	4%	4%
		Right	0%	0%
Kawaihae Road and Main Gate access	Northbound	Left	45%	44%
		Thru	8%	4%
	Southbound	Thru	5%	5%
		Right	30%	0%
	Eastbound	Left	80%	0%
		Right	90%	45%
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound	Left	6%	6%
		Right		
	Eastbound	Thru	9%	9%
		Right		
	Westbound	Left	4%	4%
		Thru		

4. Non-motorized Traffic

Several pedestrians and bicyclists were observed in the study area. No pedestrian pathways, crosswalks, designated bike lanes, or significant shoulder widths exist along Kawaihae Road in the vicinity of the harbor which makes current pedestrian access and movement difficult. Pedestrians desiring access to the harbor offices have to go through a security check prior to entering the harbor facilities. Additionally, no pathways or crosswalks exist for access to the commercial buildings located on the mauka side of the road at the north end of the harbor.

C. Level of Service

1. Intersection Level of Service

Level of service (LOS) is an operational analysis rating system used in traffic engineering to measure the effectiveness of roadway operating conditions. There are six LOS ranging from A to F. LOS A is defined as being the least interrupted flow conditions with little or no delays, whereas LOS F is defined as conditions where extreme delays exist. Guidelines from the *Hawai'i Statewide Uniform Design Manual for Streets and Highways (HDOT, October 1980)* state that an appropriate LOS for a rural State arterial, which is the classification of Kawaihae Road, is LOS C or better.

As stated in the *Highway Capacity Manual (TRB, 2010)*, LOS for a two-way stop controlled (TWSC) intersection is determined by the measured control delay, as shown in Table 4, and is defined for each

minor movement, not for the intersection as a whole. Vehicles traveling along the major, free-flow road, of a TWSC intersection, proceed through with minimal delay. Those vehicles approaching the intersection along the minor movement are controlled by a stop sign and thus experience delay attributable to the volume of vehicles passing along the free-flow road and the gaps available.

Table 4: LOS Criteria for Unsignalized Intersections

Average Control Delay (s/veh)	LOS by v/c Ratio	
	<=1.0	>1.0
≤ 10.0	A	F
>10 and ≤15	B	F
>15 and ≤25	C	F
>25 and ≤35	D	F
>35 and ≤50	E	F
>50	F	F

Another measure of intersection delay is the volume to capacity (v/c) ratio. This is the ratio of the volume of traffic utilizing the intersection compared to the maximum volume of vehicles that can be accommodated by the intersection during a specific period of time. A v/c ratio under 0.85 means the intersection is operating under capacity and excessive delays are not experienced. An intersection is operating near its capacity when v/c ratios range from 0.85 to 0.95. Unstable flows are expected when the v/c ratio is between 0.95 and 1.0. Any v/c ratio greater than or equal to 1.0 indicates that the intersection is operating at or above capacity which results in a LOS F. A traffic movement can have a poor LOS but low v/c which suggests that the traffic volumes along that movement are low but have to wait a long time to make the movement. This is common for low volume protected turn movements or side streets that have to wait through a long cycle length for their split to come up.

Existing (2010) LOS and delay was determined for the AM and PM peak hours for intersections using *Highway Capacity Software (HCS+)*, traffic analysis software. As shown in Table 5, Existing (2010) operations are operating at appropriate LOS during the AM and PM peak hours for most movements. Appendix B provides the detailed analysis reports for the Existing (2010) conditions.

Table 5: Existing (2010) Intersection Level of Service

Unsignalized Intersection	Approach-Movement	AM			PM		
		LOS	v/c	Delay	LOS	v/c	Delay
Kawaihae Road and Akoni Pule Highway	Southbound Left	A	0.02	7.7	A	0.02	8.1
	Westbound Left	B	0.37	12.4	B	0.37	13.4
Kawaihae Road and Main Gate access	Northbound Left	A	0.03	8.6	A	0.01	8.4
	Eastbound Left	B	0.05	12.8	B	0.06	11.4
Kawaihae Road and South Gate access	Northbound Left	A	0.00	8.5	A	0.00	8.5
	Eastbound Left	B	0.03	12.9	B	0.02	12.3
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound Left	F	1.12	143.4	F	1.14	112.1
	Westbound Left	A	0.35	9.6	A	0.16	8.5

2. Traffic Signal Warrant

Due to the poor LOS for the northbound left movement at Kawaihae Road and Queen Ka'ahumanu Road, a traffic signal warrant was run for peak hour conditions. The Peak Hour signal warrant from the *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)* (FHWA, 2003) was used for analysis of Existing (2010) conditions and passed for the PM peak hour. Appendix C provides the detailed traffic signal warrant analysis. It is noted in the *MUTCD* that the satisfaction of a traffic signal warrant or warrants does not in itself require the installation of a traffic signal.

3. Roadway Level of Service

LOS for roadway segments measures congestion along a corridor as determined by specific roadway type. LOS of roadway segments is determined using the peak hour bidirectional volumes and the methodologies of the *Florida Department of Transportation Quality/LOS Handbook* (FDOT, 2009), which is based on the guidelines as stated in the *2000 Highway Capacity Manual*. This can be used to gauge capacity along individual roadway segments between intersections.

The roadway segmental analysis evaluated this section of Kawaihae Road as an uninterrupted flow highway in a non-urbanized area with a population less than 5,000. Existing (2010) analysis for the road segment showed appropriate operations of LOS B.

4. Internal Circulation

There were no major problems observed in the internal traffic circulation within the harbor. Since vehicles can queue along the access road and there are two gates to enter the container yards, there was a consistent flow of vehicles entering and exiting the harbor, without delay caused by backup. It is also noted that there is sufficient storage along the access road to hold additional queues, if needed. There is also adequate space for trucks to make the U-turn in the staging area, which was necessary per old internal circulation patterns.

III. NEAR-TERM (2015) CONDITIONS

Probable action within the harbor in the near to mid-term (see Figure 5) include elements such as a new comfort station, relocated HDOT harbor permanent office, pier extension and dredging, grading of Coral Flats, and construction of security fencing.

Hawai'i Department of Transportation (HDOT) is studying improvements to the roadway system in the region. One project likely to be initiated by the end of 2012 separates the Queen Ka'ahumanu Road approach to the intersection with Kawaihae Road into separate dedicated right and left turn lanes. Also included in this project is the addition of a dedicated right turn lane for the north leg of Kawaihae Road as well as an acceleration lane for vehicles making a left turn from Queen Ka'ahumanu Highway. Related improvements in the area will be installation of new guardrail, signs, and pavement markings (including new painted islands).

Near-Term improvements were evaluated for five years from the Existing (2010) analysis. Based on the probable expansion of the harbor and the regional growth in the area, traffic volumes at the study intersections were projected to 2015 to determine operations and necessary mitigation to improve the existing roadway configuration and harbor circulation. For the Near-Term (2015) it is recommended to provide left turn lanes along Kawaihae Road at both entrances to minimize traffic congestion from queuing heavy vehicles. Recommended lane configurations at each study intersection, including anticipated improvements from HDOT projects, are provided in Figure 6.

A. Traffic Volumes

1. Background Growth

The Department of Hawaiian Homelands (DHHL) *Kawaihae Regional Plan* (DHHL, September 2010) provides an overview of the proposed Kawaihae Master Plan. This addresses the development of the 2,115 acre DHHL property mauka of Kawaihae Road and Akoni Pule Highway over a 20-year period in four 5-year phases from 2009-2029. Residential, commercial, industrial and community subdivisions are anticipated in the expansion of this area. However, at the time of this report it was noted that the DHHL Kawaihae Master Plan cannot be implemented until Kawaihae Road Bypass is constructed and an additional water supply source is provided. Due to these uncertainties, the growth from the development of the Kawaihae area was not included in the analysis of this report.

The *South Kohala Regional Traffic Forecasts* (Ng, 2002), prepared for HDOT Highways Division, projects an annual traffic growth of 2.88% for the South Kohala region through 2025. Comparing 2010 collected 24-hour hose counts and 1994 historical data taken from the HDOT Traffic Counts along Kawaihae Road, a cumulative growth increase of 2.2% per year over the 16-year period was calculated. However, using HDOT data from 2000, a cumulative growth rate of 0.6% per year was calculated for the most recent 10-year period. The *Kawaihae Road Bypass TIS* utilized a background growth of approximately 3%. It also projected traffic volumes in the area with the continued operation of the Hawai'i Superferry which effects results. To account for future growth along the adjacent roadways, the growth rate of 2.88%, as noted in the regional forecast, was deemed appropriate and applied to traffic traveling through along Kawaihae Road and Akoni Pule Highway.

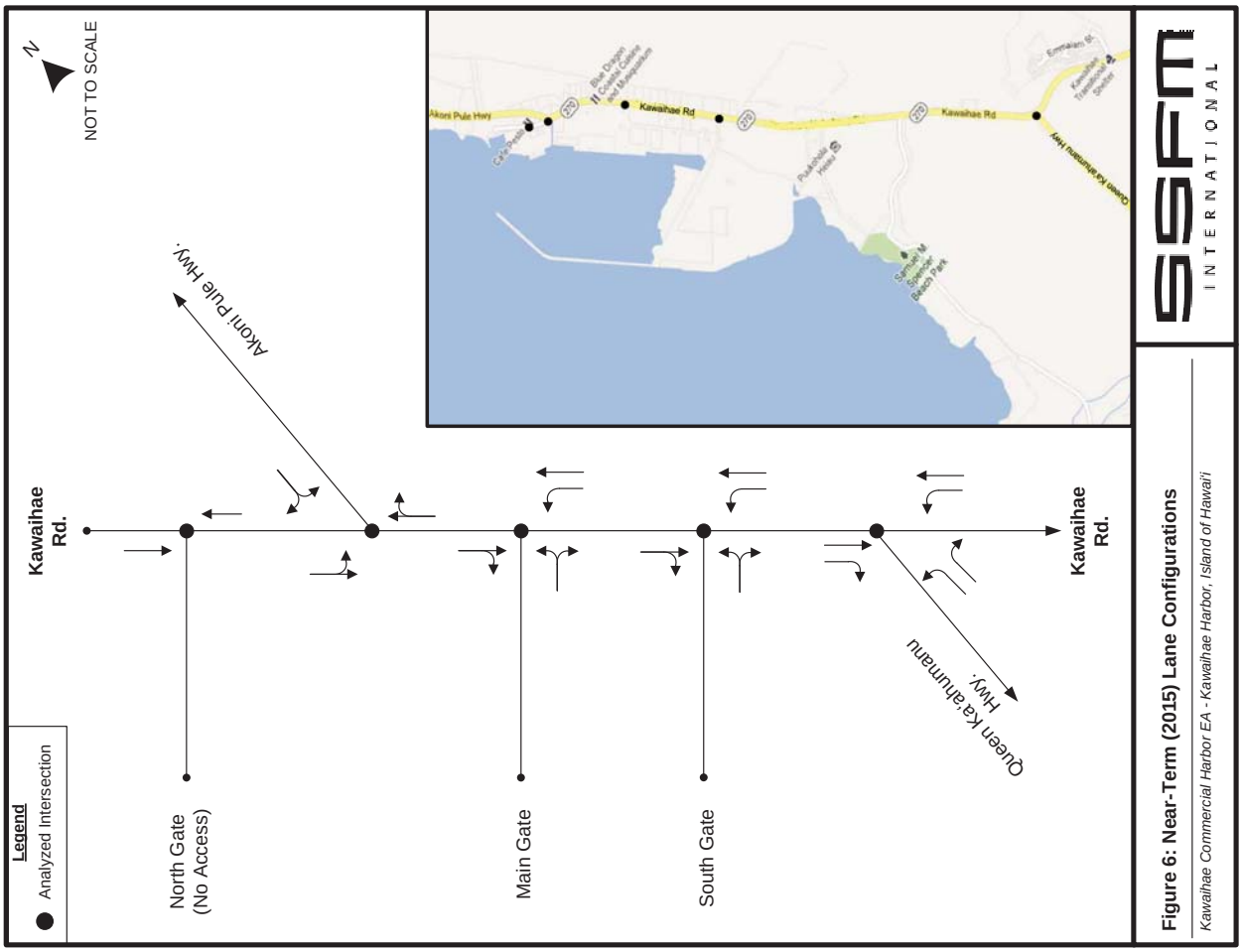

Figure 6: Near-Term (2015) Lane Configurations

Kawaihae Commercial Harbor EA - Kawaihae Harbor, Island of Hawai'i

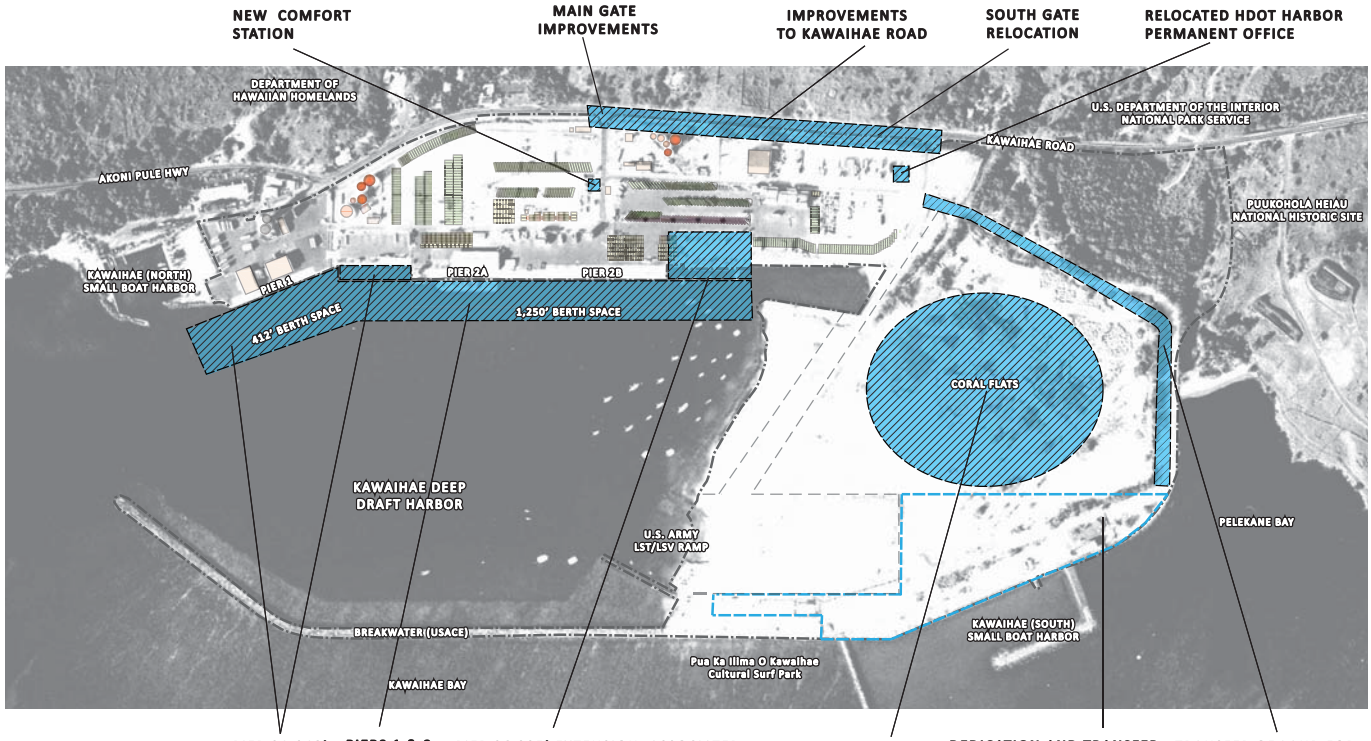

Figure 5: Conceptual Kawaihae Harbor Improvements

Kawaihae Commercial Harbor EA, Kawaihae Harbor, Island of Hawai'i

PREPARED FOR: STATE DEPT. OF TRANSPORTATION HARBORS DIVISION

PREPARED BY: SSFM INTERNATIONAL

2. Project Related Growth

The *Hawai'i Commercial Harbors Cargo and Passenger Forecast* (Moffat & Nichol, 2009) report analyzed three different forecast scenarios for future container volumes: High Case, Base Case and Low Case. For the High Case scenario, container volumes were forecast to increase 4.3% per year through 2015. The increase in imported freight directly correlates with an increase in the traffic entering and exiting the harbor facilities. The resulting project related trip generated traffic (see Table 6 and Figure 7) was distributed using existing travel patterns which corresponds with existing heavy vehicle percentage and feedback received from the truckers currently accessing the harbor.

Table 6: Near-Term (2015) Project Related Volumes

Movement	Total Existing		Growth	Project Related Near-Term	
	AM	PM		AM	PM
Ingress	49	13	4.3%	11	3
Egress	15	36	4.3%	3	8

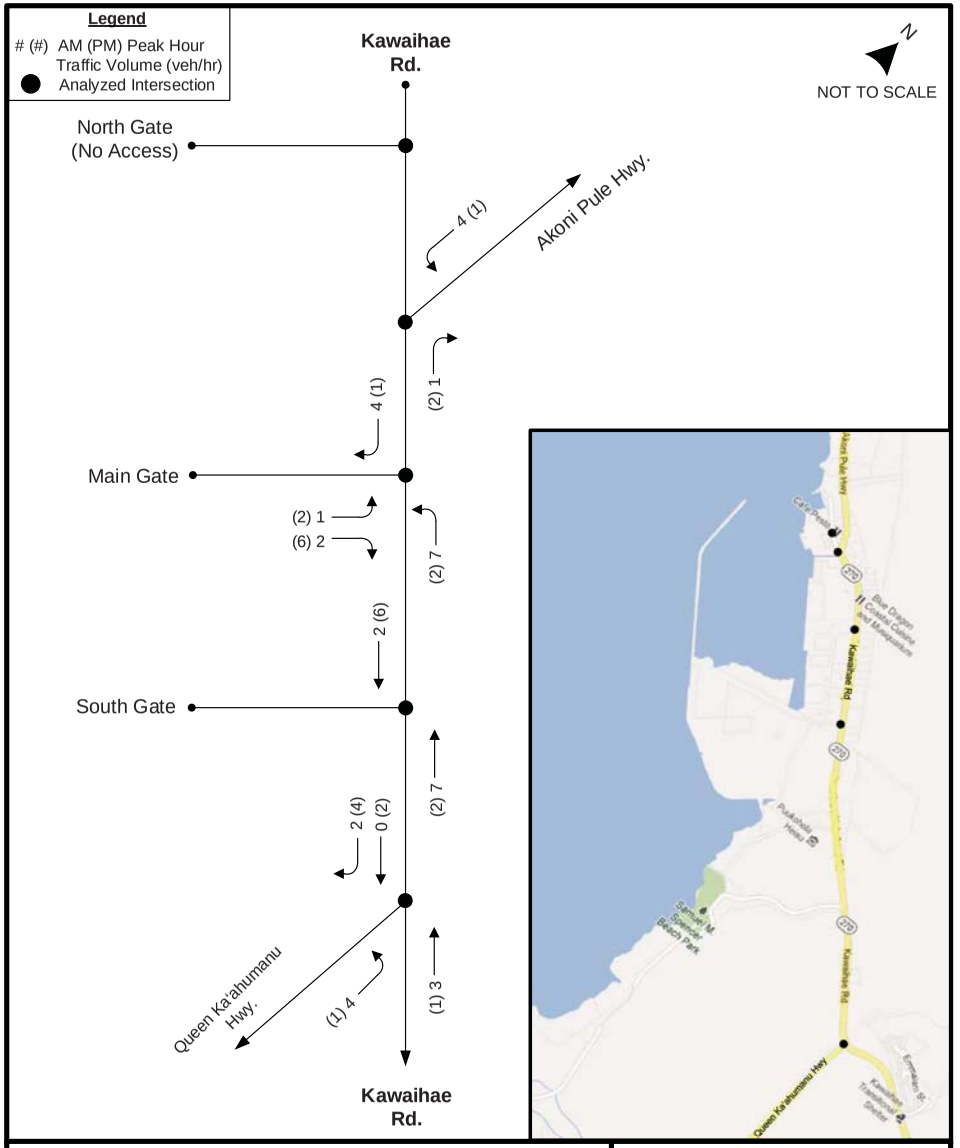

Figure 7: Near-Term (2015) Project Related Volumes

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3. Peak Hour Volumes

Figure 8 and Table 7 show resulting AM and PM peak hour volumes considering inclusion of 2.88% background and 4.3% project related growth for Near-Term (2015) conditions.

Table 7: Near-Term (2015) Peak Hour Volumes

Unsignalized Intersection	Approach	Movement	Peak Hour Volumes	
			AM	PM
Kawaihae Road and Akoni Pule Highway	Northbound	Thru	30	50
		Right	150	340
	Southbound	Left	20	20
		Thru	35	30
	Westbound	Left	285	240
		Right	10	20
Kawaihae Road and Main Gate access	Northbound	Left	40	15
		Thru	190	370
	Southbound	Thru	285	280
		Right	25	5
	Eastbound	Left	10	10
		Right	15	35
Kawaihae Road and South Gate access	Northbound	Left	5	5
		Thru	225	375
	Southbound	Thru	295	315
		Right	5	5
	Eastbound	Left	5	5
		Right	5	5
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound	Left	105	260
		Right	80	325
	Eastbound	Thru	75	120
		Right	255	220
	Westbound	Left	340	195
		Thru	85	100

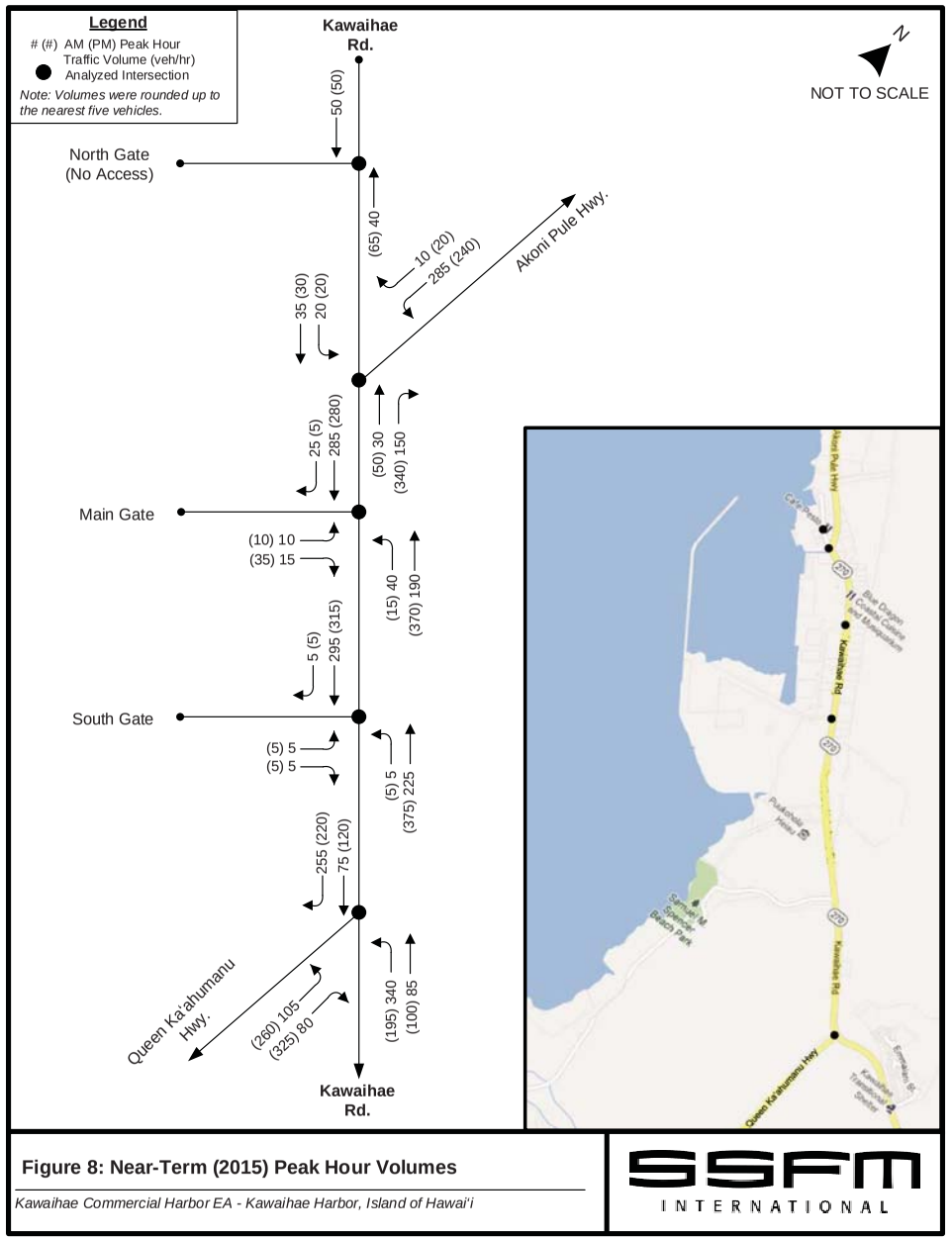

Figure 8: Near-Term (2015) Peak Hour Volumes

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4. 24-Hour Volumes

Table 8 shows the projected Near-Term (2015) average daily traffic (ADT) which was calculated by applying the K-factor (percent of peak hour volume to ADT) from Existing (2010) conditions to the Near-Term (2015) peak hour volumes in Table 7.

Table 8: Near-Term (2015) ADT

Road Segment	NB	SB
Akoni Pule Highway	3,700	2,710
Kawaihae Road	4,520	3,690

5. Heavy Vehicle Percent Traffic

Heavy vehicle percent was projected to remain 11% for Near-Term (2015) conditions throughout the day with peak hour percent reflective of values in Table 3.

6. Non-motorized Traffic

With the addition of turn lanes along Kawaihae Road, pedestrian and bike facilities will become more necessary.

B. Level of Service

1. Intersection Level of Service

Full build out of Coral Flats will likely not be completed by 2015 but to account for "double barge" and other high volume days that will utilize South Gate, traffic volume was accounted for entering and exiting the harbor at this access. LOS for No-Action Near-Term (2015) conditions, reflecting no addition of project related traffic or inclusion of turn lanes at the entrances to the harbor, are shown in Table 9. Intersection changes as a result of HDOT's project at Kawaihae Road and Queen Ka'ahumanu Highway will be considered for this analysis.

Table 9: No-Action Near-Term (2015) Level of Service

Unsignalized Intersection	Approach-Movement	AM			PM		
		LOS	v/c	Delay	LOS	v/c	Delay
Kawaihae Road and Akoni Pule Highway	Southbound Left	A	0.02	7.7	A	0.02	8.3
	Westbound Left	B	0.43	13.3	B	0.44	14.7
Kawaihae Road and Main Gate access	Northbound Left	A	0.03	8.8	A	0.01	8.5
	Eastbound Left	B	0.05	13.5	B	0.07	11.9
Kawaihae Road and South Gate access	Northbound Left	A	0.01	8.6	A	0.00	8.6
	Eastbound Left	B	0.03	13.7	B	0.02	13.2
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound Left	F	1.32	260.9	F	0.87	58.7
	Northbound Right	A	0.13	9.3	B	0.40	11.6
	Westbound Left	B	0.42	10.4	A	0.19	8.8

With the minimal additional vehicular volume resulting from growth anticipated in the region and at the harbor, the majority of study intersections are still expected to operate at appropriate LOS for Near-Term (2015) conditions as shown in Table 10. Despite the addition of dedicated turn lanes, conditions at the unsignalized intersection of Kawaihae Road and Queen Ka'ahumanu Highway remain poor. Even

though the results do not reflect LOS improvements, inclusion of the "refuge" area for left turning vehicles from Queen Ka'ahumanu Highway should improve operations in the field. Other potential mitigation options are to provide an all-way stop, which would increase delay along Kawaihae Road, or signalizing the intersection, which would be costly. Analysis reports for No-Action Near-Term (2015) and Near-Term (2015) conditions are in Appendix D.

Table 10: Near-Term (2015) Level of Service

Unsignalized Intersection	Approach-Movement	AM			PM		
		LOS	v/c	Delay	LOS	v/c	Delay
Kawaihae Road and Akoni Pule Highway	Southbound Left	A	0.02	7.7	A	0.02	8.3
	Westbound Left	B	0.45	13.7	C	0.45	15.1
Kawaihae Road and Main Gate access	Northbound Left	A	0.04	8.8	A	0.02	8.6
	Eastbound Left	B	0.09	14.5	B	0.09	12.4
Kawaihae Road and South Gate access	Northbound Left	A	0.01	8.7	A	0.01	8.7
	Eastbound Left	B	0.03	13.9	B	0.02	13.3
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound Left	F	1.46	314.7	F	0.90	64.6
	Northbound Right	A	0.13	9.3	B	0.41	11.8
	Westbound Left	B	0.43	10.4	A	0.19	8.9

2. Traffic Signal Warrant

Due to the poor LOS for the northbound left movement at Kawaihae Road and Queen Ka'ahumanu Road, the Peak Hour signal warrant was used for analysis of Near-Term (2015) conditions. This included addition of dedicated turn lanes at the intersection which still resulting in passing for the PM peak hour. Appendix C provides the detailed traffic signal warrant analysis.

3. Roadway Level of Service

The roadway is expected to continue operating at an appropriate LOS B for No-Action Near-Term (2015) and Near-Term (2015) conditions.

C. Intersection Treatments

Turn lane storage pockets are recommended at both Main Gate and South Gate access.

1. Methodology

The desirable length of the turn lanes at the entrances were calculated based upon *AASHTO's A Policy on Geometric Design of Highways and Streets* (AASHTO, 2004) stopping sight distance's guidelines and minimum storage length recommended by the *Hawai'i Statewide Uniform Design Manual for Streets and Highways (HUDM)* (HDOT, 1980). The turn lane taper length is also based on direction in the *HUDM*.

The design stopping distance is the necessary distance needed for a vehicle travelling at the design speed to safely come to a stop. As provided in *AASHTO*, the stopping sight distance for brake reaction and comfortable deceleration to a stop, from the roadway design speed of 45 mph, is 360 feet.

HUDM states that at unsignalized intersections, the storage length is based on the number of turning vehicles likely to arrive in an average two minute period within the peak hour. Also noted in the *HUDM*, at a minimum requirement, space for at least two passenger cars should be provided. When truck traffic

is over 10% a minimum storage length should be provided to include space for one passenger car and one truck. For peak conditions, the number of vehicles to arrive in an average two minute period along Kawaihae Road is equal to one vehicle resulting in minimum space for at least two vehicles to be provided. With truck traffic over 10% and the assumption that passenger and heavy vehicles are 25 and 70 feet long respectively, a storage length of 95 feet is desired.

Based on the *HUDM*, taper length for turn lanes on roadways with design speeds greater than 35 mph should be 15 times greater than the width of the lane. With 12-foot wide turn lanes and the roadways having a design speed of 45 mph, a 180 foot taper length is needed.

2. Desired Length and Location

By including the deceleration length in the taper length, total deceleration and storage (275 feet) plus taper length (180 feet) is equal to 455 feet, as shown in Table 11.

Table 11: Turn Lane Length

Roadway	Taper (ft)	Minimum Left Turn Decel. and Storage (ft)	Total Turn Lane Length (ft)
Kawaihae Road	180	275	455

At its current location, approximately 250 feet north of the Makahuna Gulch bridge crossing, the section of Kawaihae Road in advance of the South Gate is shorter than the necessary turn lane requirements. Therefore it is suggested to relocate the location where the South Gate access intersects with Kawaihae Road so as to account for a full 275-foot storage and 180-foot taper lane. With this relocation, the gate entrance would need to tie back in with the access road. Sufficient roadway exists to provide for the full storage and taper at the Main Gate and therefore should be included with the Main Gate access remaining in its current location.

An analysis was performed using *AutoTurn*, a vehicle swept path turn simulation software, to ensure there is adequate turning space for the design vehicle (WB-50 semi-trailer truck) to enter and exit the harbor facilities with the suggested improvements at Main Gate and South Gate. Appendix E includes the turning maneuvers of the design vehicle entering and exiting the harbor facilities. At both entrances, no problems are anticipated as it utilizes all of the turn lane road width as well as the shoulder.

IV. MID-TERM (2025) CONDITIONS

Mid-Term improvements were considered for 2025, 15 years from Existing (2010) conditions. Lane configurations at each study intersection for the Mid-Term (2025) conditions are as shown for Near-Term (2015) conditions.

A. Traffic Volumes

1. Background Growth

The anticipated regional annual growth of 2.88% was applied to traffic traveling through along Kawaihae Road and Akoni Pule Highway.

2. Project Related Growth

Container volumes were forecast to increase 5.0% per year between 2015 and 2025, as projected in the High Case scenario of the *Hawai'i Commercial Harbors Cargo and Passenger Forecast* (Moffatt & Nichol, 2009) report, and therefore applied to traffic volumes entering and exiting the harbor facilities at the Main Gate access. The resulting project related trip generated traffic (see Table 12) was distributed using existing travel patterns as shown in Figure 9.

Table 12: Mid-Term (2025) Project Related Volumes

Movement	Total Near-Term		Growth	Project Related Mid-Term	
	AM	PM		AM	PM
Ingress	60	16	5.0%	38	10
Egress	18	44	5.0%	11	28

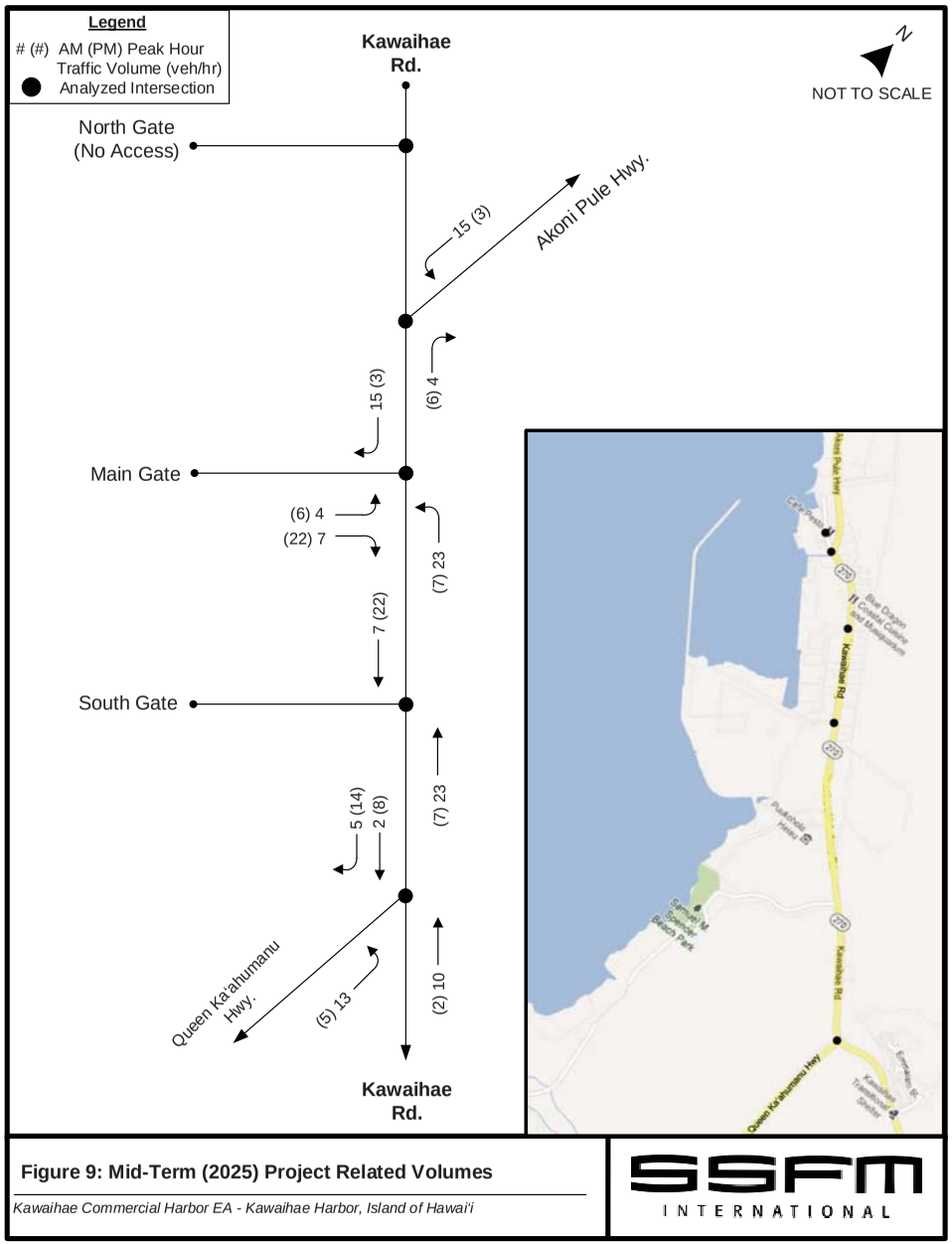

Figure 9: Mid-Term (2025) Project Related Volumes

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3. Peak Hour Volumes

Projected Mid-Term (2025) peak hour volumes are shown in Table 13 and Figure 10.

Table 13: Mid-Term (2025) Peak Hour Volumes

Unsignalized Intersection	Approach	Movement	Peak Hour Volumes	
			AM	PM
Kawaihae Road and Akoni Pule Highway	Northbound	Thru	30	50
		Right	205	455
	Southbound	Left	20	20
		Thru	35	30
	Westbound	Left	395	325
		Right	10	20
Kawaihae Road and Main Gate access	Northbound	Left	60	20
		Thru	250	490
	Southbound	Thru	380	370
		Right	40	10
	Eastbound	Left	10	15
		Right	20	60
Kawaihae Road and South Gate access	Northbound	Left	5	5
		Thru	315	505
	Southbound	Thru	395	435
		Right	5	5
	Eastbound	Left	5	5
		Right	5	5
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound	Left	150	350
		Right	105	430
	Eastbound	Thru	100	165
		Right	345	300
	Westbound	Left	455	260
		Thru	120	135

4. 24-Hour Volumes

Projected Mid-Term (2025) average daily traffic (ADT) are shown in Table 14.

Table 14: Mid-Term (2025) ADT

Kawaihae Road Segment	NB	SB
Akoni Pule Highway	4,840	3,540
Kawaihae Road	6,070	5,120

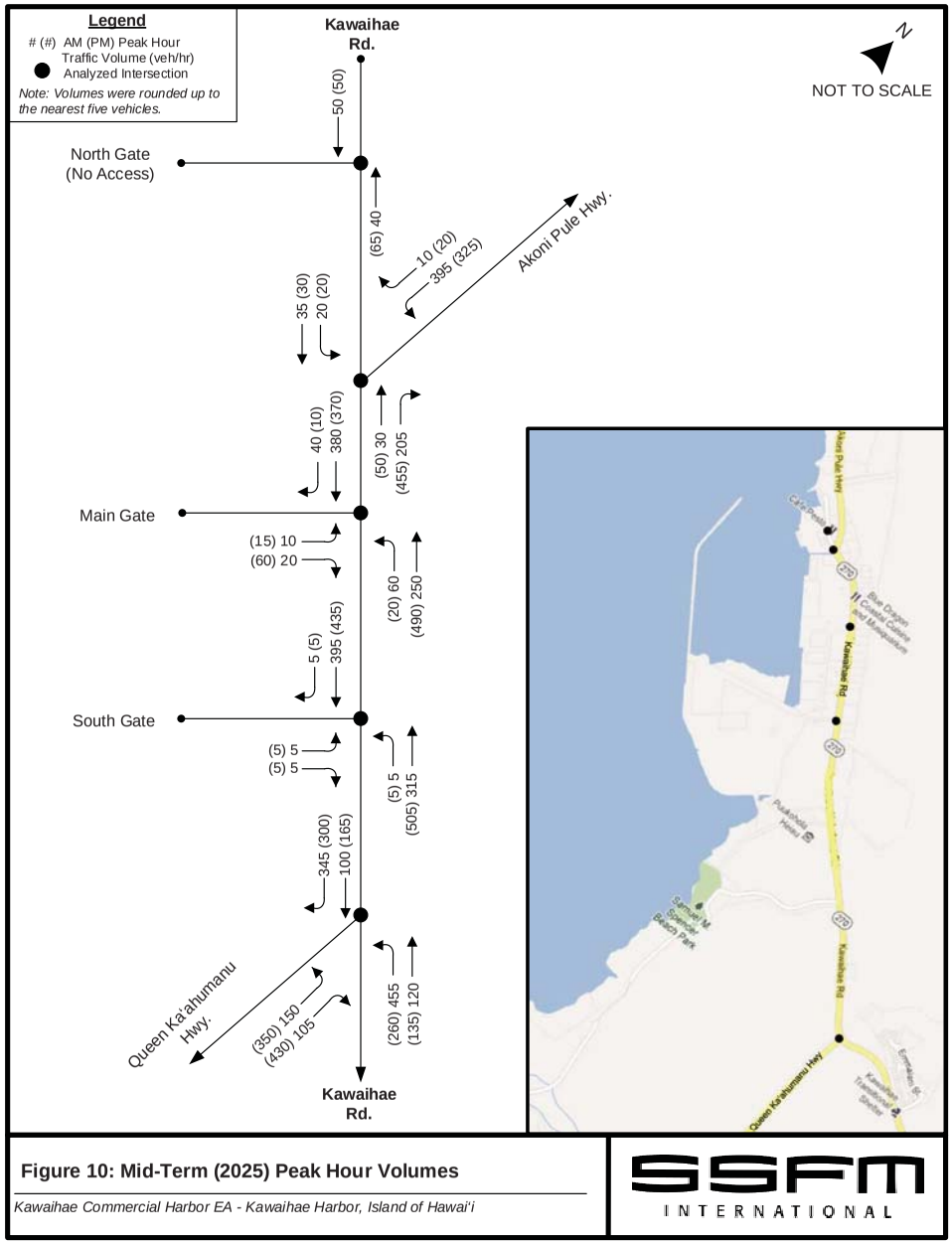

Figure 10: Mid-Term (2025) Peak Hour Volumes

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5. Heav Vehicle Percent Tra c

Heavy vehicle percent was projected to remain similar to E isting (2010) conditions at 11 for Mid-Term (2025) conditions throughout the day with peak hour percent reflective of values in Table 3.

B. evel o Service

1. Intersection evel o Service

L S for No-Action Mid-Term (2025) conditions are shown in Table 15.

Table 15: No-Action Mid-Term (2025) evel o Service

Unsignalized Intersection	Approach-Movement	AM			PM		
		S	v c	Dela	S	v c	Dela
Kawaihae Road and Akoni Pule Highway	Southbound Left	A	0.02	7.8	A	0.02	8.7
	Westbound Left		0.60	16.9		0.63	20.7
Kawaihae Road and Main Gate access	Northbound Left	A	0.03	9.2	A	0.01	8.9
	Eastbound Left		0.06	15.6		0.08	13.6
Kawaihae Road and South Gate access	Northbound Left	A	0.01	9.0	A	0.01	9.0
	Eastbound Left		0.04	16.2		0.03	15.9
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound Left	F	4.73	1862	F	1.79	412.1
	Northbound Right	A	0.18	9.7		0.56	14.6
	Westbound Left		0.63	14.2	A	0.28	9.8

With the addition of project related traffic and inclusion of turn lanes at the entrances to the harbor, as proposed in Near-Term (2015) conditions, Mid-Term (2025) L S at the study intersections are e pected to remain appropriate at the majority of intersections as shown in Table 16. onditions at the unsignali ed intersection of Kawaihae Road and Queen Ka'ahumanu Road remain poor. Appendi F provides analysis reports for No-Action Mid-Term (2025) and Mid-Term (2025) conditions.

Table 1 : Mid-Term (2025) evel o Service

Unsignalized Intersection	Approach-Movement	AM			PM		
		S	v c	Dela	S	v c	Dela
Kawaihae Road and Akoni Pule Highway	Southbound Left	A	0.02	7.9	A	0.02	8.7
	Westbound Left		0.64	18.7		0.66	22.2
Kawaihae Road and Main Gate access	Northbound Left	A	0.07	9.5	A	0.02	9.0
	Eastbound Left		0.14	17.7		0.19	15.0
Kawaihae Road and South Gate access	Northbound Left	A	0.01	9.1	A	0.01	9.2
	Eastbound Left		0.04	16.7		0.03	16.6
Kawaihae Road and Queen Ka'ahumanu Highway	Northbound Left	F	5.88	2389	F	1.93	473.5
	Northbound Right	A	0.18	9.8		0.58	15.1
	Westbound Left		0.64	14.5		0.29	10.0

2. Tra c Signal arrant

For Mid-Term (2025) conditions, the Peak Hour signal warrant passed for the AM and PM peak hours. Detailed traffic signal warrant analysis is provided in Appendi .

3. Roadway Level of Service

Even with the addition of project related traffic, the roadway is also expected to continue operating at an appropriate LOS .

. Intersection Treatments

Storage and turn lane lengths calculated for Near-Term (2015) volumes remain applicable for Mid-Term (2025) with sufficient distance to contain the number of turning vehicles likely to arrive in an average two minute period within the peak hour.

V. SUMMARY

For the Near-Term (2015) conditions it is recommended to relocate the South Gate access further north to provide sufficient left-turn lane storage and taper needs along Kawaihae Road. Main Gate access shall remain in its existing location with a left-turn lane provided along Kawaihae Road. It is suggested to maintain internal circulation as it currently operates with minor changes as deemed necessary. Conditions in the Mid-Term (2025) shall remain appropriate and left-turn lane storage distances sufficient at the gate entrances with the increase in traffic.

VI. REFERENCES

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APPENDIX A

Manual Peak Hour and 24-Hour Traffic Counts

SSFM International

501 Sumner Street, Suite 620
Honolulu, HI 96817

File Name : 100525 Akoni_Kawaihae PM
Site Code : 00005678
Start Date : 5/25/2010
Page No : 1

Groups Printed- Passenger - Lg container trucks - Other HV

	Kawaihae Rd Southbound					Akoni Pule Hwy Westbound					Kawaihae Rd Northbound					Eastbound	
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Int. Total
03:15 PM	9	9	0	0	18	45	0	3	0	48	0	14	71	0	85	0	151
03:30 PM	3	6	0	0	9	57	0	3	0	60	0	6	70	0	76	0	145
03:45 PM	5	5	0	0	10	56	0	5	0	61	0	13	77	0	90	0	161
Total	17	20	0	0	37	158	0	11	0	169	0	33	218	0	251	0	457
04:00 PM	4	11	0	0	15	58	0	5	0	63	0	13	58	0	71	0	149
04:15 PM	6	8	0	0	14	37	0	5	0	42	0	14	86	0	100	0	156
04:30 PM	5	10	0	0	15	30	0	7	0	37	0	26	50	0	76	0	128
04:45 PM	0	6	0	0	6	31	0	2	0	33	0	15	54	0	69	0	108
Total	15	35	0	0	50	156	0	19	0	175	0	68	248	0	316	0	541
05:00 PM	6	12	0	0	18	49	0	3	0	52	0	5	58	0	63	0	133
05:15 PM	2	9	0	0	11	24	0	3	0	27	0	8	59	0	67	0	105
Grand Total	40	76	0	0	116	387	0	36	0	423	0	114	583	0	697	0	1236
Apprch %	34.5	65.5	0	0		91.5	0	8.5	0		0	16.4	83.6	0			
Total %	3.2	6.1	0	0	9.4	31.3	0	2.9	0	34.2	0	9.2	47.2	0	56.4	0	
Passenger	40	76	0	0	116	378	0	36	0	414	0	114	572	0	686	0	1216
% Passenger	100	100	0	0	100	97.7	0	100	0	97.9	0	100	98.1	0	98.4	0	98.4
Lg container trucks	0	0	0	0	0	3	0	0	0	3	0	0	7	0	7	0	10
% Lg container trucks	0	0	0	0	0	0.8	0	0	0	0.7	0	0	1.2	0	1	0	0.8
Other HV	0	0	0	0	0	6	0	0	0	6	0	0	4	0	4	0	10
% Other HV	0	0	0	0	0	1.6	0	0	0	1.4	0	0	0.7	0	0.6	0	0.8

	Kawaihae Rd Southbound					Akoni Pule Hwy Westbound					Kawaihae Rd Northbound					Eastbound	
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Int. Total
Peak Hour Analysis From 03:15 PM to 05:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:30 PM																	
03:30 PM	3	6	0	0	9	57	0	3	0	60	0	6	70	0	76	0	145
03:45 PM	5	5	0	0	10	56	0	**5**	0	61	0	13	77	0	90	0	**161**
04:00 PM	4	**11**	0	0	**15**	**58**	0	5	0	**63**	0	13	58	0	71	0	149
04:15 PM	**6**	8	0	0	14	37	0	5	0	42	0	**14**	**86**	0	**100**	0	156
Total Volume	18	30	0	0	48	208	0	18	0	226	0	46	291	0	337	0	611
% App. Total	37.5	62.5	0	0		92	0	8	0		0	13.6	86.4	0			
PHF	.750	.682	.000	.000	.800	.897	.000	.900	.000	.897	.000	.821	.846	.000	.843	.000	.949

SSFM International

501 Sumner Street, Suite 620
Honolulu, HI 96817

File Name : 100525 Akoni_Kawaihae AM
Site Code : 00001234
Start Date : 5/25/2010
Page No : 1

Groups Printed- Passenger - Lg container trucks - Other HV

	Kawaihae Rd Southbound					Akoni Pule Hwy. Westbound					Kawaihae Rd Northbound					Eastbound	
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Int. Total
06:00 AM	4	6	0	0	10	45	0	1	1	47	0	2	28	0	30	0	87
06:15 AM	0	7	0	0	7	61	0	4	0	65	0	2	24	0	26	0	98
06:30 AM	1	2	0	0	3	58	0	0	0	58	0	3	26	0	29	0	90
06:45 AM	5	5	0	0	10	43	0	2	0	45	0	7	30	0	37	0	92
Total	10	20	0	0	30	207	0	7	1	215	0	14	108	0	122	0	367
07:00 AM	3	7	0	0	10	65	0	2	0	67	0	4	38	0	42	0	119
07:15 AM	5	14	0	0	19	70	0	2	0	72	0	10	33	0	43	0	134
07:30 AM	5	6	0	0	11	66	0	3	0	69	0	7	27	0	34	0	114
07:45 AM	1	6	0	0	7	27	0	1	0	28	0	3	20	0	23	0	58
Total	14	33	0	0	47	228	0	8	0	236	0	24	118	0	142	0	425
08:00 AM	1	7	0	0	8	55	0	1	0	56	0	4	22	0	26	0	90
08:15 AM	1	0	0	0	1	9	0	0	0	9	0	2	9	0	11	0	21
Grand Total	26	60	0	0	86	499	0	16	1	516	0	44	257	0	301	0	903
Apprch %	30.2	69.8	0	0		96.7	0	3.1	0.2		0	14.6	85.4	0			
Total %	2.9	6.6	0	0	9.5	55.3	0	1.8	0.1	57.1	0	4.9	28.5	0	33.3	0	
Passenger	25	59	0	0	84	471	0	16	1	488	0	43	241	0	284	0	856
% Passenger	96.2	98.3	0	0	97.7	94.4	0	100	100	94.6	0	97.7	93.8	0	94.4	0	94.8
Lg container trucks	0	1	0	0	1	13	0	0	0	13	0	1	7	0	8	0	22
% Lg container trucks	0	1.7	0	0	1.2	2.6	0	0	0	2.5	0	2.3	2.7	0	2.7	0	2.4
Other HV	1	0	0	0	1	15	0	0	0	15	0	0	9	0	9	0	25
% Other HV	3.8	0	0	0	1.2	3	0	0	0	2.9	0	0	3.5	0	3	0	2.8

	Kawaihae Rd Southbound					Akoni Pule Hwy. Westbound					Kawaihae Rd Northbound					Eastbound	
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:15 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 06:45 AM																	
06:45 AM	**5**	5	0	0	10	43	0	2	0	45	0	7	30	0	37	0	92
07:00 AM	3	7	0	0	10	65	0	2	0	67	0	4	**38**	0	42	0	119
07:15 AM	5	**14**	0	0	**19**	**70**	0	2	0	**72**	0	**10**	33	0	**43**	0	**134**
07:30 AM	5	6	0	0	11	66	0	**3**	0	69	0	7	27	0	34	0	114
Total Volume	18	32	0	0	50	244	0	9	0	253	0	28	128	0	156	0	459
% App. Total	36	64	0	0		96.4	0	3.6	0		0	17.9	82.1	0			
PHF	.900	.571	.000	.000	.658	.871	.000	.750	.000	.878	.000	.700	.842	.000	.907	.000	.856

SSFM International

501 Sumner Street, Suite 620
Honolulu, HI 96817

File Name : 100525 Kawaihae_Main Gate PM
Site Code : 00003434
Start Date : 5/25/2010
Page No : 1

Groups Printed- Passenger - Lg Container trucks - Other HV

	Kawaihae Rd. Southbound					Westbound	Kawaihae Rd. Northbound					Main Gate Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
03:15 PM	0	47	3	0	50	0	5	82	0	0	87	2	0	7	0	9	146
03:30 PM	0	61	0	0	61	0	2	72	0	0	74	2	0	7	0	9	144
03:45 PM	0	63	0	0	63	0	2	91	0	0	93	2	0	8	0	10	166
Total	0	171	3	0	174	0	9	245	0	0	254	6	0	22	0	28	456
04:00 PM	0	70	1	0	71	0	0	75	0	0	75	1	0	7	0	8	154
04:15 PM	0	43	3	0	46	0	3	89	0	0	92	3	0	1	0	4	142
04:30 PM	0	37	1	0	38	0	1	75	0	0	76	2	0	6	0	8	122
04:45 PM	0	44	0	0	44	0	2	75	0	0	77	2	0	9	0	11	132
Total	0	194	5	0	199	0	6	314	0	0	320	8	0	23	0	31	550
05:00 PM	0	51	1	0	52	0	1	64	0	0	65	1	0	1	0	2	119
05:15 PM	0	37	1	0	38	0	2	67	0	0	69	1	0	4	0	5	112
Grand Total	0	453	10	0	463	0	18	690	0	0	708	16	0	50	0	66	1237
Apprch %	0	97.8	2.2	0			2.5	97.5	0	0		24.2	0	75.8	0		
Total %	0	36.6	0.8	0	37.4	0	1.5	55.8	0	0	57.2	1.3	0	4	0	5.3	
Passenger	0	439	10	0	449	0	10	669	0	0	679	16	0	34	0	50	1178
% Passenger	0	96.9	100	0	97	0	55.6	97	0	0	95.9	100	0	68	0	75.8	95.2
Lg Container trucks	0	5	0	0	5	0	8	11	0	0	19	0	0	13	0	13	37
% Lg Container trucks	0	1.1	0	0	1.1	0	44.4	1.6	0	0	2.7	0	0	26	0	19.7	3
Other HV	0	9	0	0	9	0	0	10	0	0	10	0	0	3	0	3	22
% Other HV	0	2	0	0	1.9	0	0	1.4	0	0	1.4	0	0	6	0	4.5	1.8

	Kawaihae Rd. Southbound					Westbound	Kawaihae Rd. Northbound					Main Gate Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:15 PM to 05:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:15 PM																	
03:15 PM	0	47	**3**	0	50	0	**5**	82	0	0	87	**2**	0	7	0	9	146
03:30 PM	0	61	0	0	61	0	2	72	0	0	74	2	0	7	0	9	144
03:45 PM	0	63	0	0	63	0	2	**91**	0	0	**93**	2	0	**8**	0	**10**	**166**
04:00 PM	0	**70**	1	0	**71**	0	0	75	0	0	75	1	0	7	0	8	154
Total Volume	0	241	4	0	245	0	9	320	0	0	329	7	0	29	0	36	610
% App. Total	0	98.4	1.6	0			2.7	97.3	0	0		19.4	0	80.6	0		
PHF	.000	.861	.333	.000	.863	.000	.450	.879	.000	.000	.884	.875	.000	.906	.000	.900	.919

SSFM International

501 Sumner Street, Suite 620
Honolulu, HI 96817

File Name : 100525 Kawaihae_Main Gate AM
Site Code : 00001212
Start Date : 5/25/2010
Page No : 1

Groups Printed- Passenger - Lg Container Trucks - Other HV

	Kawaihae Rd. Southbound					Westbound	Kawaihae Rd. Northbound					Main Gate Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:00 AM	0	53	3	0	56	0	3	29	0	0	32	0	0	0	0	0	88
06:15 AM	0	64	2	0	66	0	0	31	0	0	31	1	0	6	0	7	104
06:30 AM	0	55	2	0	57	0	2	28	0	0	30	3	0	0	0	3	90
06:45 AM	0	53	4	0	57	0	7	37	0	0	44	0	0	1	0	1	102
Total	0	225	11	0	236	0	12	125	0	0	137	4	0	7	0	11	384
07:00 AM	0	60	7	0	67	0	5	38	0	0	43	2	0	2	0	4	114
07:15 AM	0	78	3	0	81	0	10	39	0	0	49	1	0	0	0	1	131
07:30 AM	0	65	5	0	70	0	7	44	0	0	51	1	0	3	0	4	125
07:45 AM	0	44	5	0	49	0	7	41	0	0	48	1	0	5	0	6	103
Total	0	247	20	0	267	0	29	162	0	0	191	5	0	10	0	15	473
08:00 AM	0	53	0	0	53	0	8	28	0	0	36	3	0	8	0	11	100
Grand Total	0	525	31	0	556	0	49	315	0	0	364	12	0	25	0	37	957
Apprch %	0	94.4	5.6	0			13.5	86.5	0	0		32.4	0	67.6	0		
Total %	0	54.9	3.2	0	58.1	0	5.1	32.9	0	0	38	1.3	0	2.6	0	3.9	
Passenger	0	493	21	0	514	0	26	287	0	0	313	4	0	2	0	6	833
% Passenger	0	93.9	67.7	0	92.4	0	53.1	91.1	0	0	86	33.3	0	8	0	16.2	87
Lg Container Trucks	0	17	3	0	20	0	21	9	0	0	30	4	0	17	0	21	71
% Lg Container Trucks	0	3.2	9.7	0	3.6	0	42.9	2.9	0	0	8.2	33.3	0	68	0	56.8	7.4
Other HV	0	15	7	0	22	0	2	19	0	0	21	4	0	6	0	10	53
% Other HV	0	2.9	22.6	0	4	0	4.1	6	0	0	5.8	33.3	0	24	0	27	5.5

	Kawaihae Rd. Southbound					Westbound	Kawaihae Rd. Northbound					Main Gate Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 07:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	60	**7**	0	67	0	5	38	0	0	43	**2**	0	2	0	4	114
07:15 AM	0	**78**	3	0	**81**	0	**10**	39	0	0	49	1	0	0	0	1	**131**
07:30 AM	0	65	5	0	70	0	7	**44**	0	0	**51**	1	0	3	0	4	125
07:45 AM	0	44	5	0	49	0	7	41	0	0	48	1	0	**5**	0	**6**	103
Total Volume	0	247	20	0	267	0	29	162	0	0	191	5	0	10	0	15	473
% App. Total	0	92.5	7.5	0			15.2	84.8	0	0		33.3	0	66.7	0		
PHF	.000	.792	.714	.000	.824	.000	.725	.920	.000	.000	.936	.625	.000	.500	.000	.625	.903

SSFM International, Inc.

501 Sumner Street, Suite 620
Honolulu, Hawaii 96817
(808) 531-1308

Akoni Pule Hwy
North of Kawaihae Harbor
Latitude: 20' 2.370 North
Longitude: 155' 49.800 West

Start Time	24-May-1 Mon	SB		NB		Combined		25-May Tue	SB		NB		Combined	
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00		*	*	*	*	*	*		4	51	0	43	4	94
12:15		*	*	*	*	*	*		6	52	3	30	9	82
12:30		*	*	*	*	*	*		3	50	1	34	4	84
12:45		*	*	*	*	*	*		6	35	3	46	9	81
01:00		*	*	*	*	*	*		2	51	1	41	3	92
01:15		*	*	*	*	*	*		2	56	0	43	2	99
01:30		*	*	*	*	*	*		2	47	0	39	2	86
01:45		*	*	*	*	*	*		4	42	1	44	5	86
02:00		*	*	*	*	*	*		3	59	2	54	5	113
02:15		*	*	*	*	*	*		2	54	2	49	4	103
02:30		*	*	*	*	*	*		0	63	0	48	0	111
02:45		*	*	*	*	*	*		0	56	3	50	3	106
03:00		*	48	*	31	*	79		1	44	4	48	5	92
03:15		*	60	*	***53***	*	***113***		0	68	9	41	9	109
03:30		*	***73***	*	***56***	*	***129***		1	***69***	5	***58***	6	***127***
03:45		*	***54***	*	***50***	*	***104***		1	***67***	4	***55***	5	***122***
04:00		*	***75***	*	***52***	*	***127***		0	***64***	9	***68***	9	***132***
04:15		*	***74***	*	39	*	113		2	***90***	21	***47***	23	***137***
04:30		*	62	*	51	*	113		1	58	22	42	23	100
04:45		*	57	*	40	*	97		3	57	19	30	22	87
05:00		*	59	*	35	*	94		5	61	40	48	45	109
05:15		*	49	*	34	*	83		5	55	39	32	44	87
05:30		*	44	*	29	*	73		5	43	38	30	43	73
05:45		*	45	*	24	*	69		19	57	36	25	55	82
06:00		*	42	*	18	*	60		31	30	50	33	81	63
06:15		*	38	*	20	*	58		26	51	58	22	84	73
06:30		*	38	*	15	*	53		22	41	60	19	82	60
06:45		*	40	*	25	*	65		23	38	***52***	19	75	57
07:00		*	25	*	12	*	37		40	33	***74***	14	***114***	47
07:15		*	31	*	14	*	45		40	33	***71***	15	***111***	48
07:30		*	21	*	15	*	36		30	20	***66***	12	***96***	32
07:45		*	24	*	12	*	36		33	31	43	9	***76***	40
08:00		*	24	*	8	*	32		24	24	64	12	88	36
08:15		*	30	*	5	*	35		27	20	49	12	76	32
08:30		*	18	*	7	*	25		34	24	49	8	83	32
08:45		*	17	*	7	*	24		35	15	39	9	74	24
09:00		*	15	*	3	*	18		30	20	49	14	79	34
09:15		*	18	*	10	*	28		40	30	42	9	82	39
09:30		*	12	*	7	*	19		32	26	43	4	75	30
09:45		*	12	*	7	*	19		38	19	48	2	86	21
10:00		*	23	*	6	*	29		40	20	40	6	80	26
10:15		*	24	*	4	*	28		39	26	30	7	69	33
10:30		*	15	*	4	*	19		46	17	41	4	87	21
10:45		*	15	*	0	*	15		34	12	39	3	73	15
11:00		*	13	*	2	*	15		***41***	14	43	1	84	15
11:15		*	16	*	3	*	19		***43***	14	38	1	81	15
11:30		*	8	*	1	*	9		***41***	12	51	1	92	13
11:45		*	7	*	2	*	9		***44***	7	30	1	74	8
Total		0	1226	0	701	0	1927		910	1926	1431	1282	2341	3208
Day Total		1226		701		1927			2836		2713		5549	
% Total		0.0%	63.6%	0.0%	36.4%				16.4%	34.7%	25.8%	23.1%		
Peak			03:30		03:15		03:15		11:00	03:30	06:45	03:30	07:00	03:30
Vol.			276		211		473		169	290	263	228	397	518
P.H.F.			0.920		0.942		0.917		0.960	0.806	0.889	0.838	0.871	0.945

SSFM International, Inc.

501 Sumner Street, Suite 620
Honolulu, Hawaii 96817
(808) 531-1308

Akoni Pule Hwy
North of Kawaihae Harbor
Latitude: 20' 2.370 North
Longitude: 155' 49.800 West

Start Time	26-May-1 Wed	SB		NB		Combined		27-May Thu	SB		NB		Combined	
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00		5	*	1	*	6	*		*	*	*	*	*	*
12:15		1	*	1	*	2	*		*	*	*	*	*	*
12:30		6	*	3	*	9	*		*	*	*	*	*	*
12:45		3	*	2	*	5	*		*	*	*	*	*	*
01:00		5	*	1	*	6	*		*	*	*	*	*	*
01:15		2	*	2	*	4	*		*	*	*	*	*	*
01:30		0	*	0	*	0	*		*	*	*	*	*	*
01:45		3	*	0	*	3	*		*	*	*	*	*	*
02:00		2	*	2	*	4	*		*	*	*	*	*	*
02:15		3	*	2	*	5	*		*	*	*	*	*	*
02:30		4	*	2	*	6	*		*	*	*	*	*	*
02:45		1	*	2	*	3	*		*	*	*	*	*	*
03:00		1	*	6	*	7	*		*	*	*	*	*	*
03:15		1	*	8	*	9	*		*	*	*	*	*	*
03:30		1	*	6	*	7	*		*	*	*	*	*	*
03:45		1	*	5	*	6	*		*	*	*	*	*	*
04:00		1	*	9	*	10	*		*	*	*	*	*	*
04:15		2	*	16	*	18	*		*	*	*	*	*	*
04:30		0	*	22	*	22	*		*	*	*	*	*	*
04:45		3	*	24	*	27	*		*	*	*	*	*	*
05:00		4	*	28	*	32	*		*	*	*	*	*	*
05:15		5	*	29	*	34	*		*	*	*	*	*	*
05:30		9	*	31	*	40	*		*	*	*	*	*	*
05:45		12	*	52	*	64	*		*	*	*	*	*	*
06:00		39	*	48	*	87	*		*	*	*	*	*	*
06:15		22	*	61	*	83	*		*	*	*	*	*	*
06:30		25	*	43	*	68	*		*	*	*	*	*	*
06:45		28	*	49	*	77	*		*	*	*	*	*	*
07:00		26	*	***64***	*	***90***	*		*	*	*	*	*	*
07:15		32	*	***63***	*	***95***	*		*	*	*	*	*	*
07:30		32	*	***66***	*	***98***	*		*	*	*	*	*	*
07:45		***40***	*	***52***	*	***92***	*		*	*	*	*	*	*
08:00		***28***	*	58	*	86	*		*	*	*	*	*	*
08:15		***25***	*	42	*	67	*		*	*	*	*	*	*
08:30		***41***	*	50	*	91	*		*	*	*	*	*	*
08:45		31	*	52	*	83	*		*	*	*	*	*	*
09:00		17	*	17	*	34	*		*	*	*	*	*	*
09:15		*	*	*	*	*	*		*	*	*	*	*	*
09:30		*	*	*	*	*	*		*	*	*	*	*	*
09:45		*	*	*	*	*	*		*	*	*	*	*	*
10:00		*	*	*	*	*	*		*	*	*	*	*	*
10:15		*	*	*	*	*	*		*	*	*	*	*	*
10:30		*	*	*	*	*	*		*	*	*	*	*	*
10:45		*	*	*	*	*	*		*	*	*	*	*	*
11:00		*	*	*	*	*	*		*	*	*	*	*	*
11:15		*	*	*	*	*	*		*	*	*	*	*	*
11:30		*	*	*	*	*	*		*	*	*	*	*	*
11:45		*	*	*	*	*	*		*	*	*	*	*	*
Total		461	0	919	0	1380	0		0	0	0	0	0	0
Day Total		461		919		1380			0		0		0	
% Total		33.4%	0.0%	66.6%	0.0%				0.0%	0.0%	0.0%	0.0%		
Peak		07:45		07:00		07:00								
Vol.		134		245		375								
P.H.F.		0.817		0.928		0.957								

ADT	ADT 5,549	AADT 5,549

SSFM International, Inc.

501 Sumner Street, Suite 620
Honolulu, Hawaii 96817
(808) 531-1308

Kawaihae Rd.
South of Kawaihae Harbor
Latitude: 0' 0.000 Undefined
Longitude: 0' 0.000 Undefined

Start Time	24-May-1 Mon	NB A.M.	NB P.M.	SB A.M.	SB P.M.	Combined A.M.	Combined P.M.	25-May Tue	NB A.M.	NB P.M.	SB A.M.	SB P.M.	Combined A.M.	Combined P.M.
12:00		*	*	*	*	*	*		2	58	0	56	2	114
12:15		*	*	*	*	*	*		7	79	3	56	10	135
12:30		*	*	*	*	*	*		2	58	1	58	3	116
12:45		*	*	*	*	*	*		4	60	3	54	7	114
01:00		*	*	*	*	*	*		2	61	4	68	6	129
01:15		*	*	*	*	*	*		1	73	2	63	3	136
01:30		*	*	*	*	*	*		2	56	0	74	2	130
01:45		*	*	*	*	*	*		4	63	1	***67***	5	130
02:00		*	*	*	*	*	*		1	75	2	***72***	3	147
02:15		*	*	*	*	*	*		3	65	3	***63***	6	128
02:30		*	*	*	*	*	*		2	72	0	***78***	2	150
02:45		*	*	*	*	*	*		0	64	3	57	3	121
03:00		*	*	*	*	*	*		2	50	3	77	5	127
03:15		*	*	*	*	*	*		0	85	12	52	12	137
03:30		*	*	*	*	*	*		3	75	5	73	8	***148***
03:45		*	*	*	*	*	*		3	***94***	2	72	5	***166***
04:00		*	*	*	*	*	*		2	***76***	10	75	12	***151***
04:15		*	***85***	*	46	*	***131***		3	***94***	18	52	21	***146***
04:30		*	***77***	*	***49***	*	***126***		4	***77***	20	43	24	120
04:45		*	***72***	*	***38***	*	***110***		7	74	18	49	25	123
05:00		*	***62***	*	***46***	*	***108***		8	64	34	53	42	117
05:15		*	55	*	***57***	*	112		13	71	36	43	49	114
05:30		*	47	*	33	*	80		12	59	47	32	59	91
05:45		*	52	*	37	*	89		39	70	35	41	74	111
06:00		*	55	*	27	*	82		27	38	48	42	75	80
06:15		*	46	*	32	*	78		39	51	61	33	100	84
06:30		*	37	*	45	*	82		27	42	74	44	101	86
06:45		*	51	*	36	*	87		38	35	46	29	84	64
07:00		*	36	*	19	*	55		49	41	59	27	108	68
07:15		*	34	*	29	*	63		50	37	***78***	20	128	57
07:30		*	22	*	22	*	44		53	28	***70***	14	123	42
07:45		*	29	*	24	*	53		51	30	***66***	22	117	52
08:00		*	25	*	30	*	55		43	22	***67***	18	110	40
08:15		*	26	*	10	*	36		45	21	58	26	103	47
08:30		*	18	*	12	*	30		29	23	59	23	88	46
08:45		*	16	*	16	*	32		56	13	51	32	107	45
09:00		*	15	*	6	*	21		46	19	66	15	112	34
09:15		*	17	*	15	*	32		***58***	28	48	9	106	37
09:30		*	18	*	10	*	28		***61***	30	63	18	***124***	48
09:45		*	11	*	13	*	24		***77***	17	56	4	***133***	21
10:00		*	21	*	11	*	32		***61***	21	59	10	***120***	31
10:15		*	26	*	8	*	34		53	24	56	4	***109***	28
10:30		*	12	*	9	*	21		60	20	53	9	113	29
10:45		*	19	*	0	*	19		50	14	40	6	90	20
11:00		*	11	*	3	*	14		60	13	54	5	114	18
11:15		*	17	*	7	*	24		68	12	43	5	111	17
11:30		*	11	*	0	*	11		59	11	59	4	118	15
11:45		*	7	*	3	*	10		59	6	41	2	100	8
Total		0	1030	0	693	0	1723		1345	2269	1637	1849	2982	4118
Day Total		1030		693		1723			3614		3486		7100	
% Total		0.0%	59.8%	0.0%	40.2%				18.9%	32.0%	23.1%	26.0%		
Peak			04:15		04:30		04:15		09:15	03:45	07:15	01:45	09:30	03:30
Vol.			296		190		475		257	341	281	280	486	611
P.H.F.			0.871		0.833		0.906		0.834	0.907	0.901	0.897	0.914	0.920

SSFM International, Inc.

501 Sumner Street, Suite 620
Honolulu, Hawaii 96817
(808) 531-1308

Kawaihae Rd.
South of Kawaihae Harbor
Latitude: 0' 0.000 Undefined
Longitude: 0' 0.000 Undefined

Start Time	26-May-1 Wed	NB A.M.	NB P.M.	SB A.M.	SB P.M.	Combined A.M.	Combined P.M.	27-May Thu	NB A.M.	NB P.M.	SB A.M.	SB P.M.	Combined A.M.	Combined P.M.
12:00		3	*	5	*	8	*		*	*	*	*	*	*
12:15		3	*	2	*	5	*		*	*	*	*	*	*
12:30		5	*	3	*	8	*		*	*	*	*	*	*
12:45		3	*	1	*	4	*		*	*	*	*	*	*
01:00		4	*	3	*	7	*		*	*	*	*	*	*
01:15		2	*	1	*	3	*		*	*	*	*	*	*
01:30		0	*	1	*	1	*		*	*	*	*	*	*
01:45		2	*	0	*	2	*		*	*	*	*	*	*
02:00		2	*	0	*	2	*		*	*	*	*	*	*
02:15		3	*	3	*	6	*		*	*	*	*	*	*
02:30		3	*	3	*	6	*		*	*	*	*	*	*
02:45		1	*	2	*	3	*		*	*	*	*	*	*
03:00		2	*	5	*	7	*		*	*	*	*	*	*
03:15		2	*	10	*	12	*		*	*	*	*	*	*
03:30		3	*	4	*	7	*		*	*	*	*	*	*
03:45		3	*	5	*	8	*		*	*	*	*	*	*
04:00		0	*	7	*	7	*		*	*	*	*	*	*
04:15		4	*	14	*	18	*		*	*	*	*	*	*
04:30		2	*	17	*	19	*		*	*	*	*	*	*
04:45		8	*	23	*	31	*		*	*	*	*	*	*
05:00		8	*	28	*	36	*		*	*	*	*	*	*
05:15		8	*	23	*	31	*		*	*	*	*	*	*
05:30		17	*	39	*	56	*		*	*	*	*	*	*
05:45		34	*	45	*	79	*		*	*	*	*	*	*
06:00		32	*	52	*	84	*		*	*	*	*	*	*
06:15		31	*	59	*	90	*		*	*	*	*	*	*
06:30		33	*	42	*	75	*		*	*	*	*	*	*
06:45		41	*	46	*	87	*		*	*	*	*	*	*
07:00		***49***	*	60	*	109	*		*	*	*	*	*	*
07:15		***50***	*	***72***	*	***122***	*		*	*	*	*	*	*
07:30		***59***	*	***67***	*	***126***	*		*	*	*	*	*	*
07:45		***72***	*	***61***	*	***133***	*		*	*	*	*	*	*
08:00		40	*	***74***	*	***114***	*		*	*	*	*	*	*
08:15		38	*	44	*	82	*		*	*	*	*	*	*
08:30		47	*	61	*	108	*		*	*	*	*	*	*
08:45		51	*	69	*	120	*		*	*	*	*	*	*
09:00		42	*	50	*	92	*		*	*	*	*	*	*
09:15		18	*	12	*	30	*		*	*	*	*	*	*
09:30		*	*	*	*	*	*		*	*	*	*	*	*
09:45		*	*	*	*	*	*		*	*	*	*	*	*
10:00		*	*	*	*	*	*		*	*	*	*	*	*
10:15		*	*	*	*	*	*		*	*	*	*	*	*
10:30		*	*	*	*	*	*		*	*	*	*	*	*
10:45		*	*	*	*	*	*		*	*	*	*	*	*
11:00		*	*	*	*	*	*		*	*	*	*	*	*
11:15		*	*	*	*	*	*		*	*	*	*	*	*
11:30		*	*	*	*	*	*		*	*	*	*	*	*
11:45		*	*	*	*	*	*		*	*	*	*	*	*
Total		725	0	1013	0	1738	0		0	0	0	0	0	0
Day Total		725		1013		1738			0		0		0	
% Total		41.7%	0.0%	58.3%	0.0%				0.0%	0.0%	0.0%	0.0%		
Peak		07:00		07:15		07:15								
Vol.		230		274		495								
P.H.F.		0.799		0.926		0.930								

ADT	ADT 7,100	AADT 7,100

APPENDIX B

Analysis Reports
Existing (2010) Conditions

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

```
Analyst:              jtw
Agency/Co.:           SSFM International
Date Performed:       1/25/2012
Analysis Time Period: AM Peak
Intersection:         Akoni Pule/Kawaihae
Jurisdiction:         South Kohala, HI
Units: U. S. Customary
Analysis Year:        Existing 2010
Project ID:  2007_086.003
East/West Street:     Akoni Pule Hwy
North/South Street:   Kawaihae Rd
Intersection Orientation: NS                Study period (hrs):  0.25
```

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		28	128	18	32	
Peak-Hour Factor, PHF		0.91	0.91	0.66	0.66	
Hourly Flow Rate, HFR		30	140	27	48	
Percent Heavy Vehicles		--	--	7	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	244		9			
Peak Hour Factor, PHF	0.88		0.88			
Hourly Flow Rate, HFR	277		10			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		27		287				
C(m) (vph)		1378		772				
v/c		0.02		0.37				
95% queue length		0.06		1.73				
Control Delay		7.7		12.4				
LOS		A		B				
Approach Delay				12.4				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:	jtw
Agency/Co.:	SSFM International
Date Performed:	1/25/2012
Analysis Time Period:	PM Peak
Intersection:	Akoni Pule/Kawaihae
Jurisdiction:	South Kohala, HI
Units: U. S. Customary	
Analysis Year:	Existing 2010
Project ID:	2007_086.003
East/West Street:	Akoni Pule Hwy
North/South Street:	Kawaihae Rd
Intersection Orientation: NS	Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		46	291	18	30	
Peak-Hour Factor, PHF		0.84	0.84	0.80	0.80	
Hourly Flow Rate, HFR		54	346	22	37	
Percent Heavy Vehicles		--	--	0	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	208		18			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	231		20			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage		No	/			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		22		251				
C(m) (vph)		1170		677				
v/c		0.02		0.37				
95% queue length		0.06		1.71				
Control Delay		8.1		13.4				
LOS		A		B				
Approach Delay				13.4				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:	jtw
Agency/Co.:	SSFM International
Date Performed:	1/25/2012
Analysis Time Period:	AM Peak
Intersection:	Main Gate/Kawaihae
Jurisdiction:	South Kohala, HI
Units: U. S. Customary	
Analysis Year:	Existing 2010
Project ID:	2007_086.003
East/West Street:	Kawaihae Harbor Main Gate
North/South Street:	Kawaihae Road
Intersection Orientation: NS	Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	29	162			247	20
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	30	172			301	24
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		10
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				7		15
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	30						22	
C(m) (vph)	1028						486	
v/c	0.03						0.05	
95% queue length	0.09						0.14	
Control Delay	8.6						12.8	
LOS	A						B	
Approach Delay							12.8	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: Main Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Existing 2010
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor Main Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	9	320			241	4
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	10	363			280	4
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				7		29
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				7		32
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	10						39	
C(m) (vph)	1072						603	
v/c	0.01						0.06	
95% queue length	0.03						0.21	
Control Delay	8.4						11.4	
LOS	A						B	
Approach Delay							11.4	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Existing 2010
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	186			252	5
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	5	197			307	6
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				7		7
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	5						14	
C(m) (vph)	1040						469	
v/c	0.00						0.03	
95% queue length	0.01						0.09	
Control Delay	8.5						12.9	
LOS	A						B	
Approach Delay							12.9	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Existing 2010
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	324			265	5
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	5	368			308	5
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				5		5
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	5						10	
C(m) (vph)	1044						502	
v/c	0.00						0.02	
95% queue length	0.01						0.06	
Control Delay	8.5						12.3	
LOS	A						B	
Approach Delay							12.3	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: Kawaihae/Queen K
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Existing 2010
Project ID: 2007_086.003
East/West Street: Kawaihae Rd
North/South Street: Queen Kaahumanu Hwy
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		64	220	296	68	
Peak-Hour Factor, PHF		0.84	0.84	0.69	0.69	
Hourly Flow Rate, HFR		76	261	428	98	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	0		1	1	
Configuration		TR			L	T
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	84		68			
Peak Hour Factor, PHF	0.62		0.62			
Hourly Flow Rate, HFR	135		109			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration	LR					

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L		LR				
v (vph)		428		244				
C(m) (vph)		1211		218				
v/c		0.35		1.12				
95% queue length		1.61		11.33				
Control Delay		9.6		143.4				
LOS		A		F				
Approach Delay				143.4				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst:	jtw
Agency/Co.:	SSFM International
Date Performed:	1/25/2012
Analysis Time Period:	PM Peak
Intersection:	Kawaihae/Queen K
Jurisdiction:	South Kohala, HI
Units: U. S. Customary	
Analysis Year:	Existing 2010
Project ID:	2007_086.003
East/West Street:	Kawaihae Rd
North/South Street:	Queen Kaahumanu Hwy
Intersection Orientation: EW	Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		100	184	168	84	
Peak-Hour Factor, PHF		0.84	0.84	0.88	0.88	
Hourly Flow Rate, HFR		119	219	190	95	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	1	1	
Configuration			TR		L T	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	224		280			
Peak Hour Factor, PHF	0.89		0.89			
Hourly Flow Rate, HFR	251		314			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L		LR				
v (vph)		190		565				
C(m) (vph)		1210		496				
v/c		0.16		1.14				
95% queue length		0.56		19.49				
Control Delay		8.5		112.1				
LOS		A		F				
Approach Delay				112.1				
Approach LOS				F				

APPENDIX C

Traffic Signal Warrant

Traffic Signal Warrant for Kawaihae Commercial Harbor EA TIAR
Queen Ka'ahumanu Hwy/Kawaihae Rd

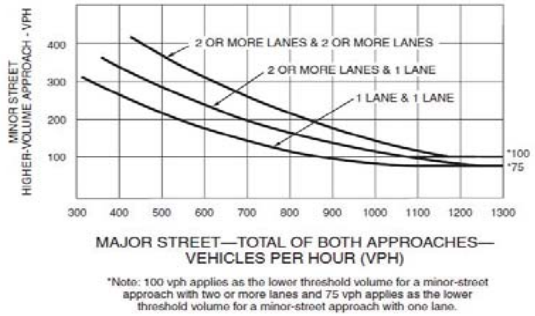
Existing (2010) Volumes

Peak Hour Warrant - Figure 4C-4

	Approach Type	# of Lanes	AM		PM		Pass?
Kawaihae Road/	Major	2	648	No	536	Pass	Pass
Queen Kaahumanu Highway	Minor	1	152		504		

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: MUTCD 2003

Traffic Signal Warrant for Kawaihae Commercial Harbor EA TIAR
Queen Ka'ahumanu Hwy/Kawaihae Rd

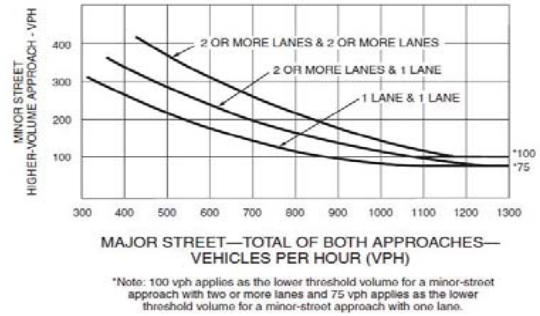
Near-Term (2015) Volumes

Peak Hour Warrant - Figure 4C-4

	Approach Type	# of Lanes	AM		PM		Pass?
Kawaihae Road/	Major	2	755	No	635	Pass	Pass
Queen Kaahumanu Highway	Minor	2	185		585		

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

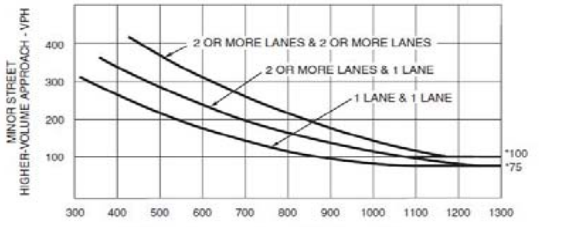
Source: MUTCD 2003

Traffic Signal Warrant for Kawaihae Commercial Harbor EA TIAR
Queen Ka'ahumanu Hwy/Kawaihae Rd

Mid-Term (2025) Volumes
Peak Hour Warrant - Figure 4C-4

	Approach Type	# of Lanes	AM		PM		Pass?
Kawaihae Road/	Major	2	1020	Pass	860	Pass	Pass
Queen Kaahumanu Highway	Minor	2	255		780		

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: MUTCD 2003

APPENDIX D

Analysis Reports
Near-Term (2015) Conditions

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: Akoni Pule/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-term 2015 No-Action
Project ID: 2007_086.003
East/West Street: Akoni Pule Hwy
North/South Street: Kawaihae Rd
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		28	147	18	32	
Peak-Hour Factor, PHF		0.91	0.91	0.66	0.66	
Hourly Flow Rate, HFR		30	161	27	48	
Percent Heavy Vehicles		--	--	7	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	281		9			
Peak Hour Factor, PHF	0.88		0.88			
Hourly Flow Rate, HFR	319		10			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		27		329				
C(m) (vph)		1353		762				
v/c		0.02		0.43				
95% queue length		0.06		2.19				
Control Delay		7.7		13.3				
LOS		A		B				
Approach Delay				13.3				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: Akoni Pule/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 No-Action
Project ID: 2007_086.003
East/West Street: Akoni Pule Hwy
North/South Street: Kawaihae Rd
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		46	335	18	30	
Peak-Hour Factor, PHF		0.84	0.84	0.80	0.80	
Hourly Flow Rate, HFR		54	398	22	37	
Percent Heavy Vehicles		--	--	0	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	239		18			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	265		20			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		22		285				
C(m) (vph)		1119		653				
v/c		0.02		0.44				
95% queue length		0.06		2.22				
Control Delay		8.3		14.7				
LOS		A		B				
Approach Delay				14.7				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: Main Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor Main Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	29	186			284	20
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	30	197			346	24
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		10
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				7		15
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	30						22	
C(m) (vph)	987						448	
v/c	0.03						0.05	
95% queue length	0.09						0.15	
Control Delay	8.8						13.5	
LOS	A						B	
Approach Delay							13.5	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: Main Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor Main Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	9	368			277	4
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	10	418			322	4
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				7		29
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				7		32
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	10						39	
C(m) (vph)	1032						559	
v/c	0.01						0.07	
95% queue length	0.03						0.22	
Control Delay	8.5						11.9	
LOS	A						B	
Approach Delay							11.9	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	214			290	5
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	5	227			353	6
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				7		7
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	5						14	
C(m) (vph)	997						428	
v/c	0.01						0.03	
95% queue length	0.02						0.10	
Control Delay	8.6						13.7	
LOS	A						B	
Approach Delay							13.7	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	373			305	5
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	5	423			354	5
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				5		5
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	5						10	
C(m) (vph)	1001						450	
v/c	0.00						0.02	
95% queue length	0.02						0.07	
Control Delay	8.6						13.2	
LOS	A						B	
Approach Delay							13.2	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: ayu
Agency/Co.: SSFM International
Date Performed: 02/01/2012
Analysis Time Period: AM Peak
Intersection: Kawaihae/Queen K
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-term 2015 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Rd
North/South Street: Queen Kaahumanu Hwy
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		74	253	340	78	
Peak-Hour Factor, PHF		0.84	0.84	0.69	0.69	
Hourly Flow Rate, HFR		88	301	492	113	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1		1	1
Configuration		T	R		L	T
Upstream Signal?		No				No

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	97		78			
Peak Hour Factor, PHF	0.62		0.62			
Hourly Flow Rate, HFR	156		125			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		492	156		125			
C(m) (vph)		1159	118		959			
v/c		0.42	1.32		0.13			
95% queue length		2.16	10.38		0.45			
Control Delay		10.4	260.9		9.3			
LOS		B	F		A			
Approach Delay				149.0				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: ayu
Agency/Co.: SSFM International
Date Performed: 02/01/2012
Analysis Time Period: PM Peak
Intersection: Kawaihae/Queen K
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-term 2015 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Rd
North/South Street: Queen Kaahumanu Hwy
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		115	212	193	97	
Peak-Hour Factor, PHF		0.84	0.84	0.88	0.88	
Hourly Flow Rate, HFR		136	252	219	110	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1		1	1
Configuration		T	R		L	T
Upstream Signal?		No				No

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	258		322			
Peak Hour Factor, PHF	0.89		0.89			
Hourly Flow Rate, HFR	289		361			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		219	289		361			
C(m) (vph)		1160	331		902			
v/c		0.19	0.87		0.40			
95% queue length		0.69	8.11		1.95			
Control Delay		8.8	58.7		11.6			
LOS		A	F		B			
Approach Delay				32.5				
Approach LOS				D				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: Akoni Pule/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-term 2015 With Project
Project ID: 2007_086.003
East/West Street: Akoni Pule Hwy
North/South Street: Kawaihae Rd
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		30	150	20	35	
Peak-Hour Factor, PHF		0.91	0.91	0.66	0.66	
Hourly Flow Rate, HFR		32	164	30	53	
Percent Heavy Vehicles		--	--	7	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	285		10			
Peak Hour Factor, PHF	0.88		0.88			
Hourly Flow Rate, HFR	323		11			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage		No	/			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		30		334				
C(m) (vph)		1347		745				
v/c		0.02		0.45				
95% queue length		0.07		2.33				
Control Delay		7.7		13.7				
LOS		A		B				
Approach Delay				13.7				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: Akoni Pule/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 With Project
Project ID: 2007_086.003
East/West Street: Akoni Pule Hwy
North/South Street: Kawaihae Rd
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		50	340	20	30	
Peak-Hour Factor, PHF		0.84	0.84	0.80	0.80	
Hourly Flow Rate, HFR		59	404	24	37	
Percent Heavy Vehicles		--	--	0	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	240		20			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	266		22			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage		No	/			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		24		288				
C(m) (vph)		1109		642				
v/c		0.02		0.45				
95% queue length		0.07		2.32				
Control Delay		8.3		15.1				
LOS		A		C				
Approach Delay				15.1				
Approach LOS				C				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: Main Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor Main Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	40	190			285	25
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	42	202			347	30
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				10		15
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				15		23
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	42						38	
C(m) (vph)	981						418	
v/c	0.04						0.09	
95% queue length	0.13						0.30	
Control Delay	8.8						14.5	
LOS	A						B	
Approach Delay							14.5	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: Main Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor Main Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	15	370			280	5
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	17	420			325	5
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				10		35
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				11		38
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	17						49	
C(m) (vph)	1028						536	
v/c	0.02						0.09	
95% queue length	0.05						0.30	
Control Delay	8.6						12.4	
LOS	A						B	
Approach Delay							12.4	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	225			295	5
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	5	239			359	6
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				7		7
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	5						14	
C(m) (vph)	991						420	
v/c	0.01						0.03	
95% queue length	0.02						0.10	
Control Delay	8.7						13.9	
LOS	A						B	
Approach Delay							13.9	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-Term 2015 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	375			315	5
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	5	426			366	5
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				5		5
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	5						10	
C(m) (vph)	990						442	
v/c	0.01						0.02	
95% queue length	0.02						0.07	
Control Delay	8.7						13.3	
LOS	A						B	
Approach Delay							13.3	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: ayu
Agency/Co.: SSFM International
Date Performed: 02/01/2012
Analysis Time Period: AM Peak
Intersection: Kawaihae/Queen K
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-term 2015 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Rd
North/South Street: Queen Kaahumanu Hwy
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		75	255	340	85	
Peak-Hour Factor, PHF		0.84	0.84	0.69	0.69	
Hourly Flow Rate, HFR		89	303	492	123	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1		1	1
Configuration		T	R		L	T
Upstream Signal?		No				No

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	105		80			
Peak Hour Factor, PHF	0.62		0.62			
Hourly Flow Rate, HFR	169		129			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		492	169		129			
C(m) (vph)		1156	116		958			
v/c		0.43	1.46		0.13			
95% queue length		2.17	11.94		0.46			
Control Delay		10.4	314.7		9.3			
LOS		B	F		A			
Approach Delay				182.5				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: ayu
Agency/Co.: SSFM International
Date Performed: 02/01/2012
Analysis Time Period: PM Peak
Intersection: Kawaihae/Queen K
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Near-term 2015 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Rd
North/South Street: Queen Kaahumanu Hwy
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		120	220	195	100	
Peak-Hour Factor, PHF		0.84	0.84	0.88	0.88	
Hourly Flow Rate, HFR		142	261	221	113	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1		1	1
Configuration		T	R		L	T
Upstream Signal?		No				No

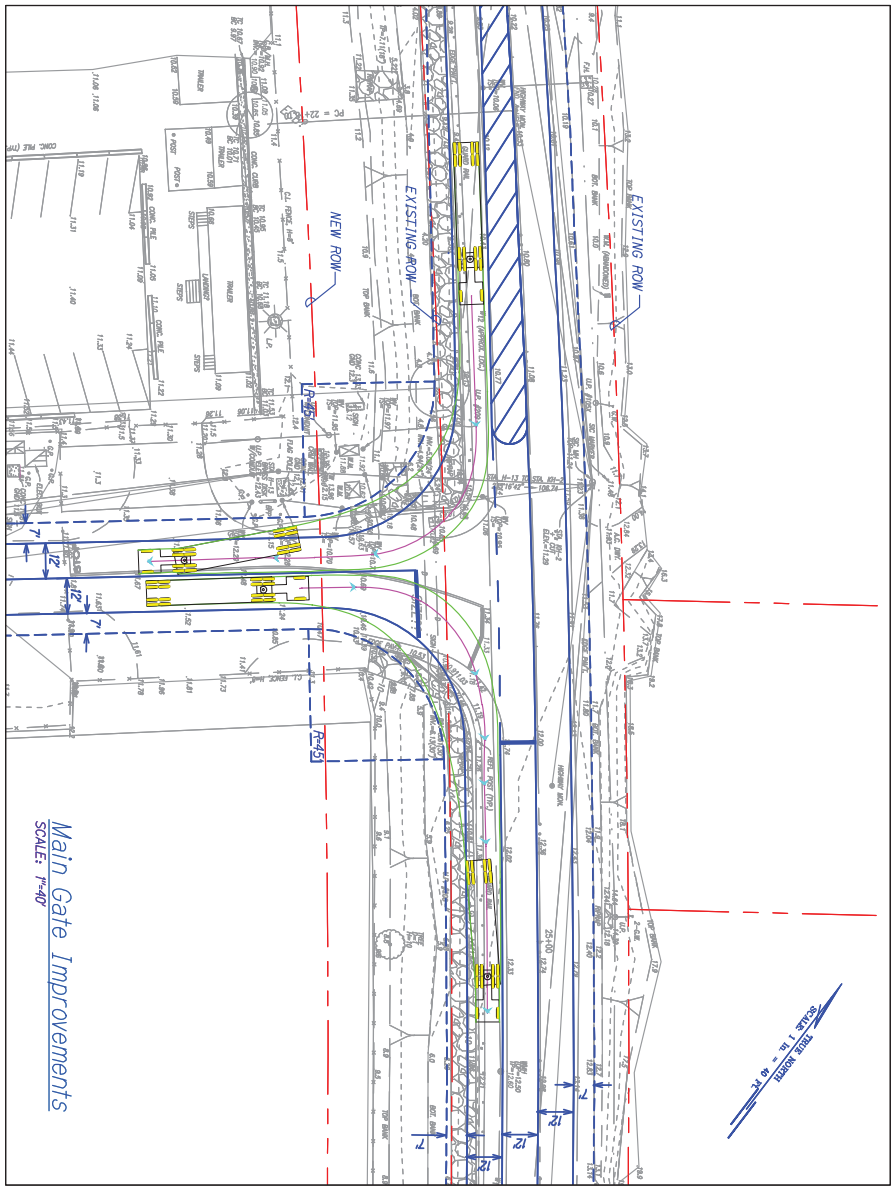
Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	260		325			
Peak Hour Factor, PHF	0.89		0.89			
Hourly Flow Rate, HFR	292		365			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

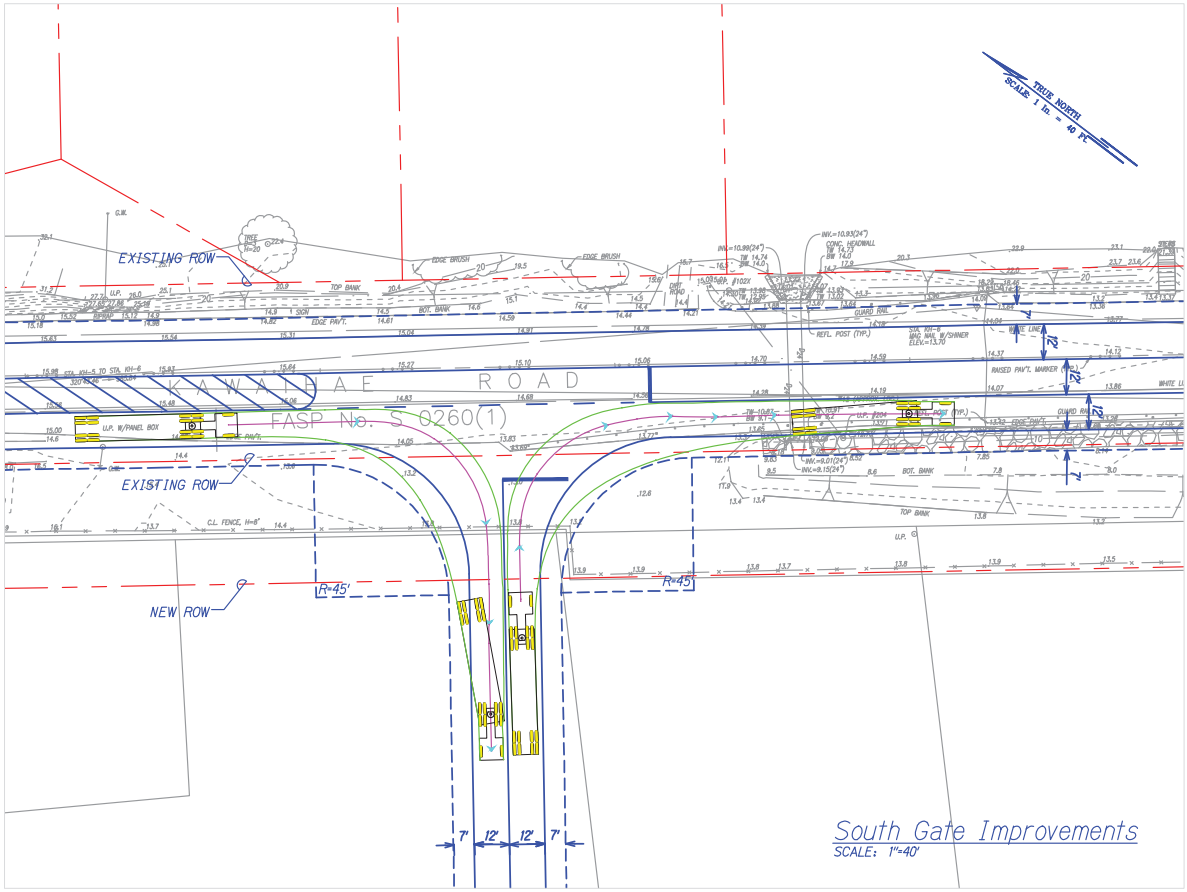
Delay, Queue Length, and Level of Service

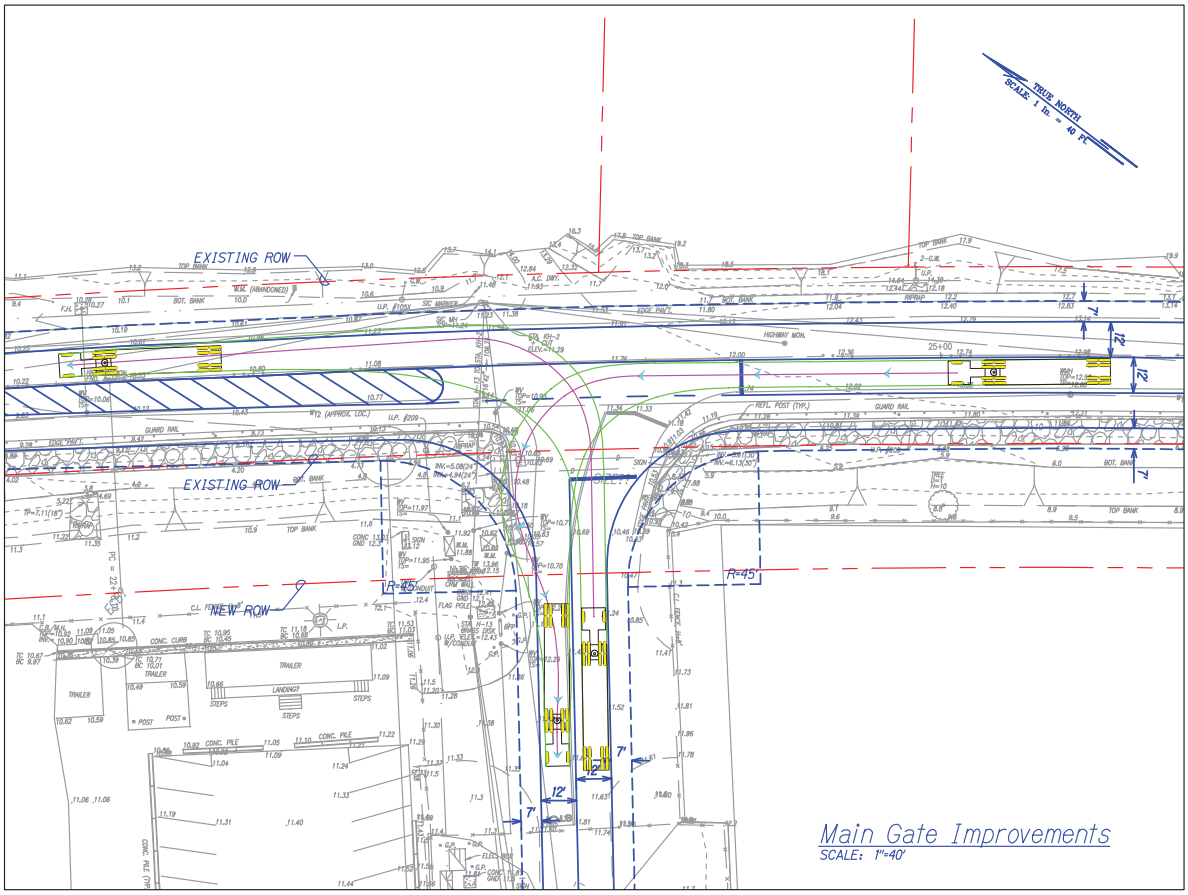
Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		221	292		365			
C(m) (vph)		1145	324		895			
v/c		0.19	0.90		0.41			
95% queue length		0.71	8.65		2.01			
Control Delay		8.9	64.6		11.8			
LOS		A	F		B			
Approach Delay				35.2				
Approach LOS				E				

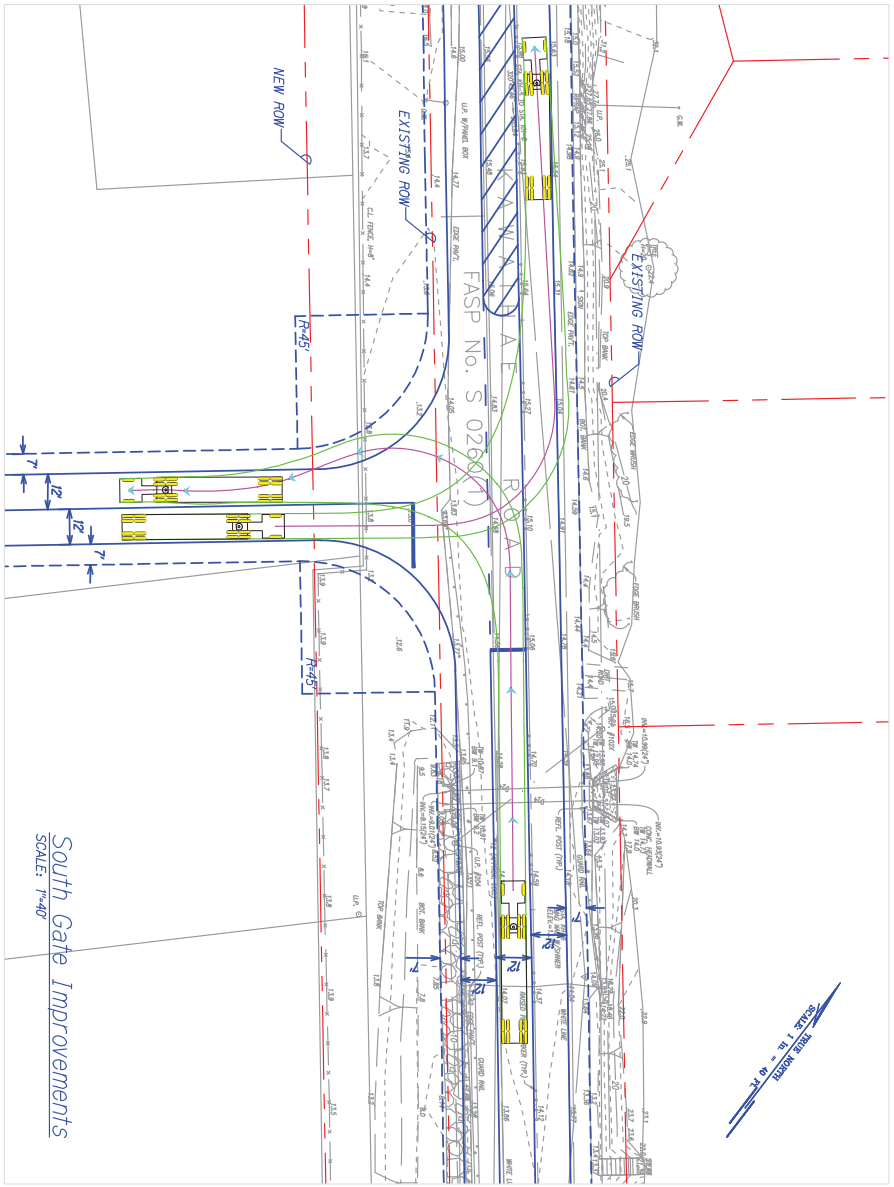
APPENDIX E

Design Vehicle and AutoTurn Analysis




TRUE NORTH
SCALE 1 in. = 40 Ft.
EXISTING ROW
EXISTING ROW
NEW ROW
KAWAIHAE ROAD
FASP No. S 0260(1)
R=45'
R=45'
7'
12'
12'
7'
South Gate Improvements
SCALE: 1"=40'


TRUE NORTH
SCALE 1 in. = 40 Ft.
EXISTING ROW
EXISTING ROW
NEW ROW
R=45'
R=45'
7'
12'
12'
7'
Main Gate Improvements
SCALE: 1"=40'



APPENDIX F

Analysis Reports
Mid-Term (2025) Conditions

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: Akoni Pule/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-term 2025 No-Action
Project ID: 2007_086.003
East/West Street: Akoni Pule Hwy
North/South Street: Kawaihae Rd
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		28	196	18	32	
Peak-Hour Factor, PHF		0.91	0.91	0.66	0.66	
Hourly Flow Rate, HFR		30	215	27	48	
Percent Heavy Vehicles		--	--	7	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	374		9			
Peak Hour Factor, PHF	0.88		0.88			
Hourly Flow Rate, HFR	425		10			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage		No	/			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		27		435				
C(m) (vph)		1292		731				
v/c		0.02		0.60				
95% queue length		0.06		3.98				
Control Delay		7.8		16.9				
LOS		A		C				
Approach Delay				16.9				
Approach LOS				C				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: Akoni Pule/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 No-Action
Project ID: 2007_086.003
East/West Street: Akoni Pule Hwy
North/South Street: Kawaihae Rd
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		46	446	18	30	
Peak-Hour Factor, PHF		0.84	0.84	0.80	0.80	
Hourly Flow Rate, HFR		54	530	22	37	
Percent Heavy Vehicles		--	--	0	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	318		18			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	353		20			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage		No	/			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		22		373				
C(m) (vph)		1001		595				
v/c		0.02		0.63				
95% queue length		0.07		4.36				
Control Delay		8.7		20.7				
LOS		A		C				
Approach Delay				20.7				
Approach LOS				C				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: Main Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor Main Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	29	247			378	20
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	30	262			460	24
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		10
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				7		15
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	30						22	
C(m) (vph)	889						363	
v/c	0.03						0.06	
95% queue length	0.10						0.19	
Control Delay	9.2						15.6	
LOS	A						C	
Approach Delay							15.6	
Approach LOS							C	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: Main Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor Main Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	9	489			368	4
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	10	555			427	4
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				7		29
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				7		32
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	10						39	
C(m) (vph)	937						459	
v/c	0.01						0.08	
95% queue length	0.03						0.28	
Control Delay	8.9						13.6	
LOS	A						B	
Approach Delay							13.6	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	285			386	5
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	5	303			470	6
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				7		7
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	5						14	
C(m) (vph)	895						336	
v/c	0.01						0.04	
95% queue length	0.02						0.13	
Control Delay	9.0						16.2	
LOS	A						C	
Approach Delay							16.2	
Approach LOS							C	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	496			406	5
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	5	563			472	5
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				5		5
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	5						10	
C(m) (vph)	898						340	
v/c	0.01						0.03	
95% queue length	0.02						0.09	
Control Delay	9.0						15.9	
LOS	A						C	
Approach Delay							15.9	
Approach LOS							C	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: ayu
Agency/Co.: SSFM International
Date Performed: 02/01/2012
Analysis Time Period: AM Peak
Intersection: Kawaihae/Queen K
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-term 2025 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Rd
North/South Street: Queen Kaahumanu Hwy
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		98	336	452	104	
Peak-Hour Factor, PHF		0.84	0.84	0.69	0.69	
Hourly Flow Rate, HFR		116	400	655	150	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1		1	1
Configuration		T	R		L	T
Upstream Signal?		No				No

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	129		104			
Peak Hour Factor, PHF	0.62		0.62			
Hourly Flow Rate, HFR	208		167			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		655	208		167			
C(m) (vph)		1040	44		926			
v/c		0.63	4.73		0.18			
95% queue length		4.65	23.78		0.66			
Control Delay		14.2	1862		9.7			
LOS		B	F		A			
Approach Delay				1037				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: ayu
Agency/Co.: SSFM International
Date Performed: 02/01/2012
Analysis Time Period: PM Peak
Intersection: Kawaihae/Queen K
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-term 2025 No-Action
Project ID: 2007_086.003
East/West Street: Kawaihae Rd
North/South Street: Queen Kaahumanu Hwy
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		153	282	257	129	
Peak-Hour Factor, PHF		0.84	0.84	0.88	0.88	
Hourly Flow Rate, HFR		182	335	292	146	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1		1	1
Configuration		T	R		L	T
Upstream Signal?		No				No

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	343		428			
Peak Hour Factor, PHF	0.89		0.89			
Hourly Flow Rate, HFR	385		480			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		292	385		480			
C(m) (vph)		1039	215		850			
v/c		0.28	1.79		0.56			
95% queue length		1.16	26.66		3.61			
Control Delay		9.8	412.1		14.6			
LOS		A	F		B			
Approach Delay				191.5				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: Akoni Pule/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-term 2025 With Project
Project ID: 2007_086.003
East/West Street: Akoni Pule Hwy
North/South Street: Kawaihae Rd
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		30	205	20	35	
Peak-Hour Factor, PHF		0.91	0.91	0.66	0.66	
Hourly Flow Rate, HFR		32	225	30	53	
Percent Heavy Vehicles		--	--	7	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	395		10			
Peak Hour Factor, PHF	0.88		0.88			
Hourly Flow Rate, HFR	448		11			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage		No	/			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		30		459				
C(m) (vph)		1279		714				
v/c		0.02		0.64				
95% queue length		0.07		4.71				
Control Delay		7.9		18.7				
LOS		A		C				
Approach Delay				18.7				
Approach LOS				C				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: Akoni Pule/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 With Project
Project ID: 2007_086.003
East/West Street: Akoni Pule Hwy
North/South Street: Kawaihae Rd
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		50	455	20	30	
Peak-Hour Factor, PHF		0.84	0.84	0.80	0.80	
Hourly Flow Rate, HFR		59	541	24	37	
Percent Heavy Vehicles		--	--	0	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	325		20			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	361		22			
Percent Heavy Vehicles	4		0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage		No	/			/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		24		383				
C(m) (vph)		987		583				
v/c		0.02		0.66				
95% queue length		0.07		4.82				
Control Delay		8.7		22.2				
LOS		A		C				
Approach Delay				22.2				
Approach LOS				C				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: Main Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor Main Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	60	250			380	40
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	63	265			463	48
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				10		20
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				15		31
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	63						46	
C(m) (vph)	867						330	
v/c	0.07						0.14	
95% queue length	0.23						0.48	
Control Delay	9.5						17.7	
LOS	A						C	
Approach Delay							17.7	
Approach LOS							C	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: Main Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor Main Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	20	490			370	10
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	22	556			430	11
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				15		60
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				16		66
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	22						82	
C(m) (vph)	928						442	
v/c	0.02						0.19	
95% queue length	0.07						0.67	
Control Delay	9.0						15.0-	
LOS	A						B	
Approach Delay							15.0-	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: AM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	315			395	5
Peak-Hour Factor, PHF	0.94	0.94			0.82	0.82
Hourly Flow Rate, HFR	5	335			481	6
Percent Heavy Vehicles	45	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.63		0.63
Hourly Flow Rate, HFR				7		7
Percent Heavy Vehicles				80		90
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	5						14	
C(m) (vph)	886						321	
v/c	0.01						0.04	
95% queue length	0.02						0.14	
Control Delay	9.1						16.7	
LOS	A						C	
Approach Delay							16.7	
Approach LOS							C	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: jtw
Agency/Co.: SSFM International
Date Performed: 1/25/2012
Analysis Time Period: PM Peak
Intersection: South Gate/Kawaihae
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-Term 2025 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Harbor South Gate
North/South Street: Kawaihae Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	505			435	5
Peak-Hour Factor, PHF	0.88	0.88			0.86	0.86
Hourly Flow Rate, HFR	5	573			505	5
Percent Heavy Vehicles	44	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				5		5
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				5		5
Percent Heavy Vehicles				0		45
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	5						10	
C(m) (vph)	871						321	
v/c	0.01						0.03	
95% queue length	0.02						0.10	
Control Delay	9.2						16.6	
LOS	A						C	
Approach Delay							16.6	
Approach LOS							C	

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: ayu
Agency/Co.: SSFM International
Date Performed: 02/01/2012
Analysis Time Period: AM Peak
Intersection: Kawaihae/Queen K
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-term 2025 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Rd
North/South Street: Queen Kaahumanu Hwy
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		100	345	455	120	
Peak-Hour Factor, PHF		0.84	0.84	0.69	0.69	
Hourly Flow Rate, HFR		119	410	659	173	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1		1	1
Configuration		T	R		L	T
Upstream Signal?		No				No

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	150		105			
Peak Hour Factor, PHF	0.62		0.62			
Hourly Flow Rate, HFR	241		169			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		659	241		169			
C(m) (vph)		1028	41		922			
v/c		0.64	5.88		0.18			
95% queue length		4.85	28.20		0.67			
Control Delay		14.5	2389		9.8			
LOS		B	F		A			
Approach Delay				1408				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.4

TWO-WAY STOP CONTROL SUMMARY

Analyst: ayu
Agency/Co.: SSFM International
Date Performed: 02/01/2012
Analysis Time Period: PM Peak
Intersection: Kawaihae/Queen K
Jurisdiction: South Kohala, HI
Units: U. S. Customary
Analysis Year: Mid-term 2025 With Project
Project ID: 2007_086.003
East/West Street: Kawaihae Rd
North/South Street: Queen Kaahumanu Hwy
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		165	300	260	135	
Peak-Hour Factor, PHF		0.84	0.84	0.88	0.88	
Hourly Flow Rate, HFR		196	357	295	153	
Percent Heavy Vehicles		--	--	4	--	--
Median Type/Storage	Undivided			/		
RT Channelized?			No			
Lanes		1	1		1	1
Configuration		T	R		L	T
Upstream Signal?		No				No

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	350		430			
Peak Hour Factor, PHF	0.89		0.89			
Hourly Flow Rate, HFR	393		483			
Percent Heavy Vehicles	6		6			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		295	393		483			
C(m) (vph)		1007	204		835			
v/c		0.29	1.93		0.58			
95% queue length		1.23	28.75		3.79			
Control Delay		10.0+	473.5		15.1			
LOS		B	F		C			
Approach Delay				220.7				
Approach LOS				F				

Checklist #1: TIR Project Initiation	Response/Location
1.1 - Key players identified	Section I. Introduction - SSFM International (preparer); HDOT Harbors Division, HDOT-HWY - Planning Branch (reviewer).
1.2 - Scoping meeting(s)	Scoping meeting occurred with SSFM Planning and HDOT project manager.
1.3 - Phasing of the TIR	Report will be prepared in support of the DEA and FEA.
1.4 - Review cycles and schedule	Draft report will be submitted to HDOT Harbors Division. Additional HDOT departments may review following request by HDOT's project manager.
1.5 - Comment resolution	Following comment period, responses will be created and addressed through edits, comment resolution sheet, or meetings, as needed.

Checklist #2: TIR Scoping	Response/Location
2.1 - Project understanding and background	Section I. Introduction - EA adressing short-term improvements. TIAR being created in support of the EA.
2.2 - Existing and future land uses	Section I. Introduction - Kawaihae Harbor is essential for the import and export of cargo. With probable harbor expansion, location of facilities and traffic circulation need to be considered.
2.3 - Triggers (when HDOT would require a TIR?)	Section I. Introduction - TIAR is being created in support of the EA.
2.4 - Study area limits	Section II. Existing (2010) Traffic Conditions - provides description of study area
2.5 - Number of project phases	Project phases based on the container forecasts. Existing (2010), Near-Term (2015) and Mid-Term (2025) conditions were considered
2.6 - Horizon year of buildout or years for multiphase projects	Project phases based on the container forecasts. Existing (2010), Near-Term (2015) and Mid-Term (2025) conditions were considered
2.7 - Full build out of area per existing zoning	Full build out not assumed in area; DHHL development mauka of Kawaihae Road not considered likely to occur in near future.
2.8 - Background traffic data assumptions and methods for forecasting growth	Section III. Near-Term (2015) Conditions, A. Traffic Volumes; IV. Mid-Term (2025) Conditions, A. Traffic Volumes - Used regional growth 2.88% for South Kohala region through 2025
2.9 - Other developments currently approved or underway	Kawaihae Road Bypass in planning process for long-term (2035) conditions. DHHL development mauka of Kawaihae Road not likely for construction in near future.
2.10 - Other studies/environmental documents/coordination	Section VI. References- Studies referenced include Kawaihae Road Bypass Waimea to Kawaihae (Section III.A.), South Kohala Regional Traffic Forecasts (Section III.A.), Kawaihae Regional Plan (Section III. A.), Hawai'i Commercial Harbors Cargo and Passenger Forecast (Section III. A.), Hawai'i Island Commercial Harbors 2035 Mater Plan (Section I.), Kawaihae Commercial Harbor Development Plan Traffic Circulation Memorandum (Section I.), Kawaihae Commercial Harbor Development Plan (Section I.)
2.11 - Modal considerations	Discussed Heavy Vehicle and Non-motorized traffic in Section II, B, 3-4; Section III, A, 5-6; Section IV, A, 5.
2.12 - Traffic counts needed	Section II, B. Traffic Volumes - 24-hr counts on Kawaihae Road and Akoni Pule Hwy and manual turning movement counts at Kawaihae Rd/Akoni Pule Hwy and Kawaihae Rd/Main Gate access. Both completed on Tuesday, May 25, 2010
2.13 - Study intersections	Section II, Figure 1. Location Map
2.14 - Trip generation method and sources	Section III, A and Section IV, A - application of projected cargo growth rates per expansion to determine project related trips
2.15 - Trip reduction factors	Not applicable
2.16 - Trip distribution methodology	Used existing peak hour vehicle distribution at study intersections to route future traffic.
2.17 - Analysis software/methodology	Section II, C, 1. Intersection LOS - HCS+ used in intersection analysis; FDOT Handbook used for roadway segment analysis
2.18 - Committed and programmed roadway improvements	Section III - Prior to 2015, HDOT anticipates improving the intersection of Kawaihae Rd/Queen Kaahumanu Hwy (QK) by providing "separate dedicated right and left turn lanes" on QK approach with "acceleration lane for vehicles making a left turn from QK". A"dedicated right turn lane" would be provided on North leg of Kawaihae Rd. "For the Near-Term (2015) it is recommended to provide left turn lanes along Kawaihae Road at both entrances to minimize traffic congestion from queueing heavy vehicles."; Kawaihae Road Bypass is assumed to be constructed in long-term (2035) and not included in this TIAR
2.19 - Safety data resources	Section III, C. Intersection Treatments - Turn lane lengths provided for vehicle to come to a safe stop.
2.20 - Potential safety hazards	Section III, C. Intersection Treatments - Turn lane lengths provided for vehicle to come to a safe stop.
2.21 - Number, locations, capacity, and safety issues related to access points	Section I. Introduction - Main Gate and South Gate currently utilized to access harbor facilities.
2.22 - Potential mitigation opportunities	Section III, C. Intersection Treatments - Turn lanes considered at access to harbor in Near-Term (2015) to mitigate queueing of heavy vehicles along Kawaihae Rd; need to relocate South Gate to accommodate turn lane.
2.23 - TIR process for review	Draft report will be prepared for review by HDOT
2.24 - Sources of data	Section VI. References
2.25 - Sample TIRs	None provided

APPENDIX G

TIR Checklists

Checklist #6: TIR Mitigation Analysis	Response/Location
6.1 - Need for mitigation	Section III, C. Intersection Treatments - Turn lanes considered at access to harbor in Near-Term (2015) to mitigate queueing of heavy vehicles along Kawaihae Rd; need to relocate South Gate to accommodate turn lane.
6.2 - Types of mitigation	Section III, C. Intersection Treatments - Turn lanes considered at access to harbor in Near-Term (2015) to mitigate queueing of heavy vehicles along Kawaihae Rd; need to relocate South Gate to accommodate turn lane.
6.3 - Assuring mitigation addresses impacts	Section III, C. Intersection Treatments - Turn lanes considered at access to harbor in Near-Term (2015) to mitigate queueing of heavy vehicles along Kawaihae Rd; need to relocate South Gate to accommodate turn lane. Resulting LOS appropriate.
6.4 - Clarity and feasibilty of mitigation	Appendix E - AutoTurn figure of turn lane
6.5 - Determining impact fees	Not applicable
6.6 - Specifying follow-up	If necessary, follow-up can be discussed

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Traffic Impact Analysis Report

Checklist #3: TIR Data Collection	Response/Location
3.1 - Days to collect data (weekday/weekend)	Section II, B. Traffic Volumes - Data collected on Tuesday, May 25, 2010; Field work conducted on Sept. 3, 2010
3.2 - Peak hours	Section II, B. Traffic Volumes - 7:00-8:00am and 3:15-4:15pm
3.3 - Specific weeks/seasons to collect data or avoid	Data collection correlates with barge schedule. Seasonal distribution not considered applicable for the area.
3.4 - Quantity of data needed	Section II, B. Traffic Volumes - Collected 24-hour and peak period counts on one day
3.5 - Data variation	Section II, B. Traffic Volumes - Compared 24-hour and Peak Hour counts confirming minimal variation between data collected. Data only collected on one day. No balancing needed between intersections.
3.6 - Data collection locations	Section II, B, 1 & 2 - Location of 24-hour and Peak Hour counts provided
3.7 - Traffic data types (counts, turning movements, modes, and trucks)	Section II, B. Traffic Volumes, Appendix A - 24-hour counts include vehicle classification; Peak counts include turning movement counts and classification of vehicles, trucks and pedestrians.
3.8 - Use of other historical data mixed in with new data (acceptable age)	Section III, A and IV, A - Historical data and other reports used to determine existing volumes and growth rates
3.9 - Information from other projects	Section VI. References- Other studies referenced include Kawaihae Road Bypass TIAR (Section III.A.), South Kohala Regional Traffic Forecasts (Section III.A.), Kawaihae Regional Plan (Section III. A.), Hawai'i Commercial Harbors Cargo and Passenger Forecast (Section III. A.), Hawai'i Island Commercial Harbors 2035 Mater Plan (Section I.), Kawaihae Commercial Harbor Development Plan Traffic Circulation Memorandum (Section I.), Kawaihae Commercial Harbor Development Plan (Section I.).
3.10 - Use of model data (vs. field)	Regional model not used
3.11 - Other data	Section II, A. Internal Harbor Traffic Operations - Field visits and harbor tours were conducted

Checklist #4: TIR Analysis	Response/Location
4.1 - Use of ITE and other sources	Section III, A and IV, A - Projected trips determined from cargo forecasts; *ITE Trip Generation* not applicable; *AASHTO* and *HUDM* for turn lane length. *HCM* for LOS analysis. *MUTCD* for traffic signal warrants.
4.2 - Land use codes	Not applicable
4.3 - Independent variable selection	Not applicable
4.4 - Other trip generation data	Section III, A and IV, A - Historical data and other reports used to determine growth rates.
4.5 - Pass-by trips	Not applicable
4.6 - Forecasting approaches (growth rates, travel demand model, and trip distribution)	Section III, A and IV, A - Historical data and other reports used to determine growth rates. Trip distribution based on existing turning movement data.
4.7 - Warrants and other system improvements	Traffic signal warrants considered for Kawaihae Rd/Queen Ka'ahumanu Hwy intersection.
4.8 - Use of software (analytical/simulation) - discussion of specific tools (e.g., Synchro) and inputs	Section II, C, 1. Intersection LOS - *HCS+* traffic analysis software. Section II, C, 2. Roadway LOS - *FDOT LOS Handbook*
4.9 - Evaluation of other modes	Discussed Heavy Vehicle and Non-motorized traffic in Section II, B, 3-4; Section III, A, 5-6; Section IV, A, 5.
4.10 - Safety evaluation	Provided turn lanes with sufficient taper, deceleration and storage legnths along Kawaihae Road.

Checklist #5: TIR Determination of Impacts	Response/Location
5.1 - Use of appropriate horizon years	Based on the container forecasts, Near-Term (2015) and Mid-Term (2025) conditions were considered
5.2 - Impact analysis by mode	Discussed Heavy Vehicle and Non-motorized traffic in Section II, B, 3-4; Section III, A, 5-6; Section IV, A, 5.
5.3 - Anaylsis elements	Section III, C. Intersection Treatments - Turn lanes considered at access to harbor in Near-Term (2015). Relocation of South Gate should be implemented so that expansion does not degrade the existing system; Roadway segments also analyzed.
5.4 - Project versus cumulative impacts	Not applicable
5.5 - Significance levels - especially for existing conditions LOS F	LOS C or better for all conditions analyzed (Existing, Near-Term (2015) and Mid-Term (2025)) except at Kawaihae Rd/Queen Ka'ahumanu Hwy (QK) intersection in which QK approach left turn is LOS F for all conditions analyzed.
5.6 - Uncertainty in projections	Reviewed several reports to determine best possible assumptions: Section VI. References- Other studies referenced include Kawaihae Road Bypass TIAR (Section III.A.), South Kohala Regional Traffic Forecasts (Section III.A.), Kawaihae Regional Plan (Section III. A.), Hawai'i Commercial Harbors Cargo and Passenger Forecast (Section III. A.), Hawai'i Island Commercial Harbors 2035 Mater Plan (Section I.), Kawaihae Commercial Harbor Development Plan Traffic Circulation Memorandum (Section I.), Kawaihae Commercial Harbor Development Plan (Section I.).